THE ESSELTINE DRAIN:
BOOK 1 - REPORT

Municipal Drainage Report
Prepared for the Town of Kingsville

RC SPENCER ASSOCIATES INC.
Consulting Engineers

17 June 2016

Project No.: 14-425

RC SPENCER ASSOCIATES INC.
Consulting Engineers

17 June 2016
File No. 14-425

Re: **Navigating the Esseltine Drain Report**

Dear Resident:

Due to the size of the drainage report, we have prepared this letter to assist you in navigating through this document by highlighting sections of the report that will help answer questions that you may have such as:

1) What work is being proposed?
2) What will this cost me?
3) Would I receive any allowances for damages to my property?
4) How would the construction work affect my property?
5) How would this affect my trees?
6) Where do I find the amount of money assessed against my property?

Pages 1 to 23 of the report explains the scope of work of the project, refers to various sections of The Drainage Act, and describes how assessments, allowances, and grants were determined. Answers to all of the questions listed above can be found in the report under the following sections:

Section No.	**Description of Section**
2	Section 2 on Pages 1 & 2 describes the purpose and scope of the proposed work.
12	Section 12 on Pages 9 & 10 describes the recommended work in further detail.
23	Section 23 provides general information about The Drainage Act pertaining to how drainage assessments are made against individual properties and roads.
24 to 33	The **'Allowances'** can be found in these sections in chart-form following Page 23 of the report. The 'Allowance' charts show monetary compensation for land taken, trees removed, temporary material storage, etc. against certain affected properties.
34	Details of the **'Special Benefit'** assessments made against certain properties can be found in this section, following the 'Allowance' charts. This section breaks down the individual costs that relate to each 'Special Benefit' assessment.
35, 37 & 39	The **'Items of Construction'** are found in these sections, and show breakdowns of the total cost of the proposed work on the Esseltine Drain, the Richard Hicks Branch Drain and the Mucci-Hicks Branch Drain, respectively.
36, 38 & 40	The **'Schedules of Assessment'** are found in these sections following the 'Items of Construction'. The 'Schedules of Assessment' show the estimated assessments made against each property within the drainage areas of the Richard Hicks Branch Drain and the Mucci-Hicks Branch Drain, respectively.

The remaining sections of the report pertain to recommended construction practices for the contractor, as well as, the approvals of various government agencies.

Yours Truly,
RC Spencer Associates Inc.

Richard C Spencer, M.A.Sc., P.Eng.
President

L. Zarlenga

Lou Zarlenga, P.Eng.
Senior Engineer, Drainage Specialist

ESSELTINE DRAIN

INDEX

Report Contents

41.0 APPENDICES

41.1 RC SPENCER ASSOCIATES INC. APPENDICES:

Appendix A: Hydrologic Modeling Analysis

Appendix B: Review of Historical Drainage Reports in the Esseltine Drain and Tributary Municipal Drains

Appendix C: Summary of Additional Drainage Reports, Reviewed for Surrounding Municipal Drains

Appendix D: Minutes of On-Site Meeting May 21, 2015

Appendix E: Specifications

41.2 GOLDER ASSOCIATES LTD. APPENDICES:

Appendix F: Golder Geotechnical Investigation and Slope Stability Assessment

Appendix G: Golder Geotechnical Comments, Proposed SWM Ponds Base Flow

41.3 BIOLOGIC INCORPORATED APPENDICES:

Appendix H: BioLogic Natural Heritage Report

Appendix I: BioLogic Letter – Esseltine Residential Tree Evaluation Program

42.0 DRAWINGS, INCLUDING TITLE PAGE AND SHEETS 1 TO 47

June 17, 2016

Mayor and Municipal Council
Corporation of the Town of Kingsville
Kingsville, Ontario

Mayor Santos and Councillors

SUBJECT: Drainage Report
Esseltine Drain
Town of Kingsville
Our Project Reference 14-425

1.0 AUTHORIZATION

Pursuant to Section 78 of The Drainage Act, the Corporation of the Township of Kingsville accepted a request from the Town's Manager of Municipal Services to repair and improve the Esseltine Drain. The Corporation of the Town of Kingsville, acting as the initiating municipality subsequently appointed the firm of RC Spencer Associates Inc., to make an examination and to prepare a report under the provisions of "The Drainage Act, R.S.O. 1990, Chapter D.17, as amended 2010".

As requested by Council, we have made a survey and examination of the Esseltine Drain, situated within the Town of Kingsville and we report thereon as follows.

2.0 PURPOSE OF REPORT

The intent of this report is to provide for the repair and improvement of the Esseltine Drain, being an existing municipal drain and to convert the natural watercourse downstream of County Road 20 to a municipal drain. The repair and improvement of the drain would be performed under Section 78 of The Drainage Act, in fulfilment of the Town's responsibility to maintain and repair the municipal drain under the provisions of "The Drainage Act, 1990".

This would also involve the following work:

a) Extend the existing Esseltine Drain situated north of County Road 20 (Seacliff Drive) to a sufficient outlet into Lake Erie.

b) Provide bank stabilization to the ravine area situated south of County Road 20 by providing imported clay fill to raise the existing bottom and flatten side slopes of the natural watercourse.

c) Provide substantial protection to the outlet of the Esseltine Drain in order to safeguard the improvements made to the upstream areas of the Drain. The work includes an interlocking precast concrete block outlet weir with step-down installation, armour stone protection along the shoreline and a CC-70 cable concrete erosion protection pad.

d) Provide erosion protection with cable concrete precast panels south of County Road 20.

e) Remove trees as necessary to accommodate the clay cut and fill operations and provide replacement planted trees.

f) Realign portions of the upstream-situated open municipal drain north of County Road 20 to provide stable banks and maintainable side slopes on east and west drain banks.

g) Provide two new culvert crossings to accommodate two residential developments (Porrone Subdivision and Branco Subdivision).

h) Repair and improve the banks or the existing municipal drain in the northerly reaches of the existing municipal drain extending northerly to the south side of County Road 34 (Talbot Road).

This final report provides plans and specifications for the construction of the preferred option as described above and further described in the preliminary report. This final report also provides a detailed description of the recommended works and provides an estimated cost of the works. This final report further contains a schedule of assessment which provides a distribution of the estimated costs to be shared by all owners of affected lands either using the drain as an outlet for their stormwater runoff or receiving a benefit from the drainage works. The assessments shown on the accompanying schedule of assessment are based upon the estimated cost of the work. These assessments will be pro-rated to the actual cost of the project once all of the work has been completed.

This report further provides a schedule of assessment which divides the cost of the recommended work to all of those lands using the drain as an outlet or to those lands benefiting from the existence of the drain.

3.0 ORDER OF PROCEDURE UNDER THE DRAINAGE ACT

The following is the general order of procedure that is followed in order to repair, improve and extend a Municipal Drainage System after a request from the Town Road Authority to repair and improve a drainage works.

a) Council accepts petition.

b) Council appoints an Engineer.

c) Engineer conducts on site meeting.

d) Engineer determines sufficiency of the petition.

e) Need for preparation of Preliminary Report is decided.

f) Engineer completes and provides Preliminary Report, if required.

g) Council considers Preliminary Report at public meeting with affect landowners.

h) At the meeting to consider the Preliminary Report, Council gives opportunity to any person who signed the petition to withdraw their signature and Council also gives opportunity to any person owning land in the area requiring drainage to sign the petition if they had not already done so. If at the end of the meeting the petition does not contain a sufficient number of names, the process stops and the original petitioners are charged the cost to date. If at the end of the meeting the petition contains a sufficient number of names, the Council may instruct the Engineer to prepare a final report.

i) The engineer prepares a Final Report if directed to do so by Council.

j) Engineer provides Final Report.

k) Council considers Final Report at a public meeting with the affected landowners.

l) At the meeting to consider the final report Council again give opportunity to have names deleted or added to the petition, as per the procedures described in (h) above. The process stops if the petition is not sufficient. If the petition is sufficient, the Council may instruct the Engineer to proceed.

m) If at the end of the meeting for consideration of the Final Report Council wishes to proceed, the report is adopted by Council.

n) Court of Revision is held at a subsequent meeting with the affected landowners to discuss any disputes regarding assessment of cost to lands and roads.

o) Council passes by-law for construction of the work after statutory waiting periods and appeal periods expire.

p) Tenders are received by the Town to perform the recommended works and construction is performed.

q) Final costs are assessed to the affected landowners by the Town.

4.0 CURRENT DRAINAGE REPORT

The current drainage report for the Esseltine Drain situated immediately upstream of the southerly situated ravine area is a drainage report prepared by the late William J. Setterington dated December 21, 1976. This report established that the south end of the Esseltine Municipal Drain was situated 2,437 feet southerly of the 2nd Concession Road (now known as Road 2 East). This measurement has been determined to be situated at Station 0+873. Accordingly, this point is situated approximately 873 metres from the shoreline of Lake Erie.

5.0 WATERSHED DESCRIPTION

The Esseltine Drain has a large number of tributary drains contributing to the flow of rainwater in the Esseltine Drain. There are approximately 14 individual drains contributing to the main section of the Esseltine Drain. Attached Appendix B is a chart of the Historical Drainage reports for the various contributing branches. Our review included a total of 26 Drainage reports for this purpose.

Additionally there were another 19 drainage reports from adjacent municipal drains that were reviewed in order to accurately determine the extent of the drainage boundary of the Esseltine Drain. Attached Appendix C is a chart of the Historical Drainage reports for surrounding adjacent Municipal Drains. Our review included a total of 24 Drainage reports for this purpose.

The Esseltine Drain drainage limits contain approximately 300 hectares of land. Attached plan (Sheet Number 2) provides a map identifying the drainage boundary of the Esseltine Drain.

There is approximately 27.325 metres differential in the elevation of the Drain bottom from the upper end at Road 3 East to the outlet at Lake Erie.

We have identified that the upper section (north of Station 0+873) of the Esseltine Drain is classified as a municipal drain and the lower section (south of Station 0+873) is classified as a natural watercourse.

6.0 ON-SITE MEETING

A meeting with the affected landowners and others was conducted on 21 May 2015 at the Town of Kingsville arena. A summary of the proceedings and list of those attending is attached as Appendix D.

As the project evolved, many of the landowners living in the southerly portion of the natural watercourse contacted our office for additional information. In several cases, requests for onsite attendance from the Engineer were accommodated due to complexity of this project. These events are also added to the on-site meeting minutes.

7.0 SURVEY

We commenced our survey for this project at Station 0+000 being the outlet of the natural watercourse into Lake Erie. We then continued northerly and upstream along the bottom of the existing channel to Station 0+520 being the south end of a 2440mm x 3650mm concrete culvert situated under County Road 20. We continued our survey northerly through the concrete culvert to its north end being at Station 0+551 continuing northerly following the existing open channel of the natural watercourse to Station 0+873 being the legal end of the natural watercourse pursuant to the current drainage report dated December 1976 for this location.

We continued northerly following the course of the Esseltine Drain to Station 1+616 where the Esseltine Drain turns to the west. We then continued our survey following the course of the open drain to Station 1+815 where the drain turns to the north. We continued following the open drain northerly to Station 2+156 where the drain turns westerly. We continued following the course of the open drain Station 2+273 where the drain turns northerly up to Station 2+387 being the south side of County Road 34 Road allowance. This is also the northerly limit of the Esseltine Drain repair and improvement investigation.

Further to the survey conducted above, a condition survey was also conducted of the upper reaches of the Esseltine Drain.

The conditions survey of the Esseltine Drain started at Station 2+387 being the south limit of the road allowance for County Road 34 (Talbot Road). We proceeded northerly to Station 2+595 where the drain turns westerly along the north side of the former C&O Rail Road tracks. We then proceeded westerly to 3+070 being the east road limits for County Road 34. We then followed the open drain northerly to Station 3+300 where the open drain becomes enclosed up to Station 4+035. After Station 4+035 the Esseltine Drain becomes an open drain situated along the north side of the Road 3 East. We continued following the open drain easterly to Station 4+883 being at the north west corner of the intersection with Spinks Drive.

Further to conducting the condition survey, we find that the Esseltine Drain situated from Station 2+387 to 4+883 is in good to excellent condition and does not require any improvements at this time.

8.0 GEOTECHNICAL INVESTIGATION

The firm of Golder Associates was retained to investigate and report on soil conditions and provide comments on existing conditions and proposed drain repair options.

Accordingly Golder Associates conducted soil sampling and placement of a series of boreholes to determine the composition of the earth banks from the shoreline at Lake Erie and extending to Road 2 East.

The information determined by Golder Associates is reported in Appendix F and G.

Golder Associates have carefully inspected the existing ravine area situated south of County Road 20 and have reported that the existing sideslopes within the ravine area are unstable. Accordingly, we have reviewed several suggested and common drain enclosure systems as well as surface oriented erosion control systems as potential drain repair systems. We have recommended for this site and conditions an articulated precast concrete block product combined with a clay fill operation would be the most effective solution.

Golder Associates have reviewed this proposal and indicates the proposed system would stabilize the existing side slopes.

9.0 ENVIRONMENTAL – NATURAL HERITAGE REPORT

The lower reaches of the Esseltine Drain provide a wide variety of habitat features. All environmental concerns were carefully reviewed and reported upon by BioLogic Incorporated.

A Natural Heritage Report has been prepared and is provided in Appendix H.

The proposed design for the Esseltine Drain will alleviate any of the ongoing and excessive erosion issues within the Esseltine Drain. We have evaluated the proposed Esseltine Drain improvements and any potential impacts to the natural heritage system can be avoided and/or mitigated with the recommendations provided in Section 6 of the Natural Heritage Report.

Habitat for species protected under the Endangered Species Act (Eastern Foxsnake) will occur as temporary impacts provided construction timing windows are followed. All impacts are considered temporary as the site will be revegetated and there will be no permanent loss of habitat. Within the reinforced channel portion, actively eroding banks will be replaced with stabilized cable concrete that allows grasses to grow in the gaps. This growth will take some time so the temporary effect is considered mid-term (two to three years). Safe foraging habitat will be expanded as a result and provide long term benefits. Other excavated areas will be revegetated and this will result in a short-term temporary impact (one year). No other habitat sensitivities were noted with respect to fish, breeding birds or plants. Eastern Mole (Special Concern) was noted but sufficient habitat is being avoided and restoration of side slopes upgradient of the floodway will provide habitat once stabilized. Below the floodway, habitat for Eastern Mole, as with Eastern Foxsnake, is compromised due to active erosion and instability.

Some recommendations for fish habitat improvements were reviewed but given the elevation difference between the lake levels and a stable channel slope from County Road 20 (approximately 4 metres) and the poor fish community representation in the drain extension, these options were abandoned as a result of a poor cost/benefit ratio.

An artificial hibernaculum has been suggested in the upper reaches of the municipal drain (north of County Road 20). Some Northern Flicker boxes are suggested for the area downstream of County Road 20.

The largest issue related to this project is the magnitude of work and timing restrictions for various acts related to natural heritage protection and preservation. These timing restrictions need to be carefully considered and discussions with the various approval agencies should be initiated well ahead of tender award to ensure a smooth construction process.

In regards to the abundant forestry features present at this site, BioLogic Incorporated has further provided comments and recommendations including a tree evaluation report. The tree evaluation report further provides for a tree replacement program in consideration of the trees situated in the ravine area south of County Road 20.

Recommendations provided by the Ministry of Natural Resources and Forests have been incorporated within the proposed tree evaluation program.

Upon Council adoption of this drainage report and with respect to Department of Fisheries and Oceans (DFO) concerns and comments, the proposed works to the Esseltine Drain will need to be self-assessed by the Town of Kingsville through the DFO website. Through the self-assessment process a determination can be made if these works will require a formal authorization under the Fisheries Act.

10.0 RC SPENCER, HYDROLOGIC MODELING

Hydrologic modeling was performed for sizing and confirming flow capacity for all recommended drainage components. Additionally, intensive modeling was performed for base flow consideration in respect to the influence storm water detention systems would have on the downstream lands to assist the Essex Region Conservation Authority in their evaluation of developments in the Town of Kingsville. Recommendations were further provided for flow designs for future developments. Any existing stormwater management facilities situated south of Road 2 East within the Esseltine drainage area will be required to maintain their existing SWM systems as designed.

Refer to Appendix A for further information

11.0 EXISTING SITE CONDITIONS

Further to our site survey and review of the Golder Associates reports, the existing ravine area situated south of County Road 20 is in need of repair and improvement. The sideslopes have been deemed to be marginally unstable. The existing gradient of the bottom of the clay flow channel is very steep. The wooded sideslopes in some areas have been degraded by dumping leaves, grass cuttings and waste from vegetable growing operations, all of which increases the moisture on the sideslopes and probability of slope failure.

At the lower reaches of the ravine, the sideslopes are higher and steep and a considerable volume of dead trees have accumulated within the drain bottom, thus preventing the free flow of water and results in bank erosion. The continuing process of erosion and bank failure will jeopardize the existing homes situated around the top of the ravine.

The existing watercourse on the north side of County Road 20 consists of a highly overgrown shallow gully with various trees situated throughout the gully area. The watercourse is a fairly small channel meandering throughout the gully; however there exists several areas serving as dumping areas from construction activities. Portions of the waterway up to Station 0+873 are considered to be a natural watercourse and the water courses situated north of Station 0+873 are all municipal drains. The adjacent landowners have indicated a desire to conduct operations to enable future maintenance work to enhance the drainage and appearances.

12.0 RECOMMENDATIONS

Further to reviewing the site, conditions, reports of experts, extensive discussions with landowners, review with the Essex Region Conservation Authority and recommendations from MNRF, we recommend the following:

a) We recommend that temporary access be provided to the site throughout the construction of the works specified herein. A permanent access will be provided to sustain heavy loading for the Town's maintenance equipment for future maintenance access purposes. We further recommend that for Access Site #1 located at Station 0+280 (1510 Whitewood Road) that the tree removals and permanent hydro pole relocation (at the expense of Hydro One pursuant to Section 26 of the Drainage Act) be completed prior to the commencement of any other construction activities.

b) From Station 0+000 to 0+650, reconstruct the existing flow channel by raising the existing drain bottom approximately 4 metres by placing and compacting imported clay fill and provide a new flow channel protected with a precast articulated concrete blocks mat system, and provide an adjacent access corridor to enable maintenance operations and inspections on a frequent basis.

c) We further recommend a product for the above being cable concrete manufactured and supplied by International Erosion Control Systems or approved equal.

d) We further recommend that from Station 0+650 to 1+300 the existing watercourse be realigned with an open channel with bottom width of 2.5 metres and 2:1 side slopes including the regrading of existing side slopes to a slope of 2:1.

e) We recommend that the Tree Evaluation Program prepared by BioLogic Incorporated be utilized for the suggested tree removals due to construction and a replacement scheme for replanting and/or compensation for the landowner.

f) Upon adoption of this report and completion of the construction works, the extent of the finished municipal drain shall be as follows:

- Station 0+000 to 0+520, the municipal drain consists of the entire bottom and side slopes of the watercourse terminating at the top of banks.
- Station 0+520 to 0+551, the extent of the concrete box culvert shall be considered part of the municipal drain.
- Station 0+551 to 1+300, the municipal drain consists of the entire bottom and side slopes of the watercourse terminating at the top of banks.
- Station 1+300 to 2+387, the municipal drain consists of the entire bottom and side slopes of the watercourse terminating at the top of banks.

g) We further recommend that the existing 300mm diameter watermain beneath the concrete box culvert at County Road 20 be lowered.

h) Upon completion of the works specified herein, permanent lockable lift bars and "DO NOT ENTER PRIVATE PROPERTY" signs shall be installed as a barricade at all three site access points.

i) Upon completion of the works specified herein, we recommend that the Town Drainage Superintendent conduct monthly inspections of the cable concrete areas including the outlet weir and shoreline protection at Station 0+000 and report on any condition changes.

j) In regards to the anticipated construction of this project, we have estimated approximately 6 months of continuous work will be required to complete this project. In regards to commencement of the improvements to the ravine area situated between Station 0+000 to 0+520, the construction must be conducted without any interruptions. Therefore, it will be necessary to commence construction operations as early as possible in the year. It is important that all of the environmental issues are addressed and all of the related approvals are received as soon as possible after the adoption of this report.

We would further recommend that all of the above recommended work be performed according to this report, the attached specifications and the accompanying drawings and that this work be carried out under the provisions of The Drainage Act, 1990.

13.0 DRAWINGS AND SPECIFICATIONS

Attached to this report as Item 22.0 are the drawings (Cover Sheet and Sheets 1 to 47), providing a clear and concise description of the recommended works, including cross-sections, profiles and details. Specifications are included in this report in Appendix E, providing descriptions of materials and construction practices to which the Contractor must adhere.

14.0 ALLOWANCE FOR DRAINAGE WORKS PREVIOUSLY PERFORMED

On December 18, 2015, we were initially contacted by Mr. Scott Shilson, who indicated that in July of 2013 a severe rain storm occurred resulting in substantial storm runoff into the natural watercourse causing extensive erosion to the west bank of the natural watercourse adjacent to his residence.

The erosive action of the storm runoff and subsequent bank failure exposed portions of his house foundation at the northwest corner of the house. Fearing his home was in jeopardy, Mr. Shilson contacted the Essex Region Conservation Authority and discussed the situation with Mr. Tim Byrne at ERCA.

Mr. Shilson is a professional drainage contractor with considerable experience. Ultimately repairs were commenced by Mr. Shilson by hauling various granular, clay and rock material to the site (1510 Whitewood Road) to reconstruct the failed side slope. Material was placed at this location from July 27, 2013 to September 3, 2013. Construction materials were placed into the natural watercourse from Station 0+250 to Station 0+300 (50 linear metres) by Mr. Shilson to repair a bank failure at this location further to severe rainfall.

Accordingly, on December 18, 2015, Mr. Shilson requested consideration under the Drainage Act, for a financial allowance for a portion of his costs pursuant to Section 31 of the Drainage Act for the works he performed and paid for in July and August of 2013.

In regards to the request for an allowance for costs we contacted the Municipal Drainage Division of the Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and requested an opinion on the Shilson request. The response was affirmative on use of Section 31 for consideration of an allowance subject to proof of costs and effectiveness of the work.

As part of the bank reconstruction process, the adjacent bank on the David Dann property being 1512 Whitewood Road was also reconstructed by Mr. Shilson. Both the Shilson and Dann properties are situated along the outside bank of the natural watercourse.

For the purpose of the request for allowance, we have considered all of the materials noted above and have determined that only 472 cubic metres of rock, being a non-erodible material, may be considered as a permanent repair to the natural watercourse. In order to determine a value of this non-erodible repair, we have estimated an equivalent volume of permanent repair material (imported clay fill) at a unit cost of $20.00 per cubic metre to arrive at an allowance equal to $9,440.00. This value is shown in Chart 7 of this report.

15.0 ALLOWANCES FOR LAND USED AND DAMAGES

In accordance with the provisions of "The Drainage Act, 1990" allowances are provided to be paid to those landowners from which land is required to be used for the construction of a new drain or for the establishment of an easement for the construction and future maintenance of a drain or for land required to dispose of excavated material or for land required to obtain access to a Municipal Drainage System.

Therefore we find that each of the following owners is entitled to and should receive the following amounts as compensation for the value of land taken in order to repair and improve the drain namely:

15.1 Summary of Allowances

The total amount for the compensation to landowners for land taken and damages is further explained in Sections 15.2 to 15.10 as follows.

TOTAL ALLOWANCES **$ 131,210.00**
(Refer to Chart 1)

15.2 Land Used – Flow Channel & Maintenance Corridor, Stations 0+000 to 0+520

We find that each of the affected landowners is entitled to and should receive compensation for land used for the construction of the cable concrete flow channel and maintenance corridor including land used for final grading and restoration.

TOTAL FOR FLOW CHANNEL **$ 48,144.00**
(Refer to Chart 2)

We have provided for this in our estimate as is provided for under sub-section (a) of Section 29 of "The Drainage Act, 1990".

15.3 Land Incorporated as Part of Municipal Drain, Stations 0+000 to 0+520

We find that each of the affected landowners is entitled to and should receive compensation for the undisturbed land situated along the top of bank that is to be incorporated as part of the Municipal Drain.

TOTAL FOR INCORPORATED LAND **$ 3,549.00**
(Refer to Chart 3)

We have provided for this in our estimate as is provided for under sub-section (a) of Section 29 of "The Drainage Act, 1990".

15.4 Damages to Trees in Residential Area, Stations 0+000 to 0+520

We find that each of the affected landowners is entitled to and should receive compensation for existing tree removals that are unable to be replaced as per the proposed compensation plan outlined in "Appendix I: BioLogic Letter – Esseltine Residential Tree Evaluation Program."

TOTAL FOR DAMAGES TO TREES *(Refer to Chart 4)*	**$ 43,830.00**

We have provided for this in our estimate as is provided for under Section 30 of "The Drainage Act, 1990".

15.5 Value of Existing Natural Watercourse, Stations 0+000 to 0+520

We find that each of the affected landowners is entitled to and should receive nominal compensation for the length of the existing natural watercourse abutting the landowner's property.

TOTAL FOR NATURAL WATERCOURSE *(Refer to Chart 5)*	**$ 9,660.00**

We have provided for this in our estimate as is provided for under Section 31 of "The Drainage Act, 1990".

15.6 Land Used – Construction Access & Material Storage, Stations 0+000 to 0+520

We find that each of the affected landowners is entitled to and should receive compensation for land used for permanent or temporary access to the working space. This section shall also provide compensation for land used for temporary materials storage required during construction.

TOTAL FOR ACCESS & MATERIAL STORAGE *(Refer to Chart 6)*	**$ 5,835.00**

We have provided for this in our estimate as is provided for under sub-section (1) of Section 63 of "The Drainage Act, 1990".

15.7 Previous Repairs to Watercourse, Stations 0+000 to 0+520

We find that the affected landowner is entitled to and should receive compensation for the volume of previously installed approved rock fill material in the existing natural watercourse as this work provides an equivalent reduction in the amount of imported clay fill required for the drain improvements.

TOTAL FOR PREVIOUS REPAIRS *(Refer to Chart 7)*	**$ 9,440.00**

We have provided for this in our estimate as is provided for under Section 31 of "The Drainage Act, 1990".

15.8 Land Used – Flow Channel & Side Slope Grading, Stations 0+551 to 2+387

We find that each of the affected landowners is entitled to and should receive compensation for land used for the construction of the cable concrete flow channel as well as land used for final grading of side slopes and restoration.

TOTAL FOR FLOW CHANNEL *(Refer to Chart 8)*	**$ 6,798.00**

We have provided for this in our estimate as is provided for under sub-section (a) of Section 29 of "The Drainage Act, 1990"

15.9 Value of Existing Natural Watercourse, Stations 0+551 to 2+387

We find that each of the affected landowners is entitled to and should receive nominal compensation for the length of the existing natural watercourse abutting the landowner's property.

TOTAL FOR NATURAL WATERCOURSE *(Refer to Chart 9)*	**$ 3,220.00**

We have provided for this in our estimate as is provided for under Section 31 of "The Drainage Act, 1990".

15.10 Land Used – Temporary Material Storage, Stations 0+551 to 2+387

We find that each of the affected landowners is entitled to and should receive compensation for land used for temporary materials and storage required during construction.

TOTAL FOR MATERIAL STORAGE	**$ 734.00**
(Refer to Chart 10)	

We have provided for this in our estimate as is provided for under sub-section (1) of Section 63 of "The Drainage Act, 1990".

16.0 DESCRIPTION OF WORKING CORRIDOR

Pursuant to Section 63 of the Drainage Act, the Contractor shall restrict his equipment to the working corridors as specified in this Section. Any damage resulting from non-compliance with this Clause shall be borne by the Contractor. The working corridor shall be as follows:

ENTRY NUMBER	FROM	TO	WORKING CORRIDOR
1	0+000	0+520	Land being 40 metres wide following the path of the cable concrete flow channel and maintenance lane including side slope restoration area.
2	0+520	0+551	Entire width of the County Road 20 right-of-way.
3	0+551	0+650	Land being 35 metres wide consisting of 30 metre wide natural watercourse area and 5 metres along the top of east bank.
4	0+650	0+873	Land being 40 metres wide consisting of 30 metre wide natural watercourse area and including 5 metres wide along the west and the east drain bank.
5	0+873	1+150	Land being 40 metres wide consisting of 30 metre wide existing open municipal drain and including 5 metres wide along the west and east drain bank.
6	1+150	1+300	Land being 5.5 metres wide and situated along the west top of the bank of the existing municipal drain.
7	1+300	1+616	Land being 5.5 metres wide and situated along the south side of the existing municipal drain.
8	1+616	1+815	Land being situated on the south side of the existing drain and further situated within the 20 metre wide road right-of-way allowance of Road 2 East.
9	1+815	2+156	Land being 5.5 metres wide and situated along the east side of the existing municipal drain.
10	2+156	2+273	Land being 5.5 metres wide and situated on both the south side and north side of the existing municipal drain.
11	2+273	2+387	Land being 5.5 metres wide situated on both the east side and west side of the existing municipal drain.

17.0 ASSESSMENT FOR ROAD, HIGHWAY AND ACCESS CROSSINGS

Under normal circumstances, pursuant to Section 26 of the Drainage Act, the Municipal Road Authority would be responsible for construction costs and maintenance costs of bridges situated within Municipal road allowances.

We would recommend that the construction costs and maintenance costs for the crossings and culverts be assessed as follows:

a) **Concrete Access Culvert with South End at Station 0+280**
   - Construction costs at the expense of all affected land owners within the drainage area of the Esseltine Municipal Drain.
   - Maintenance shall be completed by the Town and the cost shall be assessed to all affected land owners within the drainage area of the Esseltine Municipal Drain.

b) **1600mm Diameter Residential Road Culvert with East End at Station 1+726**
   - Construction costs at the expense of Christina Porrone (Roll Number 290-22100)
   - Maintenance costs at the expense of the Municipality after completion of the residential development, once the Municipality has assumed the road allowance.

c) **1400mm Diameter Residential Road Culvert with South End at Station 2+116**
   - Construction costs at the expense of Mucci/Branco (Roll Number 290-22309)
   - Maintenance costs at the expense of the Municipality after completion of the residential development, once the Municipality has assumed the road allowance.

18.0 MAINTENANCE

We would recommend that these drainage works be kept up at the expense of the lands and roads herein assessed for its construction and in the proportions herein contained excluding any amounts assessed as Special Benefit or until otherwise determined under the provisions of the Drainage Act.

19.0 UTILITIES

It may become necessary to temporarily or permanently relocate utilities that may conflict with the construction recommended under this report. In accordance with Section 26 of the Drainage Act, we assess any relocation cost against the public utility having jurisdiction. Under Section 69 of the Drainage Act, the public utility is at liberty to do the work with its own forces, but if it should not exercise this option within a reasonable time, the Municipality will arrange to have this work completed and the costs will be charged to the appropriate public utility.

20.0 FISHERIES ISSUES

The Esseltine Drain has been classified by the Department of Fisheries and Oceans as a Type 'C' drain. Type C drains have permanent warm water flow and have no sensitive species and/or communities present. Standard practices to be followed to minimize disruption to fish habitat include embedment of the culvert a minimum 10% below grade, constructing the work during low water levels in the drain, maintaining a 3.0 metre wide grass buffer strip along the drain banks, providing silt fencing until permanent erosion protection is in place on drain banks and cutting only trees necessary to do the work (no clear-cutting).

In addition, to alleviate potentially harmful impacts and avoid disruption to fish habitat, the following is recommended:

- In order to protect local fish populations during their spawning and nursery periods no '**in-water**' work should be conducted from March 15 – June 30 (DFO/MNR) timing window without prior authorization from DFO (Department of Fisheries and Oceans) for emergency situations.

- All in-stream work should be completed in '**the dry**'.

- Sediment and erosion control measures should be implemented prior to work and regularly inspected and maintained during the work phase, to prevent entry of sediment into the water.

- All materials and equipment used for the purpose of site preparation and project completion should be operated and stored in a manner that prevents any deleterious substance (e.g. petroleum products, silt, etc.) from entering the water.

- All disturbed areas should be stabilized immediately, and upon completion of work returned to a pre-disturbed state or better as soon as conditions allow.

21.0 DEFINITION OF DRAIN COMPONENTS

For the purpose of defining the actual components of the Municipal Drain, the construction limits of the repaired and improved Esseltine Drain shall consist of the open drain from Stations 0+000 to 2+387 including all access and road culverts shown on the accompanying plan and profile.

The Richard Hicks Branch Drain shall consist of the enclosed drain from Station 0+000 to 0+038 which outlets into the Esseltine Drain at Station 0+484.

The Mucci-Hicks Branch Drain shall consist of the enclosed drain from Station 0+000 to 0+086.5 including all catch basins shown on the accompanying plan and profile and this drain outlets into the Esseltine Drain at Station 0+542.

The Mastronardi Branch Drain shall be extended easterly approximately 20m to the cable concrete flow channel and outlet into the Esseltine Drain at Station 0+635.

22.0 GRANTS

In accordance with the provisions of Sections 85, 86 and 87 of the Drainage Act, a grant in the amount of 33-1/3 percent of the assessment eligible for a grant may be made in respect to the assessment made under this report upon privately owned lands used for agricultural purposes. The assessments levied against privately owned agricultural land must also satisfy all other eligibility criteria set out in the Agricultural Drainage Infrastructure Program policies. Most of the privately owned lands are used for agricultural purposes and are eligible under the Agricultural Drainage Infrastructure Program policies. We are not aware of any lateral drains involved in this work that would not be eligible for a grant. We recommend that application be made to the Ministry of Agriculture, Food and Rural Affairs in accordance with Section 88 of the Drainage Act, for this grant, as well as for all other grants for which this work may be eligible.

23.0 GENERAL INFORMATION AND DISCUSSION

a) Assessment Information

The following terms related to assessments are defined and described in the Drainage Act as follows:

- Benefit – means the advantages to any lands, roads, buildings or other structures from the construction, improvement, repair or maintenance of a drainage works, such as will result in a higher market value or increased crop production or improved appearance or better control of surface or subsurface water or any other advantages relating to the betterment of lands, road, buildings or other structures.

Assessment for Benefit is provided for under Section 22 of the Act wherein lands, roads, buildings, utilities or other structures that are increased in value or are more easily maintained as a result of the construction, improvement, maintenance or repair of a drainage works may be assessed for benefit.

- Outlet Liability – means the part of the cost of the construction, improvement or maintenance of a drainage works that is required to provide such outlet or improved outlet.

  Assessment for Outlet Liability is provided for under Section 23 (1) of the Act wherein lands and roads that use a drainage works as an outlet, or for which, when the drainage works is constructed or improved, an improved outlet is provided either directly or indirectly through the medium of any other drainage works or of a swale, ravine, creek or watercourse, may be assessed for outlet liability. The assessment amount is provided for under Section 23 (3) of the Act wherein the assessment for outlet liability shall be based upon the volume and rate of flow of the water artificially caused to flow upon the injured land or road or into the drainage works from the lands and roads liable for such assessments.

- Special Benefit – means any additional work or feature included in the construction, repair or improvement of a drainage works that has no effect on the functioning of the drainage works.

  Assessment for Special Benefit is provided for under Section 24 of the Act wherein the engineer may assess for special benefit any lands for which special benefits have been provided by the drainage works.

- Road Authority – means a body having jurisdiction and control of a common or public highway or road, or any part thereof, including a street, bridge and any other structure incidental thereto and any part thereof.

  Assessment to Road Authorities is provided for under Section 26 of the Act wherein in addition to all other sums lawfully assessed against the property of a public utility or road authority under this Act, and notwithstanding that the public utility or road authority is not otherwise assessable under this Act, the public utility or road authority shall be assessed for and shall pay all the increase of cost of such drainage works caused by the existence of the works of the public utility or road authority.

b) Determination of Assessments

For the purpose of preparing the values for allowances and the accompanying Schedule of Assessment for this report the following criteria have been used.

1) Allowances - Pursuant to Section 29 of the Drainage Act, allowances may be paid to the residents. In order to provide reasonable values for this purpose, we have obtained an appraisal for residential and agricultural lands within the Esseltine Drainage area. The appraisal value from Fuerland Realty Limited for residential properties in the ravine area was determined as $2.50 per square foot. This land value relates to a value of $269,097.00 per hectare ($108,900.00 per acre). The appraisal value from Fuerland Realty Limited for agricultural properties was determined as $16,500.00 per acre. This land value relates to a value of $40,772.00 per hectare.

For the residential land used for cable concrete flow channel and maintenance corridor or for side slope grading, land value was calculated using a nominal value of 15% of the residential appraisal value, totalling $40,360 per hectare.

For the residential land incorporated as part of the municipal drain, land value was calculated using a nominal value of 1% of the residential appraisal value, totalling $2,690 per hectare.

For the residential land used to provide construction access and permanent maintenance access, land value was calculated using 100% of the residential appraisal value, totalling $269,097.00 per hectare.

For the agricultural land used for the flow channel, maintenance corridor or for side slope grading, land value was calculated using a nominal value of 15% of the agricultural appraisal value, totalling $6,120 per hectare.

For the agricultural land used for temporary construction access and material storage, land value was calculated using a nominal value of 10% of the agricultural appraisal value, totalling $4,080.00 per hectare.

For the allowances for damages to trees in the ravine area, the nominal allowance rate of $175.00 per unplanted 50mm caliper tree and $230.00 per unplanted 70mm caliper tree was calculated based on M. Putzer Hornby Nursery Ltd. 2015 Price List.

For the property abutting the natural watercourse, a nominal value of $10.00 per lineal metre of property abutting the watercourse was used to calculate the allowance.

2) Benefit and Outlet – The cost of performing the general drain items of brushing, excavating, placement of clay fill, installation of cable concrete flow channel and maintenance corridor, outlet protection at Lake Erie, maintenance access culvert, allowances and incidental costs has been assessed to all affected lands and roads as Benefit and Outlet.

Total Value of Benefit for the Esseltine Drain was calculated to be $1,142,250.00 which sum was then assessed to all affected lands lying adjacent to the Drain at a rate of approximately $11,089.00 per hectare.

For the Richard Hicks Branch Drain the total Value of Benefit was $2,900.00 which sum was then assessed to all affected lands lying adjacent to the Drain at a rate of approximately $11,373.00 per hectare.

For the Mucci-Hicks Branch Drain the total Value of Benefit was $12,822.00 which sum was then assessed to all affected lands lying adjacent to the Drain at a rate of approximately $30,456.00 per hectare.

Total Value of Outlet for the Esseltine Drain was calculated to be $2,665,249.00 which sum was then assessed to all affected lands situated within the drainage basin at an average rate of approximately $2,404.00 per equivalent hectare of agricultural land. The actual outlet assessment rate varies from approximately $1,474.00 to $2,948.00 per equivalent agricultural hectare based on the location of each land parcel along the length of the Drain. Lands situated at the upper end of the Drain will be assessed at the higher rates as they use more of the Drain. Also, the property land use will have an effect on storm runoff from the lands; therefore the equivalent agricultural rate is multiplied by 0.5 for bush lands, by 2 for institutional lands, by 3 for residential lands, by 6 for roads, by 6.5 for commercial and light industrial lands, by 8 for gravel area, by 9 for asphalt or concrete area and by 10 for roof area.

For the Richard Hicks Branch Drain the total Value of Outlet was $6,767.00 which sum was then assessed to all affected lands situated within the drainage basin at a rate of approximately $9,451.00 per equivalent hectare of agricultural land.
For the Mucci-Hicks Branch Drain the total Value of Outlet was $29,917.00 which sum was then assessed to all affected lands situated within the drainage basin at a rate of approximately $9,408.00 per equivalent hectare of agricultural land.

3) Special Benefit – The cost of performing special works to the drain that are required to service select properties are assessed to the individual property or properties for which the special works are provided.

Total Value of Special Benefit for the Esseltine Drain was calculated to be $207,100.00 which sum was then assessed to the affected lands as shown in the "Details of Special Benefit" included in this report.

c) Future Maintenance Issues

- Allowances – In respect to future maintenance of the works the Drainage Act does not provide for payment of allowances for damages to lands. Therefore there would be no compensation made to landowners for spreading of excavated material on their lands.

- Working Area – The working areas specified in the report continue to exist in the future for maintenance purposes and the landowner, whose property is specified to be used for working area, should keep the working area clear of obstructions.

- Disposal of Excavated Material – The specified method shown in the report by which excavated material is to be spread or disposed of continues to exist in the future for maintenance purposes.

d) Environmental Issues

All future maintenance shall be performed in accordance with the current environmental legislation.

e) Lateral Drains

The cost of installing and maintaining private service connections, private tile outlets into the Drain or quarried rock protection at surface swale inlets or tile outlets is the responsibility of the landowner for which said works were provided.

All of which is respectfully submitted,

RC SPENCER ASSOCIATES INC.
CONSULTING ENGINEERS
261 SHEPHERD STREET EAST
WINDSOR, ONTARIO
N8X 2K6

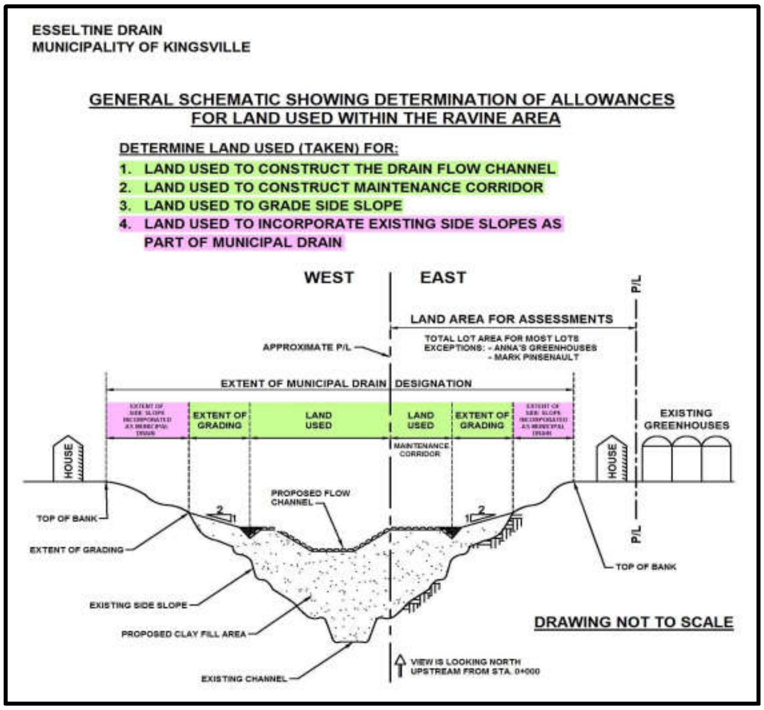
REGISTERED PROFESSIONAL ENGINEER
L. ZARLENGA
PROVINCE OF ONTARIO

L. Zarlenga

Lou Zarlenga, P.Eng.

ESSELTINE DRAIN
CHART 1 - SUMMARY OF ALLOWANCES

CHART 2 - ALLOWANCES FOR LAND USED TO CONSTRUCT FLOW CHANNEL AND MAINTENANCE CORRIDOR STATIONS 0+000 TO 0+520	$48,144.00
CHART 3 - ALLOWANCES FOR UNDISTURBED LAND USED BEING INCORPORATED AS PART OF THE MUNICIPAL DRAIN STATIONS 0+000 TO 0+520	$3,549.00
CHART 4 - ALLOWANCES FOR DAMAGES TO TREES IN THE RESIDENTIAL RAVINE AREA STATIONS 0+000 TO 0+520	$43,830.00
CHART 5 - ALLOWANCES FOR THE VALUE OF EXISTING NATURAL WATERCOURSE ABUTTING LANDOWNER'S PROPERTY STATIONS 0+000 TO 0+520	$9,660.00
CHART 6 - ALLOWANCES FOR LAND USED FOR CONSTRUCTION ACCESS AND MATERIAL STORAGE STATIONS 0+000 TO 0+520	$5,835.00
CHART 7 - ALLOWANCES FOR VALUE OF DRAINAGE WORKS PREVIOUSLY PERFORMED STATIONS 0+000 TO 0+520 (PLACEMENT OF ROCK FILL)	$9,440.00
CHART 8 - ALLOWANCES FOR LAND USED FOR FLOW CHANNEL AND SIDE SLOPE GRADING STATIONS 0+551 TO 2+387	$6,798.00
CHART 9 - ALLOWANCES FOR THE VALUE OF EXISTING NATURAL WATERCOURSE ABUTTING LANDOWNER'S PROPERTY STATIONS 0+551 TO 2+387	$3,220.00
CHART 10 - ALLOWANCES FOR LAND USED FOR TEMPORARY MATERIAL STORAGE STATIONS 0+551 TO 2+387	$734.00
TOTAL ALLOWANCES	$131,210.00



NOTE: STATIONING NOTED ABOVE REFERS TO THE DISTANCE IN METRES FROM THE DRAIN'S OUTLET INTO LAKE ERIE BEING STATION 0+000

17 June 2016
Project Reference: 14-425

ESSELTINE DRAIN

CHART 2 - ALLOWANCES FOR LAND USED IN RAVINE AREA FOR CONSTRUCTION OF CABLE CONCRETE FLOW CHANNEL AND MAINTENANCE CORRIDOR

STATIONS 0+000 TO 0+520

A) STATIONS 0+000 TO 0+520

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LAND AREA FOR ALLOWANCE (Ha)	ALLOWANCE RATE ($ / Ha)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
1	1504 Whitewood Rd	290-10100	RESIDENTIAL	1 E.D.	11	2.16	2.16	0.874	0.201	$40,360.00	0+000 to 0+167	JEAN-MARC JOSEPH & ISABELLA MARGARET PINSONNEAULT	**$ 8,112.00**
2	1506 Whitewood Rd	290-10000	RESIDENTIAL	1 E.D.	11	0.65	0.65	0.261	0.025	$40,360.00	0+167 to 0+185	STEVEN ROBERT MARCHAND & FELICIA RICO	**$ 1,009.00**
3	1508 Whitewood Rd	290-09900	RESIDENTIAL	1 E.D.	11	0.85	0.85	0.344	0.095	$40,360.00	0+185 to 0+257	DAVID WALTER & SUSAN LYNN ANNETTE WHITE	**$ 3,834.00**
4	1510 Whitewood Rd	290-09800	RESIDENTIAL	M19	7	0.98	0.98	0.398	0.034	$40,360.00	0+257 to 0+300	SCOTT ARNOLD SHILSON	**$ 1,372.00**
5	1512 Whitewood Rd	290-09700	RESIDENTIAL	M19	6	0.43	0.43	0.172	0.048	$40,360.00	0+310 to 0+333	DAVID ANDREW DANN	**$ 1,937.00**
6	1514 Whitewood Rd	290-09600	RESIDENTIAL	M19	5	0.42	0.42	0.168	0.064	$40,360.00	0+333 to 0+370	JIN ZHU	**$ 2,583.00**
7	1516 Whitewood Rd	290-09500	RESIDENTIAL	M19	4	0.51	0.51	0.207	0.064	$40,360.00	0+370 to 0+415	GEOFFREY BROOK GARDNER & JENNIFER ISOBEL FRASER	**$ 2,583.00**
8	1518 Whitewood Rd	290-09400	RESIDENTIAL	M19	3	0.40	0.40	0.160	0.039	$40,360.00	0+415 to 0+455	JONI LYNN BALTZER	**$ 1,574.00**
9	1520 Whitewood Rd	290-09300	RESIDENTIAL	M19	2	0.35	0.35	0.142	0.033	$40,360.00	0+455 to 0+490	JASON VERN & JENNIFER SUSAN SCOPE	**$ 1,332.00**
10	1522 Whitewood Rd	290-09200	RESIDENTIAL	M19	1	0.31	0.31	0.127	0.023	$40,360.00	0+490 to 0+520	LEO & KATHY PROBE	**$ 928.00**
11	1517 Brookview Dr	290-09100	RESIDENTIAL	1 E.D.	11	1.07	1.07	0.434	0.178	$40,360.00	0+235 to 0+345	CONNIE-JEAN LATAM	**$ 7,184.00**
12	1519 Brookview Dr	290-09000	RESIDENTIAL	1 E.D.	11	0.61	0.61	0.248	0.075	$40,360.00	0+345 to 0+390	DEBORAH LORI & EDMOND JULIEN ROLLIER	**$ 3,027.00**
13	1521 Brookview Dr	290-08900	RESIDENTIAL	1 E.D.	11	0.47	0.47	0.190	0.074	$40,360.00	0+390 to 0+428	GREGORY & VICKI CALCOTT	**$ 2,987.00**
14	1523 Brookview Dr	290-08800	RESIDENTIAL	1 E.D.	11	0.44	0.44	0.178	0.071	$40,360.00	0+428 to 0+453	JAMES ERNEST & SHIRLEY ANNE JENSEN	**$ 2,866.00**
15	Brookview Dr	290-08700	RESIDENTIAL	1 E.D.	11	0.37	0.37	0.150	0.066	$40,360.00	0+453 to 0+486	PHYLLIS MARIE HICKS	**$ 2,664.00**
16	1525 Brookview Dr	290-08600	RESIDENTIAL	1 E.D.	11	0.34	0.34	0.138	0.046	$40,360.00	0+486 to 0+520	RICHARD CLARE & PHYLLIS MARIE HICKS	**$ 1,857.00**
17	1875 County Rd 20	290-08401	AGRICULTURAL	1 E.D.	11	9.38	9.38	3.796	0.375	$6,120.00	0+000 to 0+230	(2462284 ONTARIO INC) ANNA'S GREENHOUSES	**$ 2,295.00**
Total Affected Lands							**19.74**	**7.987**				**Total Allowance**	**$ 48,144.00**

The "LAND AREA FOR ALLOWANCE" is made up of the following components:

1) Land used for construction of cable concrete flow channel

2) Land used for construction of cable concrete access and maintenance corridor

3) Land used for final grading and restoration

*Residential Nominal Allowance Rate of $40,360 per Hectare is determined as 15% of the Appraisal Value for Residential Property ($269,097 per Hectare)

*Agricultural Nominal Allowance Rate of $6,120 per Hectare is determined as 15% of the Appraisal Value for Agricultural Property ($40,772 per Hectare)

17 June 2016
Project Reference: 14-425

ESSELTINE DRAIN
CHART 3 - ALLOWANCES FOR UNDISTURBED LAND USED ALONG UPPER PORTIONS OF EXISTING SIDE SLOPES BEING INCORPORATED AS PART OF THE MUNICIPAL DRAIN IN RAVINE AREA
STATIONS 0+000 TO 0+520

A) STATIONS 0+000 TO 0+520

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LAND AREA FOR ALLOWANCE (Ha)	ALLOWANCE RATE ($ / Ha)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
1	1504 Whitewood Rd	290-10100	RESIDENTIAL	1 E.D.	11	2.16	2.16	0.874	0.275	$2,690.00	0+000 to 0+167	JEAN-MARC JOSEPH & ISABELLA MARGARET PINSONNEAULT	**$ 740.00**
2	1506 Whitewood Rd	290-10000	RESIDENTIAL	1 E.D.	11	0.65	0.65	0.261	0.054	$2,690.00	0+167 to 0+185	STEVEN ROBERT MARCHAND & FELICIA RICO	**$ 145.00**
3	1508 Whitewood Rd	290-09900	RESIDENTIAL	1 E.D.	11	0.85	0.85	0.344	0.111	$2,690.00	0+185 to 0+257	DAVID WALTER & SUSAN LYNN ANNETTE WHITE	**$ 299.00**
4	1510 Whitewood Rd	290-09800	RESIDENTIAL	M19	7	0.98	0.98	0.398	0.110	$2,690.00	0+257 to 0+300	SCOTT ARNOLD SHILSON	**$ 296.00**
5	1512 Whitewood Rd	290-09700	RESIDENTIAL	M19	6	0.43	0.43	0.172	0.019	$2,690.00	0+310 to 0+333	DAVID ANDREW DANN	**$ 51.00**
6	1514 Whitewood Rd	290-09600	RESIDENTIAL	M19	5	0.42	0.42	0.168	0.000	$2,690.00	0+333 to 0+370	JIN ZHU	**$ -**
7	1516 Whitewood Rd	290-09500	RESIDENTIAL	M19	4	0.51	0.51	0.207	0.000	$2,690.00	0+370 to 0+415	GEOFFREY BROOK GARDNER & JENNIFER ISOBEL FRASER	**$ -**
8	1518 Whitewood Rd	290-09400	RESIDENTIAL	M19	3	0.40	0.40	0.160	0.005	$2,690.00	0+415 to 0+455	JONI LYNN BALTZER	**$ 13.00**
9	1520 Whitewood Rd	290-09300	RESIDENTIAL	M19	2	0.35	0.35	0.142	0.010	$2,690.00	0+455 to 0+490	JASON VERN & JENNIFER SUSAN S COPE	**$ 27.00**
10	1522 Whitewood Rd	290-09200	RESIDENTIAL	M19	1	0.31	0.31	0.127	0.014	$2,690.00	0+490 to 0+520	LEO & KATHY PROBE	**$ 38.00**
11	1517 Brookview Dr	290-09100	RESIDENTIAL	1 E.D.	11	1.07	1.07	0.434	0.162	$2,690.00	0+235 to 0+345	CONNIE-JEAN LATAM	**$ 436.00**
12	1519 Brookview Dr	290-09000	RESIDENTIAL	1 E.D.	11	0.61	0.61	0.248	0.052	$2,690.00	0+345 to 0+390	DEBORAH LORI & EDMOND JULIEN ROLLIER	**$ 140.00**
13	1521 Brookview Dr	290-08900	RESIDENTIAL	1 E.D.	11	0.47	0.47	0.190	0.001	$2,690.00	0+390 to 0+428	GREGORY & VICKI CALCOTT	**$ 3.00**
14	1523 Brookview Dr	290-08800	RESIDENTIAL	1 E.D.	11	0.44	0.44	0.178	0.000	$2,690.00	0+428 to 0+453	JAMES ERNEST & SHIRLEY ANNE JENSEN	**$ -**
15	Brookview Dr	290-08700	RESIDENTIAL	1 E.D.	11	0.37	0.37	0.150	0.005	$2,690.00	0+453 to 0+486	PHYLLIS MARIE HICKS	**$ 13.00**
16	1525 Brookview Dr	290-08600	RESIDENTIAL	1 E.D.	11	0.34	0.34	0.138	0.001	$2,690.00	0+486 to 0+520	RICHARD CLARE & PHYLLIS MARIE HICKS	**$ 3.00**
17	1875 County Rd 20	290-08401	AGRICULTURAL	1 E.D.	11	9.38	9.38	3.796	0.500	$2,690.00	0+000 to 0+230	(2462284 ONTARIO INC) ANNA'S GREENHOUSES	**$ 1,345.00**
Total Affected Lands							**19.74**	**7.987**				**Total Allowance**	**$ 3,549.00**

The "LAND AREA FOR ALLOWANCE" is made up of the following components:

1) Undisturbed land situated along the top of bank and incorporated as part of the municipal drain

***Nominal Allowance Rate of $2,690 per Hectare is determined as 1% of the Appraisal Value for Residential Property ($269,097 per Hectare)**

17 June 2016
Project Reference: 14-425

ESSELTINE DRAIN
CHART 4 - ALLOWANCES FOR DAMAGES TO TREES IN RESIDENTIAL RAVINE AREA
STATIONS 0+000 TO 0+520

A) STATIONS 0+000 TO 0+520

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	UNPLANTED 50mm CALIPER TREES (Each)	UNPLANTED 70mm CALIPER TREES (Each)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
1	1504 Whitewood Rd	290-10100	RESIDENTIAL	1 E.D.	11	2.16	2.16	0.874	25	17	0+000 to 0+167	JEAN-MARC JOSEPH & ISABELLA MARGARET PINSONNEAULT	**$ 8,285.00**
2	1506 Whitewood Rd	290-10000	RESIDENTIAL	1 E.D.	11	0.65	0.65	0.261	7	3	0+167 to 0+185	STEVEN ROBERT MARCHAND & FELICIA RICO	**$ 1,915.00**
3	1508 Whitewood Rd	290-09900	RESIDENTIAL	1 E.D.	11	0.85	0.85	0.344	8	6	0+185 to 0+257	DAVID WALTER & SUSAN LYNN ANNETTE WHITE	**$ 2,780.00**
4	1510 Whitewood Rd	290-09800	RESIDENTIAL	M19	7	0.98	0.98	0.398	0	0	0+257 to 0+300	SCOTT ARNOLD SHILSON	**$ -**
5	1512 Whitewood Rd	290-09700	RESIDENTIAL	M19	6	0.43	0.43	0.172	2	6	0+310 to 0+333	DAVID ANDREW DANN	**$ 1,730.00**
6	1514 Whitewood Rd	290-09600	RESIDENTIAL	M19	5	0.42	0.42	0.168	0	0	0+333 to 0+370	JIN ZHU	**$ -**
7	1516 Whitewood Rd	290-09500	RESIDENTIAL	M19	4	0.51	0.51	0.207	2	2	0+370 to 0+415	GEOFFREY BROOK GARDNER & JENNIFER ISOBEL FRASER	**$ 810.00**
8	1518 Whitewood Rd	290-09400	RESIDENTIAL	M19	3	0.40	0.40	0.160	1	2	0+415 to 0+455	JONI LYNN BALTZER	**$ 635.00**
9	1520 Whitewood Rd	290-09300	RESIDENTIAL	M19	2	0.35	0.35	0.142	3	11	0+455 to 0+490	JASON VERN & JENNIFER SUSAN S COPE	**$ 3,055.00**
10	1522 Whitewood Rd	290-09200	RESIDENTIAL	M19	1	0.31	0.31	0.127	1	0	0+490 to 0+520	LEO & KATHY PROBE	**$ 175.00**
11	1517 Brookview Dr	290-09100	RESIDENTIAL	1 E.D.	11	1.07	1.07	0.434	21	18	0+235 to 0+345	CONNIE-JEAN LATAM	**$ 7,815.00**
12	1519 Brookview Dr	290-09000	RESIDENTIAL	1 E.D.	11	0.61	0.61	0.248	6	4	0+345 to 0+390	DEBORAH LORI & EDMOND JULIEN ROLLIER	**$ 1,970.00**
13	1521 Brookview Dr	290-08900	RESIDENTIAL	1 E.D.	11	0.47	0.47	0.190	7	4	0+390 to 0+428	GREGORY & VICKI CALCOTT	**$ 2,145.00**
14	1523 Brookview Dr	290-08800	RESIDENTIAL	1 E.D.	11	0.44	0.44	0.178	1	6	0+428 to 0+453	JAMES ERNEST & SHIRLEY ANNE JENSEN	**$ 1,555.00**
15	Brookview Dr	290-08700	RESIDENTIAL	1 E.D.	11	0.37	0.37	0.150	0	0	0+453 to 0+486	PHYLLIS MARIE HICKS	**$ -**
16	1525 Brookview Dr	290-08600	RESIDENTIAL	1 E.D.	11	0.34	0.34	0.138	2	9	0+486 to 0+520	RICHARD CLARE & PHYLLIS MARIE HICKS	**$ 2,420.00**
17	1875 County Rd 20	290-08401	AGRICULTURAL	1 E.D.	11	9.38	9.38	3.796	12	28	0+000 to 0+230	(2462284 ONTARIO INC) ANNA'S GREENHOUSES	**$ 8,540.00**
Total Affected Lands							**19.74**	**7.987**				**Total Allowance**	**$ 43,830.00**

There are a number of standardized processes for tree valuation which can be used in many circumstances whereby tree removal affects property value. When circumstances are not reflected by the standardized methods, the protocol recommends the use of professional judgement to obtain a fair and equitable compensation. For this site, the proposed construction activities are designed to ultimately protect property value through bank stabilization. As a result, we have developed a compensation plan unique to this site.

Affected trees have been categorized according to general condition and/or size. Dead trees or trees showing greater than 60% canopy decline that are in the construction zone were not considered in the evaluation. Trees less than 25cm diameter at breast height (DBH) were deemed Category 1 trees. Trees 25cm DBH and greater were deemed Category 2 trees.

The proposed compensation plan is to replace Category 1 trees with 50mm caliper, wire basket condition landscape trees at a 1:1 ratio and Category 2 trees with 70mm caliper, wire basket condition landscape trees at a ratio of 2:1. For example if eight Category 1 trees, and thirteen Category 2 trees are being removed the calculated number of replacement trees will be eight 50mm cal. and twenty-six 70mm cal. trees for a total of 34 trees.

Trees will be planted on a 7.5m X 7.5m grid which equals 56.25m2 required per tree. Not all properties will have enough space to plant the allotted number of replacement trees. Continuing the above example, if the area of property impacted is 1000m2 and after construction of the new drain only 900m2 are available for planting, only 16 trees can be planted due to space requirements. There are then 18 trees remaining which cannot be planted. In this case the monetary value of the remaining trees will be paid out, less installation costs.

*Allowance Rate of $175 per Unplanted 50mm Caliper Tree and $230 per Unplanted 70mm Caliper Tree is calculated based on M. Putzer Hornby Nursery Ltd. 2015 Price List
*Please refer to "Appendix I: BioLogic Letter - Esseltine Residential Tree Evaluation Program" for further clarification
*Tree Evaluation Prepared by *Biologic Incorporated - Aquatic and Terrestrial Ecosystem Planners*

17 June 2016
Project Reference: 14-425

ESSELTINE DRAIN
CHART 5 - ALLOWANCES FOR THE VALUE OF EXISTING NATURAL WATERCOURSE ABUTTING LANDOWNER'S PROPERTY
STATIONS 0+000 TO 0+520

A) STATIONS 0+000 TO 0+520

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LENGTH FOR ALLOWANCE (L.M.)	ALLOWANCE RATE ($ / L.M.)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
1	1504 Whitewood Rd	290-10100	RESIDENTIAL	1 E.D.	11	2.16	2.16	0.874	167	$10.00	0+000 to 0+167	JEAN-MARC JOSEPH & ISABELLA MARGARET PINSONNEAULT	$ 1,670.00
2	1506 Whitewood Rd	290-10000	RESIDENTIAL	1 E.D.	11	0.65	0.65	0.261	18	$10.00	0+167 to 0+185	STEVEN ROBERT MARCHAND & FELICIA RICO	$ 180.00
3	1508 Whitewood Rd	290-09900	RESIDENTIAL	1 E.D.	11	0.85	0.85	0.344	57	$10.00	0+185 to 0+257	DAVID WALTER & SUSAN LYNN ANNETTE WHITE	$ 570.00
4	1510 Whitewood Rd	290-09800	RESIDENTIAL	M19	7	0.98	0.98	0.398	43	$10.00	0+257 to 0+300	SCOTT ARNOLD SHILSON	$ 430.00
5	1512 Whitewood Rd	290-09700	RESIDENTIAL	M19	6	0.43	0.43	0.172	23	$10.00	0+310 to 0+333	DAVID ANDREW DANN	$ 230.00
6	1514 Whitewood Rd	290-09600	RESIDENTIAL	M19	5	0.42	0.42	0.168	37	$10.00	0+333 to 0+370	JIN ZHU	$ 370.00
7	1516 Whitewood Rd	290-09500	RESIDENTIAL	M19	4	0.51	0.51	0.207	38	$10.00	0+370 to 0+415	GEOFFREY BROOK GARDNER & JENNIFER ISOBEL FRASER	$ 380.00
8	1518 Whitewood Rd	290-09400	RESIDENTIAL	M19	3	0.40	0.40	0.160	33	$10.00	0+415 to 0+455	JONI LYNN BALTZER	$ 330.00
9	1520 Whitewood Rd	290-09300	RESIDENTIAL	M19	2	0.35	0.35	0.142	35	$10.00	0+455 to 0+490	JASON VERN & JENNIFER SUSAN S COPE	$ 350.00
10	1522 Whitewood Rd	290-09200	RESIDENTIAL	M19	1	0.31	0.31	0.127	30	$10.00	0+490 to 0+520	LEO & KATHY PROBE	$ 300.00
11	1517 Brookview Dr	290-09100	RESIDENTIAL	1 E.D.	11	1.07	1.07	0.434	88	$10.00	0+235 to 0+345	CONNIE-JEAN LATAM	$ 880.00
12	1519 Brookview Dr	290-09000	RESIDENTIAL	1 E.D.	11	0.61	0.61	0.248	45	$10.00	0+345 to 0+390	DEBORAH LORI & EDMOND JULIEN ROLLIER	$ 450.00
13	1521 Brookview Dr	290-08900	RESIDENTIAL	1 E.D.	11	0.47	0.47	0.190	30	$10.00	0+390 to 0+428	GREGORY & VICKI CALCOTT	$ 300.00
14	1523 Brookview Dr	290-08800	RESIDENTIAL	1 E.D.	11	0.44	0.44	0.178	25	$10.00	0+428 to 0+453	JAMES ERNEST & SHIRLEY ANNE JENSEN	$ 250.00
15	Brookview Dr	290-08700	RESIDENTIAL	1 E.D.	11	0.37	0.37	0.150	33	$10.00	0+453 to 0+486	PHYLLIS MARIE HICKS	$ 330.00
16	1525 Brookview Dr	290-08600	RESIDENTIAL	1 E.D.	11	0.34	0.34	0.138	34	$10.00	0+486 to 0+520	RICHARD CLARE & PHYLLIS MARIE HICKS	$ 340.00
17	1875 County Rd 20	290-08401	AGRICULTURAL	1 E.D.	11	9.38	9.38	3.796	230	$10.00	0+000 to 0+230	(2462284 ONTARIO INC) ANNA'S GREENHOUSES	$ 2,300.00
Total Affected Lands							**19.74**	**7.987**				**Total Allowance**	**$ 9,660.00**

The "LENGTH FOR ALLOWANCE" is made up of the following components:

1) Length of Existing Natural Watercourse abutting the Landowner's Property

*Allowance Rate of $10 per Lineal Metre per Property is determined as a Nominal Value for the Existing Natural Watercourse

Project Reference: 14-425

ESSELTINE DRAIN
CHART 6 - ALLOWANCES FOR LAND USED FOR CONSTRUCTION ACCESS AND MATERIAL STORAGE
STATIONS 0+000 TO 0+520

A) STATIONS 0+000 TO 0+520

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LAND AREA FOR ALLOWANCE (Ha)	ALLOWANCE RATE ($ / Ha)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
1	1504 Whitewood Rd	290-10100	RESIDENTIAL	1 E.D.	11	2.16	2.16	0.874	0.000		0+000 to 0+167	JEAN-MARC JOSEPH & ISABELLA MARGARET PINSONNEAULT	$ -
2	1506 Whitewood Rd	290-10000	RESIDENTIAL	1 E.D.	11	0.65	0.65	0.261	0.000		0+167 to 0+185	STEVEN ROBERT MARCHAND & FELICIA RICO	$ -
3	1508 Whitewood Rd	290-09900	RESIDENTIAL	1 E.D.	11	0.85	0.85	0.344	0.000		0+185 to 0+257	DAVID WALTER & SUSAN LYNN ANNETTE WHITE	$ -
4	1510 Whitewood Rd	290-09800	RESIDENTIAL	M19	7	0.98	0.98	0.398	0.018	$269,097.00	0+257 to 0+300	SCOTT ARNOLD SHILSON	$ **4,844.00**
5	1512 Whitewood Rd	290-09700	RESIDENTIAL	M19	6	0.43	0.43	0.172	0.000		0+310 to 0+333	DAVID ANDREW DANN	$ -
6	1514 Whitewood Rd	290-09600	RESIDENTIAL	M19	5	0.42	0.42	0.168	0.000		0+333 to 0+370	JIN ZHU	$ -
7	1516 Whitewood Rd	290-09500	RESIDENTIAL	M19	4	0.51	0.51	0.207	0.000		0+370 to 0+415	GEOFFREY BROOK GARDNER & JENNIFER ISOBEL FRASER	$ -
8	1518 Whitewood Rd	290-09400	RESIDENTIAL	M19	3	0.40	0.40	0.160	0.000		0+415 to 0+455	JONI LYNN BALTZER	$ -
9	1520 Whitewood Rd	290-09300	RESIDENTIAL	M19	2	0.35	0.35	0.142	0.000		0+455 to 0+490	JASON VERN & JENNIFER SUSAN S COPE	$ -
10	1522 Whitewood Rd	290-09200	RESIDENTIAL	M19	1	0.31	0.31	0.127	0.000		0+490 to 0+520	LEO & KATHY PROBE	$ -
11	1517 Brookview Dr	290-09100	RESIDENTIAL	1 E.D.	11	1.07	1.07	0.434	0.000		0+235 to 0+345	CONNIE-JEAN LATAM	$ -
12	1519 Brookview Dr	290-09000	RESIDENTIAL	1 E.D.	11	0.61	0.61	0.248	0.000		0+345 to 0+390	DEBORAH LORI & EDMOND JULIEN ROLLIER	$ -
13	1521 Brookview Dr	290-08900	RESIDENTIAL	1 E.D.	11	0.47	0.47	0.190	0.000		0+390 to 0+428	GREGORY & VICKI CALCOTT	$ -
14	1523 Brookview Dr	290-08800	RESIDENTIAL	1 E.D.	11	0.44	0.44	0.178	0.000		0+428 to 0+453	JAMES ERNEST & SHIRLEY ANNE JENSEN	$ -
15	Brookview Dr	290-08700	RESIDENTIAL	1 E.D.	11	0.37	0.37	0.150	0.000		0+453 to 0+486	PHYLLIS MARIE HICKS	$ -
16	1525 Brookview Dr	290-08600	RESIDENTIAL	1 E.D.	11	0.34	0.34	0.138	0.000		0+486 to 0+520	RICHARD CLARE & PHYLLIS MARIE HICKS	$ -
17	1875 County Rd 20	290-08401	AGRICULTURAL	1 E.D.	11	9.38	9.38	3.796	0.243	$4,080.00	0+000 to 0+230	(2462284 ONTARIO INC) ANNA'S GREENHOUSES	$ **991.00**
Total Affected Lands							**19.74**	**7.987**				**Total Allowance**	**$ 5,835.00**

The "LAND AREA FOR ALLOWANCE" is made up of the following components:

1) Land used for permanent access to the municipal drain

2) Land used for temporary access to the municipal drain

3) Land used for temporary materials storage during construction

***Allowance Rate for Permanent Use of Residential Land of $269,097 per Hectare is determined as 100% of the Appraisal Value for Residential Property ($269,097 per Hectare)**

***Nominal Allowance Rate for Temporary Use of Agricultural Land of $4,080 per Hectare is determined as 10% of the Appraisal Value for Agricultural Property ($40,772 per Hectare)**

17 June 2016
Project Reference: 14-425

ESSELTINE DRAIN
CHART 7 - ALLOWANCES FOR VALUE OF DRAINAGE WORKS PREVIOUSLY PERFORMED
STATIONS 0+000 TO 0+520

A) STATIONS 0+000 TO 0+520

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	VOLUME OF IMPORTED FILL (C.M.)	ALLOWANCE RATE ($ / C.M.)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
1	1504 Whitewood Rd	290-10100	RESIDENTIAL	1 E.D.	11	2.16	2.16	0.874			0+000 to 0+167	JEAN-MARC JOSEPH & ISABELLA MARGARET PINSONNEAULT	$ -
2	1506 Whitewood Rd	290-10000	RESIDENTIAL	1 E.D.	11	0.65	0.65	0.261			0+167 to 0+185	STEVEN ROBERT MARCHAND & FELICIA RICO	$ -
3	1508 Whitewood Rd	290-09900	RESIDENTIAL	1 E.D.	11	0.85	0.85	0.344			0+185 to 0+257	DAVID WALTER & SUSAN LYNN ANNETTE WHITE	$ -
4	1510 Whitewood Rd	290-09800	RESIDENTIAL	M19	7	0.98	0.98	0.398	472.0	$20.00	0+257 to 0+300	SCOTT ARNOLD SHILSON	$ **9,440.00**
5	1512 Whitewood Rd	290-09700	RESIDENTIAL	M19	6	0.43	0.43	0.172			0+310 to 0+333	DAVID ANDREW DANN	$ -
6	1514 Whitewood Rd	290-09600	RESIDENTIAL	M19	5	0.42	0.42	0.168			0+333 to 0+370	JIN ZHU	$ -
7	1516 Whitewood Rd	290-09500	RESIDENTIAL	M19	4	0.51	0.51	0.207			0+370 to 0+415	GEOFFREY BROOK GARDNER & JENNIFER ISOBEL FRASER	$ -
8	1518 Whitewood Rd	290-09400	RESIDENTIAL	M19	3	0.40	0.40	0.160			0+415 to 0+455	JONI LYNN BALTZER	$ -
9	1520 Whitewood Rd	290-09300	RESIDENTIAL	M19	2	0.35	0.35	0.142			0+455 to 0+490	JASON VERN & JENNIFER SUSAN S COPE	$ -
10	1522 Whitewood Rd	290-09200	RESIDENTIAL	M19	1	0.31	0.31	0.127			0+490 to 0+520	LEO & KATHY PROBE	$ -
11	1517 Brookview Dr	290-09100	RESIDENTIAL	1 E.D.	11	1.07	1.07	0.434			0+235 to 0+345	CONNIE-JEAN LATAM	$ -
12	1519 Brookview Dr	290-09000	RESIDENTIAL	1 E.D.	11	0.61	0.61	0.248			0+345 to 0+390	DEBORAH LORI & EDMOND JULIEN ROLLIER	$ -
13	1521 Brookview Dr	290-08900	RESIDENTIAL	1 E.D.	11	0.47	0.47	0.190			0+390 to 0+428	GREGORY & VICKI CALCOTT	$ -
14	1523 Brookview Dr	290-08800	RESIDENTIAL	1 E.D.	11	0.44	0.44	0.178			0+428 to 0+453	JAMES ERNEST & SHIRLEY ANNE JENSEN	$ -
15	Brookview Dr	290-08700	RESIDENTIAL	1 E.D.	11	0.37	0.37	0.150			0+453 to 0+486	PHYLLIS MARIE HICKS	$ -
16	1525 Brookview Dr	290-08600	RESIDENTIAL	1 E.D.	11	0.34	0.34	0.138			0+486 to 0+520	RICHARD CLARE & PHYLLIS MARIE HICKS	$ -
17	1875 County Rd 20	290-08401	AGRICULTURAL	1 E.D.	11	9.38	9.38	3.796			0+000 to 0+230	(2462284 ONTARIO INC) ANNA'S GREENHOUSES	$ -
Total Affected Lands							**19.74**	**7.987**				**Total Allowance**	**$ 9,440.00**

The "VOLUME OF IMPORTED FILL" is made up of the following components:

1) Volume of previously installed approved rock fill material from Station 0+257 to 0+300 in the existing natural watercourse

***Allowance Rate of $20.00 per Cubic Metre of Rock Fill is determined as the Same Rate as Imported Clay Fill ($20.00 per Cubic Metre)**

17 June 2016
Project Reference: 14-425

ESSELTINE DRAIN
CHART 8 - ALLOWANCES FOR LAND USED FOR FLOW CHANNEL AND SIDE SLOPE GRADING
STATIONS 0+551 TO 2+387 (SITUATED NORTH OF COUNTY ROAD 20)

B) STATIONS 0+551 TO 0+873

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LAND AREA FOR ALLOWANCE (Ha)	ALLOWANCE RATE ($ / Ha)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
18	1876 County Road 20	290-18200	AGRICULTURAL	1 E.D.	11	72.49	72.49	29.336	0.761	$6,120.00	0+551 to 1+100	MUCCI FARMS LTD	**$ 4,657.00**

C) STATIONS 0+873 TO 1+300

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LAND AREA FOR ALLOWANCE (Ha)	ALLOWANCE RATE ($ / Ha)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
19	1814 County Rd 20	290-17900	AGRICULTURAL	1 E.D.	11	32.20	32.20	13.031	0.060	$6,120.00	1+100 to 1+270	SOUTHSHORE GREENHOUSES INC	**$ 367.00**

D) STATIONS 1+300 TO 1+873

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LAND AREA FOR ALLOWANCE (Ha)	ALLOWANCE RATE ($ / Ha)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
20	Road 2 E	290-22333	AGRICULTURAL	12M585	25	2.01	2.01	0.813	0.027	$6,120.00	1+827 to 1+873	DOMENICO MUCCI	**$ 165.00**
21	County Rd 34	290-22100	AGRICULTURAL	2 E.D.	11	42.44	42.44	17.175	0.036	$6,120.00	1+616 to 1+827	CRISTINA PORRONE	**$ 220.00**
22	1717 Road 2 E	290-38700	AGRICULTURAL	1 E.D.	10 & 11	47.78	47.78	19.336	0.146	$6,120.00	1+100 to 1+605	MUCCI FARMS LTD	**$ 894.00**

E) STATIONS 1+873 TO 2+387

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LAND AREA FOR ALLOWANCE (Ha)	ALLOWANCE RATE ($ / Ha)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
23	Road 2 E	290-22334	AGRICULTURAL	12M585	26	0.30	0.30	0.120	0.061	$6,120.00	1+873 to 1+972	DOMENICO MUCCI	**$ 373.00**
24	County Rd 34	290-22309	AGRICULTURAL	2 E.D.	10	21.37	21.37	8.648	0.020	$6,120.00	1+972 to 2+380	DOMENICO MUCCI	**$ 122.00**

Total Allowance	**$ 6,798.00**

The "LAND AREA FOR ALLOWANCE" is made up of the following components:

1) Land used for construction of cable concrete flow channel

2) Land used for final grading of side slopes and restoration

***Agricultural Nominal Allowance Rate of $6,120 per Hectare is determined as 15% of the Appraisal Value for Agricultural Property ($40,772 per Hectare)**

17 June 2016
Project Reference: 14-425

ESSELTINE DRAIN
CHART 9 - ALLOWANCES FOR THE VALUE OF EXISTING NATURAL WATERCOURSE ABUTTING LANDOWNER'S PROPERTY
STATIONS 0+551 TO 2+387 (SITUATED NORTH OF COUNTY ROAD 20)

B) STATIONS 0+551 TO 0+873

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LENGTH FOR ALLOWANCE (L.M.)	ALLOWANCE RATE ($ / L.M.)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
18	1876 County Road 20	290-18200	AGRICULTURAL	1 E.D.	11	72.49	72.49	29.336	322	$10.00	0+551 to 1+100	MUCCI FARMS LTD	$ 3,220.00

C) STATIONS 0+873 TO 1+300

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LENGTH FOR ALLOWANCE (L.M.)	ALLOWANCE RATE ($ / L.M.)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
19	1814 County Rd 20	290-17900	AGRICULTURAL	1 E.D.	11	32.20	32.20	13.031	0	$10.00	1+100 to 1+270	SOUTHSHORE GREENHOUSES INC	$ -

D) STATIONS 1+300 TO 1+873

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LENGTH FOR ALLOWANCE (L.M.)	ALLOWANCE RATE ($ / L.M.)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
20	Road 2 E	290-22333	AGRICULTURAL	12M585	25	2.01	2.01	0.813	0	$10.00	1+827 to 1+873	DOMENICO MUCCI	$ -
21	County Rd 34	290-22100	AGRICULTURAL	2 E.D.	11	42.44	42.44	17.175	0	$10.00	1+616 to 1+827	CRISTINA PORRONE	$ -
22	1717 Road 2 E	290-38700	AGRICULTURAL	1 E.D.	10 & 11	47.78	47.78	19.336	0	$10.00	1+100 to 1+605	MUCCI FARMS LTD	$ -

E) STATIONS 1+873 TO 2+387

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LENGTH FOR ALLOWANCE (L.M.)	ALLOWANCE RATE ($ / L.M.)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
23	Road 2 E	290-22334	AGRICULTURAL	12M585	26	0.30	0.30	0.120	0	$10.00	1+873 to 1+972	DOMENICO MUCCI	$ -
24	County Rd 34	290-22309	AGRICULTURAL	2 E.D.	10	21.37	21.37	8.648	0	$10.00	1+972 to 2+380	DOMENICO MUCCI	$ -

Total Allowance	$ 3,220.00

The "LENGTH FOR ALLOWANCE" is made up of the following components:
1) Length of Existing Natural Watercourse abutting the Landowner's Property

*Allowance Rate of $10 per Lineal Metre per Property is determined as a Nominal Value for the Existing Natural Watercourse

17 June 2016
Project Reference: 14-425

ESSELTINE DRAIN

CHART 10 - ALLOWANCES FOR TEMPORARY LAND USED FOR MATERIAL STORAGE DURING CONSTRUCTION

STATIONS 0+551 TO 2+387 (SITUATED NORTH OF COUNTY ROAD 20)

B) STATIONS 0+551 TO 0+873

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LAND AREA FOR ALLOWANCE (Ha)	ALLOWANCE RATE ($ / Ha)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
18	1876 County Road 20	290-18200	AGRICULTURAL	1 E.D.	11	72.49	72.49	29.336	0.000	$4,080.00	0+551 to 1+100	MUCCI FARMS LTD	$ -

C) STATIONS 0+873 TO 1+300

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LAND AREA FOR ALLOWANCE (Ha)	ALLOWANCE RATE ($ / Ha)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
19	1814 County Rd 20	290-17900	AGRICULTURAL	1 E.D.	11	32.20	32.20	13.031	0.180	$4,080.00	1+100 to 1+270	SOUTHSHORE GREENHOUSES INC	$ 734.00

D) STATIONS 1+300 TO 1+873

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LAND AREA FOR ALLOWANCE (Ha)	ALLOWANCE RATE ($ / Ha)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
20	Road 2 E	290-22333	AGRICULTURAL	12M585	25	2.01	2.01	0.813	0.000	$4,080.00	1+827 to 1+873	DOMENICO MUCCI	$ -
21	County Rd 34	290-22100	AGRICULTURAL	2 E.D.	11	42.44	42.44	17.175	0.000	$4,080.00	1+616 to 1+827	CRISTINA PORRONE	$ -
22	1717 Road 2 E	290-38700	AGRICULTURAL	1 E.D.	10 & 11	47.78	47.78	19.336	0.000	$4,080.00	1+100 to 1+605	MUCCI FARMS LTD	$ -

E) STATIONS 1+873 TO 2+387

ENTRY NO.	ADDRESS	TAX ROLL NO.	LAND USE	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	LAND AREA FOR ALLOWANCE (Ha)	ALLOWANCE RATE ($ / Ha)	STATIONS	OWNERS NAME	VALUE OF ALLOWANCE
23	Road 2 E	290-22334	AGRICULTURAL	12M585	26	0.30	0.30	0.120	0.000	$4,080.00	1+873 to 1+972	DOMENICO MUCCI	$ -
24	County Rd 34	290-22309	AGRICULTURAL	2 E.D.	10	21.37	21.37	8.648	0.000	$4,080.00	1+972 to 2+380	DOMENICO MUCCI	$ -

Total Allowance	$ 734.00

The "LAND AREA FOR ALLOWANCE" is made up of the following components:
1) Land used for temporary materials storage during construction

***Nominal Allowance Rate for Temporary Use of Agricultural Land of $4,080 per Hectare is determined as 10% of the Appraisal Value for Agricultural Property ($40,772 per Hectare)**

17 June 2016
Project Reference: 14-425

DETAILS OF SPECIAL BENEFIT

ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

TAX ROLL NO.	LANDOWNER(S)	ITEM DESCRIPTION	ESTIMATED COST	VALUE OF ENGINEERING	SPECIAL BENEFIT
290-10100	JEAN-MARC JOSEPH & ISABELLA MARGARET PINSONNEAULT	Station 0+120 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**
290-10000	STEVEN ROBERT MARCHAND & FELICIA RICO	Station 0+175 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**
290-09900	DAVID WALTER & SUSAN LYNN ANNETTE WHITE	Station 0+205 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**
290-08401	2462284 ONTARIO INC	Station 0+210 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	$500.00
		Station 0+220 - Supply and install new 1500mm diameter concrete manhole and approximately 8.5 metres of 750mm diameter DuroMaxx outlet pipe.	$18,000.00	$2,700.00	$20,700.00
			$18,500.00	$2,700.00	**$21,200.00**
290-09100	CONNIE-JEAN LATAM	Station 0+265 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**
290-09800	SCOTT ARNOLD SHILSON	Station 0+270 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**
290-09700	DAVID ANDREW DANN	Station 0+320 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**
290-09600	JIN ZHU	Station 0+350 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**
290-09000	DEBORAH LORI & EDMOND JULIEN ROLLIER	Station 0+365 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**
290-09500	GEOFFREY BROOK GARDNER & JENNIFER ISOBEL FRASER	Station 0+400 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**

DETAILS OF SPECIAL BENEFIT

ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

TAX ROLL NO.	LANDOWNER(S)	ITEM DESCRIPTION	ESTIMATED COST	VALUE OF ENGINEERING	SPECIAL BENEFIT
290-08900	GREGORY & VICKI CALCOTT	Station 0+410 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**
290-09400	JONI LYNN BALTZER	Station 0+435 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**
290-08800	JAMES ERNEST & SHIRLEY ANNE JENSEN	Station 0+440 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**
290-09300	JASON VERN & JENNIFER SUSAN S COPE	Station 0+470 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**
290-08700	PHYLLIS MARIE HICKS	Station 0+475 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**
290-08600	RICHARD CLARE & PHYLLIS MARIE HICKS	Station 0+495 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**
290-09200	LEO & KATHY PROBE	Station 0+500 - Supply and install 40.0 metres of 150mm diameter PVC pipe for private rainwater drain connection.	$500.00	$0.00	**$500.00**
290-17900	SOUTHSHORE GREENHOUSES INC	Station 0+635 - Supply and Install approximately 20 metres of 600mm diameter pipe for existing Mastronardi Branch of the Esseltine Drain.	$7,000.00	$1,000.00	**$8,000.00**
290-18200	MUCCI FARMS LTD	Station 0+923 - Supply and place quarried rock slope protection at 600mm diameter outlet pipe from Mucci Farms pond.	$1,000.00	$0.00	$1,000.00
		Stations 1+000 to 1+050 - Haul existing trash along east bank off-site to a disposal site arranged for by the Contractor.	$5,000.00	$0.00	$5,000.00
			$6,000.00	$0.00	**$6,000.00**

DETAILS OF SPECIAL BENEFIT

ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

TAX ROLL NO.	LANDOWNER(S)	ITEM DESCRIPTION	ESTIMATED COST	VALUE OF ENGINEERING	SPECIAL BENEFIT
290-22100	CRISTINA PORRONE	Station 1+726 - Supply and install 76 metres of 1600 mm diameter Hel-Cor corrugated steel pipe including precast concrete block headwalls for new residential road culvert.	$85,600.00	$12,800.00	**$98,400.00**
290-22309	DOMENICO MUCCI	Station 2+116 - Supply and install 44 metres of 1400 mm diameter Hel-Cor corrugated steel pipe including precast concrete block headwalls for new residential road culvert.	$56,450.00	$8,450.00	**$64,900.00**

CONSTRUCTION ITEMS FOR THE ESSELTINE DRAIN

Part "A" Natural Watercourse South of County Road 20, Stations 0+000 to 0+520

1. Establish permanent access to the site using Scott Shilson lands at Station 0+280

a) Topsoil stripping as required, being approximately 35 cubic metres.

Complete at Lump Sum ***$ 400.00***

b) Spade and relocate existing ornamental trees at a location specified by the landowner.

Approximately 3 trees at $250.00 each ***$ 750.00***

c) Supply labour and equipment to excavate for and dispose of surplus native material required for access excavation, being approximately 150 cubic metres.

Complete at Lump Sum ***$ 4,500.00***

d) Supply and place 100mm of asphalt on 450mm thick granular 'A' for 3.0m wide access from Whitewood Road to ravine limit (approximately 30 lineal metres), being approximately 23 tonnes of asphalt and 110 tonnes of granular 'A'.

Complete at Lump Sum ***$ 8,000.00***

e) Supply and place 100mm of asphalt on 300mm thick granular 'A' on 300mm thick granular 'B' Type II for 3.0m wide access from ravine limit to Esseltine Drain (approximately 45 lineal metres), being approximately 34 tonnes of asphalt, 110 tonnes of granular 'A' and 110 tonnes of granular 'B' Type II.

Complete at Lump Sum ***$ 13,600.00***

f) Upon completion, remove existing asphalt and supply and place 100mm of asphalt over existing granular base, being approximately 57 tonnes of asphalt.

Complete at Lump Sum ***$ 12,500.00***

g) Use topsoil from stockpile to provide topsoil and seed restoration as required.

Complete at Lump Sum ***$ 300.00***

Total for Item 1 - Permanent Access at Station 0+280 **$ 40,050.00**

2. Hydro One to relocate the existing hydro pole located in the proposed access corridor at Station 0+280. All costs associated with the removal and relocation of the hydro pole to be paid by Hydro One pursuant to Section 26 of the Drainage Act.

Complete at Lump Sum **$ 5,000.00**

3. Establish temporary access to site using Anna's Flowers lands, Station 0+050 to 0+150. Provide, place and compact clay at southwest end of greenhouse in ravine area at approximately Station 0+050 to 0+150 to provide descending access to work area.

Approximately 3000 cubic metres at $20.00 per cubic metre **$ 60,000.00**

4. Establish access to site by providing the Maintenance Corridor, Station 0+000 to 0+520. Strip, salvage topsoil (if material is suitable) and grade the clay level for the temporary 5.0 metre wide access corridor along the east top of bank (as shown on Sheet 45) to allow for truck access during construction, approximately 520 lineal metres.

Complete at Lump Sum **$ 18,000.00**

5. Supply and install permanent lockable lift bar and "DO NOT ENTER PRIVATE PROPERTY" sign as a barricade for site access points.

3 lift bars and signs at $1,500.00 per location **$ 4,500.00**

6. Close cut clearing (stump remains) required from Stations 0+000 to 0+520

a) Removal and disposal of deadfalls, dead trees, being anything broken, lying down on ground, along bottom and banks of the drain as required.

Complete at Lump Sum ***$ 15,000.00***

b) Close cut removal of selected trees. Contractor shall meet with the Land Owner, if the Land Owner would like to salvage the timber, the Contractor shall cut the tree into 16" sections and store on the Landowner's property. Otherwise, the Contractor shall dispose of the tree off-site. Tree Mulch from tree removal to be disposed of off-site. Contractor shall conduct his operations in conjunction with the Tree Evaluation Program with regards to tree removal recommendations.

i) less than 250mm diameter

Approximately 111 trees at $200.00 each ***$ 22,200.00***

ii) greater than 250mm diameter

Approximately 117 trees at $300.00 each ***$ 35,100.00***

c) Provide protection for Tulip Trees as required and maintain construction access around tree.

Approximately 5 trees at $250.00 each ***$ 1,250.00***

d) Provide protection for Kentucky Coffee Tree at approximately Station 0+375 and maintain construction access around tree.

Approximately 1 trees at $500.00 each ***$ 500.00***

Total for Item 6 - Tree Removal and Protection **$ 74,050.00**

7. Supply and install replacement trees in conjunction with the Tree Evaluation Program with regards to species composition.

a) 50mm caliper, wire basket condition landscape tree

Approximately 65 trees at $350.00 each	***$ 22,750.00***	

b) 70mm caliper, wire basket condition landscape tree

Approximately 72 trees at $460.00 each	***$ 33,120.00***	
Total for Item 7 - Tree Replacement		**$ 55,870.00**

8. Excavate, remove and salvage existing precast concrete headwall blocks (approximately 30) at Station 0+230. Contractor to haul concrete blocks to Station 0+000 to be used as shore protection.

Complete at Lump Sum		**$ 2,000.00**

9. Supply and install new manhole and outlet at Station 0+220 (east bank):

a) 1500mm diameter manhole concrete structure connected to active outlet pipes, approximately 4.3m high, flat top with MSU Type M Aluminum Access Hatch. Price to include cutting existing pipes and excavation of soil material to accommodate concrete structure.

Complete at Lump Sum	***$ 13,000.00***	

b) Supply and install approximately 8.5m of new 750mm diameter DuroMaxx outlet pipe.

Complete at Lump Sum	***$ 5,000.00***	
Total for Item 9 - Outlet Structure at Station 0+220		**$ 18,000.00**

10. Supply and install new 3000mm x 2400mm concrete box culvert with south end at Station 0+280 as per details on Sheet 46:

a) Remove and dispose of existing Tulip Tree root ball.

Complete at Lump Sum	***$ 1,000.00***	

b) Supply to site 10 metres of 3000mm x 2400mm Precast Concrete Box Culvert. Contractor must request a modified design to account for the cover less than 0.6m. Precast unit and modified design by M CON Products Inc. or approved equivalent.

Complete at Lump Sum	***$ 50,000.00***	

c) Supply to site 750 x 750 x 1500mm precast concrete blocks for headwall including bench block at top course to create a curb as shown on detail drawings. Price to include 150mm thick 3/4" clear stone bedding. Precast concrete blocks by Underground Specialties or approved equivalent.

Complete at Lump Sum	***$ 14,400.00***	

d) Supply labour and equipment to excavate for and install specified box culvert sections and headwalls including all drain excavation, disposal of surplus material and all drain bank and road restoration and bank seeding & mulching.

Complete at Lump Sum ***$ 29,235.00***

e) Supply and place approximately 240 cubic metres of imported clay fill for abutment walls as shown on the detail drawings.

Complete at Lump Sum ***$ 1,200.00***

f) Supply and install all granular 'B' Type II material for bedding and backfill to road sub-grade, being approximately 300 tonnes.

Complete at Lump Sum ***$ 5,000.00***

g) Supply and install all granular 'A' material for road base up to the height of the curb, being approximately 70 tonnes.

Complete at Lump Sum ***$ 1,500.00***

h) Supply and install approximately 41 square metres of Waterproofing Membrane (Per OPSD 3370.100) and Protection Board to cover the top of the entire culvert and wrap over 0.3m onto the east and west side of the box culvert.

Complete at Lump Sum ***$ 2,665.00***

i) Supply and install approximately 96 metres of guide rail system using steel beam and wooden post assembly (Per OPSD 912.140) including steel base plates (Per OPSD 912.105) anchored to the culvert (watertight) as shown on detail drawings.

Complete at Lump Sum ***$ 15,500.00***

Total for Item 10 - Precast Concrete Access Culvert **$ 120,500.00**

11. Supply and install water control pipe Station 0+000 to 0+500, approximately 500 metres of 600mm diameter Boss 2000 pipe for low-flow water control during construction. Price to include 3/4" clear stone bedding, Terrafix 270R filter fabric surrounding bedding excavation and preliminary access as required.

Approximately 500 metres at $270.00 per metre **$ 135,000.00**

12. Supply and install 1200mm diameter concrete manhole structure at Station 0+500 equipped with frame and grate cover (temporary) installed at the existing bottom of drain. Price to include connection to the 600mm diameter HDPE water control pipe. When the drain is filled with clay to final grade, the Contractor shall install proper manhole riser sections to finished grade and install watertight manhole frame and cover set flush with the cable concrete. Watertight frame and cover to be Lifespan System by Hamilton Kent or approved equivalent.

Complete at Lump Sum **$ 15,000.00**

13. Maintenance/diversion of existing Esseltine Drain water flows to allow for proper installation during all pipe installations and cable concrete installation.

Complete at Lump Sum **$ 100,000.00**

14. Excavate for, supply and install approximately 520 metres of 150mm diameter PVC SDR35 rigid perforated drainage pipe wrapped in filter fabric (Terrafix 270R or approved equal) directly beneath the invert of the cable concrete. Price to include a minimum 300mm x 300mm surrounding 3/4" clear stone bedding.

Approximately 520 metres at $20.00 per metre **$ 10,400.00**

15. Supply and install residential drain connections. Each being approximately 40 metres of 150mm diameter PVC pipe with wye and PVC riser at every property, connected to 600mm diameter low-flow water control pipe.

Approximately 17 at $500.00 each **$ 8,500.00**

16. Regrade side slopes accommodating the cable concrete, using a 650 John Deer

Approximate 250 hours at $80.00 per hour **$ 20,000.00**

17. Supply and Install cable concrete from Station 0+000 to 0+520

a) Supply and place CC45 cable concrete mat along drain bottom and maintenance corridor as per plans and cross sections including 3/8 to 3/4 inch (10 to 20mm) diameter crushed stone in the open area of the articulating concrete block system.

Approximately 11,900 square metre at $90.00 per square metre **$ 1,071,000.00**

b) Supply, place and compact clear stone levelling course under cable concrete in areas of minor sub-grade imperfections.

Approximately 200 tonnes at $15.00 per tonne **$ 3,000.00**

c) Supply and place 30MPa air entrained concrete to fill the open area of the articulating concrete block system at areas of high flow velocity as instructed by the Engineer.

Approximately 5 cubic metres at $400.00 per cubic metre **$ 2,000.00**

18. Supply and install outlet weir, including:

a) 750x750x1500mm Precast Interlocking Concrete Block Wall at Station 0+000 for outlet to Lake Erie.

Approximately 385 blocks at $250.00 per block **$ 96,250.00**

b) Supply and place CC70 cable concrete mat shoreline protection as per plans and cross sections including 3/8 to 3/4 inch (10 to 20mm) diameter crushed stone in the open area of the articulating concrete block system.

Approximately 655 square metres at $105.00 per square metre **$ 68,775.00**

19. Supply and install Model 88-DB1 Duckbill Earth Anchors by MPS Civil Products or approved equivalent including stainless steel wire rope.

Approximately 980 anchors at $40.00 each **$ 39,200.00**

20. Supply and install 'Golden U-Bolt' forged wire clips by Vanguard Steel Ltd. or an approved equivalent.

Approximately 7,200 clips at $0.50 each **$ 3,600.00**

21. Supply and place armour rock at outlet to Lake Erie including excavation. Minimum 2 tonnes per rock.

Approximately 1000 tonnes at $100.00 per tonne **$ 100,000.00**

22. County Road 20 concrete culvert outlet work:

a) Cut steel sheet pile to below concrete and remove and dispose of surplus. Bottom portion to remain undisturbed.

Complete at Lump Sum **$ 500.00**

b) Maintain and protect existing sewage chamber at 1525 Brookview during earth works in back yard. Utilize existing septic tank as pumping chamber during construction. Existing septic system including tank and distribution system is to be replaced at new elevation.

Complete at Lump Sum **$ 5,000.00**

c) Fill existing area along east bank at Richard Hick's property to elevations shown on cross sections and plans.

Approximately 360 cubic metres at $20.00 per cubic metre **$ 7,200.00**

d) Supply to site 750 x 750 x 1500mm precast concrete blocks immediately south of the culvert at Station 0+520 for 1.0m invert change as shown on detail drawings Sheet 39. Price to include 150mm thick 3/4" clear stone bedding. Precast concrete blocks by Underground Specialties or approved equivalent.

6 Blocks at $250.00 per block **$ 1,500.00**

23. Supply and place 100mm thick imported topsoil along both banks as required for restoration.

Approximately 600 cubic metres at $40.00 per cubic metre **$ 24,000.00**

24. Supply and place seeding and mulching to all topsoiled areas and disturbed areas along both banks and working areas as required.

Approximately 6000 square metres at $1.60 per square metre **$ 9,600.00**

25. Supply and install geotextile snake barrier fence with 1.5m above ground and 20cm entrenched using wood stakes.

Approximately 1040 metres at $10.00 per metre **$ 10,400.00**

26. Supply and install a sufficient length of "standard tile end" non-perforated plastic pipe extension with rodent grate for lateral tile drains. If existing lateral is plastic, utilize a plastic coupler in place of an adapter.

Approximately 5 extensions at $200.00 per extension **$ 1,000.00**

27. Miscellaneous

a) Supply, place and compact granular 'A' as required.

Approximately 500 tonnes at $20.00 per tonne **$ 10,000.00**

SUB-TOTAL CONSTRUCTION FOR PART "A"
NATURAL WATERCOURSE SOUTH OF C.R. 20
STATIONS 0+000 TO 0+520 **$ 2,139,895.00**

Part "B" Natural Watercourse North of County Road 20, Stations 0+542 to 0+873

1. Close cut clearing (stump remains) required for trees situated in earth cut or fill areas from Station 0+550 to 0+873

a) Brushing and removal and disposal of deadfalls, being anything broken, lying down on ground, along bottom and banks of the drain as required.

Complete at Lump Sum **$ 7,500.00**

b) Close cut removal of selected trees.

i) less than 250mm diameter

Approximately 20 trees at $200.00 each **$ 4,000.00**

ii) greater than 250mm diameter

Approximately 20 trees at $300.00 each **$ 6,000.00**

2. Supply and install 750 x 750 x 1500mm precast concrete block erosion protection wall from Station 0+550 to 0+650 on East side slope.

Approximately 134 blocks at $225.00 per unit **$ 30,150.00**

3. Supply and place CC45 cable concrete mat along drain corridor as per plans and cross sections from station 0+550 to 0+650 including 3/8 to 3/4 inch (10 to 20mm) diameter crushed stone in the open area of the articulating concrete block system.

Approximately 1250 square metres at $90.00 per square metre **$ 112,500.00**

4. Supply and install Model 88-DB1 Duckbill Earth Anchors by MPS Civil Products or approved equivalent including stainless steel wire rope.

Approximately 112 anchors at $40.00 each **$ 4,480.00**

5. Supply and install 'Golden U-Bolt' forged wire clips by Vanguard Steel Ltd. or an approved equivalent.

Approximately 800 clips at $0.50 each **$ 400.00**

6. Supply and Install 600mm diameter pipe at Station 0+635 for existing Mastronardi Branch of the Esseltine Drain, approximately 20m to cable concrete low flow channel.

Approximately 20 metres at $350.00 per metre **$ 7,000.00**

7. Supply and install geotextile snake barrier fence with 1.5m above ground and 20cm entrenched using wood stakes.

Approximately 662 metres at $10.00 per metre **$ 6,620.00**

8. Supply and place 100mm thick imported topsoil along both banks as required for restoration.

Approximately 800 cubic metres at $40.00 per cubic metre **$ 32,000.00**

9. Supply and place seeding and mulching to all topsoiled areas and disturbed areas along both banks and working areas as required.

Approximately 8000 square metres at $1.60 per square metre **$ 12,800.00**

10. Supply, place and compact clay fill in front yard and side yard area of Mun. No. 1838 County Road 20 and Mun. No. 1876 County Road 20 for Neil McTavish and Bert Mucci respectively, to create positive fall toward the Esseltine Drain top of bank, approximately 375 cubic metres. Price to include 100mm topsoil and seeding restoration as required.

Complete at Lump Sum **$ 10,000.00**

11. Supply and install a sufficient length of "standard tile end" non-perforated plastic pipe extension with rodent grate for lateral tile drains. If existing lateral is plastic, utilize a plastic coupler in place of an adapter.

Approximately 5 extensions at $200.00 per extension **$ 1,000.00**

SUB-TOTAL CONSTRUCTION FOR PART "B"
NATURAL WATERCOURSE NORTH OF C.R. 20
STATIONS 0+542 TO 0+873 **$ 234,450.00**

Part "C" South End of Existing Municipal Drain, Stations 0+873 to 1+600

1. Close cut clearing (stump remains) required from Station 0+873 to 1+600

a) Brushing and removal and disposal of deadfalls, being anything broken, lying down on ground, along bottom and banks of the drain as required.

Complete at Lump Sum **$ 10,000.00**

b) Close cut removal of selected trees.

i) less than 250mm diameter

Approximately 10 trees at $200.00 each **$ 2,000.00**

ii) greater than 250mm diameter

Approximately 10 trees at $300.00 each **$ 3,000.00**

2. Supply and place quarried rock protection (300mm thick) using 150mm-225mm diameter stone, over 600mm diameter outlet pipe from Mucci Farms pond at Station 0+923

Approximately 25 square metres at $40.00 per square metre **$ 1,000.00**

3. Excavate, remove and salvage for the owner the existing 1610 x 1950mm corrugated steel pipe at Station 1+107. Headwalls and footings to be excavated, removed and disposed of off-site. Steel pipe to be placed at the top of bank after removal for the owner.

Complete at Lump Sum **$ 1,000.00**

4 Supply and install geotextile snake barrier fence with 1.5m above ground and 20cm entrenched using wood stakes.

Approximately 1454 metres at $10.00 per metre **$ 14,540.00**

5 Supply and place 100mm thick imported topsoil along both banks as required for restoration.

Approximately 1000 cubic metres at $40.00 per cubic metre **$ 40,000.00**

6 Supply and place seeding and mulching to all topsoiled areas and disturbed areas along both banks and working areas as required.

Approximately 10,000 square metres at $1.60 per square metre **$ 16,000.00**

7 Haul existing trash along east bank from approximately Stations 1+000 to 1+050 off-site to a disposal site arranged for by the Contractor.

Complete at Lump Sum **$ 5,000.00**

8	Supply and install a sufficient length of "standard tile end" non-perforated plastic pipe extension with rodent grate for lateral tile drains. If existing lateral is plastic, utilize a plastic coupler in place of an adapter.	
	Approximately 5 extensions at $200.00 per extension	**$ 1,000.00**

SUB-TOTAL CONSTRUCTION FOR PART "C" **SOUTH END OF EXISTING MUNICIPAL DRAIN** **STATIONS 0+873 TO 1+600**	**$ 93,540.00**

Part "D" Municipal Drain South of County Road 34, Stations 1+600 to 2+387

1. Brushing and tree trimming as required to enable bank grading as shown on Contract Drawings from Station 1+600 to 2+387. Approximately 0.8 hectares.

Complete at Lump Sum **$ 5,000.00**

2. Supply and install new culvert for Porrone subdivision with the east end at Station 1+726:

a) Supply to site 76 metres of 1600 mm diameter Hel-Cor corrugated steel pipe 2.8 mm thick (12 gauge) wall thickness, aluminized steel Type II with 125 mm x 25 mm corrugations with rolled annular ends and required couplers.

Complete at Lump Sum ***$ 29,650.00***

b) Supply to site 600 x 600 x 1200mm precast concrete blocks and 600 x 150 x 1200mm precast concrete caps for headwall as shown on detail drawings. Price to include 150mm thick 3/4" clear stone bedding. Precast concrete blocks by Underground Specialties or approved equivalent.

Complete at Lump Sum ***$ 8,500.00***

c) Supply labour and equipment to excavate for and install specified pipe and headwall including all drain excavation, disposal of surplus material and all drain bank and road restoration and bank seeding & mulching.

Complete at Lump Sum ***$ 28,000.00***

d) Excavate approximately 150 cubic metres of imported clay fill and haul to fill area as shown on the detail drawings.

Complete at Lump Sum ***$ 1,000.00***

e) Supply and install all granular 'B' Type II material for bedding and backfill to road sub-grade, being approximately 750 tonnes.

Complete at Lump Sum ***$ 11,250.00***

f) Supply and install all granular 'A' material for road base up to finish road grade, being approximately 260 tonnes.

Complete at Lump Sum ***$ 5,200.00***

g) Supply and install a total of approximately 50 square metres of sloped quarried rock erosion protection (300mm thick) at east end of pipe including all excavation and disposal of surplus materials, and placement of geotextile non-woven filter fabric.

Complete at Lump Sum ***$ 2,000.00***

Total for Item 2 - Porrone Subdivision Culvert at Station 1+726 **$ 85,600.00**

3. Supply and install new culvert for Branco subdivision with south end at Station 2+116:

a) Supply to site 44 metres of 1400 mm diameter Hel-Cor corrugated steel pipe 2.8 mm thick (12 gauge) wall thickness, aluminized steel Type II with 125 mm x 25 mm corrugations with rolled annular ends and required couplers.

Complete at Lump Sum ***$ 15,200.00***

b) Supply to site 600 x 600 x 1200mm precast concrete blocks and 600 x 150 x 1200mm precast concrete caps for headwall as shown on detail drawings. Price to include 150mm thick 3/4" clear stone bedding. Precast concrete blocks by Underground Specialties or approved equivalent.

Complete at Lump Sum ***$ 14,500.00***

c) Supply labour and equipment to excavate for and install specified pipe and headwall including all drain excavation, disposal of surplus material and all drain bank and road restoration and bank seeding & mulching.

Complete at Lump Sum ***$ 17,750.00***

d) Excavate approximately 70 cubic metres of imported clay fill and haul to fill area as shown on the detail drawings.

Complete at Lump Sum ***$ 500.00***

e) Supply and install all granular 'B' Type II material for bedding and backfill to road sub-grade, being approximately 300 tonnes.

Complete at Lump Sum ***$ 4,500.00***

f) Supply and install all granular 'A' material for road base up to finish road grade, being approximately 200 tonnes.

Complete at Lump Sum ***$ 4,000.00***

Total for Item 3 - Branco Subdivision Culvert at Station 2+116 **$ 56,450.00**

4. Supply and install geotextile snake barrier fence with 1.5m above ground and 20cm entrenched using wood stakes.

Approximately 1574 metres at $10.00 per metre **$ 15,740.00**

5. Supply and place 100mm thick imported topsoil along both banks as required for restoration.

Approximately 500 cubic metres at $40.00 per cubic metre **$ 20,000.00**

6. Supply and place seeding and mulching to all topsoiled areas and disturbed areas along both banks and working areas as required.

Approximately 5000 square metres at $1.60 per square metre **$ 8,000.00**

7. Supply and install a sufficient length of "standard tile end" non-perforated plastic pipe extension with rodent grate for lateral tile drains. If existing lateral is plastic, utilize a plastic coupler in place of an adapter.

Approximately 2 extensions at $200.00 per extension	**$ 400.00**
SUB-TOTAL CONSTRUCTION FOR PART "D" MUNICIPAL DRAIN SOUTH OF C.R. 34 STATIONS 1+600 TO 2+387	**$ 191,190.00**

Part "E" Earthworks, Stations 0+000 to 2+387

1. Clearing and stripping of all existing deleterious material such as unsuitable topsoil material, wood chips, leaves and any other miscellaneous debris that is required prior to the excavation or placement of any clay earthworks including off-site disposal of debris.

Approximately 4,210 bank cubic metres at $10.00 per bank cubic metre **$ 42,100.00**

2. Excavation along banks and drain bottom to grades shown on profile and cross sections as required including hauling of suitable fill to a fill area and placing, compacting and grading this clay fill along drain bottom to grades shown on profile and cross sections. Contractor to note that static compaction equipment must be used for all compaction in the ravine area situated from Station 0+000 to 0+650. Vibratory compaction methods in this area will not be permitted.

Approximately 14,100 bank cubic metres at $10.00 per bank cubic metre **$ 141,000.00**

3. Supply, haul, place, compact and grade suitable imported clay fill material along drain bottom to grades shown on profile and cross sections. Contractor to note that static compaction equipment must be used for all compaction in the ravine area situated from Station 0+000 to 0+650. Vibratory compaction methods in this area will not be

Approximately 16,200 bank cubic metres at $20.00 per bank cubic metre **$ 324,000.00**

SUB-TOTAL CONSTRUCTION FOR PART "E"
EARTHWORKS, STATIONS 0+000 TO 2+387 **$ 507,100.00**

SUMMARY OF ABOVE SUB-TOTALS

Subtotal Construction for Part "A" (Stations 0+000 to 0+520)	$ 2,139,895.00
Subtotal Construction for Part "B" (Stations 0+542 to 0+873)	$ 234,450.00
Subtotal Construction for Part "C" (Stations 0+873 to 1+600)	$ 93,540.00
Subtotal Construction for Part "D" (Stations 1+600 to 2+387)	$ 191,190.00
Subtotal Construction for Part "E" (Stations 0+000 to 2+387)	$ 507,100.00
TOTAL CONSTRUCTION MAIN DRAIN PRICE (not including HST)	**$ 3,166,175.00**
Contingency Allowance	$ 250,000.00
Engineering Design Fees	$ 185,778.00
Contract Administration & Inspection Services (based on 6 months duration)	$ 150,000.00
Golder Associates Geotechnical Report	$ 41,795.00
BioLogic Inc. Environmental Report	$ 19,620.00
Replace Missing/Damaged Property Bars	$ 5,500.00
Total Allowances for Land Used	$ 65,060.00
Total Allowances for Damages to Trees	$ 43,830.00
Total Allowances for Value of Existing Drain	$ 22,320.00
TOTAL MAIN DRAIN PRICE (not including HST)	**$ 3,950,078.00**
1.76% H.S.T. Net Payable on Above	$ 69,521.00
TOTAL MAIN DRAIN COST (including HST)	**$ 4,019,599.00**
TOTAL RICHARD HICKS BRANCH DRAIN COST (including HST)	**$ 9,667.00**
TOTAL MUCCI-HICKS BRANCH DRAIN COST (including HST)	**$ 42,739.00**
TOTAL PROJECT COST (including HST)	**$ 4,072,005.00**

Our estimate of the total cost of this work, including all incidental expenses, is the sum of four million, seventy-two thousand, five dollars (**$4,072,005.00**) as per the above Construction Items for the Esseltine Drain.

We would recommend that the cost of this work be assessed against the lands and roads affected in accordance with the 3 accompanying Schedules of Assessment.

ESSELTINE DRAIN
SCHEDULE OF ASSESSMENT
MUNICIPALITY OF KINGSVILLE
PROJECT REFERENCE NUMBER 14-425

A) MUNICIPAL LANDS

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
1	ROAD 3 E				5.99	2.424	TOWN OF KINGSVILLE	$ -	$ 42,876.00	$ -	$ -	$ 42,876.00
2	COUNTY ROAD 45				3.47	1.404	COUNTY OF ESSEX	$ -	$ 24,838.00	$ -	$ -	$ 24,838.00
3	COUNTY ROAD 34				8.65	3.501	COUNTY OF ESSEX	$ 38,818.00	$ 57,789.00	$ -	$ -	$ 96,607.00
4	NEAL STREET				0.23	0.092	TOWN OF KINGSVILLE	$ -	$ 1,573.00	$ -	$ -	$ 1,573.00
5	ELGIN STREET				1.80	0.730	TOWN OF KINGSVILLE	$ -	$ 12,481.00	$ -	$ -	$ 12,481.00
6	LEE ROAD				0.52	0.210	TOWN OF KINGSVILLE	$ -	$ 3,714.00	$ -	$ -	$ 3,714.00
7	PEACH DRIVE				0.86	0.350	TOWN OF KINGSVILLE	$ -	$ 5,984.00	$ -	$ -	$ 5,984.00
8	WOOD FERN AVENUE				1.98	0.800	TOWN OF KINGSVILLE	$ -	$ 13,207.00	$ -	$ -	$ 13,207.00
9	WILLOW DRIVE				0.57	0.230	TOWN OF KINGSVILLE	$ -	$ 3,797.00	$ -	$ -	$ 3,797.00
10	PRINCE STREET				0.50	0.204	TOWN OF KINGSVILLE	$ -	$ 3,368.00	$ -	$ -	$ 3,368.00
11	QUEEN BOULEVARD				2.25	0.910	TOWN OF KINGSVILLE	$ -	$ 15,022.00	$ -	$ -	$ 15,022.00
12	REGENT STREET				1.53	0.620	TOWN OF KINGSVILLE	$ -	$ 10,235.00	$ -	$ -	$ 10,235.00
13	SERVICE ROAD				1.01	0.410	TOWN OF KINGSVILLE	$ -	$ 6,527.00	$ -	$ -	$ 6,527.00
14	FAIRLEA CRESCENT				1.06	0.430	TOWN OF KINGSVILLE	$ -	$ 6,845.00	$ -	$ -	$ 6,845.00
15	MAYFAIR STREET				0.91	0.370	TOWN OF KINGSVILLE	$ -	$ 5,890.00	$ -	$ -	$ 5,890.00
16	NEVAN COURT				0.23	0.094	TOWN OF KINGSVILLE	$ -	$ 1,496.00	$ -	$ -	$ 1,496.00
17	BRANCO DRIVE				0.72	0.290	TOWN OF KINGSVILLE	$ -	$ 4,445.00	$ -	$ -	$ 4,445.00
18	NOAH CRESCENT				0.72	0.290	TOWN OF KINGSVILLE	$ -	$ 4,616.00	$ -	$ -	$ 4,616.00
19	ROAD 2 EAST				3.67	1.485	TOWN OF KINGSVILLE	$ 16,469.00	$ 22,767.00	$ -	$ -	$ 39,236.00
20	COUNTY ROAD 20				3.55	1.437	COUNTY OF ESSEX	$ 15,931.00	$ 15,246.00	$ -	$ -	$ 31,177.00
21	GREENWOOD ROAD				1.30	0.526	TOWN OF KINGSVILLE	$ -	$ 4,963.00	$ -	$ -	$ 4,963.00
22	WHITEWOOD ROAD				1.05	0.425	TOWN OF KINGSVILLE	$ -	$ 4,008.00	$ -	$ -	$ 4,008.00
23	COTTONWOOD ROAD				0.50	0.202	TOWN OF KINGSVILLE	$ -	$ 1,909.00	$ -	$ -	$ 1,909.00
Total Affected Lands					**43.08**	**17.434**						
Total Assessment on Municipal Lands								**$ 71,218.00**	**$ 273,596.00**	**$ -**	**$ -**	**$ 344,814.00**

B) PRIVATELY OWNED - NON-AGRICULTURAL LANDS

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
24	440-04300	2 E.D.	9	12.57	**3.49**	1.412	STERLING ACRE FARMS LIMITED	$ -	$ 12,495.00	$ -	$ -	$ 12,495.00
25	340-05900	3 E.D.	10	65.78	**23.00**	9.308	SUN-BRITE CANNING LIMITED	$ -	$ 30,484.00	$ -	$ -	$ 30,484.00
26	340-01410	3 E.D.	PS1/2 lot 11	0.52	0.52	0.210	BENJEMIN KNELSEN	$ -	$ 1,861.00	$ -	$ -	$ 1,861.00
27	340-01405	3 E.D.	PS1/2 lot 11	1.25	1.25	0.506	KRISTOPHER JOHN KLASSEN & JENNIFER RUTH ELLWOOD	$ -	$ 4,474.00	$ -	$ -	$ 4,474.00
28	340-01000	3 E.D.	PS1/2 lot 11	0.71	0.71	0.287	ABRAM & HELENA FRIESEN	$ -	$ 2,541.00	$ -	$ -	$ 2,541.00
29	340-00900	3 E.D.	PS1/2 lot 11	0.36	0.36	0.146	SARA KLASSEN	$ -	$ 1,288.00	$ -	$ -	$ 1,288.00
30	340-00800	3 E.D.	PS1/2 lot 11		0.35	0.142	PETER & ELISABETH DYCK	$ -	$ 1,253.00	$ -	$ -	$ 1,253.00
31	340-00700	3 E.D.	PS1/2 lot 11	0.47	0.47	0.190	AGANETHA GIESBRECHT	$ -	$ 1,682.00	$ -	$ -	$ 1,682.00
32	340-00600	3 E.D.	PS1/2 lot 11		0.46	0.186	ANTONIA ALETTA EVERS	$ -	$ 1,646.00	$ -	$ -	$ 1,646.00
33	340-00500	3 E.D.	11	1.08	1.08	0.437	FAIRVIEW CEMETERY	$ -	$ 1,288.00	$ -	$ -	$ 1,288.00
34	300-32800			0.54	0.54	0.219	HARRY O'BRIEN	$ -	$ 1,933.00	$ -	$ -	$ 1,933.00
35	300-32701			0.61	0.61	0.247	JACOB FRIESEN	$ -	$ 2,183.00	$ -	$ -	$ 2,183.00
36	300-32700	2 E.D.	9		0.20	0.081	DONALD GARY & PAMELA NADINE ATKINSON	$ -	$ 716.00	$ -	$ -	$ 716.00
37	300-32601	2 E.D.	9	0.27	0.27	0.109	CHRISTINE ELIZABETH FRIDAY & ROBERT REES	$ -	$ 966.00	$ -	$ -	$ 966.00
38	300-32400	2 E.D.	9	0.23	0.23	0.093	ALFREDO DIMENNA	$ -	$ 2,317.00	$ -	$ -	$ 2,317.00
39	300-32102	2 E.D.	9	1.83	1.83	0.741	KENNETH HINCKS IN TRUST	$ -	$ 18,395.00	$ -	$ -	$ 18,395.00
40	300-32100	2 E.D.	9	14.85	14.85	6.010	2435895 ONTARIO LIMITED	$ -	$ 58,471.00	$ -	$ -	$ 58,471.00
41	300-31900	2 E.D.	9	0.40	0.40	0.162	CANADA POST CORPORATION	$ -	$ 1,432.00	$ -	$ -	$ 1,432.00
42	300-31800	2 E.D.	9	0.29	0.29	0.117	TRUDY ALICE WOOD	$ -	$ 1,038.00	$ -	$ -	$ 1,038.00
43	300-31700	2 E.D.	9	0.14	0.14	0.057	HENRY ENNS & ANETHA THIESSEN	$ -	$ 501.00	$ -	$ -	$ 501.00
44	300-31600	2 E.D.	9	0.44	0.44	0.178	RUTHVEN AUTO TOWING & REPAIRS LTD	$ -	$ 3,412.00	$ -	$ -	$ 3,412.00
45	300-31502	2 E.D.	9	0.07	0.07	0.028	THORBOURN WIGLE ESTATE	$ -	$ 83.00	$ -	$ -	$ 83.00
46	300-31501	2 E.D.	9	0.04	0.04	0.017	THORBOURN WIGLE ESTATE	$ -	$ 399.00	$ -	$ -	$ 399.00
47	300-31500	2 E.D.	9	0.34	0.34	0.138	TINA SALLOWS & ROGER PARENT	$ -	$ 3,245.00	$ -	$ -	$ 3,245.00
48	300-31400	183	PT LOT 9	0.25	0.25	0.101	ALAN EDWARD & IRENE MARIA FOX	$ -	$ 895.00	$ -	$ -	$ 895.00
49	300-31300	183	PT LOT 8		0.25	0.101	STEPHEN PATRICK & LESLIE ANN STEPHENSON	$ -	$ 895.00	$ -	$ -	$ 895.00
50	300-31205	183	PT LTS 8 & 9 CON 2	0.42	0.42	0.170	JOSEPH & LORI BERESH	$ -	$ 1,503.00	$ -	$ -	$ 1,503.00
51	300-31200	183	PT LTS 8 & 9 CON 2	0.39	0.39	0.158	JOHN RICHARD OLIVER & SHARON LOUISE PARENT	$ -	$ 1,396.00	$ -	$ -	$ 1,396.00
52	300-31100	M48	36		0.20	0.081	ALLAN JONATHAN & VIRGINIA ANN CAMPBELL	$ -	$ 692.00	$ -	$ -	$ 692.00
53	300-31000	M48	35		0.20	0.081	ERIC ALFRED & SUSANNE BERNADETTE TIESSEN	$ -	$ 692.00	$ -	$ -	$ 692.00

B) PRIVATELY OWNED - NON-AGRICULTURAL LANDS

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
54	300-30900	M48	34	0.21	0.21	0.085	MARY CLAIRE INGRATTA	$ -	$ 727.00	$ -	$ -	$ 727.00
55	300-30800	M48	33		0.21	0.085	BERNHARD ENNS & MARIA SCHROEDER	$ -	$ 727.00	$ -	$ -	$ 727.00
56	300-30700	M48	32	0.27	0.27	0.109	MARY-ELIZABETH SCHAUER	$ -	$ 934.00	$ -	$ -	$ 934.00
57	300-30600	M48	31	0.27	0.27	0.109	RAYMOND GORDON JR & GAIL CAROL ANN FOSTER	$ -	$ 934.00	$ -	$ -	$ 934.00
58	300-30500	M48	30	0.27	0.27	0.109	MANUEL & ERMILINDA FURTADO	$ -	$ 902.00	$ -	$ -	$ 902.00
59	300-30400	M48	29		0.21	0.085	JOHAN & SARA HILDEBRANDT	$ -	$ 701.00	$ -	$ -	$ 701.00
60	300-30300	M48	28		0.21	0.085	MARY ANN BECHARD	$ -	$ 701.00	$ -	$ -	$ 701.00
61	300-30200	M48	27	0.21	0.21	0.085	FRANK BRAUN & NELINORA KNELSEN GUENTHER	$ -	$ 701.00	$ -	$ -	$ 701.00
62	300-30100	M48	26		0.21	0.085	HEINRICH & SARA HILDEBRAND	$ -	$ 701.00	$ -	$ -	$ 701.00
63	300-30000	M48	25		0.17	0.069	JOSE MEDEIROS & MARIA INES FURTADO	$ -	$ 568.00	$ -	$ -	$ 568.00
64	300-29900	M48	24		0.18	0.073	HEINRICH & MARGARETHA FEHR	$ -	$ 601.00	$ -	$ -	$ 601.00
65	300-29700	M48	23		0.38	0.154	JOSE VITORINO & TERESA TAVARES MEDEIROS	$ -	$ 1,269.00	$ -	$ -	$ 1,269.00
66	300-29600	M48	22	0.38	0.38	0.154	S MAUREEN RYAN	$ -	$ 1,269.00	$ -	$ -	$ 1,269.00
67	300-29500	M48	21	0.38	0.38	0.154	JOHN & AGNES PEREIRA	$ -	$ 1,269.00	$ -	$ -	$ 1,269.00
68	300-29401	12M48	BLK H	0.02	0.02	0.008	KINGSVILLE TOWN	$ -	$ 21.00	$ -	$ -	$ 21.00
69	300-29400	M48	20		0.38	0.154	DAVID LINDSAY & JOANNE MILDRED GRAHAM	$ -	$ 1,224.00	$ -	$ -	$ 1,224.00
70	300-29329	M81	6	0.38	0.38	0.154	MARIA DOMENICA CAPUSSI & GIOVANNA DILAUDO	$ -	$ 1,224.00	$ -	$ -	$ 1,224.00
71	300-29328	M81	5	0.38	0.38	0.154	JOHN WALTER & BESSIE JANE UNRAU	$ -	$ 1,224.00	$ -	$ -	$ 1,224.00
72	300-29327	M81	4	0.38	0.38	0.154	VIRGILIO & MARIA PEREIRA	$ -	$ 1,224.00	$ -	$ -	$ 1,224.00
73	300-29326	M81	3	0.38	0.38	0.154	RANDY & MARY THIESSEN	$ -	$ 1,224.00	$ -	$ -	$ 1,224.00
74	300-29325	M81	2	0.38	0.38	0.154	ROBERTO FORTUNA & MARIA JESUS SILVA PIMENTEL	$ -	$ 1,179.00	$ -	$ -	$ 1,179.00
75	300-29324	M81	1		0.43	0.174	STANLEY ANGUS A & SHEILA MARLENE BALTZER	$ -	$ 1,334.00	$ -	$ -	$ 1,334.00
76	300-29323	M105	24		0.35	0.142	GARRY DOUGLAS & DONNA LYNN JOHNSON	$ -	$ 1,086.00	$ -	$ -	$ 1,086.00
77	300-29322	M105	23	0.30	0.30	0.121	ANGELA MARIE SCHNEKENBURGER	$ -	$ 931.00	$ -	$ -	$ 931.00
78	300-29321	M105	22	0.30	0.30	0.121	JOHN PAUL DOUGLAS & HELEN AFFLECK	$ -	$ 931.00	$ -	$ -	$ 931.00
79	300-29320	M105	21	0.30	0.30	0.121	ABRAHAM BICKER & SUSANA NEUDORF	$ -	$ 931.00	$ -	$ -	$ 931.00
80	300-29319	M105	20	0.30	0.30	0.121	NEIL FEHR & TRACY LEE REIMER	$ -	$ 931.00	$ -	$ -	$ 931.00
81	300-29318	M105	19	0.30	0.30	0.121	VINCENZO & SANTINA MARCOVECCHIO	$ -	$ 931.00	$ -	$ -	$ 931.00
82	300-29317	M105	18		0.30	0.121	JACOB & AGATHA SAWATZKY	$ -	$ 931.00	$ -	$ -	$ 931.00
83	300-29316	M105	17		0.31	0.125	ROGER DAVID RUSSELO	$ -	$ 999.00	$ -	$ -	$ 999.00

B) PRIVATELY OWNED - NON-AGRICULTURAL LANDS

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
84	300-29315	M105	16	0.24	0.24	0.097	JOHN S & BARBARA F BAKER	$ -	$ 773.00	$ -	$ -	$ 773.00
85	300-29314	M105	15	0.24	0.24	0.097	NICK & ROSINA TOTARO	$ -	$ 773.00	$ -	$ -	$ 773.00
86	300-29313	M105	14	0.24	0.24	0.097	JOSEPH & ODETTE PEREIRA	$ -	$ 773.00	$ -	$ -	$ 773.00
87	300-29312	M105	13	0.24	0.24	0.097	ISSAK & AMY NEUFELD	$ -	$ 773.00	$ -	$ -	$ 773.00
88	300-29311	M105	12		0.42	0.170	DARRELL J & JULIE A SCRATCH	$ -	$ 1,353.00	$ -	$ -	$ 1,353.00
89	300-29310	M105	11		0.41	0.166	PEDRO & MAGARETHA KNELSEN	$ -	$ 1,321.00	$ -	$ -	$ 1,321.00
90	300-29309	M105	10	0.22	0.22	0.089	RUDY & HELEN HEDY SPITSE	$ -	$ 709.00	$ -	$ -	$ 709.00
91	300-29308	M105	9 & Pt Lot 15		0.28	0.113	TODD & MARTHA JOAN JENNER	$ -	$ 902.00	$ -	$ -	$ 902.00
92	300-29307	M105	8		0.26	0.105	AARON & MARIA WALL	$ -	$ 837.00	$ -	$ -	$ 837.00
93	300-29306	M105	7	0.26	0.26	0.105	PETER & JUSTINA BERGEN	$ -	$ 837.00	$ -	$ -	$ 837.00
94	300-29305	M105	6	0.26	0.26	0.105	KIRSTYN LAUREL FARNSWORTH	$ -	$ 837.00	$ -	$ -	$ 837.00
95	300-29304	M105	5	0.26	0.26	0.105	FRANK ANTHONY QUATRINI	$ -	$ 837.00	$ -	$ -	$ 837.00
96	300-29303	M105	4		0.27	0.109	MARY MARGARET RUSSELO	$ -	$ 870.00	$ -	$ -	$ 870.00
97	300-29302	M105	3		0.32	0.130	DAVID ALAN & TAMMIE BARBARA MILLS	$ -	$ 1,031.00	$ -	$ -	$ 1,031.00
98	300-29301	M105	2		0.23	0.093	JACOB GOERTZEN & ANNA GIESBRECHT NEUFELD	$ -	$ 768.00	$ -	$ -	$ 768.00
99	300-29300	M105	1	0.23	0.23	0.093	PHILIP GERHARD & LYDIA LOUISE HAMM	$ -	$ 768.00	$ -	$ -	$ 768.00
100	300-29200	M48	19	0.23	0.23	0.093	TRACEY YOUNG	$ -	$ 768.00	$ -	$ -	$ 768.00
101	300-29100	M48	18	0.23	0.23	0.093	KENNETH ROSS & SUSAN ILENE COSFORD	$ -	$ 768.00	$ -	$ -	$ 768.00
102	300-29000	M48	17		0.23	0.093	GERARDO & ANNA NEUFELD	$ -	$ 768.00	$ -	$ -	$ 768.00
103	300-28900	M48	16	0.39	0.39	0.158	VICTOR MANUEL & MARIA NATALIA PEREIRA	$ -	$ 1,256.00	$ -	$ -	$ 1,256.00
104	300-28800	M48	Pt Lot 15		0.36	0.146	CAROLYN WENZLER	$ -	$ 1,160.00	$ -	$ -	$ 1,160.00
105	300-28700	M48	14	0.22	0.22	0.089	MAXIMINO SANTOS & MARIA OLYMPIA MATEUS	$ -	$ 735.00	$ -	$ -	$ 735.00
106	300-28600	M48	13	0.22	0.22	0.089	JOCHEM JOHANNES & JANNY GRIETA VANDENBERG	$ -	$ 735.00	$ -	$ -	$ 735.00
107	300-28500	M48	12	0.29	0.29	0.117	ARMANDO PALLOTTA	$ -	$ 969.00	$ -	$ -	$ 969.00
108	300-28400	M48	11	0.29	0.29	0.117	JUAN BOSCHMAN & ANNA FEHR	$ -	$ 969.00	$ -	$ -	$ 969.00
109	300-28300	M48	10	0.25	0.25	0.101	ABRAM KRAHN PENNER & MARIA DYCK	$ -	$ 865.00	$ -	$ -	$ 865.00
110	300-28200	M48	9	0.25	0.25	0.101	ISAAC HAMM & HELENA FEHR	$ -	$ 865.00	$ -	$ -	$ 865.00
111	300-28100	M48	8		0.25	0.101	DAVID CARL & ROSALINA CABRAL	$ -	$ 865.00	$ -	$ -	$ 865.00
112	300-28000	M48	7		0.22	0.089	JOHN & WILHELMINA VANDERBEEK	$ -	$ 761.00	$ -	$ -	$ 761.00
113	300-27900	M48	6		0.21	0.085	CHENG HUY & NGOP TAING	$ -	$ 727.00	$ -	$ -	$ 727.00

B) PRIVATELY OWNED - NON-AGRICULTURAL LANDS

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
114	300-27800	M48	5		0.21	0.085	RANDAL ERLE & NOREEN ANN NASH	$ -	$ 727.00	$ -	$ -	$ 727.00
115	300-27700	M48	4		0.21	0.085	HARRIS LOWELL BICKFORD & DIANE LOUISE MC KNIGHT	$ -	$ 727.00	$ -	$ -	$ 727.00
116	300-27600	M48	3		0.21	0.085	ANTONIO & CHARLYNN FAYE MARIE AGOSTA	$ -	$ 727.00	$ -	$ -	$ 727.00
117	300-27500	M48	2		0.22	0.089	JOE & CONNIE CACILHAS	$ -	$ 761.00	$ -	$ -	$ 761.00
118	300-27400	M48	1		0.23	0.093	GARY PATRICK & FERNANDA ARLETTA GILLIS	$ -	$ 796.00	$ -	$ -	$ 796.00
119	300-27300	183	PT LOT 4	0.31	0.31	0.125	GEOFFREY DOUGLAS & DEBRA LYNNE DUNMORE	$ -	$ 1,073.00	$ -	$ -	$ 1,073.00
120	300-27200	183	PT LOT 4	0.31	0.31	0.125	ROBERT ARTHUR SHORTT & DEBRA LYNNE DUNMORE	$ -	$ 1,073.00	$ -	$ -	$ 1,073.00
121	300-27100	183	PT LT 6 PT LT 7		0.34	0.138	DIEDRICH & SARA KNELSEN	$ -	$ 1,176.00	$ -	$ -	$ 1,176.00
122	300-27000	183	PT LOT 6 PT LOT 7	0.16	0.16	0.065	SARA KNELSEN	$ -	$ 554.00	$ -	$ -	$ 554.00
123	300-26900	183	PT LOT 7		0.21	0.085	ROGER OLIVER JR PARENT	$ -	$ 727.00	$ -	$ -	$ 727.00
124	300-26800	183	PT LOT 6 / 7	0.29	0.29	0.117	KAREN SUE BROWN	$ -	$ 1,003.00	$ -	$ -	$ 1,003.00
125	300-26700	183	PT LOT 4 / 5	0.31	0.31	0.125	PETER KLASSEN & JUSTINA QUIRING	$ -	$ 1,073.00	$ -	$ -	$ 1,073.00
126	300-26600	183	PT LOT 4	0.31	0.31	0.125	DONALD GREGORY & HEATHER ANN DUNMORE	$ -	$ 1,073.00	$ -	$ -	$ 1,073.00
127	300-26500	183	PT LOT 3		0.38	0.154	LARRY NEIL & ANN JOYCE DUNMORE	$ -	$ 1,315.00	$ -	$ -	$ 1,315.00
128	300-26400	183	PT LOT 3		0.06	0.024	AMANDA KATHLEEN GRAY	$ -	$ 208.00	$ -	$ -	$ 208.00
129	300-26300	183	PT LOT 3 W/S MAIN	0.17	0.17	0.069	PAUL WAYNE WIGLE & STACY LEE DESCHAMPS	$ -	$ 588.00	$ -	$ -	$ 588.00
130	300-26200	183	PT LOT 3	0.17	0.17	0.069	EVA STEIN	$ -	$ 588.00	$ -	$ -	$ 588.00
131	300-26100	183	PT LOT 3		0.16	0.065	MARVIN DAVID & HELENA KLASSEN	$ -	$ 554.00	$ -	$ -	$ 554.00
132	300-26000	2 E.D.	9		0.53	0.214	UNITED CHURCH OF CANADA	$ -	$ 1,222.00	$ -	$ -	$ 1,222.00
133	300-25900	183	PT LOT 1 / 2		0.10	0.040	UNITED CHURCH OF CANADA	$ -	$ 111.00	$ -	$ -	$ 111.00
134	300-25800	183	PT LOT 1 / 2	0.20	0.20	0.081	KELLY ANN BLAKE	$ -	$ 668.00	$ -	$ -	$ 668.00
135	300-25700	183	PT LOTS 1 & 2 W/S	0.28	0.28	0.113	MARCOVECCHIO CONSTRUCTION LTD	$ -	$ 935.00	$ -	$ -	$ 935.00
136	300-25600	183	PT LOT 2		0.19	0.077	MARCOVECCHIO CONSTRUCTION LTD	$ -	$ 635.00	$ -	$ -	$ 635.00
137	300-25500	183	PT LOT 1 / 2	0.22	0.22	0.089	MARCOVECCHIO HOLDINGS INC	$ -	$ 735.00	$ -	$ -	$ 735.00
138	300-25400	2 E.D.	9	0.37	0.37	0.150	ADAM JOSEPH WILHELM & MICHELLE LEE WARMENHOVEN	$ -	$ 1,236.00	$ -	$ -	$ 1,236.00
139	300-25300	2 E.D.	9	0.25	0.25	0.101	ROBERT STEPHEN & ROSE DALE HAINES	$ -	$ 835.00	$ -	$ -	$ 835.00
140	300-25202	2 E.D.	9	0.19	0.19	0.077	JACOB GIRARD & CHARLOTTE HILLIS	$ -	$ 612.00	$ -	$ -	$ 612.00
141	300-25200	2 E.D.	9	0.19	0.19	0.077	COREY WILLIAM & TAMMY MICHELLE LECLAIRE	$ -	$ 612.00	$ -	$ -	$ 612.00
142	300-25100	2 E.D.	9	0.19	0.19	0.077	ONT. ABORIGINAL HOUSING SUPPORT	$ -	$ 612.00	$ -	$ -	$ 612.00
143	300-25000	2 E.D.	9	0.19	0.19	0.077	MITSUJI YAMAMOTO	$ -	$ 612.00	$ -	$ -	$ 612.00

B) PRIVATELY OWNED - NON-AGRICULTURAL LANDS

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
144	300-24900	2 E.D.	9	0.19	0.19	0.077	JOHN REID & BARBARA ANN POTTER	$ -	$ 612.00	$ -	$ -	$ 612.00
145	300-24800	2 E.D.	9	0.19	0.19	0.077	BRIAN EDWIN & DIANE STOCKTON	$ -	$ 612.00	$ -	$ -	$ 612.00
146	300-24700	2 E.D.	9	0.19	0.19	0.077	DAVID ENNS & MARIA KNELSEN FRIESEN	$ -	$ 612.00	$ -	$ -	$ 612.00
147	300-24600	2 E.D.	9	0.19	0.19	0.077	ROBYN RAE LANGLOIS	$ -	$ 612.00	$ -	$ -	$ 612.00
148	300-24500	2 E.D.	9		0.28	0.113	ROSEMARY & JOHN V PEDERSEN	$ -	$ 869.00	$ -	$ -	$ 869.00
149	300-24400	2 E.D.	9		0.28	0.113	ABRAM & ANNA GIESBRECHT	$ -	$ 869.00	$ -	$ -	$ 869.00
150	300-00030	2 E.D.	9	2.50	**0.89**	0.360	CONSERVATION AUTHORITY ESSEX	$ -	$ 2,134.00	$ -	$ -	$ 2,134.00
151	290-38800	1 E.D.	10	1.20	1.20	0.486	CAROL ANNE & CATHY LYNN HARRISON	$ -	$ 3,579.00	$ -	$ -	$ 3,579.00
152	290-38706	1 E.D.	10	0.88	0.88	0.356	MICHELE DI VINCENZO & MICHELLE HILL	$ -	$ 2,625.00	$ -	$ -	$ 2,625.00
153	290-38705	1 E.D.	10	0.88	0.88	0.356	CHRISTOPHER KENNETH & MICHELLE RAE WEBSTER	$ -	$ 2,625.00	$ -	$ -	$ 2,625.00
154	290-38704	1 E.D.	10	0.87	0.87	0.352	VICTOR MANUEL & MARIA NATALIA PEREIRA	$ -	$ 2,595.00	$ -	$ -	$ 2,595.00
155	290-38703	1 E.D.	10	0.88	0.88	0.356	MARIA CONCEICOA & SILVESTRE FREITAS GONTARDE	$ -	$ 2,625.00	$ -	$ -	$ 2,625.00
156	290-38702	1 E.D.	10	0.87	0.87	0.352	TONINO INGRATTA	$ -	$ 2,595.00	$ -	$ -	$ 2,595.00
157	290-38701	1 E.D.	10	1.59	1.59	0.643	PETER & MARGARETHA NEUFELD	$ -	$ 4,742.00	$ -	$ -	$ 4,742.00
158	290-38650	2 E.D.	10	0.24	0.24	0.097	STEVEN RONALD & VIKTORIA ANDREEVNA BARTEL	$ -	$ 744.00	$ -	$ -	$ 744.00
159	290-38630	2 E.D.	10	0.25	0.25	0.101	MARK HAROLD & MARIANNE HOTZ WISTERNOFF	$ -	$ 775.00	$ -	$ -	$ 775.00
160	290-38620	2 E.D.	10	0.25	0.25	0.101	HEINRICH KROEKER & SUSANA FRIESSEN	$ -	$ 775.00	$ -	$ -	$ 775.00
161	290-38610	2 E.D.	10	0.22	0.22	0.089	PETER & HELEN ELAINE STRAVATO	$ -	$ 682.00	$ -	$ -	$ 682.00
162	290-38600	2 E.D.	10	0.22	0.22	0.089	JOHAN & HELENA FEHR	$ -	$ 682.00	$ -	$ -	$ 682.00
163	290-38500	1601	21		0.91	0.368	BENJAMIN WIEBE & TINA FRIESEN REDECOP	$ -	$ 2,823.00	$ -	$ -	$ 2,823.00
164	290-38400	1601	22	0.18	0.18	0.073	DAVID WALL & ELIZABETH FRIESEN BRAUN	$ -	$ 558.00	$ -	$ -	$ 558.00
165	290-38300	1601	23	0.18	0.18	0.073	DAVID WALL & ELIZABETH FRIESEN BRAUN	$ -	$ 558.00	$ -	$ -	$ 558.00
166	290-38200	1601	24	0.18	0.18	0.073	DAVID LOPEZ & JILL ANNETTE GEDDES	$ -	$ 580.00	$ -	$ -	$ 580.00
167	290-38100	1601	25	0.18	0.18	0.073	CARLOS SANTOS	$ -	$ 580.00	$ -	$ -	$ 580.00
168	290-38000	1601	26		0.18	0.073	TONINO & GLORIA ELLEN DI MENNA	$ -	$ 580.00	$ -	$ -	$ 580.00
169	290-37900	1601	27		0.18	0.073	AARON & MARGARETA WALL NEUFELD	$ -	$ 580.00	$ -	$ -	$ 580.00
170	290-37800	1601	28		0.18	0.073	ABRAM NEUSTAETER FRIESSEN & HELENA HIEBERT BOSCHMAN	$ -	$ 580.00	$ -	$ -	$ 580.00
171	290-37700	1601	29	0.18	0.18	0.073	CLIFFORD JOSEPH & DOREEN ELAINE NEUTS	$ -	$ 580.00	$ -	$ -	$ 580.00
172	290-37600	1601	30		0.18	0.073	KEVIN EARL & LORI JEAN DAVID	$ -	$ 601.00	$ -	$ -	$ 601.00
173	290-37500	1601	57		0.19	0.077	DALE ANDREW & TANYA KAY DILLEN	$ -	$ 612.00	$ -	$ -	$ 612.00

B) PRIVATELY OWNED - NON-AGRICULTURAL LANDS

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
174	290-37400	1601	58	0.19	0.19	0.077	JASON WALL	$ -	$ 612.00	$ -	$ -	$ 612.00
175	290-37300	1601	59	0.18	0.18	0.073	HEINRICH FRIESEN BERGEN	$ -	$ 580.00	$ -	$ -	$ 580.00
176	290-37200	1601	60	0.18	0.18	0.073	GENARO RODRIGUEZ HERNANDEZ & KIM DENISE DERODRIGUEZ	$ -	$ 580.00	$ -	$ -	$ 580.00
177	290-37100	1601	61	0.19	0.19	0.077	PETER BLOKKER	$ -	$ 612.00	$ -	$ -	$ 612.00
178	290-37000	1601	62		0.19	0.077	ELSIE KUBINEC	$ -	$ 612.00	$ -	$ -	$ 612.00
179	290-36900	1601	63 Pt Lot 64		0.29	0.117	MURRAY HARTFORD	$ -	$ 934.00	$ -	$ -	$ 934.00
180	290-36800	1601	65 Pt Lot 64	0.28	0.28	0.113	DENNIS LEE & MARY THERESA BROWN	$ -	$ 902.00	$ -	$ -	$ 902.00
181	290-36700	1601	66	0.18	0.18	0.073	PETER ZACHARIAS & ELIZABETH ZACHARIAS BERGEN	$ -	$ 580.00	$ -	$ -	$ 580.00
182	290-36600	1601	67	0.19	0.19	0.077	HELENA & VICTOR DUTRA ANDRADE	$ -	$ 612.00	$ -	$ -	$ 612.00
183	290-36500	1601	68		0.19	0.077	PAOLINO & ELENA MARCOVECCHIO	$ -	$ 612.00	$ -	$ -	$ 612.00
184	290-36400	1601	31	0.23	0.23	0.093	FREDERICK ALLAN & SANDRA ANN GRANT	$ -	$ 768.00	$ -	$ -	$ 768.00
185	290-36300	1601	32	0.23	0.23	0.093	LAMBERT ROLIN & LORIE ANNE WYBENGA	$ -	$ 768.00	$ -	$ -	$ 768.00
186	290-36200	1601	33	0.23	0.23	0.093	CORY ANDREW & HEATHER JENNIFER-ANN LANIGAN	$ -	$ 768.00	$ -	$ -	$ 768.00
187	290-36100	1601	34	0.23	0.23	0.093	VINCENZO & MARIA MASTRONARDI	$ -	$ 768.00	$ -	$ -	$ 768.00
188	290-36000	1601	35	0.23	0.23	0.093	VELMA JANE NOVAK	$ -	$ 768.00	$ -	$ -	$ 768.00
189	290-35900	1601	36	0.23	0.23	0.093	DOMENICO ANTONIO & ANTONIETTA MASSANISSO	$ -	$ 768.00	$ -	$ -	$ 768.00
190	290-35800	1601	37	0.25	0.25	0.101	EMILLIO MASSANISSO	$ -	$ 835.00	$ -	$ -	$ 835.00
191	290-35700	1601	BLK C	1.28	1.28	0.518	KINGSVILLE TOWN	$ -	$ 1,425.00	$ -	$ -	$ 1,425.00
192	290-35600	1601	38	0.19	0.19	0.077	ROBERT BRUCE MYLES & KAREN MARIE SCHILLER	$ -	$ 635.00	$ -	$ -	$ 635.00
193	290-35500	1601	39	0.19	0.19	0.077	ETELVIRO SOARES & FATIMA FERNANDES FREITAS	$ -	$ 635.00	$ -	$ -	$ 635.00
194	290-35400	1601	40	0.19	0.19	0.077	CHARLES GORDON & DONNA LOUISE GIRTY	$ -	$ 635.00	$ -	$ -	$ 635.00
195	290-35300	1601	41	0.19	0.19	0.077	JOSEPH MICHAEL & ELIZABETH BERESH	$ -	$ 635.00	$ -	$ -	$ 635.00
196	290-35200	1601	42	0.19	0.19	0.077	MARIO & THERESA CAPPELLI	$ -	$ 635.00	$ -	$ -	$ 635.00
197	290-35100	1601	43	0.18	0.18	0.073	LEE FRANCIS & BRENDA GAY MILLER	$ -	$ 601.00	$ -	$ -	$ 601.00
198	290-35000	1601	44		0.19	0.077	GUILLERMO & ELIZABETH WIEBE	$ -	$ 612.00	$ -	$ -	$ 612.00
199	290-34900	1601	45	0.19	0.19	0.077	MATTHEW JAMES MCRAE	$ -	$ 612.00	$ -	$ -	$ 612.00
200	290-34800	1601	46	0.19	0.19	0.077	JOSE VICENTE & AGUIDA PACHECO	$ -	$ 612.00	$ -	$ -	$ 612.00
201	290-34700	1601	47	0.18	0.18	0.073	CYNTHIA DENISE WARE	$ -	$ 580.00	$ -	$ -	$ 580.00
202	290-34600	1601	48		0.19	0.077	BARBARA GRIEVE	$ -	$ 612.00	$ -	$ -	$ 612.00
203	290-34500	1601	49		0.18	0.073	KATHARINA & ANNA REIMER	$ -	$ 580.00	$ -	$ -	$ 580.00

B) PRIVATELY OWNED - NON-AGRICULTURAL LANDS

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
204	290-34400	1601	50		0.18	0.073	DAVID ALVIN & MARY ELIZABETH TOEWS	$ -	$ 580.00	$ -	$ -	$ 580.00
205	290-34300	1601	51		0.18	0.073	WILHELM & KATAREN DYCK	$ -	$ 580.00	$ -	$ -	$ 580.00
206	290-34200	1601	52	0.18	0.18	0.073	SHELDON VICTOR WIENS	$ -	$ 580.00	$ -	$ -	$ 580.00
207	290-34100	1601	53	0.18	0.18	0.073	BERNHARD & ANNA FROESE	$ -	$ 580.00	$ -	$ -	$ 580.00
208	290-34000	1601	54	0.18	0.18	0.073	RUDOLF & ELIZABETH BAUMANN	$ -	$ 580.00	$ -	$ -	$ 580.00
209	290-33900	1601	55	0.18	0.18	0.073	FRANK CAPPELLI	$ -	$ 580.00	$ -	$ -	$ 580.00
210	290-33800	1601	56		0.21	0.085	ANNITA ASSUNTA MATTIA	$ -	$ 676.00	$ -	$ -	$ 676.00
211	290-33700	1601	20		0.24	0.097	JENNIFER LYNN SMITH	$ -	$ 744.00	$ -	$ -	$ 744.00
212	290-33600	1601	19	0.22	0.22	0.089	JOHAN FEHR & MARGARETHA FRIESSEN	$ -	$ 682.00	$ -	$ -	$ 682.00
213	290-33500	1601	18	0.22	0.22	0.089	MICHAEL STEVEN & SANDRA ELIZABETH STEIN	$ -	$ 682.00	$ -	$ -	$ 682.00
214	290-33400	1601	17	0.22	0.22	0.089	WILHELM & KATHARINA HIEBERT	$ -	$ 682.00	$ -	$ -	$ 682.00
215	290-33300	1601	16	0.22	0.22	0.089	JOHN & ALICE FRIESEN	$ -	$ 682.00	$ -	$ -	$ 682.00
216	290-33200	1601	15	0.22	0.22	0.089	TREVOR MATTHEW BROWN & SHERI LYN REEKIE	$ -	$ 682.00	$ -	$ -	$ 682.00
217	290-33100	1601	14	0.22	0.22	0.089	ARTHUR JOHN & HEDWIG TIESSEN	$ -	$ 682.00	$ -	$ -	$ 682.00
218	290-33000	1601	13	0.21	0.21	0.085	HEINRICH REIMER & MARGARETHA FRIESEN	$ -	$ 651.00	$ -	$ -	$ 651.00
219	290-32900	1601	12	0.21	0.21	0.085	JEREMY FLOYD & MINDY LEE COLENUTT	$ -	$ 651.00	$ -	$ -	$ 651.00
220	290-32800	1601	11		0.20	0.081	ANNA MARIA VALERI & ROSE SPIDALIERI	$ -	$ 620.00	$ -	$ -	$ 620.00
221	290-32700	1601	10	0.18	0.18	0.073	DAVID & JUSTINA FEHR	$ -	$ 558.00	$ -	$ -	$ 558.00
222	290-32600	1601	9	0.18	0.18	0.073	KENNETH CARLYLE BRUNER	$ -	$ 558.00	$ -	$ -	$ 558.00
223	290-32500	1601	8	0.18	0.18	0.073	DAVID MARTEN FRIESEN	$ -	$ 580.00	$ -	$ -	$ 580.00
224	290-32400	1601	7	0.18	0.18	0.073	ABRAM WALL	$ -	$ 580.00	$ -	$ -	$ 580.00
225	290-32300	1601	6	0.18	0.18	0.073	BENJAMIN & AGATHA BOSCHMAN	$ -	$ 580.00	$ -	$ -	$ 580.00
226	290-32200	1601	5	0.18	0.18	0.073	RAYMOND MOISE KENNETTE	$ -	$ 580.00	$ -	$ -	$ 580.00
227	290-32100	1601	4	0.18	0.18	0.073	ABRAM & KATHERINA DYCK	$ -	$ 580.00	$ -	$ -	$ 580.00
228	290-32000	1601	3	0.18	0.18	0.073	ERCOLINO DI MENNA & VIORICA JEFFERY	$ -	$ 580.00	$ -	$ -	$ 580.00
229	290-31902	2 E.D.	11	0.51	0.51	0.206	792743 ONTARIO INC	$ -	$ 1,066.00	$ -	$ -	$ 1,066.00
230	290-31900	1601	2		0.18	0.073	JOAO & ISALTINA REGO	$ -	$ 580.00	$ -	$ -	$ 580.00
231	290-31800	1601	1		0.35	0.142	MILDRED BERYL HALL	$ -	$ 1,169.00	$ -	$ -	$ 1,169.00
232	290-31700	2 E.D.	10		0.68	0.275	EVA HARMS & JACOB HARMS-DYCK	$ -	$ 2,271.00	$ -	$ -	$ 2,271.00
233	290-31600	M182	PT Lots 1 & 2		0.13	0.053	SELMA SUMARAH	$ -	$ 450.00	$ -	$ -	$ 450.00

B) PRIVATELY OWNED - NON-AGRICULTURAL LANDS

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
234	290-31500	M182	Pt Lot 2		0.60	0.243	JAMES MARTENS FRIESEN	$ -	$ 2,076.00	$ -	$ -	$ 2,076.00
235	290-31400	M182	Pt Lot 2		0.74	0.299	T G & SON MARKETING LTD	$ -	$ 2,560.00	$ -	$ -	$ 2,560.00
236	290-31300	M182	Pt Lot 2		0.36	0.146	BRENDA LEE TAGGART	$ -	$ 1,245.00	$ -	$ -	$ 1,245.00
237	290-31200	M182	Pt Lot 3		0.19	0.077	SARAH ANNE WYBENGA & SCOTT CAMPBELL INGLIS	$ -	$ 657.00	$ -	$ -	$ 657.00
238	290-31100	M182	Lot 4 PT Lot 3		0.72	0.291	DONALD STEWART & MARGARET JEAN DUNMORE	$ -	$ 2,491.00	$ -	$ -	$ 2,491.00
239	290-31001	M182	Pt Lot 5	0.43	**0.36**	0.146	PETER & ELIZABETH FRIESSEN	$ -	$ 1,245.00	$ -	$ -	$ 1,245.00
240	290-31000	M182	Lot 6 Pt Lot 5		0.44	0.178	ANDREW KROSLAK & ASHLEY CHAUVIN	$ -	$ 1,522.00	$ -	$ -	$ 1,522.00
241	290-30900	M182	Pt Lot 7 Lot 5		0.51	0.206	JOHN & MARIA FONTES	$ -	$ 1,764.00	$ -	$ -	$ 1,764.00
242	290-30700	M182	Lot 15 Pt Lot 14		0.24	0.097	BERNHARD NEUFELD & HELENA DRIEDGER FRIESEN	$ -	$ 830.00	$ -	$ -	$ 830.00
243	290-30600	M182	Lot 13 Pt Lot 14		0.15	0.061	BRIAN EDWARD & LISA MARLENE GALE	$ -	$ 519.00	$ -	$ -	$ 519.00
244	290-30500	M182	12		0.27	0.109	JONATHAN GEORGE BADAOA	$ -	$ 934.00	$ -	$ -	$ 934.00
245	290-30400	M182	11		0.18	0.073	CARLOS MANUEL CORDEIRO	$ -	$ 623.00	$ -	$ -	$ 623.00
246	290-30300	M182	10		0.20	0.081	PERRY THOMAS & LUCIA FATIMA KENNEY	$ -	$ 692.00	$ -	$ -	$ 692.00
247	290-30200	M182	9		0.19	0.077	SHAWNA LYNN & MARGARET JEAN MACKENZIE	$ -	$ 657.00	$ -	$ -	$ 657.00
248	290-30100	M182	8		0.19	0.077	GARY STEWART & SHEILA ANNE DUNMORE	$ -	$ 657.00	$ -	$ -	$ 657.00
249	290-30000	M182	7		0.23	0.093	JAMES EDWARD & JUDY JEFFREY	$ -	$ 796.00	$ -	$ -	$ 796.00
250	290-29900	M182	6		0.25	0.101	PETER & AGANETHA PENNER	$ -	$ 865.00	$ -	$ -	$ 865.00
251	290-29800	M182	5		0.27	0.109	ANDREW ORR & CAROL ANN CARRUTHERS	$ -	$ 934.00	$ -	$ -	$ 934.00
252	290-29400	M182	3	1.32	1.32	0.534	TONY & MICHELE ANNETTE DIMENNA	$ -	$ 9,895.00	$ -	$ -	$ 9,895.00
253	290-29200	M182	5 to 6		0.30	0.121	GORDON JACOB & HEATHER MARILYN EPP	$ -	$ 1,038.00	$ -	$ -	$ 1,038.00
254	290-29100	182	8 TO 14 PT	8.56	8.56	3.464	TRUSTEES OF CORNERSTONE CUMMUN	$ -	$ 20,424.00	$ -	$ -	$ 20,424.00
255	290-29000	M182	7	0.20	0.20	0.081	HUMBERTO PAVAO	$ -	$ 716.00	$ -	$ -	$ 716.00
256	290-28900	M182	6 Pt Lot 5	0.22	0.22	0.089	PASQUALE & JO ANNE ISABELLE MATTIA	$ -	$ 787.00	$ -	$ -	$ 787.00
257	290-28800	M182	PT LOT 4 / 5	0.19	0.19	0.077	RENZE & MARJORIE ANN POSTMA	$ -	$ 680.00	$ -	$ -	$ 680.00
258	290-28700	M182	Pt Lot 4	0.15	0.15	0.061	JAMES BISHOP & ADELAIDA LAGANG TAGA-OC	$ -	$ 537.00	$ -	$ -	$ 537.00
259	290-28600	M182	Pt Lot 3 / 4	0.18	0.18	0.073	ROBERT & GWENDOLYN ULCH	$ -	$ 644.00	$ -	$ -	$ 644.00
260	290-28500	M182	Pt Lots 2 & 3		0.35	0.142	DWAYNE LARRY & KIM IRENE TESKEY	$ -	$ 1,253.00	$ -	$ -	$ 1,253.00
261	290-28100	2 E.D.	10	0.33	0.33	0.134	JOHN PENNER	$ -	$ 1,181.00	$ -	$ -	$ 1,181.00
262	290-28000	2 E.D.	10	1.40	1.40	0.567	MICHELINA POLICELLA	$ -	$ 5,011.00	$ -	$ -	$ 5,011.00
263	290-27900	2 E.D.	10	1.40	1.40	0.567	MAURINO SOARES & BETTY JEAN FREITAS	$ -	$ 5,011.00	$ -	$ -	$ 5,011.00

B) PRIVATELY OWNED - NON-AGRICULTURAL LANDS

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
264	290-27800	2 E.D.	10	1.91	1.91	0.773	FRANCESCO & MARIA MASTRONARDI	$ -	$ 6,836.00	$ -	$ -	$ 6,836.00
265	290-27710	2 E.D.	10	1.06	1.06	0.429	TONY & LINDA MASTRONARDI	$ -	$ 3,794.00	$ -	$ -	$ 3,794.00
266	290-27600	2 E.D.	10		0.50	0.202	JACOB & ANNA FEHR	$ -	$ 1,789.00	$ -	$ -	$ 1,789.00
267	290-27420	2 E.D.	10	0.35	0.35	0.142	DENNIS & LILLY REIVE	$ -	$ 1,253.00	$ -	$ -	$ 1,253.00
268	290-27410	2 E.D.	10	0.39	0.39	0.158	DENNIS & LILLY REIVE	$ -	$ 1,396.00	$ -	$ -	$ 1,396.00
269	290-27400	2 E.D.	10	0.47	0.47	0.190	MICHAEL JONATHAN DEL CIANCIO	$ -	$ 1,682.00	$ -	$ -	$ 1,682.00
270	290-23500	2 E.D.	11	0.94	0.94	0.380	ABRAM & HELENA PENNER	$ -	$ 3,364.00	$ -	$ -	$ 3,364.00
271	290-23400	2 E.D.	11	0.66	0.66	0.267	ROY WILLIAM HALL	$ -	$ 2,362.00	$ -	$ -	$ 2,362.00
272	290-23201	2 E.D.	11	0.69	0.69	0.279	RICHARD HENRY ENNS	$ -	$ 2,470.00	$ -	$ -	$ 2,470.00
273	290-23200	2 E.D.	11	0.69	0.69	0.279	HARRY GERD & GUGLIELMINA KELLER	$ -	$ 2,470.00	$ -	$ -	$ 2,470.00
274	290-23100	2 E.D.	11	0.73	0.73	0.295	DANIEL FAGUNDE CABRAL	$ -	$ 2,613.00	$ -	$ -	$ 2,613.00
275	290-23000	2 E.D.	11	0.69	0.69	0.279	JEREMY MARTIN CHOBRDA	$ -	$ 2,470.00	$ -	$ -	$ 2,470.00
276	290-22900	2 E.D.	11	0.69	0.69	0.279	NELSON DUTRA & KIMBERLY ELIZABETH ANDRADE	$ -	$ 2,470.00	$ -	$ -	$ 2,470.00
277	290-22800	2 E.D.	11	0.69	0.69	0.279	JOHAN & JUSTINA GIESBRECHT	$ -	$ 2,470.00	$ -	$ -	$ 2,470.00
278	290-22700	2 E.D.	11	0.69	0.69	0.279	ROBERT J PAUL GRAHAM	$ -	$ 2,470.00	$ -	$ -	$ 2,470.00
279	290-22600	2 E.D.	10	0.40	0.40	0.162	JOHAN & ANNA HILDEBRAND	$ -	$ 1,432.00	$ -	$ -	$ 1,432.00
280	290-22500	2 E.D.	10	0.34	0.34	0.138	RICHARD WAYNE & WINNIFRED JEAN NEAL	$ -	$ 1,217.00	$ -	$ -	$ 1,217.00
281	290-22420	2 E.D.	10	1.17	1.17	0.473	TONY & MICHELLE ANNETTE DIMENNA	$ -	$ 4,187.00	$ -	$ -	$ 4,187.00
282	290-22410	2 E.D.	10	1.26	1.26	0.510	DINO & VERA DIMENNA	$ -	$ 4,510.00	$ -	$ -	$ 4,510.00
283	290-22334	12M585	26	0.30	0.30	0.120	DOMENICO MUCCI	$ 1,330.00	$ 153.00	$ -	$ -	$ 1,483.00
284	290-22333	12M585	25	2.01	2.01	0.813	DOMENICO MUCCI	$ 9,020.00	$ 1,039.00	$ -	$ -	$ 10,059.00
285	290-22332	12M585	23	0.21	0.21	0.084	1552843 ONTARIO LTD	$ -	$ 645.00	$ -	$ -	$ 645.00
286	290-22331	12M585	22	0.20	0.20	0.082	CHARLIE & NICOLE EVA ABDUL-MASSIH	$ -	$ 631.00	$ -	$ -	$ 631.00
287	290-22330	12M585	21	0.36	0.36	0.145	DONALD FURTADO & DIANE DASILVA QUADROS	$ -	$ 1,113.00	$ -	$ -	$ 1,113.00
288	290-22329	12M585	20	0.28	0.28	0.112	DAVID THIESSEN & MARIA BARTSCH REIMER	$ -	$ 894.00	$ -	$ -	$ 894.00
289	290-22328	12M585	19	0.38	0.38	0.156	BRIAN EDWIN & DIANE STOCKTON	$ -	$ 1,238.00	$ -	$ -	$ 1,238.00
290	290-22327	12M585	18	0.20	0.20	0.082	JASON WILSON & MILKA ELENA PIEPER	$ -	$ 656.00	$ -	$ -	$ 656.00
291	290-22326	12M585	17	0.21	0.21	0.084	LUIS & NELIA MONIZ	$ -	$ 670.00	$ -	$ -	$ 670.00
292	290-22325	12M585	16	0.22	0.22	0.088	1552843 ONTARIO LTD	$ -	$ 697.00	$ -	$ -	$ 697.00
293	290-22324	12M585	15	0.20	0.20	0.079	1552843 ONTARIO LTD	$ -	$ 629.00	$ -	$ -	$ 629.00

B) PRIVATELY OWNED - NON-AGRICULTURAL LANDS

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
294	290-22323	12M585	14	0.20	0.20	0.079	1552843 ONTARIO LTD	$ -	$ 629.00	$ -	$ -	$ 629.00
295	290-22322	12M585	13	0.21	0.21	0.085	ADAM HERBERT & SANDRA ISABEL PILLON	$ -	$ 677.00	$ -	$ -	$ 677.00
296	290-22321	12M585	12	0.24	0.24	0.097	1552843 ONTARIO LTD	$ -	$ 774.00	$ -	$ -	$ 774.00
297	290-22320	12M585	11	0.23	0.23	0.092	1552843 ONTARIO LTD	$ -	$ 732.00	$ -	$ -	$ 732.00
298	290-22319	12M585	10	0.30	0.30	0.122	1552843 ONTARIO LTD	$ -	$ 968.00	$ -	$ -	$ 968.00
299	290-22318	12M585	9	0.34	0.34	0.137	SUSY BRANCO TEIXEIRA	$ -	$ 1,090.00	$ -	$ -	$ 1,090.00
300	290-22317	12M585	8	0.34	0.34	0.136	1552843 ONTARIO LTD	$ -	$ 1,084.00	$ -	$ -	$ 1,084.00
301	290-22316	12M585	7	0.30	0.30	0.121	DOMENICO MUCCI	$ -	$ 925.00	$ -	$ -	$ 925.00
302	290-22315	12M585	6	0.20	0.20	0.080	MICHAEL DIAB & DEANNA ETHEL MATHIES	$ -	$ 614.00	$ -	$ -	$ 614.00
303	290-22314	12M585	5	0.24	0.24	0.095	LOUIS CARLOS & REBECCA ANNE RODRIGUES	$ -	$ 730.00	$ -	$ -	$ 730.00
304	290-22313	12M585	4	0.21	0.21	0.085	KEVIN & JENNY MELISSA CARDOSO	$ -	$ 652.00	$ -	$ -	$ 652.00
305	290-22312	12M585	3	0.20	0.20	0.079	STEPHEN & MICHELLE LYNNE MARCOVECCHIO	$ -	$ 606.00	$ -	$ -	$ 606.00
306	290-22311	12M585	2	0.20	0.20	0.079	KEITH & SHARON BOEHME	$ -	$ 606.00	$ -	$ -	$ 606.00
307	290-22310	12M585	1	0.22	0.22	0.088	1552843 ONTARIO LTD	$ -	$ 671.00	$ -	$ -	$ 671.00
308	290-22308	2 E.D.	9 & 10	0.25	0.25	0.102	EVA KRAHN	$ -	$ 874.00	$ -	$ -	$ 874.00
309	290-22305	2 E.D.	10	0.62	0.62	0.251	RUTHVEN MONTESSORI ACAD. INC	$ -	$ 2,145.00	$ -	$ -	$ 2,145.00
310	290-22200	2 E.D.	11	2.55	2.55	1.032	617812 ONTARIO LIMITED	$ -	$ 19,115.00	$ -	$ -	$ 19,115.00
311	290-22102	2 E.D.	11	0.60	0.60	0.243	792743 ONTARIO INC - FRANCO PORRONE	$ -	$ 2,076.00	$ -	$ -	$ 2,076.00
312	290-22101	2 E.D.	11	0.92	0.92	0.371	FRANCO & CRISTINA PORRONE	$ -	$ 3,174.00	$ -	$ -	$ 3,174.00
313	290-22050	2 E.D.	11	0.56	0.56	0.228	MARY PORRONE	$ -	$ 1,948.00	$ -	$ -	$ 1,948.00
314	290-22025	2 E.D.	11	0.17	0.17	0.069	JOHN GEORGE & MADELEINE MUNRO	$ -	$ 588.00	$ -	$ -	$ 588.00
315	290-22001	2 E.D.	11	0.17	0.17	0.069	JUAN LOEWEN & ELISABETH DYCK	$ -	$ 588.00	$ -	$ -	$ 588.00
316	290-18350	1 E.D.	11	0.50	0.50	0.202	ERIEVIEW ACRES INC	$ -	$ 1,074.00	$ -	$ -	$ 1,074.00
317	290-18300	1 E.D.	11	0.23	0.23	0.093	MAXINE ELIZABETH & JOSEPH ROGER KNIGHT	$ -	$ 494.00	$ -	$ -	$ 494.00
318	290-18000	1 E.D.	11	0.34	0.34	0.139	NEIL & ANJANETTE MACTAVISH	$ 1,542.00	$ 738.00	$ -	$ -	$ 2,280.00
319	290-17950	1 E.D.	11	0.69	0.69	0.278	WILL BERNHARD & HELENA WIEBE	$ -	$ 1,475.00	$ -	$ -	$ 1,475.00
320	290-17850	1 E.D.	11	0.56	0.56	0.227	ANTONIO & ELENA DIMENNA	$ -	$ 1,203.00	$ -	$ -	$ 1,203.00
321	290-17800	1 E.D.	10 & 11	0.51	0.51	0.208	FRANK GAETANO MASTRONARDI	$ -	$ 1,102.00	$ -	$ -	$ 1,102.00
322	290-17700	1 E.D.	10	0.71	0.71	0.287	GEMINO & VENERANDA MASTRONARDI	$ -	$ 1,525.00	$ -	$ -	$ 1,525.00
323	290-12900	1 E.D.	11	0.73	0.73	0.294	RICHARD THIESSEN & ANNA GUENTHER	$ -	$ 1,472.00	$ -	$ -	$ 1,472.00

B) PRIVATELY OWNED - NON-AGRICULTURAL LANDS

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
324	290-12800	1 E.D.	11		0.10	0.040	SHEILA MARLENE FORMAN	$ -	$ 203.00	$ -	$ -	$ 203.00
325	290-12750	1 E.D.	11	0.20	0.20	0.081	EMIL A H KUNTZ	$ -	$ 406.00	$ -	$ -	$ 406.00
326	290-12700	M41	12		0.30	0.121	JACOB & HELENA KRAHN	$ -	$ 573.00	$ -	$ -	$ 573.00
327	290-12600	M41	11	0.28	0.28	0.113	ROBERT CARLTON & CATHERINE ELAINE TANNER	$ -	$ 534.00	$ -	$ -	$ 534.00
328	290-12500	M41	10		0.40	0.162	DANNY PULCINELLI	$ -	$ 764.00	$ -	$ -	$ 764.00
329	290-12400	M41	9		0.50	0.202	BRADLEY LANE & CHARLOTTE ROSEANNE MAKSYMETZ	$ -	$ 895.00	$ -	$ -	$ 895.00
330	290-12300	M41	8		0.50	0.202	CARRIE LEEANN GROSSI	$ -	$ 895.00	$ -	$ -	$ 895.00
331	290-12200	M41	7	0.34	0.34	0.138	CORNELIUS & SUSANA THIESSEN	$ -	$ 649.00	$ -	$ -	$ 649.00
332	290-12100	M41	6	0.32	0.32	0.130	DAVID GEORGE & PATRICIA ANNE POWELL	$ -	$ 611.00	$ -	$ -	$ 611.00
333	290-12000	M41	5	0.32	0.32	0.130	GREGORY RICHARD & PEGGY MOCKLER	$ -	$ 611.00	$ -	$ -	$ 611.00
334	290-11900	M41	4		0.30	0.121	JAMES GUALTIERI & JENNIFER LYNN GROSSI	$ -	$ 608.00	$ -	$ -	$ 608.00
335	290-11800	M41	3		0.30	0.121	STEPHEN PAUL SR & NANCY ELIZABETH SEBELE	$ -	$ 608.00	$ -	$ -	$ 608.00
336	290-11700	M41	2		0.30	0.121	HUGH ROBERT KING	$ -	$ 608.00	$ -	$ -	$ 608.00
337	290-11600	M41	1		0.30	0.121	FRANK FRIESEN & MARIA KNELSEN	$ -	$ 608.00	$ -	$ -	$ 608.00
338	290-11500	M19	15	0.21	0.21	0.084	MOHAMED JOSEPH	$ -	$ 421.00	$ -	$ -	$ 421.00
339	290-11400	M19	14	0.20	0.20	0.082	LAURA ANNE & JAMES ARTHUR HUGH STEVENSON	$ -	$ 410.00	$ -	$ -	$ 410.00
340	290-11300	M19	13	0.29	0.29	0.116	GARRY PAUL & KRISTYN JEAN SYMONS	$ -	$ 583.00	$ -	$ -	$ 583.00
341	290-11200	M19	12	0.29	0.29	0.118	GYPSY ANNE CARROLL	$ -	$ 589.00	$ -	$ -	$ 589.00
342	290-11100	M19	11	0.27	0.27	0.111	ALINE MARIE ROCKS	$ -	$ 557.00	$ -	$ -	$ 557.00
343	290-11000	M19	10	0.26	0.26	0.106	ROBERT WILLIAM & CATHY LYNN BAKES	$ -	$ 501.00	$ -	$ -	$ 501.00
344	290-10900	M19	9	0.30	0.30	0.121	BRIAN WILLIAM & SONYA ANN CORNIES	$ -	$ 572.00	$ -	$ -	$ 572.00
345	290-10800	M19	8	0.31	0.31	0.125	GEORGE EGGLEZOS & AIMEE OMSTEAD	$ -	$ 589.00	$ -	$ -	$ 589.00
346	290-10700	1 E.D.	11		0.16	0.065	CATHERINE GAIL STIEGLER	$ -	$ 286.00	$ -	$ -	$ 286.00
347	290-10601	1 E.D.	RP 12R6839		0.28	0.113	KINGSVILLE TOWN	$ -	$ 1,002.00	$ -	$ -	$ 1,002.00
348	290-10600	1 E.D.	11		0.23	0.093	GAIL ANN KELTON	$ -	$ 412.00	$ -	$ -	$ 412.00
349	290-10500	1 E.D.	11		0.09	0.036	JEAN JANE TOWLE	$ -	$ 161.00	$ -	$ -	$ 161.00
350	290-10400	1 E.D.	11	1.04	**0.83**	0.337	JEAN JANE TOWLE	$ -	$ 1,489.00	$ -	$ -	$ 1,489.00
351	290-10300	1 E.D.	11	1.16	**0.93**	0.377	JOHN & LOUISE WIEBE	$ -	$ 1,667.00	$ -	$ -	$ 1,667.00
352	290-10200	1 E.D.	11	0.92	**0.74**	0.298	DAVID ROBERT & JACQUELINE GULYAS	$ -	$ 1,320.00	$ -	$ -	$ 1,320.00
353	290-10100	1 E.D.	11	2.16	2.16	0.874	JEAN-MARC JOSEPH & ISABELLA MARGARET PINSONNEAULT	$ 9,693.00	$ 3,865.00	$ 500.00	$ -	$ 14,058.00

B) PRIVATELY OWNED - NON-AGRICULTURAL LANDS

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
354	290-10000	1 E.D.	11	0.65	0.65	0.261	STEVEN ROBERT MARCHAND & FELICIA RICO	$ 2,898.00	$ 1,155.00	$ 500.00	$ -	$ 4,553.00
355	290-09900	1 E.D.	11	0.85	0.85	0.344	DAVID WALTER & SUSAN LYNN ANNETTE WHITE	$ 3,811.00	$ 1,621.00	$ 500.00	$ -	$ 5,932.00
356	290-09800	M19	7	0.98	0.98	0.398	SCOTT ARNOLD SHILSON	$ 4,416.00	$ 1,878.00	$ 500.00	$ -	$ 6,794.00
357	290-09700	M19	6	0.43	0.43	0.172	DAVID ANDREW DANN	$ 1,907.00	$ 811.00	$ 500.00	$ -	$ 3,218.00
358	290-09600	M19	5	0.42	0.42	0.168	JIN ZHU	$ 1,864.00	$ 793.00	$ 500.00	$ -	$ 3,157.00
359	290-09500	M19	4	0.51	0.51	0.207	GEOFFREY BROOK GARDNER & JENNIFER ISOBEL FRASER	$ 2,291.00	$ 1,035.00	$ 500.00	$ -	$ 3,826.00
360	290-09400	M19	3	0.40	0.40	0.160	JONI LYNN BALTZER	$ 1,773.00	$ 801.00	$ 500.00	$ -	$ 3,074.00
361	290-09300	M19	2	0.35	0.35	0.142	JASON VERN & JENNIFER SUSAN S COPE	$ 1,571.00	$ 710.00	$ 500.00	$ -	$ 2,781.00
362	290-09200	M19	1	0.31	0.31	0.127	LEO & KATHY PROBE	$ 1,404.00	$ 634.00	$ 500.00	$ -	$ 2,538.00
363	290-09100	1 E.D.	11	1.07	1.07	0.434	CONNIE-JEAN LATAM	$ 4,816.00	$ 2,048.00	$ 500.00	$ -	$ 7,364.00
364	290-09000	1 E.D.	11	0.61	0.61	0.248	DEBORAH LORI & EDMOND JULIEN ROLLIER	$ 2,750.00	$ 1,170.00	$ 500.00	$ -	$ 4,420.00
365	290-08900	1 E.D.	11	0.47	0.47	0.190	GREGORY & VICKI CALCOTT	$ 2,110.00	$ 954.00	$ 500.00	$ -	$ 3,564.00
366	290-08800	1 E.D.	11	0.44	0.44	0.178	JAMES ERNEST & SHIRLEY ANNE JENSEN	$ 1,975.00	$ 893.00	$ 500.00	$ -	$ 3,368.00
367	290-08700	1 E.D.	11	0.37	0.37	0.150	PHYLLIS MARIE HICKS	$ 1,664.00	$ 251.00	$ 500.00	$ -	$ 2,415.00
368	290-08600	1 E.D.	11	0.34	0.34	0.138	RICHARD CLARE & PHYLLIS MARIE HICKS	$ 1,529.00	$ 691.00	$ 500.00	$ -	$ 2,720.00
369	290-08500	1 E.D.	11	0.51	0.51	0.205	STANLEY LAWRENCE GEVAERT	$ -	$ 1,025.00	$ -	$ -	$ 1,025.00
370	290-08402	1 E.D.	11	0.36	0.36	0.146	ENRICO HENRY MASTRONARDI	$ -	$ 776.00	$ -	$ -	$ 776.00
371	290-08302	1 E.D.	11	0.49	0.49	0.198	ALBERT MASTRONARDI	$ -	$ 1,052.00	$ -	$ -	$ 1,052.00
Total Affected Lands					**179.49**	**72.639**						
Total Assessment on Privately Owned Non-Agricultural Lands (Not Grantable)								**$ 58,364.00**	**$ 539,884.00**	**$ 8,000.00**	**$ -**	**$ 606,248.00**

C) PRIVATELY OWNED - AGRICULTURAL LANDS (GRANTABLE)

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
372	340-05200	3 E.D.	PW1/2 lot 10	4.45	**2.59**	1.048	GIOVANNI & ANNA COLASANTI	$ -	$ 3,090.00	$ -	$ -	$ 3,090.00
373	340-05100	3 E.D.	PW1/2 lot 10	4.50	**2.92**	1.182	PIETRO & ITALIA COLASANTI	$ -	$ 3,485.00	$ -	$ -	$ 3,485.00
374	340-01400	3 E.D.	PS1/2 lot 11	31.25	31.25	12.647	JOHN DAVID & JENNIFER LYNNETTE FITTLER	$ -	$ 42,105.00	$ -	$ -	$ 42,105.00
375	340-01300	3 E.D.	PS1/2 lot 11	18.19	**5.00**	2.023	JOHN DAVID & JENNIFER LYNNETTE FITTLER	$ -	$ 9,007.00	$ -	$ -	$ 9,007.00
376	340-01200	3 E.D.	PS1/2 lot 11	27.64	**14.00**	5.666	WALTER RICHARD & MARLENE ELIZABETH ANN HOCH DICK	$ -	$ 11,780.00	$ -	$ -	$ 11,780.00

C) PRIVATELY OWNED - AGRICULTURAL LANDS (GRANTABLE)

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
377	300-32500	2 E.D.	9	43.26	**7.12**	2.883	617885 ONTARIO LIMITED	$ -	$ 8,923.00	$ -	$ -	$ 8,923.00
378	300-32200	2 E.D.	9	1.89	1.89	0.765	EXCALIBUR PLASTICS LTD	$ -	$ 19,032.00	$ -	$ -	$ 19,032.00
379	290-38700	1 E.D.	10 & 11	47.78	47.78	19.336	MUCCI FARMS LTD	$ 214,417.00	$ 324,756.00	$ -	$ -	$ 539,173.00
380	290-30800	182	8 Pt Lots 7 / 9	3.30	3.30	1.335	ERCOLE DIMENNA	$ -	$ 26,724.00	$ -	$ -	$ 26,724.00
381	290-28400	2 E.D.	10	3.81	3.81	1.542	DANNY & JOHNNY R VESPA	$ -	$ 6,409.00	$ -	$ -	$ 6,409.00
382	290-28300	2 E.D.	10	2.68	2.68	1.085	GIOVANNI & FRANCA VESPA	$ -	$ 6,744.00	$ -	$ -	$ 6,744.00
383	290-28200	2 E.D.	10	17.60	17.60	7.123	FRANCESCO & MARIA MASTRONARDI	$ -	$ 20,997.00	$ -	$ -	$ 20,997.00
384	290-27700	2 E.D.	10	2.27	2.27	0.919	ISAAK & HELENA NEUFELD	$ -	$ 6,400.00	$ -	$ -	$ 6,400.00
385	290-27500	2 E.D.	10	3.48	3.48	1.408	BERNARD WIEBE & ELIZABETH WIEBE FRIESEN	$ -	$ 30,351.00	$ -	$ -	$ 30,351.00
386	290-27350	2 E.D.	10	3.73	3.73	1.510	MUCCIPAC LTD	$ -	$ 35,581.00	$ -	$ -	$ 35,581.00
387	290-27300	2 E.D.	10 & 11	16.00	16.00	6.475	RUTHVEN INDUSTRIAL PARK CORPORATION	$ -	$ 54,913.00	$ -	$ -	$ 54,913.00
388	290-27210	2 E.D.	10 & 11	33.60	33.60	13.598	RUTHVEN INDUSTRIAL PARK CORPORATION	$ -	$ 40,085.00	$ -	$ -	$ 40,085.00
389	290-27200	2 E.D.	10 & 11	30.06	30.06	12.165	TONY & MICHELE ANNETTE DIMENNA	$ -	$ 35,861.00	$ -	$ -	$ 35,861.00
390	290-27100	2 E.D.	11	35.00	35.00	14.164	CAROLYN JEAN STOCKWELL	$ -	$ 39,646.00	$ -	$ -	$ 39,646.00
391	290-27000	2 E.D.	11	25.53	**4.30**	1.739	SUN GRO FARMS INC	$ -	$ 2,563.00	$ -	$ -	$ 2,563.00
392	290-23301	2 E.D.	11	3.45	**1.74**	0.703	971174 ONTARIO LIMITED	$ -	$ 1,037.00	$ -	$ -	$ 1,037.00
393	290-23300	2 E.D.	11	10.94	**4.62**	1.870	ERIC & CINDY ZIMMER	$ -	$ 12,331.00	$ -	$ -	$ 12,331.00
394	290-22400	2 E.D.	10 & 11	20.78	20.78	8.410	TONY & MICHELE ANNETTE DIMENNA	$ -	$ 82,591.00	$ -	$ -	$ 82,591.00
395	290-22309	2 E.D.	10	21.37	21.37	8.648	DOMENICO MUCCI	$ 95,900.00	$ 21,838.00	$ 64,900.00	$ -	$ 182,638.00
396	290-22100	2 E.D.	11	42.44	42.44	17.175	CRISTINA PORRONE	$ 190,453.00	$ 50,489.00	$ 98,400.00	$ -	$ 339,342.00
397	290-18400	1 E.D.	11	30.45	**6.09**	2.465	2269029 ONTARIO LIMITED	$ -	$ 29,805.00	$ -	$ -	$ 29,805.00
398	290-18200	1 E.D.	11	72.49	72.49	29.336	MUCCI FARMS LTD	$ 325,305.00	$ 493,320.00	$ 6,600.00	$ -	$ 825,225.00
399	290-17900	1 E.D.	11	32.20	32.20	13.031	SOUTHSHORE GREENHOUSES INC	$ 144,500.00	$ 219,916.00	$ 8,000.00	$ -	$ 372,416.00
400	290-17601	1 E.D.	10	24.48	**14.79**	5.985	1382296 ONTARIO LIMITED	$ -	$ 103,389.00	$ -	$ -	$ 103,389.00
401	290-08401	1 E.D.	11	9.38	9.38	3.796	2462284 ONTARIO INC	$ 42,094.00	$ 40,234.00	$ 21,200.00	$ -	$ 103,528.00
402	290-08400	1 E.D.	11	8.14	8.14	3.294	ENRICO HENRY & ANNA MASTRONARDI	$ -	$ 38,852.00	$ -	$ -	$ 38,852.00
403	290-08301	1 E.D.	11	3.81	3.81	1.542	H & A MASTRONARDI FARMS LTD	$ -	$ 25,107.00	$ -	$ -	$ 25,107.00
404	290-08300	1 E.D.	11	6.93	6.93	2.805	FIORINA CAPUSSI	$ -	$ 4,409.00	$ -	$ -	$ 4,409.00
Total Affected Lands					**513.16**	**207.673**						
Total Assessment on Privately Owned Agricultural Lands (Grantable)								**$ 1,012,669.00**	**$ 1,851,770.00**	**$ 199,100.00**	**$ -**	**$ 3,063,539.00**

D) UTILITIES

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
405							HYDRO ONE	$ -	$ -	$ -	$ 5,000.00	$ 5,000.00
Total Affected Lands												
Total Assessment for Utilities								**$ -**	**$ -**	**$ -**	**$ 5,000.00**	**$ 5,000.00**

TOTAL ASSESSMENT FOR SECTIONS A, B, C & D	**$ 1,142,250.00**	**$ 2,665,249.00**	**$ 207,100.00**	**$ 5,000.00**	**$ 4,019,599.00**

SUMMARY FOR TOTAL LANDS AFFECTED

A) Municipal Lands	**43.08 Acres**	**17.434 Hectares**
B) Non-Agricultural Lands	**179.49 Acres**	**72.639 Hectares**
C) Agricultural Lands	**513.16 Acres**	**207.673 Hectares**
Total Lands Affected:	**735.73 Acres**	**297.746 Hectares**

1 Hectare = 2.471 Acres

***NOTE: Assessment Values have been rounded to the nearest whole dollar for presentation purposes.**

17 June 2016

CONSTRUCTION ITEMS FOR THE RICHARD HICKS BRANCH DRAIN

1. Supply and install new outlet for Richard Hicks Branch Drain at Station 0+484 as per the General Specification for Construction of Covered Storm Drains in Appendix E:

a) Excavate, remove and dispose of existing 375mm diameter corrugated steel pipe with transition to 750mm diameter corrugated steel pipe as well as complete removal of the 450mm diameter Boss pipe, being approximately 40 linear metres as shown on detail drawings.

Complete at Lump Sum ***$ 2,400.00***

b) Supply to site 40 metres of 200mm Diameter PVC DR35 Pipe.

Complete at Lump Sum ***$ 1,600.00***

c) Supply labour and equipment to excavate for and install specified pipe including all drain excavation, disposal of surplus material and all drain bank and road restoration and bank seeding & mulching.

Complete at Lump Sum ***$ 2,500.00***

d) Supply and install all 19mm (3/4") nominal clear stone for pipe bedding including appropriate compaction, being approximately 30 tonnes.

Complete at Lump Sum ***$ 800.00***

e) Supply and install all granular 'A' material for pipe backfill to minimum 300mm above pipe obvert including appropriate compaction, being approximately 25 tonnes.

Complete at Lump Sum ***$ 500.00***

f) Parge outlet holes in west side of existing catchbasin to seal voids after existing pipes have been removed.

Complete at Lump Sum ***$ 500.00***

Total for Item 1 - Richard Hicks Branch Drain **$ 8,300.00**

TOTAL TENDER BASE PRICE (not including HST)	**$ 8,300.00**
Engineering Design Fees	$ 1,200.00
TOTAL PROJECT BASE PRICE (not including HST)	**$ 9,500.00**
1.76% H.S.T. Net Payable on Above	$ 167.00
TOTAL PROJECT COST (including HST)	**$ 9,667.00**

Our estimate of the total cost of this work, including all incidental expenses, is the sum of nine thousand, six hundred, sixty-seven dollars (**$9,667.00**) as per the above Construction Items for the Richard Hicks Branch Drain.

We would recommend that the cost of this work be assessed against the lands and roads affected in accordance with the accompanying Schedule of Assessment.

RICHARD HICKS BRANCH DRAIN
SCHEDULE OF ASSESSMENT
MUNICIPALITY OF KINGSVILLE
PROJECT REFERENCE NUMBER 14-425

B) PRIVATELY OWNED - NON-AGRICULTRUAL LANDS

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
1	290-08700	1 E.D.	11	0.37	0.06	0.024	PHYLLIS MARIE HICKS	$ 276.00	$ 229.00	$ -	$ -	$ 505.00
2	290-08600	1 E.D.	11	0.34	0.06	0.024	RICHARD CLARE & PHYLLIS MARIE HICKS	$ 276.00	$ 688.00	$ -	$ -	$ 964.00
3	290-08500	1 E.D.	11	0.51	0.51	0.206	STANLEY LAWRENCE GEVAERT	$ 2,348.00	$ 5,849.00	$ -	$ -	$ 8,197.00
Total Affected Lands					**0.63**	**0.255**						
Total Assessment on Privately Owned Non-Agricultrual Lands (Not Grantable)								**$ 2,900.00**	**$ 6,767.00**	**$ -**	**$ -**	**$ 9,667.00**

SUMMARY FOR TOTAL LANDS AFFECTED

A) Municipal Lands	0.00 Acres	0.000 Hectares
B) Non Agricultural Lands	0.63 Acres	0.255 Hectares
C) Agricultural Lands	0.00 Acres	0.000 Hectares
Total Lands Affected:	0.63 Acres	0.255 Hectares

1 Hectare = 2.471 Acres

***NOTE: Assessment Values have been rounded to the nearest whole dollar for presentation purposes.**

CONSTRUCTION ITEMS FOR THE MUCCI-HICKS BRANCH DRAIN

1. Supply and install new outlet for Mucci-Hicks Branch Drain at Station 0+542 as per the General Specification for Construction of Covered Storm Drains in Appendix E:

a) Saw cut asphalt, excavate, remove and dispose of existing 750mm diameter corrugated steel pipe, being approximately 15 linear metres as shown on detail drawings.

Complete at Lump Sum ***$ 600.00***

b) Supply all labour, equipment and materials to flush, clean and video existing 750mm diameter corrugated steel pipe situated under and crossing County Road 20, being approximately 71 linear metres as shown on detail drawings.

Complete at Lump Sum ***$ 350.00***

c) Supply and install 4MPa non-shrink grout and provide adequate number of risers to complete grouting of existing 750mm diameter corrugated steel pipe and ensure pipe is filled within the County Road 20 right-of-way or as directed by the Engineer, being approximately 28 linear metres.

Complete at Lump Sum ***$ 2,800.00***

d) Supply to site 86 metres of 600mm diameter Boss 2000 High Density Polyethylene (HDPE) Pipe with minimum 320kPa pipe stiffness.

Complete at Lump Sum ***$ 8,600.00***

e) Excavate for, supply and install 1200mm diameter precast concrete storm manhole complete with 450mm sump, transition/flat-cap where necessary, taper cone, compacted granular backfill, parging, adjustment rings and frame and cover.

Complete at Lump Sum ***$ 6,500.00***

f) Supply labour and equipment to excavate for and install specified pipe including all drain excavation, disposal of surplus material and all drain bank and road restoration and bank seeding & mulching.

Complete at Lump Sum ***$ 12,000.00***

g) Supply and install all 19mm (3/4") nominal clear stone for pipe bedding including appropriate compaction, being approximately 30 tonnes.

Complete at Lump Sum ***$ 800.00***

h) Supply and install all granular 'A' material for pipe haunching, initial backfill and final backfill to minimum 300mm above pipe obvert including appropriate compaction, being approximately 170 tonnes.

Complete at Lump Sum ***$ 3,400.00***

i) Core drill into existing 2.44m x 3.65m concrete box culvert to connect 600mm diameter Boss 2000 pipe to Esseltine Drain. Price to include filling surrounding voids with non-shrink grout.

Complete at Lump Sum	***$ 1,500.00***
Total for Item 1 - Outlet for Mucci-Hicks Branch Drain	**$ 36,550.00**

TOTAL TENDER BASE PRICE (not including HST)	**$ 36,550.00**
Engineering Design Fees	$ 5,450.00
TOTAL PROJECT BASE PRICE (not including HST)	**$ 42,000.00**
1.76% H.S.T. Net Payable on Above	$ 739.00
TOTAL PROJECT COST (including HST)	**$ 42,739.00**

Our estimate of the total cost of this work, including all incidental expenses, is the sum of fourty-two thousand, seven hundred, thirty-nine dollars (**$42,739.00**) as per the above Construction Items for the Mucci-Hicks Branch Drain.

We would recommend that the cost of this work be assessed against the lands and roads affected in accordance with the accompanying Schedule of Assessment.

MUCCI-HICKS BRANCH DRAIN
SCHEDULE OF ASSESSMENT
MUNICIPALITY OF KINGSVILLE
PROJECT REFERENCE NUMBER 14-425

C) PRIVATELY OWNED - AGRICULTRUAL LANDS (GRANTABLE)

ENTRY NO.	TAX ROLL NO.	CON. OR PLAN NO.	LOT OR PART OF LOT	ACRES OWNED	ACRES AFFT'D	HECTARES AFFT'D	OWNERS NAME	(SECTION 22) VALUE OF BENEFIT LIABILITY	(SECTION 23) VALUE OF OUTLET LIABILITY	(SECTION 24) VALUE OF SPECIAL BENEFIT	(SECTION 26) VALUE OF SPECIAL ASSESSMENT	TOTAL ASSESSMENT
1	290-18200	1 E.D.	11	72.49	1.04	0.421	MUCCI FARMS LTD	$ 12,822.00	$ 29,917.00	$ -	$ -	$ 42,739.00
Total Affected Lands					**1.04**	**0.421**						
Total Assessment on Privately Owned Agricultrual Lands (Grantable)								**$ 12,822.00**	**$ 29,917.00**	**$ -**	**$ -**	**$ 42,739.00**

SUMMARY FOR TOTAL LANDS AFFECTED

A) Municipal Lands	**0.00**	**Acres**	**0.000**	**Hectares**
B) Non Agricultural Lands	**0.00**	**Acres**	**0.000**	**Hectares**
C) Agricultural Lands	**1.04**	**Acres**	**0.421**	**Hectares**
Total Lands Affected:	**1.04**	**Acres**	**0.421**	**Hectares**

1 Hectare = 2.471 Acres

***NOTE: Assessment Values have been rounded to the nearest whole dollar for presentation purposes.**

APPENDIX A

RC SPENCER ASSOCIATES HYDROLOGIC MODELING ANALYSIS

HYDROLOGIC MODELING ANALYSIS

Computer Applications

The design storm flows generated from different storm frequency events were estimated using computer application 'Hydroflow Hydrograph Extension for AutoCAD® Civil 3D® 2009 ' by Autodesk, Inc. v6.066**.**

The drain hydraulic calculations were performed using software HEC-RAS Version 4.1.0., developed at the Hydrologic Engineering Centre (HEC), which is a division of the Institute for Water Recourses (IWR), U.S. Army Corps of Engineers.

Assumptions and Methods

The Soil Conservation Service (SCS) Method, now known as (NRCS) National Resource Conservation Service was used for the design flow rates. This Method was developed to partition the total depth of rainfall represented by a design storm hydrograph, into initial abstractions, retention and effective rainfall.

The rainfall amounts for the calculations were obtained from the AES data for 24 hours duration storm published December 21, 2014 for Windsor Airport. Type II distribution and standard shape factor 484 was chosen for the models.

The hydraulic drain calculations were performed as one-dimensional hydraulic steady flow calculations, applying critical depth boundary conditions.

Drainage Area

The total drainage area was estimated in the process of detailed analysis of the existing drainage pattern and the history of drainage reports for previous years. The final watershed area contributing to the Esseltine Drain was estimated as 304 Ha.

The total watershed area was divided into sub-areas based on existing drainage patterns and the location of the discharge points. The sub-area arrangement and assumed discharge points are demonstrated on Figure H1 .

Curve Number

Curve Number (CN) was established based on existing soil classification, drainage conditions and type of land cover.

Soil Classification

Hydraulic soil group was defined from the Ontario Ministry of Natural Resource's publication *'Essex Region Conservation Report, 1975'*

The drainage area is divided in 2 parts:

- First part north of County Road 34 is generally characterized as harrow loams and burford loam. This soil type has good natural drainage and is assigned in the report to hydrologic soil group 'B'.
- The second part is south of County Road 34 and generally characterized as parkhill loam and berrien sandy loam. This soil type has fair to poor natural drainage and is assigned in the report to hydrologic soil group 'C'.

Lag Time

Lag time is defined as a function of time to peak which represents the time from the beginning of a rainfall to the peak of the runoff generated. This value is indicative of the area's response to storm events. It depends on the physical characteristics of the watershed such as length, slope area and surface cover. TR55 method was used for the calculation of the upstream time of concentration. The area A1 time of concentration was ignored for the reason of potential underestimation of the design flows because of extremely low flow velocities in the wooded area.

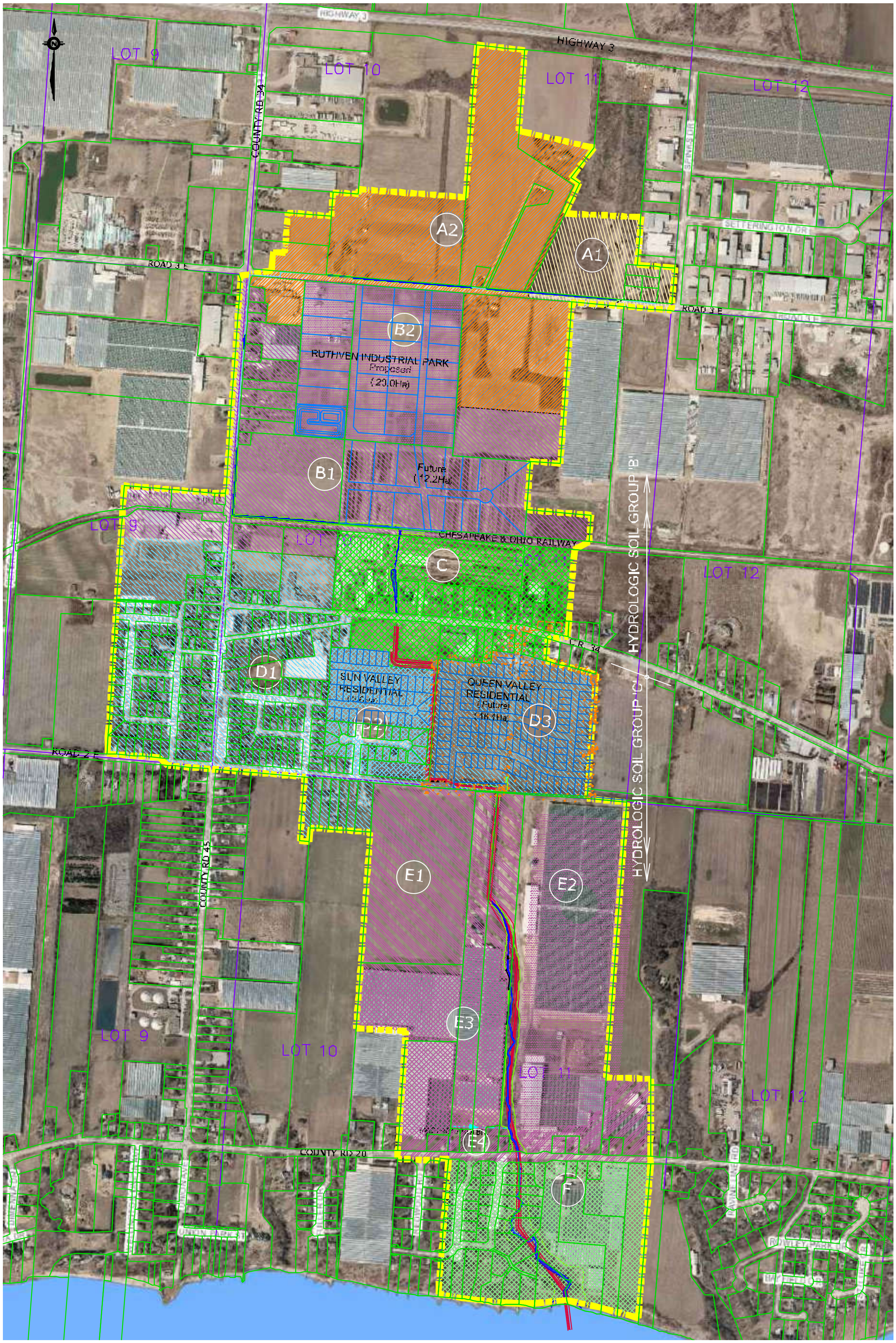
Modeling Specifics

There are a few land parcels in the watershed area which are currently under development or are planned to be developed in the near future. The provisions for new development were provided in the drain modeling.

It is proposed to release additional storm water flows generated by any new development south of Road 2 East without any restriction due to close proximity to the outlet and the proposed drain capacity.

During the design process the proposed drain modifications were analyzed for major and minor storm events including 1:100 year storm frequency and for few different scenarios, such as the existing conditions, the impact of the future developments with storm water management facilities, and the impact of the potential greenhouses extension. The base flows in the drain were accounted for in the final flow calculations.

The hydrologic analysis demonstrates the proposed drain modifications will provide sufficient capacity for the flows accumulated from the Esseltine Drain watershed area during major storm events, including potential imperviousness increase of the lands located south of Road 2 East.



Kingsville ONTARIO

RC SPENCER ASSOCIATES INC.
Consulting Engineers

261 Shepherd Street E.
Windsor, On, N8X 2K6
Phone: (519) 946-1122

Professional Engineers Ontario

18 Talbot St. W.
Leamington, On, N8H 1M4
Phone: (519) 324-0606

RC SPENCER ASSOCIATES INC. 25th ANNIVERSARY 1989 - 2014

ESSELTINE DRAIN ENGINEERING REPORT

DRAINAGE SUB-AREA
ARRANGEMENT

FIGURE H1

PROJECT NO.
14-425

scale 1:10000

APPENDIX B

REVIEW OF HISTORICAL DRAINAGE REPORTS IN THE ESSELTINE DRAIN AND TRIBUTARY MUNICIPAL DRAINS

APPENDIX B

File No. 14-425
June 17, 2016

REVIEW OF HISTORICAL DRAINAGE REPORTS ON THE ESSELTINE DRAIN AND TRIBUTARY MUNICIPAL DRAINS

Entry No.	Drainage Report Title	Municipality	Report Date	Report Prepared By	Recommended Works	By-Law No.	Comments	Drain Report Status	Report	Drawing No.
1	Whitewood Road Drain South Outlet Work	Town of Kingsville	Aug. 11, 2014	Gerard Rood, P.Eng.	Provide 45m of 300mm diameter polyethylene pipe and remove existing CSP outlet pipes from Whitewood Road to the existing ravine.				Yes	REI2013D025
2	Improvements to the Esseltine Drain	Town of Kingsville	May 20, 2011	Bruce D. County Roadozier, P.Eng.	Open drain repairs between County Road 34 and Road 2		** Not Constructed	Not Adopted	Yes	E10 (BC-10-034) Sheets 1-8
3	Colasanti Branch of the Esseltine Drain	Town of Kingsville	Sep. 10, 2004	Gerard Rood, P.Eng.	Install new 300mm diameter high density polyethylene HDPE tile on Road 3 East situated east of County Road 34 and west of Spinks Drive	By-Law 31-2005		Current Report		E10G (D04-006)
4	Third Concession Road Branch of the Esseltine Drain	Township of Gosfield South	Mar. 7, 1997	N.J. Peralta, P.Eng.	Drain widening and installation of approximately 131 metres corrugated aluminized steel Ultra-Flo Arch Pipe on the 3rd Concession Road situated east of Union Road	By-Law 14-1997		Current Report		E10D (95-036) Sheets 1-3
5	Relocation of part of Esseltine Drain	Township of Gosfield South	Aug. 21, 1991	Lou Zarlenga, P.Eng.	Relocate part of open drain situated south of County Road 34 to accommodate development	By-Law 50-1991		Current Report		E10 (BC-91-042)
6	Elgin Street Drain	Township of Gosfield South	Dec. 22, 1988	Lou Zarlenga, P.Eng.	Install new precast concrete manholes and catch basins onto existing 18 inch diameter, 15 inch diameter and 12 inch diameter concrete drain pipe along Elgin Street.	By-Law 13-1989		Current Report		E8 (A-139;BC-88-070)
7	Mastronardi Branch of the Esseltine Drain	Township of Gosfield South	Nov. 1, 1984	William J. Setterington, P.Eng.	Install new tile drain from the eastern limit of the Mastronardi property on the west to the existing ravine located through the Mucci property on the east 146 metres of 600mm diameter PVC Two 900mm diameter corrugated steel pipe catch water basin with cast-iron grate	By-Law 497		Current Report		Original copy
8	2nd Concession Branch of the Esseltine Drain	Township of Gosfield South	Dec. 21, 1976	William J. Setterington, P.Eng.	Excavation and cleaning of open drain along 2nd concession Road for 1183 feet then southerly 2,437 feet to the end of the established municipal drain. Note that from this point southerly the watercourse is classified as a natural watercourse to its outlet into Lake Erie. This Report confirms the south end of the existing Esseltine Municipal Drain	By-Law 404		Current Report		E10c

REVIEW OF HISTORICAL DRAINAGE REPORTS ON THE ESSELTINE DRAIN AND TRIBUTARY MUNICIPAL DRAINS

Entry No.	Drainage Report Title	Municipality	Report Date	Report Prepared By	Recommended Works	By-Law No.	Comments	Drain Report Status	Report	Drawing No.
9	Storm water drainage system report Hamlet of Ruthven	Township of Gosfield South	July 26, 1976	William J. Setterington, P.Eng.	Storm water report for new storm sewers on Regent, Mayfair, Oak Street, 36" diameter Sewer on Road 2 East					
10	Harris Drain Outlet, 2nd Concession Branch of the Esseltine Drain	Township of Gosfield South	Apr. 29, 1974	William J. Setterington, P.Eng.	Improvements to the outlet of the Harris Subdivision Drain and the Clearwater Park Subdivision Drain at the upper end of the open portion of the 2nd. Concession Branch of the Esseltine Drain. Extending the existing 24" diameter concrete pipe, the existing 27" diameter concrete pipe, and the existing 24" diameter corrugated steel pipe	By-Law 385		Current Report		
11	Peachtree (Harris) Subdivision Drain	Township of Gosfield South	Apr. 19, 1973	William J. Setterington, P.Eng.	Installed 27 inch diameter concrete storm pipe on 2nd Concession Road (west of County Road 45) and 27 inch diameter concrete storm pipe on 2nd Concession Road. (east of County Road 45). The Municipal drain start at Queen Street and flows easterly via the 27 inch diameter concrete pipe.	By-Law 381		Current Report		H1 Sheets 1-5
12	North-West Branch of the Esseltine Drain	Township of Gosfield South	Mar. 29, 1973	William J. Setterington, P.Eng.	Installation of 18 inch diameter corrugated steel pipe in the existing open drain situated just easterly of the rear lot lines of the lots fronting onto Mayfair Street from Regent Street to 2nd Concession Road, being the outlet	By-Law 382		Current Report		E10f (TT-406)
13	Greenwood Avenue Drain	Township of Gosfield South	Nov. 16, 1971	William J. Setterington, P.Eng.	Provided for the installation of 628 feet of 12 inch diameter concrete and 297 feet of 15 inch diameter concrete pipe and 5 manholes as part of the municipal drain. The outlet for the Greenwood Avenue Drain is provided by the Whitewood Road Drain outletting through a 15 inch diameter pipe situated between 1512 and 1514 Whitewood Road	By-Law 372		Current Report	Yes	G5

REVIEW OF HISTORICAL DRAINAGE REPORTS ON THE ESSELTINE DRAIN AND TRIBUTARY MUNICIPAL DRAINS

Entry No.	Drainage Report Title	Municipality	Report Date	Report Prepared By	Recommended Works	By-Law No.	Comments	Drain Report Status	Report	Drawing No.
14	Whitewood Road Drain	Township of Gosfield South	Jul. 2, 1969	William J. Setterington, P.Eng.	Provided for installation of: 420 feet of 15 inch concrete storm sewer on Whitewood Road 560 feet of 10 inch diameter concrete storm sewer on Whitewood Road 760 feet of 6 inch tile Drain connections 86 feet of 15 inch corrugated steel pipe on the ravine slope Pipes were placed within the Whitewood Road allowance and two drain outlets within the west bank of the ravine sideslope.	By-Law 350		Current Report	Yes	W6
15	Service Road Drain	Township of Gosfield South	Jul. 18, 1967	C.G. Russell Armstrong	Installed 12 inch diameter concrete storm sewer along service road north of the 2nd Concession Road and east side of CR 45.	By-Law 330		Current Report		S4 (3K-531)
16	Esseltine Drain (upper portion)	Township of Gosfield South	Sept. 8, 1966	William J. Setterington, P.Eng.	Cleaned open drain from upper end of drain on Road 3 just west of Spinks Drive and proceeded downstream to just southerly of the Chesapeake and Ohio Rail Road.	By-Law 514 & 313		Superceeded		E10
17	Esseltine Drain Extension (Wigle Branch of Esseltine Drain)	Township of Gosfield South	Jul. 4, 1966	William J. Setterington, P.Eng.	Provide closed drain for branch of the Esseltine Drain on the west side of the King's Highway #3 near the northern limit of the lands of the Chesapeake and Ohio Railway.	By-Law 312		Current Report	Oct. 1966	E10b
18	Fairlea Crescent Drain	Township of Gosfield South	Sep. 5, 1965	C.G. Russell Armstrong, P.Eng.	Provided for installation of 12 inch diameter concrete storm pipe on Fairlea Crescent Road.	By-Law 304		Current Report	Yes	F1 (3M-806)
19	Part of the Esseltine Drain	Township of Gosfield South	Aug. 15, 1964	C.G. Russell Armstrong, P.Eng.	Provided for installation of 18 inch diameter and 24 inch diameter concrete storm pipe along north side of 2nd Concession Road east of County Road 45 for approximately 1,100 feet and further cleaned the downstream balance of open drain situated on north side of Road 2 for distance of approximately 1,220 feet.	By-Law 299		Current Report	Yes	E10 (3P-446)

REVIEW OF HISTORICAL DRAINAGE REPORTS ON THE ESSELTINE DRAIN AND TRIBUTARY MUNICIPAL DRAINS

Entry No.	Drainage Report Title	Municipality	Report Date	Report Prepared By	Recommended Works	By-Law No.	Comments	Drain Report Status	Report	Drawing No.
20	Regent St. and Mayfair St. Drain	Township of Gosfield South	Mar. 9, 1961	C.G. Russell Armstrong, P.Eng.	Provided for installation of: 765 feet of 12 inch concrete crock on Regent Street 360 feet of 15 inch diameter concrete crock on Mayfair Street 315 feet of 18 inch diameter concrete crock on Mayfair Street		No By-Law Found		Yes	R4 (3H235)
21	Part of The Esseltine Drain	Township of Gosfield South	Jul. 25, 1958	C.G. Russell Armstrong, P.Eng.	Provided for cleaning of the open drain along the north side of the 2nd Concession Road for approximately 2,300 feet and southerly 1,600 feet to the south end of the municipal drain.	By-Law 256		Superceeded	Yes	E10 (3N-317)
22	3rd Con. Rd. Branch of the Esseltine Drain	Township of Gosfield South	Jul. 31, 1952	C.G. Russell Armstrong, P.Eng.	Cleaning upstream portion of the drain situated north of the railway tracks.	Amended By-Law 226A			Yes	E10d (TT-406)
23	Extension of Esseltine Drain	Township of Gosfield South	Nov. 12, 1949	C.G. Russell Armstrong, P.Eng.	Provided for cleaning of the drain situated south of the 3rd Concession Road	By-Law 207		Superceeded	Yes	E10 (YY-106)
24	Esseltine Drain and Branch	Township of Gosfield South	Jun. 6, 1947	C.G. Russell Armstrong, P.Eng.	Provided for cleaning of the drain along the north side of 2nd Concession Road and southerly downstream approximately 1,500 feet	By-Law 171		Superceeded	Yes	E10 (VV-337)
25	Esseltine Drain and Branch	Township of Gosfield South	Sep. 6, 1930	James Laird, Engineer	Provided for cleaning of the open drain situated along the north side of the second Concession Road	By-Law 133		Superceeded	Yes	E10
26	Esseltine Drain and Branch	Township of Gosfield South	Sep. 25, 1920	James Laird, Engineer	Provided for cleaning of the open drain situated on the north side of the second Concession Road			Superceeded	Yes	E10

APPENDIX C

SUMMARY OF ADDITIONAL DRAINAGE REPORTS PROVIDED, REVIEWED FOR SURROUNDING MUNICIPAL DRAINS

APPENDIX C
PAGE 1 OF 2
File No. 14-425
June 17, 2016

SUMMARY OF ADDITIONAL DRAINAGE REPORTS PROVIDED REVIEWED FOR SURROUNDING MUNICIPAL DRAINS

Entry No.	Drainage Report Title	Municipality	Report Date	Report Prepared By	Recommended Works	By-Law No.	Comments	Drain Report Status	Report	Drawing No.
1	East Branch, Fleming-Wigle Drain	Township of Gosfield South	Nov. 23, 1974	William J. Setterington, P.Eng.	Improve open drain from southern limit of the former Windsor, Essex and Lakeshore Rapid Railway to 2,040 feet south	By-Law 390				
2	Part of the Fleming Wigle Drain	Township of Gosfield South	Jun. 1, 1971	William J. Setterington, P.Eng.	Provide for cleaning of part of the Fleming-Wigle Drain approx. 609' north of 2nd Concession Road, for a total of 2160' southerly.	By-Law 371				F-5
3	Part of the Fleming Wigle Drain	Township of Gosfield South	Apr. 29, 1948	C.G.R. Armstrong, P.Eng.						F-5
4	Chesapeake and Ohio Branch of Fleming Wigle Drain	Township of Gosfield South	May 30, 1979	William J. Setterington, P.Eng.	Provide for cleaning of open drain along Chesapeake and Ohio Branch of Fleming Wigle Drain	By-Law 526/526A				F-5 (c)
5	Danube Drain	Township of Gosfield South	Nov. 29, 1985	William J. Setterington, P.Eng.	Located at 1583 County Road 34 along Peterson Road	By-Law 507A				D-2
6	2nd Concession Road Drain and Branch No. 1	Township of Gosfield South	Feb. 9, 1998	Nick Peralta, P.Eng. Gerard Rood, P.Eng.	Provide cleaning of Peterson Branch and 2nd Concession Drain from Peterson Road to ERCA corridor	By-Law 14-1998				S10
7	East 3rd Concession Drain Extension	Township of Gosfield South	Oct. 9, 1998	Lou Zarlenga, P.Eng.	Drain enclosure along Colasanti Farms north of 3rd Concession road West of County Road 34					T8
8	East 3rd Conc. Drain	Township of Gosfield South	Aug. 16, 1979	William J. Setterington, P.Eng.	Provide for open drain along 3rd Concession Road	By-Law 420				T8
9	Drain Enclosure on Pt Lot 12, Concession 3 Spinks Subdivision Drain	Municipality of Kingsville	Oct. 20, 2004	Tim Oliver, P.Eng.	Located along Spinks Dr.	By-Law 66-2004				S-19
10	Spinks Subdivision Drain and Branches	Township of Gosfield South	Mar. 30, 1992	Lou Zarlenga, P.Eng.	Located along Spinks Dr.	By-Law 26-1992	Cover of By-Law provided			
11	Fox-Jakait Drain	Municipality of Kingsville	Jul. 25, 2014	Gerard Rood, P.Eng.	located along Road 3E, east of Esseltine Drain-Need to know status					
12	Bert Mucci Drain	Township of Gosfield South	Aug. 15, 1995	Lou Zarlenga, P.Eng.	Located north of County Road 20, west of Esseltine Drain	By-Law 32-1995				B-8
13	Union Avenue Drain	Township of Gosfield South	Aug. 17, 1987	Lou Zarlenga, P.Eng.	Located south of Road 2E east of County Road 45					U-1
14	Lower Part Albert Gunning Drain	Township of Gosfield South	Jun. 18, 1980	William J. Setterington, P.Eng.	600mm diameter concrete storm sewer along the west side of County Road 45 from approx. 281 feet south of 2nd Concession Road southerly	By-Law 436				A-4
15	Upper Part Albert Gunning Drain	Township of Gosfield South	Mar. 20, 1981	William J. Setterington, P.Eng.	Located south of Road 2E west of County Road 45	By-Law 442				A-4

File No. 14-425
June 17, 2016

SUMMARY OF ADDITIONAL DRAINAGE REPORTS PROVIDED REVIEWED FOR SURROUNDING MUNICIPAL DRAINS

Entry No.	Drainage Report Title	Municipality	Report Date	Report Prepared By	Recommended Works	By-Law No.	Comments	Drain Report Status	Report	Drawing No.
16	Union Water Drain	Municipality of Kingsville	Jul. 27, 2012	Gerard Rood, P.Eng.	Located south of Road 2E west of County Road 45					Union Water
17	Redwood Road Drain	Municipality of Kingsville	Feb. 10, 1999	Lou Zarlenga, P.Eng.	Located West of Greenwood Road	By-Law 19-1999				R-3
18	Setterington Mastronardi Branch of King's Highway No. 3 Branch of the Sturgeon Creek	Municipality of Kingsville	July 28, 2003	D.A. Averill, P.Eng.	Located along Highway No. 3 east of County Road 34	By-Law 91-2005				S-24
19	King's Highway No. 3 Branch of the Sturgeon Creek	Township of Gosfield South	Apr. 4, 1974	William J. Setterington, P.Eng.	Located along Highway No. 3 east of County Road 34					S-24

NOTE: In order to confirm the extent of the drainage limits of the Esseltine Drain the above noted drainage reports for surrounding Municipal Drains were reviewed by the Engineering Consultant.

APPENDIX D

MINUTES OF ON-SITE MEETING
MAY 21, 2015

ESSELTINE DRAIN

MINUTES OF ON SITE MEETING

AND SUBSEQUENT CONSULTATION WITH LANDOWNERS

The on-site meeting was held on May 21, 2015 indoors at the Town of Kingsville arena to enable everyone to hear the proceedings. At this meeting, the condition of the existing ravine downstream of County Road 20 was discussed and possible alternative solutions to provide a sufficient outlet to the municipal drain were discussed. A summary of the meeting is listed below:

In Attendance:	**Representing:**
1. Lou Zarlenga	RC Spencer Associates
2. Amy Grenier	RC Spencer Associates
3. Ken Vegh	Town of Kingsville
4. Sandra Ingratta	Town of Kingsville
5. Nik Mastronardi	Landowner
6. Phyllis Hicks	1525 Brookview
7. Richard Hicks	1525 Brookview
8. Stephanie Gevaert	Landowner
9. Vicki Calcott	1521 Brookview
10. Keith St. Denis	1524 Brookview
11. Jim Jensen	1523 Brookview
12. Shirley Jensen	1523 Brookview
13. Joe Knight	1916 Seacliff
14. Don Kennedy	1496 Whitewood
15. Jean Towle	1496 Whitewood
16. Susan Fernandes	1519 Brookview
17. Representative for	1827 Seacliff Drive
18. Conni and Jim Latam	1517 Brookview
19. Steve Marchand	1506 Whitewood
20. Felicia Rico	1506 Whitewood
21. Karen Schiller/Myles	1648 Regent St.
22. Jacob Agatha Sawatzky	Landowner
23. Joe Pereira	1527 Woodfern Ave.
24. Sara Klassen	1892 Road 3E
25. Isaac Klassen	Landowner
26. Ercole Dimenna	1568 Union Ave.
27. Abram Friesen	1910 Road 3
28. Andrew Dann	1512 Whitewood
29. Sheila Baltzer	1824 Queen Blvd.
30. Butch Baltzer	1824 Queen Blvd.
31. Peggy Mockler	1508 Greenwood

In Attendance:	Representing:
32. Greg Mockler	1508 Greenwood
33. Ken Cosford	1527 Willow Dr.
34. Cathy Bakes	1511 Whitewood Rd.
35. Dennis Reive	1576 County Rd. 34
36. Bob Bakes	1511 Whitewood Rd.
37. Donna and Garry Johnson	1604 Road 2
38. Rudy and Helen Spitse	1851 Woodfern Ave.
39. C & C Harrison	1671 Road 2
40. Brook Gardner	1516 Whitewood Rd.
41. Pat Mattia	1636 Hwy 3
42. Garry Atkinson	1573 County Road 34
43. Carolyn Stockwell	1777 Road 3 E
44. Mike Stein	1654 Road 2E
45. Bill Hiebert	1648 Road 2E
46. Lori Beresh	1562 Lee Rd
47. Joe Beresh	1562 Lee Rd
48. Dennis Brown	1649 Regent
49. Anjanette MacTavish	1838 Seacliff Dr.
50. Sue and Dave White	1508 Whitewood
51. Joni Baltzer	1518 Whitewood
52. Christine Friday	1575 County Rd 34
53. Marc Pinsonneault	1504 Whitewood
54. Scott and Lori Shilson	1510 Whitewood
55. Tony Mastronardi	1586 County Rd 34
56. Nancy Penner	1722 Union Ave.
57. Bradley Lane	1775 Cottonwood
58. Todd Jenner	1859 Woodfern
59. Leo Probe	1522 Whitewood
60. Gianni Mucci	1876 Seacliff Dr.
61. Frank and Nelly Guenther	1532 Willow Dr.
62. Jackie Bruno and David Gulyas	1502 Whitewood
63. Harry Keller	1810 Talbot
64. Christina Porrone	1811 Talbot
65. Tony DiMenna	1766 Talbot
66. Anna Guenther	1801 Seacliff
67. Mindy Colenutt	1628 Road 2 E
68. George Dekkin	SSGH
69. Garry Symons	1517 Whitewood
70. Rudy Mastronardi	H.A. Mastronardi

The Drainage Superintendent, Ken Vegh, made introductions, announced the Engineer on Record and noted that the authorization to proceed with this project is provided under Section 78 of the drainage act, to repair, improve and extend the existing municipal drain to a sufficient outlet.

The Engineer on Record, Lou Zarlenga, P.Eng. provided a brief history of the drainage act and summary of the procedures under section 78 of the Drainage Act and described the affected drainage area and answered questions as follows:

1. The drainage area was described as being approximately 315 hectares and the length of existing watercourse requiring repair under this report is approximately 2,400 metres.

2. The above noted 2,400 metres under report consists of approximately 1,530 metres of existing municipal drain, and 870 metres of ravine and natural watercourse.

3. In general, the natural watercourse situated between Lake Erie and County Road 20 is approximately 520 metres in length and will require stabilization of the watercourse bottom. Alternatives are being reviewed such as installing a pipe along the drain bottom (concrete box culvert, corrugated steel pipe arches, etc.) and the use of concrete products to line the open drain bottom.

4. From County Road 20 northerly to Road 2 East, being approximately 1080 metres in length, the watercourse requires cleaning and realigning to straighten meandering sections and to move the drain away from the west bank in some sections.

5. North of Road 2 East to County Road 34, being approximately 790 metres in length, the municipal drain requires brushing and excavation to current report design grade and several pipe bridges are to be installed to accommodate residential and industrial development.

6. It was noted that after considering all of the options, the Engineer will prepare a drainage report which will describe the drainage issues and remedies, provide a cost estimate of all of the works, along with a schedule of assessment identifying each owner's portion of the cost. The owners will be provided a copy of the drainage report (at least 10 days prior to the meeting to consider the report) and will be notified of the meeting to consider the report, followed by the Court of Revision (after 40 days) to address issues on assessments. Once the report is adopted, a contractor will be chosen. The anticipated timeline was noted as late fall of this year to consider the drainage report, with construction possibly starting in late fall of 2016.

7. A slide show presentation was presented to illustrate the drainage area, and to show the existing condition of the natural watercourse downstream of County Road 20.

General Concerns of Landowners:

a) Leo Probe questioned whether the watercourse in the ravine area from County Road 20 southerly is maintained by the municipality. The Engineer noted that the southerly section is a natural watercourse, which is a legal entity providing the adjacent landowner a right of drainage, however, the residents have to accept the water from upstream lands. The current natural watercourse is aging; therefore, if repair and improvements are not provided, it may have severe consequences to abutting lands. If improvements are made, the owners may be required to pay for maintenance on a yearly basis. Drainage superintendent Ken Vegh added that the municipality has presently no authority to conduct works in the natural watercourse unless it is adopted as a municipal drain. The Engineer noted the methodology of payment for municipal drains is to assess properties based on rate and amount of water flowing from their property into the drain. Agricultural land without greenhouses will have an approximate average assessment rate of 10 times less than those with greenhouses, and residential lands will be approximately 3 times more than bare agricultural lands.

b) David Gulyas at 1502 Whitewood (backing onto Lake Erie and not onto the ravine) noted that he has lived there since 1986 and has not noticed much change in the watercourse. Mr. Gulyas referred to the slide show presentation and asked how the slippage will be fixed. The Engineer noted that substantial work is required south of County Road 20, extending to the outlet into Lake Erie. The work would include raising the drain bottom elevation with imported clay fill to stabilize the toe of slope, which will allow the upper side slopes to stabilize. Re-grading and fill may be required on various portions of existing banks. Work up to the top of the ravine would be prohibitive and that type of work is not presently contemplated. A seepage collector system along the bottom of the proposed flow channel would control water piping under the erosion control mats.

c) Andrew Dann at 1512 Whitewood questioned whether existing residential properties would be tapped into the seepage pipe. The Engineer indicated this issue will be reviewed as part of the seepage control.

d) Mark Pinsonneault at 1504 Whitewood questioned how the outlet at Lake Erie will look if we raise the watercourse bed. The Engineer indicated the outlet would consist of a weir with gabion baskets filled with quarried limestone and having steps across the weir and down to the shoreline.

e) Ken Cosford at 1527 Willow Drive questioned whether the assessments calculated by the Engineer have an end date or if it is continuous. Drainage superintendent Ken Vegh noted that the actual repair and improvement costs are one time costs however maintenance costs will continue and vary depending on maintenance activities.

f) Vicky Calcott at 1521 Brookview Drive requested the Engineer to inspect her property. She mentioned the yard is losing trees, land, habitat, fire pit, path, etc.

g) Sue White at 1508 Whitewood Rd. is requesting photos of the proposed works and requested the Engineer to attend at her property to inspect the existing banks.

h) Joni Baltzer at 1518 Whitewood requested the Engineer to inspect her property.

i) A letter dated May 20, 2015 was received from Neil MacTavish, at 1838 County Road 20, who was unable to attend the on site meeting, addressing his concerns on the project. A summary of the concerns are as follows:

- They are concerned about tree clearing of the east side of the drain on the adjacent Mucci property, as the existing trees are providing a barrier to reduce noise, filter dust, block the view of the building, and reduce the light from the parking lot. They would like to encourage any near natural way of firming up the bank.

- Mr. and Ms. McTavish strongly support the paving of the adjacent Mucci Pac parking lot to reduce dust.

- Should the project require removal of trees from the drain bank, a large barrier is requested to be placed adjacent to the driveway. An alternative request was to have the town or ERCA purchase their property at a reasonable price.

General Comments:

a) There was question as to what caused all of the problems to the drain. The Engineer explained that it is a natural watercourse created by water running through it and erosion will happen naturally. Given the elevation difference along the ravine, erosion may be accelerated depending on the native soil. It was noted that all of the developments upstream of County Road 20 have storm water management systems restricting the rainfall release rate to the pre-developed storm flows; therefore, theoretically there is no change in storm water flow rate from the new developments.

b) There was question as to whether a petition was signed. Drainage superintendent Ken Vegh noted that the Town initiated this project and in this case a petition was not required from the residents as the Town proceeded under Section 78 of the Drainage Act. The Engineer noted that Section 78 allows the Town to request these works as the existing Esseltine municipal drain requires a sufficient outlet.

c) There was a question whether the Town would take over the drain if the drain could be abandoned. The drainage superintendent noted it would not be in the Town's best interest to abandon the Esseltine Drain due to the number of agricultural properties it services. It was clarified that a greenhouse is considered to be agricultural land use. A question was raised whether all greenhouses have sufficient stormwater management systems. The Engineer indicated the municipality has a policy requiring storm water management for greenhouse operations.

d) There was a question on the aesthetics of the drain after construction. The Engineer explained the drainage improvement would consist of building up the existing watercourse bottom by installing imported clay fill to an approximate height of 5 metres. Above this clay would be created a flow channel using articulated modular concrete erosion control matts. To address the maintenance issue, an access path will be constructed adjacent to the flow channel. Modules can be seeded, such that in a few years, the channel will take on a vegetated appearance.

e) A question was raised whether filling the ravine 5 metres would be higher than the existing surface of the adjacent properties. The Engineer noted that some areas of fill may require additional grading. However, some properties (i.e. Richard Hicks' property) will require less fill.

f) A question was raised whether the system will be designed to allow future development and are development charges considered. The Engineer noted that future developments north of County Road 20 are considered; however, the assessments are not related to the Town's Development Charges. Drainage assessments are levied directly to the affected landowners.

g) A question was raised whether old developments would be required to update to include a holding pond as new developments have. The Engineer noted that all new development will have to provide stormwater management systems. However, all existing developments and ponds remain as present unless the development are enlarged.

h) A resident questioned whether this drain will be similar to that of the Judson Morse Drain constructed approximately 17 years ago. The Engineer explained the previous project was situated within the Town of Leamington with a small portion situated in the Town of Kingsville. The work performed was to supply and place clay fill and install 1200mm diameter pipe for the hundred year flow. The drain was also filled and landscaped and seeded. Pipe options have been considered for the Esseltine project and are more expensive. Photos of projects and the erosion matts were requested, or a similar project to look at. Photos were subsequently provided to the drainage superintendent.

i) A question was raised how a Landowner can object if they feel they should not be included in the drainage area. The Engineer explained that changes can be made to hectares affected at the Court of Revision and the Drainage Act provides several appeal opportunities. The drainage superintendent noted that the first step would be to talk to the Engineer and the drainage superintendent.

j) A question was raised as to what other studies have been or are being done for the drain. The Engineer explained that Biologic Inc. from London will be reporting on the environmental aspect of the drainage works and Golder Associates will be reporting on geotechnical, soils and stability issues.

k) There was concern that the work should be done up to the top of the ravine instead of just the bottom. The Engineer explained the consultant was addressing the request of the Town to extend the existing municipal drain to a sufficient outlet. The ravine will be converted to a municipal drain and individual concerns can then be dealt with at a later time with the Town. Additionally, filling the ravine to the top may not receive residents' approval.

l) A question was raised whether we have looked at stepping the drain. The Engineer noted that we have considered this, similar to the McCain sideroad drain (which has a series of 300mm steps with steel sheet piling). The circumstances are different at the Esseltine project and grade breaks may not be a best option.

m) A question was raised as to how the assessment will be performed. The Engineer noted that there are a number of methods identified in the Drainage Act, such as benefit assessments, outlet assessment (based on the amount of water), and special benefits. Culverts would be in the report as a special benefit to whoever requested them, as well the affected road systems would be assessed.

n) A question was raised as to whether there is funding available by the government. The drainage superintendent noted that a 33% grant for agricultural properties may be available for qualified agricultural lands; however at this time there are no grants for residential properties.

o) It was questioned whether the assessment will be based on current land use or future. The Engineer noted that future development will be considered and the assessment is based on current use. It was also noted that any property damages to be paid will be based on current land value.

p) Concern was raised on the condition of the Third Concession Drain between the DiMenna property, and why we are not considering this section in this report. The Engineer explained that our mandate is up to County Road 34 for repairs to the Esseltine municipal drain. The drain does continue north; however it is not part of our scope of work. Concerns regarding maintenance of the DiMenna Drain should be brought up to the drainage superintendent.

Subsequent Property Inspections Requested by Landowners

1. Consultation with Richard Hicks (1525 Brookview):

   On June 1, 2015, Richard Hicks called Mr. Zarlenga to say it rained all day on May 31, 2015 and his neighbour across the drain (Leo Probe at 1522 Whitewood) had his steel wall wash out. Richard has a rain gauge and received 4 inches rain yesterday (May 31, 2015). Mrs. Hicks believes the water came off of the road and washed the steel sheet pile out.

   On December 16, 2015, Mr. Zarlenga received an e-mail from Richard and Phyllis Hicks indicating they will be away 3 to 4 months in the New Year and to contact them via e-mail if required about Esseltine drain project.

2. Consultation with Jackey Bruno and David Gulyas (1502 Whitewood):

   On November 3, 2015, Jackey Bruno called Mr. Zarlenga and said she is not affected by the Esseltine Drain as she is on the south side of Whitewood Road and backs onto Lake Erie. Jackey explained a lot of debris has been floating up and onto her lakefront shoreline, some of which Jackey believes is from the Esseltine Drain. Mr. Zarlenga indicated if the drain is improved much of the soil erosion will be controlled. Mr. Zarlenga indicated next time he is in Town he will drop in to inspect.

   David Gulyas called Mr. Zarlenga later that day and indicated he noticed the Esseltine Drain creates silt and debris. When it storms his waterfront receives a lot of plastics that are deposited on their beach. He asked if the Esseltine Drain could be fitted with a screen to prevent this from going down the watercourse. Mr. Zarlenga indicated these products may be originating from other areas; also screens would not be a good approach to control the floating debris. Mr. Zarlenga recommended Mr. Gulyas call ERCA for more information on the shoreline.

3. Consultation with Deborah and Edmond Rollier (1519 Brookview):

   On December 18, 2015, Mr. Zarlenga and Amy Grenier met at the site with Mr. Edmond Rollier, owner of 1519 Brookview and described the potential work on the watercourse and the effect on existing trees.

   Mr. Rollier also indicated he and his wife were not notified of the drainage project when they just purchased this home. Mr. Zarlenga recommended that Mr. Rollier contact the Town administration to discuss this situation.

4. Consultation with Sue White (at 1508 Whitewood):

On May 26, 2015, Sue White called Mr. Zarlenga and asked to have him attend the site and describe how her property would be affected. Sue also requested photos of cable concrete to be sent to her.

On November 17, 2015, Sue White called our office to report on dark water and suds flowing in the natural watercourse. Photos were e-mailed. Mr. Zarlenga suggested to Sue that she call the Town, as process water should not be going to an outside stream. Sue indicated this same situation occurred 3 weeks before this event.

On December 18, 2015, Mr. Zarlenga met on site at 1508 Whitewood Road with Sue White, David White and Scott Shilson to describe a proposed re-alignment to eliminate the severe bend in the drain situated on the White lands. Sue indicated the proposal would cut off access to the back of her property and requested other options.

On December 21, 2015, Sue White called our office and spoke with Mr. Zarlenga and requested the routing to follow the existing open drain. Mr. Zarlenga indicated this was being looked at.

5. Consultation with Harry Keller (1810 Talbot Road):

On September 1, 2015, a phone message was received from Harry Keller requesting a meeting. Mr. Zarlenga was in the area and met with Mr. Keller. Mr. Keller had questions on assessments. Mr. Zarlenga explained how the drainage assessments are calculated and that his residential lot would only be assessed for outlet.

6. Consultation with Joni Baltzer (1518 Whitewood):

On August 11, 2015, Mr. Zarlenga attended 1518 Whitewood with Joni Baltzer. Joni indicated she was planning on selling her house and wished to know what was going to be done to the drain on her property. Mr. Zarlenga inspected the back yard and watercourse. The flow was at base flow, the banks showed evidence of bank slipping, and a dead tree was blocking flow. The back yard has a low area, bonfire and sitting area, and several large trees. Mr. Zarlenga indicated to Joni the approximate height of the clay fill and described the proposed cable concrete flow channel. The proposed fill height would not affect her low sitting area.

7. Consultation with Neil McTavish (1838 County Road 20)

On April 9, 2015, Neil McTavish called Mr. Zarlenga and indicated his house was west of the drainage work. Mr. McTavish commented on the easterly situated greenhouse lands and operations and requested consideration of erosion protection to the drain just north of County Road 20 at the drain crossing and to review the storm water management system at the greenhouse compound.

On November 25, 2015, an e-mail was sent from Neil McTavish to Mr. Zarlenga indicating he might sell his property to the easterly situated landowner.

Mr. Zarlenga indicated design of the Esseltine flow channel was under way and bank and erosion protection was being considered for the area adjacent to the Mucci easterly-situated compound as previously requested.

8. Consultation with Mark Pinsonneault (1504 Whitewood):

On July 15, 2015, Mr. Zarlenga met on site with Mark Pinsonneault who had some concerns with the existing cliff at the outlet of the Esseltine watercourse into Lake Erie. Mr. Zarlenga again met with Mark on November 5, 2015 and provided a preliminary cost estimate of armour stone for tree protection of approximately $25,000. Mark indicated he would not pursue the tree protection at the shoreline.

9. Consultation with ERCA:

On July 8, 2015, Mr. Zarlenga met with Tim Byrne and John Henderson (of ERCA) regarding a request for further modelling of the base flow channel of the Esseltine Drain. A Hydrologic Study was prepared for the Esseltine Drain drainage area; however, ERCA requested additional modelling of multiple storm water management systems during rain events.

In regard to the above, an e-mail received from the Kingsville CAO on July 14, 2015 indicating the additional modelling would not be required.

10. Consultation with Marion Fantetti:

    On July 17, 2015, Mr. Zarlenga met with Marion Fantetti from Windsor Essex Economic Development regarding development areas and ERCA flow modelling information. Mr. Zarlenga provided Marion mapping of the Esseltine Drain. Golder Associates additionally provided a report on stability of sideslopes and the benefit of multiple storm water systems operating together.

11. Consultation with Joni Baltzer:

    On March 9, 2016, Mr. Zarlenga received a phone call from Joni Baltzer, 1518 Whitewood. Joni advised Mr. Zarlenga that she was planning on selling her property. Mr. Zarlenga advised her to notify the Town.

12. Consultation with David Dann:

    On April 16, 2016, Mr. Zarlenga met with Mr. David Dann at 1512 Whitewood Road on Saturday April 16, 2016 upon a request from Mr. Dann. Upon meeting at the site, Mr. Dann requested a description of the potential drain improvements and effect upon his back yard. Mr. Zarlenga provided a description and Mr. Dann indicated his hope the project proceeds as his home and adjacent Shilson residence were in jeopardy until Mr. Shilson performed preliminary repairs to the west sideslope of the natural watercourse.

13. Consultation with Scott Shilson:

    On December 18, 2015, Mr. Zarlenga was originally contacted by Mr. Shilson, who indicated that in July of 2013 a severe rain storm occurred, resulting in substantial storm runoff into the natural watercourse. This caused extensive erosion to the west bank of the natural watercourse adjacent to his residence.

14. Consultation with Bert Mucci, MB1876, Mucci Farms:

Mr. Zarlenga met with Mr. Bert Mucci on June 1, 2016 and reviewed general restoration of the gulley situated totally on the Mucci lands north of County Road 20. Mr. Mucci indicated the majority of the trees in the gulley were in poor condition and potentially dangerous as maintenance had not been performed for an extended period. Mr. Mucci indicated his wish to be able to maintain a realigned drain and gulley in a sightly condition with selected trees of his choice remaining. Sidesloping of the gulley was discussed in depth as Mr. Mucci indicated over excavation of the sideslopes might expose previous debris used to backfill areas of the gulley.

Mr. Mucci also agreed to provide an area on his farm for the contractor to store equipment and materials for this project. We further reviewed a proposed new farm culvert to be situated at Station 1+100 to Station 1+175 allowing for truck traffic to cross the Esseltine Drain and provide ability to square off several greenhouses situated west of the Esseltine Drain.

* Please note that all of the above entries have been sorted by Landowner and will therefore not appear in chronological order.

APPENDIX E

SPECIFICATIONS

- Special Provisions
- Environmental Protection Special Provisions
- General Specification for Construction of Open Drains
- General Specifications for Construction of Covered Storm Drains
- Material and Installation Specifications for Cable Concrete

SPECIFICATIONS
SPECIAL PROVISIONS
ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

SPECIFICATIONS
SPECIAL PROVISIONS
ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

Contents

SPECIFICATIONS
SPECIAL PROVISIONS
ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

1.0 EARTHWORKS

Please note that the quantities listed below are approximate and for informational purposes only. The Contractor will be paid for the following earthworks items under the corresponding item in Part E of the Construction Items for the Esseltine Drain.

Stations	Clearing/ Stripping (C.M.)	Excavation/ Cut (C.M.)	Total Fill (C.M.)
0+000 to 0+520	1,820	2,580	23,100
0+542 to 0+873	990	3,970	4,010
0+873 to 1+600	1,300	6,590	2,915
1+600 to 2+387	100	960	275
TOTAL	**4,210**	**14,100**	**30,300**

Imported Clay Fill can be calculated as the difference between the Total Required Fill and the Total Excavation of Suitable Clay Material as follows:

30,300 m^3 – 14,100 m^3 = 16,200 m^3

Therefore, 16,200 bank cubic metres of imported clay fill are required.

1.1 Excavation of Drain Bottom

Totalling 2,387 linear metres of drain and approximately 14,100 m^3 of material.

Excavation of the drain channel shall be carried out as specified herein. The Contractor shall clean and shape the bottom of the drain in all cases to the bottom width shown on the Drawings. **The existing banks of the drain shall not be disturbed unless specified herein or identified by the Drainage Superintendent as requiring repair.**

Excavation shall be carried out in accordance with the profile shown on the Drawings. In all cases, the Contractor shall use the bench marks to establish the proposed grade. However, for convenience, the Drawings provide the approximate depth from the surface of the ground and from the existing drain bottom to the proposed grades.

The excavation shall generally follow the course of the existing drain, excluding the areas of re-alignment as shown on the Drawings. **THE CONTRACTOR SHALL NOT EXCAVATE DEEPER THAN THE GRADE LINES SHOWN ON THE DRAWINGS.** Existing drain side slopes, which are stable (in the opinion of the Drainage Superintendent) and do not require excavation to achieve the specified bottom width, shall not be disturbed by the Contractor.

All excavation work shall be done in such a manner as to not harm any vegetation or trees not identified in this report or by the Drainage Superintendent for clearing. Any damages to trees or vegetation caused by the Contractor's work shall be rectified to the satisfaction of the Drainage Superintendent.

1.2 Clearing and Topsoil Stripping

Removal of existing deleterious material as required, including unsuitable topsoil, wood chips, leaves and any other miscellaneous debris.

Totalling 2,387 linear metres of drain and approximately 4,210 cubic metres of clearing and stripped topsoil material.

From Station 0+000 to 0+520 (ravine area) and 0+551 to 0+650, the Contractor shall strip all areas for the proposed cable concrete flow channel and maintenance corridor as well as any areas of side slope grading to match existing grade at a slope of 2H:1V.

From Station 0+650 to 1+300 (gulley area), the Contractor shall strip all areas requiring excavation or fill for the flow channel and side slope grading as per the cross sections in the Drawings.

From Station 1+300 to 2+387, the work is primarily reconditioning of the existing municipal drain; therefore, there is not a significant amount of stripping expected. For the stripped material in this section, the Contractor shall cast the material onto the adjoining land and shall be spread evenly to a depth not exceeding 100mm and kept at least 1.2m clear from the finished edge of the drain.

1.3 Hauling and Levelling of Excavated Materials

From Station 0+000 to Station 2+387, suitable clay material shall be required to be hauled, placed and compacted at the fill areas, mainly located from Station 0+000 to Station 1+300. It is expected that there will not be any hauling and off-site disposal of any suitable clay fill material as there is a significant quantity of required clay fill for this project.

1.4 Trucking of Excavated Materials

Trucking of excavated materials on-site will be required to transport the suitable clay fill to the fill areas, mainly located from Station 0+000 to Station 1+300.

Totalling approximately 14,100 cubic metres of material.

1.5 Imported Clay Fill

This project will require the Contractor to provide, haul and place suitable imported clay material. The imported clay material shall be tested by a geotechnical consultant to assure suitability for this project.

Totalling approximately 16,200 bank cubic metres of material.

The imported clay material shall be excavated from a borrow pit for measurement purposes. The material shall be tested by a geotechnical consultant and approved by the Engineer. Previously excavated and stockpiled clay material will not be accepted for this project. The Engineer will have a survey conducted of the borrow pit area, prior to and after the project, to determine payment for material used.

For any additional imported clay material required for miscellaneous purposes, in excess of the material used from the borrow pit, the Contractor may import suitable clay material by truck load as long as the material has been tested by a geotechnical consultant and approved by the Engineer. This imported clay fill must be weighed on a public weigh scale and tickets must be provided to the Engineer or on-site Inspector immediately upon delivery of the material to the site. The use of weighed imported clay will only be used for special consideration.

1.6 Ontario Provincial Standard Specifications

Except as extended and amended herein, the work shall conform to the current specification of OPSS Form 206 for the Earth Excavation and Grading, OPSS Form 212 for Earth Borrow and OPSS Form 902 for Excavating and Backfilling.

2.0 EROSION PROTECTION WORKS

The Contractor shall supply and install the required quantities of graded stone rip-rap erosion protection materials as follows:

- Station 0+923 (Roll No. 290-18200) – Over 600mm diameter outlet pipe from Mucci Farms pond. Install 25 square metres of stone rip-rap erosion protection..
- Station 1+726 (Roll No. 290-22100) – At east end of the proposed 2-1600mm diameter Hel-Cor CSP culvert. Install 50 square metres of stone rip-rap erosion protection.

3.0 BRUSHING AND GRUBBING

From Station 0+000 to 0+520 the Contractor shall close cut and dispose of any brush. All trees removed from this area shall be in strict compliance with the Tree Removal Program provided herein. The total number of tree removals specified in this program is 228, using close cutting and application of stump killer.

From Station 0+551 to Station 1+100 the Contractor shall close cut and dispose of any brush. All trees situated within a cut or fill area or as per landowner's request shall be removed and disposed of at an off-site disposal area arranged for by the Contractor at their own expense.

From Station 1+100 to Station 2+387 the Contractor shall close cut and dispose of any brush. For any areas where the Drain is being widened or improved, the trees shall be removed as required. All other trees located in this area shall be trimmed.

Brushing of the drain where required shall include disposal of brush. **All** brush and trees located within the drain side slopes shall be cut parallel to the side slopes, as close to the ground as practicable. Except as noted herein, stumps shall be left in place and shall be sprayed with a single application of an approved stump killer. Tree branches that overhang the drain shall be trimmed. The Contractor shall make every effort to preserve mature trees which are beyond the drain side slopes, and the working corridors. If requested to do so by the Drainage Superintendent, the Contractor shall preserve certain mature trees. **However, trees and brush located within the drain cross-section shall be cut in all cases.**

As part of the work, the Contractor shall remove any loose timber, logs, stumps, large stones or other debris from the drain bottom and from the side slopes. Timber, logs and stumps shall be disposed of off-site. In all cases, trees shall be stockpiled on the property on which they were cut if requested by the landowner.

It is the responsibility of the Contractor to dispose of the stockpiled brush **by means of saw-cutting and chipping the trees and brush and disposal of ALL chipped materials and brush, off the site. Burning is not permitted on this project.**

Following completion of the drainage works, the Contractor is to trim up any broken or damaged tree limbs on trees which remain standing, disposing of the branches cut off along with other brush and leaving the trees in a neat and tidy condition.

4.0 SEEDING

The Contractor shall place seeding and mulching to all excavated portions of the drain sideslopes and all areas backfilled, restored, excavated or disturbed in accordance with General Specifications Item Number 15.0, Page GS-6.

5.0 LOCATION OF THE DRAIN

The location of the drain shall generally follow the course of the present watercourse.

6.0 DISPOSAL OF MATERIAL

For the purpose of constructing this drain and for future maintenance as provided for under Section 16 of "The Drainage Act, 1990", the Contractor shall dispose of all excess excavated material as follows: Where the material is specified to be disposed of, the Contractor shall load and haul the surplus excavated material to a location off-site to be determined by him and at his own expense. Where excavated material is specified to be cast and spread, the Contractor shall cast and spread the excavated material in accordance with the General Specification or as amended below.

Station 0+000 to Station 2+387

7.0 WORKING AREA

For the purpose of constructing this drain and for future maintenance as provided for under Section 63 of "The Drainage Act, 1990", the Contractor shall be allowed to use the working area described below and for which the current private landowners have received an allowance for damages to construct the drain.

Station 0+000 to Station 2+387

8.0 STAKES

Stakes were originally placed at 25 metre intervals along the centreline of the drain for the purpose of establishing the requirements of the repairs and improvements.

Prior to construction, the Contractor must place stakes at 25 metre intervals along the proposed centreline of the drain, numbered consecutively 0+000, 0+025, 0+050 etc. The depths to which the drain is to be dug, as shown on the profile, are measured in metres from the surface of the ground beside the stakes. The contractor will be held responsible during the progress of the work for the preservation of all stakes, bench marks and survey markers, which fall within the limits of the work. The cost of replacing any bench mark or survey marker defaced or destroyed by the Contractor as a result of his work will be deducted from any money due the Contractor.

9.0 MATERIALS

The Contractor shall supply all labour, equipment and materials necessary for the proper completion of the project. Materials shall be as specified or shown in the tender items, plans and specifications and shall meet current applicable Ontario Provincial Standard Specifications.

10.0 CULVERT WORK

a) The Contractor shall perform all the work as described in the tender items providing for the culvert works.

b) Where culvert pipes are specified to be salvaged and reused, the Contractor shall carefully excavate and remove and clean said culvert without causing damage to the pipe. Where the existing pipe is found to be structurally inadequate for reuse, the Contractor shall dispose of said pipe and provide new pipe in accordance to the profile information and as directed by the engineer. Payment for the new pipe will be made to the Contractor as extra work under the Contingency Item.

c) Where headwalls are required to be constructed, the Contractor shall remove and dispose of existing headwalls. The Contractor shall supply and install new headwalls or end treatment in accordance to the tender item description, detail and specifications. Headwall work not conforming to the detail and specifications will not be accepted.

d) Where culverts or pipes are specified to be cleaned to grade, the work may be done mechanically by hand, cable drawn devices, or by power flushing. In any case, the material removed from the culvert is to be loaded and hauled to a disposal site. Over-digging of the drain bottom at either end of the culvert, to accommodate material flushed from the culvert, will not be allowed.

e) Construction of bagged concrete headwalls shall be in accordance to General Specifications Item 11.0, Page GS-3.

11.0 BEDDING AND BACKFILL FOR CULVERTS

Where the culvert is installed in a confined trench condition, the Contractor shall provide Granular "A" bedding for all newly installed drain pipe. The bedding shall extend from 150mm (6") below the bottom of the pipe to 300mm (12") above the top of the pipe. The backfill material shall consist of select native excavated material within the boulevard areas, and Granular "A" across all roadways and driveways. All roadways and driveways shall further be restored by supplying 300mm (12") thickness of Granular "A" to the top of the trench area. The minimum trench width shall be equal to the outer diameter of the pipe plus 500mm and the maximum trench width allowed shall equal the outer diameter of the pipe plus 750mm.

Where the culvert is a new culvert installed in a full-width excavated portion of the open drain, Granular "B" backfill material may be substituted for the above noted backfill over top of the Granular "A" bedding and below the Granular "A" surface restoration.

In general all granular materials placed as bedding or backfill shall be compacted to 100% Standard Proctor Density. All native backfill material placed underneath grass areas shall be compacted to 95% Standard Proctor Density. The Contractor shall utilize approved compaction equipment to achieve the above noted compaction requirements and his methods and equipment shall be approved prior to the start of construction by the Town Drainage Superintendent and/or Engineer. The Contractor shall take extra precautions in placing and compacting the backfill material so that the pipe is not distorted or damaged in any way. If there is evidence of deflection or damage in the drain pipe as a result of the backfilling and compaction operations, the drain may be televised as provided for by General Specifications Item 10.0, Page GSSD-6.

12.0 CATCH WATER BASINS

The connection pipe shall be 150mm diameter P.V.C. complete with a cut-in tee fitting at the mainline.

13.0 PRIVATE SERVICE CONNECTIONS

All private storm service connections or storm drain tile encountered along the proposed enclosed drain and that are connected to the existing drain shall be reconnected to the new drain using similar materials as the existing private drain and approved couplers or connections as directed by the Drainage Superintendent or Engineer.

14.0 RESTORATION

The Contractor will be fully responsible for the restoration of all areas disturbed by his operations in the carrying out of this work. The Contractor shall excavate and set aside sufficient topsoil from the trench excavation or supply additional topsoil so that he can place a minimum of 100mm (4") in depth of topsoil over the backfilled trench as detailed on the drawings. Any depressions in any lawn caused by equipment or due to the movement of materials shall be backfilled with topsoil and satisfactorily levelled and raked in place on all lawn areas to be restored. The Contractor shall seed and mulch said areas in accordance to General Specifications Item No. 15.0, Page GS-6 and the Contractor shall also spread fertilizer prior to seeding as specified.

Where the Contractor has installed the drain across any driveway or roadway or road shoulder the backfill material as specified herein shall be placed for the full width of the driveway, roadway or road shoulder and for the full width of the excavated area and the Contractor shall restore the finished surface of the driveway, roadway, or road shoulder with materials of the same quality and thickness as the existing surface. The Contractor will be further required to properly sawcut the full depth of any paved driveways or roadways which are to be restored so as to have a straight edge parallel to the drain trench.

15.0 EXISTING UTILITIES

All utilities or private services crossing under the drain are to be hand excavated and exposed prior to commencement of construction. Any such utilities or services found to be less than 600mm below the new drain gradeline are to be reported to the inspector. Should it be necessary to lower said services, the Contractor shall coordinate his work with the utilities.

The Contractor's attention is drawn to the existence of cables along the side of the Drain.

16.0 RESPONSIBILITY FOR DAMAGES TO UTILITIES

The Contractor shall note that overhead and underground utilities such as hydro, gas, telephone and water are not necessarily shown on the Drawings. It is the Contractor's responsibility to contact Utility Companies for information regarding utilities, to exercise the necessary care in construction operations and to take other precautions to safeguard the utilities from damage. The Contractor will be liable for any damage to utilities.

17.0 GENERAL CO-ORDINATION

The Contractor shall be responsible for the co-ordination between the working forces of other organizations and utility companies in connection with this work. The Contractor shall have no cause of action against the Municipality or Engineer for delays based on the allegation that the site of the work was not made available to him by the Municipality or the Engineer by reason of the acts, omissions, misfeasance or non-feasance of other organizations or utility companies engaged in other work.

18.0 TRAFFIC CONTROL

The Contractor shall exercise all due care and attention in working within the road allowances. The Contractor shall comply to all current safety regulations, and to signing requirement according to Book 7 of the Ontario Traffic Manual (OTM) for Temporary Conditions. The Contractor shall provide sufficient flag persons while working within the road allowance to ensure safety to workers and the public in general.

The Contractor shall, without notice or order from the Engineer, and at his own expense, provide, erect and maintain adequate traffic protection signs, barricades and lights to ensure safety to the public. The Contractor shall designate an employee to be responsible for the protection of devices at night, on Sundays and holidays. All barricades and obstructions shall be illuminated at night and all lights shall be kept burning from sunset to sunrise. The Contractor shall be responsible for all accidents or expenses arising by reason of neglect or failure to comply with this clause. Contractors are reminded of the requirements of the Occupational Health and Safety act pertaining to Traffic Protection Plans for workers and Traffic Control Plan for Public Safety.

19.0 GRADE CONTROL

The Contractor will be required to provide laser grade control to perform the drain excavation and culvert work. The grade shall be set on the laser by qualified personnel by the Contractor. The grade shall be determined from the bench marks provided and shall be periodically checked by the Contractor during the course of performing the excavation work. The Contractor shall also assist the Engineer and or Drainage Superintendent in checking the laser set up or the elevation or any part of the excavated drain.

20.0 LIQUATED DAMAGES

Liquidated damages, consisting of additional costs incurred by the Engineer or Town, may be charged to the Contractor if the work is not completed within the specified Time of Completion.

Additional costs incurred by the Engineer or Town to inspect or re-check corrective work, resulting from faulty work by the Contractor, may be charged to the Contractor.

21.0 TAXES

The Contractor shall include all applicable taxes in his tender submission, except HST, which will be separately delineated in the Form of Tender.

22.0 ACCESS TO WORK AND WORKING AREAS

The Contractor shall protect private property at all times during the course of the work and any damage caused by his failure to do so shall be made good at his expense. The Contractor will not be permitted to work beyond the limits of the defined working areas and in the event that he trespasses on any private lands, he shall be liable for any changes and expenses resulting therefrom.

Access to the work shall only be obtained from public road allowances, easements, right-of-way or within the working area for spreading earth as specified herein. No access shall be gained to any portion of the work over other private property. The description of the working corridor has been outlined in Item 14.0 of this Drainage Report.

The construction access to the site shall be as follows:

Access Site #1
Station 0+280, 1510 Whitewood Road, owned by Mr. Scott Shilson.
This access shall be a temporary access for construction and permanent access for future maintenance.

Access Site #2
Station 0+050 to 0+150, 1875 County Road 20, owned by 2462284 Ontario Inc.
This access shall be a temporary construction access only.

Access Site #3
Station 0+520, 1525 Brookview Drive, owned by Richard & Phyllis Hicks.
This access shall be a temporary construction access and a permanent limited cable concrete access maintenance corridor.

Access will only be allowed to the Town of Kingsville for maintenance purposes. Public access will not be permitted.

If the Contractor fails to comply with the requirements of this clause or he wilfully trespasses or damages any property, he shall be fully liable for any costs or expense arising therefrom.

23.0 TEMPORARY SITE ACCESS #2 – DESCRIPTION OF WORKS

The intent of the work at Anna's Flowers lands, Station 0+050 to 0+150, is to provide temporary access to the outlet portion of the proposed Municipal Drain. The works requiring construction in this area generally consist of installation of the low-flow water control pipe, placement of clay fill in the existing watercourse, construction of the cable concrete flow channel and maintenance corridor, installation of the precast concrete block outlet weir, placement of armour rock at the outlet to Lake Erie, and any other works not identified herein. The general area of the construction works for this access are outlined on Sheet 45 of the Drawings.

24.0 STANDARD CONTRACT DOCUMENTS

The contract documents may include standard Town specifications as appropriate.

The contract documents may also include special provisions of contract, special conditions, general conditions of contract and form of agreement. These will be contained in the tender documents and taken into account by the Contractor in submitting his price for the work.

It is the intent of any special or general specifications and conditions of contract to insure the adequate and proper construction of the work in accordance with the requirements and intent of these specifications. All work shall comply with the Applicable Ontario Provincial Standard Specification.

25.0 M.T.O. ENCROACHMENT PERMIT

Where any work is to be performed within or across a road allowance under the jurisdiction of the Ontario Ministry of Transportation, an encroachment permit must be obtained from said Ministry prior to any work being performed.

The encroachment permit and required fee will be applied for and paid by the Town to the Chatham Office of the Ministry of Transportation. The Contractor will be required to obtain a copy of the encroachment permit from the Town and have said permit available at the job site prior to and during any work within the M.T.O. road allowance.

The Contractor’s attention is drawn to the insurance requirement of 5 Million Dollars liability limit when working within M.T.O. road allowances.

Also the Contractor’s attention is drawn to the requirements shown on the encroachment permit particularly those of advance notice of commencement of work and notice of work completion.

26.0 CERTIFICATE OF CLEARANCE

The Contractor will be required to submit to the Municipality; a Certificate of Good Standing from the Workplace Safety & Insurance Board prior to the commencement of the work and the Contractor will be required to submit to the Municipality, a Certificate of Clearance for the project from the Workplace Safety & Insurance Board before final payment is made to the Contractor.

27.0 APPROVALS, PERMITS & NOTICES

The construction of the works and all operations connected therewith are subject to the approval, inspection, by-laws and regulations of all Municipal, Provincial, Federal and other authorities having jurisdiction in respect to any matters embraced in this Contract. The Contractor shall obtain all approvals and permits and notify the affected authorities when carrying out work in the vicinity of any public utility, power, underground cables, railways, etc.

28.0 PROGRESS ORDERS

Monthly progress orders for payment shall be furnished to the Contractor by the Drainage Superintendent or Engineer. Said orders shall not be for more than 90% of the value of the work done and the materials furnished on the site. The paying of the full 90% does not imply that any portion of the work has been accepted. The remaining 10% will be paid 45 days after the final acceptance and completion of the work, in accordance with the Construction Lien Act, 1983.

29.0 MEASUREMENT AND PAYMENT

Payment for the work shall be on a lump sum basis unless otherwise indicated on the Form of Tender and shall include all the work shown on the accompanying drawings and specifications.

30.0 DRAINAGE SUPERINTENDENT

Where the word “Drainage Superintendent” is used in this specification, it shall mean the person or persons appointed by the Council of the Municipality having jurisdiction, to superintend the work.

The Drainage Superintendent will be permitted to make minor variations in the work so long as these variations will result in either a more satisfactory drain or a more economical one. These variations, however, must not be such as to change the intent of the work performed nor are they to reduce the standard of quality.

31.0 INSURANCE

After the contract has been awarded to him, the Contractor shall furnish to the Clerk of the Municipality, satisfactory evidence that he has insurance to cover risk and liability in accordance with the General Conditions for the period of the execution of the work.

The Liability Insurance shall have a limit of liability of not less than 5 Million Dollars inclusive for any one occurrence. The Contractor shall note that where construction work is to be performed within the lands owned by a railway company or a road allowance owned by the Ministry of Transportation the liability insurance shall have a limit of liability of not less than 5 Million Dollars inclusive for any one occurrence. It shall be a comprehensive liability insurance covering all operations and liability assumed under the Contract and it shall name the Municipality, its officials and the Consulting Engineer as equally insured under the policy and shall also contain a cross liability and save harmless clause for the said Municipality and said Consulting Engineer. The liability insurance shall not contain any exclusions or limitations in respect to shoring, underpinning, raising or demolition of any building or structure, pile driving, caisson work, collapse of any structure or subsidence of any property, structure or land from any cause. The liability insurance shall be endorsed to provide that the policy shall not be altered, cancelled or allowed to lapse without 30 days prior written notice to the Municipality. Such copy of this policy to be submitted to the Clerk of the Municipality prior to commencement of the work.

32.0 EXTRA WORK

Extra work is work which is required, but not described, in the Contract Documents or on the plans. No work shall be regarded as extra work unless it is approved in writing by the Engineer, and with the agreed price and method of payment for it specified in the said approval, provided the said price is not otherwise determined by the Contract.

All notification of claims for extra work shall be made to the Engineer before the extra work is started. Notwithstanding anything contained in the General Conditions, when it is necessary to perform work additional to the Tender items, unit prices to cover the cost of the work shall be negotiated whenever possible.

Where it is impractical, due to the nature of the work, to negotiate unit prices for extra work not included in the Tender, the cost of the additional work may be paid for by a force account, previously agreed upon and authorized by an order issued prior to carrying out the work, and for which payment is based on the O.P.S.S. 127, Schedule of Rental Rates, April 1, 1996 or a percentage thereof.

33.0 CONSTRUCTION SAFETY ACT

The Contractor shall comply with all the requirements of the Occupational Health and Safety Act, 1990 and Regulations for Construction Projects, as administered by the Ontario Ministry of Labour and all subsequent amendments of the said Act. In the event that the Contractor fails to comply with the requirements of the above mentioned Act, the Engineer may suspend the operation of the work forthwith and the suspension will remain in effect until the Contractor has taken whatever remedies are necessary to comply with the said Act. Suspension of the work by the Engineer on account of the provisions of this clause, shall not allow the Contractor any extension of the Time of Completion and the Contractor may be liable for liquidated damages to the Town.

34.0 MAINTENANCE

The Contractor shall repair and make good at his expense any damages or faults in the work that may appear within one year after its completion (as evidenced by the final inspection report), as the result of imperfect or defective work done or materials furnished. Nothing herein contained shall be construed as in any way restricting or limiting the liability of the Contractor under the appropriate laws under which the work is being done.

35.0 INSPECTOR'S POWERS

An inspector acting as agent for the Engineer or an inspector acting as agent for the Town, may be employed to see that the provisions of the specifications are faithfully adhered to, especially as regard to quality of workmanship, and materials. An inspector may stop the work if any of the provisions of these specifications are not strictly adhered to or for any good and sufficient cause. Any work done in the absence of an inspector may be ordered to be opened up for thorough examination and must be rebuilt or replaced as directed and at the Contractor's expense. Approval by an inspector shall not be taken or be construed as an acceptance of defective or improper work or material which must, in every case, be removed and properly replaced whenever discovered at any stage of the work. Orders given by an inspector relating to the quality or type of material and workmanship shall be at once obeyed by the Contractor.

36.0 CLEANING UP

The Contractor shall leave the whole of the site of the work in a neat, thorough and workmanlike appearance to the full satisfaction of the Commissioner. He shall haul away any excess earth from the site. He shall haul to the site, sufficient earth to fill any depressions caused by his work at his own expense. The site shall be left as close as possible in the same condition as it was prior to the commencement of the work.

37.0 ONTARIO PROVINCIAL STANDARD SPECIFICATIONS

Except as extended and amended herein the General Specifications, the construction of the whole work shall conform with the current Ontario Provincial Standard Specifications (OPSS) as jointly prepared by the Ministry of Transportation, the Ministry of the Environment, the Municipal Engineers Association and the Ontario Clean Water Agency and shall be current.

The Contractor will be required to have available, the current specifications of the OPSS and the Ministry of Transportation with respect to all aspects of the construction. The Contractor is advised that these specifications are available from ServiceOntario Publications.

The Contractor's attention is drawn to the following OPSS forms that shall apply and govern except as amended herein.

a)	Earth Excavation and Grading	OPSS Form 206
b)	Sewer Pipe Installation	OPSS Form 410
c)	Culvert Pipe Installation	OPSS Form 421
d)	Clearing and Grubbing	OPSS Form 201
e)	Protection of Existing Trees	OPSS Form 801
f)	Manholes, Catch Basins, Ditch Inlets	OPSS Form 407
g)	Rip Rap & Rock Protection	OPSS Form 511
h)	Gabion Basket Protection	OPSS Form 512
i)	Gabion Baskets Material Specification	OPSS Form 1430
j)	Trenching & Backfilling & Compacting for Pipe Installation	OPSS Form 401
k)	Excavation & Backfilling & Compacting Manholes and Structures	OPSS Form 402
l)	Topsoil	OPSS Form 802
m)	Sodding	OPSS Form 803
n)	Seeding & Mulching	OPSS Form 804
o)	Geotextile Filter Fabric	OPSS Form 1860
p)	Temporary Flow Control for Construction in Waterbodies	OPSS Form 185
q)	Environmental Protection for Construction in Waterbodies	OPSS Form 182
r)	Precast Reinforced Concrete Box Culverts	OPSS Form 422
s)	Earth Borrow	OPSS Form 212
t)	Excavating and Backfilling	OPSS Form 902

38.0 LINES, LEVELS AND GRADES

The Contractor shall take note that the Engineer will carry out surface surveys and establish bench marks and references showing the lines and levels required for the work. The Contractor will be responsible for establishing the lines and grades for the work from the references and benchmarks established by the Engineer.

The Engineer shall have the right to check all lines and grades to see whether they conform to the required lines and grades. The Contractor shall protect from damage or loss, all markers, stakes, benchmarks or other appurtenances established by the Engineer. In case any such markers or stakes are lost or destroyed, the Contractor shall notify the Engineer in writing and all expense incurred by the Engineer in replacing same shall be charged against the Contractor and shall be deducted or collected from the Contract Price.

Any work done without accurate lines and levels having been established or without the supervision of the Engineer or Inspector, may not be estimated or paid for and if found to be inaccurate, shall be removed or corrected by the Contractor at his own expense.

The Contractor shall be responsible for marking and protecting all property bars during construction. All missing or damaged bars shall be replaced at the Contractor's expense upon completion by an Ontario Land Surveyor.

39.0 CABLE CONCRETE

The Contractor shall provide all labour, materials, and equipment required to perform all operations in association with the installation of the Cable Concrete units in accordance with the lines, grades, design and dimensions shown in the Contract Drawings and as specified in the Cable Concrete Installation Procedures found in Appendix E, Material Specifications for Cable Concrete. The following products will be used in the installation of the Cable Concrete units and shall be installed as per their respective installation guides found in Appendix E, Material Specifications for Cable Concrete:

- CC 45 Cable Concrete system and CC 70 Cable Concrete system as specified on the Contract Drawings by International Erosion Control Systems or an approved equivalent
- Model 88-DB1 Duckbill Earth Anchors by MPS Civil Products or an approved equivalent including stainless steel wire rope
- 'Golden U-Bolt' forged wire rope clips by Vanguard Steel Ltd. or an approved equivalent

40.0 MAINTENANCE OF FLOW IN NATURAL WATERCOURSE

The Contractor shall provide all labour, materials, and equipment required to maintain flow in the Natural Watercourse from Station 0+000 to Station 0+873 at all times. The Contractor must install the 600mm diameter low-flow water control pipe as outlined in the Form of Tender and shall conduct his earth cut and fill operations in such a manner not to cause a back-up of flow in the channel. The Contractor shall be solely responsible for ensuring that all work is carried out in the dry. The method or methods of controlling surface or subsurface water shall be by pumping, ditching, dyking, close sheet piling, or a combination of these or other methods and must be approved by the Engineer. These diversion/ maintenance of flow activities will require approval by MNRF.

41.0 PROPERTY BARS AND SURVEY MONUMENTS

The Contractor shall be responsible for marking and protecting all property bars and survey monuments during construction. All missing, disturbed or damaged property bars and survey monuments shall be replaced at the Contractor's expense, by an Ontario Land Surveyor. All property bars along the bottom of the existing drain will be replaced by the Town at the Town's expense.

42.0 TIME OF COMPLETION

The Contractor shall complete all work on or before the date fixed at the time of tendering. The Contractor will be held liable for any damages or expenses occasioned by his failure to complete the work on time and for any expenses of inspection, superintending, re-tendering or re-surveying, due to their neglect or failure to carry out the work in a timely manner.

43.0 TEMPORARY MATERIALS STORAGE DURING CONSTRUCTION

For the purposes of the materials handling for this project, two areas have been arranged for temporary Contractor material storage. The properties are 1875 County Road 20 owned by 2462284 Ontario Inc. and 1814 County Road 20 owned by Southshore Greenhouses Inc.

The storage area for 1875 County Road 20 is located at the southwest end of the property at Station 0+050 to 0+150 and is approximately 1.5 Hectares in area.

The storage area for 1814 County Road 20 is located at the northeast corner of the property at Station 1+150 to 1+250 and is approximately 0.18 Hectares in area.

The Contractor must meet with the landowners on-site and clarify the exact location of the materials storage area and identify any restrictions. The Contractor shall restore the site to the original condition for the landowner.

The above noted storage areas may not be totally sufficient for the Contractor's requirements. It will be the Contractor's responsibility to arrange for additional storage requirements at the expense of the Contractor.

44.0 TREE PLANTING

This shall include all labour, material, equipment and related services necessary to furnish and install all plantings indicated on the Approved Drawings or Approved Contract specifications. The work includes, but is not limited to the following:

a) Furnishing: providing plant material, including delivery to site. Making a concerted effort to minimize the time between the plants being dug in the nursery and the actual time of planting.

b) Installation: installing of plants listed on the plant list.

c) Mulching: mulching all trees to a depth of 10cm contained in a 10cm deep edge and keeping the mulch away from the trunk.

d) Staking: staking all trees

e) Watering: thoroughly watering all trees at the time of planting with water that is certified suitable for irrigation and free from ingredients harmful to plant life. This shall be the responsibility of the homeowner.

f) Information: informing the homeowners of the planting routines and providing information on proper tree care (instructions for watering, monitoring and who to contact).

g) Planting Holes: creating a minimum 90cm planting area or 1.5 times the width of the root (whichever is greater) with a 10cm deep edge to minimize grass competition.

h) Planting Soil: using indigenous soil as much as possible to avoid creating container type growing conditions. Where necessary, use pulverized topsoil free of subsoil, noxious weeds and/or seeds, stones or other foreign matter.

i) Fertilizer: using a slow release fertilizer to promote root development.
(i.e. 10-25-10)

j) Tree Root Protection: taking all necessary measures to ensure that the tree roots are protected from the elements (freezing and drying) by proper heeling-in, mudding and proper packing for transportation.

k) Debris Disposal: any rejected plants, soil, pruning, binding and/or any other material which has been brought to the project site shall be removed promptly, keeping the area clean at all times. Upon completion of the planting, all excess soil, stones, and debris which have not been previously cleaned up shall be removed from the site and disposed of. All ground disturbed as a result of planting operations shall be restored to its original appearance or to the desired new appearance.

45.0 BRIDGE/CULVERT WORKS

45.1 Private Access Bridge Removal Work

The Contractor shall completely remove the existing private access bridges as follows:

- Culvert No. 2 – Station 1+107. Remove and salvage existing 1610mm x 1950mm corrugated steel pipe (C.S.P.) for Mucci Farms Ltd. Headwalls and footings to be excavated, removed and disposed of off-site.

45.2 New Culvert Installations

The Contractor shall supply and install the new culverts as follows:

- Station 0+280 – Supply and install new 3000mm x 2400mm concrete box culvert including precast concrete block headwalls, waterproofing membrane and guide rail system.
- Station 1+726 for Cristina Porrone – Supply and install new 2-1600mm diameter Hel-Cor corrugated steel pipe including precast concrete block headwalls, granular backfill and sloped quarried rock erosion protection.
- Station 2+116 for Domenico Mucci (Branco Development) – Supply and install new 2-1400mm diameter Hel-Cor corrugated steel pipe including precast concrete block headwalls and granular backfill up to road sub-grade.

45.3 Lateral Tile Drains

The Contractor shall re-route any outlet tile drains in consultation with Drainage Superintendent, as required to accommodate the new culverts. Tile drain outlets through the wall of the new culvert pipe will not be permitted.

45.4 Culvert Installation

Suitable dykes shall be constructed in the drain so that the installation of the pipe can be accomplished in the dry. The drain bottom shall be cleaned, prepared, shaped and compacted to suit the new culvert configuration, as shown on the Drawing. Granular materials shall be compacted to 100% of their maximum dry density; native materials shall be compacted to 95% of their maximum dry density. The Contractor shall exercise caution while removing the existing culvert to avoid damage to the pipe.

46.0 TILE INLET REPAIR AND/OR RELOCATION WORKS

At the following locations, the Contractor shall excavate a sufficient distance into the drain bank to accommodate the proposed inlet pipe replacement and/or relocation. All new pipes shall be equipped with a new galvanized rodent gate and shall be as per detail in Drawings.

47.0 SUBGRADE PREPARATION AND CABLE CONCRETE INSTALLATION

The Contractor shall review and familiarize themselves with "ASTM Designation: D6884-03 for Installation of Articulating Concrete Block (ACB) Revetment systems" and "Duckbill Engineered Earth Anchor Systems Installation Guidelines" found in Appendix E of this report.

The sub-grade shall be defined as the graded clay surface upon which the geotextile fabric is to be placed.

The sub-grade shall be cleared of all irregularities such as roots, grade stakes, and stones that impair the sub-base. The sub-grade shall be uniformly compacted to a minimum 90% Standard Proctor density for existing clay sub-grade and compacted to a minimum 95% Standard Proctor density for suitable imported clay material.

Compaction shall be completed using static compaction with a sheeps foot roller for all compaction in the ravine area situated from Station 0+000 to 0+650. Vibratory compaction methods in this area will NOT be permitted.

The open area of the articulating concrete block system shall be backfilled using 3/8 to 3/4 inch (10 to 20mm) diameter crushed stone.

The unit price per square metre of cable concrete mat installation shall include the geotextile fabric and 3/8 to 3/4 inch (10 to 20mm) diameter crushed stone in the open area of the ACB system.

48.0 FINAL INSPECTION

All work shall be carried out to the satisfaction of the Drainage Superintendent for the Municipality, in compliance with the Specifications, Drawings and the Drainage Act. Upon completion of the project the work will be inspected by the Engineer and the Drainage Superintendent. Any deficiencies noted during the final inspection shall be immediately rectified by the Contractor.

SPECIFICATIONS
ENVIRONMENTAL PROTECTION SPECIAL PROVISIONS
ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

SPECIFICATIONS
ENVIRONMENTAL PROTECTION SPECIAL PROVISIONS
ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

Contents

SPECIFICATIONS
ENVIRONMENTAL PROTECTION SPECIAL PROVISIONS
ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

1.0 GENERAL

These Environmental Protection Special Provisions shall apply and form part of this Contract. All costs associated with conforming to these Special Provisions shall be included in the Tender prices bid.

2.0 FIRES

Fires and burning of rubbish on site will be permitted only with special approval from the Town.

3.0 DISPOSAL OF WASTES

The Contractor shall not bury rubbish and waste materials on site unless approved by the Engineer and all applicable approving authorities. The site shall be maintained free of accumulated waste and rubbish. All waste materials should be disposed of in a legal manner at a site approved by all local approving authorities and the Engineer.

The Contractor shall not allow deleterious substances, waste or volatile materials such as mineral spirits, or paint thinner, to enter into waterways, storm or sanitary sewers.

The disposal of dredge material where applicable shall be in accordance with the above.

4.0 POLLUTION CONTROL

The Contractor shall maintain under this Contract temporary erosion, sediment and pollution control features installed.

The Contractor shall control emissions from equipment and plant to local authorities emission requirements.

The Contractor shall not cause excessive turbidity when performing in-water work. The Contractor shall not allow any debris, fill or other foreign matter to enter into the waterway. The Contractor shall remove from the waterway, all extraneous materials resulting from in-water work.

The Contractor shall abide by local noise By-Laws for the duration of the Contract.

Spills of deleterious substances into waterways and on land shall be immediately contained by the Contractor and the Contractor shall cleanup in accordance with Provisions regulatory requirements. All spills shall be reported to the Ontario Spills Action Centre (1-800-268-6060), local authorities having jurisdiction and the Engineer. To reduce the risk of fuel entering the waterway, refuelling of machinery must take place a safe distance from the waterway. The Contractor shall note that the Engineer or the Owner takes no responsibility for spills, this shall be the sole responsibility of the Contractor.

5.0 WHMIS

The Contractor shall comply with the requirements of Workplace Hazardous Material Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials and regarding labelling and the provision of material safety data sheets acceptable to Labour Canada.

6.0 DRAINAGE

The Contractor shall not pump water containing suspended materials into waterways, sewers or drainage systems. The Contractor shall be solely responsible for the control, disposal or runoff of water containing suspended materials or other harmful substances in accordance with these specifications, and local authority requirements. The Contractor shall provide temporary drainage and pumping as necessary to keep excavations and site free from water.

The Contractor shall install and maintain sediment control devices as indicated on the Contract Drawing and as directed by the Engineer.

7.0 PROTECTION OF VEGETATION

The Contractor shall exercise the utmost caution to ensure that existing trees and plants on-site and on adjacent properties are not damaged or disturbed unless noted otherwise in the Removals Special Provisions of this Contract. The Contractor shall restrict tree removal to areas indicated on the Contract Drawings and/or designated on-site. No trees or shrubs shall be removed without the approval of the Engineer.

8.0 DUST CONTROL

The Contractor will be solely responsible for controlling dust nuisance resulting from his operations, both on the site and within adjacent right-of-ways.

Water and calcium chloride shall be applied to areas on or adjacent to the site as authorized by the Engineer as being necessary and unavoidable for the prevention of dust nuisance or hazard to the public. No payment will be made for dust control unless otherwise specified in the Special Provisions.

9.0 RESTRICTIONS FOR IN-WATER WORKS

The Contractor shall only perform in-water works during times when conditions permit reasonable production rates to be achieved. The Contractor shall be required to adopt good housekeeping practices that minimize disturbance to the site and the adjacent waterway.

The Contractor shall note that this Project is subject to approval from the Essex Region Conservation Authority and as such, any possible turbidity caused by the construction of the shore protection works is of key importance.

The Contractor shall minimize the turbidity (sedimentation) produced by any in-water works construction or operations. The Contractor will be ordered to cease operations if, in the opinion of the Engineer or authorities having jurisdiction, the in-water work is producing unacceptable amounts of turbidity in the waterway. Based on this, the Contractor shall either adjust his operation(s) to produce lower turbidity levels, wait for more favourable conditions before operations will be allowed to continue, or undertake approved mitigating measure (e.g. sediment control, etc.). All costs associated with the above will be the sole responsibility of the Contractor, and no claims for extras or delays will be considered.

10.0 FISH HABITAT

No work shall be undertaken when there is likelihood of adverse effects on fish spawning or fish habitat in downstream waters.

Refer to Appendix H, Section 6.0 – Potential Impacts and Mitigation for BioLogic Incorporated recommendations. There have been 28 recommendations outlined in this section of their report.

11.0 TIMING RESTRICTIONS

Refer to Appendix H, Section 6.5 – Timing Restriction Summary of the BioLogic Incorporated Natural Heritage Report. Table 8 in this section outlines the sensitive construction periods for Fish, SAR Snakes, SAR Turtles and Migratory Birds. The Contractor must abide by the timing restrictions noted in Table 8 and receive all required approvals and construct all recommended mitigation measures prior to the commencement of construction.

GENERAL SPECIFICATIONS
FOR CONSTRUCTION OF OPEN DRAINS
ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

GENERAL SPECIFICATIONS
FOR CONSTRUCTION OF OPEN DRAINS
ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

Contents

GENERAL SPECIFICATIONS
FOR CONSTRUCTION OF OPEN DRAINS
ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

1.0 EXAMINATION OF SITE, PLANS AND SPECIFICATIONS

Each tenderer must visit the site and review the plans and specifications before submitting his tender and must satisfy himself as to the extent of the work and local conditions to be met during the construction period. He is not to claim at any time after submission of his tender that there was any misunderstanding of the terms and conditions of the contract relating to site conditions. The quantities shown as indicated on the drawings or in the report are estimates only and are for the sole purpose of indicating to the tenderers the general magnitude of the work. The tenderer is responsible for checking quantities for accuracy prior to submitting his tender.

2.0 SUPPLY OF MATERIALS

The Contractor shall supply all labour, equipment and materials necessary for the proper completion of the project.

3.0 PROFILE

The excavation of the drain must be at least to the depth intended by the grade line as shown on the profile, which grade line is governed by the bench marks. The profile shows, for the convenience of the Contractors and others, the approximate depth of cut from the surface of the ground at the points where the numbered stakes are set to the final invert of the channel and also the approximate depth of cut from the bottom of the existing channel to the final invert of the channel. Bench marks which have been established along the course of the drain, shall govern the final elevation of the drain. The location and elevation of the bench marks are shown on the profile.

4.0 ALIGNMENT

The alignment of the drain throughout shall be to the full satisfaction of the Commissioner in charge. The whole of the work shall be done in a neat, thorough and workmanlike manner to the full satisfaction of the Commissioner in charge. The bottom widths and side slopes of the various sections of the finished drain are to be true to line and grade as shown on the profile. When completed the drain shall have a uniform and even bottom and in no case shall such bottom project above the grade line as shown on the accompanying drawing, and as determined from the bench mark.

5.0 BRUSHING AND GRUBBING

When there is any brush or rubbish in the course of the drain, including both side slopes of the drain, or where the earth is to be spread or on that strip of land between where the earth is to be spread and the edge of the drain, all such brush or rubbish shall be grubbed out and close cut and the whole to be burned (with Town approval) or removed from the drain, hauled away and disposed of by the Contractor.

Existing select hardwood trees greater than 200mm (8") in diameter situated in the drain bank within 1.0 metre from the top of the bank may be selectively left standing if the Township Drainage Superintendent considers the trees will not adversely affect the flow of water within the drain. Prior to removing any trees the Contractor shall meet at the site with the drainage superintendent to review if any vegetation or select trees are environmentally significant for preservation.

6.0 SPREADING EXCAVATED EARTH

The excavated material where specified to be cast onto the adjoining land shall be well and evenly spread over a sufficient area so that no portion of the excavated earth is more than 100mm in depth or as otherwise specified and kept at least 1.2 metres clear from the finished edge of the drain, care being taken not to fill up any existing tile, ditches, furrows or drains with the excavated material. The excavated material to be spread upon the lands shall be free from rocks, boulders, stumps, rubble, rubbish or other similar material and other materials if encountered, shall be hauled away by the Contractor and disposed of at a site to be obtained by him at his expense.

Where the drain crosses any lawn, garden, orchard or driveway, etc. the excavated material for the full width of the above mentioned areas, shall be hauled away by the Contractor and disposed of upon the adjacent lands and spread as previously specified.

7.0 FENCING

The Contractor will be required to exercise extreme care in the removal of any fence so as to cause minimum damage to the fence. The Contractor will be required to replace any fence that is taken down in order to proceed with the work and the fence shall be replaced in a neat and workmanlike manner. The Contractor will not be required to procure any new materials for rebuilding the fence provided he has used reasonable care in the removing and replacing of the same. Where any fence is removed by the Contractor and the Owner thereof deems it advisable and procures new materials for replacing the fence so removed, the Contractor shall replace the fence using the new materials and the materials from the present fence shall remain the property of the Owner. The Contractor is not to leave any fence open when he is not at work in the immediate vicinity.

8.0 LOCATION OF STRUCTURES AND UTILITIES

The Contractor shall satisfy himself as to the exact location, nature and extent of any existing structure, utility or other object which he may encounter during the course of the work. The Contractor shall indemnify and save harmless, the Town and the Engineer for any damages which he may cause or sustain during the progress of the work. He shall not hold the Town or the Engineer liable for any legal action arising out of any claims brought about by such damage caused by him.

9.0 ACCESS BRIDGES

The Contractor shall satisfactorily clean through all existing bridges to the grade line as shown on the accompanying drawing.

10.0 BACKFILL FOR CULVERTS

Where specified and after the corrugated steel pipe has been set, the Contractor shall backfill the pipe with granular "B" material, O.P.S.S. Spec. 1010 with the exception of the top 30 cm (12") of the backfill over the top and ends of the corrugated steel pipe. The top 30 cm of the backfill for the full width of the excavated area (between each side slope of the drain) and for the top width of the driveway, shall be granular "A" material, O.P.S.S. Spec. 1010. The granular backfill shall be compacted in place to a Standard Proctor Density of 100% by means of mechanical compactors. The equipment and method of compacting the backfill material shall be to the full satisfaction of the Drainage Superintendent or Engineer.

11.0 BAGGED HEADWALLS AND ROCK PROTECTION FOR CULVERTS

a) Bagged Concrete Headwalls

Where specified and after the Contractor has set in place the new pipe, he shall completely backfill the same and install new concrete jute bag headwalls at the locations indicated on the drawing. When constructing the concrete jute bag headwalls, the Contractor shall place the bags so that the completed headwall will have a slope inward from the bottom of the pipe to the top of the finished headwall, the slope of the headwall shall be one unit horizontal to five units vertical. The Contractor shall completely backfill in behind the new concrete jute bag headwalls with granular material, Granular "A" and "B" per O.P.S.S. 1010 and as additionally specified under Special Provisions Item No. 11.0 and the granular material shall be compacted in place with a standard proctor density of 100%. The placing of the jute bag headwalls and the backfilling shall be performed in lifts simultaneously. The granular backfill shall be placed and compacted in lifts not to exceed 300mm (12 inches) in thickness.

The concrete jute bag headwalls shall be constructed by filling jute bags with concrete. All concrete used to fill the jute bags shall have a minimum compressive strength of 20.7 MPa in 28 days and shall be provided and placed only as a wet mix, under no circumstance, shall the concrete to be used for filling the jute bags, be placed as a dry mix. The jute bags, before being filled with concrete, shall have a dimension of 460mm x 660mm (18" x 26"). The jute bags shall be filled with concrete, so that when they are laid flat, they will be approximately 100mm (4") thick, 300mm (12") to 380mm (15") wide and 460mm (18") long. The concrete jute bag headwall to be provided at the end of the pipe shall be of single bag wall construction or as specified otherwise. The concrete filled bags shall be laid so that the 460mm (18") dimension is parallel with the length of the new pipe. The concrete filled bags shall be laid on a footing of plain concrete being 460mm (18") wide, extending for the full length of the wall, and from 300mm (12") below the bottom of the corrugated pipe to the bottom of the culvert pipe. All concrete used for the footing shall have a minimum compressive strength of 20.7 MPa in 28 days. The completed jute bag headwalls shall be securely embedded a minimum of 500mm (20") into the side slopes of the drain.

Upon completion of the jut bag headwall the Contractor shall cap the top row of concrete filled bags with layer of plain concrete, 150mm (6") thick, and hand trowelled to obtain a pleasing appearance. The Contractor shall fill all voids between the concrete filled jute bags and the corrugated steel pipe with concrete, particular care being taken underneath the pipe haunches to fill all voids.

As an alternate to constructing a concrete filled jute bag headwall, the Contractor may construct a grouted concrete rip rap headwall. The specifications for the installation of a concrete filled jute bag headwall shall be followed with the exception that broken sections of concrete may be substituted for the jute bags. The concrete rip rap shall be approximately 18" square and four inches thick and shall have two flat parallel sides. The rip rap shall be fully mortared in place using a mixture composed of three parts of clean, sharp sand to one part of Portland Cement.

b) Quarried Rock End Protection

The backfill over the ends of the corrugated steel pipe shall be set on a slope of 1½ metres horizontal to 1 metre vertical from the bottom of the corrugated steel pipe to the top of each side slope and between both side slopes. The top 30 cm (12") in thickness of the backfill over the ends of the corrugated steel pipe shall be quarried rock. The quarried rock shall be placed on a slope of 1½ metres horizontal to 1 metre vertical from the bottom of the corrugated steel pipe to the top of each side slope of the drain and between both side slopes. The quarried rock shall have a minimum dimension of 100mm (4") and a maximum dimension of 230mm (9"). Prior to placing quarried rock end protection over the granular material, the Contractor shall lay a non-woven geotextile filter fabric equal to a "Terrafix 270R" or approved equal. The geotextile filter fabric shall extend from the bottom of the corrugated steel pipe to the top of each side slope of the drain and between both side slopes of the drain. The Contractor shall take extreme care not to damage the geotextile filter fabric when placing the quarried rock on top of the filter fabric.

12.0 PLACING OF CORRUGATED STEEL PIPE

When specified, the Contractor shall install all culvert bridges in the location directed by the Commissioner. The excavation for placing the culvert, the type and class of bedding and backfill and culvert end treatment shall be carried out to the width, depth and alignment as specified herein. The surface on which the culvert is to be laid shall be true to grade and alignment and shaped to accept the materials to be placed. The pipe shall be laid to the alignment and grade shown in the report but may not be placed on a bed containing frozen materials. The Contractor shall carefully place the bedding and backfill material so damage to or movement of the pipe is avoided. Backfill and cover materials shall be placed in layers not exceeding 250mm (10") in thickness, loose measurement. Each layer shall be thoroughly compacted before the next layer is placed. Backfill on each side of the pipe shall be placed simultaneously and at no time shall the levels on each side of the pipe differ by more than 250mm. Where native backfill is approved to be used the material shall not contain boulders larger than 150mm or other deleterious material. The Contractor will be required to fully restore all paved driveways with materials of similar type and depths. The Contractor shall neatly saw cut all paved driveways at a distance of 300mm beyond the edge of the excavated trench and this shall be done immediately prior to final restoration of the paved driveway.

When an access culvert or bridge does not have to be lowered or replaced, the Contractor shall clean it to its full cross sectional area using care to avoid causing damage to it in the process. Where a pipe culvert is to be reset to a new grade, the Contractor shall carefully remove it, clean it to its full cross sectional area and replace it in the drain as specified herein. Where a culvert is to be replaced, the Contractor shall carefully remove the existing pipe from the drain, clean it to its full cross sectional area and leave it on the drain bank unless otherwise specified. Should either the property owner or the Commissioner in charge not require the salvaged pipe then the Contractor shall dispose of the pipe at the Contractor's expense.

The helical corrugated steel pipe, when specified shall be installed so that the helix angle is constant for the total length of the installation and each pipe section shall be installed next to the previous section such that the lock seam forms a continuous helix. Riveted corrugated steel pipe, when specified, shall be laid with the inside circumferential laps pointing in the direction of flow. The longitudinal laps shall be located in the upper half of the pipe. Corrugated steel pipe sections shall be joined together by means of a plant manufactured steel coupler. The couplers shall be installed to lap approximately equal portions of pipe sections being connected, such that the corrugations or projections of the coupler properly engage the pipe corrugations.

The Contractor, if using a batter board system for establishing the grade of the culvert pipe, shall utilize a minimum of three batter board stakes for each culvert. The Contractor shall ensure that the batter board stakes placed on the grade stakes shall line up, this being done prior to any excavation taking place for the proposed culvert.

Where pipes are scheduled to be moved or replaced the Contractor shall confirm the new location of the culvert pipe with the owner prior to installation. Where the Contractor has excavated a culvert pipe which has been scheduled to be cleaned and reinstalled and it is found that the condition of the existing culvert pipe is not satisfactory to be reused, the Contractor shall immediately notify the Commissioner in charge who will verify the condition of the existing pipe and may instruct the Contractor to supply a new length of corrugated steel pipe.

Where pipes are scheduled to be cleaned and flushed only, the material which is removed from the culvert pipe is to be loaded and hauled away. Over digging of the drain at the downstream end of the culvert to accommodate material flushed from a culvert pipe will not be allowed.

13.0 CUTS

The cuts as shown on the accompanying drawing are to be taken from the ground beside the stakes to the bottom of the finished drain, unless otherwise noted on the drawing.

14.0 DAMAGE TO TRAVELLED PORTION OF MUNICIPAL ROAD

The Contractor will be responsible for any damage caused by him to any portion of the municipal road system, especially to the travelled portion. When excavation work is being carried out and the excavation equipment is placed on the travelled portion of a road, the travelled portion shall be protected by having the excavation equipment placed on satisfactory timber planks or timber pads. If any part of the travelled portion of the road is damaged by the Contractor, the Municipality shall have the right to have the necessary repair work done by its employees and the cost of all labour and materials used to carry out the repair work shall be deducted from the Contractor's contract and credited to the Municipality.

15.0 SEEDING AND MULCHING

The Contractor shall fine grade the finished surfaces and shall apply hydroseeding and mulch. The seeding and mulching operation shall be carried out according to O.P.S.S. Spec. 572 or as amended herein and the operation shall include the supplying and placing of the following:

Standard Mix #1 – Station 1+300 to 2+387

A) Seed Mixture	- Creeping Red Fescue	- 50%
	- Red Top	- 20%
	- Canada Blue Grass	- 15%
	- Kentucky Blue Grass	- 15%
B) Nurse Crop	- Oats if seeding and mulching is performed during May or June.	
	- Annual Rye Grass if seeding and mulching is performed during September or October.	

C) Fertilizer - 5-20-10 mixture
D) Mulch - Wood Cellulose Fibre or Straw
E) Adhesive - Asphalt Emulsion if straw mulch used
- Liquid Polyvinyl Acetate if wood fibre mulch used

The application rates shall be as follows:

A) Grass Seed Mixture - 90 lbs/acre
B) Fertilizer - 350 lbs/acre
C) Nurse Crop Seed - 55 lbs/acre
D) Mulch - 1300 lbs/acre if wood fibre used
- 1" to 2" depth if straw used
E) Adhesive - 200 imp. gal/acre for Asphalt Emulsion
- 205 lbs/acre for Liquid Polyvinyl Acetate

Standard Mix #2 – Station 0+000 to 1+300

ERCA Recommended Type 5 – Bank Stabilizer Seed Mix

A) Seed Mixture - Creeping Red Fescue - 45%
- Timothy - 20%
- White Clover and/or Red Clover - 35%
B) Nurse Crop - Annual Oats or Millet
C) Fertilizer - 5-20-10 mixture
D) Mulch - Wood Cellulose Fibre or Straw
E) Adhesive - Asphalt Emulsion if straw mulch used
- Liquid Polyvinyl Acetate if wood fibre mulch used

The application rates shall be as follows:

A) Grass Seed Mixture - 30 lbs/acre
B) Fertilizer - 350 lbs/acre
C) Nurse Crop Seed - 11 lbs/acre
D) Mulch - 1300 lbs/acre if wood fibre used
- 1" to 2" depth if straw used
E) Adhesive - 200 imp. gal/acre for Asphalt Emulsion
- 205 lbs/acre for Liquid Polyvinyl Acetate

The seeding and mulching operation shall be only carried out as weather conditions permit during the months of May and June in the Spring, and September and October in the Fall. If the excavation work is carried out during the months of May and June, or September or October, the Contractor has the option of contacting the Drainage Superintendent and if the Contractor receives his written permission, the seed mixture as above specified, may be placed on the excavated side slopes by the Contractor by hand, daily, at the completion of his daily excavation operation. If the Contractor has been given written permission by the Drainage Superintendent to place the seeding mixture by hand daily, at the completion of his daily excavation operation, the Contractor shall be responsible to give the side slopes a rough, harrowed texture prior to placing the seed mixture.

16.0 QUARRIED ROCK

The Contractor shall place quarried rock protection at the areas indicated on the accompanying plans. The quarried rock shall be graded in size from a minimum size of 100mm (4") to a maximum size of 230mm (9"). The quarried rock shall be placed 300mm (12") in thickness on a layer of geotextile filter fabric placed on the bottom of the excavation. The filter fabric shall be "Terrafix 270-R" or approved equal. The Contractor shall excavate for the quarried rock so that the top of the completed quarried rock protection is level with the adjacent ground.

The Contractor shall remove all trees, brush and debris from the area on which the quarried rock is to be placed. The quarried rock shall be carefully placed by the Contractor at the locations and to the dimensions as shown on the accompanying specifications. The specified filter cloth shall be hand laid and have an overlap of 600mm (24") and all quarried rock that is to be placed over the filter cloth shall be carefully hand or machine placed so that it does not damage the filter cloth. The filter cloth shall extend up the sides of the trench excavated to accept the quarried rock and the quarried rock shall extend 300mm (12") above the top of the surface inlet pipe where applicable.

17.0 MAINTAINING FLOW AND EXISTING SEWERS

The Contractor shall support and maintain the flow of any existing sewers and house connections and any other drainage works encountered in the progress of the work and at no expense to the owner. The Contractor shall obtain written approval from the Engineer to stop up any drain, and if necessary provide pumping equipment, build necessary by-passes, etc. at no expense to the owner.

18.0 SPECIAL PROVISIONS

The part of the Specifications headed "Special Provisions" which is attached hereto forms part of this Specification and is to be read with it. Where there is any difference between the requirements of this General Specification and those of the Special Provisions, the Special Provisions shall govern.

19.0 REMOVAL OF TREES

Whenever practical, existing trees not scheduled for removal will be preserved. The Contractor shall exercise the utmost caution to ensure that the trees are not damaged or disturbed.

GENERAL SPECIFICATION
FOR CONSTRUCTION OF COVERED STORM DRAINS
ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

GENERAL SPECIFICATION
FOR CONSTRUCTION OF COVERED STORM DRAINS
ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

Contents

GENERAL SPECIFICATION
FOR CONSTRUCTION OF COVERED STORM DRAINS
ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

1.0 SCOPE OF WORK

These Specifications and the accompanying drawings contemplate the furnishing of all labour, materials, equipment and supplies required for the performance of all operations relating to the storm sewer. All work shall be done in a first class and workmanlike manner, complete in all respects, and including all items specified herein, or as necessary for the accomplishment of a complete, satisfactory and approved installation.

It is the intent of these specifications to assign to the Contractor, the full responsibility for the complete storage, installation and protection of the sewer systems including all appurtenances. The Contractor shall furnish all materials, including pipe, pipe specials, manholes, catch water basins, branches, etc. and all labour, tools, equipment and machinery necessary for the construction of the sewer works, in accordance with the plans, profiles and specification prepared by RC Spencer Associates Inc., Consulting Engineers, 261 Shepherd Street East, Windsor, Ontario N8X 2K6.

The works shall include, but not necessarily be limited to the following items: all trenching, tunnelling, pumping, baling and draining; all sheeting, shoring, bracing, supporting and forming; watching; making all provisions necessary to maintain and to protect existing structures of whatever kind, such as watermains, gas mains, sewers, and their respective connections; telephone cables, hydro line, etc.; to repair all damages done to such structures or trees; to backfill excavations as required; to clear away all rubbish and surplus materials; to provide the labour required to do all the work necessary for the completion of the Contract.

2.0 STORAGE AND HANDLING OF SEWER PIPE AND FITTINGS

All materials shall be stored and handled by the Contractor at his own expense. He shall be responsible for the safe storage of all materials, for obtaining storage areas, for the safe transportation and distribution of all the materials at the job site and their inspection to determine defects and breakage. No additional compensation will be allowed the Contractor for any loss incurred by him in the storage and handling of the materials.

Pipe, fittings and all accessories and appurtenances must be loaded and unloaded by lifting with the means of a hoist or skidding so as to avoid shock or damage. Under no circumstances shall any sewer material or materials for sewer appurtenances be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

3.0 SEWER MATERIALS

Sewer materials for use under this contract shall conform to specifications as outlined on the Drawings, or as further outlined in the Form of Tender or as described in the Special Provisions and be new material. No damaged material shall be incorporated into the work.

4.0 LOCATION OF TRENCHES

Sewers shall be laid in trenches in locations as shown on the drawings in general, or as many be specifically directed or laid out by the Engineer, at the time of construction. The trench shall be located to clear all existing utilities and structures above, on or below the ground level.

The Contractor will be responsible at all times for a complete investigation to determine the location of all such utilities or structures known or unknown, and he shall indemnify and save harmless, the Engineer and the Owner for any responsibility, injury or liability arising from any damages to such utilities or structures by the Contractor.

The Contractor shall further contact or notify such utility company or commission of his intention to carry out work in the area and cooperate with such utility company or commission in the location, maintenance and preservation of all such utilities. The location of the pipes and appurtenances as shown on the drawings is approximate and may be changed by the Engineer if deemed advantageous for the progress of the work. The trench is to be excavated where directed.

If any part of the bottom of a trench is found to be unsound or in any way unsuitable to lay the pipe, in the Engineer's opinion, the Engineer may direct that the location of the trench be changed if it is possible to avoid unsound soil by doing so.

5.0 EXCAVATION

All excavations shall be made in compliance with the plans and in such a manner, and to such depths and widths as will give ample room for installing the pipe; the bracing, sheeting or otherwise supporting the sides of the excavation; and for the pumping of ground water if encountered. The Contractor is fully responsible for the safety of all of his men and equipment and must conform completely with the provisions of the "Construction Safety Act."

The bottoms of the trenches must be carefully excavated and trimmed to the elevation required for the pipe bidding. The top of the bedding shall be recessed to receive the hubs of bell and spigot pipe in order to allow the barrel of the pipe to be uniformly supported on compacted bedding material for its entire length. Corrections in depth of excavation, caused by excavating to an extent greater than that required for the installation of the pipes, shall be made by bedding the pipe with granular material, granular "A" O.P.S.S. Spec 1010, placed at the time the pipes are being installed and at the expense of the Contractor.

The trenches shall be excavated to the depths given by the Engineer and only as far in advance of the pipe laying as permitted by the said Engineer.

If any part of the bottom of the trench is found to be unsound or in any way unsuitable in the Engineer's opinion to lay sewer pipes, the Contractor shall remove as much material as may be required and shall replace the unsound material with sufficient approved granular material, granular "A" O.P.S.S. Spec 1010, to form a sound bed for the pipes. The Contractor shall make provisions for such additional excavation and supplying and placing of the granular material and he shall not be paid extra for this work.

Where pipes occur in disturbed or filled ground, the excavation shall be done only after the backfill has been finally settled and the Contractor shall provide all shoring, bracing or sheetpiling as necessary to maintain the banks of this excavation and he shall remove the same as the work progresses and as the filling is accomplished unless otherwise ordered by the Engineer. The arrangement of shoring must be such as to prevent any movement of the trench banks.

All timber used in shoring shall be removed on completion of the work. Timber which cannot be removed shall remain in place at the expense of the Contractor.

No extras will be allowed for excavating any hardpan, boulders, rocks, quicksand, ice or other obstacles found the in excavation or in the line of the trench or for any pumping or bailing of water required in the prosecution of the work. The trench must be drained or pumped in order to avoid the necessity of making joints under water. The trench must also be drained to avoid any possibility of ground water entering the pipe in the trench.

Where the sewer is to be laid close to existing pole lines, trees, buildings or structures, the Contractor must use a type of equipment which will permit excavating in confined areas. If, in the opinion of the Engineer, the type of equipment being used by the Contractor is causing damage to trees, poles, buildings, or other structures, he may direct the Contractor to cease operations until such time as suitable machinery can be placed into operation at the site of the work.

The Contractor shall use the minimum trench width possible where private service connections are constructed across any paved road or road that is proposed to be paved in order to minimize the area of disturbed ground under the pavement or proposed pavement.

6.0 LAYING SEWER PIPE

The Contractor shall lay the sewer pipe to the lines, levels and grades as shown on the accompanying drawings or as may be established by the Engineer at the time of construction. The Contractor will be held responsible for the said lines, levels and grades of the sewer pipe and should the Engineer determine that the Contractor has not satisfactorily adhered to such lines, levels and grades, he may direct the Contractor to take up and relay any portion of the sewer which does not conform to such lines, levels and grades.

A laser beam shall be used to maintain line and grade and the Contractor shall have a qualified operator to set up and operate the machine.

The pipe shall be laid on a true and even bedding under dry conditions. The ends of the pipe shall be kept clean and free from dirt, water and foreign material. Pipe using rubber gasket joints shall be jointed in accordance with the manufacturer's instructions using approved gaskets and lubricating and cementing materials furnished by the manufacturer.

The Contractor shall be responsible for the safe and proper handling of the pipe and shall inspect each pipe to ensure that no cracks, chips, or defects exist in the pipe prior to placing the pipe in the sewer line. Should the Contractor permit damaged pipes or materials to be installed in the sewer, he shall be responsible for the removal and replacement of same at his own expense, should the Engineer require such removal and replacement.

The pipes shall be bedded throughout the full length of the sewer using approved granular material, granular "A" O.P.S.S. Spec 1010. This granular material shall be provided to a depth of D/4 or minimum 150mm below the bottom of the pipe, to a width of O.D. + 500mm minimum and O.D. + 750mm maximum beside the pipe, and 300mm above the pipe. All such bedding material shall be thoroughly compacted and tamped by hand to 100% Standard Proctor Density or as otherwise specified in the Special Provision. Materials used for bedding shall be supplied and installed by the Contractor and the cost of bedding material shall be included in the Tender Price for supplying and laying the sewer pipe.

When sewers are laid in freezing weather, the Contractor shall take all necessary precautions to prevent damage to the pipe or to any of the materials used in the construction of the work, by heating the ingredients of the concrete and mortar to be used in the work and by proper protection of the work after it is in place. In addition, the Contractor shall take care that no frozen ground or backfill is placed in the trench in backfilling.

7.0 BACKFILLING TRENCHES

In addition to the provisions of Section 6 of these specifications, the Contractor shall backfill the remainder of the trench with native material available at the site, in the boulevard areas and Granular Material, granular "B" O.P.S.S. Spec 1010, in trenches which cross road areas, or as specified in the Special Provisions.

The backfill material used in general for backfilling, shall be installed in lifts not exceeding 1.00 metres. The material taken at the site to backfill the trenches shall be compacted to the satisfaction of the Engineer. The backfill material shall be thoroughly rolled, tamped or otherwise compacted in place at the optimum moisture content to produce the specified density. The Granular "B" material used for backfilling trenches shall be mechanically compacted in place to 100% Standard Proctor Density. The cost of supplying and placing the granular backfilling shall be included in the unit price for laying the sewer.

If required, the Contractor shall provide water for compaction so that the optimum moisture content is achieved in order to obtain the specified density.

The Contractor shall take note that the Engineer may conduct Proctor Density tests from time to time to ascertain that the degree of compaction is being obtained by him. If the result of the Proctor Density test using the standard procedure indicates that the desired density is not being obtained, the Engineer may order the Contractor to make such alternation in the method of backfilling as required to produce the necessary density. These alterations may be in the form of requiring the Contractor to provide additional compacting equipment, requiring the Contractor to change the moisture content by either adding or deleting water or by requiring the Contractor to place the material in a different depth of layer.

The Contractor will be required to achieve the specified compaction and density of the material in order to reduce ultimate settlement of the backfill.

The Contractor shall be responsible for any damage to the pipes on account of his backfilling operations. No material will be backfilled directly into the trench from a height greater than 1.20 metres. All backfilling shall be carried out with extreme care to make sure that materials are deposited over the pipe as gently as possible to avoid damage to the sewer.

Equipment used for backfilling shall meet with the approval of the Engineer.

8.0 COMPACTION TESTS

Any compaction tests which are required by the Engineer on any backfilling operations shall be carried out by a satisfactory geotechnical engineering firm, with two written copies of the report being forwarded to the Engineer. The cost of the initial testing shall be borne by the Owner; however any retesting costs shall be borne by the Contractor.

9.0 LEAKAGE TESTS ON GRAVITY SEWERS

Tests may be carried out on all sewers together with service connections and manholes for infiltration and/or exfiltration. The testing is to follow closely behind construction with not more than three sections of the sewer constructed between manholes without successful testing. Trial testing is to be carried out on the first constructed section of not less than 92 metres to qualify each pipe-laying crew and/or material. The Contractor is to pay the cost of all testing including water used.

The infiltration leakage test for gravity sewers shall not exceed 4.49 litres per 100mm diameter for 30 metres of sewer pipe per hour. The exfiltration test shall include the raising of the water level above the crown of the pipe to not less than 50cm at the highest end of the line provided that the maximum head on the line does not exceed 4.50 metres. The allowable exfiltration leakage in the gravity sewer pipes shall not exceed 1.40 litres per 25mm diameter per 30 metres of sewer pipe per hour.

The allowable leakage in manholes shall not exceed 0.91 litres per hour per 30cm of head above the invert of each manhole in test section.

Leakage up to 25% in excess of the allowable limits may be approved in any section, if the excess if offset by leakage in adjacent sections so that the total leakage is within the limits for the combined section.

10.0 TV CAMERA INSPECTION

The Contractor shall note that the sewers may be televised. When the Contractor has completed all main line sewers along with all private service connections and catch basin connections, the Engineer may have the sewers televised by a satisfactory firm, authorized to do business in Canada, at the expense of the Owner. If any deficiencies are noted and corrective measure are to be taken by the Contractor, the sewers, where corrections have been made by the Contractor, shall be re-televised, at the Contractor’s expense.

The Contractor shall thoroughly flush and clean the sewers prior to their being televised. He shall also string the sewers with a nite-line of sufficient size to pull the T.V. Camera through the sewers. The costs incurred by the Contractor for this work shall be included in his unit price for laying the sewers.

The TV Camera report shall also include the as-construction location for all private service connections and catch water basin connections, as they enter the main sewer.

11.0 MANHOLE CONSTRUCTION

Manholes shall be constructed in accordance with these specifications and as may be shown on the accompanying drawings and profiles, and they shall be of the type as outlined in the Form of Tender. Manhole frames and covers shall be constructed of good quality cast-iron, free from flaws and defects, and shall be a 600mm diameter, heavy duty, frame and cover as shown on the accompanying drawings.

Precast, concrete manholes shall conform to A.S.T.M. Specifications C76/65 III and have a minimum internal diameter 1219mm. A minimum of three courses of brick shall be placed on the top of the precast concrete manhole section to adjust the height of the cast-iron frame and cover to the elevations as shown on the accompanying drawings. Sand lime bricks will be not accepted. Manholes shall be fitted with a 1.9cm diameter aluminum drop rungs (65 ST6) at 300mm centres for the full depth of the manhole.

The brick adjustment courses will be smoothly parged inside and outside and the outside parging will extend neatly over the top of the precast. The top of the precast section will be thoroughly cleaned and dampened prior to placing the grout mixture for the adjustment bricks.

All precast manhole sections shall be sealed with a rubber gasket and be suitably grouted on the inside to prevent infiltration of sand or water. Cast-iron frames shall be securely grouted in place to prevent lateral movement of the frames.

All concrete to be used for manhole construction shall have a strength of 21 MPa in 28 days. All reinforcing steel shall be of the size and placed at the spacing as shown on the accompanying plans. Reinforcing steel shall be of the deformed type and shall conform to C.S.A. Specification G30.1 for billet steel, or G30.2 for rail steel.

12.0 CATCH WATER BASINS

Catch water basins shall be precast concrete or corrugated steel pipe and sized in accordance with the accompanying drawings and of the type as outlined in the Form of Tender or the Special Provisions.

Catch water basin frames and grates shall be constructed of good quality cast-iron, free from flaws and defects and shall be a heavy-duty frame and grate as supplied by Domestic Foundry of Windsor or equal.

The cast-iron frame shall be securely grouted in place to prevent lateral movement of the frame. All concrete to be used for catch water basin construction shall have a strength of 21 MPa in 28 days. The top of all catch water basins shall be adjusted to the grade as shown on the drawings.

The precast concrete catch water basins shall have a minimum of three (3) courses and a maximum of six (6) courses of brick placed on the top of the precast catch basin to adjust the height of the cast-iron frame and grate to the elevations as shown on the accompanying plans. Sand lime bricks will not be acceptable.

The corrugated steel catch water basins shall be 600mm in diameter and the wall thickness of the corrugated steel pipe shall be 2.0mm (14 gauge). The corrugated steel pipe shall be of a sufficient length so that the top of the catch water basin may be set at the ground level and that the bottom 300mm of the corrugated steel pipe may be filled with plain concrete having a compressive strength of 21MPa in 28 days. A 300mm sump shall be left between the top of the concrete and the invert or inside bottom of the tile or pipe. The cast iron grate shall be 600mm in diameter as manufactured by Domestic Foundry Limited of Windsor, or equal.

A 150mm diameter, P.V.C. sewer connection from the catch basin to the main drain shall be supplied with each catch basin. The P.V.C. pipe shall conform to specifications for P.V.C. pipe DR-28.

The Contractor shall place plain concrete mortar at the connection of each pipe and the wall of the catch water basin or manhole. The mortar shall be a mixture composed of 3 parts of clean sharp sand to 1 part Portland cement.

13.0 CROSSING EXISTING LINES

The Contractor shall provide for suitable support for sewers and other pipe lines crossing the trench above the proposed sewer. The Contractor shall furnish a solid support suitably embedded in the trench side and/or bottom from the underside of the existing pipe conduit.

14.0 RELOCATING UTILITIES AND UTILITY POLES

Wherever necessary, the Contractor shall make all arrangements for the relocation, if necessary and the protection of any utilities or utility poles, including gas mains, telephone lines and cables, etc. which he may encounter during the course of the work. The Contractor shall notify the Utility in writing, affected by the work and he shall comply with all of the requirements of that Utility in making any relocation or in moving any utilities or poles.

15.0 SHEETING AND SHORING

The Contractor shall take note that in general, all open cut sewer construction shall be carried out using a minimum width of trench and shall be carefully sheeted, shored and braced to provide for the satisfactory protection and safety of the workmen and to comply with all the requirement of legislation affecting trenching operations.

Whenever the sewer trench passes, crosses or runs parallel with any pavement, existing sewer or other buried utility, the Contractor shall take special precautions to provide for adequate bracing and shoring of the trench and for sheet piling and sheeting as may be required in order to reduce any possible hazard of settlement, subsidence or cave-in caused by any damp or wet condition around the pavement, existing sewer or other buried utility.

The Contractor shall further take note that the precise location of such existing pavements, sewers and pipes is not indicated on the drawings and the position as shown on such drawings is for the guidance and information on the Contractor only.

The Contractor shall therefore make a detailed inspection and investigation to ascertain the precise location of the pavements, sewers, and other buried utilities at the time of construction and shall take all possible precautions for supporting and sustaining such pipes in accordance with the General Conditions of the Contract and this specification.

The cost of all sheeting, shoring, bracing and other supporting of the trench and existing pipe, sewer, etc. shall be at the Contractor's expense and shall be included in his total cost for the work.

16.0 SUPPORTING GAS MAINS, BURIED UTILITIES SEWERS AND OTHER STRUCTURES

The Contractor is to take note of any gas mains, buried telephone cables and other structures. He shall be required to completely support and maintain these utilities and structures at his own expense. The Contractor shall be liable for all expenses incurred due to damages to these structures and shall indemnify the owner from all claims arising from such damage and be wholly responsible therefor. The Contractor shall receive no additional remuneration because of the fact that the sewer may run parallel to or alongside of or across or over or under such buried gas mains, utilities, sewers or other structures.

17.0 MATERIALS LEFT IN PLACE

If, in the opinion of the Engineer, the removal of sheeting, shoring, bracing etc., shall have an adverse effect upon existing structures, sewer pipes, etc., the Contractor shall leave the material in place in the trench. The Contractor will be reimbursed for the cost only of steel sheeting left in place. Prior to the placement of any sheeting by the Contractor, he shall notify the Engineer in writing, of the dimension of the steel sheeting to be used at the site and the Engineer will negotiate a price with the Contractor on a unit price per square metre or on a unit price per tonne for the steel sheeting if it is to be left in place. All steel timber or other sheeting or shoring used on the job site and not left in place shall be supplied by the Contractor at his expense.

18.0 MAINTENANCE OF TRAFFIC DETOURS, ETC.

The Contractor shall take extreme care to maintain traffic detours, barricades, flagmen and safety lanterns for the information and general safety of the public at large. He shall assume full responsibility for any claims or other legal action caused by his inattention to the general safety of the public. Detour signs, etc. to be supplied by the Contractor, shall conform to the specifications of and be placed at the locations required by the Road Superintendent or Engineer having jurisdiction over the road or highway.

19.0 ACCURACY OF DRAWINGS AS TO THE LOCATION OF EXISTING UTILITIES

The drawings indicate approximately, the location of existing utilities as far as can be ascertained. The Contractor is in no way to construe this location as being absolute or exact and shall make his own investigation in the field prior to the submission of the tender or the commencement of the work. The Engineer shall not be liable for any errors or omissions in designating the location of underground utilities and the Contractor shall receive no additional recompense on account of any encounter with any known or unknown utility.

20.0 MAINTAINING FLOW IN EXISTING SEWERS

The Contractor shall support and maintain the flow in existing sewers and house connections and any other drainage works encountered in the progress of the work at no expense to the owner. The Contractor shall obtain written approval from the Engineer to stop up any drain, and if necessary, provide pumping equipment, build necessary bypasses, etc. at no expense to the Owner.

21.0 CONNECTING EXISTING SEWERS

The Contractor will be required to connect into the new sewer, all intercepted tiles or pipes. The Contractor will be required to supply the materials for and connect to the satisfaction of the Engineer, all intercepted tiles or pipes. Where tiles or pipes are intercepted, the Contractor shall cut a suitable opening in the side walls of the new sewer with a concrete saw and cement into the existing sewer walls, an adapter of the same type and diameter of the intercepted tiles or pipes. The adapters shall be cemented to the existing walls to the satisfaction of the Engineer.

22.0 REMOVING TREES AND SHRUBBERY

The Contractor shall be fully responsible for removing any unnecessary trees and shrubbery encountered in the course of the work wherever it is necessary to remove any tree or shrubbery. However, the Contractor shall receive the approval of the Engineer before such a tree or shrubbery is removed and the Contractor shall satisfy the Engineer of the necessity of removing such a tree or shrubbery. In addition, the Contractor shall give the owner of such tree or shrubbery, the notification of his intention to remove such tree or shrubbery so that the owner may cause the same to be removed by himself and the Contractor shall cooperate with the owner of the property in this regard. The Contractor shall assist the owner in relocating these items, if the owner so desires and if the Contractor fails to give the owner of the property the proper notice of his intentions, the Engineer may direct that the owner be provided with a replacement of such tree or shrubbery at the Contractor's expense.

The Contractor will not be paid for removing any trees or shrubbery unless the sewer is relocated or any structure is relocated and the relocation thereby causes the Contractor to remove trees or shrubbery which were not shown on the drawing or which would not have been required to be removed except for the relocation of the work. If the Contractor is entitled to any payment in this regard, it will be made in accordance with the General Conditions of Contract.

The Contractor shall not use equipment which will tend to damage or destroy trees whether on highway, street, roadway, etc. property. If trees are required by the Engineer to be removed, the Contractor shall cut down, trim, haul away and dispose of such trees, together with the stumps and roots. He shall further provide sufficient suitable material to fill up any holes or depressions left by the removal of such stumps or roots. He shall also provide a suitable place to dump or destroy or burn such trees after they have been cut down.

MATERIAL AND INSTALLATION SPECIFICATIONS
FOR CABLE CONCRETE
ESSELTINE DRAIN
TOWN OF KINGSVILLE
PROJECT 14-425

International Erosion Control Systems
22253 Hoskins Line, Rodney ON, N0L 2C0
Ph: 1-800-821-7462 Fx: 1-866-496-1990

Cable Concrete®
Specifications

A. DESCRIPTION

Cable Concrete® is an articulated concrete block revetment system, developed by International Erosion Control Systems, to control various types of erosion due to water, wind, or vehicular traffic.
This system is made up of 2.44m x 4.88m long (8'x16') mats placed side by side and clamped together to provide one homogeneous erosion protection system. Smaller mats are available as required.
The mats consist of concrete blocks interlocked by integrally woven stainless steel cables, which are poured within each block. Geotextile fabric is attached to the base of each concrete mat. The blocks typically have 292.10mm (11.5") square top faces and 393.70mm (15.5") square bottoms. Variations between the mat systems are the block heights and weights.

SYSTEM	Minimum BLOCK WEIGHT		Minimum BLOCK HEIGHT		Open Area %
	kg/sm	***lbs/sf***	***mm***	***inches***	
CC 35	180.65-195.30	37-40	114.3-127.0	4 1/2-5	20
CC 45	229.47-253.88	47-52	139.7-152.4	5 1/2-6	20
CC 70	351.53-380.83	72-78	215.9-228.6	8 1/2-9	20

B. CONCRETE

The concrete shall meet the requirements of CSA A23.1/A23.2 for materials, testing, and methods of construction. The concrete mix shall be designed to meet CSA A23.1 Exposed Class C-2 requirements. The minimum required concrete strength shall be 25 MPA or 3625.9425 psi @ 28 days with a minimum of 5-8 % air entrainment throughout.

C. CABLES

The cables shall be made of type 302/304 stainless steel aircraft cable, 1x19 construction.
Cables shall be integral (poured into) to the concrete block and shall traverse through each block in both longitudinal and lateral directions, providing a flexible interlocked system.

STAINLESS STEEL CABLE				
System	Lengthwise		Widthwise	
	mm	inches	mm	inches
CC35	4	5/32"	4	5/32"
CC45	4	5/32"	4	5/32"
CC70	4.8	3/16"	4.8	3/16"

D. GEOTEXTILE

The standard geotextile material used is a needle punched non-woven fabric which is attached to the underside of the mats. An overlap shall be incorporated on three sides. The overlap provides area for the adjoining mats to be placed upon and prevent undermining of the erosion control system.
It should be noted that when different geotextile weights are used and or when additional overlap area is added to the mat, additional cost adjustments shall be made.

E. CLAMPS

Sufficient malleable or stainless steel cable clamps may be used to connect adjoining Cable Concrete® mats. The standard placement of clamps shall be placed on 1.22m (4') centre's connecting adjoining mats together. Clamps are recommended in applications exceeding 3.05m (10') per second.
When placing clamps under existing water, the manufacture will specify a clamp for the condition.

F. ANCHORING

Cable Concrete® mats are designed to take certain velocities in certain slope and bedding situations. This information is founded on engineered flume testing. The data shows maximum limits of the mat system, based on unanchored mats.
Anchoring Cable Concrete® mats offer additional safety to the erosion protection system. If a situation arises where velocities may exceed maximum limits of a system, or if slopes of 1.5:1 or greater are encountered, then anchoring becomes an item to be specified by the governing project engineer.

G. INSTALLATION

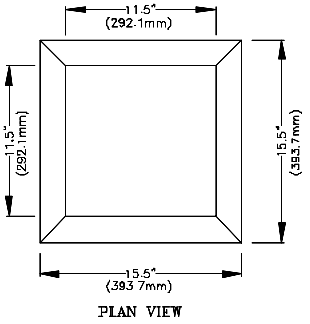
Installation equipment shall have a lifting capacity, capable of completely lifting the concrete mat and the lifting bar during unloading, stockpiling and installing etc.
Prepared areas shall be graded to a smooth plane finish. Any roots, debris and stones must be removed and regraded. Specified geotextile to be placed according to manufacturing recommendations. There shall not be any dragging, tearing or damaging of the geotextile. The mats shall be laid on the geotextile in such a manner to produce a smooth plane surface. Intimate contact with the subsurface is critical to the systems performance in the field.
The gap between each mat shall not be greater than 2", preferably 1" or it must be closed using a cement mixture.

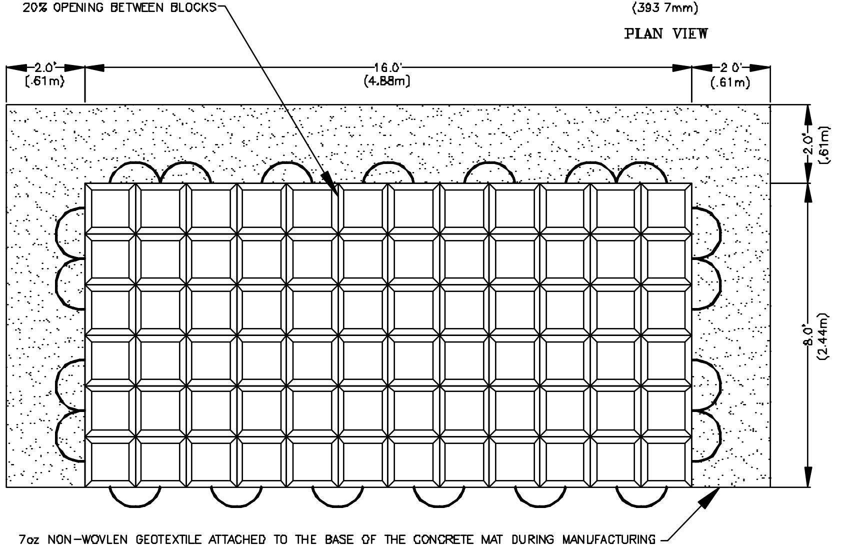
It is recommended that after the installation of the mat system, that it be covered with desired backfill. If vegetation is required, the mat system shall be backfilled and seeded. This will allow moisture to traverse back and forth from sub grade to vegetation. Vegetation will lend support and an even grade for maintenance vehicles (mowers) to traverse over it. Any surface application should not be placed prior to the inspection of the systems clamping and anchoring.

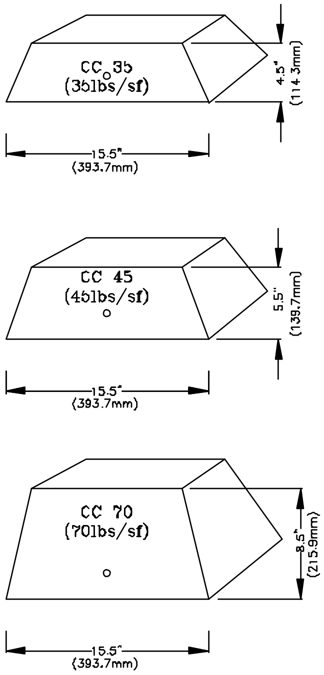
H. PAYMENT

Payment shall be by the square metre and shall include Cable Concrete® mats and manufacturer's recommended geotextile.
Stainless Steel cable clamps, anchors, lifting bar rental and delivery are separate cost items.
Upgrades or additional items shall be considered additional costs.

CABLE CONCRETE ®
TYPICAL UNIT DEPTHS







IECS

INTERNATIONAL EROSION
CONTROL SYSTEMS

22253 Hoskins Line
Rodney, ON, N0L 2C0

Phone: 800-821-7462
Fax: 866-496-1990

www.iecs.com

CABLE CONCRETE ®
TYPICAL UNIT DEPTHS

DRAWN BY: D. J	CHECKED BY: L.A

SCALE: N.T.S	DATE: 10/21/13	SHEET 1 OF 1

IECS ENVIRONMENTAL INC.
Head Office: 22295 Hoskins Line, Rodney, ON N0L 2C0
Alberta Office: #300-160 Quarry Park Blvd. SE, Calgary, AB T2C 3G3
Ph: 1-800-821-7462 Fx: 1-866-496-1990

CABLE CONCRETE

Installation Procedures

1. General

1.1. The Contractor shall provide all labor, materials, and equipment required and perform all operations in association with the installation of the Cable Concrete® units in accordance with the lines, grades, design and dimensions shown in the Contract Drawings and as specified herein.

1.2. Cable Concrete® is recommended to control erosion problems, improve access routes or aesthetics of certain disturbed areas, or to envelop an existing downgraded area. The gross area of each individual block shall maintain direct contact with the geotextile, which is adhered directly onto the base of each block during manufacturing.

2. Installation Scope

2.1. This specification addresses the installation procedures for correct placement of the Cable Concrete® articulating concrete block (ACB) revetment system. The correct placement of an ACB revetment system is essential in order to attain the desired hydraulic performance and the stability required to withstand the erosive forces generated by hydraulic forces.

2.2. This specification should only be functional as a reference for the installation of the Cable Concrete® articulating concrete block (ACB) revetment system, and meant to complement any information based on experience and professional judgment for onsite installation. The contractor should abide by the regulations mandated by OSHA (Occupational Safety and Health Administration) as well as any other relevant codes/regulations pertinent to the specific project.

2.3. This specification is proposed to increase the understanding and to outline the significance of correct installation procedures required to maintain proper function of the revetment system. Throughout the installation process the concrete units shall be installed in a manner so that the concrete units will maintain intimate contact with the site-specific geotextile, and so that the geotextile shall remain in intimate contact with the prepared subgrade.

2.4. This specification addresses the Foundation Preparation, Geotextile Fabric Placement, Placement of Cable Concrete® Units, Connection Detail, and Project Completion issues in the following sections.

3. Foundation Preparation

3.1. Areas on which Cable Concrete® units are to be placed shall be constructed to the lines and grades shown on approved IFC Contract Drawings as well as to the tolerances stated in the Contract Documents, and approved by the Project Engineer. The transitions between the lands contours shall be compacted and graded to facilitate the installation of the ACB system to assure that intimate contact is maintained throughout the entire Cable Concrete® system.

3.2. The slopes shall be graded to a smooth plane surface to ensure that intimate contact is achieved between the prepared slope and the geotextile, and the entire bottom surface of the Cable Concrete® units. The sub-grade preparation is an essential feature of installation and proper performance; all slope irregularities such as roots, grade stakes, and stones that impair the prepared sub base must be removed. Holes, slope board teeth marks, footprints, or other voids greater than 25.4mm in depth normal to the local slope face shall not be allowable. No grooves or recessions greater than 12.7mm in depth normal to the local slope face with a dimension exceeding 300mm in any direction shall be allowable. Where such areas are apparent, they shall be brought to grade by placing compacted approved infill material. The slope and slope face shall be uniformly compacted, and the Engineer shall determine the depth of layers, homogeneity of soil, and amount of compaction.

3.3. Immediately prior to placing the Cable Concrete® units, the prepared area shall be inspected by the Engineer and/or the owner's representative, and by the manufacturer's representative. No fabric or units shall be placed thereon until that area has been approved by each of these parties. Any area that becomes unacceptable prior to the ACB installation shall be re-graded, re-compacted, or replaced at the discretion of the engineer and/or manufacturers representative.

4. Geotextile Fabric Placement

4.1. The exposed 600mm overlap of geotextile shall not be walked on or distressed in a manner resulting in the loss of intimate contact between the Cable Concrete® block and prepared sub-grade. The placement is initiated at the toe of the slope and proceeds to the top of slope. The geotextile filter fabric shall be placed so that the upstream strip of fabric overlaps the downstream strip, when applicable. The geotextile shall extend at least 600mm beyond the top and bottom revetment finish points.

5. Placement of Cable Concrete® Units

5.1. Cable Concrete® units shall be constructed within the specified lines and grades shown on the Contract Drawings. Attention shall be taken while installing the system in order to avoid damage to the geotextile or the underlying subgrade.

5.2. The Cable Concrete® units shall be placed in such a manner as to produce a smooth plane surface in intimate contact with the prepared subgrade. This placement pattern will produce a tightly interconnected solution. No individual unit within the plane of the system shall protrude more than one-half inch or as otherwise specified by the Engineer. The units shall be placed side by side so that the blocks abut each other; therefore distinct changes in grade will result in an irregular surface. To assure that the Cable Concrete® units remain level and maintain a close connection with the prepared sub-grade; the units shall be "settled" by a method that is approved by the Engineer. Care shall be taken during installation so as to avoid damage to the geotextile or concrete units during the installation process. The system placement shall begin at the toe of slope and then proceed to the top of slope.

5.3. When installation initiates downstream and advances upstream, a toe trench is located at the finished upstream edge to protect against erosive forces. These erosive forces theoretically could undermine the system if proper installation procedures are not followed. Vertical offsets throughout the system shall not exceed 12.7mm.

6. Connection Detail

6.1. The provided cable clamps are to be secured to each Cable Concrete® mat ensuring a secure mat-to-mat connection is established. 6 clamps total are to be used per mat – 2 clamps on the short ends, and 4 clamps on the long sides of each mat. Clamps are to be installed @ 1.2m intervals snug to the base of the concrete block by sliding the cable clamp down the adjacent loop, then tighten clamp securely. Excess loops to be buried under adjacent block or cut once the clamp has been secured; ensuring no cables are protruding from any connection point.

6.2. When placing the mats, the spacing between the mats shall not exceed 2”; any void spacing resulting in spacing larger than 2” is to be grouted with an approved concrete mixture to provide a seamless sealed transition between two mats.

7. Project Completion

7.1. The visible edges shall be backfilled and compacted until flush. The integrity of an approved imported soil or granular backfill must be preserved so as to assure a smooth flush surface with the top of the Cable Concrete®. Toe trenches shall be backfilled as shown on the Contract Drawings. Backfilling and compaction shall be accomplished in a timely manner. Backfilling is required at the top of slope on both sides of the ditch to protect from undermining the exposed outer edge of the concrete unit system.

7.2. When desired, the system shall be backfilled and compacted with suitable materials. This will assure that there are no voids and the compacted material will extend from the filter fabric to one-inch above the surface of the block.

7.3. When required, the manufacturer of the concrete units shall provide design and construction advice during the design and initial installation phases of the project. The subgrade preparation, placement of geotextile filter fabric, placement of the Cable Concrete® concrete units, and the final completed project shall be inspected and approved by a qualified individual.

International Erosion Control Systems
22253 Hoskins Line, Rodney, ON N0L 2C0
Ph: 1-800-821-7462 Fx: 1-866-496-1990
519-785-1420 519-785-1425

SAFE WORK PROCEDURE:

Installation of 'Cable Concrete®'

Purpose

The purpose of this procedure is to provide installation personnel with a guideline for the safe handling of the Cable Concrete® mats as they are handled and installed on each jobsite.

Scope

This procedure will be referred to and adhered to by all personnel involved in the installation of ACB mats any time they are charged with a task related to the installation. This includes supervisors, engineers, crane and lift operators, signalmen, and laborers. Keep in mind that there may be other procedures and practices you should refer to that apply to this task, such as forklift, crane operation, and load lifting/suspended loads.

PPE Required

- CSA Approved Green Patch Steel Toed Boots
- CSA Approved Hard Hat
- CSA Approved Z96-09 HVSA Safety Vest
- CSA Approved Z94.3 Safety Glasses
- Work Gloves (Full Finger, Leather Palm)

Field Level Risk Assessment

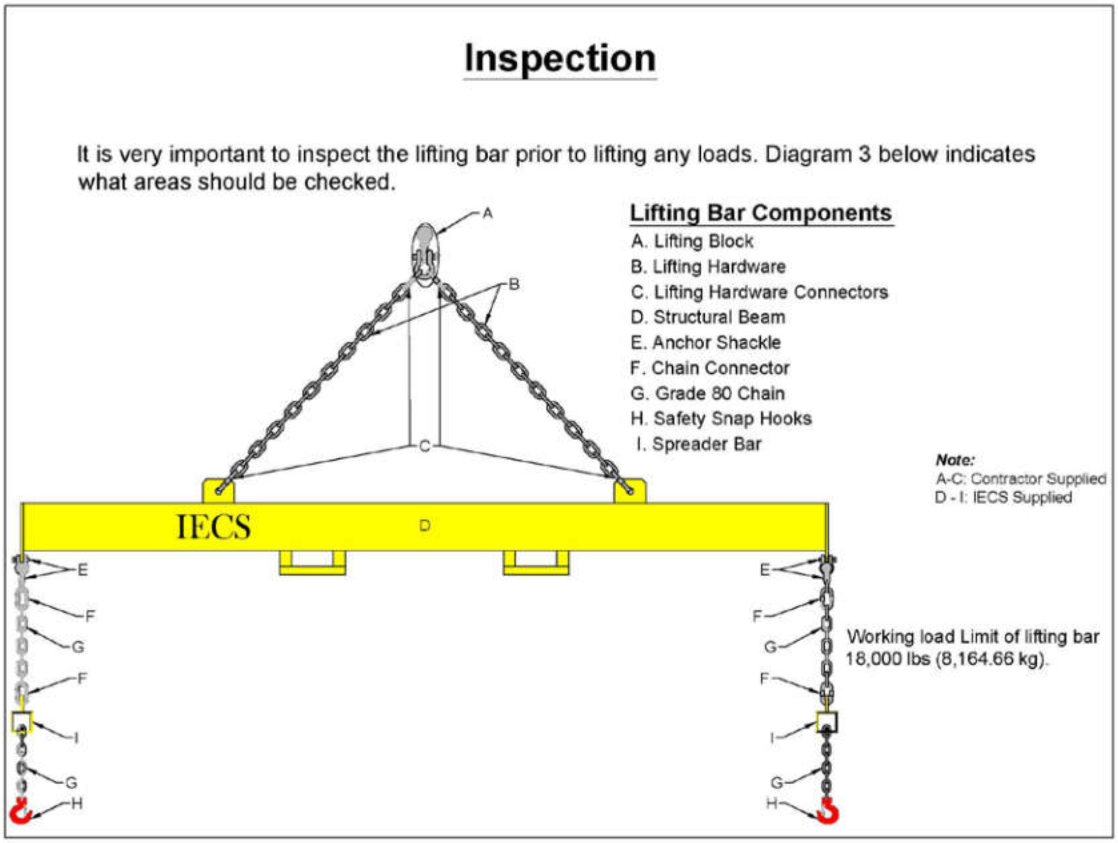
HAZARD	CONTROL
Heavy object.	Use forklift or hoist to perform lift.
Suspended/swinging load.	Inspect hoist and rigging. Ensure personnel stay clear of load.
Pinch points	Ensure as few personnel as possible are in the approved work area. Ensure personnel stay clear of pinch points when mat is being lowered. Ensure personnel are clear of the load before signalman gives direction to load/unload.
Environmental conditions	Do not try to free frozen materials mechanically, Thaw them out instead. Avoid installation in/on over saturated ground.

Mats are kept to a maximum of 8’ width for shipping purposes. Each mat is loaded onto the truck by a spreader bar and secured by four to six connections on each short arm of the lifting bar.

(Optional) A guide line (rope) is attached to the lifting bar or one end of the mat so when the mat is lifted on site personnel can maneuver and assist in guiding the mat into place.

Once mat has been placed in approved location on the ground, workers may safely detach all Safety Snap Hooks on each side of the mat, and then a signalman may signal to operator that it is safe to raise the lifting bar.

Inspection



Inspection

It is very important to inspect the lifting bar prior to lifting any loads. Diagram 3 below indicates what areas should be checked.

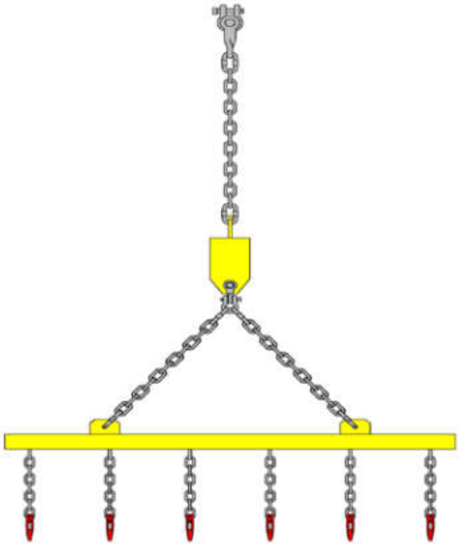
Lifting Bar Components

A. Lifting Block
B. Lifting Hardware
C. Lifting Hardware Connectors
D. Structural Beam
E. Anchor Shackle
F. Chain Connector
G. Grade 80 Chain
H. Safety Snap Hooks
I. Spreader Bar

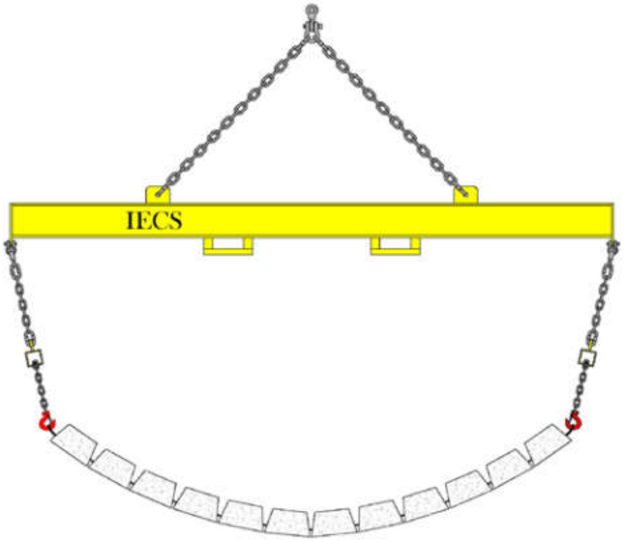
Note:
A-C: Contractor Supplied
D - I: IECS Supplied

Working load Limit of lifting bar 18,000 lbs (8,164.66 kg).

It is very important to thoroughly inspect the Lifting Bar prior to lifting any loads. The diagram below indicates what areas should be checked and noted.



8’ Lifting Bar complete with 6 lifting points



Procedure

- ✓ Complete the FLRA (Field Level Risk Assessment) and review with all personnel.
- ✓ Inspect the equipment or the hoist and rigging that is going to be used. If repairs or adjustments are necessary, complete them now, before beginning the task.
- ✓ Refer to the manufacturer's literature for the weight of the ACB mat.

Warning!

- ➢ If the ACB mat requires repositioning, use a forklift or overhead hoist. Do not attempt to manually move the mat as you may strain a muscle or cause other injury.

1. Offloading

- ✓ The Lifting Bar is used for lifting and placing ACB mats. ACB mats range from 5,000 to 12,000lbs per mat with spreader bar. Because of the wide spectrum in mat weight, the appropriate bar must be specified for each project.
- ✓ Mats can only be lifted one (1) to a maximum of two (2) at a time, provided equipment on site is capable of safely lifting mats.

Warning!

- ➢ Riggers should be careful to keep hands and fingers clear of the snap hooks when attaching the mat to the spreader bar cables.

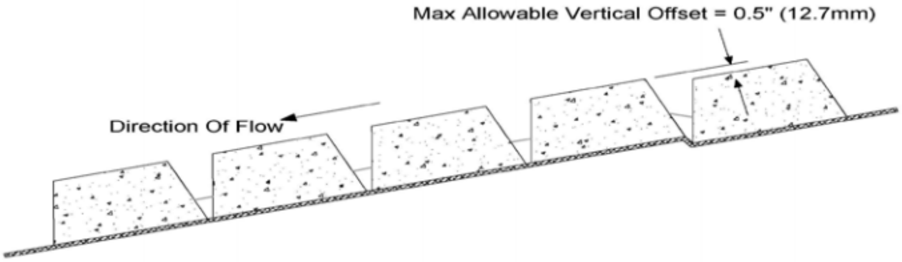
- Attach the mat to the lifting bar cables to prepare for lifting. Most mats will have four (4) to six (6) attachment points.
- (Optional) Guide ropes may be attached to the lifting bar or from the corners of the mat in order to stabilize the lift. Only those personnel holding the guide ropes should be in the area when the lift occurs, and should stand back as much as possible.
- Ensure all unnecessary personnel are clear of the mat before giving the signal to the operator to lift the mat.
- ACB Mats should be lifted in a manner that will minimize the bowing of the mat. A properly adjusted Lifting Bar is necessary to maintain as flat a profile as possible when lifting the mats. Minimizing the bowing of the mats during lifting reduces the stress on the cables and blocks.

Warning!

- When lifting mats, all personnel should be well clear of the underside of the mat. Do not give the signal to lift until all personnel are clear.
- When using a "friction band" type crane, the operator must take caution not to "snap" the load with the brake when lowering it into position. The high inertia forces generated by "snapping" the load can be detrimental to the wire ropes, concrete units, lifting bar, and the crane itself.

2. **Setting the Mat down**

- ACBs must be placed on the geotextile in such a manner as to produce a smooth plane surface in intimate contact with the geotextile. In curvature and grade change areas, alignment of the individual block and the orientation of the neighboring adjacent block must provide intimate block to fabric contact.
- Care shall be taken to avoid damage to the geotextile or subgrade during the block installation process. The ACB system placement should begin at the downstream end and proceed upstream.
- On sloped sections, where practical, placement shall begin at the toe of the slope and proceed up the slope. Individual blocks within the plane of the finished system should not exceed the protrusion tolerance beyond that used in the stability design of the system. The maximum vertical offset tolerance for any given block is 0.5 inches (13 mm) (See Diagram below).



- Always ensure a straight line of vision between the signalman and crane operator.
- Communicate clearly, using recognised hand signals.
- Ensure all unnecessary personnel are clear of the mat before giving the signal to the operator to lower the mat.
- One to two persons should now step in, ensure there is no tension on the cables and unhook the mats from the lifting bar cables.
- When clear to do so, give the signal to the operator to raise the lifting bar away.

Warning!

- ➢ When lowering mats, all personnel should be well clear of the underside of the mat. Do not give the signal to lower until all personnel are clear.
- ➢ When unhooking the mats, be wary of swinging spreader bar. Beware of the pinch points between each block and keep your hands and fingers clear at all times.
- ➢ Beware of the pinch points between mats as they are laid side by side and keep your hands and fingers clear at all times.
- ➢ Beware of the pinch points at the snap hooks when unhooking the mat.

3. Anchoring

- Standard applications have several points requiring the mats be secured to other structures and to one another. These are listed below.

Adjoining Mats
Angled Mats
Turning of Corners
Anchoring to Other Structures
Termination Trenches

- Anchoring may be required at the crest of an installation such as a levee, channel slope, or shoreline slope. The anchoring method is normally determined by the steepness of the slope to be protected. The following rule of thumb is recommended:

✓ If the slope is less than or equal to 3H: 1V, no mechanical anchors are required in the crest termination trench, but can be used if specified or if the user simply wants the additional anchoring.

✓ If the slope is greater than or equal to 2H: 1V, mechanical anchors may be required in the termination trench at the crest.

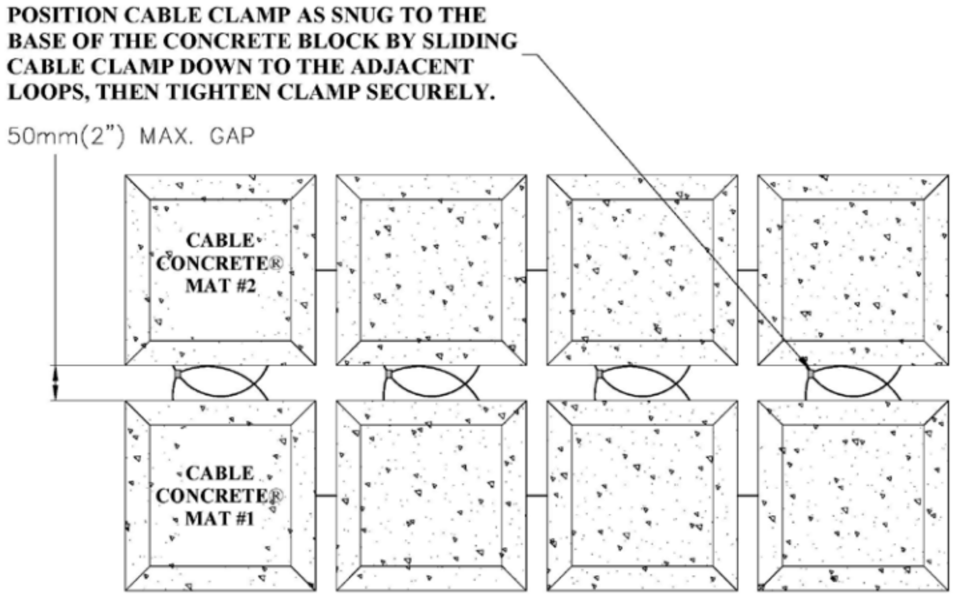
✓ All of the leading edges must be terminated in a trench. The same rule of thumb applies to these areas as in items 1 and 2.

✓ The two main mechanical anchors are; duckbill anchors and arrow head earth anchors.

4. Connection Points – Cable Clamps

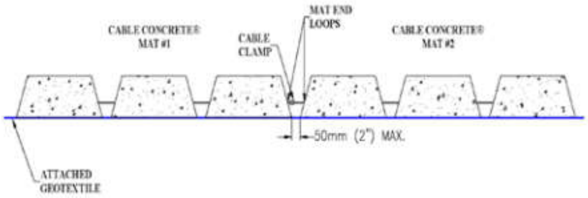
Once all of the mats are laid the loose ends of the side cables must be clamped together to make one system of all the mats. This is accomplished with the clamps provided with the first shipment of mats.

PLAN VIEW



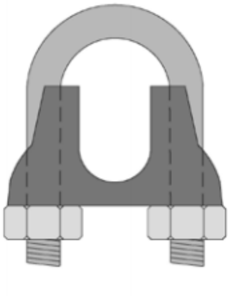
Recommendation: 6 clamps per mat.

PROFILE VIEW



WHEN PLACING THE MATS, THE GAP BETWEEN THE MATS SHOULD NOT BE ANY LARGER THAN A 50mm (2") MAXIMUM. IF THE MATS ARE PLACED WITH A LARGER SPACE THAN 50mm (2"), IT IS RECOMMENDED TO GROUT THE SEAM BETWEEN THE MATS.

CABLE CLAMP



NOTE:
CABLE CLAMPS ARE MADE OF A U-BOLT, A COVER SADDLE, AND TWO 3/16" NUTS.

5. Subgrade Preparation

Compacted and stable subgrade soil should be prepared to all specifications, lines, grades, and cross sections shown on the final drawings. Termination trenches, embankment crests, and toes should all be compacted and graded to ensure that water cannot migrate under the ACB and geotextile material at these points.

Final subgrade should be graded smooth to ensure complete contact with the geotextile and ACBs. Unacceptable soils, soils to wet too achieve compaction, and soils with debris in them should be removed and replaced with approved material and compacted to specifications.

1. Remove all surface vegetation and debris. This removed material should not be used as backfill or placed back on the surface. Prepare the surface for installation of the ACB system.
2. When installing ACB systems the subgrade must be stable prior to installation. ACB systems maintain slope stability and prevent erosion, but are not slope stabilization systems. For this reason the subgrade must be as clean and level as possible.
3. The block systems are designed to allow for block protrusions of one-half inch on random blocks. However, the goal is to minimize non-conformities in the subgrade. Geotextile products are strong and durable, but the area to be covered should be free of debris or any materials that may tear or puncture the geotextile.
4. Compaction of the subgrade should be to 90% - 95% of standard proctor. This insures that the soils are stable and will not erode when water is flowing over and through the installation.
5. After preparation of the subgrade installation of the geotextile can begin.

Appendix A

- ASTM – D6684-03
  ~ Standard Practice for Installation of Articulating Concrete Block (ACB) Revetment Systems[1]

Standard Practice for
Installation of Articulating Concrete Block (ACB) Revetment Systems[1]

This standard is issued under the fixed designation D6884; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 The purpose of this standard is to provide recommended guidelines for the proper installation of articulating concrete block (ACB) revetment systems.

1.2 This practice offers a set of instructions for performing one or more specific operations. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace standard of care by which adequacy of a given professional service must be judged, nor should this document be applied without considerations of a project's many unique aspects. The word "standard" in the title of this document means only that the document has been approved through the ASTM consensus process.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C33 Specification for Concrete Aggregates

C698 Test Methods for Chemical, Mass Spectrometric, and Spectrochemical Analysis of Nuclear-Grade Mixed Oxides ($(U, Pu)O_2$)

3. Terminology

3.1 *Definitions:*

3.1.1 *articulating concrete block (ACB) revetment system, n*—a matrix of interconnected concrete block units for erosion protection. Units are connected by geometric interlock, cables, ropes, geotextiles, geogrids, or a combination thereof, and typically include a geotextile underlayment for subsoil retention.

4. Summary of Practice

4.1 The proper installation of articulated concrete block revetment systems is essential to the adequate functioning and performance of the system during the design hydrologic event. This standard provides guidelines for maximizing the correspondence between the design intent and the actual field-finished conditions of the project.

4.2 This standard addresses the preparation of the subgrade, geotextile placement, block system placement, backfilling and finishing, and inspection.

5. Significance and Use

5.1 This standard is intended for use by designers and contractors to assist in understanding the importance of proper installation of articulating concrete block revetment systems in order to achieve suitable hydraulic performance and maintain stability against the erosive force of flowing water.

5.2 An articulating concrete block system is comprised of a matrix of individual concrete blocks placed together to form an erosion-resistant overlay with specific hydraulic performance characteristics. The system includes a geotextile underlay compatible with the subsoil that allows hydraulic infiltration and exfiltration to occur while providing particle retention. The blocks within the matrix shall be dense and durable and the matrix shall be flexible and porous.

5.3 Articulating concrete block systems are used to provide erosion protection to underlying soil materials from the forces of flowing water. The term "articulating," as used in this standard, implies the ability of individual blocks of the system to conform to changes in the subgrade while remaining interconnected by virtue of block interlock and/or additional system components such as cables, ropes, geotextiles, or geogrids.

---

[1] This practice is under the jurisdiction of ASTM Committee D18 on Soil and Rock and is the direct responsibility of Subcommittee D18.25 on Erosion and Sediment Control Technology.

Current edition approved May 1, 2010. Published September 2010. Originally approved in 2003. Last previous edition approved in 2003 as D6884–03. DOI: 10.1520/D6884-03R10.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

5.4 The definition of articulating concrete block systems does not distinguish between interlocking and non-interlocking block geometries, between cable-tied and non-cable-tied systems, between vegetated and non-vegetated systems or between methods of manufacturing or placement. Furthermore, the definition does not restrict or limit the block size, shape, strength, or longevity; however, guidelines and recommendations regarding these factors are incorporated into this standard. This standard does not specify size restrictions for individual block units. Block systems are available in either open-cell or closed-cell varieties.

5.5 The installation of articulated concrete block systems shall be performed so as to maintain intimate contact between the blocks, the geotextile filter and the subgrade that the system is intended to protect.

6. Procedure

6.1 *Subgrade Preparation:*

6.1.1 Stable and compacted subgrade soil shall be prepared to the lines, grades and cross sections shown on the contract drawings. Termination trenches and transitions between slopes, embankment crests, benches, berms and toes shall be compacted, shaped and uniformly graded to facilitate the development of intimate contact between the ACB system and the underlying grade. Termination between the articulating concrete block revetment system and a concrete slab, wall or similar structure, shall be secured in a manner which prevents soil migration.

6.1.2 The subgrade soil conditions shall meet or exceed the required material properties described in 6.1.4. prior to placement of the block. Soils not meeting the requirements shall be removed and replaced with acceptable material.

6.1.3 Care shall be exercised so as not to excavate below the grades shown on the contract drawings, unless directed by the Engineer to remove unsatisfactory materials. Any excessive excavation shall be filled with approved backfill material and compacted. Where it is impractical, in the opinion of the Engineer, to dewater the area to be filled, over-excavations shall be backfilled with approved backfill material.

6.1.4 When placing in the dry, the areas to receive the ACB system shall be graded to establish a smooth surface and ensure that intimate contact is achieved between the subgrade surface and the geotextile, and between the geotextile and the bottom surface of the ACB system. Unsatisfactory soils, soils having excessive in-place moisture content and soils containing clods, roots, sod, brush, or other organic materials shall be removed, backfilled with approved material and compacted. It is recommended that the subgrade be uniformly compacted to a minimum of 90 percent of Standard Proctor density (Test Method D698). Should the subgrade surface for any reason become rough, corrugated, uneven, textured or traffic marked prior to ACB installation, such unsatisfactory portion shall be scarified, reworked, re-compacted or replaced as directed by the Engineer. Excavation of the subgrade above the water line shall not be more than 2 in. (50 mm) below the grade indicated on the contract drawings. Where such areas are below the allowable grades, they shall be brought to grade by placing and compacting approved material in layers not exceeding 6 in. (150 mm) thick. Where such areas are above the allowable grades, they shall be brought to grade by removing material or reworking existing material and compacting. The subgrade shall be raked, screeded, or rolled by hand or machine to achieve a smooth compacted surface that is free of loose material.

6.2 *Placement of Geotextile:*

6.2.1 Immediately prior to placing the geotextile and ACB system, the prepared subgrade shall be inspected. The geotextile shall be placed directly on the prepared area, in intimate contact with the subgrade and free of folds or wrinkles. The geotextile shall be placed in such a manner that placement of the overlying materials will not excessively stretch or tear the geotextile. After geotextile placement, the work area shall not be disturbed so as to result in a loss of intimate contact between the concrete block, the geotextile, and the subgrade. The geotextile shall not be left exposed longer than the manufacturer's recommendation to minimize potential damage due to ultraviolet radiation.

6.2.2 The geotextile shall be placed so that upstream strips overlap downstream strips and so that upslope strips overlap downslope strips. Overlaps shall be in the direction of flow wherever possible. The longitudinal and transverse joints shall be overlapped at least 3 ft (91 cm) for below-water installations and at least 1.5 ft (46 cm) for dry installations. If a sewn seam is to be used for the seaming of the geotextile, the thread to be used shall consist of high strength polypropylene or polyester and shall be resistant to ultraviolet radiation. The geotextile shall extend beyond the top, toe and side termination points of the revetment. If necessary to expedite construction and to maintain the recommended overlaps anchoring pins, "U"-staples or weights shall be used. Granular filters may be used in place of, or in combination with, the geotextile per the Engineer's design drawings and specifications.

6.3 *Placement of Articulating Concrete Block System:*

6.3.1 The articulating concrete block system shall be placed on the geotextile in such a manner as to produce a surface in accordance with 6.3.3 that achieves intimate contact with the geotextile.

6.3.2 Placement of the ACB system, whether as mats or by hand, shall be performed to ensure that the individual blocks lie in intimate contact with the geotextile and subgrade. For blocks within a mat and blocks that are hand placed, the joint spacing between adjacent blocks is to be maintained so that binding of blocks does not occur and so that block to block interconnection is achieved. In areas of curvature or grade change, alignment of an individual block with adjacent blocks shall be oriented such that intimate contact between the block, geotextile, and subgrade is maintained and block to block interconnection is achieved.

6.3.3 Care shall be taken during block installation so as to avoid damage to the geotextile or subgrade during the installation process. Preferably, where the geotextile is laid on the ground prior to the ACB installation, the ACB placement shall begin at the upstream section and proceed downstream. If an ACB system is to be installed starting downstream and proceeding in the upstream direction, a contractor option is to construct a temporary toe trench at the front edge of the ACB system to protect against flow which could otherwise undermine the system during flow events. On sloped sections where practical, placement shall begin at the toe of the slope and proceed upslope. Block placement shall not bring block-to-block interconnections into tension. Individual blocks within the plane of the finished system shall not exceed a 0.5 in. (13 mm) protrusion or greater protrusion than the tolerance referenced in the contract documents.

6.3.4 If assembled and placed as large mats, the ACB mats can be attached to a spreader bar to aid in the lifting and placing of the mats in their proper position with a crane or backhoe. The mats shall be placed side by side and/or end to end, so that the mats abut each other. Mat seams or openings between mats that are 2 in. (50 mm) or greater in the matrix shall be filled with grout. Whether placed by hand or as mats, distinct grade changes shall be accommodated with a well-rounded transition (that is, minimum radius per specific system characteristics). However, if a discontinuous revetment surface exists in the direction of flow, a grout seam at the grade change location shall be provided to produce a continuous, flush finished surface.

6.4 *Termination Trenches:*

6.4.1 Termination of blocks shall be in excavated trenches which shall be properly backfilled with approved material flush with the top of the finished surface of the blocks (see 6.1.4). The integrity of the trench backfill shall be maintained to ensure a finished surface that is flush with the top surface of the articulating blocks.

6.5 *Anchor Penetrations:*

6.5.1 Anchor penetrations through the geotextile shall be grouted with approved material to prevent migration of subsoil through the penetration point.

6.6 *Finishing:*

6.6.1 The open area of the articulating concrete block system is typically either backfilled with suitable soil for revegetation, or with ⅜ to ¾ in. (10 to 20 mm) diameter crushed stone. Backfilling with soil or granular fill within the cells of the system shall be completed as soon as practicable after the revetment has been installed. When topsoil is used as a fill material above the normal waterline, overfill by 1 to 2 in. (25 to 50 mm) to account for backfill material consolidation.

6.7 *Inspection:*

6.7.1 The subgrade preparation, geotextile placement and ACB system installation, and overall finished condition including termination trenches shall be inspected.

7. Keywords

7.1 articulating concrete block (ACB) revetment systems; erosion control; geotextile; subgrade; termination trenches; toe-ins

MPS Civil Products

Duckbill Earth Anchors

Features >>>

- Tree Support
- Theft Deterrent
- Erosion Control
- Multi-Purpose

Benefits >>>

- Faster Installation and Penetrates Harder Soils
- Quicker Loading, Stronger Hold
- More Stable Drive Plane Installation Angle

Breakthrough Earth Anchoring Technology

DUCKBILL®
EARTH ANCHORS

The Duckbill Anchor Principle >>>

Saving time and labor, patented Duckbill® Anchors work like toggle bolts in the soil.

Duckbill Anchors are driven into the ground (with no holes, no digging and no concrete), providing a safe and environmentally sensitive installation.

An upward pull on the anchor tendon rotates the Duckbill Anchor into a perpendicular "load lock" position in undisturbed soil.

Duckbill Anchor systems offer the most effective, lightweight, economical solutions to any anchoring application, large or small.

Models >>>

Model 40

300 lbs. capacity in normal soils

Model 68

1,100 lbs. capacity in normal soils

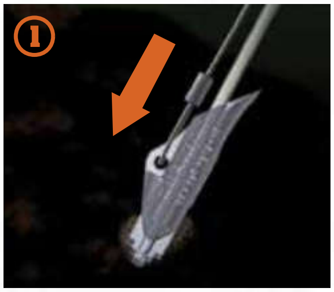
Model 88

3,000 lbs. capacity in normal soils

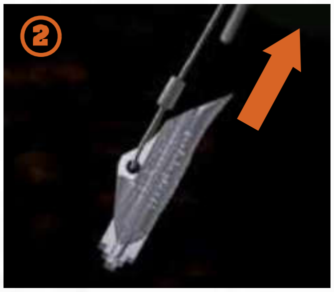
Model 138

5,000 lbs. capacity in normal soils

How It Works >>>

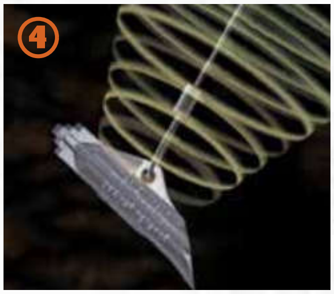


Drive Anchor



Remove Drive Steel

Pull On Wire Rope



Load Locked

① Drive anchor into the soil using a hammer and drive steel rod (a small jack hammer can also be used with power drive steel).

② Once anchor is at the proper depth, remove the drive steel.

③ Set the anchor in the soil by pulling up on the wire rope.

④ The upward pull on the wire rope rotates the anchor into a perpendicular load locked position.

> **Safe**

> **Strong**

> **Easy to Install**

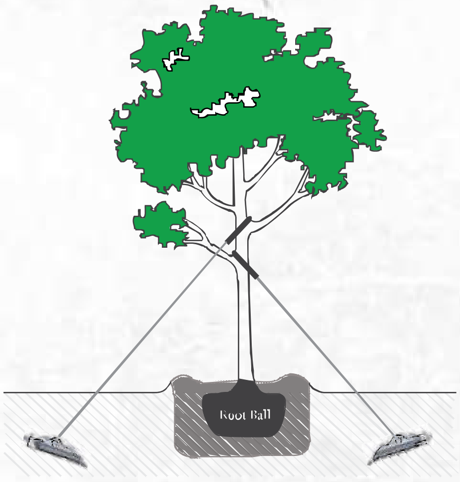
Tree Support Kits

No time wasted assembling various components. With Duckbill Anchors, everything is done for you. All kits are available with galvanized steel, clear or highly visible orange / white vinyl coated wire rope.

The Advantages

- Easy, safe installation
- More trees anchored per hour
- Professional appearance

**One kit anchors one tree. Drive steel additional.*



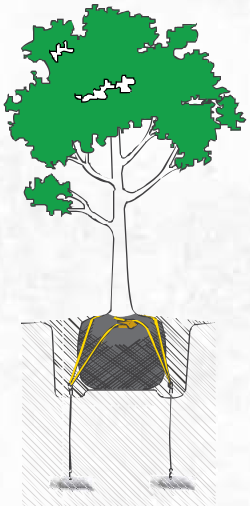
Tree Support Kit Specifications

Product	**Model 40 DTS Kit** For trees up to 3 in (75 mm) diameter	**Model 68 DTS Kit** For trees up to 6 in (150 mm) diameter	**Model 88 DTS Kit** For trees up to 11 in (279 mm) diameter
Kit Contents	▪ 3 DUCKBILL® anchors ▪ 12 ft (3.6 m) of wire rope per anchor attached ▪ 3 tree collars ▪ 3 1/16 in (1.6 mm) wire rope clamps	▪ 3 DUCKBILL® anchors ▪ 13 ft (4 m) of wire rope per anchor attached ▪ 3 tree collars ▪ 6 ⅛ in (3.2 mm) wire rope clamps	▪ 3 DUCKBILL® anchors ▪ 15 ft (4.6 m) of wire rope per anchor attached ▪ 3 tree collars ▪ 6 3/16 in (4.8 mm) wire rope clamps
			
Capacity (Per Anchor)	300 lbs (1.33 kN) in normal soil	1,100 lbs (4.89 kN) in normal soil	3,000 lbs (13.39 kN) in normal soil
Standard Case & Weight	12 units at 10 lbs (4.6 kg)	6 units at 24 lbs (11 kg)	4 units at 30 lbs (13.5 kg)

Drive Steel for DUCKBILL Anchors >>>

Model 40	Model 68	Model 88	Model 138
DS-40: ⅜ in (9.7 mm) round 2 ft (0.6 m) long hand drive steel with large striking head	**DS-68:** ½ in (12.7 mm) round 3 ft (0.9 m) long hand drive steel with large striking head **DS-68 HD (Heavy Duty):** ¾ in (19 mm) round 4 ft (1.2 m) long hand drive steel with large striking head **Power Drive Steel:** 4 ft (1.2 m) drive tip to under collar, for use with mechanized jack hammer	**DS-88:** ¾ in (19 mm) round 4 ft (1.2 m) long hand drive steel with large striking head **Power Drive Steel:** 4 ft (1.2 m) drive tip to under collar, for use with mechanized jack hammer	**Power Drive Steel:** 5 ft (1.6 m) drive tip to under collar, for use with mechanized jack hammer

Rootball Kits



Perfect when guy systems are not possible or desirable, such as in playgrounds or where sidewalk plantings are required. A completely underground system designed to hold the root ball firmly in place.

The Advantages

- Fast, easy, safe installation
- No poles or stakes
- Completely underground

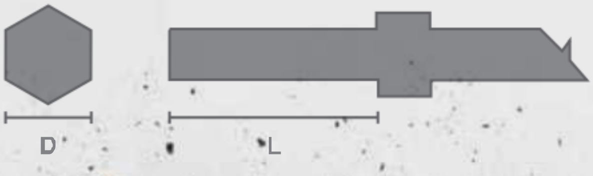
**One kit anchors one tree. Drive steel additional.*

Rootball Kit Specifications

Product	**Model 40 RBK Kit** For trees up to 2 in (50 mm diameter	**Model 68 RBK Kit** For trees up to 3 in (75 mm) diameter	**Model 88 RBK Kit** For trees up to 6 in (150 mm diameter
Kit Contents	▪ 3 DUCKBILL® anchors with D-ring ▪ 1 6ft strap with hand ratchet	▪ 3 DUCKBILL® anchors with D-ring ▪ 1 20ft strap with hand ratchet	▪ 3 DUCKBILL® anchors with D-ring ▪ 1 21ft strap with hand ratchet
			
Capacity (Per Anchor)	300 lbs (1.33 kN) in normal soil	1,100 lbs (4.89 kN) in normal soil	3,000 lbs (13.39 kN) in normal soil
Standard Case & Weight	6 units at 6.71 lbs (3 kg)	6 units at 13 lbs (6 kg)	6 units at 32 lbs (14.5 kg)

How to Select Power Drive Steel

1. Determine the Duckbill Anchor to be installed.
2. Measure hex size (D) across flats of a shank that fits the hammer
3. Measure shank length (L) from top of hex to bottom of collar
4. Call with special shank sizes or if you need more information on determining what drive steel is needed.



Each Duckbill Anchor has unique drive steel determined by the jack hammer and the anchor model.

EXAMPLE: For a Model 88 Anchor with 1 in x 4 ¼ in shank, drive steel is PDS8810.

Part Number:

PDS 88 10

Anchor Size
Shank Code

To get the Shank Code, multiply the hex size (**D**) by the shank length (**L**).

D x L = Shank Code

1 in x 4 ¼ in = 10

Applications >>>

Duckbill Anchors are used worldwide to secure items that can be stolen, moved or blown down. Duckbill Anchors are intended for light duty applications in normal soils.

For highly corrosive environments, Duckbill Anchors can be fabricated with stainless steel wire rope, plastic impregnated wire rope or other corrosion-resistant solutions.

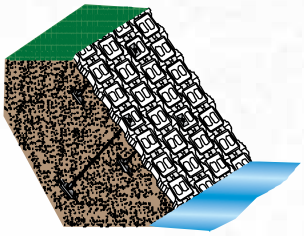
Ideal for:

- Tree Support
- Fences
- Structures
- Tents
- Towers
- Scaffolding
- Tree Revetments
- Turf Reinforcment
- Sheds
- Theft Deterrent
- Vineyards
- And More

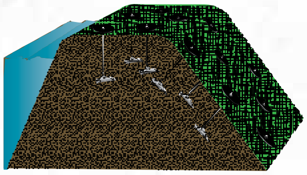
> **"I would like to inform you as to how the Cleveland Metroparks System utilizes your Duckbill Anchors. They are attached to both ends of a picnic table, preventing park patrons from moving the tables from their designated area. The anchors have also eliminated vandalism problems we have experienced. In the five years we have been using the Duckbill Anchor system, it has virtually solved both of these situations."**
>
> **- Metroparks**
> *Cleveland, Ohio USA*

Multi-Purpose

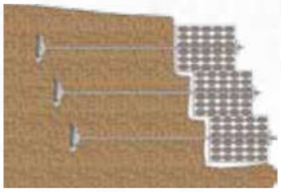
Erosion Control



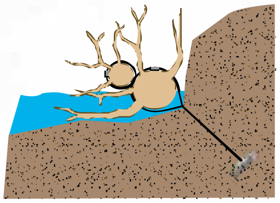
ACB Mat



TRM Mat



Gabions



Tree Revetment

Multi Purpose Specifications

	Model 40-DB1	Model 68-DB1	Model 88-DB1	Model 138-DB1
Capacity (Per Anchor)	300 lbs (1.33 kN) in normal soil	1,100 lbs (4.89 kN) in normal soil	3,000 lbs (13.39 kN) in normal soil	5,000 lbs (22.24 kN) in normal soil
Wire Rope Length	20 in (0.51 m)	2 ½ ft (0.76 m)	3 ½ ft (1.07 m)	5 ft (1.52 m)
Galvanized Wire Rope	$^{1}/_{16}$ in (1.6 mm) 7 x 7 GAC	⅛ in (3.2 mm) 7 x 7 GAC	¼ in (6.4 mm) 7 x 19 GAC	$^{5}/_{16}$ in (7.9 mm) 7 x 19 GAC
Wire Rope Breaking Strength	480 lbs (2.14 kN)	1,700 lbs (7.56 kN)	7,000 lbs (31.13 kN)	9,800 lbs (43.59 kN)
Anchor Weight	1.0 oz (28 gm)	4.5 oz (128 gm)	14 oz (397 gm)	2.5 lbs (1.1 kg)
Standard Case & Weight	50 units at 3.7 lbs (1.7 kg)	24 units at 7 lbs (3.2 kg)	12 units at 11 lbs (5.0 kg)	12 units at 32 lbs (14.5 kg)

Theft Deterrent Specifications

	Wire Rope Anti-Theft Anchors		Chain Anti-Theft Anchors	
Product	Model 68-ATI	Model 88-ATI	Model 68-ATC	Model 88-ATC
Kit Contents	▪ 1 DUCKBILL® anchor ▪ 5 ft (1.5 m) of $^{3}/_{16}$ in (4.8 mm) galvanized wire rope	▪ 1 DUCKBILL® anchor ▪ 6 ft (1.8 m) of ¼ in (6.4 mm) galvanized wire rope	▪ 1 DUCKBILL® anchor ▪ 4 ft (1.2 m) of ¼ in (6.4mm) proof coil chain attached to 1 ft (0.3 m) of wire rope	▪ 1 DUCKBILL® anchor ▪ 4 ft (1.2 m) of ¼ in (6.4 mm) proof coil chain attached to 2 ft (0.6 m) of wire rope
Capacity (Per Anchor)	1,100 lbs (1.33 kN) in normal soil	3,000 lbs (13.34 kN) in normal soil	1,100 lbs (1.33 kN) in normal soil	3,000 lbs (13.34 kN) in normal soil
Standard Case & Weight	12 units at 10 lbs (4.6 kg)	6 units at 10 lbs (4.6 kg)	12 units at 41 lbs (18.6 kg)	6 units at 27 lbs (12.3 kg)

MPS Civil Products - Building Solid Foundations.
MPS Civil Products is part of MacLean-Fogg, a diversified international manufacturing enterprise with more than half a billion dollars in sales. A result of the acquisition and merger of Joslyn, Dixie and Foresight, the three most prominent soil anchor manufacturers, MPS Civil Products is now one of the leading suppliers of steel deep foundation systems for use in residential, commercial and marine applications. Our comprehensive product line for residential and commercial applications includes engineered solutions for tension, compression and structural stabilization in many different soils. When Quality and Service is your focus, Solutions are the result.

NOTE: All underground work requires proper safety and location procedures. Do not install an anchor until you know what is below the surface. It is imperative in all cases that all anchors are fully load locked before being put in service. Foresight Products can custom engineer complete anchoring systems to meet all your specific requirements. **What do you want to anchor?**

Patented Worldwide
Nos. 7,534,073 6,237,289 D572,546

MCPB004 - REV0 - 2014

Contact us to learn more about Earth Anchors

Toll Free: 800-325-5360 | Local: 303-286-8955 | Fax: 303-287-3866
sales@earthanchor.com | www.earthanchor.com

MPS Civil Products

MacLean Power Systems
481 Munn Road - Suite 300
Fort Mill, SC 29715

DUCKBILL® EARTH ANCHORS

6430 East 49th Drive
Commerce City, Co 80022 (USA)
1-800-325-5360
TEL: 303-286-8955
FAX: 303-287-3866
www.duckbill.com
Sales@duckbill.com

DUCKBILL® ENGINEERED EARTH ANCHOR SYSTEMS

INSTALLATION GUIDELINES

MPS Civil Products Group

INTRODUCTION >>>

This guide serves to aid suppliers and installers of DUCKBILL® Earth Anchors about installation methods and techniques. DUCKBILL is offered in 4 Aluminum alloy anchor models and 3 galvanized ductile iron anchor models (for very hard / rocky soils). The anchors range in holding capacities in normal soil from 300 to 5000 lbs. (135 kg to 2250 kg) The DUCKBILL Earth Anchor has been developed to function in the total range of soils. Its design allows the installer much greater flexibility than other anchors offer. Installation details, tools and special soil conditions will be covered and should answer any questions that may arise. DUCKBILL anchoring systems offer an economic, lightweight solution to nearly any anchoring situation, big or small.

THE DUCKBILL PRINCIPLE

The DUCKBILL Anchor works very much like a toggle bolt. The anchor body is driven into the soil with a re-useable drive steel (drive rod). Once the anchor body is placed to the proper depth the drive steel is removed. A backward pull on the cable then rotates the anchor body in the ground until it is perpendicular to the cable. This is called anchor-locking the anchor. Because the DUCKBILL is driven into the earth, it is actually compacting the soil around it, not disturbing it. As the anchor is anchor-locked it cuts through the compacted soil into undisturbed soil and further compacts the soil above the anchor. As the soil above the anchor is compacted from below it forms an inverted cone of compact soil. This is called a cone of resistance. One of the most important features of the DUCKBILL anchoring concept is the ability to proof-test the anchor during normal installation. The anchor locking operation can be a proof-test of the anchor. By measuring the force required to anchor-lock the anchor the installer knows the actual holding capacity of the installation.

SOILS

Anchor holding capacity will vary in the different classes of soils. More capacity can be expected in the numerically lower classes and less capacity in the higher number classes. Knowing the type of soil does not always mean that the class is known. For example, a clay material can have a class ranging from 4 to 8 depending on whether the material is very stiff to hard or soft to very soft. Water content will affect classification. Similarly, cohesion-less soils such as sands and gravels have a wide range depending upon the density or compactness of the material.

There are various ways of testing soils. A torque probe is the best for quick classification in the field. Core samples are the best for detailed classification but are expensive and take time to obtain the test results. Generally resistance to driving the DUCKBILL is a good “seat of the pants” indicator of soil class. Stiff resistance will normally result in positive anchoring. If the anchor drives very easily, the soil is soft and steps should be taken to assure adequate capacity such as using a larger DUCKBILL Anchor. Keep in mind that simple anchor-locking will verify the capacity of the anchor in any soil class. This is recommended when a specific holding capacity is required.

SOILS

Class	Description	Probe Value
1	Solid Bedrock	Over 600 in./lbs
2	Dense Clay; Compact Gravel Dense Fine Sand; Laminated Rock; Slate; Schist; Sand Stone	500-600 in./lbs
3	Shale; Broken Bedrock; Hardpan; Compact Gravel Clay Mixtures	400-500 in./lbs
4	Gravel; Compact Gravel and Sand; Claypen	300-400 in./lbs
5	Medium-Firm Clay; Loose Standarad Gravel; Compact Coarse Sand	200-300 in./lbs
6	Medium-Firm Clay; Loose Coarse Sand; Clayey Silt; Compact Fine Sand	100-200 in./lbs
7	Fill; Loose Fine Sand; Wet Clays; Silt	100 in./lbs
8	Swamp Marsh; Saturated Silty; Humus	Under 100 in./lbs

HOLDING CAPACITY

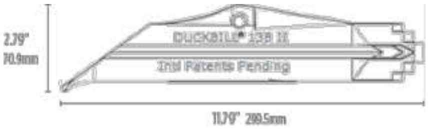
	Model 40-DB1	Model 68-DB1	Model 88-DB1	Model 138-DB1
Capacity (Per Anchor)	300 lbs (1.33 kN) in normal soil	1,100 lbs (4.89 kN) in normal soil	3,000 lbs (13.39 kN) in normal soil	5,000 lbs (22.24 kN) in normal soil
Wire Rope Length	20 in (0.51 m)	2 ½ ft (0.76 m)	3 ½ ft (1.07 m)	5 ft (1.52 m)
Galvanized Wire Rope	1⁄16 in (1.6 mm) 7 x 7 GAC	⅛ in (3.2 mm) 7 x 7 GAC	¼ in (6.4 mm) 7 x 19 GAC	5⁄16 in (7.9 mm) 7 x 19 GAC
Wire Rope Breaking Strength	480 lbs (2.14 kN)	1,700 lbs (7.56 kN)	7,000 lbs (31.13 kN)	9,800 lbs (43.59 kN)
Anchor Weight	1.0 oz (28 gm)	4.5 oz (128 gm)	14 oz (397 gm)	2.5 lbs (1.1 kg)
Standard Case & Weight	50 units at 3.7 lbs (1.7 kg)	24 units at 7 lbs (3.2 kg)	12 units at 11 lbs (5.0 kg)	12 units at 32 lbs (14.5 kg)

The anchors are rated in an average (class 5) soil condition. Again, higher capacities can be expected in harder soils and lower capacities in softer soils. The rating is mainly useful as a reference for anchor selection. Proof-loading is the only way to insure the exact capacity of each installation. This is true for all anchors on the market today.

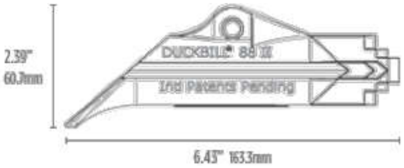
INSTALLATION > > >

The first step in any installation is to select the proper anchor for the job. Keep in mind the maximum load expected and add a reasonable safety factor.

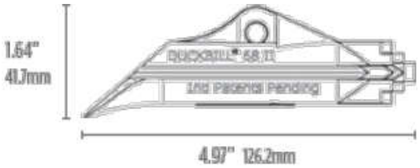
Aluminum Anchors



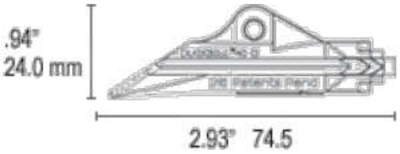
Model 138



Model 88

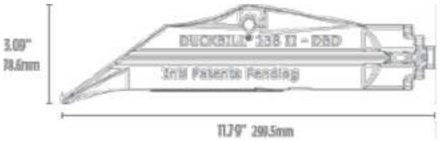


Model 68

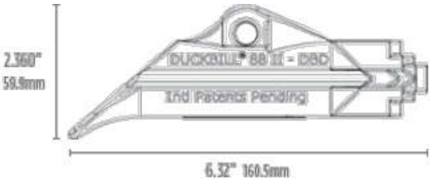


Model 40

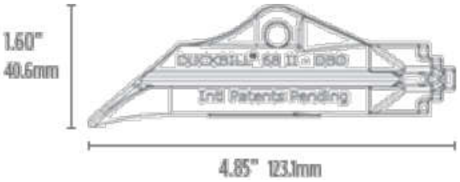
Galvanized Ductile Iron Anchors



Model 138-DI



Model 88-DI



Model 68-DI

DRIVING THE ANCHOR

The DUCKBILL® can be driven at any angle. In guy applications the angle of the installation should closely match the angle of the guy line. Start by inserting the drive steel into the anchor body. Use a sledgehammer, fence post driver or a power driven jack-hammer to drive the anchor to the proper depth. Fill hole made by anchor with soil. This will not allow water to seep down to the anchor.

MECHANICAL ANCHOR LOCKING

After the anchor has been driven to depth, the drive steel is retracted from the anchor. Pull back on the anchor cable to toggle the anchor into the perpendicular (anchor-locked) position. In average soils a rule of thumb is that the length of pull should equate to the length of the anchor. Movement will depend on soil; softer soils may require a longer distance than harder soils. For example: Model 88 anchor body measures 6" inches. A pull of 5-6" will rotate the anchor into a perpendicular position. Several methods are used to anchor lock the anchors.

HAND ANCHOR LOCKING

The smaller DUCKBILL models may be locked by hand. Insert the drive steel through the cable loop or wrap the cable around the drive steel to fashion a "T" handle. Pull on the drive steel to anchor-lock the anchor. A fulcrum is also very useful in locking anchors by hand. The DUCKBILL "hand hook" is also available.

JACKS

Ordinary automotive bumper jacks or handyman jacks work well on medium and larger sized anchors. By adding legs to the jack to form a tri-pod, angled pulls are achieved with greater ease.

JACKS

HYDRAULIC JACK

The LL-2 Anchor Locker is designed to load lock and test the full line of DUCKBILL Anchors. It is manually operated and has a maximum capacity of 8000 lbs. (36 kg).

NO MATTER WHAT METHOD IS USED, IT IS CRITICAL THAT THE ANCHOR BE PROPERLY LOCKED BEFORE TYING OFF THE OBJECT TO BE ANCHORED.

An anchor not properly locked prior to attaching will result in significant pull out before the anchor self locks. Obviously this is not desired.

Failure to install and lock the anchor at the correct angle will result in the anchor cable cutting through the soil until the angles equalize. This will cause slack in guy lines, also not desired.

SPECIAL SOILS CONSIDERATIONS >>>

SOFT SOILS

In areas where the soil proves to be softer than normal, steps should be taken to assure the capacity of the anchor. Proof-loading is especially useful in soft soils. Guesswork as to the capacity is eliminated. The installer will know immediately if the anchor point is adequate or if further steps are necessary. Backfilling and tamping the hole behind the anchor will yield somewhat higher capacity in most soft soils. Fill and tamp the hole in 3" lifts prior to anchor locking the anchor. Another option is to drive the anchor deeper in an effort to penetrate a harder layer of soil. Larger anchors may need to be placed to achieve the required load. As a last resort a number of anchors may be placed in a cluster and bridled together to form one point.

HARD SOILS AND ROCK

If excessive resistance to driving occurs it may be necessary to drill a hole for anchor placement. If the anchor stops moving and is subjected to excessive force (especially from power equipment) metal fatigue can occur and the anchor body can fracture. The DUCKBILL™ Anchor may be placed in a pre-drilled hole in hard dirt or rocky material, and achieve very good results. Hand augers and gasoline or hydraulic powered earth drills can be used to form the hole. A gasoline powered breaker/drill is very useful due to the fact that it performs both drilling and driving operations.

CLEARANCE HOLE DIAMETERS & HARD SOIL PILOT HOLE DIAMETERS >>>

Installation of Duckbill Anchors in hard soils can be greatly helped by the use of a pilot hole. Typically, the pilot hole has no significant affect on the holding power of the anchor. There are many acceptable mehods of drilling pilot holes and many manufacturers of equipment to do so. Recommended hard soil pilot hold diameters and clearance hole diameters are charted below.

Model	Clearance Hole Diameter	Minimum Pilot Hole Diameter for Hard Soil
40-DB	1.0"	0.75"
68-DB	1.50"	1.25"
88-DB	2.25"	2.00"
138-DB	2.75"	2.50"

Duckbill Earth Anchors

Holding Capacity

Duckbill Model	Ultimate Capacity	Normal Soil*	Normal Installation Depth
40	580 lbs (261 kg)	300 lbs (135 kg)	20 inches (.5m)
68	2,045 lbs (920 kg)	1,100 lbs (495 kg)	30 inches (.75m)
88	6,180 lbs (2,781 kg)	3,000 lbs (1,350 kg)	42 inches (1.05m)
138	10,670 lbs (4,802 kg)	5,000 lbs (2,250 kg)	60 inches (1.5 m)

- Typical Blow Count Per ASTM-D1586. Normal Soil Blow Count Range 24-40.
- Common Soil Type – Dense Fine Sand; Very Hard Silts and Clays; Dense Clays; Sands; and Gravel; Hard Silts and Clays.

DUCKBILL®
EARTH ANCHORS

FORESIGHT®
PRODUCTS, LLC
6430 East 49th Drive
Commerce City, CO 80022 (USA)
WATS: 1-800-325-5360
TEL: 303-286-8955
FAX: 303-287-3866
WEB: www.duckbill.com
E-Mail: sales@earthanchor.com

WIRE ROPE CLIP WARNINGS AND INFORMATION

It is very important to read and understand all information shown before using a wire rope clips

'Golden U-Bolt' Drop Forged
Heavy Duty Applications

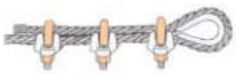
Malleable
Light Duty Applications

T-316 Stainless Steel
Light Duty Applications

⚠ WARNING

FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN SERIOUS INJURY OR DEATH!

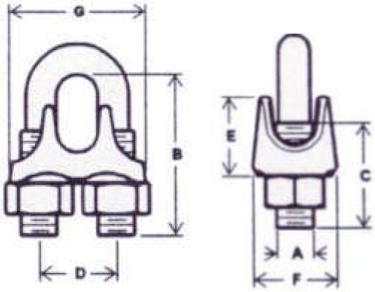
- **ALWAYS** inspect wire rope clips before use. Check for wear, damage, bending or deformation.Also check the working condition of the saddle, threads on u-bolt and nuts.
- **ALWAYS** make sure to perform regular inspection of the wire rope end termination, clips and thimbles looking for signs of wear, abuse and general adequacy
- **ALWAYS** destroy and dispose of wire rope clips that are beyond safe use
- **NEVER** substitute competitors saddle or nuts on Vanguard wire rope clips
- **NEVER** use with plastic coated wire rope
- **NEVER** stagger clips
- **NEVER** 'saddle a dead horse' - the U goes on the dead end of the rope where crushing will not affect the breaking strength of the hoist line
- **NEVER** join ropes without the use of a thimble
- **NEVER** shock load
- **ALWAYS** match the same size clip with the same sized wire rope
- **ALWAYS** make sure to prepare wire rope end and termination only as instructed, for greater detail please refer to installation steps chart shown below
- **ALWAYS** make sure that you have used the recommended number of clips and the correct amount of rope turn back from the thimble before testing the assembly. If a pulley/sheave is used instead of a thimble add one additional clip
- **ALWAYS** use at least three clips when making any prepared loop or thimble-eye termination for wire rope, especially for hoisting.
- **ALWAYS** make sure that the clips are evenly spaced apart
- **ALWAYS** make sure to test assemblies before each use. The load should be of equal or greater weight than the loads expected to be hoisted, making sure to check and retighten (if necessary the nuts to their recommended torque value.

<table>
<tr><th colspan="4">Installation</th></tr>
<tr>
<td>Step 1:
APPLY 1st clip one base width from dead end of the rope - U-bolt over dead end - live end rests in clip saddle. Tighten nuts evenly to recommended torque.
</td>
<td>Step 2:
APPLY 2nd clip as close to loop as possible - U-bolt over dead end - turn nuts firmly but do not tighten!
</td>
<td>Step 3:
ALL OTHER CLIPS - Space evenly between first two.
</td>
<td>Step 4:
APPLY TENSION and tighten all nuts to recommended torque.

RE-CHECK nut torque after rope has been in operation</td>
</tr>
</table>

MALLEABLE WIRE ROPE CLIPS

- To be used for light duty, non-critical applications only
- Typical uses include guard lines and fencing
- Electro-galvanized finish
- Rope diameter stamped on saddle
- Federal Specification FF-C-450D, Type 1, Class 2
- Torque tested threads
- The tightening torque values shown are based upon the threads being clean, dry and free of lubrication

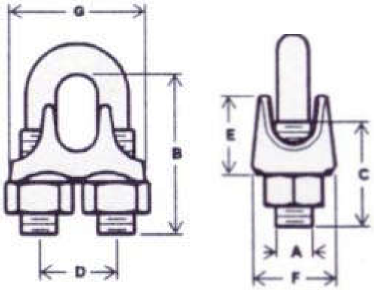


Rope Diameter	Weight (lbs/100)	Dimensions (inches)							Nut Torque (ft/lbs)	Min. No. Clips	Turn Back Length (inches)	Vanguard Code
		A	B	C	D	E	F	G				
1/16**	4.30	0.15	0.65	0.34	0.46	0.36	0.43	0.66	2.0	3	3.00	2901 0004
1/8**	4.30	0.18	0.72	0.56	0.43	0.43	0.55	0.85	3.0	3	4.75	2901 0008
3/16	6.80	0.23	0.92	0.63	0.54	0.52	0.61	1.05	4.5	3	5.50	2901 0012
1/4	14.50	0.30	1.13	0.83	0.67	0.60	0.76	1.23	15.0	3	7.00	2901 0016
5/16	15.00	0.30	1.23	0.86	0.69	0.64	0.82	1.34	15.0	3	7.75	2901 0020
3/8	21.50	0.36	1.50	1.06	0.88	0.90	0.92	1.58	30.0	3	9.50	2901 0024
7/16	24.00	0.36	1.54	1.07	0.94	0.87	0.93	1.64	40.0	3	10.25	2901 0028
1/2	37.00	0.42	1.96	1.28	1.04	0.94	1.07	1.91	45.0	4	15.25	2901 0032
5/8	59.00	0.48	2.14	1.39	1.30	1.10	1.16	2.23	75.0	4	16.00	2901 0040
3/4	84.00	0.54	2.54	1.46	1.33	1.35	1.30	2.40	75.0	5	22.25	2901 0048
7/8	128.00	0.61	2.90	1.77	1.55	1.53	1.46	2.77	130.0	5	23.50	2901 0056
1	150.00	0.61	3.23	2.15	1.81	1.73	1.74	3.02	130.0	6	31.00	2901 0100
1-1/8	243.00	0.72	4.44	2.70	1.84	1.97	1.77	3.24	200.0	7	39.00	2901 0108

** Note: 1/16” and 1/8” are not covered by Federal Specification FF-C-450D

STAINLESS WIRE ROPE CLIPS

- To be used for light duty, non-critical applications only
- Made from Type 316 stainless steel
- Electro-polished finish
- Rope diameter stamped on saddle



Rope Diameter	Weight (lbs/100)	Dimensions (inches)							Vanguard Code
		A	B	C	D	E	F	G	
1/8	4	0.19	0.81	0.55	0.40	0.40	0.51	0.82	2915 0008
5/32	5	0.17	0.93	0.63	0.52	0.46	0.55	0.92	2915 0010
3/16	6	0.23	0.97	0.60	0.56	0.50	0.55	1.00	2915 0012
1/4	13	0.30	1.24	0.85	0.71	0.59	0.71	1.24	2915 0016
5/16	15	0.30	1.40	0.90	0.80	0.60	0.77	1.38	2915 0020
3/8	28	0.37	1.81	1.15	0.90	0.88	0.82	1.58	2915 0024
1/2	42	0.44	2.14	1.34	1.20	0.90	1.00	1.93	2915 0032

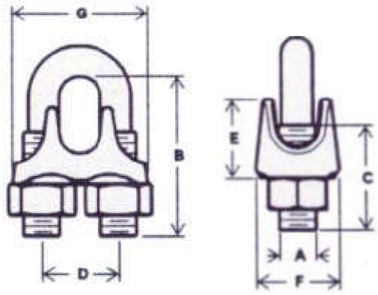
Warning:

Failure to follow these instructions can result in serious property damage, injury or death!

- **NEVER** use malleable or stainless steel clips for overhead lifting

'GOLDEN U-BOLT'® FORGED WIRE ROPE CLIPS

- Meet Federal Spec. FF-C-450, Type 1, Class 1 and ASME B30.26 standard
- Forged saddle, hot dipped galvanized, permanently embossed with VGD®, size and forged
- Gold Chromated U-Bolts and Nuts identify 'Vanguard' product
- Torque tested threads
- The tightening torque values shown are based upon the threads being clean, dry and free of lubrication.



Rope Diameter	Min. No. of Clips	Rope turn-back	Torque (ft lbs)	Weight (lbs/100)	Dimensions (inches)							Vanguard Code
					A	B	C	D	E	F	G	
1/8	2	3-1/4	4.5	6	0.20	0.75	0.54	0.41	0.48	0.80	0.90	2907 0008
3/16	2	3-3/4	7.5	10	0.24	0.98	0.65	0.56	0.55	0.95	1.16	2907 0012
1/4	2	4-3/4	15.0	19	0.30	1.06	0.67	0.78	0.67	1.18	1.54	2907 0016
5/16	2	5-1/2	30.0	29	0.37	1.35	0.80	0.84	0.77	1.33	1.65	2907 0020
3/8	2	6-1/2	45.0	44	0.42	1.50	0.81	0.96	0.98	1.55	1.92	2907 0024
1/2	3	11-1/2	65.0	73	0.48	1.83	1.10	1.12	1.19	1.91	2.29	2907 0032
5/8	3	12	95.0	102	0.54	2.40	1.22	1.38	1.33	2.05	2.50	2907 0040
3/4	4	18	130.0	142	0.61	2.84	1.51	1.51	1.40	2.25	2.82	2907 0048
7/8	4	19	225.0	212	0.73	3.10	1.79	1.73	1.60	2.41	3.16	2907 0056
1	5	26	225.0	255	0.73	3.58	1.80	1.85	1.77	2.64	3.44	2907 0100
1-1/8	6	34	225.0	280	0.73	3.90	2.09	1.95	1.95	2.74	3.52	2907 0108
1-1/4	7	37	360.0	437	0.86	4.26	2.13	2.37	2.31	3.14	4.11	2907 0116
1-1/2	7	48	360.0	531	0.86	4.78	2.42	2.53	2.51	3.35	4.41	2907 0132
1-3/4	7	53	590.0	980	1.09	5.64	2.85	3.10	2.94	3.82	5.28	2907 0148
2	8	71	750.0	1,375	1.20	6.75	3.11	3.31	3.31	4.41	5.86	2907 0200

* Additional sizes available upon request, minimum order quantity may apply.

Warning:

Failure to follow these instructions can result in serious property damage, injury or death!

- **NEVER** stagger clips
- **NEVER** mount U-Bolts over live end of rope
- **NEVER** join ropes without the use of a thimble
- For more information please see the wire rope clip warning and information section found in the hardware section of this catalogue

'GOLDEN U-BOLT'® FORGED WIRE ROPE CLIPS

Efficiency rating:

The efficiency rating for wire rope end terminations are based upon the catalogue strength of standard EIPS wire rope. The efficiency rating of properly prepared loop or thimble - eye termination for clips between the sizes of 1/8 to 7/8" is 80% and for 1 to 2" it is 90%.

Note:

- If a greater number of clips are used than shown in the table, the amount of rope turn back should be increased proportionately.
- If a pulley/sheave is used instead of a thimble add one additional clip.
- The tightening torque values shown are based upon the threads being clean, dry and free of lubrication.

The number of clips shown on this chart is based upon using RRL or RLL 6 x 19 and/or 6 x 36 classes of steel core (IWRC) and fiber core (FC) wire ropes, IPS, EIPS and EEIPS.

For Seale construction or other large outer wire type construction in the 6 x 19 classification one additional clip is required for sizes 1" or larger.

The information on this chart also covers 8 x 19 classes, IPS, EIPS and EEIPS for sizes up to and including 1-1/2" and rotation resistant 19 x 7 class, IPS, EIPS and EEIPS for sizes up to and including 1-3/4".

For elevator, personal hoist and scaffold applications refer to ANSI A17.1 and ANSI A10.4. These standards do not recommend U-bolts wire rope terminations.

APPENDIX F

GOLDER GEOTECHNICAL INVESTIGATION AND SLOPE STABILITY ASSESSMENT

November 2015

GEOTECHNICAL INVESTIGATION AND SLOPE STABILITY ASSESSMENT

Esseltine Drain Improvements, Town of Kingsville, Ontario

Submitted to:
Mr. Lou Zarlenga, P.Eng., Senior Engineer, Drainage Specialist
RC Spencer Associates Inc.
261 Shepherd Street East
Windsor, Ontario
N8X 2K6

REPORT

Report Number: 1417810-2000-R01

Distribution:

2 Copies - RC Spencer Associates Inc.
1 Copy - Golder Associates Ltd.

Golder Associates

Table of Contents

TABLES

FIGURES

APPENDICES

APPENDIX A

APPENDIX B

1.0 INTRODUCTION

This report provides the results of the geotechnical investigation and slope stability assessment carried out for the Esseltine Drain improvements project. Based on the information provided, the study area encompasses the Esseltine Drain from County Road 34 southerly to the outlet at Lake Erie. Significant areas of erosion and bank failure within the southern approximately 550 metres of the meandering natural watercourse section of the drain (upstream and downstream of County Road 20) are understood to be impeding the outlet capacity into Lake Erie.

The purpose of this geotechnical investigation and stability assessment was to explore the subsurface and stability conditions of the drain side slopes and provide geotechnical recommendations for the drain rehabilitation strategy for the project.

The work was carried out in general accordance with our proposal letter dated November 26, 2014. Authorization to proceed was provided by Mr. R. C. Spencer, P.Eng., on December 16, 2014.

Important information on the limitations of this report is attached.

2.0 BACKGROUND AND PROJECT UNDERSTANDING

It is understood that portions of the Esseltine Drain show signs of distress warranting a geotechnical assessment, investigation and possible subsequent monitoring and/or repairs. As noted above, the areas of primary concern are located within the drain south of County Road 20 to the outlet at Lake Erie, but the causes of distress are not presently fully known or described. Based on the information provided, the issues include bank instability, bank erosion and toe erosion together with sedimentation and scouring of the channel bottom. In addition, several residences and other buildings and structures are located in close proximity to the drain.

Golder Associates Ltd. (Golder) previously carried out a number of geotechnical investigations in the area of the site. A list of previous reports and relevant boreholes is provided below:

- Golder Report No. 05-1140-109 titled “Geotechnical Investigation, House Instability, 1512 Whitewood Road, Town of Kingsville, Ontario”, dated June 28, 2005. - Boreholes 1, 2 and 3.
- Golder Report No. 05-1140-196 titled “Geotechnical Investigation, Proposed Hamlet of Ruthven, Sewage Works, Town of Kingsville, Ontario”, dated January 9, 2006. – Borehole 2.
- Golder Report No. 011-4228 titled “Geotechnical Investigation, 2nd Concession Trunk Watermain, Union Water System, Town of Kingsville, Ontario”, dated December 13, 2001. – Boreholes 4, 5 and 6.

The relevant Record of Borehole sheets and results of the associated laboratory testing from these previous investigations are provided in Appendix A. The encountered and measured groundwater levels are provided in Table I and the approximate borehole locations are shown on the Location Plans, Figures 1A and 1B.

A geotechnical review was carried out for this project by Golder to gather and review the available geotechnical information for the site and suggest potential options for the design of the drain improvements. The results of the review were provided in Golder Report No. 1417810-1000 titled “Geotechnical Review, Esseltine Drain Improvements, Town of Kingsville, Ontario”, dated February 23, 2015.

A field reconnaissance was carried out by geotechnical engineers from our staff on April 16, 2015 to observe the general site conditions and carry out a geotechnical slope assessment along the drain slopes. Select site photographs are attached in Appendix B and the approximate locations of the current and previous boreholes advanced at the site are shown on Figure 1A.

3.0 DESCRIPTION OF THE SITE AND PROPOSED PROJECT

The study area comprises of about 2.5 kilometres of the Esseltine Drain channel located east of the Communities of Ruthven and Union in the Town of Kingsville, Ontario, as shown on the Key Plan and Location Plan on Figure 1A. The Esseltine Drain flows from north to south and reports to Lake Erie. The northern portion of the drain is classified as a municipal drain and the southern portion is classified as a natural watercourse. The drain traverses beneath County Road 34 through an existing CSP culvert and beneath County Road 20 in an existing box culvert. Land use in the area of the site is a mixture of agricultural and residential, with residential and greenhouse buildings in close proximity to the crest of the slopes.

R.C. Spencer Associates Inc.'s (RC Spencer's) preferred slope rehabilitation alternative is to fill the drain with up to 5.0 metres of compacted clay, provide an access lane along the west slope and cover the access road and filled channel with cable concrete. A schematic of the proposed channel regrading alternative is provided on Figure 4. In addition, new twin culverts and a culvert replacement are proposed as part of the works. The new twin culverts are to be 1,600 millimetre diameter pipes installed beneath Street 'G' at about Station 1+700 for the new Porrone Subdivision and a culvert replacement is proposed for a new entrance to the Mucci greenhouse property at about Station 1+276. The approximate locations of the proposed culverts are shown on the Location Plan, Figure 1A.

4.0 SITE GEOLOGY

The project lies within the Essex Clay Plain, a subregion of the physiographic region of southern Ontario known as the St. Clair Clay Plains, identified in "The Physiography of Southern Ontario" by Chapman and Putnam (1984). The clay plain is described as a till plain that has been smoothed by shallow deposits of lacustrine clay which settled in the depressions of the till. The prevailing soil type is reportedly the Brookston clay.

Based on the Ontario Department of Mines and Northern Affairs Preliminary Map P.750 titled "Quaternary Geology of the Windsor-Essex Area" Eastern Part, the northern portion of the project area is reportedly located in predominantly clayey silt till. The mapping also indicates that unsubdivided modern alluvium is present in the natural channel area.

The subcropping bedrock is reported to consist of limestone of the Amherstburg Formation based on the Geological Survey of Canada, Department of Energy, Mines and Resources Map 1262A, "Geology, Toronto-Windsor Area", Scale 1:250,000, dated 1969. The rock surface is reported to be at a depth of approximately 35 to 38 metres below ground surface. This corresponds to about elevation 155 to 167 metres based on the Ontario Department of Mines Preliminary Map No. P.815 titled "Drift Thickness Series, Windsor-Essex Area", dated 1973.

5.0 PROCEDURE

The slope stability assessment consisted of a desktop review of the available information for the site followed by a site reconnaissance and preliminary slope stability analyses. The desktop review consisted of examination of the geological and topographical mapping and previous geotechnical investigations carried out adjacent to the site available in our files and provided preliminary geotechnical engineering remediation options. RC Spencer provided Golder with preliminary plans, profiles and cross sections of the study area as well as photographs of the site conditions.

The geotechnical slope assessment was carried out on April 16, 2015 by members of Golder's geotechnical staff. The assessment included a walkover of the drain and observations of vegetation, soil type, seepage conditions and erosion activity were made. Slope stability assessments and measurements at selected locations along the drain were carried out using the Ontario Ministry of Natural Resources (MNR) Slopes Stability Rating Chart. A summary of the field observations and the Slope Stability Rating Chart are provided in Tables II and III, attached.

The slope stability ratings were based on visual examination of the slopes, slope inclinations measured with an Abney hand level and heights and distances measured with a measuring tape, where practical. Soil classifications were based on visual observations, geological mapping and subsurface information from the current and previous investigations.

Photographs of significant features were taken and select photographs are presented in Appendix B. The locations, directions and identification of the photographs are provided on the Location Plan, Figure 1B. Slope cross section geometries at selected locations were provided by RC Spencer.

The field work for the current investigation was carried out between May 26 and June 9, 2015 during which time six boreholes, labelled BH-101 to BH-106, were drilled at the approximate locations shown on the Location Plan, Figure 1A. The boreholes were drilled using truck-mounted drilling equipment supplied and operated by a specialist drilling contractor.

The soil stratigraphy encountered in the boreholes is shown in detail on the attached Record of Borehole sheets and on the Cross Sections, Figures 2 to 4.

Standard penetration testing and sampling was carried out in the boreholes at suitable intervals of depth using 35 millimetre inside diameter split spoon sampling equipment. All of the samples obtained during the investigation were brought to our London laboratory for further examination and representative laboratory testing. The results of the laboratory testing are provided on Figures 5 to 8. In-situ vane testing was carried out in the softer cohesive soils encountered to measure the undrained shear strength.

Groundwater conditions in the boreholes were observed throughout the drilling operations. Groundwater monitoring peizometers were installed in all of the boreholes as indicated on the corresponding Record of Borehole sheets and on the Cross Sections, Figures 2 to 4. A summary of the encountered and subsequently measured groundwater levels is provided in Table I. Upon completion of drilling, sampling and piezometer installation, the boreholes were backfilled in accordance with Ontario Regulation (O. Reg.) 903, as amended.

A member of our engineering staff designated the borehole locations in the field, obtained clearances for underground utilities, monitored the drilling, logged the boreholes and cared for the samples obtained.

The ground surface elevations at the borehole locations were surveyed by Golder staff and referenced to geodetic datum.

Slope stability analyses were carried out using SLOPE/W, a limit equilibrium analysis program produced by GEO-SLOPE International. The analyses were conducted to assess the stability of the existing drain slopes based on generalized modeling of the soil data from the current and previous investigations, the supplied survey data and the cross section data measured in the field by our staff.

6.0 GEOTECHNICAL SLOPE ASSESSMENT

As part of the work, a site reconnaissance and slope assessment was carried out along the east and west slopes of the Esseltine Drain. Due to the severity of the stability issues within the southern portion of the drain as noted above, the slope assessment was concentrated in the area from the outlet at Lake Erie (Station 0+000) to about 100 metres north of County Road 20 (Station 0+600). The slope assessment was carried out by members of our engineering staff on April 16, 2015 following a snow melt and prior to vegetal growth. During the assessment, observations were made of vegetation, soil type(s), seepage conditions and erosion activity where these were visible.

A summary of the observations made during the site reconnaissance are presented in Table II. Select site photographs and associated descriptions of the salient features observed during the site reconnaissance are provided in Appendix B. The locations, directions and identification of these photographs are indicated on Figure 1B. The following paragraphs discuss the significant slope features along the southern portion of the Esseltine Drain.

Five slope locations (Sections A to E), shown on the Location Plan, Figure 1B, were evaluated using the MNR Slope Stability Rating Chart provided in Table III. The slope stability rating chart is based on a visual inspection of the slope, measurements of slope inclinations with an Abney hand level and heights and distances measured with a measuring tape. Soil classifications at the site were based on geological mapping and subsurface information from the current and previous subsurface investigations along the drain. The slope geometries shown on Figures 2 to 4 have been developed from supplied topographic survey data from RC Spencer and our observations and measurements noted on site.

For the purposes of field classification, the following generalization is used to visually assess the stability of slopes:

- Stable: no evidence of surficial or deep-seated movements, an abundance of vegetation and a well-protected toe of slope;
- Marginally Stable: slope has undergone discernible changes in geometry resulting either from toe erosion or regression of sliding surfaces up the slope. The slope is steep but typically vegetated with small trees, shrubs and/or grasses; and
- Unstable: slope has undergone substantial changes in geometry with loss of most vegetation and significant active erosion.

In general, the existing Esseltine Drain slopes south of County Road 20 are marginally stable to unstable with toe erosion and scouring occurring along the banks. It was noted that toe erosion and scouring is more severe during storm events, particularly along the outside bends of the drain. The side slopes have evidence of previous landslide activity and habitable or other structure(s) are in close proximity (within about 50 metres) to the top of slopes. Toe erosion, coupled with seepage from the slope resulting in oversteepening, is the common contributor to the landslide activities along the drain.

6.1 Station 0+000, Section A

The east and west side slopes of the Esseltine Drain at Station 0+000 (Section A) near the outlet into Lake Erie are generally heavily vegetated with mature trees and shrubs. It was noted that several of these trees had fallen or were leaning inward towards the drain in the lower portions of the slopes. Erosion within the slopes was observed as evidenced by the exposed tree roots. The nearly vertical banks were also affected by erosion. Observations of the slope features and instabilities in the area of Section A are shown on Photographs 1 to 4 in Appendix B.

Based on the results of borehole BH-101 drilled just upstream of the outlet near the crest of the east slope on May 28, 2015, the general subsurface conditions at this location consisted of surficial topsoil and loose granular fill materials underlain by strata of loose to compact silty sand, compact to dense sandy silt, very soft to very stiff silty clay and firm to very stiff silty clay till. Groundwater was encountered about 5.2 metres below the top of the slope or at about elevation 187.6 metres during drilling.

Based on the topographic survey information provided and measurements carried out during the slope assessment, the east and west slopes at Section A are about 19 and 15 metres in height, respectively, and have overall slope inclinations of about 26 degrees to the horizontal or about 2.0 horizontal to 1 vertical (2.0H:1V), as illustrated on the section, Figure 2. The results of the slope stability rating indicate that the side slopes at Section A have ‘moderate potential’ for instability according to the MNR guidelines.

Failure zones within the adjacent lake bluff slopes were observed. Exposed silty sand and groundwater seepage were visible within the failed area on the east slope. Nearly vertical banks were subject to toe erosion and wave action from the lake.

6.2 Station 0+100, Section B

A residence is located near the top of the west slope and a greenhouse complex is located near the top of the east slope at Station 0+100 (Section B). Tension cracks were also noted at the crest of the east slope. Dumping of greenhouse soil and plant waste materials was noted within the upper portion of the east slope in this area. Failure zones and seepage were observed in the mid-to-lower portions of the slopes and toe erosion was observed along the banks. Observations of the slope features and instabilities in the area of Section B are shown on Photographs 5 to 8 in Appendix B.

Based on the results of borehole BH-102 drilled just upstream near the crest of the east slope on May 27, 2015, the general subsurface conditions at this location consisted of granular fill over strata of very loose to loose silty sand, compact sandy silt, firm to stiff silty clay, dense silt and layers of soft to hard silty clay. Groundwater was encountered about 5.2 metres below the top of the slope or at about elevation 186.6 metres during drilling.

Based on the topographic survey information provided and measurements carried out during the slope assessment, the east and west slopes at Section B are about 18 and 15 metres in height, respectively, and have overall slope inclinations of about 26 and 30 degrees to the horizontal or about 2.1H:1V and 1.7H:1V, respectively, as illustrated on the section, Figure 2. The results of the slope stability rating indicate that the side slopes at Section B have 'moderate potential' for instability according to the MNR guidelines.

6.3 Station 0+200, Section C

A greenhouse complex is location near the crest of the east slope at Station 0+200 (Section C). Failure zones and seepage were observed in the mid-to-lower portions of the slopes. Wet, sloughed materials were noted in the lower portion of the east slope and toe erosion was observed along the banks. The west bank was noted to be nearly vertical and about 7 metres in height. In the area of about Station 0+215 to 0+235, along the east bank at the bend in the drain, a fallen concrete block retaining wall was present. The retaining wall had probably toppled due to toe erosion and scouring effects beneath the bottom course of the block wall coupled with the active lateral pressures behind the wall. Observations of the slope features and toppled retaining wall in the area of Section C are shown on Photographs 9 to 14 in Appendix B.

Based on the results of borehole BH-102 drilled downstream of the crest of the east slope on May 27, 2015, the general subsurface conditions at this location consisted of granular fill over strata of very loose to loose silty sand, compact sandy silt, firm to stiff silty clay, dense silt and layers of soft to hard silty clay. Groundwater was encountered about 5.2 metres below the top of the slope or at about elevation 186.6 metres during drilling.

Based on the topographic survey information provided and measurements carried out during the slope assessment, the east and west slopes at Section C are about 14 metres in height and have overall slope inclinations of about 34 and less than 10 degrees to the horizontal or about 1.5H:1V and >5.7H:1V, respectively, as illustrated on the section, Figure 3. The results of the slope stability rating indicate that the side slopes at Section C have 'moderate potential' for instability according to the MNR guidelines.

6.4 Station 0+300, Section D

A residence is location the top of the west slope at Station 0+300 (Section D) and a horizontal bench feature has been developed at about mid-slope. Rock protection has also been scattered along the west bank in this area. A mature tree is leaning toward the drain at the top of the east bank and toe erosion has caused a nearly vertical east bank with exposed silty clay. Observations of the slope features in the area of Section D are shown on Photographs 15 to 17 in Appendix B.

Based on the results of previous borehole BH1(05-1140-109) drilled upstream of the crest of the west slope on May 19, 2005, the general subsurface conditions at this location consisted of strata of loose to compact silty sand and sand over stiff to very stiff silty clay till. Groundwater was encountered about 1.5 metres below the ground surface.

Based on the topographic survey information provided and measurements carried out during the slope assessment, the nearly vertical east bank at Section D is about 7 metres high. The west slope is about 12 metres in height and has an overall slope inclination of about 25 degrees to the horizontal or about 2.1H:1V as illustrated on the section, Figure 3. The results of the slope stability rating indicate that the side slopes at Section D have 'moderate potential' for instability according to the MNR guidelines.

6.5 Station 0+400

During the site reconnaissance, slope failures were observed at Station 0+400. Several mature trees had fallen into the drain in the area as shown on Photograph 18 in Appendix B.

6.6 Station 0+500

Residences are location the top of the east and west slopes at Station 0+500. Small failures of the east bank were observed along this area as shown on Photograph 19. A steel sheet pile wall had been installed along the west bank from about Station 0+500 to the box culvert at County Road 20 at about Station 0+520. The sheet pile wall was leaning toward the drain as shown on Photograph 20.

6.7 Station 0+575, Section E

A residence and a commercial facility (Mucci Farms) are location near the crest of the west and east slopes at Station 0+575 (Section E). The slopes in this area were observed to be heavily vegetated with bush and trees. No seepage or failure zones were observed; however, fill was piled along the crest of the east slope. Observations of the slope features in this area are shown on Photographs 21 and 22, provided in Appendix B.

Based on the results of borehole BH-104 drilled just upstream of the crest of the east slope on May 26, 2015, the general subsurface conditions at this location consisted of loose granular fill over strata of loose to dense sandy silt and firm to stiff silty clay till. Groundwater was encountered about 4.4 metres below the top of the slope or at about elevation 188.9 metres during drilling.

Based on the topographic survey information provided and measurements carried out during the slope assessment, the east slope at Section E is about 8 metres in height and has an overall slope inclination of about 29 degrees to the horizontal or about 1.8H:1V as illustrated on the section, Figure 4. The results of the slope stability rating indicate that the east side slope at Section E has 'moderate potential' for instability according to the MNR guidelines.

7.0 SUBSURFACE CONDITIONS

7.1 General

The subsurface conditions encountered in the boreholes drilled at the site are shown in detail on the attached Record of Borehole sheets. The following discussion has been simplified in terms of major soil strata for the purposes of geotechnical design. The soil boundaries indicated are inferred from non-continuous samples and observations of drilling resistance. They may represent a transition from one soil type to another and should not necessarily be interpreted to represent exact planes of geological change. Further, subsurface conditions may vary significantly between and beyond the borehole locations.

In addition, post investigation construction activities may have modified the subsurface conditions from those shown on the previous Records of Boreholes.

7.2 Soil Conditions

The soil conditions encountered in the boreholes generally consisted of fill or topsoil overlying layers of silty sand, sandy silt, silty clay and silty clay till.

7.2.1 Fill and Topsoil

Topsoil was encountered at the ground surface in borehole BH-103. The topsoil was about 100 millimetres thick and had a water content of about 27 per cent.

Topsoil was also encountered at the ground surface in boreholes 5 and 6 (011-4228). The topsoil was about 200 millimetres thick and had water contents of 23 and 33 per cent.

Fill was encountered at the ground surface in boreholes BH-101, BH-103, BH-104 and BH-105. Fill was also encountered beneath the topsoil in borehole BH-103. The fill was about 0.4 to 2.9 metres thick at the borehole locations and varied in gradation from silty clay to crushed sand and gravel. The fill had N values, as determined in the standard penetration testing, of 3 to 5 blows per 0.3 metres with in situ water contents of about 4 to 34 per cent.

Fill materials were also encountered at the ground surface in boreholes 2 and 3 (05-1140-109). The fill materials consisted of topsoil, silty sand and clayey silt. Where fully penetrated, the fill was 0.2 to 0.9 metres thick. Borehole 3 (05-1140-109) was terminated in the fill at a depth of 2.4 metres. The fill had N values ranging from 2 to 5 blows per 0.3 metres with water contents of 15 to 26 per cent.

7.2.2 Silty Sand

Very loose to compact silty sand was encountered beneath the fill in boreholes BH-101 and BH-102. Compact to dense silty sand was encountered in borehole BH-106 beneath layers of silty clay till and clayey silt. The silty sand layers ranged from about 0.6 to 2.3 metres thick. The silty sand had N values of 2 to 40 blows per 0.3 metres. Natural water contents of samples of the silty sand ranged from about 6 to 29 per cent with an average of about 13 per cent.

Layers of silty sand were also encountered at the ground surface and beneath the upper sand layer in borehole 1 (05-1140-109), beneath the fill and sand layers in borehole 2 (05-1140-109) and beneath the pavement structure in borehole 2 (05-1140-196). Where fully penetrated, the silty sand ranged in thickness from 0.6 to 1.5 metres. Borehole 2 (05-1140-109) was terminated in the silty sand after penetrating the layer for over

3.6 metres. The silty sand had N values ranging from 3 to 23 blows per 0.3 metres with water contents from about 12 to 29 per cent.

7.2.3 Sandy Silt

Layers of very loose to dense sandy silt were encountered beneath layers of silty sand in boreholes BH-101 and BH-102, beneath the fill and a layer of silty clay till in borehole BH-104 and beneath the fill in borehole BH-105. The sandy silt layers were about 0.2 to 4.3 metres thick at the borehole locations. The sandy silt had N values of 3 to 40 blows per 0.3 metres with natural water contents of 3 to 22 per cent and an average of about 15 per cent.

Two grain size distribution curves for samples of the sandy silt recovered from the standard penetration testing are shown on Figure 6.

A 0.5 metre thick layer of sandy silt was also encountered between layers of silty clay till in borehole 5 (011-4228). The sandy silt had a water content of about 16 per cent.

7.2.4 Silty Clay to Clayey Silt

Layers of very soft to hard silty clay were encountered beneath the sandy silt in boreholes BH-101, BH-102 and BH-106. Borehole BH-102 was terminated in the silty clay after exploring it for about 6.8 metres. Where fully penetrated, the silty clay layers were about 1.1 to 8.0 metres thick at the borehole locations. The silty clay had N values of nil (weight of the sampling rods) to 50 blows per 50 millimetres, and had shear strengths of 52 to over 96 kilopascals based on the in situ shear vane testing. Natural water contents of samples of the silty clay ranged from 16 to 22 per cent and had an average of about 19 per cent.

Two grain size distribution curves for samples of the silty clay recovered from the standard penetration testing are shown on Figure 7. The results of two Atterberg limits determinations carried out on samples of the silty clay are shown on Figure 8.

A 0.6 metre thick layer of clayey silt was encountered beneath the sand in borehole 2 (05-1140-196). The clayey silt had an N value of 19 blows per 0.3 metres and a water content of about 18 per cent.

7.2.5 Silty Clay to Clayey Silt Till

Soft to very stiff silty clay till was encountered beneath the silty clay in borehole BH-101, beneath the fill and the silt in borehole BH-103, beneath layers of sandy silt in boreholes BH-104 and BH-105 and beneath the silty clay and silty sand in borehole BH-106. Boreholes BH-101 and BH-103 to BH-105 were terminated in the silty clay till after exploring it for about 3.7 to 5.6 metres. Where fully penetrated the silty clay layers were about 0.7 to 4.4 metres thick at the borehole locations. The silty clay till had N values of 5 to 18 blows per 0.3 metres and had shear strengths of 91 to over 96 kilopascals based on the in situ shear vane testing. Natural water contents for silty clay till ranged from 16 to 22 per cent and had an average of about 19 per cent.

Two grain size distribution curves for samples of the silty clay till recovered from the standard penetration testing are shown on Figure 5. The results of two Atterberg limits determinations carried out on samples of the silty clay till are shown on Figure 8.

Layers of silty clay till and clayey silt till were encountered in all of the previous boreholes except boreholes 2 and 3 (05-1140-109). Where fully penetrated, the till layers were 0.3 to 1.4 metres thick. All of the boreholes that encountered the till were terminated in the till after exploring the deposit for some 2.3 to 4.8 metres. The glacial till materials had N values of 12 to greater than 100 blows per 0.3 metres and water contents of about 9 to 20 per cent. A sample of the glacial till from borehole 5 (011-4228) had plastic and liquid limits of about 17 and 27 per cent, respectively. A grain size distribution curve for a sample of the till recovered from the standard penetration testing is provided in Appendix A.

7.2.6 Silt

Layers of compact to dense silt were encountered beneath the silty clay in borehole BH-102 and the silty clay till in borehole BH-103. The silt layers were about 0.8 and 0.2 metres thick in boreholes BH-102 and BH-103, respectively. The silt had N values of 3 and 38 blows per 0.3 metres with natural water contents of about 15 and 17 per cent.

A 0.5 metre thick layer of silt was also encountered beneath the upper layer of silty clay till in borehole 5 (011-4228). The sandy silt had a water content of about 23 per cent.

7.2.7 Sandy Clayey Silt

A layer of very stiff sandy clayey silt was encountered beneath the sandy silt in borehole BH-106. The sandy clayey silt layer was about 0.7 metres thick and had an N value of 28 blows per 0.3 metres with a natural water content of about 11 per cent.

7.2.8 Sand

Layers of compact to dense sand were encountered beneath the silty clay till and gravelly sand in borehole BH-106. The sand layers were about 0.4 and 0.9 metres thick. The sand had N values of 15 to 42 blows per 0.3 metres with natural water contents of about 17 to 19 per cent.

Strata of sand were also encountered beneath the silty sand in boreholes 1 and 2 (05-1140-109), beneath the pavement structure in borehole 2 (05-1140-196) and beneath the glacial till in borehole 4 (011-4228). The sand ranged in thickness from 0.3 to 2.6 metres and had N values of 8 to 14 blows per 0.3 metres with water contents of about 20 to 27 per cent.

7.2.9 Gravelly Sand

A layer of compact to dense gravelly sand was encountered beneath a layer of silty sand in borehole BH-106. The gravelly sand layer was about 0.7 metres thick. The sand had N values of 15 to 40 blows per 0.3 metres with natural water contents of about 10 and 13 per cent.

Cobbles and boulders should be expected in the gravelly sand strata.

7.3 Groundwater

The observed and measured groundwater levels are noted on the Record of Borehole sheets and summarized in Table I. The groundwater level was encountered in the current boreholes during drilling between 1.4 and 10.4 metres below the ground surface or elevations 186.6 to 194.9 metres. The groundwater level was measured in the standpipes installed in the current boreholes between 0.4 and 10.7 metres below the ground surface or elevations 184.7 and 197.5 metres.

Boreholes 4 and 5 (011-4228) encountered groundwater seepage at depths of 1.5 and 3.0 metres or elevations 197.3 and 195.5 metres during drilling on October 16, 2001. Borehole 6 (011-4228) was dry during drilling on October 16, 2001. Groundwater in the standpipe installed in borehole 4 (011-4228) was measured at a depth of 1.9 metres or elevation 196.6 metres on November 7, 2001.

Borehole 2 (05-1140-196) encountered groundwater at a depth of 2.0 metres or about elevation 203.0 metres during drilling on September 1, 2005.

Boreholes 1, 2 and 3 (05-1140-109) encountered groundwater seepage at depths between 1.3 and 1.5 metres during drilling on May 19 and 25, 2005. Groundwater in the standpipe installed in borehole 2 (05-1140-109) was measured at a depth of 2.0 metres on May 25, 2005.

Groundwater levels should be expected to fluctuate seasonally and in response to significant precipitation events.

8.0 DISCUSSION

8.1 General

This section of the report provides our interpretation of the available geotechnical data and it is intended for the guidance of the design engineer for the conceptual design of the work within the context of the overall Environmental Assessment. Where comments are made on construction, they are provided only to highlight those aspects which could affect the design of the project.

Based on the results of our slope assessment of the Esseltine Drain, the southern portions of the drain (south of County Road 20) are unstable due to the combination toe erosion and scouring occurring along the banks, particularly along the outside bends of the drain. Toe erosion, coupled with seepage from the slope resulting in oversteepening, is the common contributor to the landslide activities along the drain.

Various remediation options were considered by others for the Esseltine Drain channel and bank slopes. It was indicated that the selected remediation option to be applied to the natural watercourse section of the drain is to place a maximum of 5 metres of cohesive fill at the base of the existing drain with the remaining side slopes inclined at 2 horizontal to 1 vertical, including the provision of an approximately 5 metre wide access road within the slope and placement of cable concrete in the new drain channel, access road and portions of the side slopes. The proposed remediation concept is shown on Figure 4.

Also, two culverts are to be installed to provide access across the Esseltine Drain; a replacement culvert at about Station 1+276 near the Mucci greenhouse property and borehole BH-105 and twin pipe culverts at about Station 1+700 for the proposed Porrone Subdivision near borehole BH-106. The proposed culvert locations are shown on the Location, Figure 1A.

8.2 Slope Stability Analyses

Slope stability analyses were carried out using SLOPE/W, a limit equilibrium analysis program produced by GEO-SLOPE International. The software calculates the factor of safety against failure by calculating all forces and moments for a series of idealized vertical slices through the ground with a bottom boundary chosen to represent a "trial" failure surface. A factor of safety for slope stability is then defined as the total forces acting to resist failure divided by the total forces or moments acting to destabilize the slope. A factor of safety of unity indicates incipient failure since the destabilizing and stabilizing forces are equal. The analyses were conducted to assess the stability of the existing slopes based on the previous soil data and existing topographic information and section data measured in the field by our staff.

Trial failure surfaces are commonly assumed to exhibit subsurface shapes similar to circular arcs, wedges or angular block shapes. Multiple published methods of analysis are also typically used to assess the influence of the assumptions that form the basis of the stability calculation methods. During the computer-assisted analyses, hundreds of trial failure surfaces are evaluated using multiple analysis methods and the trial surface producing the lowest factor of safety is considered the "critical" failure surface.

The slope stability analyses conducted for these evaluations were based on long-term "drained" conditions with no cohesion, even though some of the subsurface soils may consist of "cohesive" soils. It has long been recognized that the long-term stability of natural slopes is governed by their mechanical properties under drained conditions where the water pressures in the soils progressively equilibrate in response to stress changes. While "undrained" conditions dictate the responses to rapid stress changes, as the water pressures within the soils equilibrate over time, the long-term strength characteristics may govern. This progressive nature of the change in mechanical behaviour is exhibited in the observable conditions at the site where very steep slopes may initially appear stable and then fail at some time later. For long-term slope stability analyses, the internal angle of effective soil friction, ϕ', is the critical parameter governing soil strength.

A minimum slip surface depth of 2.0 metres was used for the slope stability analyses to eliminate 'surficial' slip surfaces and target more severe failures.

In addition to the computer-assisted analyses, "infinite slope" stability calculations were also carried out. In general, a factor of safety using these calculations is determined by comparing the tangent of the internal angle of slope friction to the tangent of the actual slope angle. At a factor of safety of unity, the slope can be said to be at its "angle of repose."

Slope stability analyses were carried out for five cross sections of the Esseltine Drain. The locations of the sections are shown on Figure 1B and the section geometries are provided on Figures 2 to 4.

The slope stability analyses were carried out to assess the stability of the existing slopes based on generalized modeling of the soil data from the current and previous investigation, topographic information and section data provided by R.C. Spencer and measured and observed conditions in the field by our staff. Additional analyses were also carried out assuming the application of the proposed remediation concept shown on Figure 4.

8.2.1 Generalized Subsurface Conditions and Properties

Generalized subsurface conditions and soil properties used in the analyses were selected based on the current and previous subsurface investigations, geologic mapping, our observations during the site reconnaissance, published correlations and our knowledge of the range of mechanical properties of these soil types. The soil properties used in the analyses are summarized in the table below.

Station	Section	Soil Type	Unit Weight (kN/m³)	Effective Cohesion Intercept, c' (kPa)	Effective Angle of Internal Friction, ϕ’ (degrees)
0+000	A	Silty Sand	21	0	32
		Sandy Silt	21	0	29
		Silty Clay	19	0	28
		Silty Clay Till	21	0	30
0+100	B	Silty Sand	21	0	32
		Sandy Silt	21	0	29
		Silty Clay	19	0	28
		Silt	21	0	28
0+200	C	Granular Fill	20	0	32
		Silty Sand	21	0	32
		Sandy Silt	21	0	29
		Silty Clay	19	0	28
		Silt	21	0	28
0+300	D	Silty Sand	21	0	32
		Silty Clay Till	21	0	30
0+575	E	Granular Fill	20	0	32
		Sandy Silt	21	0	29
		Silty Clay	19	0	28
		Silty Clay Till	21	0	30

Based on the observations during the site reconnaissance, seepage from the slope faces was noted at Sections B and C. The groundwater levels encountered in the current and previous investigations were considered when developing the slope stability models.

8.2.2 Summary of Results

The existing slope geometries and stability conditions, together with appropriate soil properties selected using data from previous investigations and geologic mapping, were utilized to establish and calibrate stability models at each of the section locations.

The estimated stability factors of safety (FOS) from the analyses are summarized in the table below.

Section	West Drain Slope FOS		East Drain Slope FOS	
	Existing Conditions	Rehabilitated Conditions	Existing Conditions	Rehabilitated Conditions
A	0.7	1.9	0.7	2.1
B	0.7	1.7	0.7	1.7
C	0.6	2.6	0.8	2.3
D	0.7	2.0	0.6	1.6
E	1.6	2.4*	1.1	1.2* / 1.6**

* Based on slope cut to 2H:1V ** Based on slope cut to 3H:1V

The rehabilitated conditions for some cross sections were modified, where appropriate, to tie into the existing slope conditions (slope flattening).

Based on our analyses, the existing bank slopes at each of the sections generally exhibited FOS against slope failure of less than 1.0. This indicates unstable conditions, consistent with the field observations and particularly in the existing scoured channel. The east bank slope at Section E exhibited a FOS of about 1.1, which indicates that the existing slope conditions are marginally stable.

Following application of the proposed remediation concept, the analyses indicate that FOSs of 1.0 and greater may be achieved. For the majority of the slopes, factors of safety of 1.3 and greater were determined for deep-seated failure surfaces. FOSs of less than 1.3 were achieved where localized oversteepened areas are present. It is expected that the FOSs of 1.3 or greater can be achieved in these areas following the proposed remedial work in conjunction with some additional localized flattening of the slopes. In the modeling, the proposed remediation concept was applied to the sections assuming the existing and new channel centrelines would be coincident; though it is understood that the channel alignment may actually be altered during the remediation works. Optimizing the new channel centreline alignment between the existing bank slopes could further improve the FOSs and reduce the need for localized flattening and/or fill volumes.

8.3 Proposed SWM Ponds

It is understood that proposed development in the subject area of the Esseltine Drain is to include the construction of storm water management (SWM) ponds associated with greenhouse developments within the Esseltine Drain watershed. These developments are currently seeking approval from the Municipality and the

Essex Region Conservation Authority (ERCA) for construction that may take place prior to the completion of the Esseltine Drain study and drainage report and construction of the remedial works for the drain. We understand that there are concerns regarding the effect(s) of combined releases of restricted storm water flows from SWM ponds on the existing drain channel.

It is anticipated that the construction of SWM ponds would reduce the overall volume of storm water reporting to the drain by containing some proportion of the water. In the case of storm event(s) where the SWM ponds may discharge to the Esseltine Drain, assuming the pond(s) would utilize overflow weirs or the like, the total flow volumes would theoretically remain unchanged from those had the SWM pond(s) not been present. Further, the initial storm flows would likely be captured in the ponds and not necessarily report to the drain. As such, it is considered that the construction of SWM pond(s) in the Esseltine Drain watershed prior to the construction of proposed upgrades to the drain itself would have a marginal net benefit to the integrity of the drain.

The design of any SWM pond(s) should incorporate an armoured outlet to the base of the drain. In addition, the locations, setbacks and the like should be reviewed by the geotechnical engineer, in conjunction with a site visit, during the SWM pond design stage.

8.4 Proposed Culverts

For the replacement of the drain crossing at the Mucci greenhouse property at about Station 1+276, various culvert options are being considered in conjunction with proposed adjustments to the channel alignment. Various lengths of twin 1.8 metre diameter pipe culverts and a 2.4 by 1.8 by 30 metre concrete box culvert are being considered. The exiting culvert is a corrugated steel pipe (CSP) with invert elevations of 192.9 to 193.1 metres.

In conjunction with the future Porrone Subdivision to the north of Road 2 East, twin 1.6 metre diameter, 38 metre long CSP culverts are proposed at about Station 1+700 with invert elevations of about 195.6 and 195.9 metres.

Assuming the replacement culvert at Station 1+276 will have a similar invert as the existing culvert, it is expected that the replacement culvert(s) may be founded on the silty clay till encountered at about elevation 192 metres in borehole BH-105 or on engineered fill placed on the native till. The culverts at the Porrone Subdivision may be founded on the silty clay till encountered at about elevation 196.6 metres in borehole BH-106. The culverts may be designed using a factored geotechnical resistance at Ultimate Limit States (ULS) of 250 kilopascals and a geotechnical reaction at Serviceability Limit States (SLS) of 100 kilopascals. The SLS value corresponds to a maximum of 25 millimetres of total settlement.

Corrugated steel pipe culverts require a minimum frost cover of 300 millimetres. It is not necessary to found a box culvert at the standard depth for frost penetration protection purposes as pre-cast box culvert structures are tolerant of small magnitude movements related to freeze-thaw cycles should these occur. Box and pipe culverts should be founded below any existing fill and surficial organic materials. It is expected that a pre cast box culvert would be constructed on a minimum 300 millimetre thick Granular A leveling pad. Pipe culverts should also be constructed on a granular leveling pad/pipe bedding.

Erosion and scour protection for the culvert backfills and drain banks should be provided as appropriate, based on hydraulic considerations. Consideration could be given to using suitable non-woven geotextile and rip rap, as required, to provide erosion protection based on hydraulic requirements. In addition, sediment control such as silt fences and erosion control blankets may be required during construction as well as during diversion/piping of the watercourses to mitigate against migration of fine particles.

8.5 Construction Considerations

Preparation of the subgrade for fill placement should include clearing and grubbing of the fill areas. All unsuitable subgrade materials, including topsoil and deleterious fill materials should be stripped from the plan limits of the proposed works. Fill materials should be placed in maximum 300 millimetre thick loose lifts, properly benched into the existing bank slopes, and compacted.

Care will be required to ensure that the construction staging is carried out such that the ongoing works do not affect the drain flows in a way that will create further unstable conditions in the drain channel and bank slopes. Diverting or piping of the drain flow may be required during construction.

8.6 Additional Input

Geotechnical input should continue throughout the EA phase of the work as well as during detailed design. The geotechnical aspects of the proposed work should be reviewed by this office prior to tendering.

We trust that this report provides all of the geotechnical information presently required. Should any point require clarification, or should you have any comments on this report, please contact this office.

GOLDER ASSOCIATES LTD.

LICENSED PROFESSIONAL ENGINEER
Nov 4/15
D.R.P. BABCOCK
100109319
PROVINCE OF ONTARIO

Daniel R. P. Babcock, P.Eng.
Geotechnical Engineer

Michael E. Beadle, P.Eng.
Associate

DB/NG/MEB/cr

n:\active\2014\1132-geo\1417810 rc spencer-inv esseltine drain-kingsville\ph 2000-geo inv\2-correspondence\5-rpts\1417810-2000-r01 nov 3 15 (final) esseltine drain inv.docx

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.

TABLE I

SUMMARY OF GROUNDWATER LEVELS

Geotechnical Review
Esseltine Drain Improvements
Town of Kingsville, Ontario

GOLDER REPORT	BOREHOLE	GROUND SURFACE ELEVATION (m)	DRILLING DATE	Installation	GROUNDWATER LEVEL (m)					
					Encountered	May 26, 2015	May 27, 2015	June 8, 2015	June 9, 2015	June 26, 2015
1417810 (Current)	BH-101	192.82	May 28, 2015	Standpipe	187.6	-	-	186.89	-	186.86
	BH-102	191.76	May 27, 2015	Standpipe (#2 Shallow)	186.6	-	185.71	186.83	-	186.83
				Standpipe (#1 Deep)		-	184.66	186.76	-	186.73
	BH-103	189.97	June 9, 2015	Standpipe	188.6	-	-	-	187.47	188.85
	BH-104	199.33	May 26, 2015	Standpipe	188.9	188.63	-	190.41	-	190.34
	BH-105	195.08	May 26, 2015	Standpipe	193.0	193.38	-	193.39	-	193.28
	BH-106	197.92	May 26, 2015	Standpipe	194.9/193.5	197.22	-	197.40	-	197.50
						May 25, 2005				
05-1140-109[1]	1	100.09	May 19, 2005	-	98.6	-				
	2	99.68	May 19, 2005	Standpipe	98.2	97.7				
	3	97.06	May 25, 2005	-	95.8	-				
05-1140-196	2	204.96	September 1, 2005	-	203.0					
						November 7, 2001				
011-4228	4	198.52	October 16, 2001	Standpipe	195.5	196.60				
	5	198.80	October 16, 2001	-	197.3	-				
	6	200.08	October 16, 2001	-	Dry	-				

NOTES:

1. Local elevations were referenced for Golder Report 05-1140-109.
2. For installation details, see Record of Borehole sheets in Appendix A.
3. For borehole locations, see Location Plan, Figure 1.
4. Table to be read in conjunction with accompanying text.

Prepared By: DB
Checked By: NG

TABLE II

SUMMARY OF FIELD OBSERVATIONS

Slope Stability Assessment
Esseltine Drain Improvements
Town of Kingsville, Ontario

STATION	SLOPE SECTION	PHOTOGRAPH NUMBER	OVERALL SLOPE ANGLE (° to horizontal)	TOE EROSION	OVERALL SLOPE CONDITION	REMARKS
0+000	A	1 to 4	West = 24 East = 24	Yes	Unstable	Mature trees fallen or leaning towards drain. Erosion observed within slopes and nearly vertical banks. Failure zones adjacent to Lake Erie bluff slopes.
0+100	B	5 to 8	West = 30 East = 26	Yes	Unstable	Residence located near top of west slope. Tension cracks along top of east slope. Dumping activities over east slope from nearby greenhouse complex. Failure zones and seepage within slopes. Toe erosion along banks.
0+200	C	9 to 11	West = <10 East = 34	Yes	Unstable	Failure zones, erosion and seepage within slopes. Sloughed debris at lower portion of east slope. Mature trees fallen at toe of slope. Toe erosion along banks.
0+300	D	15 to 17	West = 25 East = bank is near vertical	Yes	Unstable	Mature tree leaning towards drain. Silty clay exposed along nearly vertical east bank due to toe erosion. Horizontal bench feature and rock protection along west slope.
0+575	E	21 and 22	West = N/A East = 29	Yes	Marginally Stable	Heavily vegetated slope. No seepage or failure zones observed. Fill piled along top of east slope.

NOTES:
1. See Location Plan and Sections, Figures 1 to 4, for approximate locations of slope sections and typical slope geometry.
2. Slope inspection carried out on April 16, 2015.
3. Table to be read in conjunction with accompanying report.

Prepared By: DB
Checked By: MEB

TABLE III

SLOPE STABILITY RATING CHART

Slope Stability Assessment
Esseltine Drain Improvements
Kingsville, Ontario

Site Location: Esseltine Drain, Kingsville, Ontario	Project No.: 1417810-2000
Property Owner: Town of Kingsville	Inspection Date: April 16, 2015
Inspected By: Dan Babcock, P.Eng.	Weather: Sunny to Rainy, 15 to 18 °C

1. SLOPE INCLINATION Degrees horizontal:vertical	Section Station	Rating Value (select only one) A 0+000	B 0+100	C 0+200	D 0+300	E 0+575
a) 16 or less 3:1 or flatter		0	0	0	0	0
b) 16 to 26 2:1 to 3:1		6	6	6	6	6
c) 26 or more steeper than 2:1		**>16<**	**>16<**	**>16<**	**>16<**	**>16<**
2. SOIL STRATIGRAPHY						
a) Shale, Limestone (bedrock)		0	0	0	0	0
b) Sand, Gravel		6	6	6	6	6
c) Till		9	9	9	**>9<**	9
d) Clay, Silt		**>12<**	**>12<**	**>12<**	12	**>12<**
e) Fill		16	16	16	16	16
3. SEEPAGE FROM SLOPE FACE						
a) None or near bottom only		**>0<**	0	0	**>0<**	**>0<**
b) Near mid-slope only		6	**>6<**	**>6<**	6	6
c) Near crest only or from several levels		12	12	12	12	12
4. SLOPE HEIGHT						
a) 2m or less		0	0	0	0	0
b) 2.1 to 5m		2	2	2	2	2
c) 5.1 to 10m		4	4	4	4	**>4<**
d) more than 10m		**>8<**	**>8<**	**>8<**	**>8<**	8
5. VEGETATION COVER ON SLOPE FACE						
a) Well vegetated: heavy shrubs or forested with mature trees		**>0<**	**>0<**	**>0<**	0	**>0<**
b) Light vegetation: mostly grass, weeds, occasional trees, shrubs		4	4	4	**>4<**	4
c) No vegetation, bare		8	8	8	8	8
6. TABLE LAND DRAINAGE						
a) Table land flat, no apparent drainage over slope		**>0<**	**>0<**	**>0<**	**>0<**	**>0<**
b) Minor drainage over slope, no active erosion		2	2	2	2	2
c) Drainage over slope, active erosion, gullies		4	4	4	4	4
7. PROXIMITY OF WATERCOURSE TO SLOPE TOE						
a) 15 metres or more from slope toe		0	0	0	0	0
b) Less than 15 metres from slope toe		**>6<**	**>6<**	**>6<**	**>6<**	**>6<**
8. PREVIOUS LANDSLIDE ACTIVITY						
a) No		0	0	**0**	0	**>0<**
b) Yes		**>6<**	**>6<**	**>6<**	**>6<**	6
SLOPE INSTABILITY RATING	RATING VALUES TOTAL	Total **48**	Total **54**	Total **54**	Total **49**	Total **38**
INVESTIGATION REQUIREMENTS	Toe Erosion?	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**

1. Low potential	<24	Site Inspection only, confirmation, report letter.
2. Slight potential	25-35	Site inspection and surveying, preliminary study, detailed report.
3. Moderate potential	>35	Borehole investigation, piezometers, lab tests, surveying, detailed report.

NOTES:

a) This chart does not apply to rock slopes or to Leda Clay slopes (Ottawa area).

b) Choose only one from each category and compare total rating with above requirements.

c) If there is a water body (stream, creek, river, pond, bay, lake) at the slope toe, the potential for toe erosion and undercutting should be evaluated in detail and, protection provided if required.

Reference: Table 4.2, Technical Guide – River & Stream Systems: Erosion Hazard Limit. Ontario Ministry of Natural Resources.

LIST OF ABBREVIATIONS

The abbreviations commonly employed on Records of Boreholes, on figures and in the text of the report are as follows:

I. SAMPLE TYPE

AS	Auger sample
BS	Block sample
CS	Chunk sample
SS	Split-spoon
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

II. PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg. (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split spoon sampler for a distance of 300 mm (12 in.)

Dynamic Cone Penetration Resistance; N_d:

The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to “A” size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

Piezo-Cone Penetration Test (CPT)

A electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (Q_t), porewater pressure (PWP) and friction along a sleeve are recorded electronically at 25 mm penetration intervals.

III. SOIL DESCRIPTION

(a) Cohesionless Soils

Density Index (Relative Density)	N Blows/300 mm or Blows/ft.
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	over 50

(b) Cohesive Soils

Consistency	c_u,s_u	
	kPa	psf
Very soft	0 to 12	0 to 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1,000
Stiff	50 to 100	1,000 to 2,000
Very stiff	100 to 200	2,000 to 4,000
Hard	over 200	over 4,000

IV. SOIL TESTS

w	water content
w_p	plastic limit
w_l	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, G_s)
DS	direct shear test
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V	field vane (LV-laboratory vane test)
γ	unit weight

Note: 1 Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. General

π	3.1416
ln x,	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time
F	factor of safety
V	volume
W	weight

II. STRESS AND STRAIN

γ	shear strain
Λ	change in, e.g. in stress: $\Lambda\ \sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
v	poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma$-u)
σ'_{vo}	initial effective overburden stress
σ_1, σ_2, σ_3	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1+\sigma_2+\sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight*)
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

(a) Index Properties (continued)

w	water content
w_l	liquid limit
w_p	plastic limit
I_p	plasticity index = $(w_l - w_p)$
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p)/I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_a	coefficient of secondary consolidation
m_v	coefficient of volume change
c_v	coefficient of consolidation
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation pressure
OCR	over-consolidation ratio = σ'_p/σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c'	effective cohesion
c_u,s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p'	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 + \sigma_3)/2$ or $(\sigma'_1 + \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 + \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$

2 shear strength = (compressive strength)/2

* density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density x acceleration due to gravity)

PROJECT: 1417810

RECORD OF BOREHOLE BH-101

SHEET 1 OF 3

LOCATION: REFER TO LOCATION PLAN

BORING DATE: May 28, 2015

DRILLING CONTRACTOR: Henderson Drilling Inc.

DATUM: GEODETIC

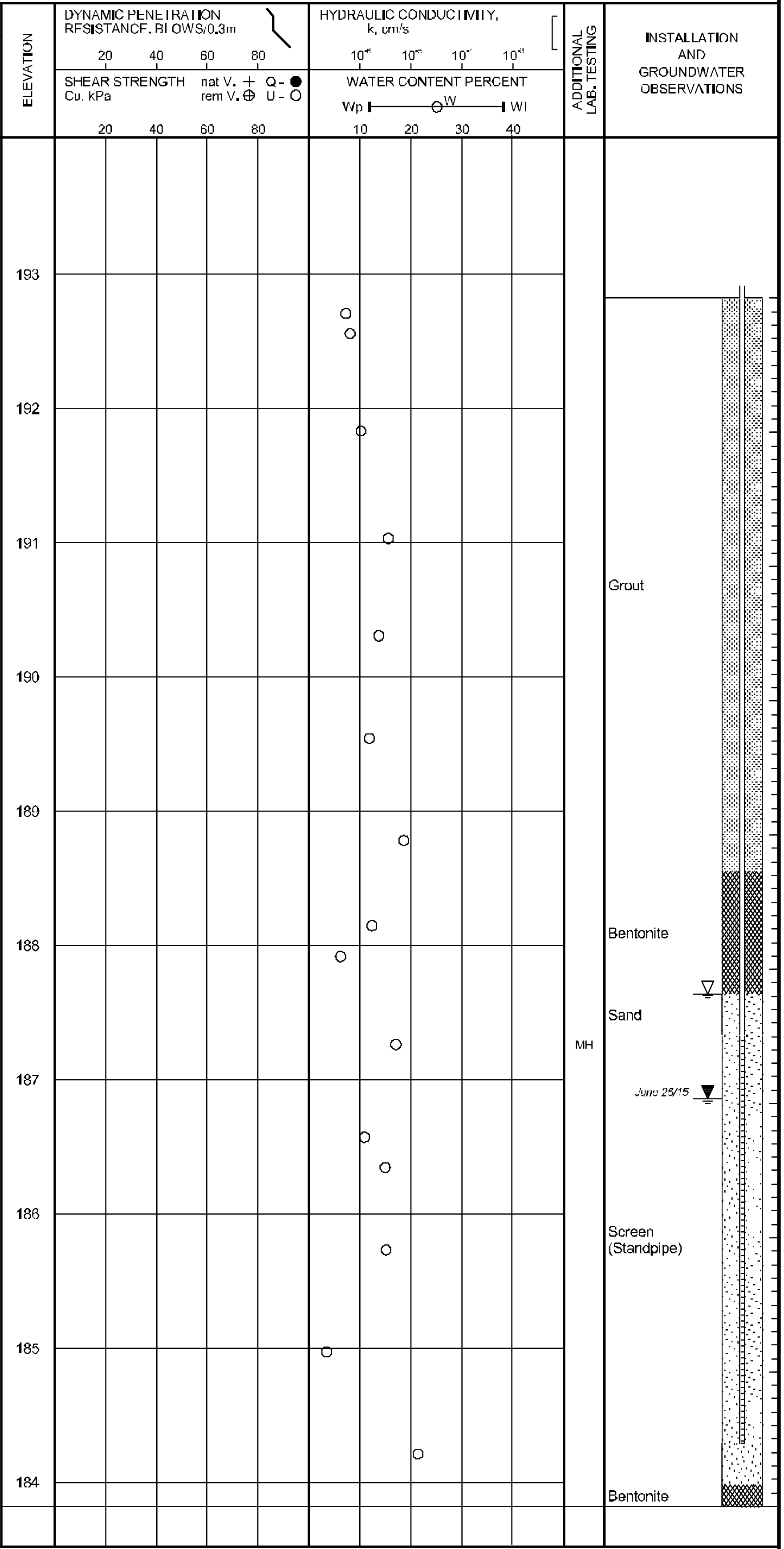
HAMMER TYPE: Auto Hammer

BORING METHOD: POWER AUGER, 89mm ID HOLLOW STEM

DEPTH SCALE METRES	SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (m)
0	GROUND SURFACE	192.82
0	**FILL -** (SM/GW) silty sand and gravel; brown	0.00
	FILL - (SM) silty sand, trace topsoil; brown; loose	192.59 0.23
1	**FILL -** (SP) sand, some gravel, some topsoil, some silt; brown and black, with wood, concrete, brick, cinders and slag fragments; loose	191.45 1.37
3	(SM) **SILTY SAND;** brown; loose to compact	189.93 2.89
5	(ML) **sandy SILT**; brown becoming grey at about elev. 185.2m; compact to dense	187.64 5.18
8	(CI) **SILTY CLAY**, trace sand, trace gravel; brown; very soft to stiff	184.59 8.23

SAMPLES NUMBER	TYPE	BLOWS/0.3m
1	AS	
2	SS	4
3	SS	4
4	SS	4
5	SS	6
6	SS	8
7	SS	11
8	SS	18
9	SS	34
10	SS	38
11	SS	28
12	SS	6

-- CONTINUED NEXT PAGE --



DEPTH SCALE

1 : 50

LOGGED: LS

CHECKED:

PROJECT: 1417810

RECORD OF BOREHOLE BH-101

SHEET 2 OF 3

LOCATION: REFER TO LOCATION PLAN

BORING DATE: May 28, 2015
DRILLING CONTRACTOR: Henderson Drilling Inc.

DATUM: GEODETIC

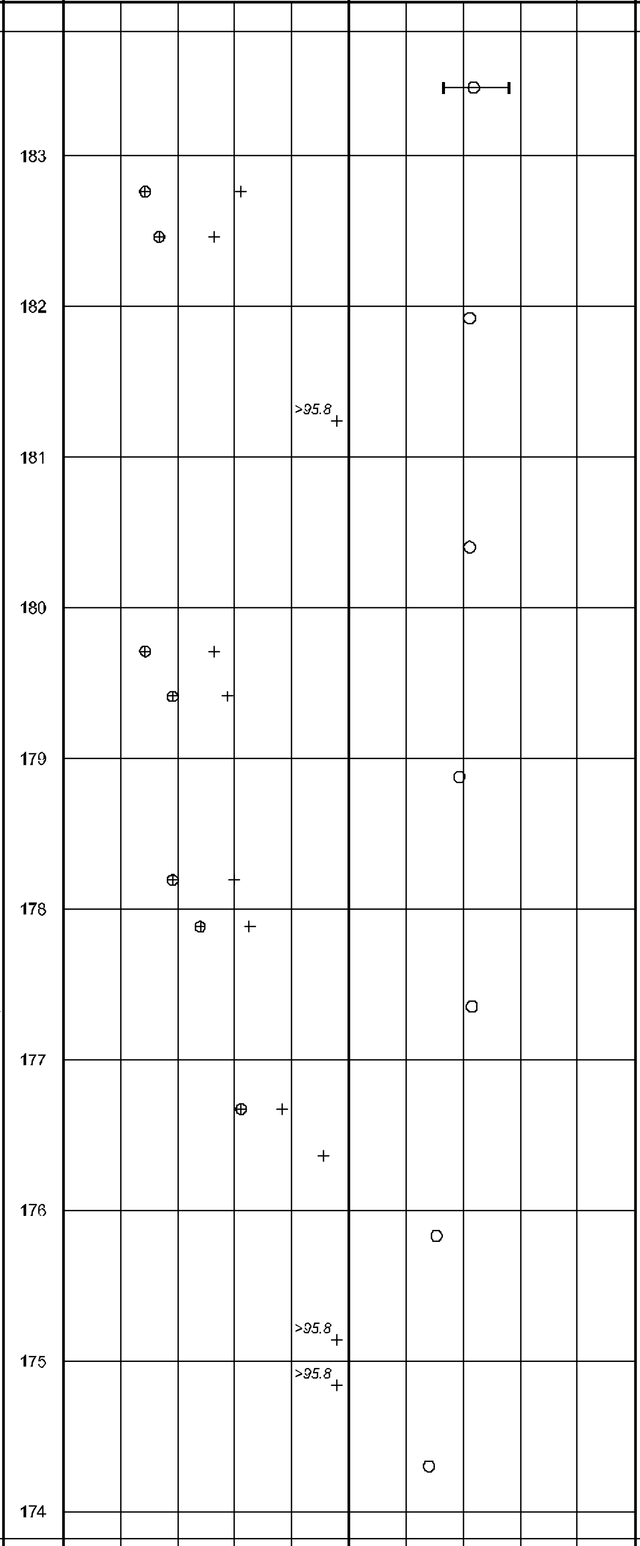
HAMMER TYPE: Auto Hammer

BORING METHOD: POWER AUGER, 89mm ID HOLLOW STEM

--- CONTINUED FROM PREVIOUS PAGE ---

SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)
(CI) **SILTY CLAY**, trace sand, trace gravel; brown; very soft to stiff	182.30 10.52
(CL) **SILTY CLAY**, some sand, some gravel; brown, with silt seams; very soft to very stiff	180.94 11.88
(CI) **SILTY CLAY**, trace sand, trace gravel; brown; very soft to stiff	176.66 16.16
(CL) **SILTY CLAY**, some sand, some gravel; grey, (**TILL**); firm to very stiff	

SAMPLES NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING
13	SS	1	MH
14	SS	5	
15	SS	WH	
16	SS	3	
17	SS	WR	
18	SS	9	
19	SS	9	



DEPTH SCALE METRES: 9 – 19

INSTALLATION AND GROUNDWATER OBSERVATIONS: Bentonite; Grout

-- CONTINUED NEXT PAGE --

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: LS
CHECKED:

PROJECT: 1417810

RECORD OF BOREHOLE BH-101

SHEET 3 OF 3

LOCATION: REFER TO LOCATION PLAN

BORING DATE: May 28, 2015
DRILLING CONTRACTOR: Henderson Drilling Inc.

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

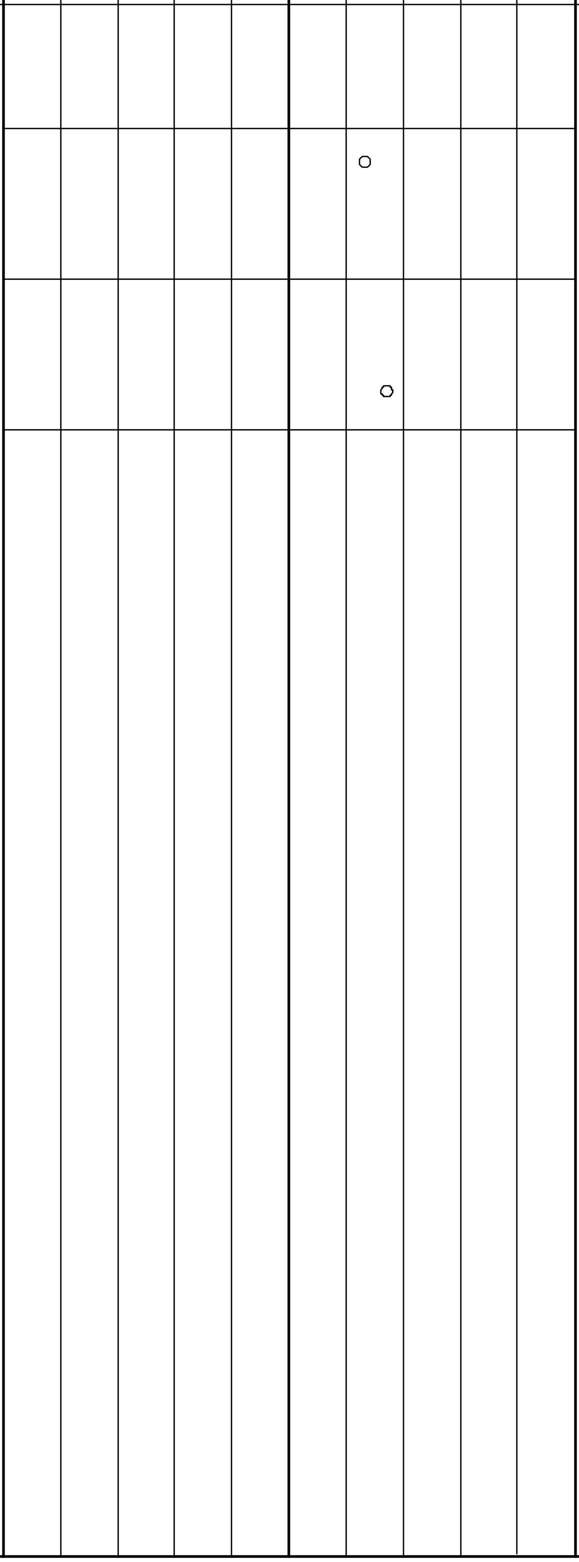
DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	ELEVATION	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
		--- CONTINUED FROM PREVIOUS PAGE ---								
19 20 21	POWER AUGER 89mm ID HOLLOW STEM	(CL) **SILTY CLAY**, some sand, some gravel; grey, (**TILL**); firm to very stiff		171.03 21.79	20 21	SS SS	8 6	173 172		Grout
22 23 24 25 26 27 28 29		END OF BOREHOLE						171		Groundwater encountered at about elev. 187.6m during drilling on May 28, 2015. Water level measured in standpipe at elev. 186.89m on June 8, 2015. Water level measured in standpipe at elev. 186.86m on June 26, 2015.

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ : 20 40 60 80

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp ⊢—○W—⊣ Wl : 10 20 30 40



DEPTH SCALE
1 : 50

LOGGED: LS
CHECKED:

PROJECT: 1417810

RECORD OF BOREHOLE BH-102

SHEET 1 OF 2

LOCATION: REFER TO LOCATION PLAN

BORING DATE: May 27, 2015
DRILLING CONTRACTOR: Henderson Drilling Inc.

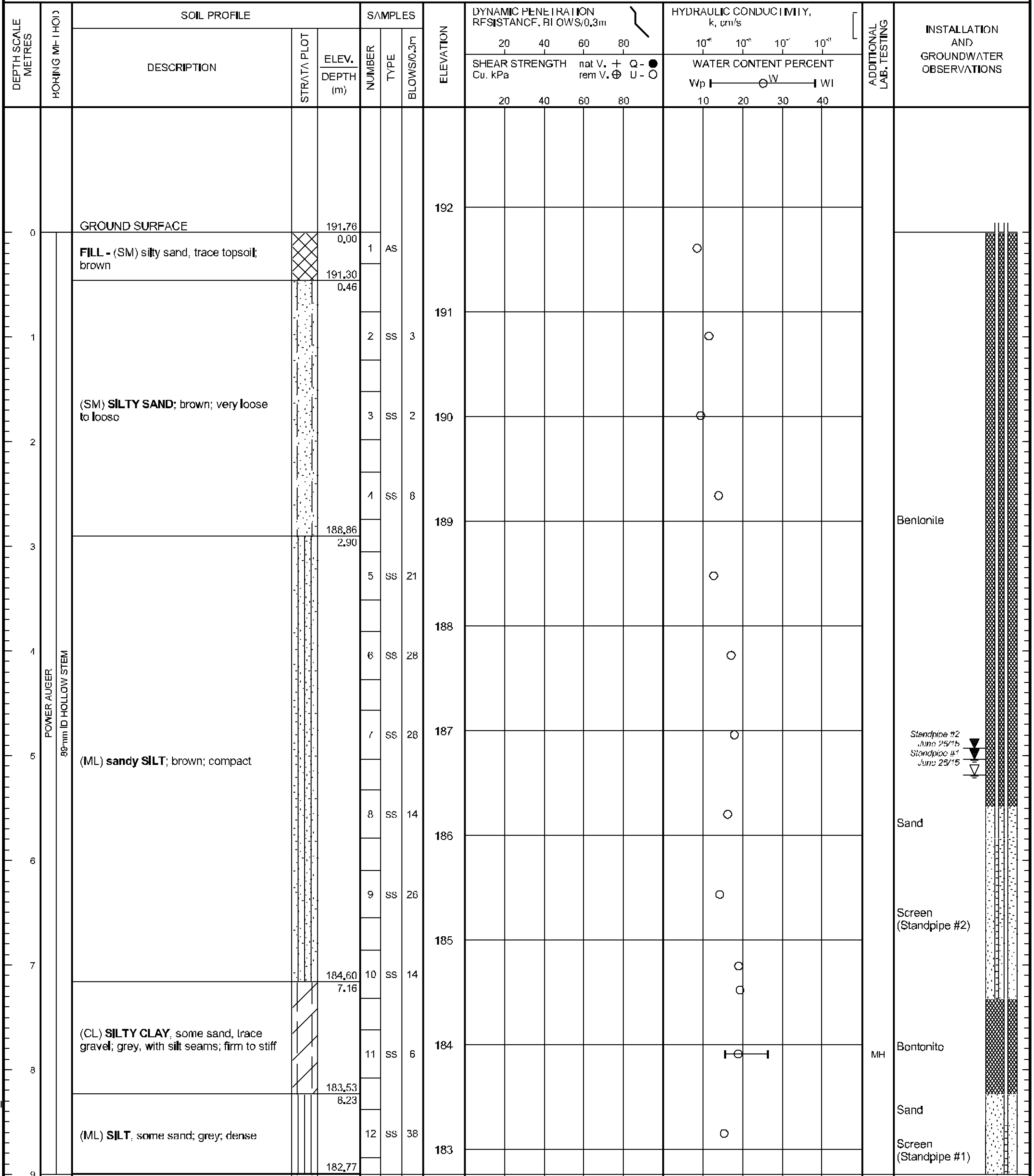
DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

BORING METHOD: POWER AUGER, 89mm ID HOLLOW STEM

SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (m)
GROUND SURFACE	191.76
FILL - (SM) silty sand, trace topsoil; brown	0.00
(SM) **SILTY SAND**; brown; very loose to loose	191.30 0.46
(ML) **sandy SILT**; brown; compact	188.86 2.90
(CL) **SILTY CLAY**, some sand, trace gravel; grey, with silt seams; firm to stiff	184.60 7.16
(ML) **SILT**, some sand; grey; dense	183.53 8.23
	182.77

NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING
1	AS		
2	SS	3	
3	SS	2	
4	SS	6	
5	SS	21	
6	SS	28	
7	SS	28	
8	SS	14	
9	SS	26	
10	SS	14	
11	SS	6	MH
12	SS	38	



-- CONTINUED NEXT PAGE --

DEPTH SCALE
1 : 50

LOGGED: LS
CHECKED:

PROJECT: 1417810

RECORD OF BOREHOLE BH-102

SHEET 2 OF 2

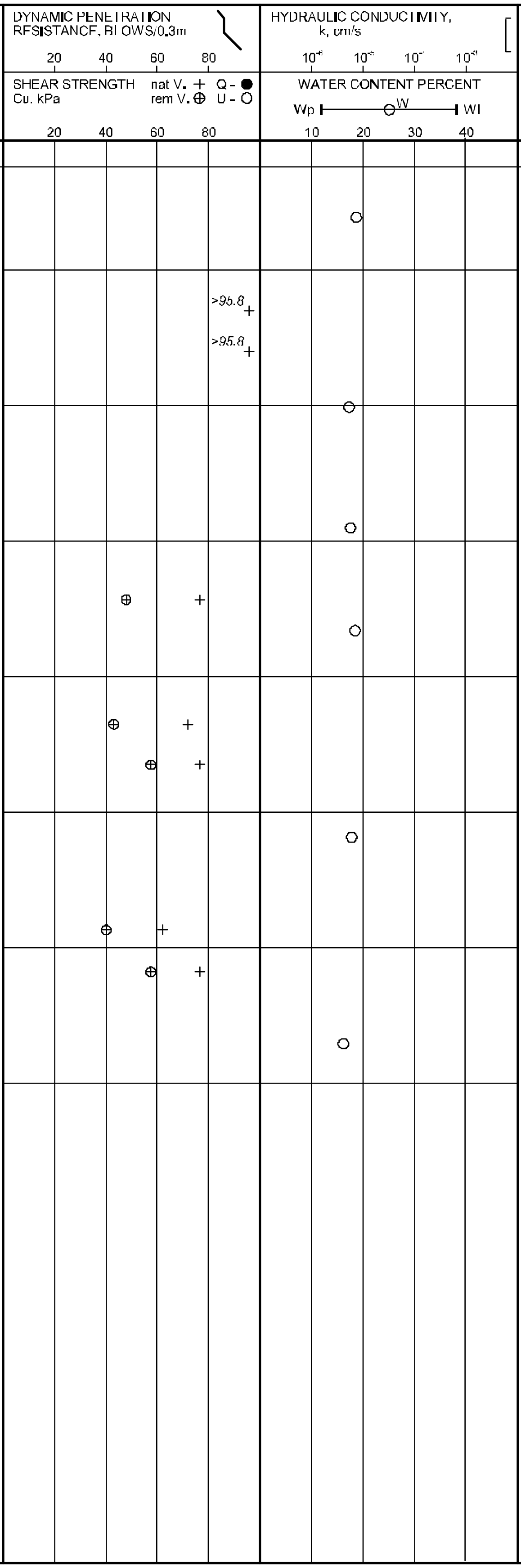
LOCATION: REFER TO LOCATION PLAN

BORING DATE: May 27, 2015
DRILLING CONTRACTOR: Henderson Drilling Inc.

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	ELEVATION	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
9		--- *CONTINUED FROM PREVIOUS PAGE* ---								
	POWER AUGER 83mm ID HOLLOW STEM	(CL) **SILTY CLAY**, some sand, some gravel; grey, with silt seams, cobbles and boulders; firm to hard		8.99	13	SS	6	182		
10										
11				180.48 11.28	14	SS	50/50mm	181		
12		(CL) **SILTY CLAY**, some sand, some gravel; grey; soft to stiff			15	SS	8	180		
13					16	SS	3	179		Bentonite
14					17	SS	3	178		
15				176.06 15.70	18	SS	5	177		
16		END OF BOREHOLE						176		
17										
18										
19										



Groundwater encountered at about elev. 186.6m during drilling on May 27, 2015.

Water level measured in standpipe #1 at elev. 184.66m and in standpipe #2 at elev. 185.71m on May 27, 2015.

Water level measured in standpipe #1 at elev. 186.76m and in standpipe #2 at elev. 186.83m on June 8, 2015.

Water level measured in standpipe #1 at elev. 186.73m and in standpipe #2 at elev. 186.83m on June 26, 2015.

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: LS
CHECKED:

PROJECT: 1417810

RECORD OF BOREHOLE BH-103

SHEET 1 OF 2

LOCATION: REFER TO LOCATION PLAN

BORING DATE: June 9, 2015
DRILLING CONTRACTOR: Henderson Drilling Inc.

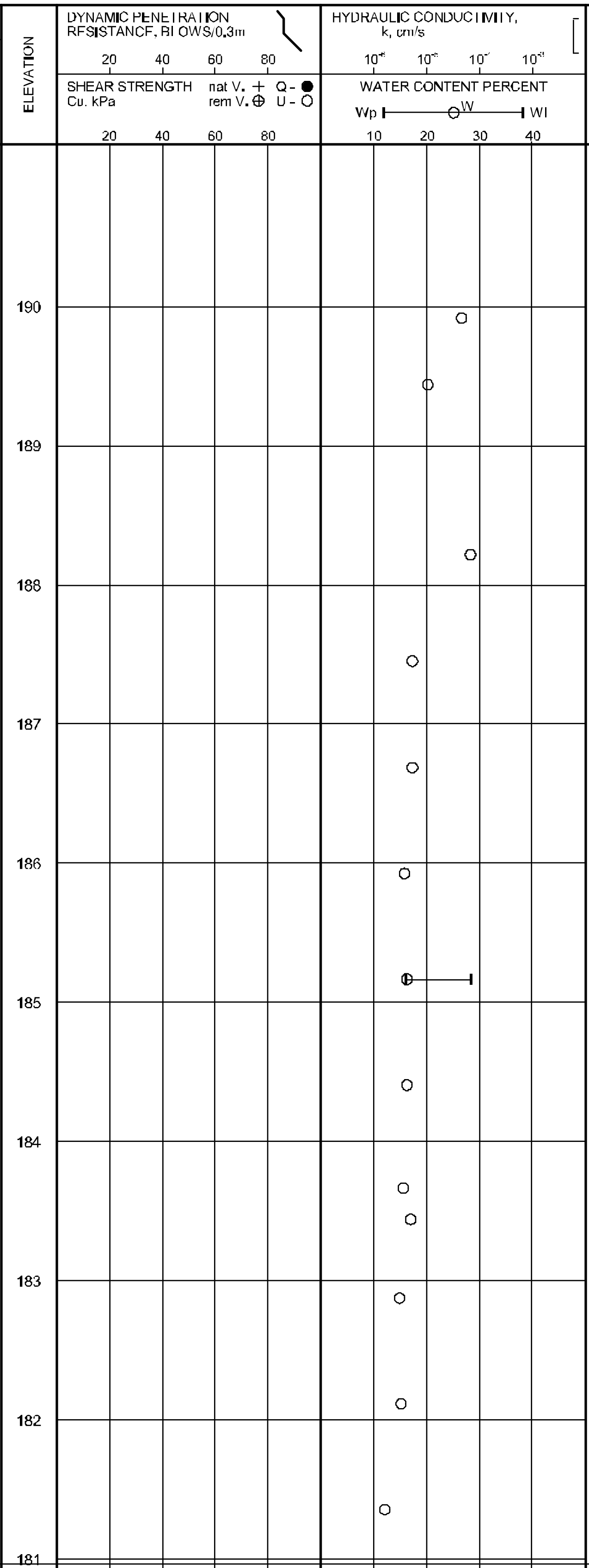
DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

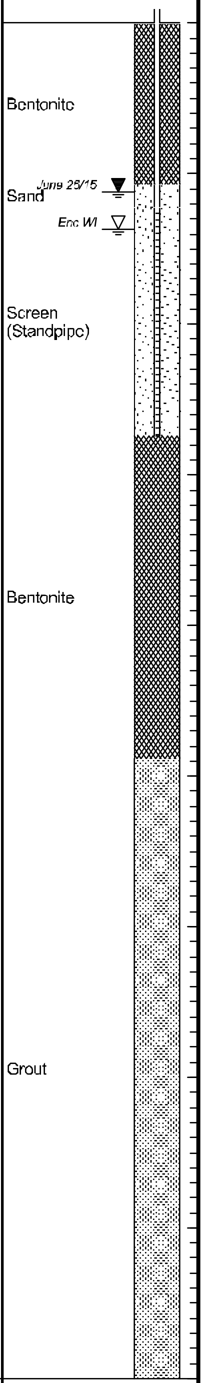
BORING METHOD: POWER AUGER, 89mm ID HOLLOW STEM

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING
0	GROUND SURFACE	189.97				
	TOPSOIL, sandy, trace gravel; brown, with roots	0.00	1	AS		
	FILL - (SM) silty sand, trace topsoil; brown, with wood; loose	0.10	2	AS		
1			3	SS	4	
	FILL - (CL) silty clay, trace sand; brown, with silt layers; firm	188.60 1.37	4	SS	5	
2	(CL) Sandy **SILTY CLAY**, trace to some gravel; grey, **(TILL)**; stiff	187.84 2.13	5	SS	9	
3			6	SS	10	
4			7	SS	9	
5			8	SS	9	MH
			9	SS	10	
6			10	SS	8	
	(ML) **SILT**, some sand; grey; loose	183.47 6.50				
7	(CL) **SILTY CLAY**, some sand, some gravel; brown to grey at about elev. 181.7m, **(TILL)**; stiff	183.27 6.70	11	SS	13	
8			12	SS	10	
9			13	SS	10	

-- CONTINUED NEXT PAGE --



INSTALLATION AND GROUNDWATER OBSERVATIONS



LDN_BHS_07 1417810.GPJ GLDR_LON.GDT 16/07/15 DATA INPUT: WDF

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: LS
CHECKED:

PROJECT: 1417810

RECORD OF BOREHOLE BH-103

SHEET 2 OF 2

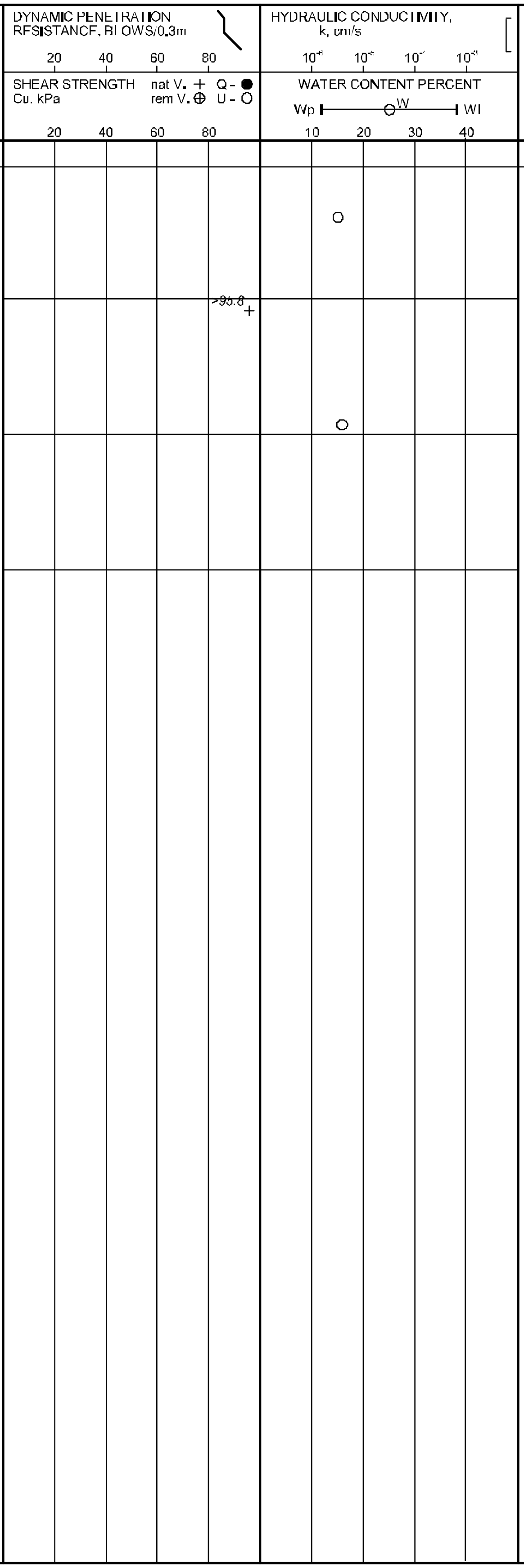
LOCATION: REFER TO LOCATION PLAN

BORING DATE: June 9, 2015
DRILLING CONTRACTOR: Henderson Drilling Inc.

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	ELEVATION	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
9		--- *CONTINUED FROM PREVIOUS PAGE* ---							
	POWER AUGER 88mm ID HOLLOW STEM	(CL) **SILTY CLAY**, some sand, some gravel; brown to grey at about elev. 181.7m, **(TILL)**; stiff		14	3	9			
10							180		Grout
11			178.84	15	SS	9	179		
		END OF BOREHOLE	11.13						Groundwater encountered at about elev. 188.6m during drilling on June 9, 2015. Water level measured in standpipe at elev. 187.47m on June 9, 2015. Water level measured in standpipe at elev. 188.85m on June 26, 2015.
12							178		
13									
14									
15									
16									
17									
18									
19									



DEPTH SCALE
1 : 50

LOGGED: LS
CHECKED:

PROJECT: 1417810

RECORD OF BOREHOLE BH-104

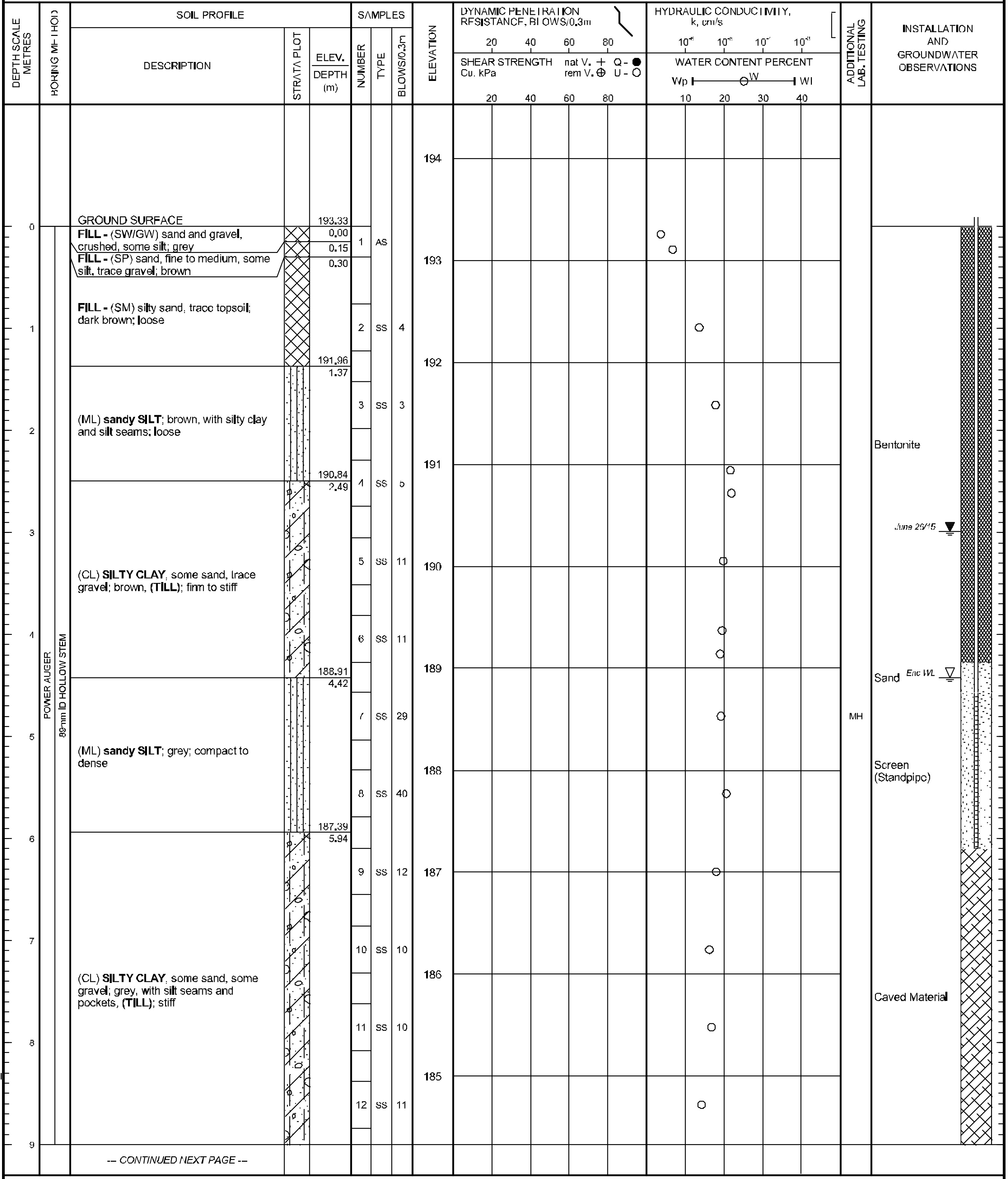
SHEET 1 OF 2

LOCATION: REFER TO LOCATION PLAN

BORING DATE: May 26, 2015
DRILLING CONTRACTOR: Henderson Drilling Inc.

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer



DEPTH SCALE METRES	DESCRIPTION	ELEV. DEPTH (m)
	GROUND SURFACE	193.33
0	**FILL** - (SW/GW) sand and gravel, crushed, some silt; grey	0.00
	FILL - (SP) sand, fine to medium, some silt, trace gravel; brown	0.15
1	**FILL** - (SM) silty sand, trace topsoil; dark brown; loose	0.30
2	(ML) **sandy SILT**; brown, with silty clay and silt seams; loose	191.96 1.37
3, 4	(CL) **SILTY CLAY**, some sand, trace gravel; brown, **(TILL)**; firm to stiff	190.84 2.49
5	(ML) **sandy SILT**; grey; compact to dense	188.91 4.42
6, 7, 8	(CL) **SILTY CLAY**, some sand, some gravel; grey, with silt seams and pockets, **(TILL)**; stiff	187.39 5.94
9	-- *CONTINUED NEXT PAGE* --	

NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING
1	AS		
2	SS	4	
3	SS	3	
4	SS	5	
5	SS	11	
6	SS	11	
7	SS	29	MH
8	SS	40	
9	SS	12	
10	SS	10	
11	SS	10	
12	SS	11	

INSTALLATION AND GROUNDWATER OBSERVATIONS:

Bentonite

June 26/15 ▽

Sand *Enc WL* ▽

Screen (Standpipe)

Caved Material

DEPTH SCALE
1 : 50

LOGGED: LS
CHECKED:

LDN_BHS_07 1417810.GPJ GLDR_LON.GDT 6/07/15 DATA INPUT: WDF

PROJECT: 1417810

RECORD OF BOREHOLE BH-104

SHEET 2 OF 2

LOCATION: REFER TO LOCATION PLAN

BORING DATE: May 26, 2015
DRILLING CONTRACTOR: Henderson Drilling Inc.

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80; SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ 20 40 60 80	HYDRAULIC CONDUCTIVITY, k, cm/s 10^{-6} 10^{-5} 10^{-4} 10^{-3}; WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl 10 20 30 40	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
9		*--- CONTINUED FROM PREVIOUS PAGE ---*										
		(CL) **SILTY CLAY**, some sand, some gravel; grey, with silt seams and pockets, **(TILL)**; stiff		183.73 9.60	13	3	8	184		○		Caved Material
		END OF BOREHOLE										Groundwater encountered at about elev. 188.9m during drilling on May 26, 2015.
10								183				Water level measured in standpipe at elev. 188.63m on May 26, 2015. Water level measured in standpipe at elev. 190.41m on June 8, 2015. Water level measured in standpipe at elev. 190.34m on June 26, 2015.
11												
12												
13												
14												
15												
16												
17												
18												
19												

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: LS
CHECKED:

PROJECT: 1417810

RECORD OF BOREHOLE BH-105

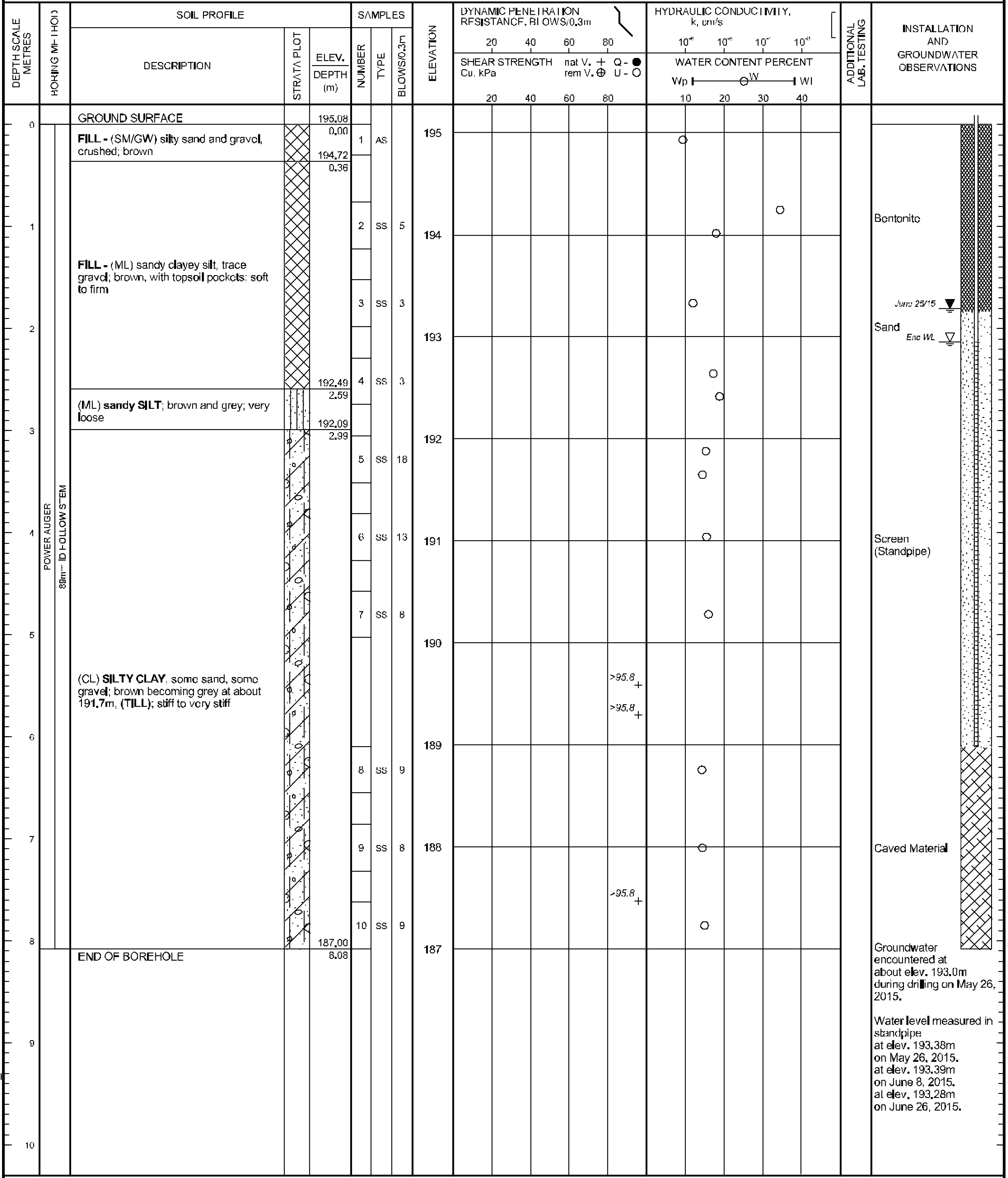
SHEET 1 OF 1

LOCATION: REFER TO LOCATION PLAN

BORING DATE: May 26, 2015
DRILLING CONTRACTOR: Henderson Drilling Inc.

DATUM: GEODETIC

HAMMER TYPE: Auto Hammer



SOIL PROFILE DESCRIPTION	ELEV. / DEPTH (m)
GROUND SURFACE	195.08
FILL - (SM/GW) silty sand and gravel, crushed; brown	0.00
FILL - (ML) sandy clayey silt, trace gravel; brown, with topsoil pockets: soft to firm	194.72 0.36
(ML) **sandy SILT**; brown and grey; very loose	192.49 2.59
(CL) **SILTY CLAY**, some sand, some gravel; brown becoming grey at about 191.7m, **(TILL)**; stiff to very stiff	192.09 2.99
END OF BOREHOLE	187.00 8.08

SAMPLES NUMBER	TYPE	BLOWS/0.3m
1	AS	
2	SS	5
3	SS	3
4	SS	3
5	SS	18
6	SS	13
7	SS	8
8	SS	9
9	SS	8
10	SS	9

Groundwater encountered at about elev. 193.0m during drilling on May 26, 2015.

Water level measured in standpipe
at elev. 193.38m
on May 26, 2015.
at elev. 193.39m
on June 8, 2015.
al elev. 193.28m
on June 26, 2015.

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: LS
CHECKED:

PROJECT: 1417810

RECORD OF BOREHOLE BH-106

SHEET 1 OF 1

LOCATION: REFER TO LOCATION PLAN

BORING DATE: May 26, 2015
DRILLING CONTRACTOR: Henderson Drilling Inc.

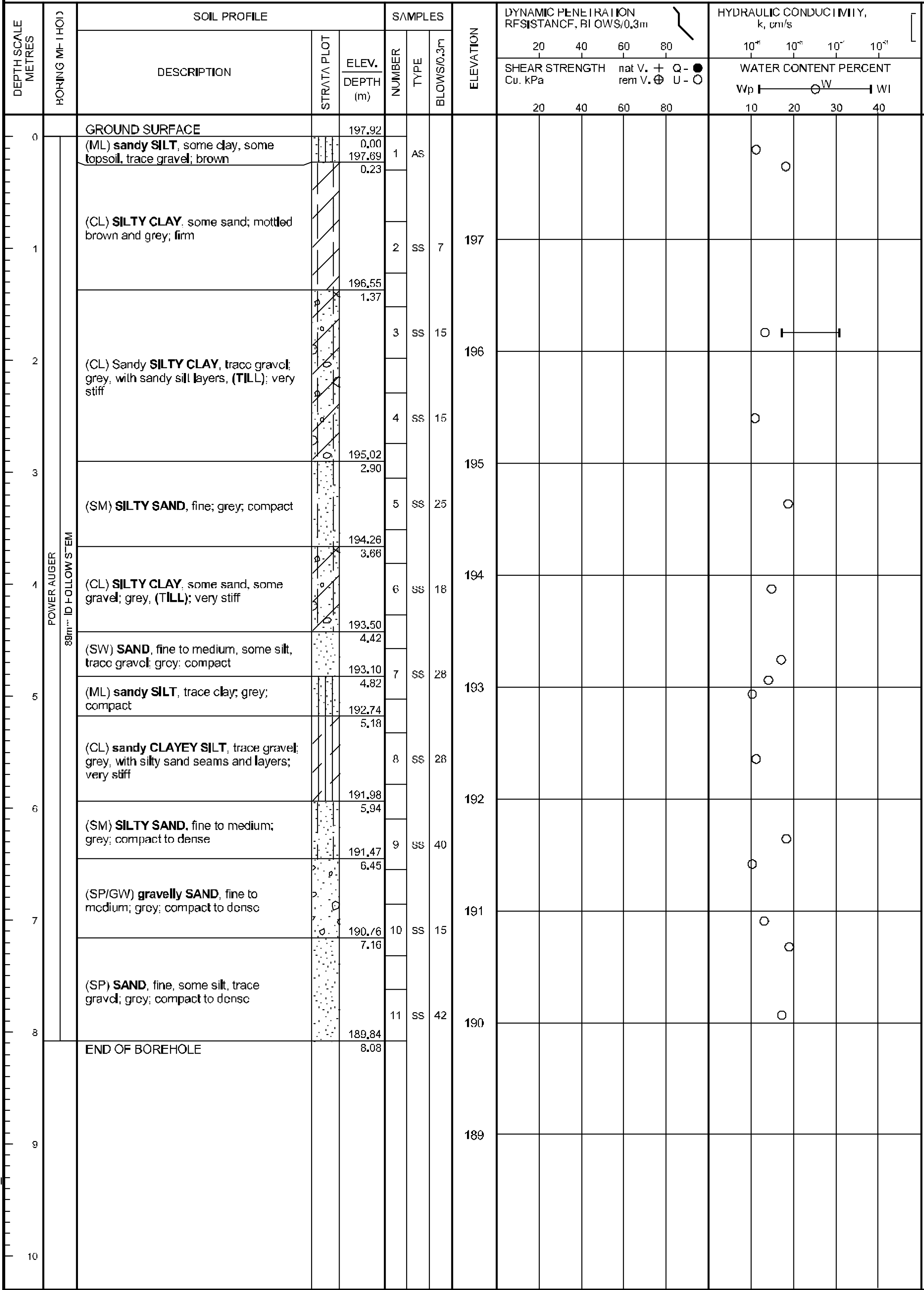
DATUM: GEODETIC

HAMMER TYPE: Auto Hammer

BORING METHOD: POWER AUGER 89mm ID HOLLOW STEM

DESCRIPTION	ELEV. DEPTH (m)
GROUND SURFACE	197.92 0.00
(ML) **sandy SILT**, some clay, some topsoil, trace gravel; brown	197.69 0.23
(CL) **SILTY CLAY**, some sand; mottled brown and grey; firm	196.55 1.37
(CL) Sandy **SILTY CLAY**, trace gravel; grey, with sandy silt layers, **(TILL)**; very stiff	195.02 2.90
(SM) **SILTY SAND**, fine; grey; compact	194.26 3.66
(CL) **SILTY CLAY**, some sand, some gravel; grey, **(TILL)**; very stiff	193.50 4.42
(SW) **SAND**, fine to medium, some silt, trace gravel; grey; compact	193.10 4.82
(ML) **sandy SILT**, trace clay; grey; compact	192.74 5.18
(CL) **sandy CLAYEY SILT**, trace gravel; grey, with silty sand seams and layers; very stiff	191.98 5.94
(SM) **SILTY SAND**, fine to medium; grey; compact to dense	191.47 6.45
(SP/GW) **gravelly SAND**, fine to medium; grey; compact to dense	190.76 7.16
(SP) **SAND**, fine, some silt, trace gravel; grey; compact to dense	189.84 8.08
END OF BOREHOLE	

SAMPLES NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING
1	AS		
2	SS	7	
3	SS	15	MH
4	SS	15	
5	SS	25	
6	SS	18	
7	SS	28	
8	SS	26	
9	SS	40	
10	SS	15	
11	SS	42	



INSTALLATION AND GROUNDWATER OBSERVATIONS

June 26/15

Bentonite

Sand

Enc WL

Screen (Standpipe)

Enc WL

Bentonite

Caved Material

Groundwater encountered at about elev. 194.9m and 193.5m during drilling on May 26, 2015.

Water level measured in standpipe
at elev. 197.22m
on May 26, 2015.
at elev. 197.40m
on June 8, 2015.
at elev. 197.50m
on June 26, 2015.

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: LS
CHECKED:

LDN_BHS_07 1417810.GPJ GLDR_LON.GDT 6/07/15 DATA INPUT: WDF

KEY PLAN

LEGEND

- - - - DENOTES ESSELTINE DRAIN
- ● BOREHOLE (Current Investigation)
- 🟢 BOREHOLE (Golder Report No.05-1140-109)
- ✦ BOREHOLE (Golder Report No.05-1140-196)
- ◆ BOREHOLE (Golder Report No.011-4228)

REFERENCE

DRAWING BASED ON 2008 AERIAL IMAGE FROM THE COUNTY OF ESSEX INTERACTIVE WEB MAPPING SITE, BY PERMISSION; AND CANMAP STREETFILES V2008.4.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT
GEOTECHNICAL INVESTIGATION
ESSELTINE DRAIN IMPROVEMENTS
TOWN OF KINGSVILLE, ONTARIO

TITLE
LOCATION PLAN

Golder Associates

PROJECT No.		1417810	FILE No.	1417810-2000-R01001A
			SCALE AS SHOWN	REV. 0
CADD	NR/DB	July 23/15	**FIGURE 1A**	
CHECK				

Drawing file: 1417810-2000-R01001A.dwg Jul 24, 2015 - 3:07pm

KEY PLAN

LEGEND

- - - - DENOTES ESSELTINE DRAIN

● BOREHOLE (Current Investigation)

● BOREHOLE (Golder Report No.05-1140-109)

● BOREHOLE (Golder Report No.05-1140-196)

● BOREHOLE (Golder Report No.011-4228)

① SITE PHOTOGRAPH LOCATION, DIRECTION AND IDENTIFICATION

REFERENCE

DRAWING BASED ON 2008 AERIAL IMAGE FROM THE COUNTY OF ESSEX INTERACTIVE WEB MAPPING SITE, BY PERMISSION; AND CANMAP STREETFILES V2008.4.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

FOR CROSS SECTIONS SEE FIGURES 2,3 & 4.

PROJECT

GEOTECHNICAL INVESTIGATION
ESSELTINE DRAIN IMPROVEMENTS
TOWN OF KINGSVILLE, ONTARIO

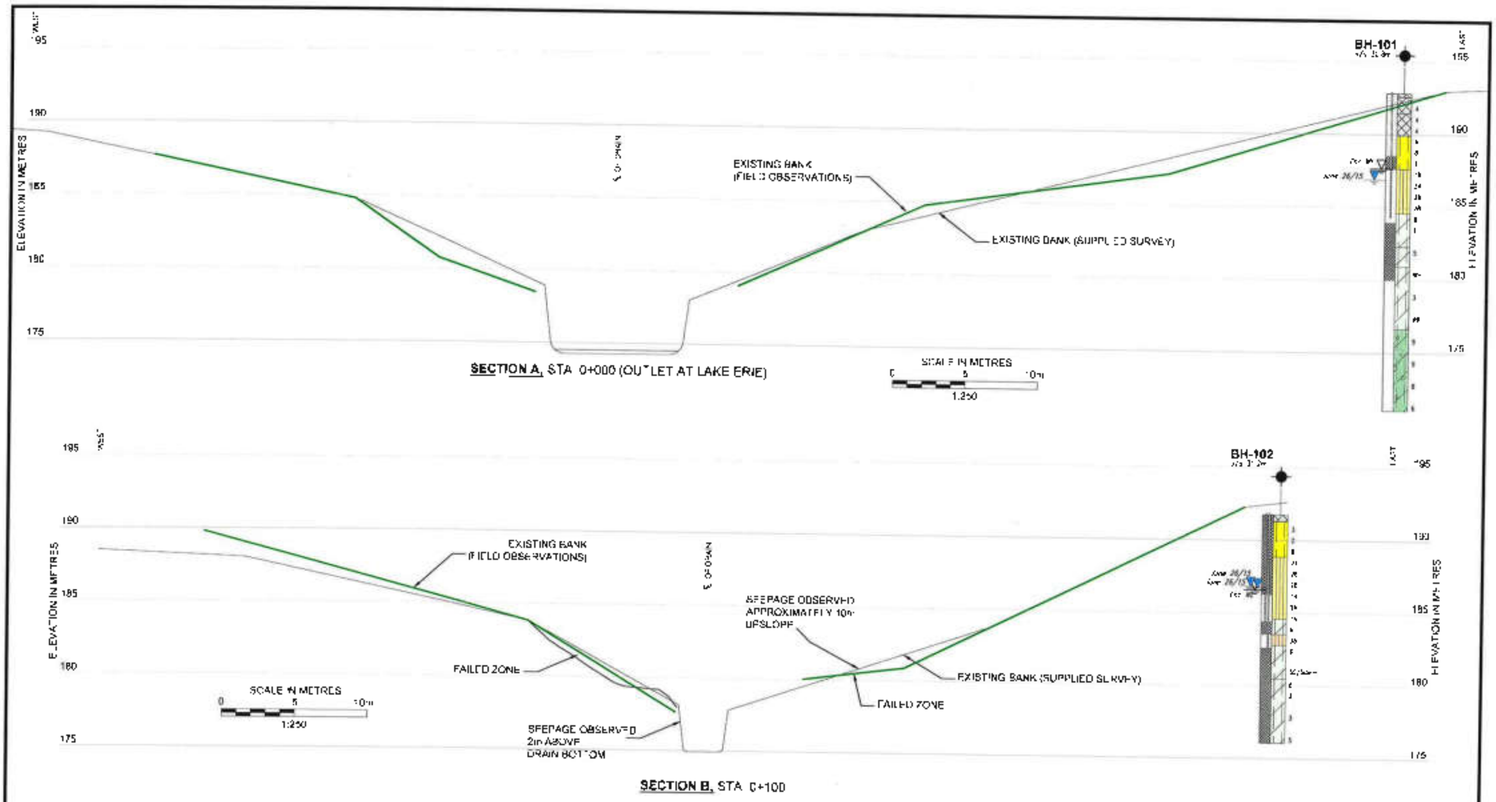
TITLE

LOCATION PLAN

Golder Associates

PROJECT No.		1417810	FILE No.	1417810-2000-R01001B
			SCALE AS SHOWN	REV. 0
CADD	NF/DB	July 2015	**FIGURE 1B**	
CHECK				

Drawing file: 1417810-2000-R01001B.dwg Jul 24, 2015 - 10:00am



SECTION A, STA 0+000 (OUTLET AT LAKE ERIE)

SECTION B, STA 0+100

LEGEND

- ● BOREHOLE (Current Investigation)
- ● BOREHOLE (Golder Report No. 05-1140-159)

WATER LEVEL
STRATA PLOT
PENETRATION RESISTANCE
FOR DETAILS REFER TO RECORD OF BOREHOLES

SIMPLIFIED STRATIGRAPHY

▨ FILL	▨ SILTY CLAY
🟨 SILTY SAND	🟩 SILTY CLAY TILL
▥ SANDY SILT	
▥ SILT	

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE

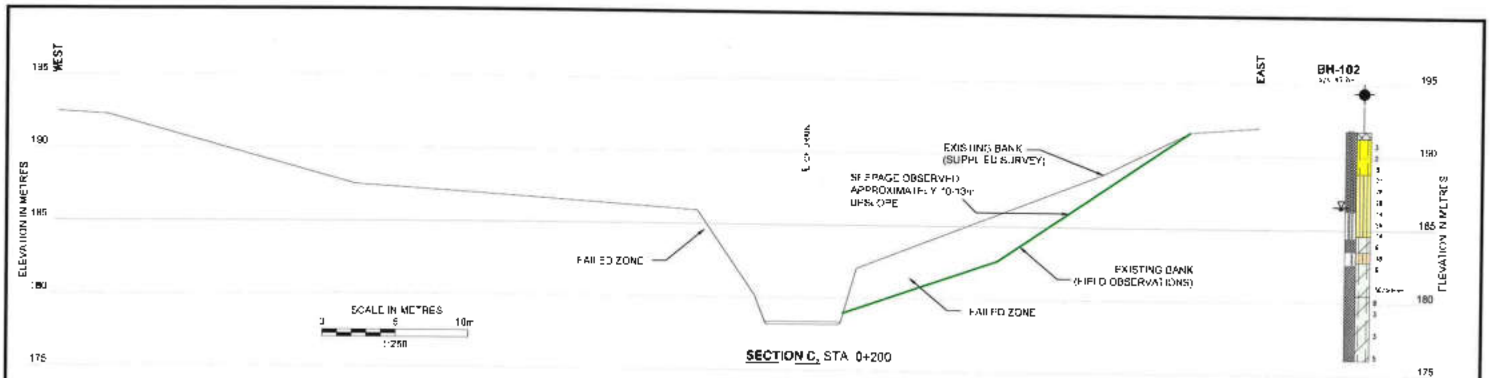
FOR LOCATION OF CROSS SECTIONS SEE FIGURE 1.

GEOTECHNICAL INVESTIGATION
ESSELTINE DRAIN IMPROVEMENTS
TOWN OF KINGSVILLE, ONTARIO

CROSS SECTIONS A AND B

Golder Associates

FIGURE 2



SECTION C, STA. 0+200

SECTION D, STA. 0+300

LEGEND

BOREHOLE (Current Investigation)

BOREHOLE (Golder Report No. 05-1140-109)

WATER LEVEL

STRATA PLOT

PENETRATION RESISTANCE

FOR DETAILS REFER TO RECORD OF BOREHOLES

SIMPLIFIED STRATIGRAPHY

▨	FILL	▥	SANDY SILT
▥	SILTY SAND	▥	SILT
□	SAND	▧	SILTY CLAY
		▧	SILTY CLAY TILL

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT

ALL LOCATIONS ARE APPROXIMATE

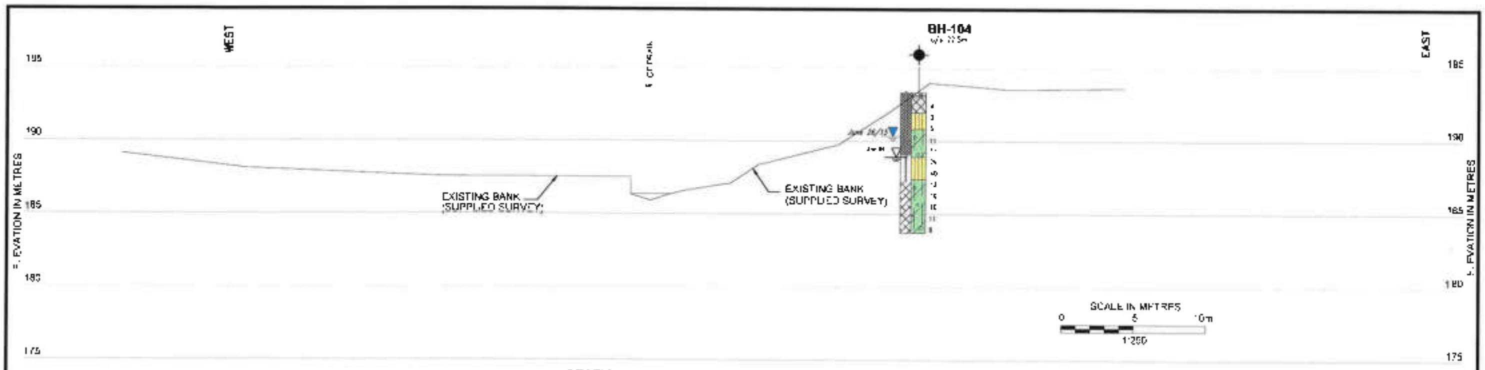
FOR LOCATION OF CROSS SECTIONS SEE FIGURE 2

GEOTECHNICAL INVESTIGATION
ESSELTINE DRAIN IMPROVEMENTS
TOWN OF KINGSVILLE, ONTARIO

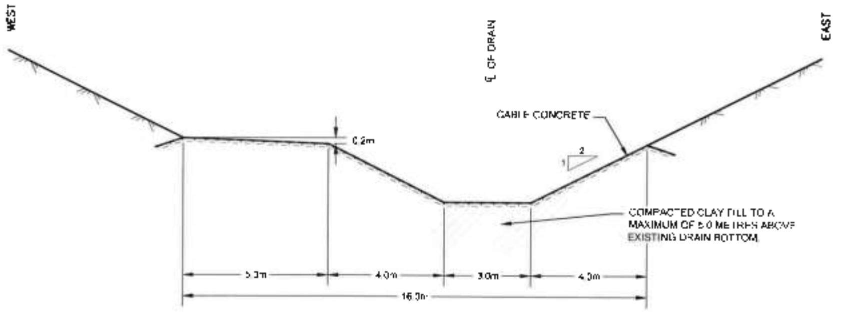
CROSS SECTIONS C AND D

Golder Associates

FIGURE 3



SECTION E, STA 0+575



PROPOSED CHANNEL REGRADING (TYPICAL DETAIL)

SCALE IN METRES
0 2.5 5m
1:125

LEGEND

- ● BOREHOLE (Current Investigation)
- ● BOREHOLE (Golder Report No. 05-1140-109)

WATER LEVEL
STRATA PLOT
PENETRATION RESISTANCE
FOR DETAILS REFER TO RECORD OF SCHEDULES

SIMPLIFIED STRATIGRAPHY

▨	FILL	▥	SANDY SILT
🟨	SILTY SAND	▥	SILT
🟨	SAND	▨	SILTY CLAY
		🟩	SILTY CLAY TILL

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE

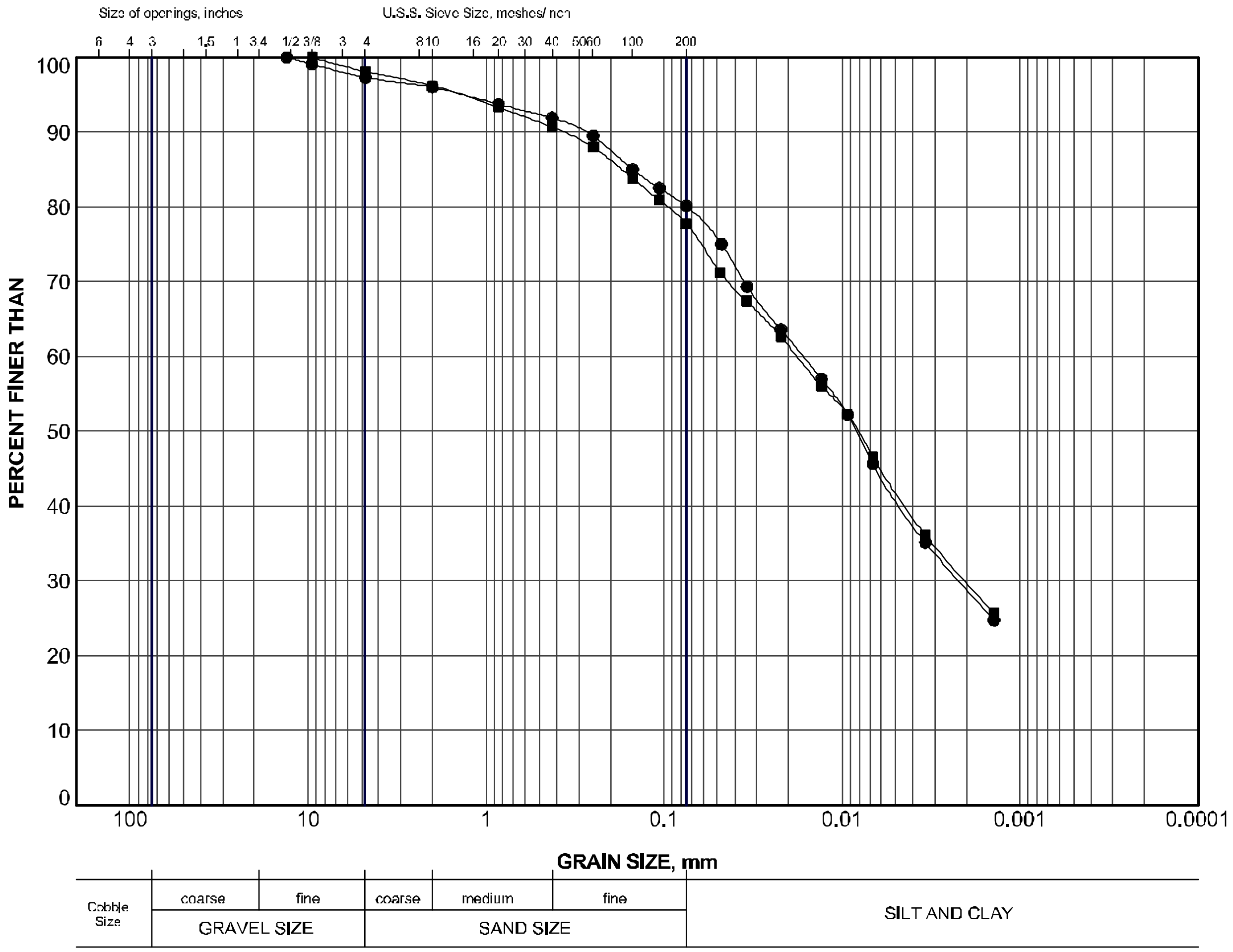
FOR LOCATION OF CROSS SECTIONS SEE FIGURE 1

GEOTECHNICAL INVESTIGATION
ESSELTINE DRAIN IMPROVEMENTS
TOWN OF KINGSVILLE, ONTARIO

CROSS SECTION E AND TYPICAL DETAIL

Golder Associates

FIGURE 4



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH-103	8	185.2
■	BH-106	3	196.2

PROJECT

GEOTECHNICAL INVESTIGATION
ESSELTINE DRAIN IMPROVEMENTS
TOWN OF KINGSVILLE, ONTARIO

TITLE

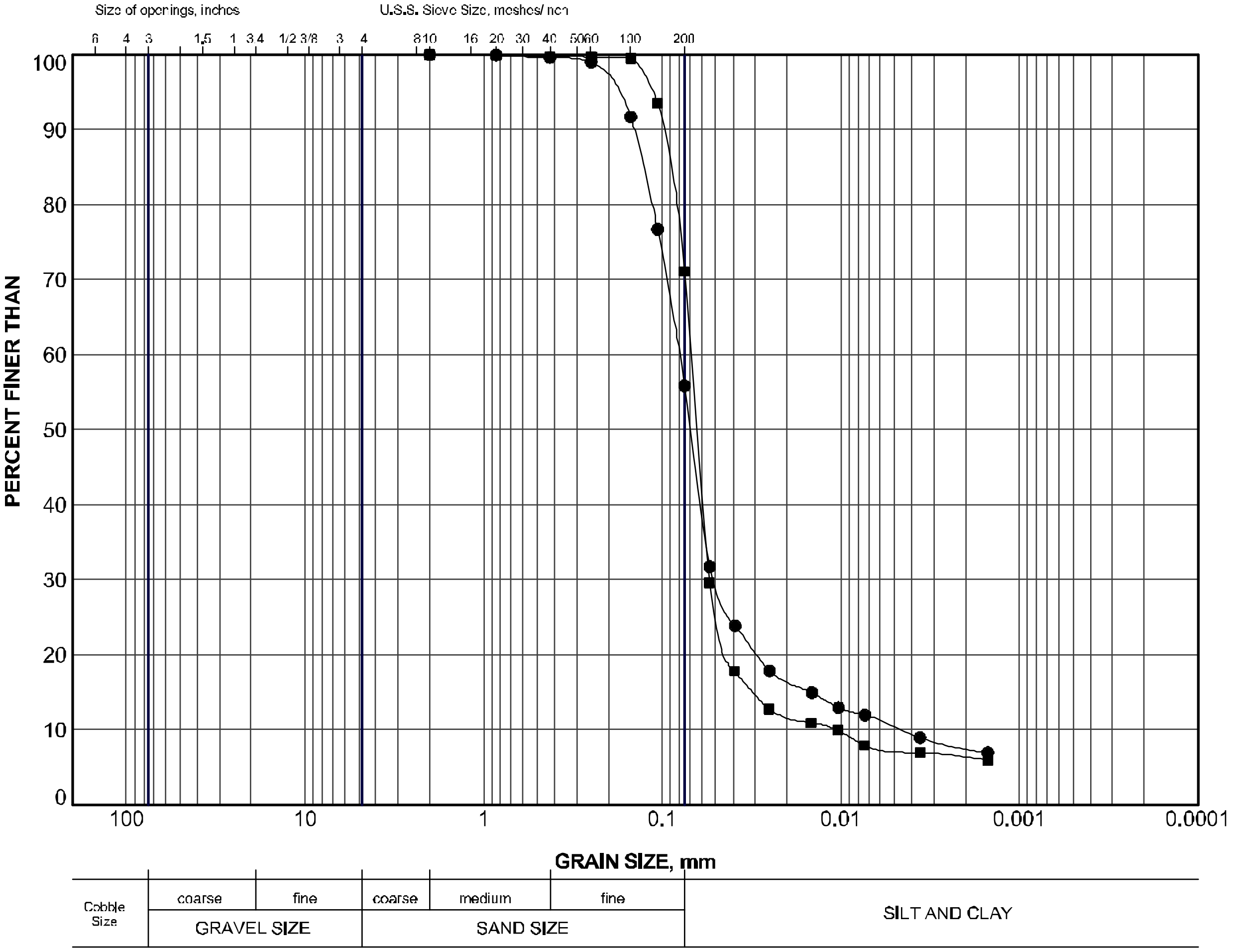
GRAIN SIZE DISTRIBUTION

SILTY CLAY (TILL)

Golder Associates

PROJECT No.		1417810	FILE No. 1417810-2000-R01005
			SCALE N/A REV.
DRAWN	WDF	July 03 15	**FIGURE 5**
CHECK			

LDN_GSD GLDR_LDN.GDT 22/06/15



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH-101	8	187.3
■	BH-104	7	188.5

PROJECT

GEOTECHNICAL INVESTIGATION
ESSELTINE DRAIN IMPROVEMENTS
TOWN OF KINGSVILLE, ONTARIO

TITLE

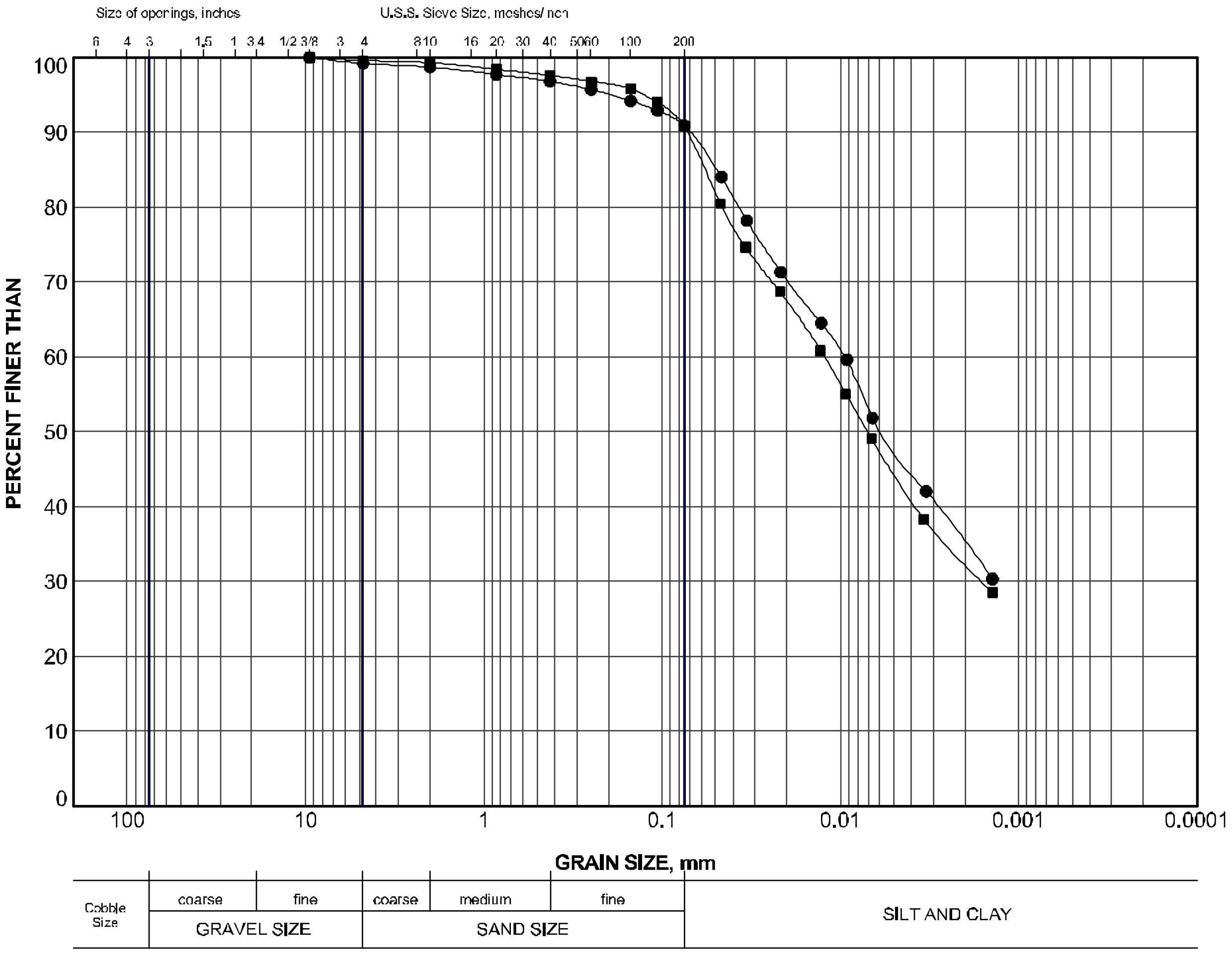
GRAIN SIZE DISTRIBUTION

sandy SILT

Golder Associates

PROJECT No.		1417810	FILE No. 1417810-2000-R01006	
			SCALE N/A	REV.
DRAWN	WDF	July 03 15	**FIGURE 6**	
CHECK				

LDN_GSD GLDR_LDN.GDT 22/06/15



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	BH-101	13	183.5
■	BH-102	11	183.9

PROJECT

GEOTECHNICAL INVESTIGATION
ESSELTINE DRAIN IMPROVEMENTS
TOWN OF KINGSVILLE, ONTARIO

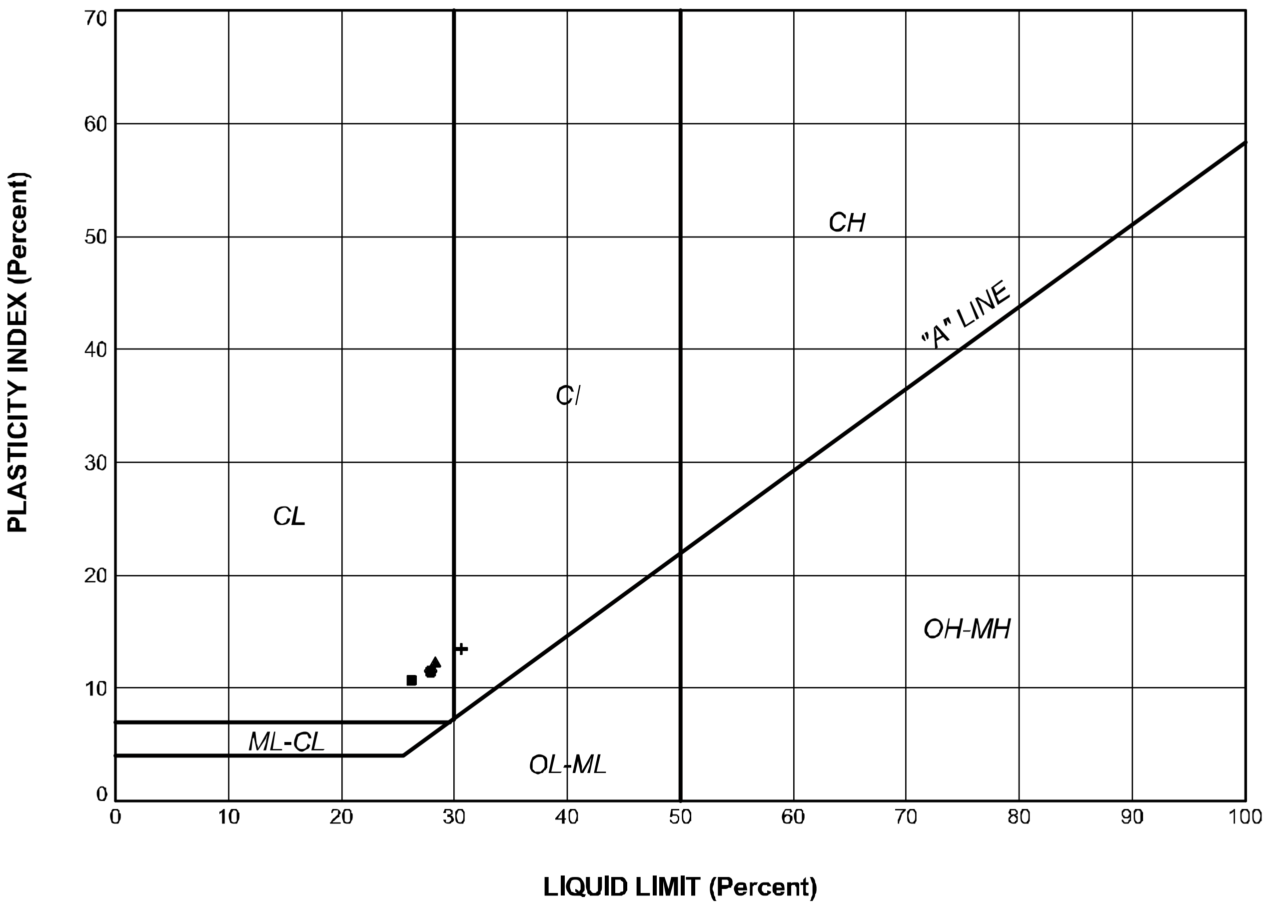
TITLE

GRAIN SIZE DISTRIBUTION

SILTY CLAY

Golder Associates

PROJECT No.		1417810	FILE No. 1417810-2000-R01007
			SCALE N/A · REV.
DRAWN	WDF	July 03 15	**FIGURE 7**
CHECK			



SOIL TYPE	**PLASTICITY**
C = Clay	L = Low
M = Silt	I = Intermediate
O = Organic	H = High

LEGEND

SYMBOL	BOREHOLE	SAMPLE	LL(%)	PL(%)	PI
●	BH-101	13	27.9	16.4	11.5
■	BH-102	11	26.2	15.5	10.8
▲	BH-103	8	28.3	16.0	12.4
✚	BH-106	3	30.6	17.1	13.5

PROJECT

GEOTECHNICAL INVESTIGATION
ESSELTINE DRAIN IMPROVEMENTS
TOWN OF KINGSVILLE, ONTARIO

TITLE

PLASTICITY CHART

Golder Associates

PROJECT No.		1417810	FILE No.	1417810-2000-R01008
			SCALE N/A	REV.
DRAWN	WDI	July 03 15	**FIGURE 8**	
CHECK				

LDN_PI GLDR_LON.GDT 22/06/15

APPENDIX A

Records of Previous Boreholes

PROJECT: 011-4228

RECORD OF BOREHOLE 4

SHEET 1 OF 1

LOCATION: SEE LOCATION PLAN

BORING DATE: October 16, 2001

DATUM: GEODETIC

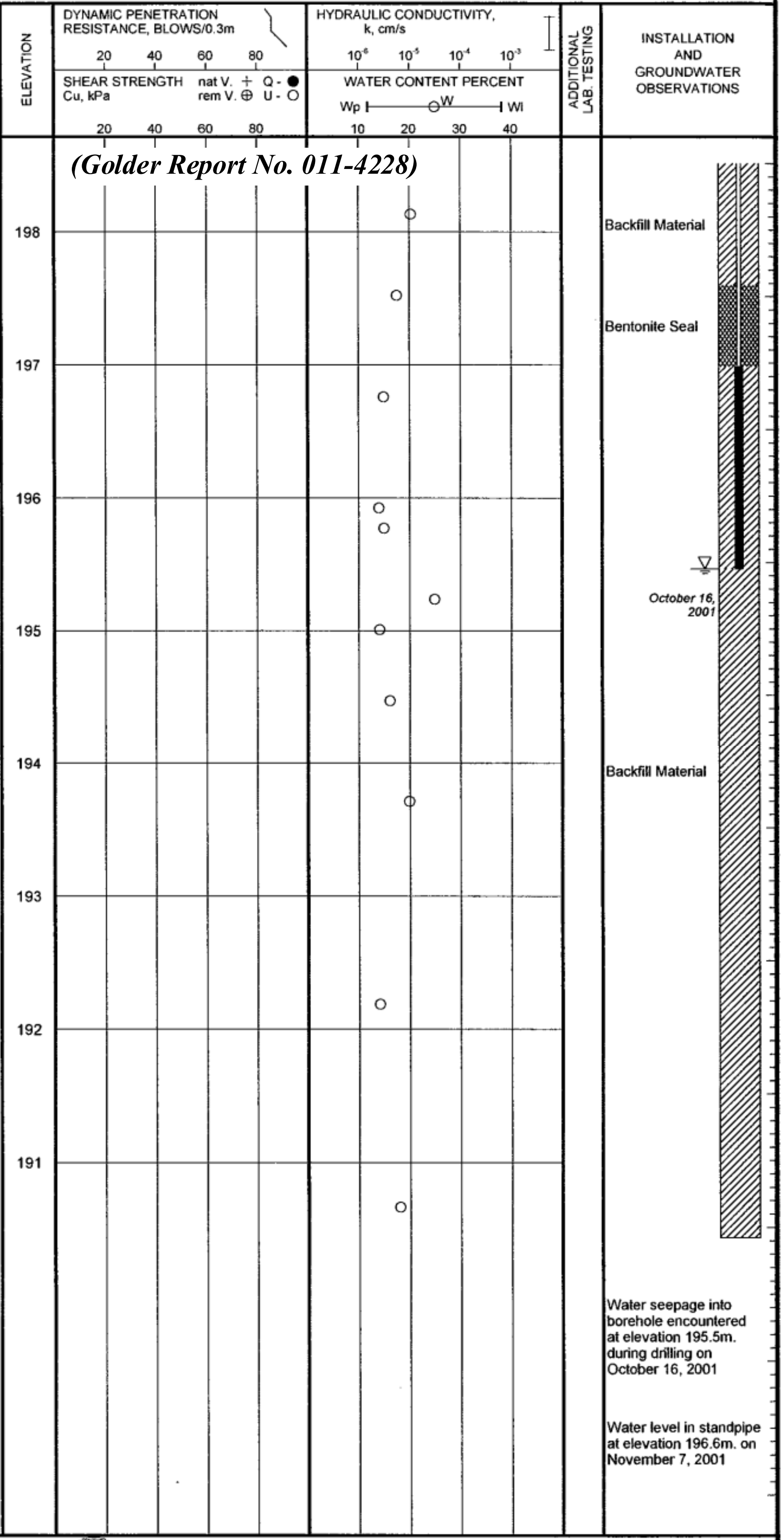
SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

(Golder Report No. 011-4228)

BORING METHOD: POWER AUGER SOLID STEM

SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m
GROUND SURFACE	198.52			
Dark brown clayey topsoil, occ. brown silty clay pockets (FILL)	0.00	1	AS	-
Hard to very stiff, mottled brown and grey SILTY CLAY, some sand, trace gravel, rootlets, fissured (TILL)	197.75 0.76	2	50 DO	31
		3	50 DO	26
Hard, brown SILTY CLAY to CLAYEY SILT, trace to some sand and gravel, fissured (TILL)	196.38 2.13	4	50 DO	40
Hard, grey SILTY CLAY to CLAYEY SILT (TILL)	195.92 2.59			
Compact, brown to grey FINE SAND, trace silt, occ. clayey zones	195.62 2.90	5	50 DO	27
Very stiff to hard, grey SILTY CLAY to CLAYEY SILT, trace to some sand and gravel, occ. to some silt and/ or fine sand pockets, partings and seams (TILL)	195.24 3.28	6	50 DO	26
		7	50 DO	24
		8	50 DO	50
		9	50 DO	98
END OF BOREHOLE	190.44 8.08			



Water seepage into borehole encountered at elevation 195.5m. during drilling on October 16, 2001

Water level in standpipe at elevation 196.6m. on November 7, 2001

DEPTH SCALE
1 : 50

LOGGED: C.C.
CHECKED:

PROJECT: 011-4228

RECORD OF BOREHOLE 5

SHEET 1 OF 1

LOCATION: SEE LOCATION PLAN

BORING DATE: October 16, 2001

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

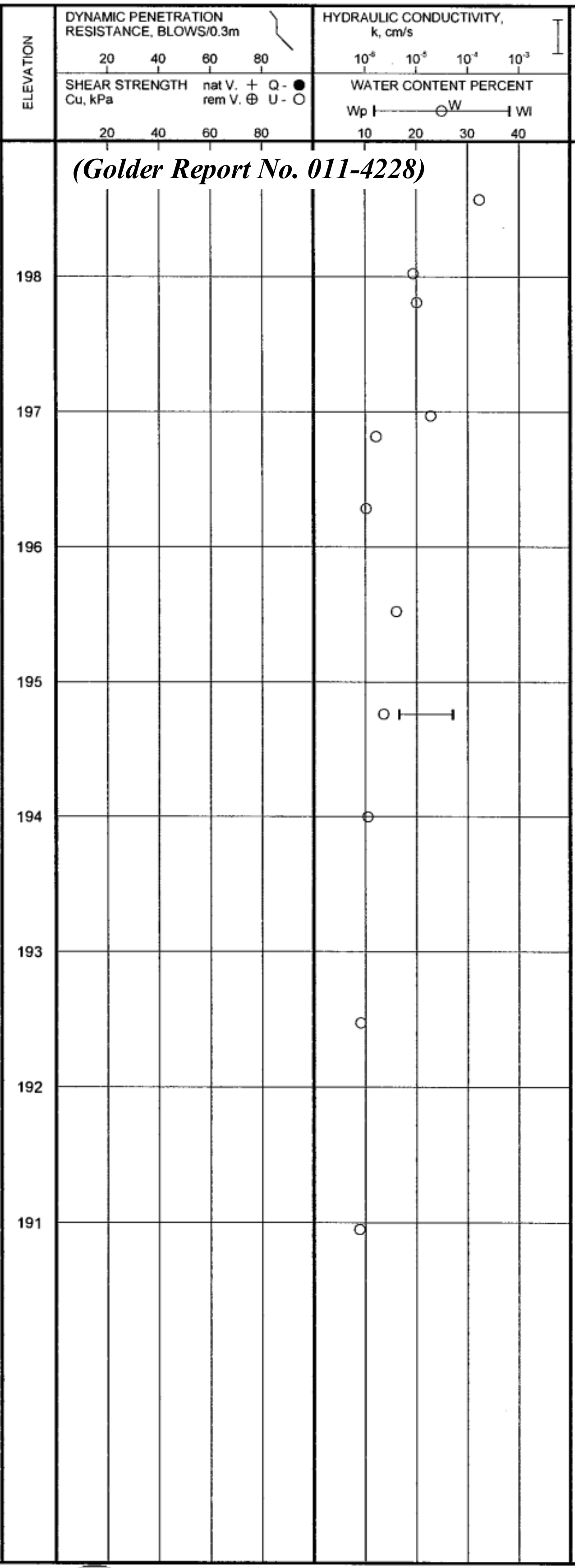
PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

(Golder Report No. 011-4228)

BORING METHOD: POWER AUGER, SOLID STEM

SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)
GROUND SURFACE	198.80 0.00
Black clayey TOPSOIL	198.57 0.23
Very stiff, mottled brown and grey SILTY CLAY, some sand, trace gravel, occ. silt pockets, fissured (TILL)	197.43 1.37
Very dense, brown SILT, trace sand, occ. clayey partings/zones	196.97 1.83
Hard, brown SILTY CLAY, fissured (TILL)	196.67 2.13
Hard, grey SILTY CLAY, some sand and gravel (TILL)	195.90 2.90
Very dense, grey SANDY SILT, occ. clayey pockets	195.45 3.35
Hard, grey SILTY CLAY to CLAYEY SILT, trace to some sand and gravel, occ. to numerous silt partings and/ or pockets (TILL)	190.72 8.08
END OF BOREHOLE	

SAMPLES NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING
1	AS	-	
2	50 DO	21	
3	50 DO	35	
4	50 DO	>55	
5	50 DO	>70	
6	50 DO	76	MH
7	50 DO	105	
8	50 DO	130	
9	50 DO	>66	



INSTALLATION AND GROUNDWATER OBSERVATIONS

Water level in open borehole at about elevation 197.3m. approximatly 4 hours of drilling completion on October 16, 2001

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: C.C.

CHECKED:

PROJECT: 011-4228

RECORD OF BOREHOLE 6

SHEET 1 OF 1

LOCATION: SEE LOCATION PLAN

BORING DATE: October 16, 2001

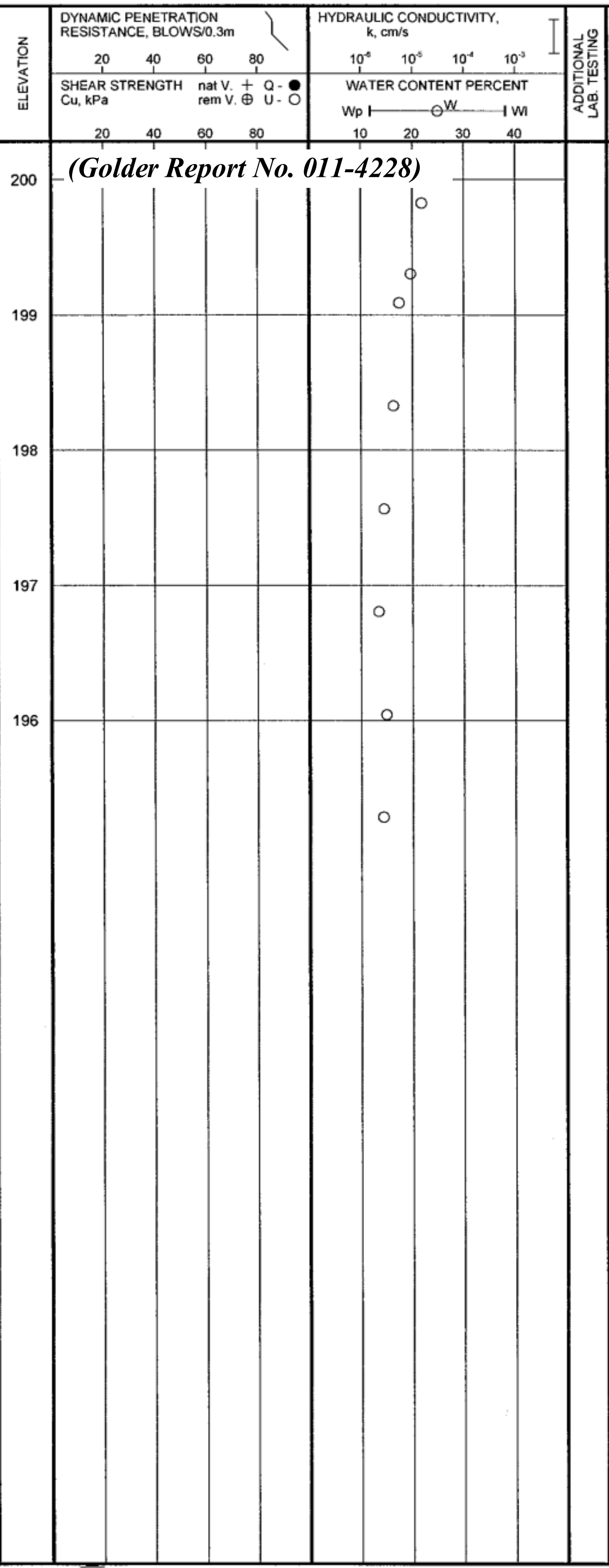
DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

(Golder Report No. 011-4228)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	INSTALLATION AND GROUNDWATER OBSERVATIONS
0	POWER AUGER SOLID STEM	GROUND SURFACE	200.08 0.00				
		Black clayey TOPSOIL	199.83 0.25				
		Very stiff, mottled brown and grey SILTY CLAY, some sand, trace gravel (TILL)		1	AS	-	
1			198.71 1.37	2	50 DO	18	
		Hard, brown SILTY CLAY, some sand and gravel, fissured (TILL)		3	50 DO	55	
2			197.39 2.69	4	50 DO	34	Borehole dry during drilling on October 16, 2001
3		Very stiff, grey SILTY CLAY to CLAYEY SILT, trace to some sand and gravel (TILL)		5	50 DO	29	
4				6	50 DO	20	
			195.05 5.03	7	50 DO	22	
5		END OF BOREHOLE					
6							
7							
8							
9							
10							



DEPTH SCALE

1 : 50

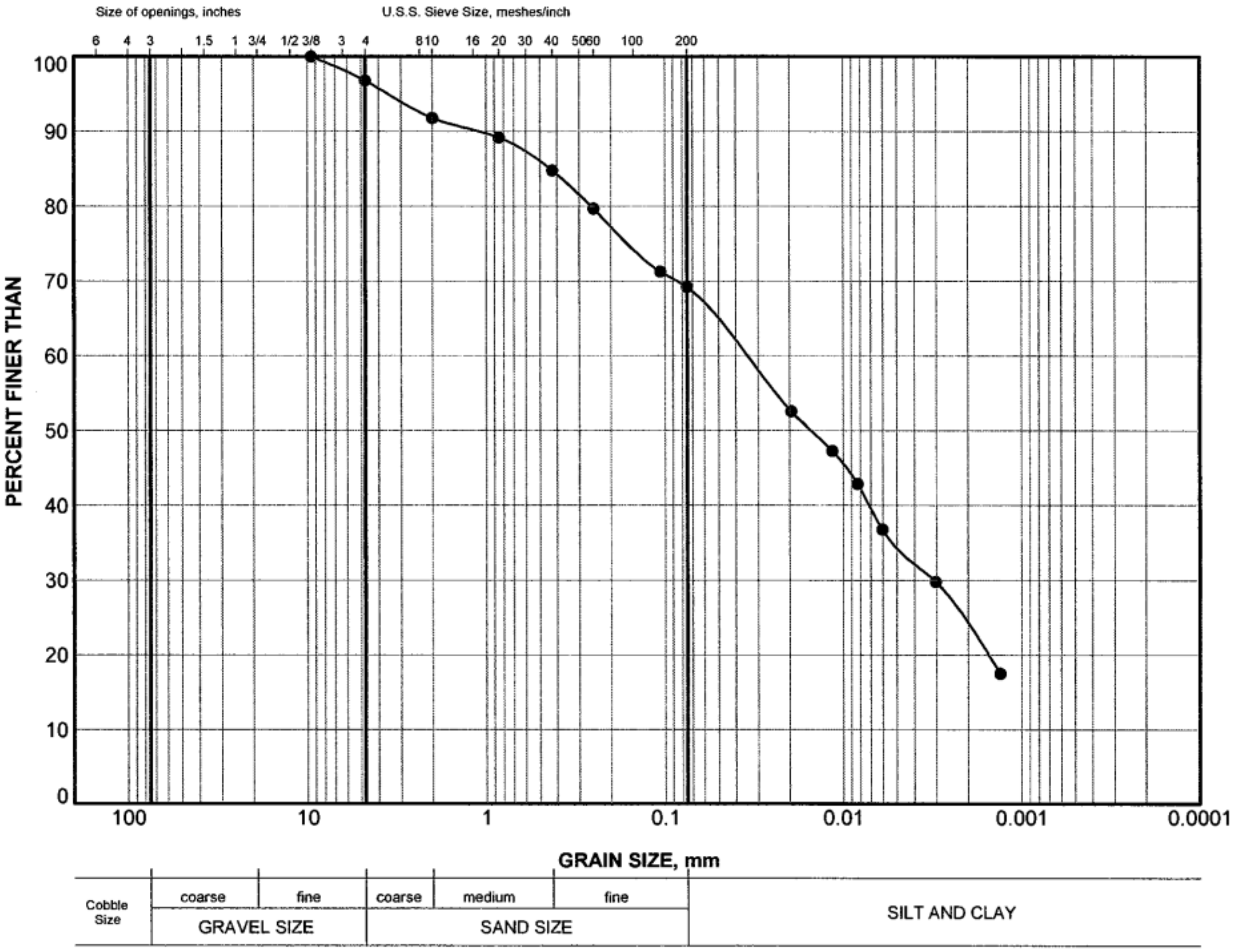
Golder Associates

LOGGED: C.C.

CHECKED:

LDN_BHS 011-4228.GPJ GLDR_CAN.GDT 12-13-01 DATA INPUT: Tony Mastroianni

(Golder Report No. 011-4228)



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	5	6	194.8

PROJECT

STANTEC CONSULTING LTD.
PROPOSED 2nd CONCESSION TRUNK WATERMAIN,
UNION WATER SYSTEM, TOWN OF KINGSVILLE, ONT.

TITLE

GRAIN SIZE DISTRIBUTION CURVE

SILTY CLAY TO CLAYEY SILT (TILL)

Golder Associates
WINDSOR, ONTARIO

PROJECT No.		011-4228	FILE No.	011-4228.GPJ	
			SCALE	N/A	REV.
DRAWN	T.M.	12-13-01	FIGURE 4		
CHECK		12-13-01			

LDN_GSD_NEW GLDR_LDN.GDT

PROJECT: 05-1140-109

LOCATION: SEE LOCATION PLAN

SAMPLER HAMMER, 63.5kg; DROP, 760mm

RECORD OF BOREHOLE 1

BORING DATE: MAY 19, 2005

SHEET 1 OF 1

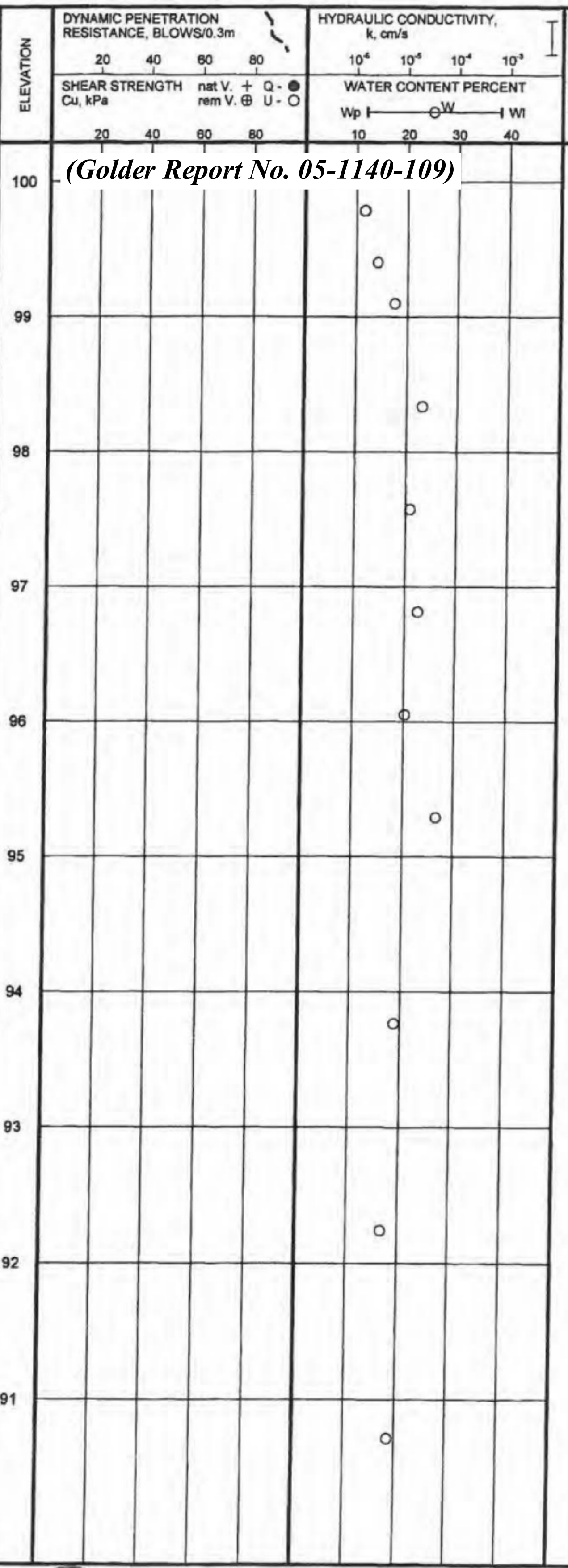
DATUM: LOCAL

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

(Golder Report No. 05-1140-109)

BORING METHOD: POWER AUGER, SOLID STEM

SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m
GROUND SURFACE	100.09 0.00			
Reddish brown, **SILTY FINE SAND**, trace clay		1	AS	-
		2	50 DO	8
	98.72 1.37			
Compact, brown, **FINE SAND**, trace silt		3	50 DO	14
	97.96 2.13			
Compact, grey, **SILTY FINE SAND** to **SANDY SILT**		4	50 DO	23
		5	50 DO	18
	96.43 3.66			
Loose to compact, grey, **FINE SAND**, trace to some silt		6	50 DO	9
		7	50 DO	8
	93.78 6.31			
Stiff to very stiff, grey, **SILTY CLAY**, trace to some sand and gravel, occ. silt seams/ partings (**TILL**)		8	50 DO	12
		9	50 DO	20
		10	50 DO	12
	90.49 9.60			
END OF BOREHOLE				



INSTALLATION AND GROUNDWATER OBSERVATIONS:

Water seepage into borehole encountered at about elevation 98.6m during drilling on May 19, 2005

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: B.G.

CHECKED:

PROJECT: 05-1140-109

RECORD OF BOREHOLE 2

SHEET 1 OF 1

LOCATION: SEE LOCATION PLAN

BORING DATE: MAY 19, 2005

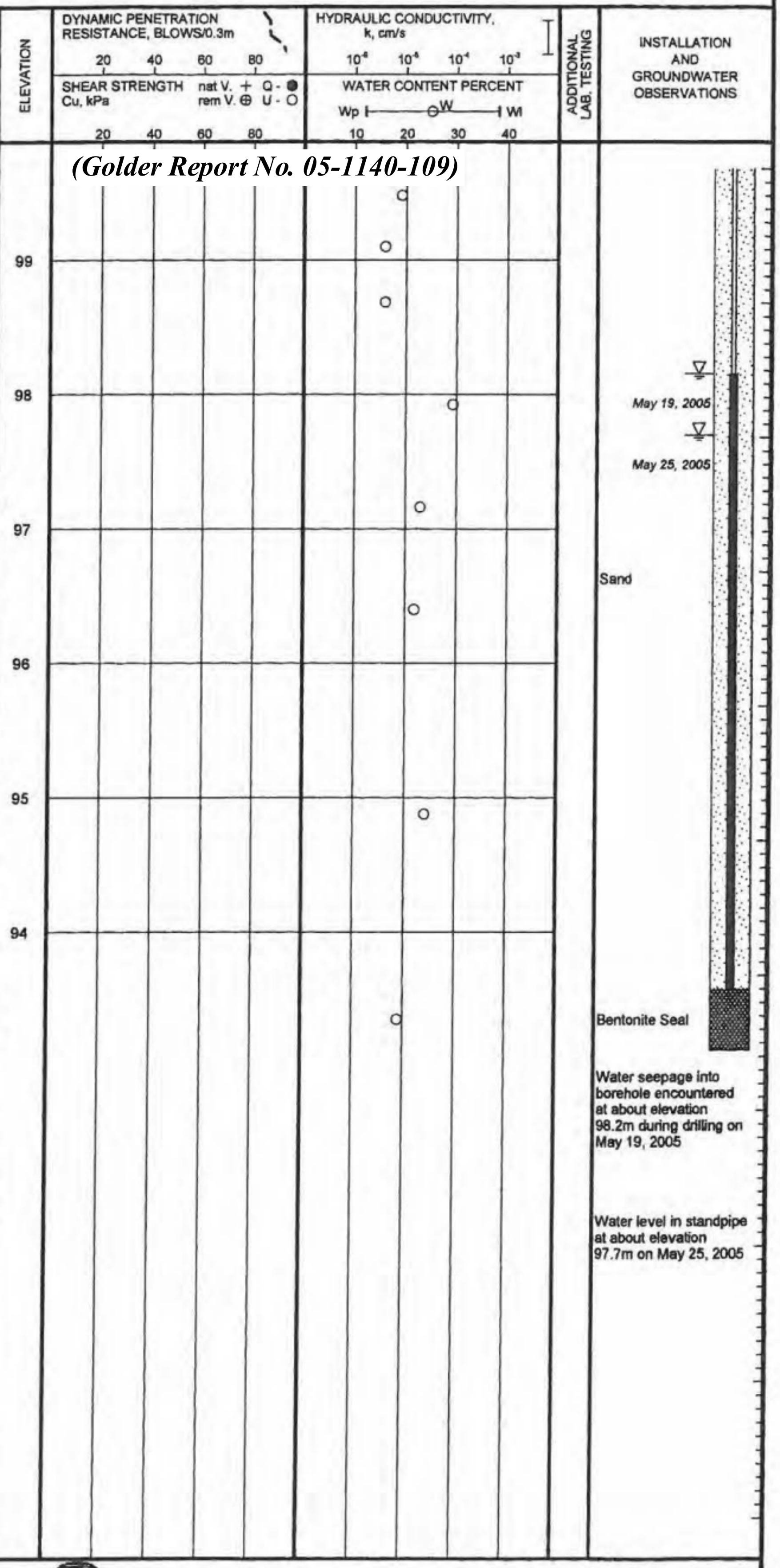
DATUM: LOCAL

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

(Golder Report No. 05-1140-109)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m
0		GROUND SURFACE	99.68			
	POWER AUGER SOLID STEM	Dark brown to black, clayey topsoil (**FILL**)	0.00	1	AS	-
		Brown, clayey silt, some sand, trace topsoil (**FILL**)	99.28 0.40			
1		Very loose, brown, **SILTY FINE SAND**, trace clay	98.92 0.76	2	50 DO	3
2		Loose to compact, brown, **SILTY FINE SAND**	98.31 1.37	3 4	50 DO 50 DO	8 14
		Compact, grey, **FINE SAND**, trace silt	97.09 2.59			
3 4 5 6		Compact, grey, **SILTY FINE SAND** to **SANDY SILT**, some clayey zones and till-like inclusions at depth	96.78 2.90	5 6 7	50 DO 50 DO 50 DO	15 18 19
7 8 9 10		END OF BOREHOLE	93.13 6.55			



Water seepage into borehole encountered at about elevation 98.2m during drilling on May 19, 2005

Water level in standpipe at about elevation 97.7m on May 25, 2005

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: B.G.

CHECKED:

PROJECT: 05-1140-109

RECORD OF BOREHOLE 3

SHEET 1 OF 1

LOCATION: SEE LOCATION PLAN

BORING DATE: MAY 25, 2005

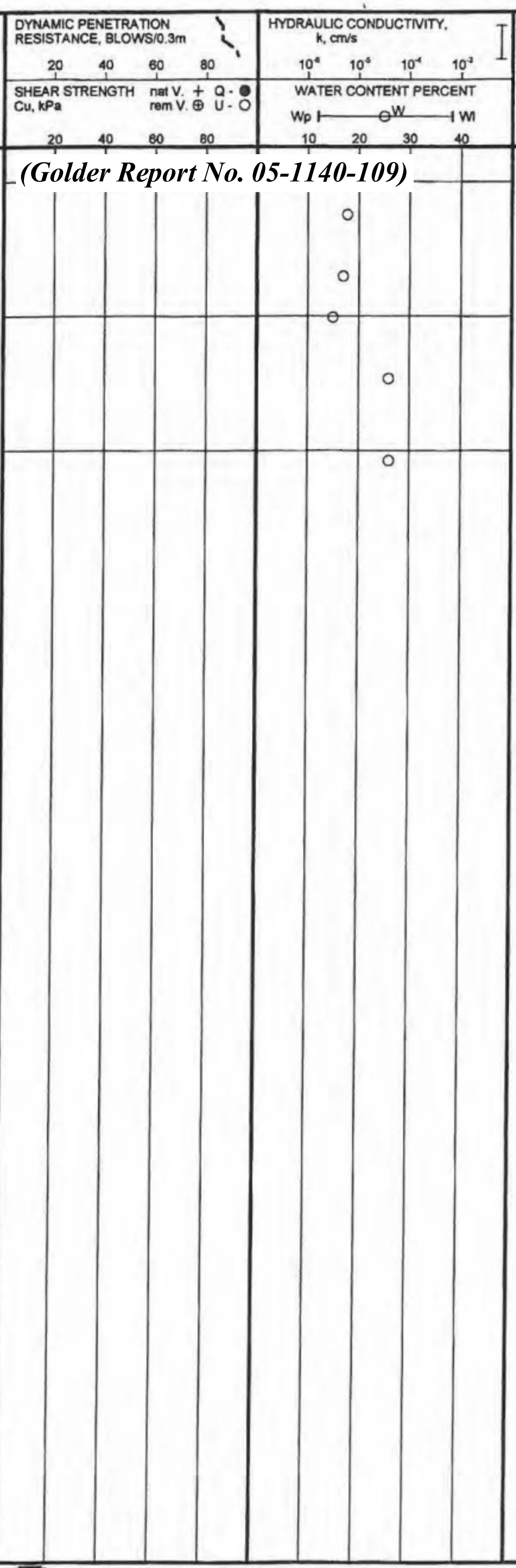
DATUM: LOCAL

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

(Golder Report No. 05-1140-109)

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	ELEVATION	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
0	MANUAL AUGER SOLID STEM	GROUND SURFACE		97.06				97		
		Dark brown, sandy topsoil, some clay, trace rootlets (FILL)	▨	0.00	1	50 DO	2			
1		Brown, silty sand, some clay, some gravel (FILL)	▨	96.76 0.30	2	50 DO	2	96		Water level in borehole at about elevation 95.8m during drilling on May 25, 2005
2		Brown and grey,clayey silt to silty clay, some sand, some organics, trace gravel and rootlets (FILL)	▨	95.84 1.22	3 4	50 DO 50 DO	2 5	95		
		END OF BOREHOLE		94.62 2.44						
3										
4										
5										
6										
7										
8										
9										
10										



LDN_BHS 05-1140-109.GPJ GLDR_CAN.GDT 6/28/05 DATA INPUT: Tony Mastroianni

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: B.G.

CHECKED:

PROJECT: 05-1140-196

LOCATION: SEE LOCATION PLAN

SAMPLER HAMMER, 63.5kg; DROP, 760mm

RECORD OF BOREHOLE 2

BORING DATE: SEPTEMBER 1, 2005

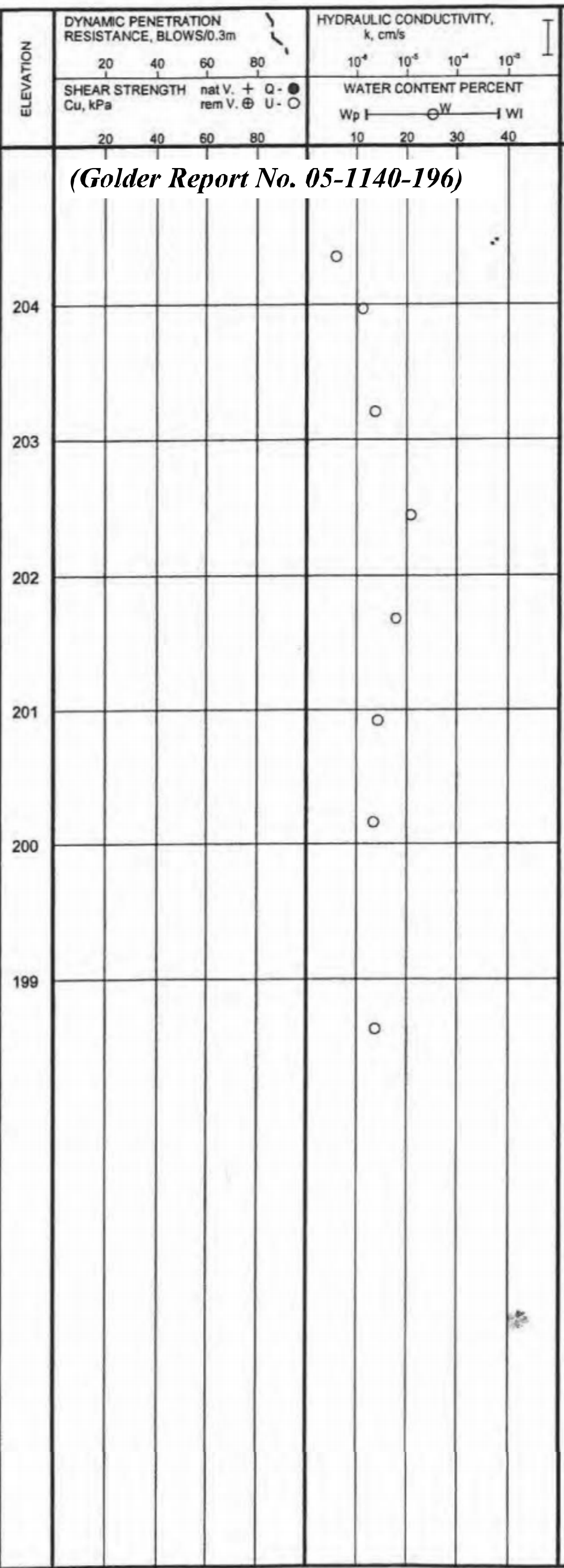
SHEET 1 OF 1

DATUM: GEODETIC

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

(Golder Report No. 05-1140-196)

BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m
POWER AUGER SOLID STEM	PAVEMENT SURFACE	204.96 0.00			
	ASPHALT	0.18			
	CONCRETE	204.50 0.46			
	Brown, granular road base (**FILL**)	204.20 0.76	1	AS	-
	Loose, reddish brown, silty, fine to medium **SAND**, trace clay	202.83 2.13	2 3	50 DO 50 DO	5 4
	Compact, brown, fine to medium **SAND**, trace to some gravel	201.76 3.20	4	50 DO	14
	Very stiff, grey, **CLAYEY SILT**, trace sand	201.15 3.81	5	50 DO	19
	Very stiff to stiff, grey, **CLAYEY SILT**, some sand, trace gravel (**TILL**)	198.41 6.55	6 7 8	50 DO 50 DO 50 DO	25 20 11
	END OF BOREHOLE				



ADDITIONAL LAB. TESTING

INSTALLATION AND GROUNDWATER OBSERVATIONS

Water seepage into borehole encountered at about elevation 202.98m during drilling

Water level in open borehole at about elevation 202.67m upon completion of drilling on September 1, 2005

DEPTH SCALE METRES: 0 1 2 3 4 5 6 7 8 9 10

DEPTH SCALE

1 : 50

Golder Associates

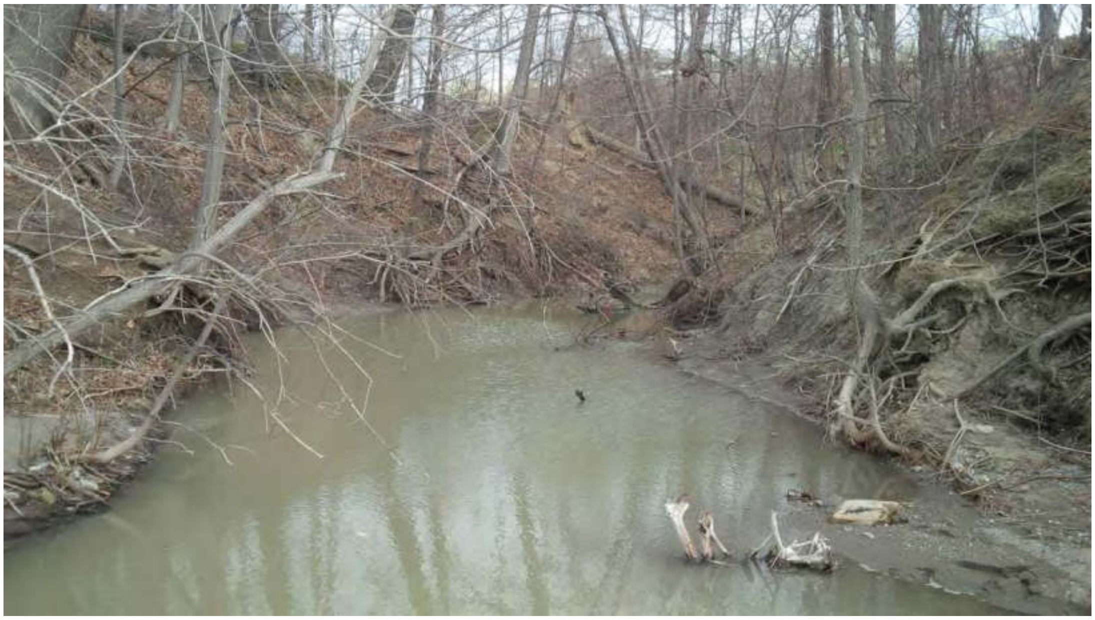
LOGGED: B.G.

CHECKED:

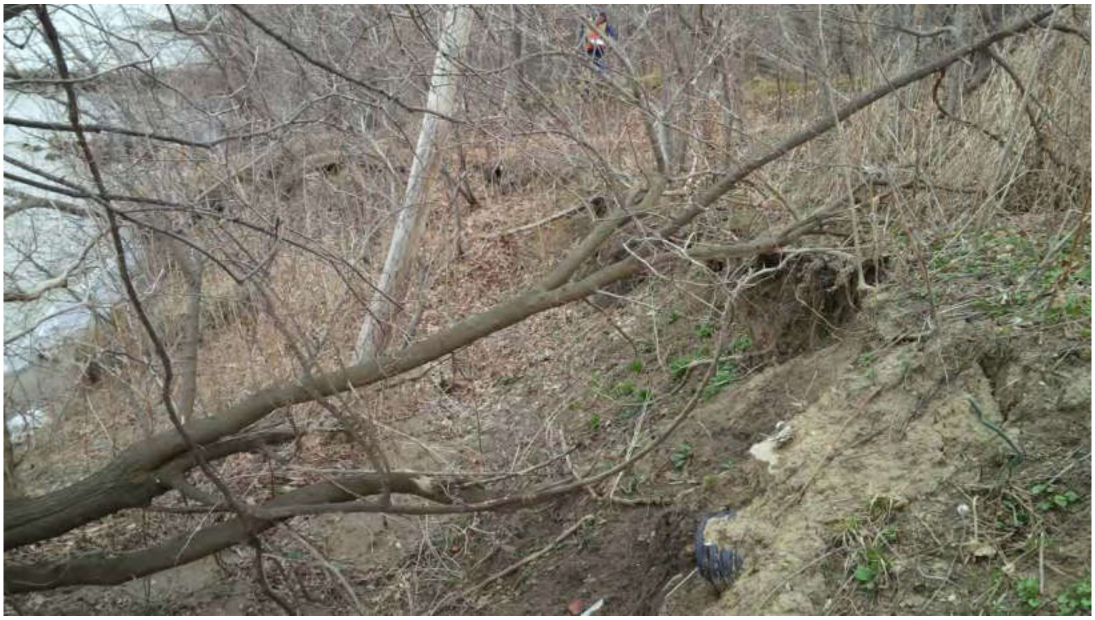
LDN_BHS 05-1140-196.GPJ GLDR_CAN.GDT 1/5/06 DATA INPUT: Tony Mastroianni

APPENDIX B

Selected Site Photographs



Photograph 1: Station 0+000, Section A looking upstream. Note fallen/leaning mature trees along banks.



Photograph 2: Station 0+000, Section A. East slope looking west. Note previous failure zone at crest of lake bluff.

Photograph 3: Station 0+000, Section A. East slope looking east. Note exposed tree roots and erosion of slope and toe.

Photograph 4: Station 0+000, Section A. West slope looking downstream at drain outlet at Lake Erie. Note erosion of slope and toe.

Photograph 5: Station 0+100, Section B. East slope looking upstream. Note tension cracks along crest.

Photograph 6: Station 0+100, Section B. East slope looking downslope. Note previous dumping and storm drains.

Photograph 7: Station 0+100, Section B looking downstream. Note failure zones and seepage from banks.

Photograph 8: Station 0+100, Section B. West slope looking upslope. Note residence near top of slope.

Photograph 9: Station 0+200, Section C. East slope looking downstream. Note large failure zone at lower portion of slope.

Photograph 10: Station 0+200, Section C. East slope looking upslope. Note seepage and wet sloughed material from about mid-slope.

Photograph 11: Station 0+200, Section C. West slope looking upslope. Note toe erosion and failed zone within west bank.

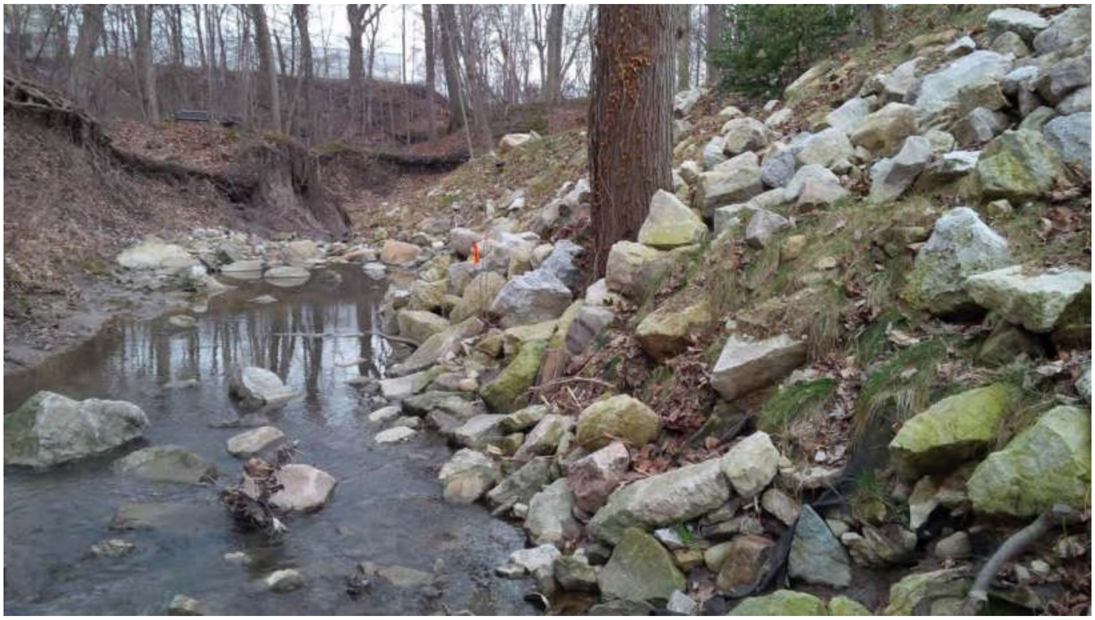
Photograph 12: Station 0+215. Looking downstream at east bank. Note failed concrete block retaining wall.

Photograph 13: Station 0+215. Looking downstream at east bank. Note concrete block retaining wall failure due to toe erosion and scouring along outside bend in drain.

Photograph 14: Station 0+235. West bank looking west. Note erosion effects exposing silty clay.

Photograph 15: Station 0+300, Section D. East slope looking upstream. Note nearly vertical east bank due to erosion.

Photograph 16: Station 0+300, Section D looking at east bank. Note toe erosion and exposed silty clay bank.



Photograph 17: Station 0+300, Section D. West bank looking downstream. Note scattered rock protection along west bank.

Photograph 18: Station 0+400, looking west. Note fallen mature tree and bank erosion at outside bend in drain.

Photograph 19: Station 0+500 looking upstream. Note east bank failure and steel sheet pile wall along west bank.

Photograph 20: Station 0+515 looking downstream. Note inward movement of steel sheet pile wall along west bank.

Photograph 21: Station 0+575, Section E. East bank looking downslope. Note heavy vegetation.

Photograph 22: Station 0+600, looking upstream. Note berm along crest of slope.

n:\active\2014\1132-geo\1417810 rc spencer-inv esseltine drain-kingsville\ph 2000-geo inv\2-correspondence\5-rpts\1417810-2000-r01 nov 3 15 (final) app b - site photos.docx

As a global, employee-owned organisation with over 50 years of experience, Golder Associates is driven by our purpose to engineer earth's development while preserving earth's integrity. We deliver solutions that help our clients achieve their sustainable development goals by providing a wide range of independent consulting, design and construction services in our specialist areas of earth, environment and energy.

For more information, visit golder.com

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 44 1628 851851
North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

solutions@golder.com
www.golder.com

Golder Associates Ltd.
309 Exeter Road, Unit #1
London, Ontario, N6L 1C1
Canada
T: +1 (519) 652 0099

Golder Associates

APPENDIX G

GOLDER GEOTECHNICAL COMMENTS, PROPOSED SWM PONDS BASE FLOW

November 3, 2015

Project No. 1417810-1000-L02

Mr. Lou Zarlenga, P.Eng., Senior Engineer, Drainage Specialist
RC Spencer Associates Inc.
261 Shepherd Street East
Windsor, Ontario
N8X 2K6

GEOTECHNICAL COMMENTS
PROPOSED SWM PONDS
ESSELTINE DRAIN IMPROVEMENTS
TOWN OF KINGSVILLE, ONTARIO

Dear Mr. Zarlenga:

Based on our recent conversations, it is understood that proposed development in the subject area of the Esseltine Drain is to include the construction of storm water management (SWM) ponds associated with industrial and residential developments within the Esseltine Drain watershed. These developments are currently seeking approval from the Municipality and the Essex Region Conservation Authority (ERCA) for construction. We understand that ERCA has expressed concerns regarding the erosive effect(s) of managed storm water flows from SWM ponds on the existing Drain base flow conditions.

Golder recently carried out a geotechnical investigation and slope stability analyses for the Esseltine Drain improvements for R.C. Spencer Associates Inc. (RC Spencer) and the results were provided in our Report No. 1417810-2000-R01 titled "Geotechnical Investigation and Slope Stability Assessment, Esseltine Drain Improvements, Town of Kingsville, Ontario" dated October 2015. The soil conditions at the Drain bottom within the ravine area are shown on Cross Sections, Figures 2 to 4 from our draft geotechnical report and on Photographs 1 to 4 in Appendix A (attached). Based on the results of our geotechnical investigation and slope assessment:

- the valley slopes consist of layers of sandy silt and silty sand above approximately elevation 185 m; and
- below approximately elevation 185 m, the slopes and the bottom of the drain generally consists of cohesive silty clay or silty clay glacial till within the ravine area.

Golder was retained to carry out stability analyses for the existing drain conditions and these are summarized in the attached report.

If detailed erosion studies are to be completed, based on the grain size analyses carried out on two samples of the silty clay, a soil-erodibility factor, K, of about 0.4 should be used for the silty clay material that forms the sides and bottom of the drain below approximately elevation 185 m. This value is compatible with slightly to moderately erodible soils, consistent with our expectation that the silty clay found near the bottom of the drain (below elevation 185 m) should be less susceptible to erosion and sediment transport than the silty and sandy soils found above approximately elevation 185 m. From a geotechnical and general erosion control perspective, the design of any SWM pond(s) should incorporate an armoured outlet to the base of the Drain for energy dissipation purposes. Any future SWM discharge locations should be designed to protect the Drain from concentrations of high-energy flow that would contribute to localized erosion.

Golder understands that hydraulic modelling was carried out by RC Spencer to assess overall Drain flows and velocities based on current conditions and estimated post-development conditions. The results of the modelling were provided to Golder in RC Spencer Report titled "Repair and Improvement of the Esseltine Drain, Town of Kingsville, Project 14-425, Base Flow Modelling", dated August 11, 2015. Based on this modelling, Golder understands that:

- overall peak storm water runoff flows reporting to the Drain will be reduced through the volume-storage time and flow attenuation that is the purpose and function of the SWM ponds;
- flow depths in the Drain at peak flow times are expected to be reduced as compared to present conditions;
- flow depths in the Drain immediately and for a period of time after peak flows are expected to increase as compared to present conditions as the SWM facilities gradually discharge accumulated water (from initial flow attenuation) into the Drain.

The RC Spencer report should be referenced for hydraulic model results.

From a geotechnical perspective, the conditions after constructing SWM ponds should not be worse than present conditions for the following reasons:

1) erosion will be governed by peak flow velocity, and turbulence and the erodibility of the soil;

2) the erodibility factor for the silty clay soil at and near the bottom of the Drain channel is consistent with slightly to moderately erodible soils;

3) if peak flow velocities are reduced through construction of SWM facilities, erosion during peak events would be reduced according to the hydraulic modelling;

4) if peak flow turbulence is reduced through construction of SWM facilities as a result of lower flow rates and lower flow depths, erosion during peak events should be reduced according to the hydraulic modelling;

5) if post-peak flow velocities are increased for a limited period of time from SWM post-peak managed outflow, erosion during post-peak periods may be greater than at present according to the hydraulic modelling; however,

6) a general review of the hydraulic modelling suggests that the post-peak velocities (1.04 and 1.30 m/s) are below the erosion threshold velocity for silty clay soils of 1.8 m/s; and

7) the net effect of factors 3 through 6, above, should result in an overall reduction of the erosive energy of the water and channel soil erosion potential over expected storm and post-storm event periods.

The present Drain conditions indicate that erosion will continue unabated in its natural course as it has for long periods of time until such time that the Drain conditions are improved. A general review of the hydraulic modelling and the geotechnical factors related to erosion suggest that, in the interim, introduction of SWM facilities may have a beneficial effect until such time Drain improvement construction is undertaken.

As noted above, Golder has provided the comments above based on a general overview of soil types, hydraulic modelling undertaken by RC Spencer, Golder's visual observations of the Drain conditions and our experience in the area. During subsequent design activities, the locations, setbacks and SWM facility details should be reviewed by the geotechnical engineer during subsequent SWM design stages.

We trust this letter provides adequate information for your current requirements. If any point requires further clarification, please contact his office.

Yours truly,

GOLDER ASSOCIATES LTD.

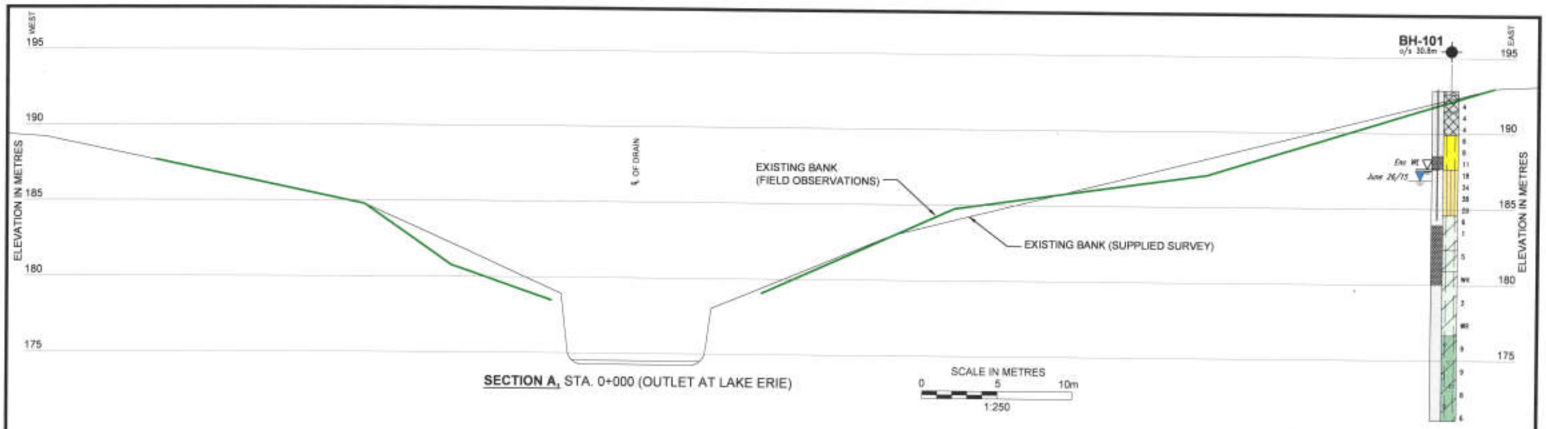
Daniel R.P. Babcock, P.Eng.
Geotechnical Engineer

Michael E. Beadle, P.Eng.
Associate

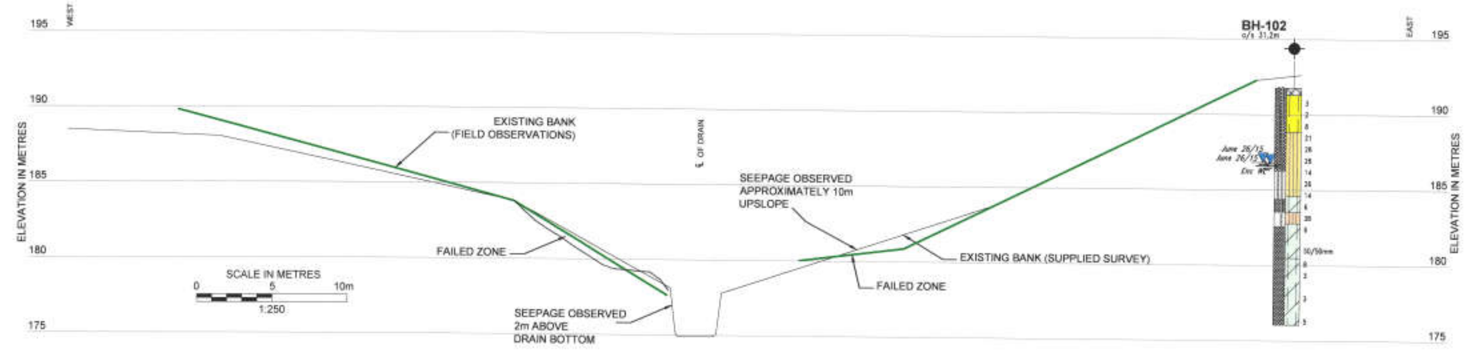
NG/DB/MEB/cr

Attachments: Figures 2 to 4
Appendix A – Site Photographs

n:\active\2014\1132-geo\1417810 rc spencer-inv esseltine drain-kingsville\ph 1000-geo assess\2-correspondence\3-ltrs\l02-final\1417810-1000-l02 nov 3 15 (final) swm ponds esseltine dr.docx



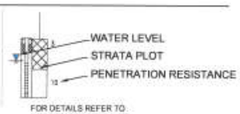
SECTION A, STA. 0+000 (OUTLET AT LAKE ERIE)



SECTION B, STA. 0+100

LEGEND

- BOREHOLE (Current Investigation)
- BOREHOLE (Golder Report No. 05-1140-109)



FOR DETAILS REFER TO
RECORD OF BOREHOLES

SIMPLIFIED STRATIGRAPHY

☒	FILL		
▥	SILTY SAND	▨	SILTY CLAY
▥	SANDY SILT	▨	SILTY CLAY TILL
▥	SILT		

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

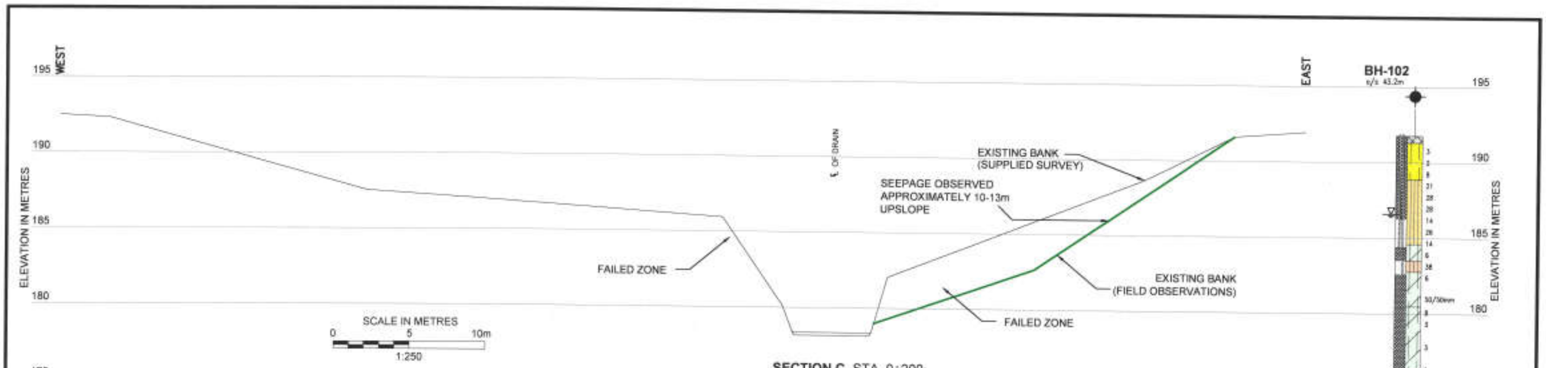
FOR LOCATION OF CROSS SECTIONS SEE FIGURE 1.

PROJECT
GEOTECHNICAL INVESTIGATION
ESSELTINE DRAIN IMPROVEMENTS
TOWN OF KINGSVILLE, ONTARIO

TITLE
CROSS SECTIONS A AND B

Golder Associates

PROJECT No.		1417810	FILE No.	1417810-2000-R01002
			SCALE AS SHOWN	REV. 0
CADD	WP/DB	July 23/15	**FIGURE 2**	
CHECK				



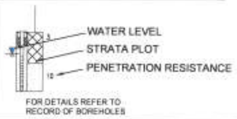
SECTION C, STA. 0+200

SECTION D, STA. 0+300

LEGEND

● BOREHOLE (Current Investigation)

● BOREHOLE (Golder Report No. 05-1140-109)



FOR DETAILS REFER TO
RECORD OF BOREHOLES

SIMPLIFIED STRATIGRAPHY

▨	FILL	▥	SANDY SILT
▥	SILTY SAND	▥	SILT
▢	SAND	▨	SILTY CLAY
		▨	SILTY CLAY TILL

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

FOR LOCATION OF CROSS SECTIONS SEE FIGURE 1.

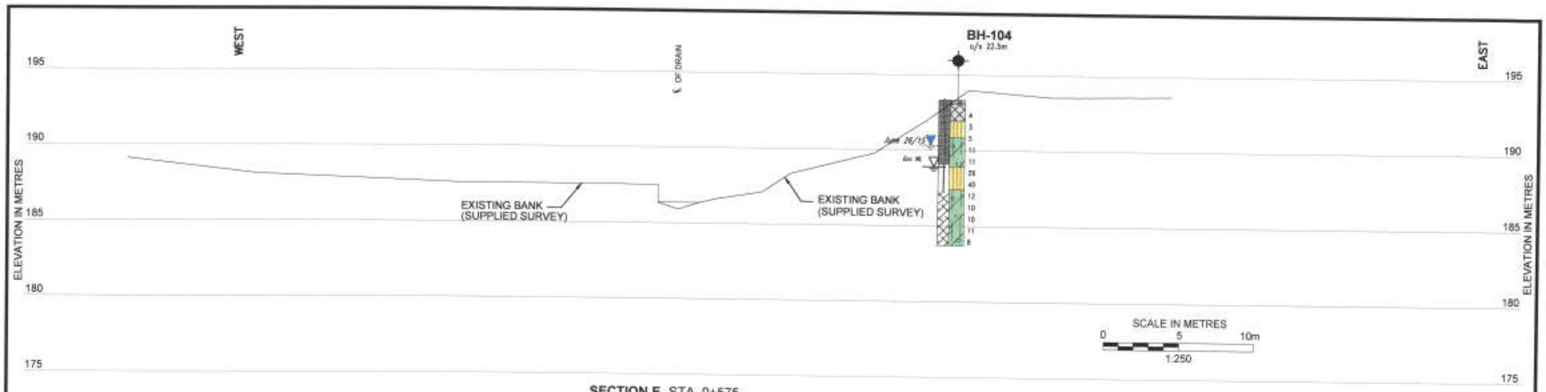
PROJECT
GEOTECHNICAL INVESTIGATION
ESSELTINE DRAIN IMPROVEMENTS
TOWN OF KINGSVILLE, ONTARIO

TITLE
CROSS SECTIONS C AND D

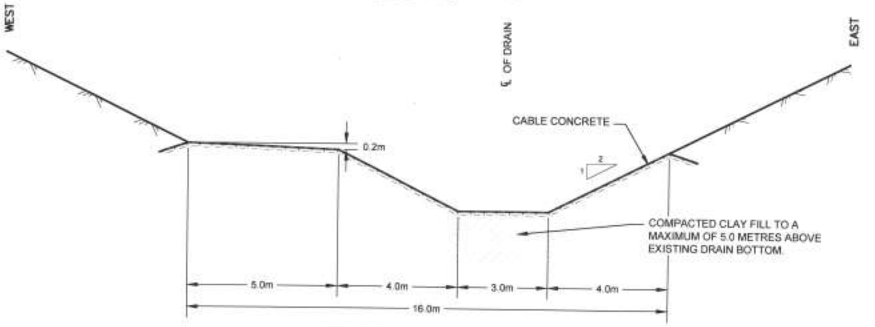
Golder Associates

PROJECT No.		1417810	FILE No.	1417810-2000-R01002
			SCALE AS SHOWN	REV. 0
CADD	WF/DB	July 2015	**FIGURE 3**	
CHECK				

Drawing file: 1417810-2000-R01002.dwg Jul 24, 2015 - 10:03am



SECTION E, STA. 0+575



PROPOSED CHANNEL REGRADING (TYPICAL DETAIL)

SCALE IN METRES
0 2.5 5m
1:125

LEGEND

- ● BOREHOLE (Current Investigation)
- ● BOREHOLE (Golder Report No. 05-1140-109)

FOR DETAILS REFER TO RECORD OF BOREHOLES

SIMPLIFIED STRATIGRAPHY

▨	FILL	▥	SANDY SILT
▥	SILTY SAND	▥	SILT
☐	SAND	▧	SILTY CLAY
		▧	SILTY CLAY TILL

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

FOR LOCATION OF CROSS SECTIONS SEE FIGURE 1.

PROJECT
GEOTECHNICAL INVESTIGATION
ESSELTINE DRAIN IMPROVEMENTS
TOWN OF KINGSVILLE, ONTARIO

TITLE
CROSS SECTION E
AND TYPICAL DETAIL

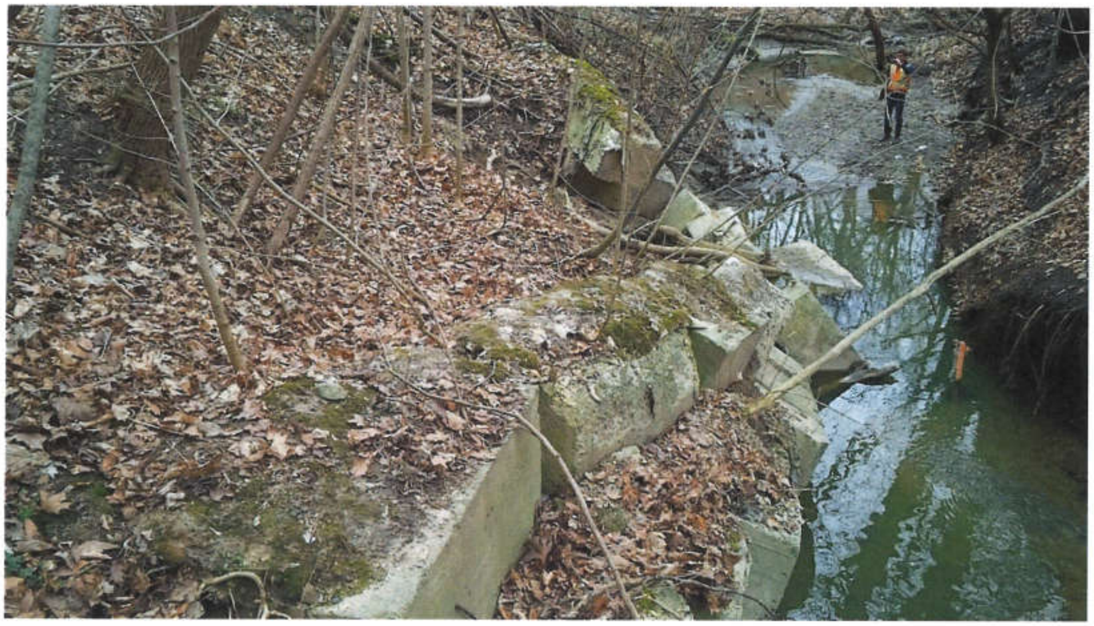
Golder Associates

PROJECT No.		1417810	FILE No.	1417810-2000-R01002
			SCALE	AS SHOWN REV. 0
CADD	WFXXX	July 2015	**FIGURE 4**	
CHECK				

Drawing file: 1417810-2000-R01002.dwg Jul 24, 2015 - 3:09pm

APPENDIX A

SITE PHOTOGRAPHS



Photograph 1: Station 0+215. Looking downstream at east bank. Note silty clay drain bottom (top right).

Photograph 2: Station 0+215. Looking downstream at east bank. Note silty clay along west bank (bottom right).

Photograph 3: Station 0+235. West bank looking west. Note exposed silty clay.

Photograph 4: Station 0+300, Section D looking at east bank. Note exposed silty clay bank.

APPENDIX H

BIOLOGIC NATURAL HERITAGE REPORT

BioLogic
Incorporated
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

Lou Zarlenga,
RC Spencer Associates Inc.,
261 Shepherd Street East,
Windsor, Ontario ,
N8X 2K6

June 16 2016

Dear Lou:

Re: Esseltine Drain Town of Kingsville - Natural Heritage Study

The Natural Heritage Study (April 22, 2016) provides an overview of existing natural heritage conditions within the proposed drainage works and adjacent lands. Habitat investigations and life science inventories were conducted over the 2015 seasons to help characterize the biological framework of the valley system and Esseltine Drain.

While supporting some fish popultations in the upper reaches of the existing Esseltine Drain, the collapsing banks within the ravine and shoreline recession has created an oversteep section from the County Road down to the lake. The resultant channel slopes, stream velocities and accumulated log jams at the mouth of the ravine have all contributed to a hostile environment for fish. The depauperate fish population in the ravine reflects these stresses.

With respect to floral and faunal species, the narrow linear ravine corridor with unstable slopes did not support sensitive or rare species. Eastern Foxsnake, with habitat and species protection, is known in the general area. However, thre was not burrows or other potential hibernaculum features within the work area of the ravine given the sloughing valley banks. Any other features such as fallen logs or basking areas did not show evidence of use and any of these features were not sustainable without correction of the actively eroding system.

We have reviewed the proposed drainage works and conclude that while the works will not provide net gains in natural heritage, the works will prevent ongoing loss and impact. Following stablization of the site, corridor linkages will be preserved, grassland areas will be formed within the protection measures and habitat features are proposed.

Provided the recommendations within our Natural Heritage Study report (April 22, 2016) are followed, we are satisfied the natural heritage system will be stabilized and protected.

Yours truly,
BioLogic

Dave Hayman

Dave Hayman MSc.
ReportCoverLetterSummary.wpd

BioLogic Incorporated
110 Riverside Drive, Suite 201
London, Ontario N6H 4S5
Telephone: 519-434-1516
Fax: 519-434-0575

www.biologic.ca

Windsor Office
2280 Ambassador Drive
Windsor, Ontario N9G 4E4
Telephone: 519-966-1645
Fax: 519-966-1645

BioLogic
Incorporated
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

NATURAL HERITAGE REPORT
Esseltine Drain

Prepared for:
R.C. Spencer and Associates
Town of Kingsville

April 22, 2016

BioLogic Incorporated
110 Riverside Drive, Suite 201
London, Ontario N6H 4S5
Telephone: 519-434-1516
Fax: 519-434-0675

www.biologic.ca

Windsor Office
2280 Ambassador Drive
Windsor, Ontario N9G 4E4
Telephone: 519-966-1645
Fax: 519-966-1645

TABLE OF CONTENTS

List of Figures - Figures after page 41

List of Tables - page number reference

List of Appendices - Appendices follow Figures

1.0 INTRODUCTION

R.C. Spencer and Associates is in the process of preparing an Engineer's Report for the Town of Kingsville for repairs and improvements to the Esseltine Drain under Section 28 of the Drainage Act. Esseltine Drain is located east of the communities of Ruthven and Union in the Town of Kingsville, Ontario. Significant areas of erosion and bank failure within the southern section of the drain (south of Highway 20) impede the outlet capacity into Lake Erie and putting existing, adjacent homes at risk.

The study area for the project extends from County Road 34 southerly 2.5km (approximately) to the outlet at Lake Erie [Figure 1]. The northern section of the drain is classified as a municipal drain and the southern section (370m north of County Road 20 to Lake Erie) is classified as a natural watercourse [Figure 1]. The Esseltine Drain is the receiving drain for a number of municipal drain tributaries, subdivisions and greenhouse developments in the area.

BioLogic has been retained by R.C. Spencer and Associates to conduct a Natural Heritage Review of the Esseltine Drain Improvements study area [Figure 1]. The Natural Heritage Review identifies, natural heritage features and functions within the study area requiring further consideration, provides an assessment of potential impacts associated with the proposed drain repairs and improvements, as well as provides recommendations to mitigate these impacts.

2.0 STUDY APPROACH

The following section details the methods and primary sources of information used in the completion of the Natural Heritage Report.

2.1 Background Information Collection and Review

The following existing data and studies were reviewed to characterize the existing environment for the study area:

- Natural Heritage Information Centre (NHIC) database;
- MNRF Natural Areas Mapping;
- Aerial photography;
- 2015 Department of Fisheries and Oceans (DFO) Species at Risk (SAR) Mapping;
- Essex Region Natural Heritage System Strategy (ERCA, 2013)

2.2 Species at Risk Screening

The Ministry of Natural Resources and Forestry (MNRF), Aylmer District was contacted with respect to provincial considerations and Species at Risk (SAR) observations for the study area. A site meeting with MNRF was conducted on May 28, 2015. A summary of the meeting conclusions was provided by MNRF by email dated June 23, 2015 [Appendix A]. Based on initial background review (NHIC, 2015) and consultation with MNRF, a working list of SAR with potential to occur within 1km of the study area was assembled [Appendix B]. In MNRF's June 23, 2015 email they recommended a floral inventory, bird survey, fish sampling and aquatic habitat surveys be completed to identify any additional SAR that may be present within the study area.

2.3 Field Investigations

A number of ecological surveys were completed within the study area to characterize the current biological environment and ecological functions and identify significant and sensitive resources. A summary of biological field inventories are summarized in Table 1.

Table 1: Summary of Field Inventories

Inventory	Dates	Times	Staff
Aquatic Environment			
Aquatic Habitat Characterization	August 12, 2015	2:00pm to 6:00pm	D. Morse; P. Mikoda
Fish Community Sampling	August 12, 2015	2:00pm to 6:00pm	D. Morse; P. Mikoda
Terrestrial Environment			
Vascular Plant Inventory	April 6, 2015	1:00pm to 5:00pm	P. Mikoda
	May 19, 2015	2:30pm to 5:00pm	G. Waldron
	July 3, 2015	7:15am to 9:30am	W. Huys
ELC	April 6, 2015	1:00pm to 5:00pm	P. Mikoda
Breeding Birds*	July 3, 2015	7:15am to 9:30am	W. Huys
Amphibians	April 6, 2015	1:00pm to 5:00pm	P. Mikoda
	April 29, 2015	10:00pm to 10:30pm	P. Mikoda
Snake Habitat	April 6, 2015	1:00pm to 5:00pm	P. Mikoda
	May 19, 2015	2:30pm to 5:00pm	P. Mikoda

* due to the request for a bird survey by MNRF made on June 23, 2015, which is after the appropriate timing for a two visit breeding bird survey, only one survey was completed.

In addition to the targeted investigations noted above, any incidental sightings and general wildlife habitat observations were also recorded.

3.0 DESCRIPTION OF THE NATURAL ENVIRONMENT

The following section summarizes the findings of the background reviews and field investigations used to characterize the biological environment within the study area.

3.1 Designated Natural Heritage

Designated natural heritage includes features and/or areas identified for protection by MNRF, the Town of Kingsville and the Essex Region Conservation Authority (ERCA).

3.1.1 Ministry of Natural Resources and Forestry

There are no provincially significant wetlands (PSW's) or Areas of Natural and Scientific Interest (ANSI's) within or directly adjacent to the study area (NHIC, 2015; Appendix A).

3.1.2 Town of Kingsville Official Plan (2011)

On Schedule B: Natural Heritage Features, the entire southern section and a portion of the northern section of the study area is designated as "Environmentally Significant Areas" [Figure 2].

3.1.3 ERCA Regulation

Lands within the study area are regulated by ERCA [Figure 3] .

3.2 Aquatic Environment

3.2.1 Aquatic Habitat

An investigation of aquatic habitat for the Esseltine Drain was conducted on August 12, 2015 by Dylan Morse and Paul Mikoda. The Esseltine Drain was divided into four (4) reaches [Figure 4; Appendix C]. The aquatic habitat investigation included an assessment of in-stream habitat features and the overall contribution of the drainage feature to fish habitat. Habitat features that would be lost or altered due to the drain improvements were the focus of this investigation. Information collected for the assessment are summarized below and in Table 2. Information included channel morphological characteristics, flow characteristics, aquatic habitat features and riparian vegetation characteristics.

Reach 1 - County Road 34 to Road 2 East ROW (Sta2+452 to Sta1+1830)

Reach 1 (R1) of the Esseltine Drain is a straightened, permanent channel resulting in a trapezoid-shaped channel. This man-made channel is flat and devoid of any pool riffle habitat. On average the water depth throughout was 0.1m and the wetted width averaged 2m wide. Bankfull measurements were approximately 0.5m deep and 5m wide. A berm has been constructed approximately 5m from the west bank along the entire length the of this reach. This berm creates a valley that is 8m to 10m wide with an approximate depth of 2m. Substrates throughout consisted of primarily clay with lesser amounts of silt, gravel/cobble and detritus.

In-stream vegetation and riparian vegetation consisted of Phragmites along both banks in the upper portion of the reach near County Road 34. In the lower portion, there was no in-stream vegetation and the riparian vegetation consisted of a cultural thicket on the west bank and agricultural field on the east bank.

Reach 2 -Road 2 East ROW to Private Culvert Crossing (Sta 1+1830 to Sta 1+0)

Reach 2 (R2) of the Esseltine Drain is a straightened, permanent channel, resulting in a trapezoid-shaped channel. This reach has steeper banks than Reach 1. This man-made channel is generally flat, however it does have some deeper pool areas. In the flat areas, wetted width was approximately 2m and water depth was 0.2m. In pool areas, water depth was 0.4m and the wetted width averaged 4m wide. Bankfull widths and depths measured 5m and 0.75m, respectively. The valley along this reach was approximately 8-10m wide and 2m deep. Substrates throughout consisted of primarily clay and gravels with lesser amounts of silt/sand and detritus.

Along the entire length of Reach 2, both banks are vegetated with a cultural woodland creating a 15m riparian corridor. Beyond the riparian corridor is active farmland and greenhouse development. No in-stream vegetation was present within Reach 2.

Reach 3 - Private Culvert Crossing to County Road 20 (Sta 1−0 to Sta 0+530)

Reach 3 (R3) of the Esseltine Drain is a more natural, permanent channel, with some evidence of straightening (two retaining wall sections along the west bank). Reach 3 has steeper banks along the east bank and gradual slopes along the west bank. Pool-riffle habitat is more evident, however much of this reach is still flat. On average, the wetted width ranged from 2m to 4m with water 0.1m to 0.3m deep. Bankfull measurements were approximately 1m deep and 5m to 6m wide. Valley widths ranged from 20m to 30m with depths ranging between 7m to 10m. Substrates throughout consisted of primarily clay and gravels with lesser amounts of silt/sand and detritus.

Along the entire length of Reach 3, both banks are vegetated with a cultural woodland creating a 25m to 30m riparian corridor. Beyond the riparian corridor, greenhouse buildings/development are present. No in-stream vegetation was present within Reach 3, however there were some undercut banks and woody debris throughout the reach.

Reach 4 - County Road 20 to Lake Erie (Sta 0+530 to Sta 0+0)

Within Reach 4 (R4) the Esseltine Drain is a natural, permanent watercourse with a defined channel. In the upstream section above County Road 20, there is some bank hardening to prevent erosion and possibly to allow adjacent greenhouse development. Immediately downstream of the box culvert under County Road 20, there is a 3m drop in elevation that creates a plunge pool and restricts fish movement upstream.

In the upper section near County Road 20, the channel consists predominately of riffles and pools with a mean wetted width of 2m to 4m (greater in the pools, and less in the riffles). The mean water depth was 0.5m to 0.8m in the pools and 0.1m to 0.2m in the riffles. Bankfull width and depth is approximately 10m and 5m, respectively. The valley is approximately 50m wide and 10m deep. Substrates throughout this reach consists mainly of cobble with lesser amounts of boulders, gravel and clay.

In the lower section near the outlet, the channel becomes more flat and is devoid of pool-riffle habitat. The channel near the mouth also becomes wider (3m to 5m wide) and deeper (0.5m to 0.75m). Bankfull width and depth is approximately 30m and 8m, respectively. The valley becomes wider and deeper (60m wide, 15m deep). Substrates closer to the outlet consists mainly of sand with lesser amounts of gravel. At the time of the investigation, there was direct flow to the lake, However, connection to the Lake would vary depending on lake water levels, beach sand deposition and flows within the drain.

Both banks within Reach 4 are vegetated with a deciduous forest creating a 60m wide riparian corridor. Throughout this reach active bank erosion is predominant. There is rip rap, concrete slabs, and cinder blocks along the banks, likely attempts to prevent bank erosion, although most of these efforts are failing.

No in-stream vegetation exists, however there is abundant woody debris and log jams present that would create in-stream cover/habitat could also potentially create a blockage to fish access.

Table 2: Esseltine Drain Channel Characteristics

Reach	Wetted Channel		Bankfull Channel		Valley Corridor		Avg. Bank Slopes (H:V)	Avg. Discharge*
	Width	Depth	Width	Depth	Width	Depth		
1	2m	0.1m	5m	0.5m	8-10m	2m	2:1	1.91m^3/s
2	2-4m	0.2-0.4m	5m	0.75m	8-10m	2m	1.5:1	3.04m^3/s
3	2-4m	0.3-0.4m	5-6m	1m	20-30m	7-10m	2:1	4.25m^3/s
4 upper	2-4m	0.1-0.8m	10m	5m	50m	10m	1.5:1	4.65m^3/s
4 lower	3-5m	0.5-0.75m	30m	8m	60m	15m	4:1	5.13m^3/s

* from R.C. Spencer

Channel Stability

The drainage feature above County Road 20 appears to be stable and R.C. Spencer has determined that the channel capacity is such that greenhouse development is not a concern although some retrofits and stormwater management (SWM) controls as part of upstream development will help alleviate some of the downstream erosion issues. The channel slope below County Road 20 is steep and likely a result of lakeshore erosion over time and the resultant shortening of channel length. This steepening of the channel slope is an issue that is facing many ravine channels along the Lake Erie shoreline. The recommendation in the engineers report has concluded stabilization at the Lake Erie-Esseltine Drain interface and bank stabilization along the natural drainage channel section of the drain is required to ensure long term protection of the properties along this ravine.

3.2.2 Fish Community

The provincial database (NHIC, 2015) and DFO Species at Risk mapping for the Essex region (DFO, 2015) indicates that there are no endangered, threatened or special concern aquatic species (i.e., fish or mussels) within the Esseltine Drain. However, DFO mapping indicates habitat for the Silver Chub (Special Concern) along the Lake Erie shoreline near the Esseltine Drain outlet. This species inhabits open lake waters or larger rivers systems.

Fish community sampling a was completed on August 12, 2015 by Dylan Morse and Paul Mikoda [Appendix C] at three stations on the Esseltine Drain [Figure 4]. Station 1 was located in the northern section in Reach 1 (R1) just downstream of County Road 34. Station 2 was located downstream of County Road 20 in Reach 4 (R4) within the plunge pool. Station 3 was located in the downstream portion of Reach 4 (R4), near the confluence with Lake Erie.

In total, six (6) species were captured [Table 3]. All species captured are common and widespread throughout Ontario. Fathead minnow were the only species found above County Rd 20 while Spottail Shiner and White Bass were at the mouth only. Green Sunfish and Pumpkinseed were found only in the plunge pool area downstream of County Road 20.

Table 3: Fish Species within the Esseltine Drain

Common Name	Scientific Name	Number Captured		
		Station 1	Station 2	Station 3
Creek Chub	*Semotilus atromaculatus*	-	1	-
Fathead Minnow	*Pimephales promelas*	10	23	-
Green Sunfish	*Lepomis cyanellus*	-	1	-
Pumpkinseed	*Lepomis gibbosus*	-	4	-
Spottail Shiner	*Notropis hudsonius*	-	-	2
White Bass	*Morone chrysops*	-	-	2

3.2.3 Aquatic Environment Summary

Overall, the Esseltine Drain is poor quality aquatic habitat due to the very limited pool-riffle structure, blocked access for upstream movement and the prevalent erosion and bank instability throughout. The fish community within the Esseltine Drain reflects this poor quality habitat and is very limited based on very low numbers and diversity of fish species utilizing the drain.

Fish movement from the lake can be intermittently blocked based on lake levels and drain flow. Additional log jams upstream of the mouth present challenging conditions for any upstream migration although the presence of sunfish species suggest these barriers can be surpassed on occasion. Erosion and instability limits the sustenance of a fish population other than Fathead Minnow which seem to be thriving (relatively speaking) in the upper reaches. The large number found in the pool downstream of

County Road 20 suggests the source population is within the upstream drain.

3.3 Terrestrial Environment

3.3.1 Vegetation Communities

Classification of riparian vegetation communities, within and adjacent to the study area, was conducted on April 6, 2015 by Paul Mikoda (certified ELC evaluator) and was based on the Ecological Land Classification (ELC) System for Southern Ontario (Lee *et al.*, 1998). ELC information sheets are provided in Appendix D, summarized in Table 4 and depicted in Figures 5a and 5b.

Table 4: Vegetation Community Descriptions

Polygon Code	ELC Code	Description	Size (ha)
Cultural Communities			
1	CUM1	Mineral Cultural Meadow Ecosite with an inclusion of: MAM2 Mineral Meadow Marsh (Phragmites dominated)	1.54
2	CUT1-4	Gray Dogwood Mineral Cultural Thicket	0.42
3a	CUW1	Mineral Cultural Woodland Ecosite (White Elm, Cottonwood and White Oak dominated)	1.4
3b	CUW1	Mineral Cultural Woodland Ecosite (Willow, Black Walnut, Cottonwood and Maple species dominated)	1.67
Woodland Communities			
4	FOD6-5	Fresh-Moist Sugar Maple Hardwood Deciduous Forest Type with an inclusion of: BBO1 Mineral Open Beach/Bar	2.54

Along County Road 34 (Talbot Road) there is a small cultural meadow (CUM1) adjacent to the drain however the immediate riparian vegetation along the Esseltine Drain is a meadow marsh inclusion (MAM2) that is dominated by Phragmites. Outside of the inclusion, the vegetation within the Community 1 is dominated by upland plants (Alternate-leaved Dogwood, Cottonwood and Garlic Mustard) and therefore reflective of cultural meadow. It is not a wetland as defined in OWES (MNR, 2014).

From Community 1, downstream towards the Road 2 ROW, the riparian vegetation becomes a cultural thicket (CUT1-4) that is flanked by agricultural fields. Below Road 2 ROW, riparian vegetation becomes a cultural woodland (Community 3a and 3b) that extends into the southern section of the study area to

County Road 20.

South of County Road 20, the riparian vegetation consists of a woodland community (FOD6-5) dominated by sugar maples and beech trees. This community occupies the steep, unstable banks of the Esseltine Drain. At the mouth of the Esseltine Drain where it outlets to Lake Erie, there is a small 2m to 3m wide beach (BBO1) inclusion.

All the riparian vegetation communities of the Esseltine Drain are common and secure in Ontario (NHIC, 2015).

3.3.2 Candidate Significant Wildlife Habitat

Candidate significant wildlife habitat (SWH) is identified by vegetation classification as outlined by supporting Criteria Schedules for Ecoregion 7E (MNRF, 2015). Based on the vegetation communities present and the habitat criteria developed by MNRF (MNRF, 2015) there is candidate habitat for the following [Appendix E] within the study area:

Seasonal Concentration Areas of Animals

- Shorebird Migratory Stopover Area - Community 4 (BBO1 inclusion)
- Raptor Wintering Areas - Community 4 for Bald Eagle
- Reptile Hibernaculum - All communities

Specialized Habitat for Wildlife

- Bald Eagle and Osprey Nesting, Foraging and Perching Habitat - Community 4
- Turtle Nesting Areas - Community 4 (BBO1 inclusion)

Species of Conservation Concern

- Terrestrial Crayfish - Community 1 (CUM1with MAM2 inclusion)
- Special Concern and Rare Wildlife Species for various plants and insects

A second step in the SWH review process to determine Confirmed SWH, field investigation findings (Section 3.3.3 and Section 3.4) are reviewed against the appropriate wildlife use thresholds (i.e., target species, population numbers, etc.). This step is completed in Section 4.5 (PPS - Natural Heritage Policy section) following a summary of field results outlined below.

3.3.3 Flora

MNRF and/or the provincial database (NHIC, 2015) have reported sixteen (16) rare plants within 1km of the study area [Appendix B]. Of the 16 rare plant species, three (3) are listed as Endangered and four (4) are listed as Threatened under the *Endangered Species Act* (ESA), while the remaining nine (9) species are recognized as species of conservation concern (S1 to S3 ranked or listed as Special Concern).

During the ELC investigation, five Butternut (native healthy Butternut species are considered Endangered under the ESA) were found south of County Road 20 within Community 4 (two on the west bank and three on the east bank) within the study area. A Butternut Health Assessment was conducted by a certified Butternut Health Inspector (Will Huys) on the five Butternut trees located within the study area. The two Butternuts on the west bank were assessed as non-retainable due to canker disease and the three Butternuts trees on the east bank were identified as hybrids. As a result, none of the Butternuts are protected under the *Endangered Species Act* (Ontario, 2007).

A detailed floral inventory was conducted on May 19, 2015 by Gerry Waldron [Appendix F]. Rare plants searches were also conducted during the ELC site visit (April 6, 2015) and the late breeding bird survey (July 3, 2015). No other floral species at risk (END or THR) were found within the study area. However, one species of conservation concern (S1 to S3 ranked or SC) was found: Trumpet Creeper (S2? - MNRF rank not confirmed). Trumpet Creepers typically inhabit deciduous woods, roadsides and hedgerows and is commonly cultivated resulting in some populations originating from escapes of cultivation (Oldham and Brinkler, 2009). The Trumpet Creeper was only found within Community 4 and are most likely escapes from surrounding residential gardens or from adjacent greenhouses. No other rare species were noted in the various other field visits conducted for this site.

3.3.4 Floral Summary

Overall, the riparian vegetation communities of the Esseltine Drain are common and secure in Ontario (NHIC, 2015). Non-retainable or hybrid Butternut trees were found within the study area south of County Road 20, and are not the protected native species under the ESA. Only one species of conservation concern (S1 to S3 ranked or SC) was found: Trumpet Creeper in Community 4. However, it was determined that it is most likely an escape from cultivation and would not need further consideration.

3.4 Wildlife

3.4.1 Amphibians

MNRF and/or the provincial database (NHIC, 2015) have not identified any rare amphibian species within 1km of the study area [Appendix B].

During ELC investigations and the first snake habitat survey (April 6, 2015), no potential amphibian breeding habitat was identified. However, a confirmation amphibian breeding survey was completed April 29, 2015. No amphibians were heard calling within the study area [Appendix G].

3.4.2 Birds

The provincial database (NHIC, 2015) have reported one rare bird within 1km of the study area: Barn Owl (END) [Appendix B].

In Ontario, Barn Owls primary foraging habitat includes old agricultural fields, rough pasture, hayfields, grassy roadsides and grassy marshes (COSEWIC, 2010). Nesting habitat includes cavities in live and dead trees, chimneys, barn lofts, silos, hangers, water towers, large bridges, attics and nest boxes (COSEWIC, 2010). Based on site investigations, no suitable habitat (nesting structures or expansive foraging habitat) exists within the study area for Barn Owl.

Following our site visit with MNRF (May 28, 2015) and their response email (June 23, 2015), a breeding bird survey was conducted on July 3, 2015 by Will Huys [Appendix G]. A total of twenty-one (21) birds were recorded for the entire study area. No bird species at risk (END or THR) or species of conservation concern (S1 to S3 ranked or SC) were found within the study area. Given the highly disturbed habitat, narrow corridor, existing development on either side, and no records from MNRF, none are anticipated. General habitat surveys (i.e., stick nests, ideal habitats, etc.) were conducted during the breeding bird survey and during other site investigations (April 6 and May 14, 2015). No notable bird habitats (i.e., stick nests) were observed.

Populations of breeding birds in North American have been assessed and those with conservation concern have been identified in the Ontario Partners in Flight (PIF) 2008 Ontario Landbird Conservation

Plan: Lower Great Lakes/St. Lawrence Plain (North American Bird Conservation Region 13). Two (2) of these landbirds were found as breeders within the study area [Table 5].

Table 5: Partners in Flight Bird Species within the Study Area

Common Name	Scientific Name	Priority Reason	North American Objective	Habitat	Focus
Baltimore Oriole	*Icterus galbula*	Regional Concern and Stewardship	reverse decline	Various	Stable in S.Ont.
Northern Flicker	*Colaptes auratus*	Regional Concern	reverse decline	Forest	snags > 30 cm dbh or nest boxes

For both the Baltimore Oriole and the Norther Flicker, numbers have declined in North America below desirable levels. However, the Baltimore Oriole is stable in southern Ontario and to help reverse the decline of the Northern Flicker population it is recommended that the availability of nesting sites is increased by retaining snags >30cm dbh and/or to creating nest boxes in suitable habitat.

3.4.3 Snakes

The provincial database (NHIC, 2015) reported Massassauga (END) snake species/habitat potentially within 1km of the study area for [Appendix B]. The study area is well beyond the current Massassuaga range (Ojibway Prairie in Windsor, Wainfleet Bog in Port Colburne, the Bruce Peninsula and Eastern Georgian Bay) (PCA, 2015) and does not need further consideration.

In the site meeting follow-up email, MNRF confirmed the study area is located within an area that is known to be used by Eastern Foxsnake (END) [Appendix A].

Snake habitat surveys were conducted on April 6 and May 14, 2015 by Paul Mikoda [Appendix G]. These surveys were conducted to identify any potential critical snake habitat features and evaluate the overall quality and character of available habitat within the study area.

Within the study area, the cultural woodland and the deciduous forest (Communities 3 and 4) would provide general foraging habitat for the Eastern Foxsnake, while the cultural meadow and cultural thicket (Communities 1 and 2) would provide more typical, better quality foraging habitat. The only potential hibernaculum noted throughout the site were various small, active mammal burrow located along the

Esseltine Drain banks. However, any existing animal burrows within the natural watercourse portion of the study area (Reach 4) would be susceptible to damage/destruction by the existing significant erosion and bank stability issues and would not be considered high quality potential hibernaculum. Overall, the study area is lacking in high quality open/semi-open habitat for Eastern Foxsnake. Eastern Foxsnake would be expected to use the study area for migration to other, higher-quality habitats, occasional foraging, and potentially hibernation. Availability of the potential hibernaculum noted [Figure 6a; 6b] will be dependent on whether the burrow users are predators but hibernaculum would not be expected to be a limiting factor to the local population. Poor quality and unstable habitat is the main limiting factor for this species. No nesting features or basking features (debris piles) were noted during site investigations.

3.4.4 Insects

The provincial database (NHIC, 2015) have reported three insects of conservation concern (S1 to S3 ranked or Special Concern) within 1km of the study area: Azure Bluet (S3), Cyrano Darner (S3) and Duke's Skipper (S2) [Appendix B].

Based on the preferred habitats of the three species (slow waters, marshes, boggy ponds, wooded wetlands) [Appendix B], there is no potential habitat for any of the insects of conservation concern and would not need further consideration.

3.4.5 Other Wildlife

Observations and/or evidence of mammals and other wildlife (i.e., tracks, dens, scat, etc.) were noted during the ELC, snake habitat, breeding bird and aquatic habitat surveys (April 6, May 14, July 3, and August 12, 2015 [Appendix C; Appendix G].

Mammals

During site investigations (May 19, 2015), evidence (tunneling) of Eastern Mole was found throughout the ravine south of County Road 20 [Appendix G]. The Eastern Mole is listed as Special Concern in Ontario. Eastern Moles (SC) requires stone-free sand and sandy loam soils with cover of woody plants which can occur in forests, open woodlands, meadows, pastures and fields (COSEWIC, 2010b).

Bats

Targeted bat surveys were not completed as part of this study. Even though, there are few large diameter wildlife trees (>25cm dbh) within Community 4 that could be used for bat maternity colonies, there are not more than 10 per hectare within Community 4 [Appendix E].

Turtles

No turtles were observed during any site investigations. Within the study area, the only area suitable for turtle nesting is near the mouth of the Esseltine Drain along the Lake Erie beach. There is potential nesting habitat within the agricultural fields adjacent to the Esseltine Drain, however these fields are outside the study area (i.e., outside the riparian corridor).

Terrestrial Crayfish

There were no terrestrial crayfish mounds observed during any of the site investigations.

3.4.6 Wildlife Summary

Based on site investigations, within the study area there is habitat or potential habitat for:

- common breeding birds
- two PIF birds: Baltimore Oriole and Norther Flicker
- Eastern Foxsnake (END) foraging and potential hibernaculum (animal burrow)
- common snake potential hibernaculum (animal burrow)
- Eastern Mole (SC)
- Turtle nesting along Lake Erie Beach and adjacent agricultural lands

4.0 NATURAL HERITAGE FEATURES AND FUNCTIONS

The following federal, provincial, and local environmental legislation, regulations and policies will be used to identify natural heritage features and functions within the study area:

- Fisheries Act;
- Migratory Birds Convention Act;
- Ontario Water Resources Act;
- Endangered Species Act ;
- Provincial Policy Statement (2014) – Section 2.1: Natural Heritage;
- Town of Kingsville Official Plan (2011); and
- ERCA Regulations

The existing conditions of the study area identified in Section 3 of this report are evaluated in the context of the above environmental legislation, regulations and policies to identify natural heritage features and/or functions are present within the study area. Any natural heritage features and functions identified will need further consideration during the design and implementation of the Esseltine Drain Improvements Project.

4.1 Fisheries Act

Fish habitat is protected under the Federal *Fisheries Act* (1985) and amendments (Bill C-38, November 2013). The *Fisheries Act* requires that projects avoid causing serious harm to fish unless authorized by the Minister of Fisheries and Oceans Canada (DFO). This applies to work being conducted in or near waterbodies that support fish that are part of or that support a commercial, recreational or Aboriginal fishery.

The Esseltine Drain is a warmwater system that contains some fish and provides fish habitat. Therefore, the Esseltine Drain is protected under the federal *Fisheries Act* and requires further consideration. This is discussed in Section 6.1.

4.2 Migratory Birds Convention Act

The federal *Migratory Birds Convention Act (MBCA)* (1994; consolidated January 2010) is applied through The Regulations Respecting the Protection of Migratory Birds that states that "[…] no person shall disturb, destroy or take a nest, egg […] of a migratory bird." This law protects all birds aside from the introduced species European Starling, House Sparrow, and Rock Pigeon. Bird nests that are destroyed during the course of construction and other related activities is referred to as "incidental take" and is illegal except under the authority of a permit obtained through the Canadian Wildlife Service (CWS). Generally, the period during which vegetation clearing is prohibited in Southwestern Ontario is typically between May 1st to July 31st but could extend into mid-August depending on the species.

The surrounding riparian vegetation along the banks of the Esseltine Drain provides suitable nesting for migratory birds. If the project is contemplating vegetation clearing surrounding the Esseltine Drain, the *Migratory Birds Convention Act* needs further consideration. This is discussed in Section 6.2.

4.3 Ontario Water Resources Act

Under Section 34 of the *Ontario Water Resources Act*, water taking is described as taking surface water or groundwater. Therefore, a by-pass pump used to maintain flow around an isolated area for a drainage works project is considered to be water taking. Passive diversion is not.

Water takings in Ontario are governed by the *Ontario Water Resources Act* (OWRA) and the Water Taking Regulation (O. Reg. 387/04) under the Act. Section 34 of the OWRA requires anyone taking more than a total of 50,000 L/day to obtan a Permit to Take Water (PTTW). It only takes about 0.5 L/s flow to reach 50,000 L/day so most sites will need to consider this permit requirement. In a rain event during construction, this volume can be easily surpassed.

If the Esseltine Drain repairs and improvements project is contemplating water taking, the *Ontario Water Resources Act* needs further consideration. This is discussed in Section 6.3.

4.4 Endangered Species Act

The *Endangered Species Act* (ESA) (2007) protects species at risk (SAR) and their habitats in Ontario. Endangered (END), threatened (THR) and extirpated (EXP) species listed on the Species at Risk in Ontario (SARO) list automatically receive legal protection from harm or harassment under the ESA. In addition to species protection, the ESA prohibits damage or destruction of habitat for endangered or threatened species. The habitat of a species may be protected through general habitat protection, or where included in a regulation, through a species specific habitat definition.

No SAR plants species were found as the Butternut (END) were either hybrids or non-retainable due to the canker disease.

Although no Eastern Foxsnakes (END) were found during site investigations, there is potential Eastern Foxsnake (END) foraging and hibernaculum within the study area, which is protected under the ESA. Further consideration to potential Eastern Foxsnake (END) habitat will be needed and is discussed in Section 6.4.

4.5 Provincial Policy Statement (2014) - Section 2.1: Natural Heritage

Policy 2.1 of the Provincial Policy Statement (PPS) (MMAH, 2014) provides direction on the protection of natural heritage resources that have been identified as 'significant'. These 'significant' features are broadly defined within the PPS and rely on the MNRF and municipalities to identify and delineate specific natural features. The Natural Heritage Reference Manual (MNR, 2010), Significant Wildlife Habitat Technical Guide (MNR, 2000) and the Significant Wildlife Habitat Criteria Schedules (MNRF, 2015) were prepared by the MNRF to provide guidance on identifying natural features and interpreting Section 2.1 of the PPS. The PPS significant natural heritage features are discussed below.

Significant Wetlands/Coastal Wetlands

No provincially significant wetlands or coastal wetlands have been identified within 1km of the study area (NHIC, 2015; Appendix A).

Significant Woodlands

Local municipalities identify significant woodlands. The Town of Kingsville identifies significant woodlands under the 'Environmentally Significant Areas' designation. This will be discussed further in municipal policy Section 4.6.

Significant Valleylands

Local municipalities identify significant valleylands. The Town of Kingsville identifies significant valleylands under the 'Environmentally Significant Areas' designation. This will be discussed further in municipal policy Section 4.6.

Significant Wildlife Habitat

Criteria to identify SWH are taken from the Significant Wildlife Habitat Criteria Schedules for Ecoregion 7E (MNRF, 2015). Candidate SWH is determined by the threshold requirements for features (i.e., ELC's, age of trees, etc.) and area (i.e. woodlands >30ha). Confirmed SWH is determined by the wildlife use thresholds by target species. Field investigations for the study area were reviewed against the appropriate wildlife use thresholds for the identified Candidate SWH in Section 3.3.2 and Appendix E.

Seasonal Concentration Areas of Animals

- Shorebird Migratory Stopover Area - Community 4 (BBO1 inclusion)

  Only one Spotted Sandpiper was observed within Community 4 in the beach inclusion (BBO1) during site investigations. Given the small area and the fact that threshold requires three target species to be present, SWH targets are not met. Confirmed **Not SWH**
- Raptor Wintering Areas - Community 4 for Bald Eagle

  None of the target species, nor any stick nests were observed within the study area during site investigations. SWH targets are not met. Confirmed **Not SWH**
- Reptile Hibernaculum - All communities

  There are several small active animal burrows throughout the study area. However, there is low potential for usage as banks are unstable within the study area and no snakes were observed during site investigations. The entire study area is treated as significant. Further consideration of reptile hibernaculum is required. Treated as **Unconfirmed SWH**

Specialized Habitat for Wildlife

- Bald Eagle and Osprey Nesting, Foraging and Perching Habitat - Community 4

  None of the target species, nor any stick nests were observed during site investigations. SWH targets are not met. Confirmed **Not SWH**
- Turtle Nesting Areas - Community 4 (BBO1 inclusion)

  None of the target species, nor any evidence of turtle nests were observed within the study area during site investigations. SWH targets are not met. Confirmed **Not SWH**

Species of Conservation Concern

- Terrestrial Crayfish - Community 1 (CUM1 with MAM 2 inclusion)

No terrestrial crayfish mounds were observed within the study area. SWH targets not met. Confirmed **Not SWH**

- Special Concern and Rare Wildlife Species for various plants and insects (See Appendix E)

  There is confirmed habitat of the Trumpet Creeper (S2) and Eastern Mole (SC) within the study area. Since the Trumpet Creeper is considered to be a escape from adjacent residential areas, only further consideration of the Eastern Mole (SC) habitat is required. **Confirmed SWH** for Eastern Mole.

Significant Area of Natural and Scientific Interest (ANSI's)

No ANSI's have been identified within 1km of the study area (NHIC, 2015; Appendix A).

Significant Habitat of Endangered and Threatened Species

Endangered (END) and Threatened (THR) species are governed by the *Endangered Species Act* (ESA). As noted in Section 4.4, potential Eastern Foxsnake (END) habitat need further consideration.

Fish Habitat

Fish habitat is governed by the federal *Fisheries Act*. As noted in Section 4.1, the *Fisheries Act* is applicable to the Esseltine Drain and will need further consideration as previously discussed.

4.6 Town of Kingsville Official Plan (2011)

The Town of Kingsville Official Plan policies that would be applicable to natural heritage is Section 4.2 and divides natural heritage features into three categories:

1. **Environmental Protection Areas** – this designation includes habitat of endangered and threatened species and significant wetlands/coastal wetlands
2. **Environmentally Significant Areas** – this designation includes significant woodlands, significant valleylands, significant wildlife habitat and ANSI's
3. **Fish Habitat** – although there is no designation for fish habitat on the Official Plan Schedules, the Town defaults to the *Fisheries Act* for fish habitat protection.

On Schedule B: Natural Heritage Features, the entire southern section and a portion of the northern section of the study area is designated as "Environmentally Significant Areas". Development and/or site alteration within and/or adjacent to "Environmentally Significant Areas" is not permitted unless it has been demonstrated, to the satisfaction of the Town, in consultation with the ERCA, that there will be no negative impacts on the natural features or on their ecological function. The Town of Kingsville is supportive of repairs to the drain and downstream outlet to resolve ongoing erosion and the resultant hazards associated with properties adjacent to the ravine (Town of Kingsville Council, December 4, 2014).

Further consideration regarding the significant woodlands, significant valleylands and significant wildlife habitat within the areas designated "Environmental Significant Areas" in the study area will be needed. Discussed Sectoin 6.5.

4.7 ERCA Regulations

The ERCA regulates wetlands, watercourses, valleylands, shorelines and other hazard areas pursuant to Ontario Regulation 158/06 (Regulation for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses) of the *Conservation Authorities Act*. Development proposed within the regulated area will require a permit from the ERCA.

The entire study area is regulated by the ERCA under Ontario Regulation 158/06 and will require further consideration. ERCA is supportive of repairs to the drain and downstream outlet to resolve ongoing erosion and the resultant hazards associated with property adjacent to the ravine (ERCA/MNRF, May 28, 2015).

4.8 Summary of Natural Heritage Features and Functions

The natural heritage features and functions in Table 6 have been identified through the policy review as requiring further consideration for the Esseltine Drain Improvements project.

Table 6: Natural Heritage Considerations

Policy Category	Natural Heritage Considerations
Fisheries Act	Fish Habitat
Migratory Bird Convention Act	Migratory Birds and their habitat
Ontario Water Resources Act	Water Taking
Endangered Species Act	Eastern Foxsnake
PPS and Town of Kingsville Official Plan	Significant Woodlands
	Significant Valleylands
	Significant Wildlife Habitat for: ▸ Reptile Hibernaculum (assumed) ▸ Eastern Mole (SC) habitat
ERCA Regulations	Regulated lands

5.0 PROPOSED WORKS

To establish a sufficient outlet and address erosion issues, the Esseltine Drain Improvement project proposes to convert the natural watercourse section into a municipal drain. This will not only provide erosion protection for the adjacent landowners but also provide a mechanism for ongoing maintenance activities in the future.

Because of the steep channel slope and constrained banks due to property ownership and efforts to limit the tree removal within the ravine system, cable concrete is considered the best long term solution for erosion protection. Below is a summary of the details of the proposed works. The reader is encouraged to review the detailed design drawings provided by RC Spencer for more details.

Esseltine Drain - Norther Section: Municipal Drain

- From County Road 34 to the Road 2 ROW (Reach 1 - Figure 7a)
    - no alterations are proposed
- Road 2 ROW to the Private Culvert (Reach 2 - Figure 7a)
    - Conduct a drain clean-out and create 2:1 bank slopes, with a 2.5m wide channel bottom and a 0.685% channel gradient
- Private Culvert
    - Update the culvert crossing by installing 2 new culverts to allow suitable access and re-align a 330m section of drain to better accommodate adjacent lands uses and new bank slopes.
- Private Culvert to End of Municipal Drain (upstream section of Reach 3 - Figure 7b)
    - Conduct a drain clean-out and create 3:1 bank slopes, with a 2.5m wide channel bottom and a 0.6% channel gradient

Esseltine Drain - Southern Section

- incorporate the downstream section into the municipal drain to allow for correction of hazard erosion issues and for future routine maintenance to prevent further bank erosion.
- End of existing Municipal Drain to County Road 20 (downstream section of Reach 3 - Figure 7b)
    - regrade the channel to 2:1 bank slopes (constrained area) with a 2.5m channel and 0.49% to 2.07% channel gradient
    - cable-concrete will be used to line the bottom of the channel bottom for approximately

100m upstream of County Road 20 to prevent down cutting of the channel in a constrained and confined valley.

- County Road 20 to Outlet at Lake Erie (Reach 4 - Figure 7b)
    - re-grade existing channel to 2:1 bank slopes, a 3m wide channel bottom with a 0.95% to 1.87% channel gradient to the outlet structure
    - floodway and channel will be lined with cable concrete
    - a gabion weir and cable concrete mat will be installed at the outlet
    - armour rock will protect the outlet weir

Opportunities to improve fish habitat characteristics of this design have been reviewed and are discussed later in this report.

6.0 POTENTIAL IMPACTS AND MITIGATION

The following text will identify potential impacts to the natural heritage features and functions within the study area, mitigation techniques or recommendations and where possible opportunities for the enhancement of the natural heritage system.

At present, the area north of County Road 34 is a municipal drain. The lower section below County Road 34 is being incorporated into the Drainage Report under the Drainage Act.

6.1 Fisheries Act

The Esseltine Drain is a warmwater system that contains some a small population of fish and provides fish habitat. The Esseltine Drain (both the existing municipal drain and section to be added)is protected under the federal *Fisheries Act*.

For projects in and around water, the *Fisheries Act* process now requires the proponent to self-assess their project against certain criteria to determine if a DFO review is necessary. If projects meet the project criteria and carry out the mitigation measures to mitigate serious harm to fish, the work is not considered to be in contravention of the *Fisheries Act* and can proceed without further DFO approval. Otherwise, DFO becomes involved in the review and approval of the project. Following a review of project details, DFO will either issue a letter of approval for the project (i.e., no serious harm) or require an application for *Fisheries Act* authorization (i.e., the project will cause serious harm).

Based on the field investigations (Section 3.2) and the details of the proposed Esseltine Drain improvements project (Section 5), the overall fish and fish habitat sensitivity in the Esseltine Drain is low and the risk of the project is moderate [Figure 8] and as such the project would not result in serious harm to fish, provided the mitigation measures outlined below are followed [Figure 8; Appendix H]. Typically, for projects as proposed, DFO will issue a letter indicating the project will not result in serious harm to fish and fish habitat [Appendix H].

A 'Request for Review' form will need to be submitted to DFO to initiate their review. To properly complete the form, details are required including the project design, project timing, the watercourse habitat, and the mitigation measures that will be carried out to minimize serious harm.

Recommendation 1: Once the design of the Esseltine Drain Repairs and Improvements project is finalized, submit a 'Request for Review' to DFO. Submission of the DFO review form should be completed as soon as possible to avoid delays. Typically, DFO aims for a four (4) week turn-around for these review requests.

The following mitigation measures to protect fish and fish habitat should be incorporated into the project and be presented in the submission to DFO,

Recommendation 2: In-water works should occur after June 30th and before March 1st (i.e., no work between March 1st and June 30th) to protect spring spawning of the fish species that utilize the downstream reach of Esseltine Drain (south of County Road 20). Work should also be scheduled to avoid work during very wet and rainy conditions to minimize erosion and water diversion challenges.

Recommendation 3: In-water works for the Esseltine Drain project should be conducted in phases so that (if possible) all in-water works can be isolated of open or free flowing water to maintain flow and minimizing the introduction of sediment to the downstream reaches (and ultimately Lake Erie).

Recommendation 4: If in-water work can be isolated, a fish salvage should be conducted to within the isolated areas.

Recommendation 5: An emergency spill kit should be on-site at all time in the event of a spill. All workers should be trained the proper spill procedure (i.e., containment, clean-up and reporting) which should also be completed in accordance with provincial standards.

Recommendation 6: Re-fueling and maintenance of construction equipment must occur a minimum 30m away from the Esseltine Drain to minimize the potential for deleterious substances from entering the water. Non-mobile equipment within the construction area should have a permanent drip pan.

Recommendation 7: A sediment and erosion control plan should be prepared to protect Lake Erie from impacts. This will include sediment fencing to control exposed bank slumping, stage construction and a low flow water conveyance pipe through the work area to protect base flow.

Recommendation 8: All installed sediment and erosion control fencing should be inspected prior to any site excavation to ensure that it was installed correctly.

Recommendation 9: Regular maintenance inspections of the sediment and erosion control fencing during construction shall occur to ensure it is functioning properly. Fencing shall be maintained until the site has stablized. Once the ravine area is a municipal drain, the town drainage superintended provides inspection and maintenance.

Recommendation 10: Site preparation, including clearing, grubbing, top soil stripping and other earthworks, shall be preformed immediately after the installation of the sediment and erosion control fencing to prevent erosion and sedimentation.

Opportunities for Fish and Fish Habitat

The fish community within the Esseltine Drain is very limited due to very low numbers and diversity of fish species utilizing the drain. The fish barrier at County Road 20, downstream log jams from eroding banks and undermined trees plus the intermittent connection to Lake Erie (sand bars at mouth) all act as fish barriers. Fish populations are largely serviced by upstream populations and not the lake.

Based on the current design, better connectivity within the Esseltine Drain (i.e., connect upstream and downstream of County Road 20) will occur with the removal of barriers. Cable concrete lined channels are not a good habitat for fish to allow for refugia, cover or fish food production. The channel slope and velocity is a challenge to introduce these features, particularly with the added constraint of space and the desire for maximum tree retention. One option to address this issue is a variation in cable concrete block size (alternating between 6" and 8" sizes) to provide for a simulated riffle pool sequence [Figure 9a].

Recommendation 11: Aquatic habitat within the cable concrete portions could be created by varying the cable concrete height (i.e., alternating pattern of 6" and 8" cable mats) every 50m along the channel.

However, the concern with this approach is potential fouling and, due to the poor existing fish community, the drainage engineer is not recommending this variation.

Connectivity to the lake will also be a challenge as proposed slope adjustments to reduce flow velocities will require a retaining wall at the mouth. This results in a 3m+ elevation difference at the lake and would represent a permanent barrier to upstream fish movement. Without extending the channel form well out into the lake, the only opportunity to mitigate existing blocked fish movement would be through a fish ladder design [Figure 9b].

Recommendation 12: Consider installing fish ladders at County Road 20 and the gabion weir at the Lake Erie outlet to improve the connectivity throughout the drain if economically feasible.

However, these measures have also been not recommended by the drainage engineer as the cost of installation is large given the poor quality fish community in the existing drain.

6.2 Migratory Birds Convention Act

The surrounding riparian vegetation along the banks of the Esseltine Drain (both the municipal drain and natural watercourse portions) provides suitable nesting for migratory birds and is protected under the federal *Migratory Birds Convention Act.*

Any vegetation clearing surrounding the Esseltine Drain will need to take into account the migratory bird active season is typically May 1st to July 31st, but could extend into mid-August depending on the species. There are two options to ensure the project is in compliance with the *Migratory Birds Convention Act*:

1. Option 1: Clear Vegetation Outside Migratory Bird Active Season

   Vegetation clearing outside the active season is acceptable and the most ideal approach to avoid scheduling delays.

2. Option 2: Clear Vegetation During Migratory Bird Active Season

   If vegetation clearing is contemplated within the migratory bird-nesting season, the surrounding vegetation will need to be inspected for nesting. If nesting is not occurring then vegetation clearing can proceed. However, if migratory birds are nesting, nesting will need to be monitored by a qualified biologist to determine when young birds have fledge the nest(s) or when the nests become inactive. Once the nests are no longer active, vegetation clearing can proceed. This option is more labor intensive (frequent monitoring) and could result in project delays if migratory birds are nesting within the project area. Alternatively, the town could apply for a Damage or Danger permit under Migratory Birds Regulations from Environment Canada.

Recommendation 13: Conduct vegetation clearing and any grubbing activities outside the Migratory Bird active season (i.e., no clearing or grubbing between May 1st and July 31st).

6.3 Ontario Water Resources Act

The Esseltine Drain improvements project is contemplating passive flow diversion by installing a low flow pipe through the work area downstream of County Road 20. A Permit to Take Water is not needed for this section. However, active diversion requires an additional approval under the *Ontario Water Resources Act* for works upstream of County Road 20 when there are in water works. Since pumping would only remove water for a short period of time and will be returned to the system with no significant change in water quantity or quality, a Category 2: Taking and Returns Permit would be required.

Recommendation 14: Where active diversions are contemplated for the Esseltine Drain improvements project, a PTTW should be obtained from the Ministry of the Environment (MOE). When applying for a PTTW, the application should cover possible higher pumping rates due to storm events that may occur during construction.

To avoid PTTW delays, the PTTW can be obtained ahead of time by the project administration provided this entity be supervising the construction works (i.e., the Municipality, Contact Administrator or even the fish salvage crew). In this way, the permit can be obtained prior to construction tender to avoid delays.

6.4 Endangered Species Act

Although no Eastern Foxsnakes (END) were found during site investigations, MNRF has indicated that habitat or individuals of Eastern Foxsnake (END) may be impacted by the proposed activity. The

Endangered Species Act (ESA) protects species listed provincially endangered and threatened and their habitats. The ESA must be considered through consultation with MNRF to avoid contravention of section 9 and 10 of the Act.

6.4.1 Esseltine Drain - Existing Municipal Drain Section

Within the municipal drain section of the Esseltine Drain, the vegetated banks have the potential to provide habitat for Eastern Foxsnake (END). As this species and its habitat are protected under the ESA, these features, functions and their protection must be considered.

Under the regulatory provisions within Ontario Regulation 242/08, Section 23.9 (Drainage Works) allows for municipalities that conduct eligible repair, maintenance, and improvement work under the *Drainage Act* to be exempt from Sections 9 and 10 of the *Endangered Species Act* (i.e.., impacts to species at risk and their habitat), so long as the rules in the regulation are followed.

Section 23.9 (Drainage Works) of Ontario Regulation 242/08, allows Municipalities to give notice to MNRF through an online registration process. The registration process allows for the Municipality to register all eligible drains along with all impacted species in one registration. Municipalities may then update their registry at any time to add drainage activities with new drains as well as add new eligible species.

In addition to registering the project, Section 23.9 of Ontario Regulation 242/08 also requires the Municipality to:

- Minimize adverse effects to the species and their habitat;
- Create and implement a mitigation plan for each species;
- Report sightings of rare species and update registration documents as necessary; and
- Report on activities completed each year (when required)
- construct during the active season for snakes

Recommendation 15: Have the Town of Kingsville register the Esseltine Drain improvements to the municipal drain section with MNRF and create a mitigation plan prior to project commencement. The mitigation plan should contain the recommended mitigation measures for Eastern Foxsnake outlined in Section 6.4.2.

Recommendation 16: During the project, the Town of Kingsville should implement the mitigation plan, maintain registration documents, and report sightings of rare species.

Recommendation 17: Upon completion of the project, the Town of Kingsville should prepare and provide a report at the completion.

Recommendation 18: To minimize impact to Eastern Foxsnake and their potential habitat, any work within the project work area being conducted under the *Drainage Act* should be completed between June 1st and September 15th to protect sensitive snake periods (i.e. hibernation and emergence). This timing window should also be included within the mitigation plan needed for registration.

6.4.2 Esseltine Drain - Drain Extension Section

Within the natural watercourse section of the study area, the riparian cultural woodland and the deciduous forest communities (Communities 3 and 4) have the potential to provide general foraging habitat for the Eastern Foxsnake, while the single animal burrow has the potential to provide hibernaculum. As Eastern Foxsnake is mainly associated with open prairie/marsh/thicket habitats, the wooded, closed canopy habitat within the natural watercourse section of the study area is not expected to provide high quality foraging opportunities. As the surrounding habitat is not expected to attract a large number of Eastern Foxsnake, there is a low likelihood that the single burrow noted during site surveys would be utilized for hibernating by this species.

If Eastern Foxsnake are present at all in this section, they are most likely there for movement and foraging. As a result, the riparian corridor is considered Category 2 habitat. The current low flow channel (3m x 530m) is not protected habitat for Eastern Foxsnake and removed from impact calculations [Table 7].

Above the normal highwater mark, there is severe erosion as a result of channel downcutting and storm flow volume and veloctiy. Cable concrete has been selected as the most cost effective stabilization approach. Spacing of the blocks within the cable concrete will allow for grass land naturalization within the footprint of the cable concrete mat above the new low flow channel [Figure10]. Notwithstanding the amount of eroded area above the low water mark, approximately 10,150m2 of riparian area will be converted to stablized grassland. As a result, this area is considered a mid-term temporary impact to allow for re-vegetation of the cable mat to occur over two to three years. Because most of this same area is already highly impacted as a result of erosion bank slumps a more stable vegetated channel bank, will be a long term benefit over what presently exists. Between the cable concrete mats and existing top of bank, there will be additional vegetation removal and infilling to match existing grade. Approximately 6200 m2 of area is in this regraded section which will be available for revegetation with native trees and grasses. Thermoregulation and refuge areas for snakes can be provided in this location. As a result, this 6200 m2 is considered a short term temporary impact (one year for vegetation establishment) [Table 7].

Table7: Habitat Impacts Downstream of County Road 20

Habitat Category			
Existing Conditions		m2	m2
	Total Area	25400 (2.54 ha)	
	Low Flow Channel	1550	
	Protected Habitat		23850
Channel Stabilization and Reconstruction		m2	
	Unaffected	7500	
	Low Flow Channel	1550	
	Short term (slope regrading)	6200	
	Medium Term (cable concrete revegetation)	10150	
	Protected Habitat		23850

The only potential snake hibernaculum (i.e., animal burrow) within the natural section of the Esseltine Drain is located at the top of slope of the valley corridor [Figure 11]. The burrow is approximately 20m from any proposed work activity. A barrier will be installed along the project works and as a result, 20m of existing vegetation will be retained adjacent to this burrow. As a result, the only potential critical habitat is being protected and no additional artificial hibernaculum are proposed for this project.

During construction there is potential for incidental encounters with the Eastern Foxsnake. To ensure project is not in contravention with section 9 and 10 of the *Endangered Species Act* (i.e., species at risk and their habitat), MNRF will need to give approval to allow for the temporary impacts within and adjacent to Eastern Foxsnake habitat (i.e. within potential foraging habitat and adjacent to potential hibernaculum).

Recommendation 19: Obtain project approval from MNRF through a Letter of Advice.

The following mitigation measures to protect Eastern Fosnake (END) should be incorporated into the submission to MNRF for their review. MNRF may request additional mitigation measures.

Recommendation 20: Any work within the project work area should be completed between June 1st and September 15th to protect sensitive snake periods (i.e. hibernation and emergence). This process will make the project work area less appealing to any potential snakes in the area and promote movement to outside of the work area.

Recommendation 21: Following clearing and grubbing, a snake barrier fence should be installed along the perimeter of the work area to prevent snakes from entering the site. While MNRF suggests barrier fences of 60 cm in height above ground and 10-20 cm embedded [Appendix 1] we recommend extending the height to 1.5m above ground and embedding the fence 20cm for Foxsnake. Ultimately, snake barrier fencing construction and installation will need to be approved by MNRF.

Recommendation 22: Construction staff will be made aware of the potential presence of Eastern Foxsnake on and adjacent to the construction site. A description of the Eastern Foxsnake and a field identification guide should be made available to construction staff for the project. Additional construction staff education activities may be required by MNRF.

Recommendation 23: Should an Eastern Foxsnake be encountered during the construction of the project, to following should be conducted:

a) all construction activities should be halted;

b) a qualified biologist (i.e., person who has specialized training in handling SAR snakes) should be notified immediately;

c) snake movement should be monitored by construction staff until the arrival of the qualified biologist;

d) the qualified biologist will either confirm the snake has left the consrtuction site or safely remove the snake from the construction site using proper handling techniques [Appendix J].

e) Once the snake has left, construction activities can resume and MNRF should be notified of the snake encounter by the qualified biologsit within 48hrs of the observation.

Recommendation 24: Banks within the work area that have been exposed or were created due to in-filling should be re-vegetated with native tree and shrub species that complement the surrounding existing vegetation. Under-seeding with a native grassland mixture will aid in bank stabilization and prevention of the establishment invasive species.

6.5 Timing Restriction Summary

Table 8: Approximate Timing Restrictions

Species	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
Fish and Fish Habitat	🟨	🟨	🟥	🟥	🟥	🟥	🟨	🟨	🟨	🟨	🟨	🟨
SAR Snakes [1]	🟥	🟥	🟥	🟥	🟥	🟨	🟨	🟨	🟨🟥	🟥	🟥	🟥
SAR Turtles[1]	🟩	🟩	🟩	🟩	🟨	🟨	🟨	🟨	🟨	🟨🟩	🟩	🟩
Migratory Birds Habitat	🟩	🟩	🟩	🟩	🟥	🟥	🟥	🟩	🟩	🟩	🟩	🟩

Red: no work; sensitive period and/or active season (shoulder times are weather dependent).

Yellow: need approval and/or mitigation measures

Green: project can proceed without any additional approvals

There will be several timing restrictions which need consideration prior to construction [Table 8]. There are measures which need to be discussed with the various agencies to ensure a smooth construction project. A long lead time is needed to address these issues and should be discussed well ahead of tender award. With approvals/permits in place from the appropriate agencies, the yellow boxes can be turned to green. Removal of vegetation outside the migratory bird timing window allows work to proceed as habitat no longer exists. Under special circumstances, a permit can be obtained from Environment Canada to impact migratory bird nests. Approval to work within the timing restrictions of SAR species is rare and would require a large lead time to discuss with MNRF.

6.5 Natural Heritage and the Town of Kingsville Official Plan

The review of the Policy 2.1 of the Provincial Policy Statement (PPS, 2014) and the Town of Kingsville Official Plan identified the following natural heritage features within the study area:

- Fish Habitat
- Significant Habitat for Endangered and Threatened Species
- Significant Woodlands
- Significant Valleylands
- Significant Wildlife Habitat

Fish Habitat is governed by the *Fisheries Act* and is discussed in Section 6.1. Significant Habitat for Endangered and Threatened Species is governed by the *Endangered Species Act* and is discussed in Section 6.4. The remaining natural heritage features are discussed below.

Significant Woodlands

The Esseltine Drain riparian corridor is identified as a significant woodland. Based on the proposed works for the project, portions of the riparain vegetation will be removed. Impacts to the woodland will only be temporary since re-naturalization of the disturbed ripairan corridor will be completed. By completing the Esseltine Drain project, banks will become more stable which will allow for the adjacent ripairian vegatation to remain, rather then being undermined and washed downstream.

Recommendation 25: Prepare and implement a re-naturalization plan for the Esseltine Drain project. The plan should identify exposed areas and in-filling areas that should be re-vegetated with native tree and shrub species that complement the surrounding existing vegetation. The plan should also include under-seeding with a native grassland mixture which will aid in bank stabilization and prevention of the establishment invasive species.

Significant Valleylands

Although the natural watercourse portion of the Esseltine Drain is identified as significant valleyland, the severe erosion and very unstable banks are creating property damage to the surrounding residences. By completing the Esseltine Drain project, the drain banks and the surrounding ravine will become more stable, thus preventing adjacent property damage.

Significant Wildlife Habitat

There is significant wildlife habitat within the Esseltine Drain in the form of:

- potential Reptile Hibernaculum (animal burrows); and
- Habitat for Species of Conservation Concern: Eastern Mole (SC)

There is potential for snake hibernaculum throughout the Esseltine Drain that will be impacted by the proposed improvements. Downstream of County Road 20, no potential hibernaculum will be impacted. However, several animal burrows in the upstream sections will be temporarily affectd. While animals will reconstruct their burrows, mitigatation of the potential temporary loss of hibernaculum for common snake species, creation of hibernaculum should be considered.

Recommendation 26: Construction of snake hibernaculum above the highwater mark within the Esseltine Drain riparian corridor upstream of County 20 could be considered. Hibernaculum construction will follow the Toronto Zoo Specifications [Appendix K] with modifications suited to Essex County soils and drainage.

Habitat for the Eastern Mole (SC) is highly impacted and very unstable due to the severe erosion occurring within the drain. By completing the project, the surrounding riparian corridor will not be susceptible to erosion and will create a more stable habitat for these species.

6.6 ERCA Regulations

The entire study area is regulated by the ERCA under Ontario Regulation 158/06. A permit from ERCA is required prior to any site alterations.

Recommendation 27: Acquire a permit from ERCA to complete work within the regulated areas surrounding the Esseltine Drain.

6.7 Opportunities

Although Northern Flicker is not considered as species of conservation concern, expanding its habitat through the establishment of nesting sites would be an opportunity.

Recommendation 28: Create nest boxes for the northern flicker within the wooded area downstream of County Road 20.

7.0 CONCLUSIONS

The proposed design for the Esseltine Drain will alleviate any of the ongoing and excessive erosion issues within the Esseltine Drain. We have evaluated the proposed Esseltine Drain improvements and any potential impacts to the natural heritage system have been avoided and/or mitigated with the recommendations provided in Section 6.

Habitat for species protected under the Endangered Species Act (Eastern Foxsnake [END]) will occur as temporary impacts provided construction timing windows are followed. All impacts are considered temporary as the site will be revegetation and there will be no permanent loss of habitat. Within the reinforced channel portion, actively eroding banks will be replaced with stablized cable concrete that allows grasses to grow in the gaps. This growth will take some time so the temporary effect is considdered mid-term (two to three years) Safe foraging habitat will be expanded as a result and provide long term benefits. Other excavated areas will be revegetated and this will result in a short-term temporary impact (one year). No other habitat sensitivities were noted with respect to fish, breeding birds or plants. Eastern Mole (Special Concern) was noted but sufficient habitat is being avoided and restoration of side slopes upgradient of the floodway will provide habitat once stablized. Below the floodway, habitat for Eastern Mole, as with Eastern Foxsnake, is compromised due to active erosion and instablity.

Some recommendations for fish habitat improvements were reviewed but given the elevation difference between the lake levels and a stable channel slope from County Road 20 (around 4m) and the poor fish community representation in the drain extension, there options were abondanded as a result of a poor cost/benefit ratio.

An artificial hibernaculum has been suggested in the upper reaches of the municipal drain (north of County Road 20). Some Northern Flicker boxes are suggested for the area downstream of County Road 20.

The largest issue related to this project is the magnitude of work and timing restrictions for various acts related to natural heritage protection and preservation. These timing restrictions need to be carefully considered and discussions with the various approval agencies should be initiated well ahead of tender award to ensure a smooth construction process.

Provided the recommendations in Section 6 are addressed/implemented, it is our opinion, from the perspective of natural heritage and correcting ongoing and excessive erosion issues, the Esseltine Drain improvements project can and should proceed.

Should you wish to clarify any questions or require additional information as part of the review of this Natural Heritage Report, do not hesitate to contact us.

BioLogic Incorporated

Dave Hayman, M.Sc
President/Senior Biologist

EsseltineDrainNatHeritageRpt_Final.wpd

[RL/PM]

8.0 REFERENCES

COSEWIC, 2010a. COSEWIC assessment and status report on the Barn Owl *Tyto alba* (Eastern population and Western population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiv + 34 pp.

COSEWIC, 2010b. COSEWIC Assessment and status report on the Eastern Mole Scalopus aquaticus in Canada. Committee on the Statuts of Endangered Wildlife in Canada. Ottawa. x + 29pp.

Department of Fisheries and Oceans (DFO), 2015. Distribution of Fish and Mussel Species at Risk. Essex Region Conservation Authority. Maps produced May 2015. Valid until May 2016. Available at: http://www.conservation-ontario.on.ca/projects/DFO.html.

Essex Region Conservation Authority (ERCA), 2013. Essex Region Natural Heritage System Strategy - (An Update to the Essex Region Biodiversity Conservation Strategy). Essex, Ontario. 319 pages.

Lee, H.T., W.D. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig, and S. McMurray. 1998. Ecological Land Classification for Southern Ontario: First Approximation and its Application. Ontario Ministry of Natural Resources, Southcentral Science Section, Science Development and Transfer Branch. Field Guide FG

Natural Heritage Information Centre Database (NHIC). 2015. Ontario Ministry of Natural Resources. Available at: http://www.mnr.gov.on.ca/MNR/nhic/nhic.cfm.

Ontario Ministry of Municipal Housing and Affairs (MMHA), 2014. Provincial Policy Statement. Ontario Ministry of Municipal Affairs, Toronto, Ontario.

Ontario Ministry of Natural Resources (MNR), 2000. Significant Wildlife Habitat Technical Guide. October 2000. Ontario, Canada. 151 pp.

Ontario Ministry of Natural Resources (MNR), 2010. Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005. Second Edition. Toronto: Queen's Printer for Ontario. 248 pp.

Ontario Ministry of Natural Resources (MNR). 2013. Reptile and Amphibian Exclusion Fencing: Best Practices, Version 1.0. Species at Risk Branch Technical Note. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. 11 pp.

Ontario Ministry of Natural Resources and Forestry (MNRF), 2015. Significant Wildlife Habitat Criteria Schedules for Ecoregion 6E. January 2015.

Ontario Ministry of Natural Resources and Forestry (MNRF), 2015. Natural Areas Mapping. Available online at: http://www.ontario.ca/page/make-natural-heritage-area-map

Ontario Partners in Flight. 2008. Ontario Landbird Conservation Plan: Lower Great Lakes/St. Lawrence Plain, North American Bird Conservation Region 13. Ontario Ministry of Natural Resources, Bird Studies Canada, Environment Canada.

Parks Canada Agency (PCA), 2015. Recovery Strategy for the Massasauga (*Sistrurus catenatus*) in Canada. *Species at Risk Act* Recovery Strategy Series. Parks Canada Agency. Ottawa. ix + 37pp.

Town of Kingsville, 2011. The Corporation of the Town of Kingsville Official Plan. Office Consolidation December 2011.

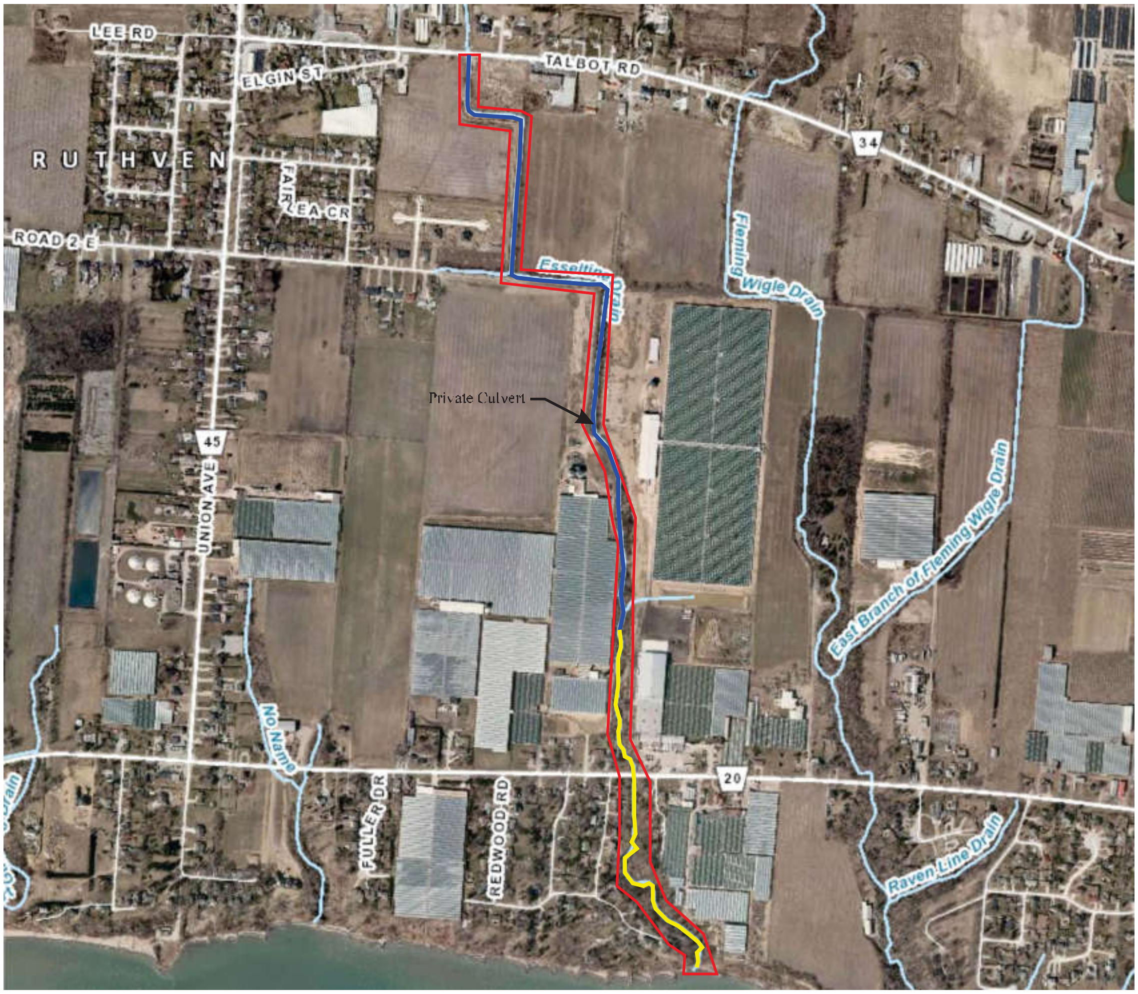


Figure 1: Site Location

(2013 ERCA Air Photo)

0 1,000
Scale 1:50,000
Key Plan

Legend:

— Study Area
— Municipal Drain Section
— Proposed Drain Extension

Print on 11X17, Landscape Orientation
0 60
Scale 1:8000
April 20 2016

BioLogic
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

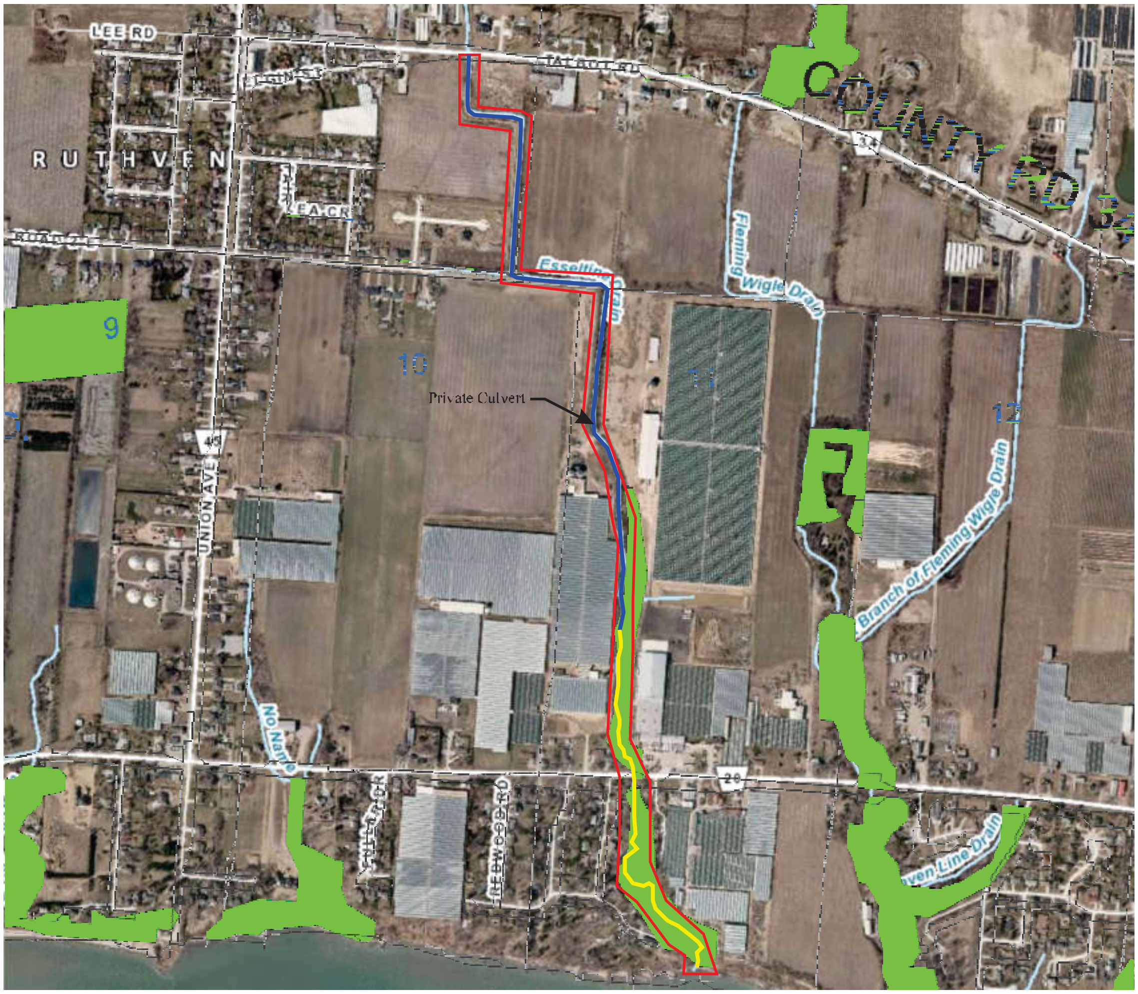


Figure 2: Natural Heritage Features

Town of Kingsville Official Plan Schedule B
(2013 ERCA Air Photo)

0 1,000
Scale 1:50,000
Key Plan

Legend:
- 🟥 Study Area
- 🟦 Municipal Drain Section
- 🟨 Proposed Drain Extension

Natural Heritage
- 🟩 Environmentally Significant Areas

Print on 11X17, Landscape Orientation
0 60
Scale 1:8000
April 20 2016

BioLogic
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

Figure 3: ERCA Regulations
(2013 ERCA Air Photo)

0 1,000
Scale 1:50,000
Key Plan

Legend:
- 🟥 Study Area
- 🟦 End of Existing Municipal Drain
- 🟨 ERCA Regulation Limits

Print on 11X17, Landscape Orientation
0 60
Scale 1:8000
April 20 2016

BioLogic
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

Figure 4: Aquatic Study Reaches and Locations

(2013 ERCA Air Photo)

0 1,000
Scale 1:50,000
Key Plan

Legend:
- 🟥 Study Area
- 🟦 Municipal Drain Section
- 🟨 Proposed Drain Extension

Aquatic Habitat Locations
- ● Fish Sampling Location
- 🟩 Aquatic Habitat Reach Boundaries

Print on 11X17, Landscape Orientation
0 60
Scale 1:8000
April 20 2016

BioLogic
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

Figure 5a: Vegetation Communities: North Portion (2013 ERCA Air Photo)

Scale 1:50,000
Key Plan

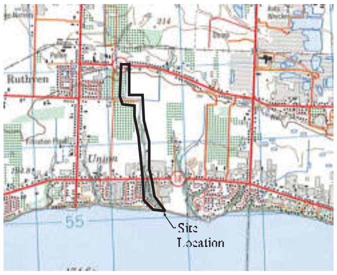
Legend:
— Vegetation Community Boundary
- - - Inclusion Boundary

Vegetation Communities
1 CUM1 Mineral Cultural Meadow Ecosite with MAM2 Mineral Meadow Marsh Ecosite inclusion (1.54ha)
2 CUT1-4 Gray Dogwood Mineral Cultural Thicket Type (0.42ha)
3a CUW1 Mineral Cultural Woodland Ecosite (1.4ha)
3b CUW1 Mineral Cultural Woodland Ecosite (1.67ha)
4 FOD6-5 Fresh-Moist Sugar Maple Hardwood Deciduous Forest Type with BBO1 Mineral Open Beach/Bar inclusion (2.57ha)

Print on 11X17, Landscape Orientation
0 80
Scale 1:4000
December 2015

BioLogic
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

Figure 5b: Vegetation Communities South Portion (2013 ERCA Air Photo)



Scale 1:50,000
Key Plan

Legend:

🟩	Vegetation Community Boundary
---	Inclusion Boundary
🟦	End of Municipal Drain

Vegetation Communities

1 CUM1 Mineral Cultural Meadow Ecosite with MAM2 Mineral Meadow Marsh Ecosite inclusion (1.54ha)
2 CUT1-4 Gray Dogwood Mineral Cultural Thicket Type (0.42ha)
3a CUW1 Mineral Cultural Woodland Ecosite (1.4ha)
3b CUW1 Mineral Cultural Woodland Ecosite (1.67ha)
4 FOD6-5 Fresh-Moist Sugar Maple Hardwood Deciduous Forest Type with BBO1 Mineral Open Beach/Bar inclusion (2.54ha)

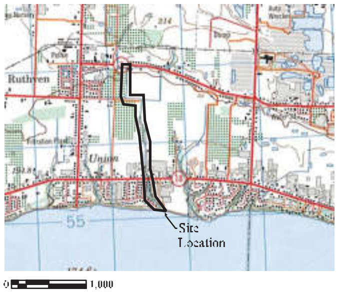
Print on 11X17, Landscape Orientation

0 80

Scale 1:4000
December 2015

BioLogic
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

Figure 6a: Potential Snake Habitat: North Portion (2013 ERCA Air Photo)



Scale 1:50,000
Key Plan

Legend:
▨ Category 2 for Eastern Foxsnake
● Potential Hibernaculum (Animal Burrows)

Print on 11X17, Landscape Orientation
0 80
Scale 1:4000
December 2015

BioLogic
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

Figure 6b: Potential Snake Habitat: South Portion (2013 ERCA Air Photo)

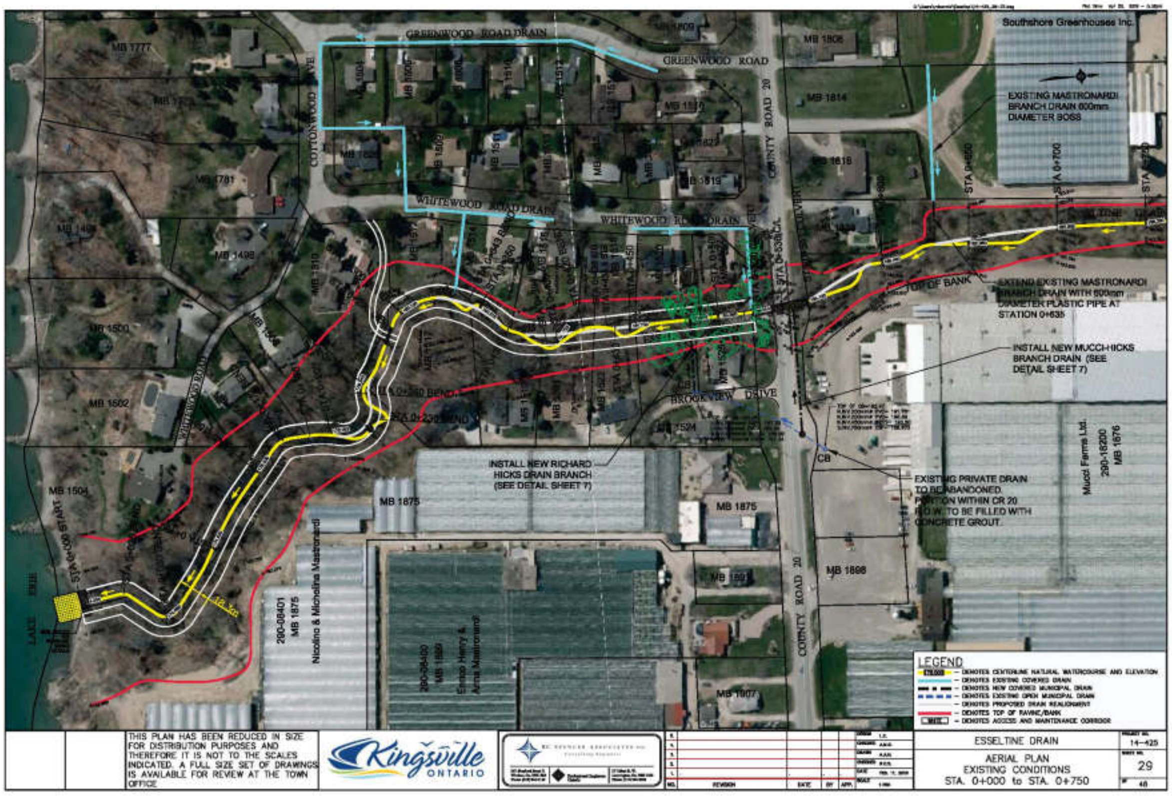
0 1,000
Scale 1:50,000
Key Plan

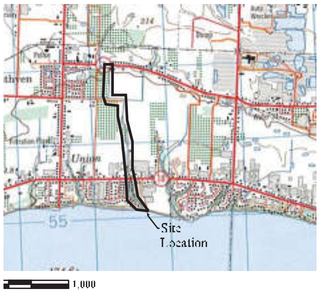
Legend:
- 🟧 Category 2 for Eastern Foxsnake
- ● Potential Hibernaculum (Animal Burrows)
- — End of Municipal Drain

Print on 11X17, Landscape Orientation
0 80
Scale 1:4000
December 2015

BioLogic
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

Figure 7: Channel Restoration -South





1,000

ie 1:50,000

y Plan

Not Scaled
April 2016

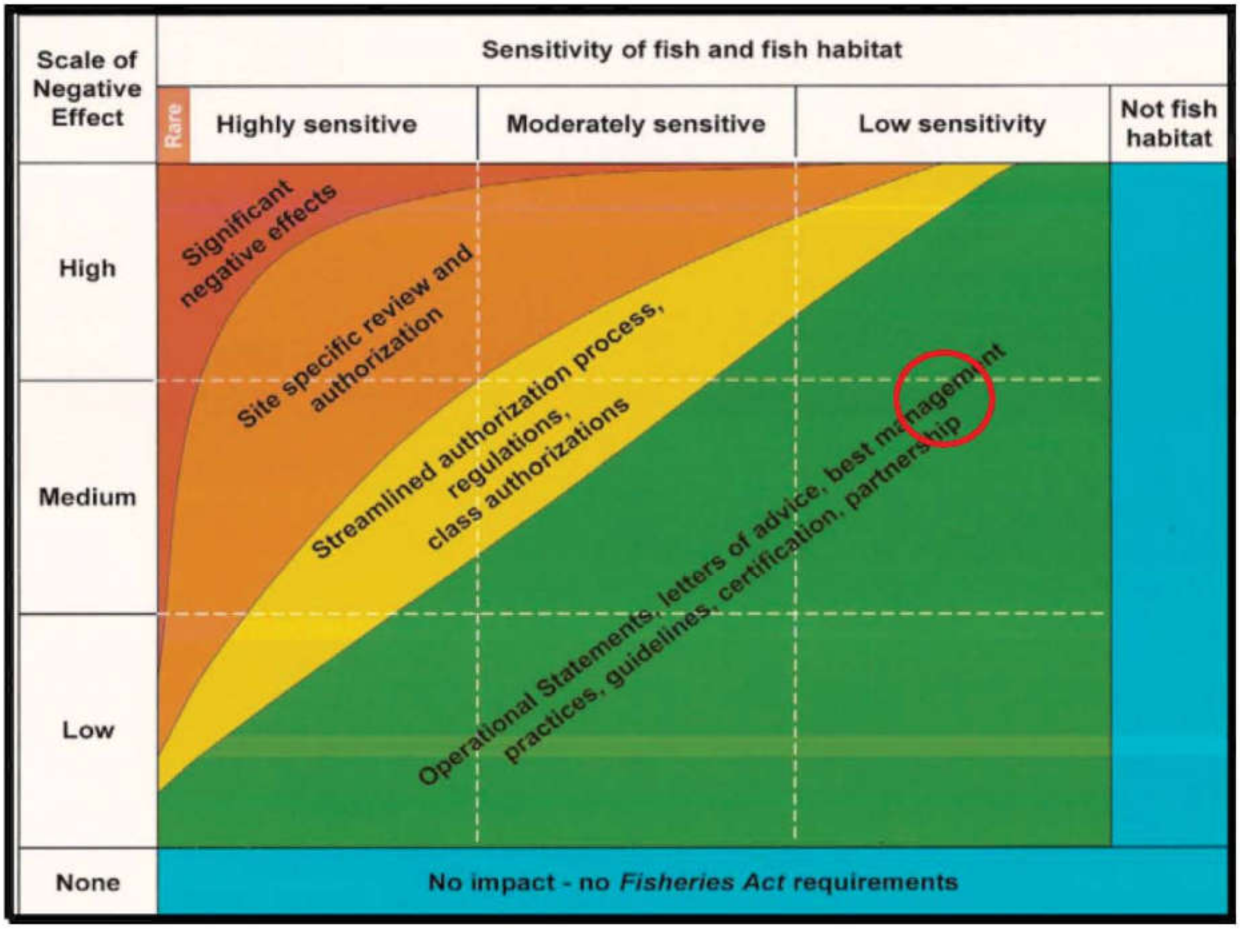


Figure 8: Risk Assessment Matrix

BioLogic
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

April 20 2016

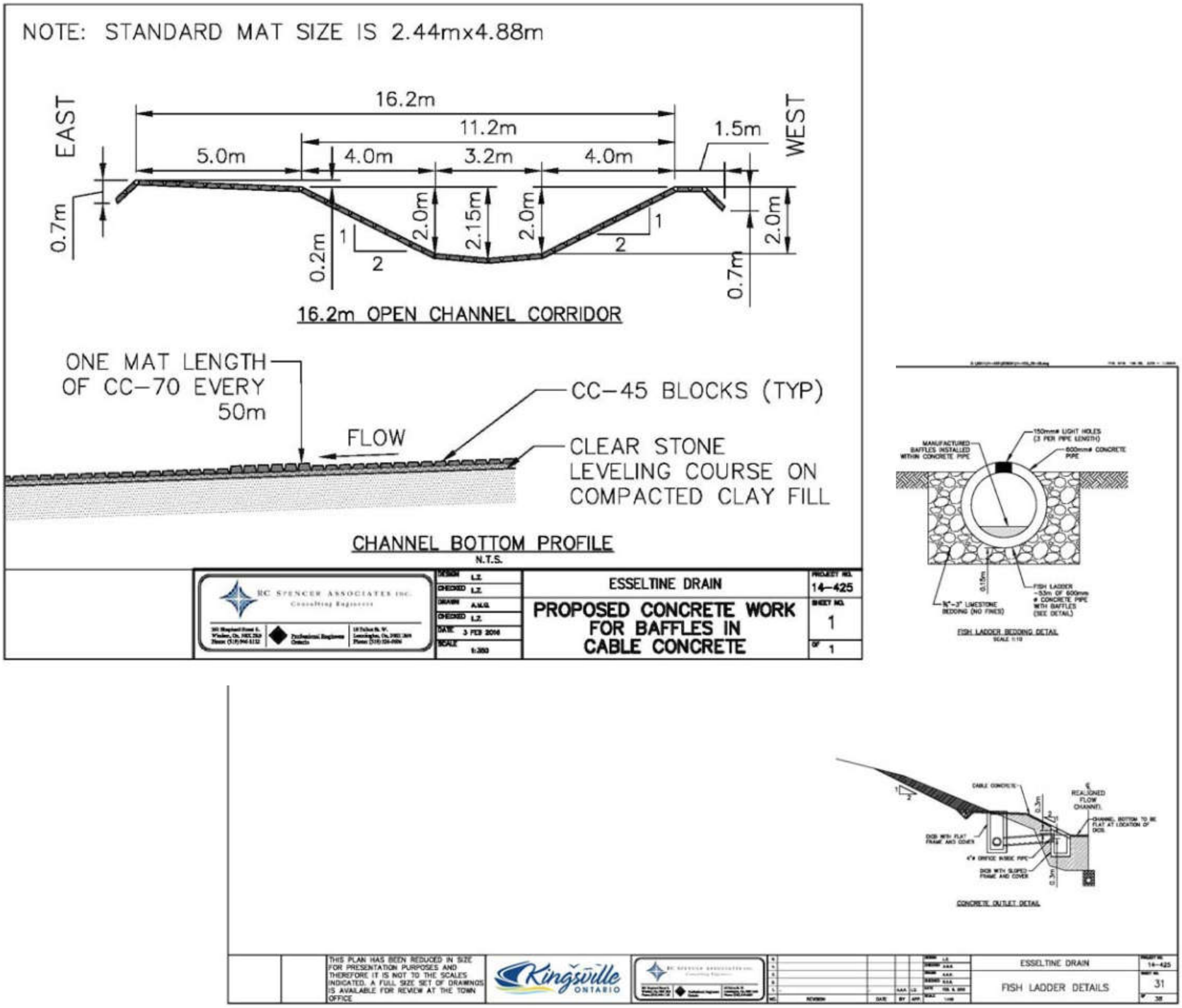
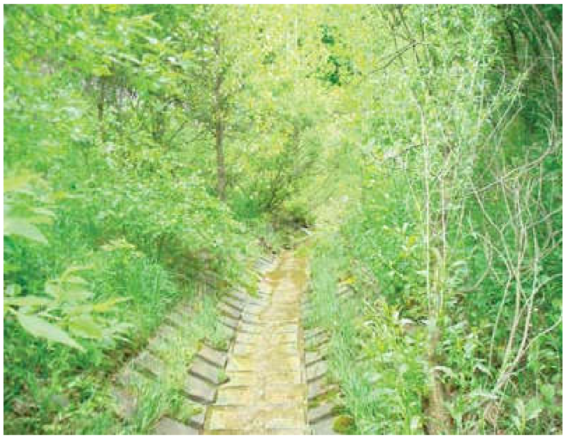


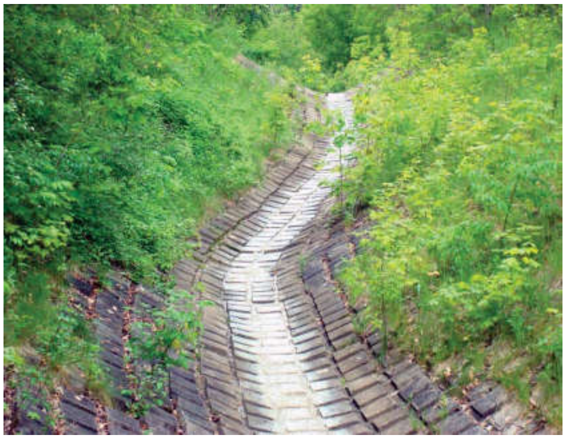
Figure 9: Simulated Riffle and Fish Ladder Concept

http://iecsusa.com/channel-lining/

http://iecsusa.com/channel-lining/

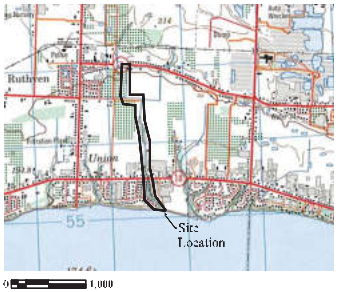


http://iecs.com/cable-concrete/



http://iecs.com/cable-concrete/

Figure 10: Cable Concrete Revegetation

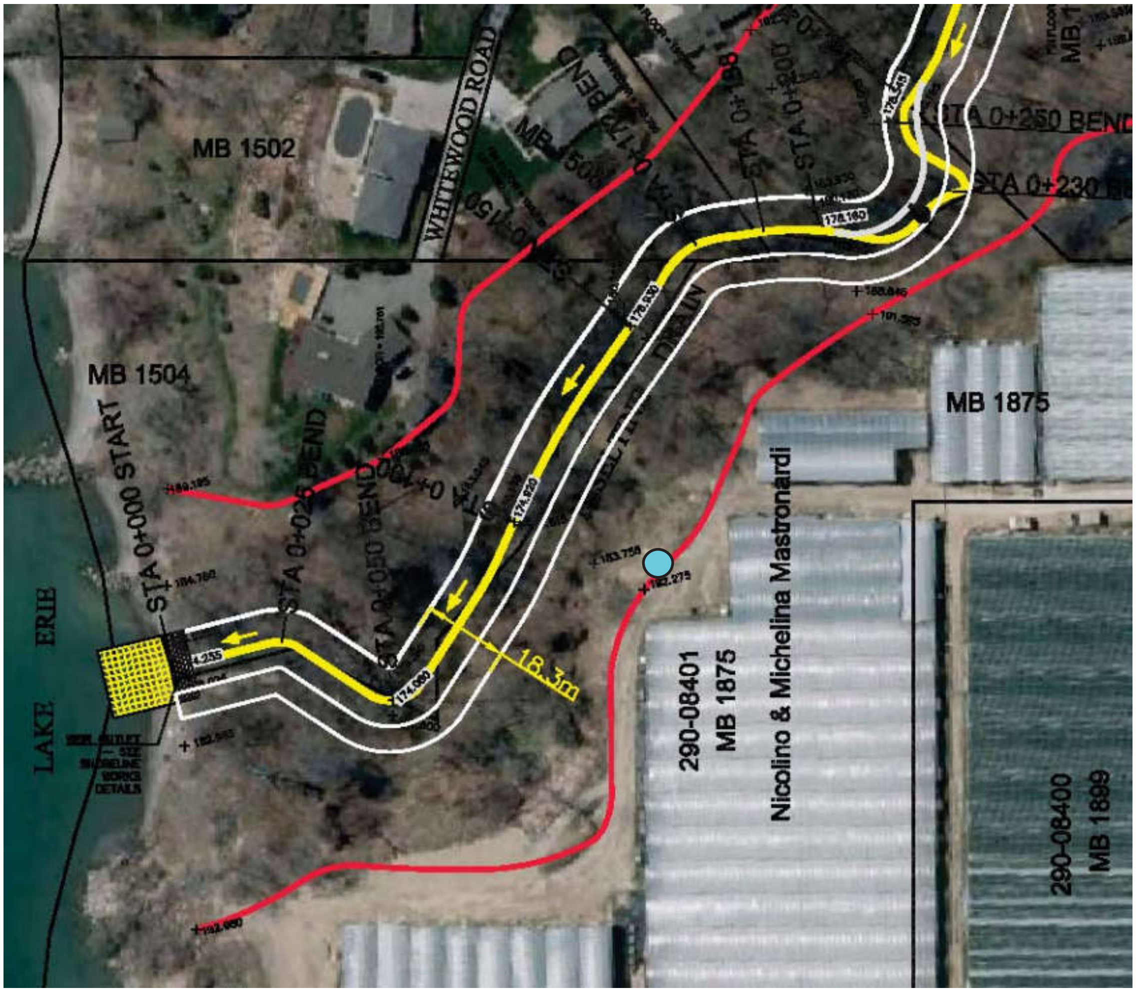


Scale 1:50,000
Key Plan

Print on 11X17, Landscape Orientation
April 20 2016

BioLogic
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

Figure 11: Burrow Close-up



0 1,000
Scale 1:50,000
Key Plan

● Potential hibernaculum (animal burrows)
- more than 20m from disturbance area

Print on 11X17, Landscape Orientation
0 7.5
Scale 1:375
April 2016

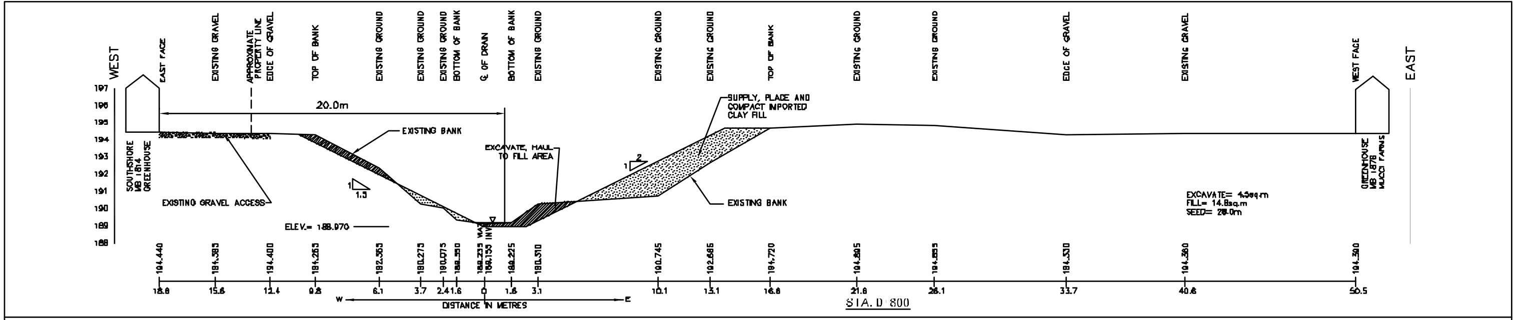
BioLogic
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

Drawings

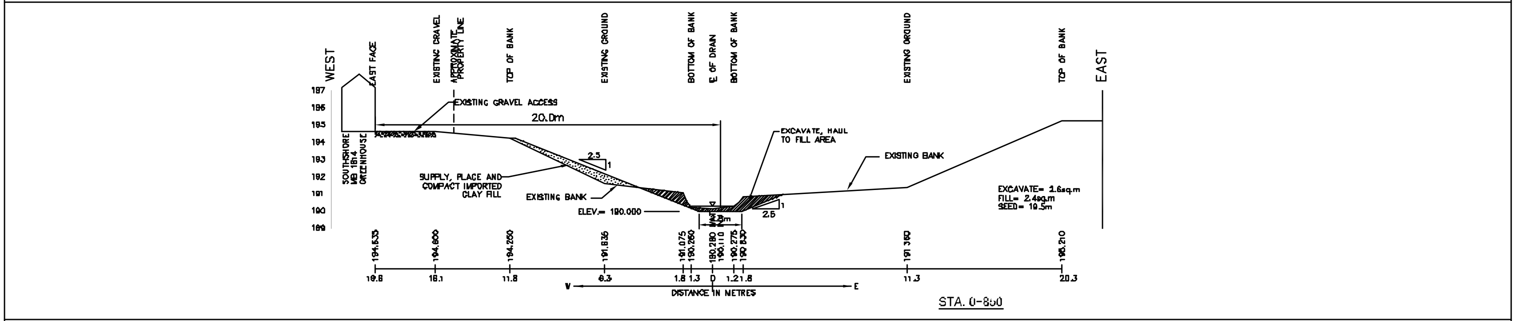
Selected Drawings from Drainage Report

Typical Cross-section North
Typical Cross-section South
Outlet Weir Detail

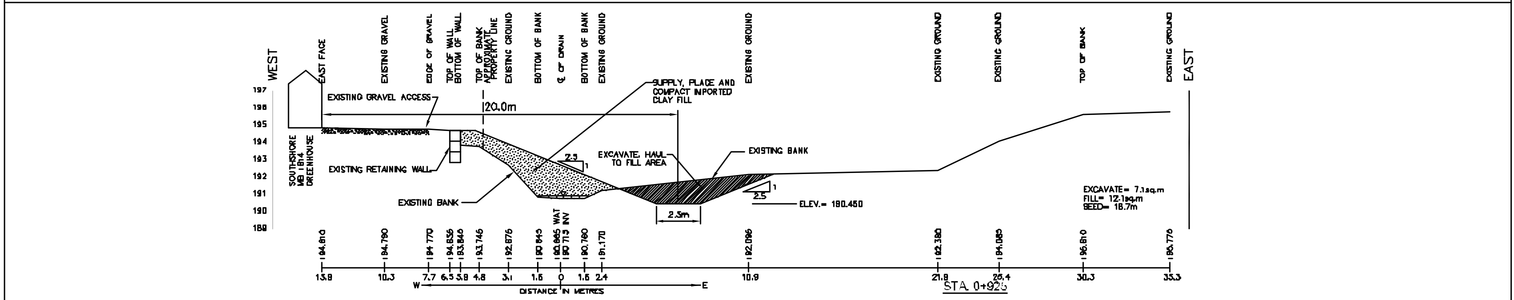
Z:\2014\14-425\DESIGN\14-425_05-25 APRIL14.dwg Plot Time: Apr 22. 2016 - 10:16am



STA. 0 800



STA. 0+850



STA. 0+925

THIS PLAN HAS BEEN REDUCED IN SIZE FOR PRESENTATION PURPOSES AND THEREFORE IT IS NOT TO THE SCALES INDICATED. A FULL SIZE SET OF DRAWINGS IS AVAILABLE FOR REVIEW AT THE TOWN OFFICE

Kingsville ONTARIO

RC SPENCER ASSOCIATES INC. Consulting Engineers

NO.	REVISION	DATE	BY	APP.
5.				
4.				
3.				
2.				
1.	-	-	-	-

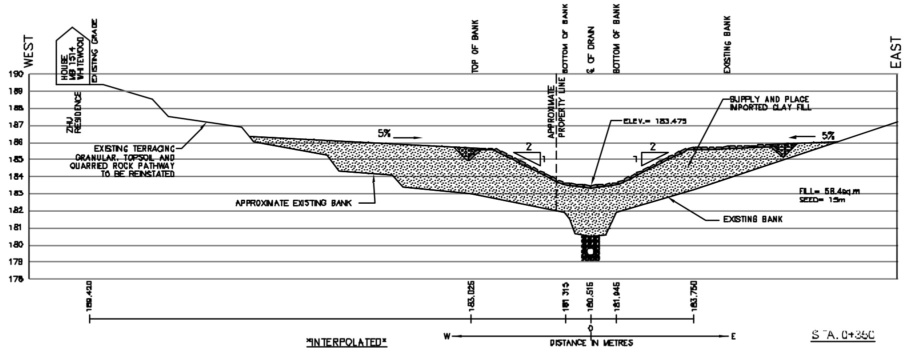
DESIGN L.Z.
CHECKED A.M.S.
DRAWN A.A.H.
CHECKED R.O.S.
DATE FEB. 25. 2016
SCALE H=1:100 V=1:100

ESSELTINE DRAIN

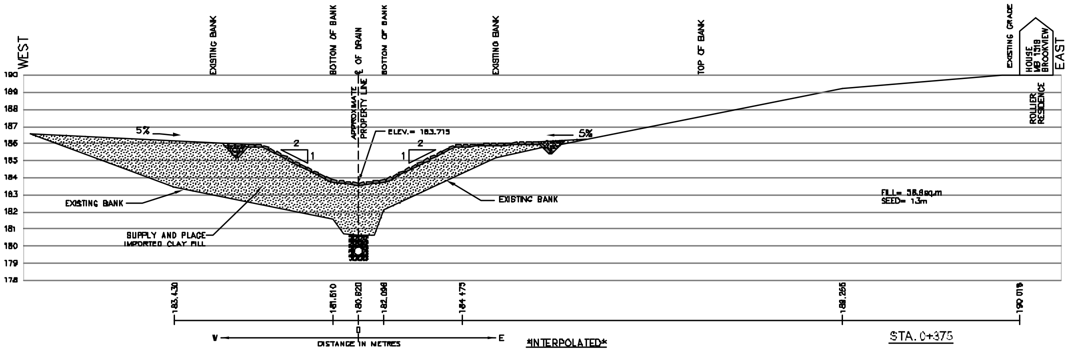
CROSS-SECTION
STA. 0+800 to STA. 0+925

PROJECT NO. 14-425
SHEET NO. 23
OF 47

Z:\2014\14-425\DESIGN\14-425_05-26 APRIL14.dwg   Plot Time: Apr 22, 2016 - 10:18am



STA. 0+350



STA. 0+375

THIS PLAN HAS BEEN REDUCED IN SIZE FOR PRESENTATION PURPOSES AND THEREFORE IT IS NOT TO THE SCALES INDICATED. A FULL SIZE SET OF DRAWINGS IS AVAILABLE FOR REVIEW AT THE TOWN OFFICE

NO.	REVISION	DATE	BY	APP.
5.				
4.				
3.				
2.				
1.	.	.	.	.

DESIGN L.Z.
CHECKED A.M.G.
DRAWN A.A.H.
CHECKED R.C.S.
DATE FEB. 25. 2016
SCALE H=1:100 V=1:100

ESSELTINE DRAIN

CROSS-SECTION
PRELIMINARY EAST SIDE ACCESS
STA. 0+350 to STA. 0+375

PROJECT NO. 14-425
SHEET NO. 14
OF 47

NOTES

1. BLOCKS TO BE 750x750x1500mm PRECAST CONCRETE BLOCKS BY UNDERGROUND SPECIALTIES, CHATHAM-KENT READY MIX OR APPROVED EQUAL. SHOP DRAWINGS TO BE PROVIDED.

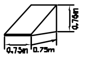
2. APPROXIMATE NUMBER OF BLOCKS IS 385

3. 600mmø WATER CONTROL PIPE TO REQUIRE MODIFICATION TO SURROUNDING BLOCKS. FILL VOIDS WITH NON-SHRINK GROUT.

4. SUITABLE CLAY ELEVATION FOR PLACING PRECAST BLOCKS AND ARMOUR ROCK TO BE DETERMINED PRIOR TO CONSTRUCTION.

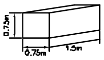
5. ALL CONCRETE BLOCKS TO BE 25MPa AIR ENTRAINED.

6. BLOCKS MUST BE INTERLOCKING.



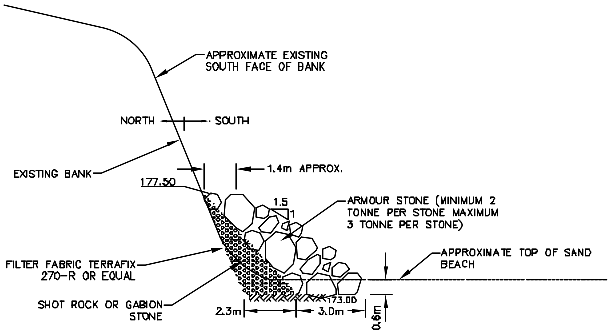
PRECAST WEDGE BLOCK DETAIL

SCALE = 1:50



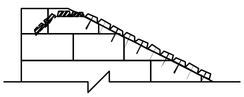
PRECAST BLOCK DETAIL

SCALE = 1:60



SIDE VIEW OF ARMOUR STONE DETAIL

SCALE = 1:75



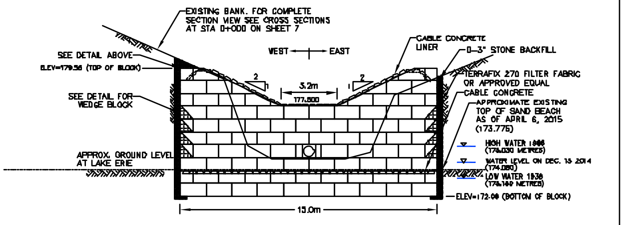
1. END BLOCKS TO BE REMOVED FROM FACE TO BACK OF CONCRETE WEIR

2. CONNECT CABLE CONCRETE TO TOP OF WEIR USING 15M BAR DRILLED 300mm INTO CONCRETE BLOCKS. FILL SURROUND WITH NON-SHRINK GROUT.

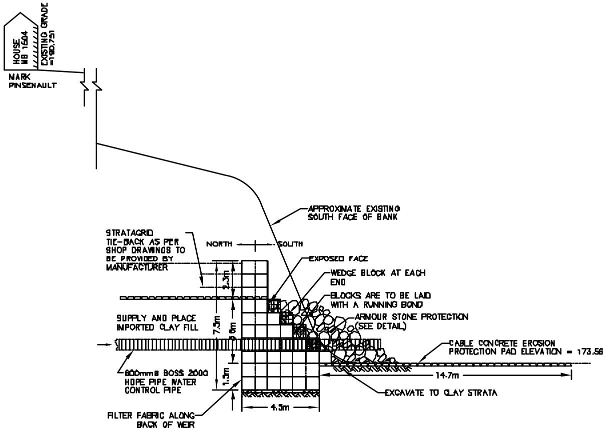
3. MISCELLANEOUS VOIDS TO BE FILLED WITH CONCRETE

FASTENING CABLE CONCRETE MAT TO PRECAST BLOCKS DETAIL

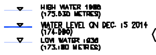
SCALE = 1:50

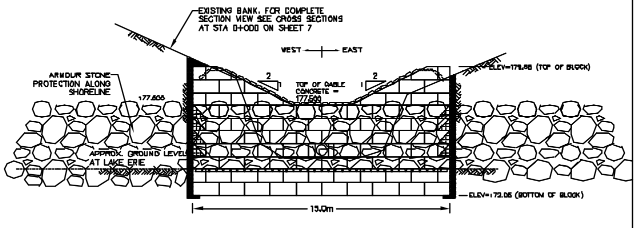


FRONT VIEW



SIDE VIEW





FRONT VIEW W/ ARMOUR ROCK

WEIR OUTLET DETAIL

SCALE = 1:100

THIS PLAN HAS BEEN REDUCED IN SIZE FOR PRESENTATION PURPOSES AND THEREFORE IT IS NOT TO THE SCALES INDICATED. A FULL SIZE SET OF DRAWINGS IS AVAILABLE FOR REVIEW AT THE TOWN OFFICE

Kingsville ONTARIO

RC SPENCER ASSOCIATES INC.
Consulting Engineers

NO.	REVISION	DATE	BY	APP.
5.				
4.				
3.				
2.				
1.			A.A.H.	L.Z.

DESIGN L.Z.
CHECKED A.M.D.
DRAWN A.A.H.
CHECKED R.C.S.
DATE FEB. 8, 2016
SCALE AS SHOWN

ESSELTINE DRAIN

WEIR DETAIL AND CROSS-SECTION

STA. 0+000 (WEIR DETAIL)

PROJECT NO. 14-425
SHEET NO. 29
OF 38

Appendix A

MNRF Correspondence

From: McAllister, Aurora (MNRF)
To: lzarlenga@rcspencer.ca
Cc: Veenhof, Dustin (MNRF); Riddell, Heather (MNRF); John Henderson; dmorse@biologic.ca
Subject: Esseltine Drain, Town of Kingsville
Date: Tuesday, June 23, 2015 1:09:11 PM

Thank you for the opportunity to visit the site on May 28th, we appreciated the opportunity to discuss the proposed project in greater detail.

The following is MNRF's general understanding of the proposed project:

- The Town of Kingsville is in the process of preparing an Engineer's Report for repairs and improvements to the existing Esseltine Drain. Work will include extending the existing drain to provide a sufficient outlet to all the lands presently using the existing watercourse.
- In order to create a sufficient outlet, modifications to the downstream natural watercourse (which outlets directly to Lake Erie) are required. It is proposed to convert this existing natural watercourse into a municipal drain.
- Significant erosion and bank stability issues exist within the ravine (downstream of the existing municipal drain) and existing homes are at risk.
- In order to address the significant erosion issues, it is proposed to turn the natural watercourse into a new municipal drain would by means of filling and re-grading of the existing stream bed and banks and lining the bottom of the stream with concrete to prevent downcutting.

While on site MNRF confirmed that the project is located within an area that is known to be used by Eastern Foxsnake (END). There are also several other species that may occur within the ravine, including Butternut (END) and Eastern Flowering Dogwood (END). On site we discussed that an authorization under the Endangered Species Act (ESA) may be required for the conversion of the watercourse into a new municipal drain. However, in order to help inform our decision we will also need to know what other species at risk (in addition to Eastern Foxsnake) may be impacted by the activity. A comprehensive survey needs to be completed to identify any SAR trees, birds and plants that may be present. Additionally, given that the proposal involves significant alternation to the existing natural watercourse, a detailed fish species and habitat inventory should also be conducted.

Once these surveys have been completed, results of the field surveys along with a detailed proposal can be submitted to MNRF for our review. Please be sure to include the amount of area (in m2) that will be impacted both temporarily and permanently.

Regards,

Aurora McAllister
Management Biologist
Ministry of Natural Resources & Forestry
Aylmer District, Southern Region
519-773-4723

From: Dylan Morse [mailto:dmorse@biologic.ca]

Sent: June-05-15 12:27 PM
To: Riddell, Heather (MNRF)
Cc: Dave Hayman
Subject: Additional EO Request - Esseltine Drain, Town of Kingsville

Hi Heather,

I sent a request for additional EO information for a stretch of the Esseltine Drain in the Town of Kingsville on February 10, 2015. Can you please provide an update on the status of this request?

Thank you,

Dylan Morse, BES
Assistant Biologist

BioLogic Incorporated
110 Riverside Drive, Suite 201
London, Ontario
N6H 4S5

Tel: 519-434-1516 ext. 103
Fax: 519-434-0575

Appendix B

Provincially Significant Species for the Study Area

Esseltine Drain Porject - Provincially Significant Species Records and their Habitat

Common Name	Scientific Name	S-Rank	Ontario ESA Listing	NHIC Identified Species (i.e., within 1km)	MNR Identified Species	General Habitat Description
Fish						
Silver Chub	*Macrhybopsis storeriana*	S2	THR	x		prefers medium to large rivers with substantial current and silt, sand or gravel bottoms, but in Ontario it is only found in the Great Lakes. It is usually found in depths between 7m and 12m and is believed to spawn in May and June in open water areas. It feeds on aquatic insect larvae, crustaceans and molluscs, including Zebra mussels. Not typically associated with aquatic macrophytes (COSEWIC, 2012)
Mussels						
Northern Riffleshell	*Epioblasma torulosa rangiana*	S1	END	x		is found in highly oxygenated riffle areas within rivers or streams with rocky, sand, or gravel bottoms. Ontario populations are restricted to the East Sydenham River and the Ausable River (Morris and Burridge, 2010).
Plants						
American Water-willow	*Justicia americana*	S1	THR	x		grows along the shores and in the waters of streams, rivers, lakes, ditches and occasionally wetlands on a substrate of gravel, sand or organic material. It can grow on wet soil and in up to 1.2 m of water, but appears to require periodic flooding and wave action to reduce competition from other aquatic plants (PCA, 2011a).
Biennial Gaura	*Oenothera gaura*	S3	n/a	x		inhabits river banks, roadsides, fields, vacant lots (MFO, 2015).
Butternut	*Juglans cinerea*	S3	END		x	shade intolerant and commonly found in riparian habitats, but is also found on rich, moist, well-drained loams and well-drained gravels, especially those of limestone origin (COSEWIC, 2003).
Coast Barnyard Grass	*Echinochloa walteri*	S3	n/a	x		inhabits banks of rivers and ponds, ditches, marshes and wet shores, locally common in the marshes at the western end of Lake Erie (MFO, 2015).
Colicroot	*Aletris farinosa*	S2	THR	x		grows in open, sunny, and moist habitats with sandy or mucky soil, such as prairies and old abandoned fields.It has also been found along roadsides and forest edges. It does not tolerate shade or competition from other plants and appears to do well in areas that are kept open by fire, drought, grazing and other disturbances (Environment Canada, 2014).
Common Hoptree	*Ptelea trifoliata*	S3	THR	x		found often along shorelines in areas of nutrient poor sandy soils, although it is sometimes found on thin soils overlying limestone. It does best in full sun and is intolerant of shade (PCA, 2012).
Dense Blazing Star	*Liatris spicata*	S2	THR	x		grows in moist prairies, grassland savannahs, wet areas between sand dunes, and abandoned fields.This plant does not do well in the shade and is usually found in areas that are kept open and sunny by fire, floods, drought, or grazing (COSEWIC, 2010a).
Eastern Flowering Dogwood	*Cornouiller fleuri*	S2?	END		x	commonly grows as an understory species in open dry-mesic oak-hickory to mesic maple-beech eastern deciduous or mixed forests. The forests where it is found are generally mid-age to mature. It can be found in open woods and forest edges within its southwestern Ontario range and can also occur along roadsides and in fencerows. Occurs on soils that range from moist, deep soils to light-textured, well-drained upland soils (COSEWIC, 2007; Bickerton & Thompson-Black, 2010).
Hairy Pinweed	*Lechea mucronata*	S3	n/a	x		inhabits sandy shores, dry prairies, and open sandy forests (MFO, 2015; Oldham & Brinker, 2009).
Hoary Tick-trefoil	*Desmodium canescens*	S2	n/a	x		inhabits sandy woods and thickets (MFO, 2015; Oldham & Brinker, 2009).
Northern Fogfruit	*Phyla lanceolata*	S2	n/a	x		inhabits moist, muddy stream and river banks and ditches, mud flats, marsh boarders, and often found in seasonally flooded areas (MFO, 2015; Oldham & Brinker, 2009).
Prostrate Tick-trefoil	*Desmodium rotundifolium*	S2	n/a	x		Dry sandy or rocky woods (Oldham & Brinker, 2009).
Red Mulberry	*Morus rubra*	S2	END	x		is an understory forest tree species found in fresh (damp) to moist, well-drained, forested habitats,. In Ontario, these include slopes and ravines of the Niagara Escarpment, and sand spits and bottom lands near Lake Erie in the Kent and Essex counties region (PCA, 2011b).

Esseltine Drain Porject - Provincially Significant Species Records and their Habitat

Common Name	Scientific Name	S-Rank	Ontario ESA Listing	NHIC Identified Species (i.e., within 1km)	MNR Identified Species	General Habitat Description
Scarlet Beebalm	*Monarda didyma*	S3	n/a	x		native in rich forests on banks and floodplains and is a frequently cultivated species;some Ontario occurrences are undoubtedly escapes from cultivation (MFO, 2015; Oldham & Brinker, 2009).
Yellow False-indigo	*Baptisia tinctoria*	S2	n/a	x		prairies, savannas, dry open sandy woods and thickets and sometimes along fencerows (MFO, 2015; Oldham & Brinker, 2009).
Yellow Stargrass	*Hypoxis hirsuta*	S3	n/a	x		Prairies, meadows, dry open sandy woods, often in fens, moist to wet meadows, swamp borders, and shores (MFO, 2015; Oldham & Brinker, 2009).
Birds						
Barn Owl	*Tyto alba*	S1	END	x		requires landscapes that provide adequate foraging habitat for their primary prey (voles and mice) and suitable nesting sites. Primary foraging habitat consists low-elevation, open country like old agricultural fields, rough pasture, hayfields, grassy roadsides and grassy marshes. A wide variety of natural and artificial nest structures are used, including cavities in live and dead tree, chimneys, elevated platforms in barns, silos, hangers, water towers, bridges, attics and nest boxes (OBORT, 2010; COSEWIC, 2010b).
Snakes						
Eastern Foxsnake (Carolinian population)	*Pantherophis gloydi pop. 2*	S2	END		x	Snakes in this population occupy old fields, prairie remnants, marshes, hedgerows and dune-shorelines in the Essex, Chatham-Kent, Lambton, Haldimand and Norfolk regions.Eastern Foxsnakes are reasonably tolerant of anthropogenic habitats and/or areas with limited or low human activity such as fields, hedgerows, canals, abandoned buildings, cottages and dump sites (EFRT, 2010).
Massasauga Rattlesnake (Carolinian population)	*Sistrurus catenatus pop. 2*	S3	THR	x		live in different types of habitats throughout Ontario, including tall grass prairie, bogs, marshes, shorelines, forests and alvars. Also require open areas to warm themselves in the sun. Pregnant females are most often found in open, dry habitats such as rock barrens or forest clearings where they can more easily maintain the body temperature required for the development of their offspring. Non-pregnant females and males forage and mate in lowland habitats such as grasslands, wetlands, bogs and the shorelines of lakes and rivers. Ontario populations are concentrated around the Ojibway Prairie Complex (Windsor), Wainfleet Bog (Port Colbourne), Bruce Penninsula and eastern Georgian Bay (PCA, 2015).
Insects						
Azure Bluet	*Enallagma aspersum*	S3	n/a	x		Vegetated slow waters and boggy ponds, often perching on the floating leaves of water-lilies. Can also be found in small temporary ponds (Jones et al., 2008)
Cyrano Darner	*Nasiaeschna pentacantha*	S3	n/a	x		Species occurs in wooded wetlands of all kinds, swamps, lake edges, and slow streams. A border of at least shrubs if not trees seems necessary. Floating and emergent vegetation does not seem to be needed (Jones et al., 2008).
Duke's Skipper	*Euphyes dukesi*	S2	n/a	x		The species is restricted in habitat to marshy areas with long grasses and patches of the foodplants, usually in partially shaded woodlands or adjacent to woods. It is never found in open marshes like most other sedge skippers. It has been seen twice in Essex County in dry ditches containing C. hyalinolepis (CBIF, 2015).

References

Bickerton, H. and M. Thompson-Black. 2010. Recovery Strategy for the Eastern Flowering Dogwood (*Cornus florida*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 21 pp

Canadian Biodiversity Information Facility (CBIF), 2015. Canadian Biodiversity Information Facility Species Bank: Butterflies of Canada. Government of Canada. Available at:
http://www.cbif.gc.ca/eng/species-bank/butterflies-of-canada/alphabetical-index/?id=1370403265522

COSEWIC, 2003. COSEWIC Assessment and Status Report on the Butternut (*Juglans cinerea*) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 32 pp.

Esseltine Drain Porject - Provincially Significant Species Records and their Habitat

COSEWIC. 2007. COSEWIC Assessment and status report on the eastern flowering dogwood *Cornus florida* in Canada. Committee of the Status of Wildlife in Canada. Ottawa. vi + 22pp.

COSEWIC. 2010a. COSEWIC assessment and status report on the Dense Blazing Star *Liatris spicata* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. ix + 23 pp.

COSEWIC. 2010b. COSEWIC assessment and status report on the Barn Owl *Tyto alba* (Eastern population and Western population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiv – 34 pp.

COSEWIC. 2012. COSEWIC assessment and status report on the Silver Chub *Macrhybopsis storeriana* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xiii + 34 pp.

Eastern Foxsnake Recovery Team (EFRT), 2010. Recovery strategy for the Eastern Foxsnake (*Pantherophis gloydi*) – Carolinian and Georgian Bay populations in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. vi + 39 pp.

Environment Canada. 2014. Recovery Strategy for the Colicroot (*Aletris farinosa*) in Canada [Proposed]. *Species at Risk Act* Recovery Strategy Series. Environment Canada, Ottawa. v + 30 p

Jones, C., A. Kingsley, P. Burke and M. Holder, 2008. Field Guide to The Dragonflies and Damselflies of Algonquin Provincial Park and the Surrounding Area." Published in Canada by the Friends of Algonquin Park. Whitney Ontario.

Michigan Flora Online (MFO), 2015. Michigan Flora Database. A. A. Reznicek, E. G. Voss, & B. S. Walters. February 2011. University of Michigan. Available at: http://michiganflora.net/home.aspx.

Morris, T. J. and M. Burridge. 2010. Recovery Strategy for the Northern Riffleshell (*Epioblasma torulosa rangiana*), Snuffbox (*Epioblasma triquetra*), Round Pigtoe (*Pleurobema sintoxia*), Mudpuppy Mussel (*Simpsonaias ambigua*) and Rayed Bean (*Villosa fabalis*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. ii – 4 pp. + Appendix viii – 76 pp.

Ontario Barn Owl Recovery Team (OBORT), 2010. Recovery strategy for the Barn Owl (*Tyto alba*) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources. Peterborough, Ontario. vi + 31 pp.

Parks Canada Agency (PCA), 2011a. Recovery Strategy for the American Water-willow (*Justicia americana*) in Canada. *Species at Risk Act* Recovery Strategy Series, Parks Canada Agency, Ottawa. vi + 36 pp.

Parks Canada Agency (PCA). 2011b. Recovery Strategy for the Red Mulberry (*Morus rubra*) in Canada. *Species at Risk Act* Recovery Strategy Series. Parks Canada Agency. Ottawa, Ontario. vi + 47 pp.

Parks Canada Agency (PCA), 2012. Recovery Strategy for the Common Hoptree (*Ptelea trifoliata*) in Canada. *Species at Risk Act* Recovery Strategy Series. Parks Canada Agency. Ottawa. vi + 61 pp.

Parks Canada Agency (PCA), 2015. Recovery Strategy for the Massasauga (*Sistrurus catenatus*) in Canada. *Species at Risk Act* Recovery Strategy Series. Parks Canada Agency. Ottawa. ix + 37pp.

Appendix C

Fish and Aquatic Habitat Data

Logic Incorporated
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

AQUATIC HABITAT ASSESSMENT
Watercourse

Project Name: Kingsville – Esseltine Drain

Date: August 12 2015

Station Name: Reach 1

Collectors: D.morse / P.Mikoda

Time Started: 2pm

Time Finished: 3pm

GENERAL INFORMATION

Weather: 60% cc 22°C

Watercourse Name: Essettine Drain

Drainage System: Lake Erie

GPS Co-ordinates:

LANDUSE		POLLUTION SOURCES	
Left Bank	**Right Bank**	**Point**	**Non-Point**
-abandoned field - agriculture -subdivision	- lawn /field - hedge row -agriculture	- tiledrains	- adjacent land use

FLOW REGIME	CHANNEL FORM
☒ Flowing	☒ Defined
☐ Dry	☐ Undefined
☒ Permanent	☐ Natural
☐ Intermittent	☒ Channelized
☐ Ephemeral	☐ Swale

BANK STABILITY	Left	Right
Stable	☐	☒
Vulnerable	☐	☐
Unstable	☒	☐
Protected	☐	☐

GROUNDWATER EVIDENCE	
None	☒
Springs/Seeps	☐
Vegetation (i.e. Watercress)	☐
Iron Staining	☐
Other	☐

WATERCOURSE MORPHOLOGY

	Pool	Riffle	Run	Glide	Other
% Area				100%	
Mean Wetted Width (m)				1.5to2m	
Mean Wetted Depth (m)				0.1m	
Mean Bankfull Width (m)				5m	
Mean Bankfull Depth (m)				0.5m	
Substrate (%)				Silt-10 CL-60 Gra/Cobb-25 detrius – 5	–

Substrate Options: BR – Bedrock; BO – Boulder; CO – Cobble; GR – Gravel; SA – Sand; SI – Silt; CL – Clay; MU – Muck; D - Detritus

Valley width 8-10m
depth 2m

	None	Undercut Banks	Boulders	Cobbles	Organic Debris	Woody Debris	Vegetation
In-stream Cover (%)						In-stream 5	In-stream 45
						Overhanging	Overhanging 50

	%	Examples
Submergent		
Floating	50	duckweed
Emergent	50	phrag, jewelweed

☒ None
☐ Slight
☐ Moderate
☐ Heavy

Examples

% of Stream Shaded	Examples
☐ 100 – 90%	
☒ 90 – 60%	
☐ 60 – 30%	
☐ 30 – 10%	
☐ 0%	

☐ None

Seasonal	Permanent
rip rap ridges would separate during lowflow	

☒ ~~Unknown~~ NONE
☐ Nursery Habitat
☐ Seasonal Refugia
☐ Spawning Habitat
☐ Deep Pools
☐ Other

Comments:

- very little flow
- shallow water
- hard to e-fish
- dense duckweed ~25m d/s of Culvert @ Cty Rd 34
- west bank heavily eroded. (exposed soil)

☐ None
☒ Fish Sampling
☐ Water Quality Sampling
☒ Benthic Sampling
☐ Flow Monitoring
☐ Mussel Sampling

Station #1

Logic Incorporated
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

AQUATIC HABITAT ASSESSMENT
Watercourse

Project Name: Kingsville - Esseltine Drain

Date: August 12, 2015

Station Name: Reach 2

Collectors: D. Morse / P. Mikoda

Time Started: 3pm

Time Finished: 4pm

GENERAL INFORMATION

Weather: 60% cc 21°C

Watercourse Name: Esseltine Drain

Drainage System: Lake Erie

GPS Co-ordinates:

LANDUSE		POLLUTION SOURCES	
Left Bank	**Right Bank**	**Point**	**Non-Point**
-agriculture -wooded riparian veg -greenhouses	-greenhouses -wooded riparian veg	-tile outlet	-adjacent land use.

FLOW REGIME

☒ Flowing
☐ Dry

☒ Permanent
☐ Intermittent
☐ Ephemeral

CHANNEL FORM

☒ Defined
☐ Undefined

☐ Natural
☒ Channelized
☐ Swale

BANK STABILITY

	Left	Right
Stable	☐	☒
Vulnerable	☐	☐
Unstable	☒	☐
Protected	☒ 2 sections	☐

GROUNDWATER EVIDENCE

None ☒
Springs/Seeps ☐
Vegetation (i.e. Watercress) ☐
Iron Staining ☐
Other ☐

WATERCOURSE MORPHOLOGY

	Pool	Riffle	Run	Glide	Other
% Area	10%		90%		
Mean Wetted Width (m)	4m		2m		
Mean Wetted Depth (m)	0.4m		0.2m		
Mean Bankfull Width (m)	5m		5 m		
Mean Bankfull Depth (m)	0.75m		0.75m		
Substrate (%)	CL - 60 GR - 30 Sand/silt 10		CL - 60 GR - 35 Detritus - 5		

Substrate Options: BR – Bedrock; BO – Boulder; CO – Cobble; GR – Gravel; SA – Sand; SI – Silt; CL – Clay; MU – Muck; D - Detritus

Valley width 8-10m
depth 2m

In-stream Cover (%)	**None**	**Undercut Banks**	**Boulders**	**Cobbles**	**Organic Debris**	**Woody Debris**	**Vegetation**
						In-stream 5	In-stream
						Overhanging	Overhanging 95

NONE	**%**	**Examples**
Submergent		
Floating		
Emergent		

☒ **None**
☐ **Slight**
☐ **Moderate**
☐ **Heavy**

Examples

% of Stream Shaded	**Examples**
☐ **100 – 90%**	
☒ **90 – 60%**	
☐ **60 – 30%**	
☐ **30 – 10%**	
☐ **0%**	

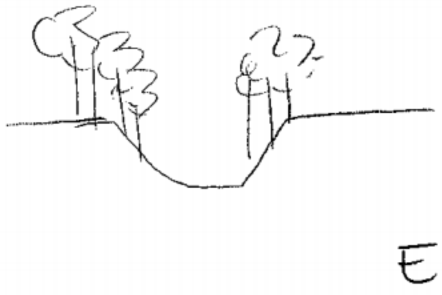
☒ **None**

Seasonal	**Permanent**

☒ ~~**Unknown**~~ NONE
☐ **Nursery Habitat**
☐ **Seasonal Refugia**
☐ **Spawning Habitat**
☐ **Deep Pools**
☐ **Other**

Comments:

- very little pool riffle structure
- generally flat w some pool areas
- west bank gets steeper near private xing
- riparian veg ~ 15m wide.



☒ **None**
☐ **Fish Sampling**
☐ **Water Quality Sampling**
☐ **Benthic Sampling**
☐ **Flow Monitoring**
☐ **Mussel Sampling**

Logic Incorporated

AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

AQUATIC HABITAT ASSESSMENT
Watercourse

Project Name: Kingsville - Esseltine Drain	
Date: August 12 2015	
Station Name: Reach 3	**Collectors:** D. Morse / P. Mikoda
Time Started: 4pm	**Time Finished:** 445pm

GENERAL INFORMATION

Weather: 21°C 60% cc	**Watercourse Name:** Esseltine Drain	**Drainage System:** Lake Erie

GPS Co-ordinates:

LANDUSE		POLLUTION SOURCES	
Left Bank	**Right Bank**	**Point**	**Non-Point**
greenhouses residential (near Cty Rd 20)	green house	- tile outlets	- adjacent landuse runoff.

FLOW REGIME		CHANNEL FORM	
☒	Flowing	☐	Defined
☐	Dry	☐	Undefined
☒	Permanent	☒	Natural
☐	Intermittent	☒	Channelized minor
☐	Ephemeral	☐	Swale

BANK STABILITY	Left	Right
Stable	☐	☐
Vulnerable	☒	☒
Unstable	☐	☐
Protected	☐	☐

GROUNDWATER EVIDENCE	
None	☒
Springs/Seeps	☐
Vegetation (i.e. Watercress)	☐
Iron Staining	☐
Other	☐

WATERCOURSE MORPHOLOGY

	Pool	Riffle	Run	Glide	Other
% Area	15%		85%		
Mean Wetted Width (m)	4m		2m		
Mean Wetted Depth (m)	0.3m		0.1m		
Mean Bankfull Width (m)	6 m		5m		
Mean Bankfull Depth (m)	1m		1m		
Substrate (%)	GR - 35 Silt+Clay-60 Detritus-5		GR - 35 silt+CL-60 Detritus - 5		

Substrate Options: BR – Bedrock; BO – Boulder; CO – Cobble; GR – Gravel; SA – Sand; SI – Silt; CL – Clay; MU – Muck; D - Detritus

Valley width 20-30m
depth 7-10m

In-stream Cover (%)	**None**	**Undercut Banks**	**Boulders**	**Cobbles**	**Organic Debris**	**Woody Debris**	**Vegetation**
						In-stream 5	In-stream 0
						Overhanging	Overhanging 95

	%	**Examples**
Submergent		
Floating		
Emergent		

☒ **None**
☐ **Slight**
☐ **Moderate**
☐ **Heavy**

Examples

% of Stream Shaded

☐ **100 – 90%**
☒ **90 – 60%**
☐ **60 – 30%**
☐ **30 – 10%**
☐ **0%**

Examples

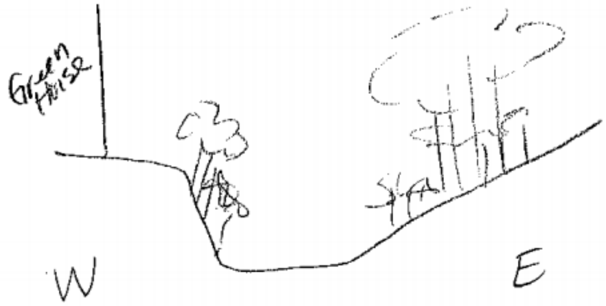
☒ **None**

Seasonal	**Permanent**

☒ ~~**Unknown**~~ NONE
☐ **Nursery Habitat**
☐ **Seasonal Refugia**
☐ **Spawning Habitat**
☐ **Deep Pools**
☐ **Other**

Comments:

- Slope graident slight
- riparian corridor 25 to 30m wide
- retainwall – 2 section along W bank
- banks really steep @ Cty Rd 20



☒ **None**
☐ **Fish Sampling**
☐ **Water Quality Sampling**
☐ **Benthic Sampling**
☐ **Flow Monitoring**
☐ **Mussel Sampling**

Logic Incorporated
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

AQUATIC HABITAT ASSESSMENT
Watercourse

Project Name: Kingsville - Esseltine Drain

Date: August 12 2015

Station Name: Reach 4

Collectors: D.Morse / P.Mikode

Time Started: 5 pm

Time Finished: 5 45pm

GENERAL INFORMATION

Weather: 60% cc, 21°C

Watercourse Name: Esseltine Drain

Drainage System: Lake Erie

GPS Co-ordinates:

LANDUSE		POLLUTION SOURCES	
Left Bank	**Right Bank**	**Point**	**Non-Point**
residential	residential/ greenhouse	-tile drainage from residences	-septic bair has an odour!

FLOW REGIME

☒ Flowing
☐ Dry

☒ Permanent
☐ Intermittent
☐ Ephemeral

CHANNEL FORM

☒ Defined
☐ Undefined

☒ Natural
☐ Channelized
☐ Swale

BANK STABILITY

	Left	Right
Stable	☐	☐
Vulnerable	☐	☐
Unstable	☒	☒
Protected steel wall	☒	☐

GROUNDWATER EVIDENCE

None ☒
Springs/Seeps ☐
Vegetation (i.e. Watercress) ☐
Iron Staining ☐
Other ☐

WATERCOURSE MORPHOLOGY

	Pool	Riffle	Run	Glide	Other
% Area	20	70		20 (at mouth)	
Mean Wetted Width (m)	3m to 4m	2m to 3m		3m - 5m	
Mean Wetted Depth (m)	05m to 0.8m	0.1m to 0.2m		0.5m - 0.75m	
Mean Bankfull Width (m)	10 m	10m		20m	
Mean Bankfull Depth (m)	5 m	5 m		10m	
Substrate (%)	BO - 20 CO - 60 GR - 10 CL - 5	BO - 10 CO - 80 GR - 10		SA - 75 GR - 25	

Substrate Options: BR – Bedrock; BO – Boulder; CO – Cobble; GR – Gravel; SA – Sand; SI – Silt; CL – Clay; MU – Muck; D - Detritus

Valley width 50m to 60m
depth 10m to 15m

	None	Undercut Banks	Boulders	Cobbles	Organic Debris	Woody Debris	Vegetation
In-stream Cover (%)						In-stream 10	In-stream
						Overhanging	Overhanging 90

	%	Examples
Submergent		
Floating		
Emergent		

	Examples
☒ None	
☐ Slight	
☐ Moderate	
☐ Heavy	

% of Stream Shaded	Examples
☐ 100 – 90%	
☒ 90 – 60%	
☐ 60 – 30%	
☐ 30 – 10%	
☐ 0%	

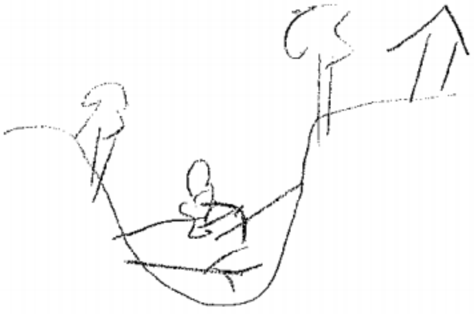
☐ None

Seasonal	Permanent
	- Cty 20 culvert perched ~3m

☒ ~~Unknown~~ NONE
☐ Nursery Habitat
☐ Seasonal Refugia
☐ Spawning Habitat
☐ Deep Pools
☐ Other

Comments:

- sheet steal wall W bank @ Cty Rd 20
- plunge pool d/s of Cty Rd 20 culvert
- high gradient slope /fast flowing water
- riparian corridor ~ 60m wide



☐ None
☒ Fish Sampling
☐ Water Quality Sampling
☒ Benthic Sampling
☐ Flow Monitoring
☐ Mussel Sampling

→ Station #2 & #3

Logic Incorporated
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

FISH SAMPLING FIELD SHEET

Project Name: Town of Kingsville - Esseltine Drain

Date: August 12, 2015

Station Name: Station #1

Collectors: D. Morse
P. Mikoda

Time Started: 4:15

Time Finished: 4:45

GPS Co-ordinates:

Watercourse Name: Esseltine Drain

Drainage System: Lake Erie

GENERAL INFORMATION

Type of Equipment: HT-2000 Backpack Electrofisher

Fishing Duration: 163s.

FISH SAMPLING INFORMATION

Fish Name	# Caught	Total Length (m)		Fish Name	# Caught	Total Length (m)	
		Max	Min			Max	Min
Fathead Minnow	10						

PAGE 1 of 1

Logic Incorporated

AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

FISH SAMPLING FIELD SHEET

Project Name: Town of Kingsville - Esseltine Drain

Date: August 12, 2015.

Station Name: Station #21

Collectors: D. Morse
P. Mikoda

Time Started: 5:15

Time Finished: 6.00

GPS Co-ordinates:

Watercourse Name: Esseltine Drain

Drainage System: Lake Erie

GENERAL INFORMATION

Type of Equipment: HT-2000 Backpack Electrofisher

Fishing Duration: 985.

FISH SAMPLING INFORMATION

Fish Name	# Caught	Total Length (m)		Fish Name	# Caught	Total Length (m)	
		Max	Min			Max	Min
Creek Chub	1						
Fathead Minnow	23						
Green Sunfish	1						
Pumpkinseed	4						

Logic Incorporated
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

FISH SAMPLING FIELD SHEET

Project Name: Town of Kingsville - Esseltine Drain

Date: August 12, 2015

Station Name: Station #3

Collectors: D. Morse
P. Mikoda

Time Started: 6:00

Time Finished: 6:15

GPS Co-ordinates:

Watercourse Name: Esseltine Drain

Drainage System: Lake Erie

GENERAL INFORMATION

Type of Equipment: HT-2000 Backpack Electrofisher

Fishing Duration: 285s.

FISH SAMPLING INFORMATION

Fish Name	# Caught	Total Length (m)		Fish Name	# Caught	Total Length (m)	
		Max	Min			Max	Min
White Bass	2						
Spottail Shiner	2						

PAGE 1 of 1

Appendix D

ELC Field Sheets

ELC **COMMUNITY DESCRIPTION & CLASSIFICATION**	SITE: ESSELTINE DRAIN		POLYGON: 1
	SURVEYOR(S): P. MIKODA	DATE: APR. 6/15	TIME: start 13:00 finish 13:30
	UTMZ:	UTME:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☒ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☒ MINERAL SOIL ☐ PARENT MIN. ☐ ACIDIC BEDRK. ☐ BASIC BEDRK. ☐ CARB. BEDRK.	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☒ TABLELAND ☐ ROLL. UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE / CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH / BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☒ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING-LVD. ☒ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☐ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☒ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WATER ☒ SURFICIAL DEP. ☐ BEDROCK			☒ OPEN ☐ SHRUB ☐ TREED		

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	3	1	RHUtyph > ACEnegu
2	SUB-CANOPY			
3	UNDERSTOREY	4,5,6	4	PHR aust >>>>>> CORNUS > POPdelt
4	GRD. LAYER	7	2	ALL peti

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	R	< 10	R	10 - 24	N	25 - 50	N	> 50
STANDING SNAGS:	N	< 10	N	10 - 24	N	25 - 50	N	> 50
DEADFALL / LOGS:	R	< 10	N	10 - 24	N	25 - 50	N	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE :	X	PIONEER		YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	**DEPTH TO MOTTLES / GLEY**	g =	G=
MOISTURE:	**DEPTH OF ORGANICS:**		(cm)
HOMOGENEOUS / VARIABLE	**DEPTH TO BEDROCK:**		(cm)

COMMUNITY CLASSIFICATION:

		ELC CODE
COMMUNITY CLASS:	CULTURAL	CU
COMMUNITY SERIES:	CULTURAL MEADOW	CUM
ECOSITE:	MINERAL CULTURAL MEADOW	CUM1
VEGETATION TYPE:		
INCLUSION	MINERAL MEADOW MARSH (PHRAGMITES DOMINATED)	MAM2
COMPLEX		

Notes: MAM2 – PHRAGMITES DOMINATES WATERCOURSE AND ITS BANKS

ELC COMMUNITY DESCRIPTION & CLASSIFICATION	SITE: ESSELTINE DRAIN		POLYGON: 2	
	SURVEYOR(S): P. Mikoda	DATE: APR 6/15	TIME: start 13:30 finish 14:00	
	UTMZ: 17	UTME: 362442	UTMN: 4656569	

POLYGON DESCRIPTION

SYSTEM

☒ TERRESTRIAL
☐ WETLAND
☐ AQUATIC

SITE

☐ OPEN WATER
☐ SHALLOW WATER
☒ SURFICIAL DEP.
☐ BEDROCK

SUBSTRATE

☐ ORGANIC
☒ MINERAL SOIL
☐ PARENT MIN.
☐ ACIDIC BEDRK.
☐ BASIC BEDRK.
☐ CARB. BEDRK.

TOPOGRAPHIC FEATURE

☐ LACUSTRINE
☐ RIVERINE
☐ BOTTOMLAND
☐ TERRACE
☐ VALLEY SLOPE
☒ TABLELAND
☐ ROLL. UPLAND
☐ CLIFF
☐ TALUS
☐ CREVICE / CAVE
☐ ALVAR
☐ ROCKLAND
☐ BEACH / BAR
☐ SAND DUNE
☐ BLUFF

HISTORY

☐ NATURAL
☒ CULTURAL

COVER

☐ OPEN
☒ SHRUB
☐ TREED

PLANT FORM

☐ PLANKTON
☐ SUBMERGED
☐ FLOATING-LVD.
☐ GRAMINOID
☐ FORB
☐ LICHEN
☐ BRYOPHYTE
☒ DECIDUOUS
☐ CONIFEROUS
☐ MIXED

COMMUNITY

☐ LAKE
☐ POND
☐ RIVER
☐ STREAM
☐ MARSH
☐ SWAMP
☐ FEN
☐ BOG
☐ BARREN
☐ MEADOW
☐ PRAIRIE
☒ THICKET
☐ SAVANNAH
☐ WOODLAND
☐ FOREST
☐ PLANTATION

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	3	3	CORfoem >> RHAtyph > RHAcath
2	SUB-CANOPY			
3	UNDERSTOREY			
4	GRD. LAYER	4	4	ALLpeti > DAUcaro > SOLcana > ASTnova

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:		< 10		10 - 24		25 - 50		> 50
STANDING SNAGS:		< 10		10 - 24		25 - 50		> 50
DEADFALL / LOGS:		< 10		10 - 24		25 - 50		> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE :	X	PIONEER		YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

		ELC CODE
COMMUNITY CLASS:	CULTURAL	CU
COMMUNITY SERIES:	CULTURAL THICKET	CUT
ECOSITE:	MINERAL CULTURAL THICKET	CUT1
VEGETATION TYPE:	GRAY DOGWOOD MINERAL CULTURAL THICKET	CUT1-4
INCLUSION		
COMPLEX		

Notes: NOT REALLY A COMMUNITY. HEDGEROW BUT GIVEN A COMMUNITY LABEL FOR HABITAT PURPOSES ONLY

ELC
COMMUNITY DESCRIPTION & CLASSIFICATION

SITE: ESSELTINE DRAIN
POLYGON: 3a
SURVEYOR(S): P. MIRODA
DATE: APR. 6/15
TIME: start 14:00 finish 15:00
UTMZ:
UTME:
UTMN:

POLYGON DESCRIPTION

SYSTEM
- ☒ TERRESTRIAL
- ☐ WETLAND
- ☐ AQUATIC

SITE
- ☐ OPEN WATER
- ☐ SHALLOW WATER
- ☒ SURFICIAL DEP.
- ☐ BEDROCK

SUBSTRATE
- ☐ ORGANIC
- ☒ MINERAL SOIL
- ☐ PARENT MIN.
- ☐ ACIDIC BEDRK.
- ☐ BASIC BEDRK.
- ☐ CARB. BEDRK.

TOPOGRAPHIC FEATURE
- ☐ LACUSTRINE
- ☐ RIVERINE
- ☐ BOTTOMLAND
- ☐ TERRACE
- ☐ VALLEY SLOPE
- ☒ TABLELAND
- ☐ ROLL. UPLAND
- ☐ CLIFF
- ☐ TALUS
- ☐ CREVICE / CAVE
- ☐ ALVAR
- ☐ ROCKLAND
- ☐ BEACH / BAR
- ☐ SAND DUNE
- ☐ BLUFF

HISTORY
- ☐ NATURAL
- ☒ CULTURAL

COVER
- ☐ OPEN
- ☒ SHRUB
- ☒ TREED

PLANT FORM
- ☐ PLANKTON
- ☐ SUBMERGED
- ☐ FLOATING-LVD.
- ☐ GRAMINOID
- ☐ FORB
- ☐ LICHEN
- ☐ BRYOPHYTE
- ☐ DECIDUOUS
- ☐ CONIFEROUS
- ☐ MIXED

COMMUNITY
- ☐ LAKE
- ☐ POND
- ☐ RIVER
- ☐ STREAM
- ☐ MARSH
- ☐ SWAMP
- ☐ FEN
- ☐ BOG
- ☐ BARREN
- ☐ MEADOW
- ☐ PRAIRIE
- ☐ THICKET
- ☐ SAVANNAH
- ☐ WOODLAND
- ☐ FOREST
- ☐ PLANTATION

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	3	ULM amer > POP delt >>> QUE alba
2	SUB-CANOPY	3	4	COR foem > RHU typh >> CRATAEGUS
3	UNDERSTOREY	4.5	3	SOLIDAGO > SYMPHOTRICUM > AMB trif
4	GRD. LAYER	6,7	2	ALL peti > GEUM

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION:
BA:

SIZE CLASS ANALYSIS:	A	< 10	O	10 - 24	O	25 - 50	N	> 50
STANDING SNAGS:	O	< 10	O	10 - 24	R	25 - 50	N	> 50
DEADFALL / LOGS:	O	< 10	O	10 - 24	O	25 - 50	N	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE :	✓	PIONEER		YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

		ELC CODE
COMMUNITY CLASS:	CULTURAL	CU
COMMUNITY SERIES:	CULTURAL WOODLAND	CUW
ECOSITE:	MINERAL CULTURAL WOODLAND	CUW1
VEGETATION TYPE:		
INCLUSION		
COMPLEX		

Notes:

ELC **COMMUNITY DESCRIPTION & CLASSIFICATION**	SITE: ESSELTINE DRAIN		POLYGON: 3b
	SURVEYOR(S): P. MIKODA	DATE: APR. 6/13	TIME: start 15:00 finish 16:00
	UTMZ:	UTME:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPOGRAPHIC FEATURE	HISTORY	PLANT FORM	COMMUNITY
☒ TERRESTRIAL	☐ ORGANIC	☐ LACUSTRINE	☐ NATURAL	☐ PLANKTON	☐ LAKE
☐ WETLAND	☒ MINERAL SOIL	☐ RIVERINE	☒ CULTURAL	☐ SUBMERGED	☐ POND
☐ AQUATIC	☐ PARENT MIN.	☐ BOTTOMLAND		☐ FLOATING-LVD.	☐ RIVER
	☐ ACIDIC BEDRK.	☐ TERRACE		☐ GRAMINOID	☐ STREAM
	☐ BASIC BEDRK.	☒ VALLEY SLOPE		☐ FORB	☐ MARSH
	☐ CARB. BEDRK.	☐ TABLELAND		☐ LICHEN	☐ SWAMP
		☐ ROLL. UPLAND		☐ BRYOPHYTE	☐ FEN
		☐ CLIFF		☒ DECIDUOUS	☐ BOG
		☐ TALUS		☐ CONIFEROUS	☐ BARREN
		☐ CREVICE / CAVE		☐ MIXED	☐ MEADOW
		☐ ALVAR			☐ PRAIRIE
		☐ ROCKLAND			☐ THICKET
		☐ BEACH / BAR			☐ SAVANNAH
		☐ SAND DUNE			☒ WOODLAND
		☐ BLUFF			☐ FOREST
					☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER			☐ OPEN		
☐ SHALLOW WATER			☐ SHRUB		
☒ SURFICIAL DEP.			☒ TREED		
☐ BEDROCK					

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	3	SALIX = JUGnigr >> POPdelt > ACER
2	SUB-CANOPY	3	4	RHUtyph >> ACEnegu > VITUS
3	UNDERSTOREY	4,5	4	VITUS > CORfoem > RHUtyph > SOLIDAGO > AMBtrif
4	GRD. LAYER	6,7	4	ALLpeti > HESmatr

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	A	< 10	A	10 - 24	R	25 - 50	N	> 50
STANDING SNAGS:	O	< 10	O	10 - 24	R	25 - 50	N	> 50
DEADFALL / LOGS:	A	< 10	A	10 - 24	O	25 - 50	N	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE :	✓	PIONEER		YOUNG		MID-AGE		MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	DEPTH TO MOTTLES / GLEY	g =	G=
MOISTURE:	DEPTH OF ORGANICS:		(cm)
HOMOGENEOUS / VARIABLE	DEPTH TO BEDROCK:		(cm)

COMMUNITY CLASSIFICATION:

			ELC CODE
	COMMUNITY CLASS:	CULTURAL	CU
	COMMUNITY SERIES:	CULTURAL WOODLAND	CUW
	ECOSITE:	MINERAL CULTURAL WOODLAND	CUW1
	VEGETATION TYPE:		
☐	INCLUSION		
☐	COMPLEX		

Notes:

ELC **COMMUNITY DESCRIPTION & CLASSIFICATION**			
SITE: ESSELINE DRAIN		POLYGON: 4	
SURVEYOR(S): P. MIKODA	DATE: APR. 6/15	TIME: start 16:00	finish 17:00
UTMZ:	UTME:	UTMN:	

POLYGON DESCRIPTION

SYSTEM
- ☒ TERRESTRIAL
- ☐ WETLAND
- ☐ AQUATIC

SITE
- ☐ OPEN WATER
- ☐ SHALLOW WATER
- ☒ SURFICIAL DEP.
- ☐ BEDROCK

SUBSTRATE
- ☐ ORGANIC
- ☒ MINERAL SOIL
- ☐ PARENT MIN.
- ☐ ACIDIC BEDRK.
- ☐ BASIC BEDRK.
- ☐ CARB. BEDRK.

TOPOGRAPHIC FEATURE
- ☐ LACUSTRINE
- ☐ RIVERINE
- ☐ BOTTOMLAND
- ☐ TERRACE
- ☒ VALLEY SLOPE
- ☐ TABLELAND
- ☐ ROLL. UPLAND
- ☐ CLIFF
- ☐ TALUS
- ☐ CREVICE / CAVE
- ☐ ALVAR
- ☐ ROCKLAND
- ☐ BEACH / BAR
- ☐ SAND DUNE
- ☐ BLUFF

HISTORY
- ☒ NATURAL
- ☐ CULTURAL

COVER
- ☐ OPEN
- ☐ SHRUB
- ☒ TREED

PLANT FORM
- ☐ PLANKTON
- ☐ SUBMERGED
- ☐ FLOATING-LVD.
- ☐ GRAMINOID
- ☐ FORB
- ☐ LICHEN
- ☐ BRYOPHYTE
- ☒ DECIDUOUS
- ☐ CONIFEROUS
- ☐ MIXED

COMMUNITY
- ☐ LAKE
- ☐ POND
- ☐ RIVER
- ☐ STREAM
- ☐ MARSH
- ☐ SWAMP
- ☐ FEN
- ☐ BOG
- ☐ BARREN
- ☐ MEADOW
- ☐ PRAIRIE
- ☐ THICKET
- ☐ SAVANNAH
- ☐ WOODLAND
- ☒ FOREST
- ☐ PLANTATION

STAND DESCRIPTION:

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (up to 4 sp) (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	CANOPY	2	4	ACER >>> QUE rubr > CEL occi > PRU sero
2	SUB-CANOPY	3	3	ACER >> FRA amer > COR amer > CAR caro
3	UNDERSTOREY	4, 5	3	ACER >> FRA amer > PRU virg
4	GRD. LAYER	6, 7	2	HED heli >>> ALL peti >> GEUM

HT CODES: 1 = >25 m 2 = 10<HT≤25 m 3 = 2<HT≤10 m 4 = 1<HT≤2 m 5 = 0.5<HT≤1 m 6 = 0.2<HT≤0.5 m 7 = HT<0.2 m

CVR CODES 0= NONE 1= 0% < CVR ≤ 10% 2= 10 < CVR ≤ 25% 3= 25 < CVR ≤ 60% 4= CVR > 60%

STAND COMPOSITION:	BA:

SIZE CLASS ANALYSIS:	O	< 10	A	10 - 24	A	25 - 50	R	> 50
STANDING SNAGS:	R	< 10	R	10 - 24	O	25 - 50	R	> 50
DEADFALL / LOGS:	O	< 10	O	10 - 24	O	25 - 50	R	> 50

ABUNDANCE CODES: N = NONE R = RARE O = OCCASIONAL A = ABUNDANT

COMM. AGE :		PIONEER		YOUNG		MID-AGE	X	MATURE		OLD GROWTH

SOIL ANALYSIS:

TEXTURE:	**DEPTH TO MOTTLES / GLEY**	g =	G=
MOISTURE:	**DEPTH OF ORGANICS:**		(cm)
HOMOGENEOUS / VARIABLE	**DEPTH TO BEDROCK:**		(cm)

COMMUNITY CLASSIFICATION:

		ELC CODE
COMMUNITY CLASS:	FOREST	FO
COMMUNITY SERIES:	DECIDUOUS FOREST	FOD
ECOSITE:	FRESH-MOIST SUGAR MAPLE	FOD6
VEGETATION TYPE:	FRESH - MOIST SUGAR MAPLE - HARDWOOD DECIDUOUS FOREST	FOD6-5
INCLUSION	MINERAL OPEN BEACH/BAR	BB01
COMPLEX		

Notes: HIGH ENERGY WATERCOURSE CAUSING HEAVY EROSION OF VALLEY
HIGH ENERGY SHORELINE DOES NOT PERMIT ESTABLISHMENT
OF VEGETATION.

Appendix E

Candidate SWH Evaluation

Candidate Significant Wildlife Habitat - ELC Communities – Esseltine Drain

Table 1.1 – Seasonal Concentration Areas

Wildlife Habitat	ELC Codes Triggers	Additional Habitat Criteria	Candidate SWH
Waterfowl Stopover and Staging Areas (Terrestrial)	C1 - CUM1 C2 - CUT1-4	- no fields with sheet water during spring present	No.
Waterfowl Stopover and Staging Areas (Aquatic)	not present	- no ponds, marshes, lakes or bays present	No.
Shorebird Migratory Stopover Area	C1 - MAM2 inclusion C4 - BBO1 inclusion	- MAM inclusion not adjacent to shoreline - Lake Erie shoreline (beach) at the mouth of the drain	**Yes.** C4
Raptor Wintering Area	C1 - CUM1 C2 - CUT1-4 C3a/b - CUW1 C4 - FOD6-5	- combination of woodland and upland present however not >20ha for hawks and owls - C4 (FOD6-5) is adjacent to Lake Erie Shoreline for bald eagles	**Yes.** C4 for Bald Eagle
Bat Hibernacula	not present	- none present	No.
Bat Maternity Colonies	C4 - FOD6-5	- there are a few large trees (>25cm dbh) snags however there is not >10 large snag trees per hectare	No.
Turtle Wintering Areas	C1 - MAM2 inclusion C4 - BBO1 inclusion	- no permanent open water areas in C1 - Lake Erie is only deep water within C4 and is beyond study area	No.
Reptile Hibernaculum	C1 - CUM1 C2 - CUT1-4 C3a/b - CUW1 C4 - FOD6-5	- no rock piles, stone fences, crumbling foundations, or rock crevices, - active animal burrows throughout study area, but significant erosion - rubble and garbage piles within C4	**Yes.** C1, C2, C3a/b & C4
Colonially-Nesting Bird Breeding Habitat (Bank / Cliff)	C1 - CUM1 C2 - CUT1-4	- no steep slopes of exposed banks or cliff faces present within C1 or C2	No.
Colonially-Nesting Bird Breeding Habitat (Trees/Shrubs)	not present	- no wetlands, lakes, island or peninsulas with live or dead standing trees present	No.
Colonially-Nesting Bird Breeding Habitat (Ground)	C1 - CUM1 C2 - CUT1-4	- no rocky islands or peninsulas present within the drain or at the mouth on Lake Erie - no open fields/pastures with scatted trees present	No.
Migratory Butterfly Stopover Areas	C1 - CUM1 C2 - CUT1-4 C4 - FOD6-5	- within 5km of Lake Ontario or Lake Erie but not >10ha in size	No.
Land Bird Migratory Stopover Areas	C4 - FOD6-5	- C4 within 5km of Lake Erie however not >5ha	No.
Deer Winter Congregation Areas	C4 - FOD6-5	- C4 not >50ha - deer yarding areas not identified (Appendix A)	No.

Table 1.2.1 – Rare Vegetation Communities

Wildlife Habitat	ELC Codes Triggers	Additional Habitat Criteria	Candidate SWH
Cliffs and Talus Slopes	not present		No.
Sand Barren	not present		No.
Alvar	not present		No.
Old Growth Forest	C4 - FOD6-5	- C4 is mature	No.
Savannah	not present		No.
Tallgrass Prairie	not present		No.
Other Rare Vegetation	not present		No.

Table 1.2.2 – Specialized Habitat for Wildlife

Wildlife Habitat	ELC Codes Triggers	Additional Habitat Criteria	Candidate SWH
Waterfowl Nesting Area	C1 - MAM2 inclusion	- MAM2 inclusion is very small >0.5ha in size	No.
Bald Eagle and Osprey Nesting, Foraging, Perching	C4 - FOD6-5	- C4 adjacent to Lake Erie	**Yes.** C4
Woodland Raptor Nesting Habitat	C3a/b - CUW1 C4 - FOD6-5	- C3a/b and C4 not >30ha and do not have >4ha of interior habitat	No.
Turtle Nesting Areas	C4 - BBO1 inclusion	- exposed sand on beach at the mouth of the drain on Lake Erie	**Yes.** C4 inclusion
Springs and Seeps	C3a/b - CUW1 C4 - FOD6-5	- C3a/b and C4 not located within a headwater area of Esseltine Drain - no springs or seeps observed	No.
Amphibian Breeding Habitat (Woodland)	C4 - FOD6-5	- no wetland, pond or vernal pool >500m^2 within or within 120m of woodland - Esseltine Drain high energy/fast flowing	No.
Amphibian Breeding Habitat (Wetlands)	C1 - MAM2 inclusion C4 - BBO1 inclusion	- C1 and C4 not >500m^2 and not >120m from woodlands	No
Woodland Area-Sensitive Bird Breeding Habitat	C4 - FOD6-5	- C4 is mature not >60yrs old - C4 not >30ha and does not have interior forest habitat.	No.

Table 1.3 – Habitats of Species of Conservation Concern (not END or THR species)

Wildlife Habitat	ELC Codes Triggers	Additional Habitat Criteria	Candidate SWH
Marsh Bird Breeding Habitat	C1 - CUM1 with MAM2 inclusion C4 - BBO1 inclusion	- C4 has no emergent vegetation - C1 emergetn vegetation in riparian corridor and would not have shallow water year round	No.
Open Country Bird Breeding Habitat	C1 - CUM1	- C1 not >30ha - no abandoned fields, mature hayfields or pasture land >30ha present - active agriculture and pasturing not considered SWH	No.
Shrub/Early Successional Bird Breeding Habitat	C2 - CUT1-4 C3a/b - CUW1	- C2 and C3a/b not >10ha - no large fields succeeding to shrub and thicket habitats > 10ha in size - active agriculture and pasturing is not SWH	No.
Terrestrial Crayfish	C1 - CUM1 with MAM2 inclusion	- wetland habitat present - cultural meadow could also be used	**Yes.** C1
Special Concern and Rare Wildlife Species (NHIC and MNRF pre-consultation)	n/a	Plants Biennial Gaura (S3), Coast Barnyard Grass (S3), Hairy Pinweed (S3), Hoary Tick-trefoil (S2), Norhter Fogfruit (S2), Prostrate Tick-trefoil (2), Scarlet Beebalm (S3), Yellow False-indigo (S2), Yellow Stargrass (S3) Insects Azure Bluet (S3), Cyrano Darner (S3), Duke's Skipper (S2)	**Yes** C1, C2, C3a/b, & C4

Table 1.4.1 – Animal Movement Corridors

Wildlife Habitat	ELC Codes that Trigger Consideration*	Additional Habitat Criteria	Candidate SWH
Amphibian Movement Corridors	n/a	- Significant Amphibian Breeding Habitat (wetlands) not present	No.

Appendix F

Floral Inventory

FLORAL SURVEY INFORMATION SUMMARY SHEET

Project: Esseltine Drain
Collector(s): G. Waldron

	Date	Start	Finish	Weather
Visit 1	19-May-15	10am	4pm	
Visit 2				
Visit 3				

									ESA	STATUS	
FAMILY	ACRONYM	C	W	WETNESS	OWES*	PHYSIOG.	**SCIENTIFIC NAME**	**COMMON NAME**	**Listing**	**ONT**	**Essex**
ACERAC	ACERFRE						Acer X freemanii	FREEMAN'S MAPLE (Hybrid)			
ACERAC	ACENEGU	0	-2	FACW-	W	N Tree	Acer negundo	BOX ELDER			
ACERAC	ACEPLAT	*	5	UPL		A Tree	ACER PLATANOIDES	NORWAY MAPLE			
ACERAC	ACESACC	5	-3	FACW	I	N Tree	Acer saccharinum	SILVER MAPLE			
ACERAC	ACESACCNIG	7	3	FACU		N Tree	Acer saccharum ssp. nigrum (A. nigrum)	BLACK MAPLE			
ACERAC	ACESACCSAC	4	3	FACU		N Tree	Acer saccharum ssp. saccharum	SUGAR MAPLE;HARD MAPLE			
LABIAT	AJUREPT	*	5	UPL		A Forb	AJUGA REPTANS	CARPET BUGLE			
CRUCIF	ALLPETI	*	0	FAC		A Forb	ALLIARIA PETIOLATA (A. OFFICINALIS)	GARLIC MUSTARD			
COMPOS	AMBTRIF	0	-1	FAC+		N Forb	Ambrosia trifida	GIANT RAGWEED			
ARACEA	ARITRIP	5	-2	FACW-	W	N Forb	Arisaema triphyllum	JACK-IN-THE-PULPIT;INDIAN-TURNIP			
ARISTO	ASACANA	6	5	UPL		N Forb	Asarum canadense	WILD-GINGER			
ASTERA	ASTLANC	3	-3	FACW	I	N Forb	Aster lanceolatus	EASTERN LINED ASTER			
BERBER	BERVULG	*	3	FACU		A Shrub	BERBERIS VULGARIS	COMMON BARBERRY			
POACEA	BROTECT	*	5	UPL		A Grass	BROMUS TECTORUM	CHEAT GRASS			
BIGNON	CAMRADI	3	0	FAC		N Vine	Campsis radicans	TRUMPET CREEPER		S2?	R5/Ir
BRASSI	CARCONC	6	3	FACU		N Forb	Cardamine concatenata (Dentaria laciniata)	CUT-LEAVED TOOTHWORT			
CYPERA	CARBLAN	3	0	FAC		N Sedge	Carex blanda	WOODLAND SEDGE			
CYPERA	CARRADI	4	5	UPL	W	N Sedge	Carex radiata (C. rosea)	STELLATE SEDGE			
BETULA	CARCARO	6	0	FAC	W	N Tree	Carpinus caroliniana	AMERICAN HORNBEAM;BLUE-BEECH			
JUGLAN	CARCORD	6	0	FAC		N Tree	Carya cordiformis	BITTERNUT HICKORY			
ULMACE	CELOCCI	8	1	FAC-		N Tree	Celtis occidentalis	HACKBERRY			
CHENOP	CHEALBU	*	1	FAC-		A Forb	CHENOPODIUM ALBUM	LAMB'S QUARTERS;"PIGWEED"			
ONAGRA	CIRLUTE	3	3	FACU		N Forb	Circaea lutetiana (C. quadrisulcata)	ENCHANTER'S-NIGHTSHADE			
ASTERA	CIRARVE	*	3	FACU		A Forb	CIRSIUM ARVENSE	CANADIAN-THISTLE			
CONVOL	CONARVE	*	5	UPL		A Forb	CONVOLVULUS ARVENSIS	FIELD BINDWEED			
CORNAC	CORALTE	6	5	UPL		N Tree	Cornus alternifolia	ALTERNATE-LEAVED DOGWOOD			
CORNAC	CORDRUM	4	0	FAC		N Shrub	Cornus drummondii	ROUGH-LEAVED DOGWOOD			
CORNAC	CORFOEM	2	-2	FACW-	W	N Shrub	Cornus foemina (C. racemosa)	GRAY DOGWOOD			
GRAMIN	DACGLOM	*	3	FACU		A Grass	DACTYLIS GLOMERATA	ORCHARD GRASS			
FUMARI	DICCANA	7	5	UPL		N Forb	Dicentra canadensis	SQUIRREL CORN			
CUCURB	ECHLOBA	3	-2	FACW-	W	N Vine	Echinocystis lobata	WILD CUCUMBER			
EQUISE	EQUARVE	0	0	FAC	W	N Fern	Equisetum arvense	COMMON or FIELD HORSETAIL			C
EQUISE	EQUHYEM	2	-2	FACW-	W	N Fern	Equisetum hyemale	SCOURING RUSH			C
BRASSI	ERYCHEI	*	3	FACU		A Forb	ERYSIMUM CHEIRANTHOIDES	WORMSEED MUSTARD			
LILIAC	ERYAMER	5	5	UPL		N Forb	Erythronium americanum	YELLOW TROUT LILY			
CELAST	EUOALAT	*	5	UPL		A Shrub	EUONYMUS ALATA	WINGED WAHOO			
CELAST	EUOOBOV	6	5	UPL		N Shrub	Euonymus obovata	RUNNING STRAWBERRY BUSH			
FAGACE	FAGGRAN	6	3	FACU		N Tree	Fagus grandifolia	AMERICAN BEECH			
OLEACE	FRAAMER	4	3	FACU		N Tree	Fraxinus americana	WHITE ASH			
OLEACE	FRAPENN	3	-3	FACW	W	N Tree	Fraxinus pennsylvanica	RED ASH			
RUBIAC	GALAPAR	4	3	FACU		N Forb	Galium aparine	ANNUAL BEDSTRAW			
GERANI	GERMACU	6	3	FACU		N Forb	Geranium maculatum	WILD GERANIUM			
ROSACE	GEUCANA	3	0	FAC	W	N Forb	Geum canadense	WHITE AVENS			
HAMAME	HAMVIRG	6	3	FACU		N Shrub	Hamamelis virginiana	WITCH-HAZEL			
	HEDEHEL					A Vine	HEDERA HELIX	ENGLISH IVY			
LILIAC	HEMFULV	*	5	UPL		A Forb	HEMEROCALLIS FULVA	ORANGE DAY-LILY			
CRUCIF	HESMATR	*	5	UPL		A Forb	HESPERIS MATRONALIS	DAME'S ROCKET			
HYDROP	HYDVIRG	6	-2	FACW-		N Forb	Hydrophyllum virginianum	VIRGINIA WATERLEAF			
BALSAM	IMPCAPE	4	-3	FACW	I	N Forb	Impatiens capensis	SPOTTED TOUCH-ME-NOT			
JUGLAN	JUGCINE	6	2	FACU+		N Tree	Juglans cinerea	BUTTERNUT	END	S3?	
ASTERA	LACCANA	3	2	FACU+		N Forb	Lactuca canadensis	TALL LETTUCE			
URTICA	LAPCANA	6	-3	FACW	W	N Forb	Laportea canadensis	WOOD NETTLE			
GRAMIN	LEEVIRG	6	-3	FACW	W	N Grass	Leersia virginica	WHITE GRASS			
LABIAT	LEOCARD	*	5	UPL		A Forb	LEONURUS CARDIACA	MOTHERWORT			
OLEACE	LIGVULG	*	1	FAC-		A Shrub	LIGUSTRUM VULGARE	EUROPEAN PRIVET			
CAPRIF	LONTATA	*	3	FACU		A Shrub	LONICERA TATARICA	SMOOTH TARTARIAN HONEYSUCKLE			
LILIAC	MAIRACE	4	3	FACU		N Forb	Maianthemum racemosum (Smilacina racem	FALSE SPIKENARD			
LILIAC	MAISTEL	6	1	FAC-		N Forb	Maianthemum stellatum (Smilacina stellata)	STARRY FALSE SOLOMON-SEAL			
DRYOPT	MATSTRU	5	-3	FACW	W	N Fern	Matteuccia struthiopteris	OSTRICH FERN			
MARACE	MORALBA	*	0	FAC		A Tree	MORUS ALBA	RUSSIAN or WHITE MULBERRY			
POACEA	MUHUNIF	9	-5	OBL		N Grass	Muhlenbergia uniflora	MUHLY GRASS; FALL DROPSEED MUHLY			
	NARCPSE					N Forb	Narcissus pseudonarcissus	COMMON DAFFODIL			
BETULA	OSTVIRG	4	4	FACU-		N Tree	Ostrya virginiana	IRONWOOD;HOP HORNBEAM			
	PACHTER					N Forb	Pachysandra terminalis	JAPANESE PACHYSANDRA			
VITACE	PARINSE	3	3	FACU		N Vine	Parthenocissus inserta (P. vitacea)	THICKET CREEPER			
GRAMIN	PHAARUN	0	-4	FACW+	W	N Grass	Phalaris arundinacea	REED CANARY GRASS			
GRAMIN	PHRAUST	0	-4	FACW+	W	N Grass	Phragmites australis (P. communis)	REED;GIANT BULRUSH			
SOLANA	PHYALKE	*	5	UPL		A Forb	PHYSALIS ALKEKENGI	CHINESE LANTERN PLANT			
NYCTAG	PHYAMER	3	1	FAC-		N Forb	Phytolacca americana	POKEWEED;INKBERRY			
POACEA	POAANNU	*	1	FAC-		A Grass	POA ANNUA	ANNUAL BLUEGRASS			
POACEA	POAPRAT	0	1	FAC-		N Grass	Poa pratensis	KENTUCKY BLUEGRASS			
MENISP	PODPELT	5	3	FACU		N Forb	Podophyllum peltatum	MAY APPLE;MANDRAKE			
LILIAC	POLPUBE	5	5	UPL		N Forb	Polygonatum pubescens	DOWNY SOLOMON SEAL			
POLYGO	POLCUSP	*	3	FACU		A Forb	POLYGONUM CUSPIDATUM	JAPANESE KNOTWEED			
POLYGO	POLVIRM	6	0	FAC		N Forb	Polygonum virginianum (Tovara v.)	JUMPSEED			
DRYOPT	POLACRO	5	5	UPL		N Fern	Polystichum acrostichoides	CHRISTMAS FERN			
SALICA	POPDELT	4	-1	FAC+		N Tree	Populus deltoides	COTTONWOOD			
ROSACE	PRUSERO	3	3	FACU		N Tree	Prunus serotina	WILD BLACK CHERRY			
ROSACE	PRUVIRG	2	1	FAC-		N Shrub	Prunus virginiana	CHOKE CHERRY			
FAGACE	QUERUBR	6	3	FACU		N Tree	Quercus rubra	NORTHEN RED OAK			
RANUNC	RANABOR	2	-2	FACW-		N Forb	Ranunculus abortivus	SMALL-FLOWERED BUTTERCUP			
RANUNC	RANHISPCAR	5	-5	OBL	I	N Forb	Ranunculus hispidus var. caricetorum (R. sep	SWAMP BUTTERCUP			
ANACAR	RHUGLAB	7	5	UPL		N Tree	Rhus glabra	SMOOTH SUMAC			
ANACAR	RHURADIRYD	0	0	FAC		N Vine	Rhus radicans ssp. rydbergii (R. rydbergii, To	POISON-IVY			
ANACAR	RHUTYPH	1	5	UPL		N Tree	Rhus typhina	STAGHORN SUMAC			
GROSSU	RIBAMER	4	-3	FACW	W	N Shrub	Ribes americanum	WILD BLACK CURRANT			
ROSACE	ROSMULT	*	3	FACU		A Shrub	ROSA MULTIFLORA	JAPANESE or MULTIFLORA ROSE			
ROSACE	RUBALLE	2	2	FACU+		N Shrub	Rubus allegheniensis	COMMON BLACKBERRY			
ROSACE	RUBIDAE	0	-2	FACW-		N Shrub	Rubus idaeus (R. strigosus)	WILD RED RASPBERRY			
ROSACE	RUBOCCI	2	5	UPL		N Shrub	Rubus occidentalis	BLACK RASPBERRY			
ROSACE	RUBODOR	3	5	UPL		N Shrub	Rubus odoratus	FLOWERING RASPBERRY			
POLYGO	RUMCRIS	*	-1	FAC+	W	A Forb	RUMEX CRISPUS	SOUR or CURLY DOCK			
POLYGO	RUMOBTU	*	-3	FACW	W	A Forb	RUMEX OBTUSIFOLIUS	BITTER DOCK			
SALICA	SALDISC	3	-3	FACW	I	N Shrub	Salix discolor	PUSSY WILLOW			
SALICA	SALFRAG	*	-1	FAC+		A Tree	SALIX FRAGILIS	CRACK WILLOW			
PAPAVE	SANCANA	5	4	FACU-		N Forb	Sanguinaria canadensis	BLOODROOT			
CARYOP	SAPOFFI	*	3	FACU		A Forb	SAPONARIA OFFICINALIS	BOUNCING BET;SOAPWORT			
LAURAC	SASALBI	6	3	FACU		N Tree	Sassafras albidum	SASSAFRAS			

FLORAL SURVEY INFORMATION SUMMARY SHEET

Project: Esseltine Drain

Collector(s): G. Waldron

	Date	Start	Finish	Weather
Visit 1	19-May-15	10am	4pm	
Visit 2				
Visit 3				

FAMILY	ACRONYM	C	W	WETNESS	OWES*	PHYSIOG.	**SCIENTIFIC NAME**	**COMMON NAME**	**ESA Listing**	**STATUS**	
										ONT	**Essex**
SOLANA	SOLDULC	*	0	FAC	W	A Vine	SOLANUM DULCAMARA	CLIMBING NIGHTSHADE			
ASTERA	SOLCAES	5	3	FACU		N Forb	Solidago caesia	BLUE-STEMMED GOLDENROD			
ASTERA	SOLCANA	1	3	FACU		N Forb	Solidago canadensis	CANADA GOLDENROD			
ASTERA	SOLFLEX	6	3	FACU		N Forb	Solidago flexicaulis	BROAD-LEAVED GOLDENROD			
ROSACE	SPIJAPO	*	5	UPL		A Shrub	SPIRAEA JAPONICA	JAPANESE SPIRAEA			
ARACEA	SYMFOET	7	-5	OBL	I	N Forb	Symplocarpus foetidus	SKUNK-CABBAGE			
ASTERA	TAROFFI	*	3	FACU		A Forb	TARAXACUM OFFICINALE	BROWN-SEED DANDELION			
RANUNC	THADIOI	5	2	FACU+		N Forb	Thalictrum dioicum	EARLY MEADOW-RUE			
TILIAC	TILAMER	4	3	FACU		N Tree	Tilia americana	LINDEN;BASSWOOD			
FABACE	TRIHYBR	*	1	FAC-		A Forb	TRIFOLIUM HYBRIDUM	ALSIKE CLOVER			
URTICA	URTDIOIDIO	*	-1	FAC+		A Forb	URTICA DIOICA SSP. DIOICA	NETTLE			
CAPRIF	VIBOPUL	*	0	FAC		A Shrub	VIBURNUM OPULUS	EUROPEAN HIGHBUSH CRANBERRY			
APOCYN	VINMINO	*	5	UPL		A Shrub	VINCA MINOR	PERIWINKLE			
VIOLAC	VIOSORO	4	1	FAC-	W	N Forb	Viola sororia	COMMON BLUE VIOLET			
VITACE	VITRIPA	0	-2	FACW-		N Vine	Vitis riparia	RIVERBANK GRAPE			
ASTERA	ASTNOVA	2	-3	FACW		N Forb	Aster novae-angliae (Virgulus n.)	NEW ENGLAND ASTER			
BETULA	CORAMER	5	4	FACU-		N Shrub	Corylus americana	HAZELNUT			
UMBELL	DAUCARO	*	5	UPL		A Forb	DAUCUS CAROTA	WILD CARROT;QUEEN-ANNE'S-LACE			
JUGLAN	JUGNIGR	5	3	FACU		N Tree	Juglans nigra	BLACK WALNUT			
FAGACE	QUEALBA	6	3	FACU		N Tree	Quercus alba	WHITE OAK			
RHAMNA	RHACATH	*	3	FACU	W	A Tree	RHAMNUS CATHARTICA	COMMON BUCKTHORN			
ULMACE	ULMAMER	3	-2	FACW-	W	N Tree	Ulmus americana	WHITE or AMERICAN ELM			

Appendix G

Wildlife Inventories

AMPHIBIAN BREEDING SURVEY INFORMATION FIELD SHEET

Project: ESSELTINE DRAIN Page 1 of 1

Station Name: CITY RD 20 Watercourse Name: ESSELTINE DRAIN

Darinage Sys.: — GPS Coordinates: 362489/4655507

Visit 1 Date: APR. 29/15 Start: 10:00 End: 10:30

Weather:

Water °C:	—	Wind:	2-3	Noise:	4	Today- Rain:	1.2	Max °C:	19
Air °C:	13	Cloud%:	90			Yesterday- Rain:	0	Max °C:	16

Control Site: [✓ Y]/N Were Frogs Calling: [✓ Y]/N Where: WINDSOR Collector(s):

Amphibian Data: NO FROGS; NO FROG HABITAT, FAST-FLOWING WATERCOURSE

Field Note Community:																	
ELC Community:																	
Species	Season	CC	#	CC	#	CC	#	CC	#	CC	#	CC	#	CC	#	CC	#
Wood Frog	e. spring																
Spring Peeper	e. spring																
Western Chorus Frog	e. spring																
Boreal Chorus Frog	e. spring																
American Toad	spring																
Northern Leopard Frog	spring																
Pickerel Frog	spring																
Gray Treefrog	spring																
Fowler's Toad	spring																
Mink Frog	summer																
Green Frog	summer																
Bullfrog	summer																

Visit 2 Date: Start: End:

Weather:

Water °C:		Wind:		Noise:		Today- Rain:		Max °C:	
Air °C:		Cloud%:				Yesterday- Rain:		Max °C:	

Control Site: Y/N Were Frogs Calling: Y/N Where: Collector(s):

Amphibian Data:

Species	Season	CC	#	CC	#	CC	#	CC	#	CC	#	CC	#	CC	#	CC	#
Wood Frog	e. spring																
Spring Peeper	e. spring																
Western Chorus Frog	e. spring																
Boreal Chorus Frog	e. spring																
American Toad	spring																
Northern Leopard Frog	spring																
Pickerel Frog	spring																
Gray Treefrog	spring																
Fowler's Toad	spring																
Mink Frog	summer																
Green Frog	summer																
Bullfrog	summer																

Visit 3 Date: Start: End:

Weather:

Water °C:		Wind:		Noise:		Today- Rain:		Max °C:	
Air °C:		Cloud%:				Yesterday- Rain:		Max °C:	

Control Site: Y/N Were Frogs Calling: Y/N Where: Collector(s):

Amphibian Data:

Species	Season	CC	#	CC	#	CC	#	CC	#	CC	#	CC	#	CC	#	CC	#
Wood Frog	e. spring																
Spring Peeper	e. spring																
Western Chorus Frog	e. spring																
Boreal Chorus Frog	e. spring																
American Toad	spring																
Northern Leopard Frog	spring																
Pickerel Frog	spring																
Gray Treefrog	spring																
Fowler's Toad	spring																
Mink Frog	summer																
Green Frog	summer																
Bullfrog	summer																

Call Level Code (CC)

0	No calls heard
1	Calls not simultaneous, number of individuals can be accurately counted (~5 or 6)
2	Some calls simultaneous, number of individuals can be reliably estimated
3	Full chorus, call continuous and overlapping, number of individuals cannot be reliably estimated (>20)

Beaufort Wind Scale

0	0-2km/h, calm (smoke rises vertically)
1	3-5km/h, light air movement (smoke drifts)
2	6-11km/h, slight breeze (wind felt on face)
3	12-19km/h, gentle breeze (leaves in constant motion)
4	20-30km/h, moderate breeze (wind rises dust and paper) **DO NOT MONITOR**

Noise Codes

0	No appreciable effect (owl calling)
1	Slight effect (dog barking, 1 car passing/min.)
2	Moderate effect (2-5 cars passing/min.)
3	Serious effect (continuous traffic, 6-10 cars/min.)
4	Profound effect (continuous traffic, construction noise)

AVIFAUNAL SURVEY INFORMATION SUMMARY SHEET

Project: Esseltine Drain
Collector(s): W.Huys
Visit 1 Date: 3-Jul-15
Visit 2 Date:
Start: 7:15am End: 9:30am
Start: End:
Weather: cool, clear, still
Weather:

Species Code	Species Name	Evidence Code	No.	S Rank	ESA Status	PIF Status	Notes
SPSA	Spotted Sandpiper	SH	1	S5			Near mouth of Drain
MODO	Mourning Dove	P	3	S5			
RBWO	Red-bellied Woodpecker	SH	1	S4	-		
DOWO	Downy Woodpecker	SH	1	S5			
NOFL	Northern Flicker	SH, SM	1	S4		RC	
EAPH	Eastern Phoebe	SM	3	S5			
WAVI	Warbling Vireo	SM	2	S5			
BLJA	Blue Jay	SM	3	S5			
AMCR	American Crow	SH	2	S5			
BCCH	Black-capped Chickadee	SH	1	S5	-		
WBNU	White-breasted Nuthatch	SM	1	S5	-		
HOWR	House Wren	SM, T	2	S5			
AMRO	American Robin	FY	8	S5			
EUST	European Starling	P	3	SNA			
YWAR	Yellow Warbler	SM	1	S5			
NOCA	Northern Cardinal	P	3	S5			
INBU	Indigo Bunting	P	2	S4			
RWBL	Red-winged Blackbird	P, FY	4	S4			
COGR	Common Grackle	P	12	S5			
BHCO	Brown-headed Cowbird	P	2	S4			
BAOR	Baltimore Oriole	FY	5	S4		RC,RS	

Evidence Codes:

Breeding Bird - Possible

SH=Suitable Habitat SM=Singing Male

Breeding Bird - Probable

T=Territory A=Anxiety Behaviour D=Display N=Nest Building P=Pair V=Visiting Nest

Breeding Bird - Confirmed

DD=Distraction NE=Eggs AE=Nest Entry NU=Nest Used NY=Nest Young FY=Fledged Young FS=Food/Faecal Sack

Other Wildlife Evidence

OB=Observed DP=Distinctive Parts TK=Tracks VO=Vocalization HO=House/Den FE=Feeding Evidence CA=Carcass
Fy=Eggs or Young SC=Scat SI=Other Signs (specify)

BioLogic
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

GENERAL SITE INFORMATION FIELD SHEET

Project: ESSELTINE
Date: APR. 6/15
Project Manager:
Collector(s): P. MIKODA
Visit #: 1
Time started: 13:06 Time finished: 17:00 Combined collectors' hours: 4
☐ NHIC List ☐ MNR EO's ☐ none ☐ not provided to collector

WEATHER CONDITIONS					WIND SCALE	
Temp. 11	Wind:	1 | 2	Cloud Cover (%) 100-80	Precipitation	0	Calm
	Direction:	S		Today: 0	1	Smoke Drifts
				Yesterday: ✓	2	Wind Felt on Face
DATA FOCUS					3	Leaves in constant motion
☐ Birds 1__ 2__		☒ ELC's		☐ Dripline	4	Wind raises dust and paper
☐ Mammals		☐ Floral V_ _ S_ _ A_		☐ Aquatic - Physical	5	Small trees sway
☐ Amphibians 1_ 2_ 3_		☐ Wetland		☐ Aquatic - Biological	6	Large branches sway
☒ Reptiles		☐ Butternut		☒ Faunal Habitat	7	Lots of resistance when walking into
☐ Inverterbrates		☒ other SAR			8	Limbs breaking off trees

FEATURES (with GPS co-ordinates where applicable)	Mapped	Follow-up Req'd		
		Yes	No	Who
Man-made Structures: ☐ None observed				
☐ Barns/Footings/Wells/other(list)				
☐ Rock Piles				
☒ Garbage				
Natural Vegetation: ☐ None observed				
☒ Fallen Logs outside woods (#'s)				
☐ Brush Piles				
☐ Snags (raptor perch)				
☐ Tree Cavities (nesting)				
☐ Sentinel Trees				
☐ Mast Trees (6E) ☐ Berry Shrubs (6E)				
Wildlife Features: ☐ None observed				
☐ Waterfowl nesting (large #'s, # of species)				
☐ Exposed Banks (nesting swallows)				
☐ Stick Nests				
☒ Animal Burrows (>10cm)				
☐ Heronry				
☐ Crayfish mounds				
☒ Sand/gravel on site beach @ mouth				
☐ Marsh/open country/shrub				
☐ Winter Deer yards				
☐ Corridor from pond to woods (ampibian movement)				
☐ Bat corridor (shorelines, escarpments)				
☐ Bat hibernacula (caves, mines, crevices, etc.)				
Aquatic Features:				
☐ Perm. pond in woodland ☐ emergents/submergents/logs ☐ temp.				
☐ Perm. pond in open ☐ emergents/submergents/logs ☐ temp.				
☒ Water in woodland ☐ pools ☑ flowing ☐ dry				
☒ Waterways flowing dry pools				
☒ natural stream ☒ ☐ ☐				
☐ swale ☐ ☐ ☐ ☐ None observed				
☒ open drain ☒ ☐ ☐				
☐ Seeps/Springs ☐ ☐ ☐				
Incidental Observations:				
003 BURROW 11. BLOWOUT				
004 ROCKS 12. BURROW + DEBRIS				
005 burrow — Muskrat 13. [illegible]				
6. Burrow. Bunny! 14. 〃				
7 - Burrow 16. burrows				
8 Burrow				
9 BRUSH PILE				
10 BURROWS/LOGS				

Graphic ☐ Attached or Name

Checked by Project Manager ☐ Date:

BioLogic
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

GENERAL SITE INFORMATION FIELD SHEET

Project: ESSELTGUE
Date: MAY 19/15 Project Manager: ______
Collector(s): P. [illegible] Visit #: ______
Time started: 14:30 Time finished: 17:00 Combined collectors' hours: ______
☐ NHIC List ☐ MNR EO's ☐ none ☐ not provided to collector

WEATHER CONDITIONS

Temp.	**Wind:**	1 | 2	**Cloud Cover (%)**	**Precipitation**
12	**Direction:**	E	100	**Today:** NO **Yesterday:** ✓

WIND SCALE

0	Calm
1	Smoke Drifts
2	Wind Felt on Face
3	Leaves in constant motion
4	Wind raises dust and paper
5	Small trees sway
6	Large branches sway
7	Lots of resistance when walking into
8	Limbs breaking off trees

DATA FOCUS

☐ Birds 1__ 2__	☐ ELC's	☐ Dripline
☐ Mammals	☐ Floral V_ _ S_ _ A_	☐ Aquatic - Physical
☐ Amphibians 1_ 2_ 3_	☐ Wetland	☐ Aquatic - Biological
☒ Reptiles	☒ Butternut	☒ Faunal Habitat
☐ Inverterbrates	☐ other SAR	

FEATURES (with GPS co-ordinates where applicable) | Mapped | Follow-up Req'd: Yes | No | Who

Man-made Structures: ☐ None observed

☐ Barns/Footings/Wells/other(list)
☒ Rock Piles
☒ Garbage

Natural Vegetation: ☐ None observed

☐ Fallen Logs outside woods (#'s)
☐ Brush Piles
☐ Snags (raptor perch)
☐ Tree Cavities (nesting)
☐ Sentinel Trees
☐ Mast Trees (6E) ☐ Berry Shrubs (6E)

Wildlife Features: ☐ None observed

☐ Waterfowl nesting (large #'s, # of species)
☐ Exposed Banks (nesting swallows)
☐ Stick Nests
☒ Animal Burrows (>10cm)
☐ Heronry
☐ Crayfish mounds
☐ Sand/gravel on site
☐ Marsh/open country/shrub
☐ Winter Deer yards
☐ Corridor from pond to woods (ampibian movement)
☐ Bat corridor (shorelines, escarpments)
☐ Bat hibernacula (caves, mines, crevices, etc.)

Aquatic Features:

☐ Perm. pond in woodland ☐ emergents/submergents/logs ☐ temp.
☐ Perm. pond in open ☐ emergents/submergents/logs ☐ temp.
☒ Water in woodland ☐ pools ☒ flowing ☐ dry

☒ Waterways	flowing	dry	pools
☒ natural stream	☒	☐	☐
☐ swale	☐	☐	☐
☐ open drain	☐	☐	☐
☐ Seeps/Springs	☐	☐	☐

☐ None observed

Incidental Observations:

362485/4655471
B NUT 362506/4655485
362511/4655442
362505/4655394
362483/4655382 - NON BUT.

EASTERN MOLE tunelling observed

Graphic ☐ Attached or Name Checked by Project Manager ☐ Date: ______

Burrow

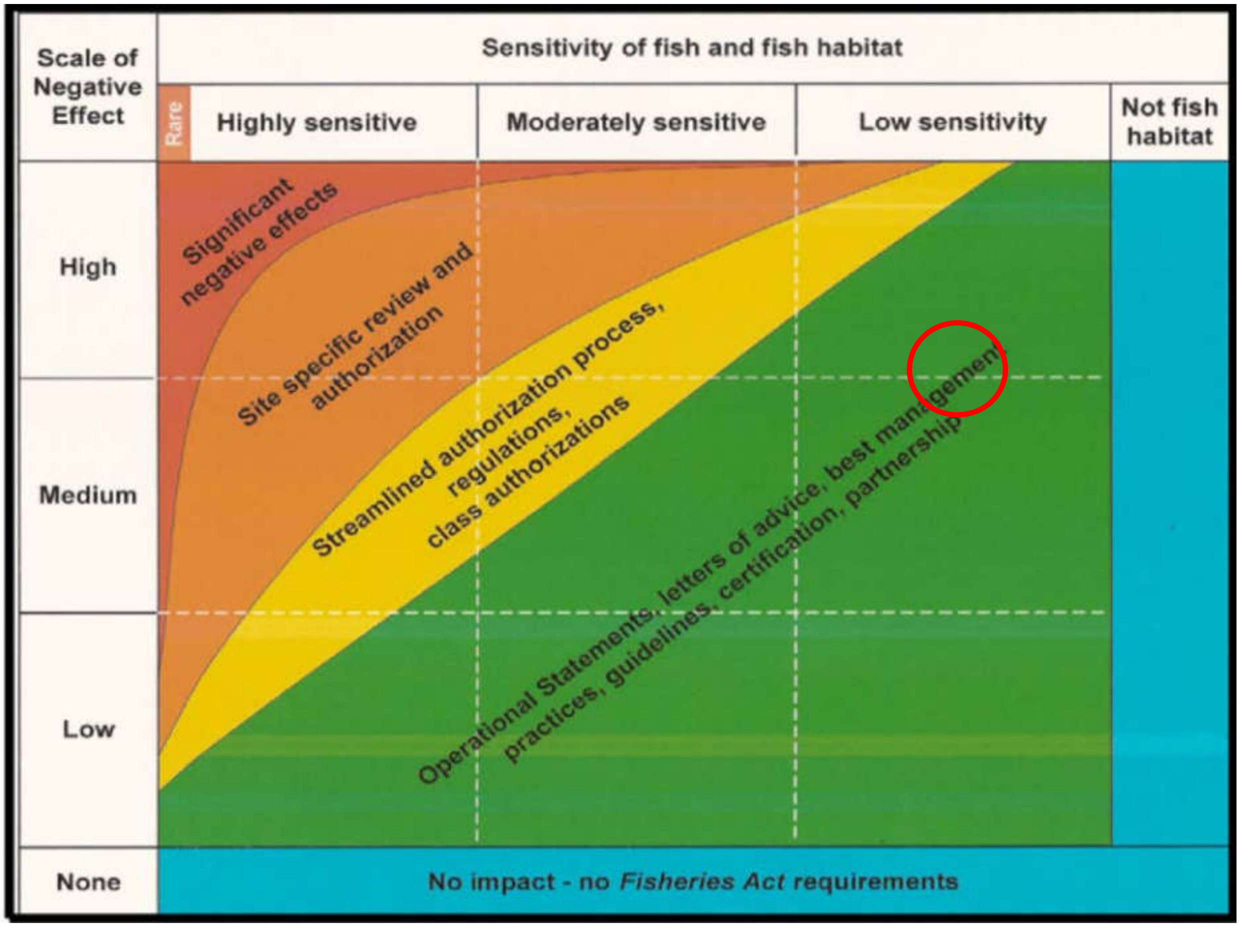
Appendix H

DFO Review Information

Scale of Sensitivity for Fish and Fish Habitat for Esseltine Drain

Attribute	Scale and Rational			
Species Sensitivity Sensitivity of species to change in environmental conditions, such as suspended sediments, water, temperature or salinity.	None	**Low**	Moderate	High
	• community dominated by common tolerant to moderately tolerant fish species • warmwater system			
Species' Dependence on Habitat Use of habitat by fish species. Some species may be able to spawn in a wide range of habitats, while others may have very specific habitat requirements.	None	**Low**	Moderate	High
	• Feeding and rearing habitat			
Rarity The relative strength of a fish population or prevalence of a particular type of habitat.	Rare	**Low**	Moderate	High
	• Habitat prevalent • Species are widespread and common • No rare species			
Habitat Resiliency Habitat resiliency refers to the ability of an aquatic ecosystem to recover from changes in environment conditions. The flow and thermal regimes of the system as well as its physical characteristics are important considerations in describing freshwater ecosystems.	None	**Low**	Moderate	High
	• Permanent, Warmwater system • Highly altered – straightened • System is resilient to change or perturbation • direct and indirect fish habitat			
Overall Fish and Fish Habitat Sensitivity	None	**Low**	Moderate	High

Risk Assessment Matrix – Esseltine Drian



Appendix I

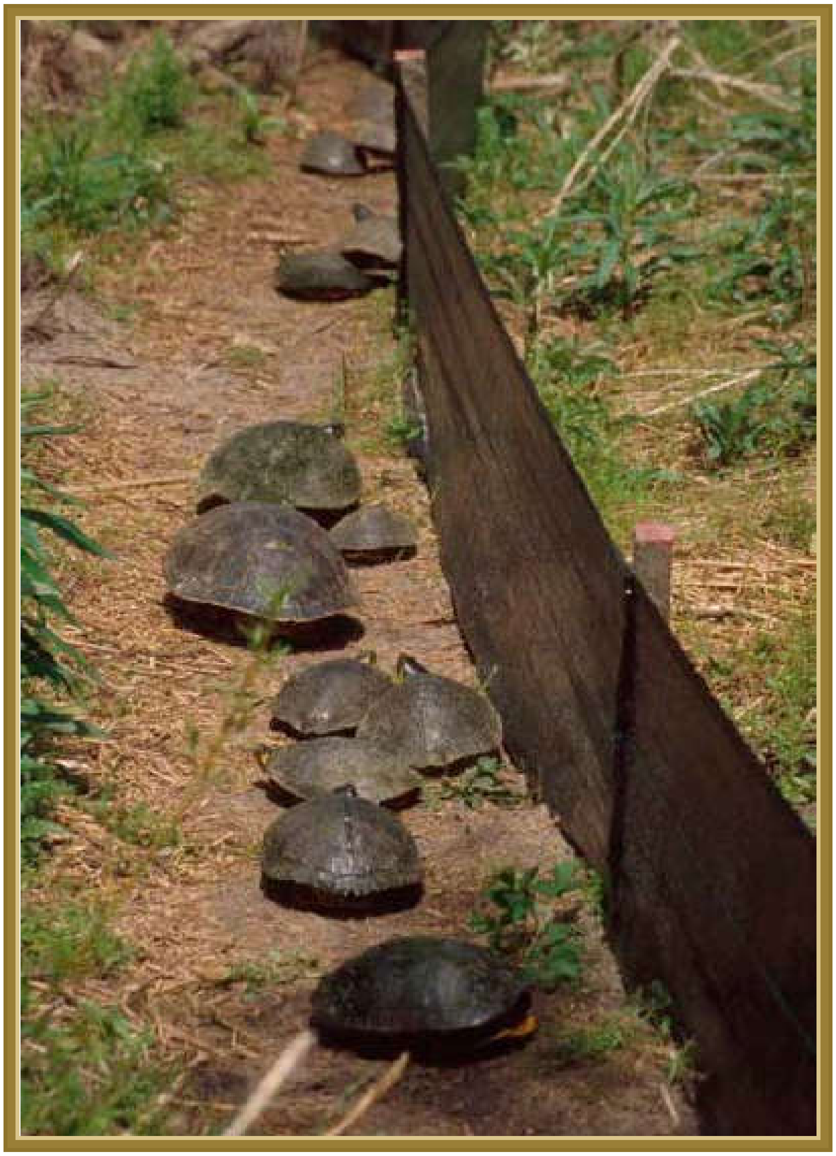
MNRF Reptile Exclusion Fencing Protocol

SPECIES AT RISK BRANCH
BEST PRACTICES TECHNICAL NOTE

REPTILE AND AMPHIBIAN EXCLUSION FENCING

Version 1.1

July 2013



Ministry of Natural Resources

July 2013

Ontario Ministry of Natural Resources
Species at Risk Branch

Recommended Citation:
OMNR. 2013. Reptile and Amphibian Exclusion Fencing: Best Practices, Version 1.0. Species at Risk Branch Technical Note. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. 11 pp.

Cover illustration: Photograph by Matthew J. Aresco, Conservation Director, Nokuse Plantation

Before an activity can be initiated, permissions, approvals or authorizations may be required from MNR (e.g. Endangered Species Act authorization, Wildlife Scientific Collector's Authorization) or other agencies, levels of government (e.g. a conservation authority, municipality, federal or provincial government), or landowners. It is your responsibility to ensure that all necessary permissions, approvals and authorizations are acquired prior to proceeding with your activity.

This document presents information as of the point in time of publication and is meant to be updated through time as improved information becomes available.

Cette publication hautement spécialisée, Reptile and Amphibian Exclusion Fencing Best Practices n'est disponible qu'en anglais en vertu du Règlement 671/92 qui en exempte l'application de la Loi sur les services en français. Pour obtenir de l'aide en français, veuillez communiquer avec le ministère des Richesses naturelles au Pamela Wesley,705-755-5217.

Document History

Revision Number	Revision Date	Summary of Changes	Originated	Reviewed	Authorized
1.1	June, 2013	Pre-publishing edits	June, 2013	June, 2013	June, 2013

REPTILE AND AMPHIBIAN EXCLUSION FENCING
- BEST PRACTICES -

The purpose of this guidance document is to provide an overview of proven design and installation techniques for reptile and amphibian exclusion fencing. Though this document points to site and species-specific design requirements, it is important to recognize that every situation is different. This guidance is not meant to replace site-specific advice obtained from local MNR staff or experienced exclusion fencing contractors. Moreover, exclusion fences are only effective when well planned, properly constructed, and maintained.

Exclusion fencing seeks to eliminate access to specific areas where activities that could harm animals are occurring (e.g. active aggregate operations, construction sites, and roads). The selection and installation of exclusion fencing can present some challenges, particularly if multiple species are being excluded. For example, some reptiles and amphibians are able to dig under fencing while others can climb over. Some may also take advantage of burrows dug by other animals. To maintain effectiveness, the bottom of the fence should be buried or secured firmly to the ground and minimum height recommendations (Table 1) are considered.

Exclusion fence design should consider the target species as well as those that might be unintentionally impacted. Fencing material should not pose a risk of entanglement or permit individuals to pass underneath or between openings. Landscape features such as topography and substrate need to be considered as they may constrain fencing design.

Including plans for fencing in advance of a project can increase efficiency and fence effectiveness. For example, long-term road projects that will include a permanent sound barrier could design the sound barrier such that it also meets the specifications of the required exclusion fence.

EFFECTIVE FENCE CHARACTERISTICS

The fence burial and height recommendations listed in Table 1 below have been compiled from scientific literature, established management practices, and practitioner best advice. These are general recommendations and at times other specifications may be more appropriate. For instance, in areas where the substrate does not permit fence burial, weighing down the fence with heavy items (e.g. sand bags) or backfilling may be acceptable. Where needed, speak with your local MNR staff or experienced exclusion fencing contractor to develop site-specific plans.

If multiple species are being excluded from the same area, and the species-specific fencing specifications differ, the uppermost minimum height and greatest depth recommendation should be used (Table 1). If you are excluding both Blanding's Turtle and Gray Ratsnake, for example, the exclusion fence should be a minimum of 2 m tall (see Gray Ratsnake section below for additional details).

Exclusion fences should be installed prior to emergence from hibernation. A survey of the enclosed/secluded area should be conducted immediately following fence installation to ensure that no individuals have been trapped on the wrong side of the fence.

Table 1. Recommended burial depth and height requirements of exclusion fencing for reptiles and amphibians. Recommended height is the height of the fence after it has been installed including the buried components and any installed overhangs or extended lips.

SPECIES	RECOMMENDED DEPTH OF FENCE BURIED (cm) *	RECOMMENDED HEIGHT OF FENCE (cm) **
Turtles – general	10 – 20	60
Eastern Musk Turtle, Wood Turtle	10 – 20	50
Massasauga, Eastern Hog-nosed Snake, Butler's Gartersnake, Queensnake	10 – 20	60
Gray Ratsnake & Eastern Foxsnake	10 – 20	200
Fowler's Toad	10 – 20	50
Snakes - general	10 – 20	100
Common Five-lined Skink	10 – 20	unknown
Salamanders	10 – 20	30

*** does not include the 10 cm horizontal lip that should extend outward an additional 10 – 20 cm (see Figure 2)**
**** the height of fencing has been provided as an approximate. Fencing materials may in fact not be available in proportions that would allow for these precise measurements. It is most effective, if the height and burial depth recommendations are met.**

DURATION OF ACTIVITIES & DEGREE OF ANTICIPATED DISTURBANCE

The type of disturbance, the proximity to disturbance, and the planned fence longevity are factors that influence which type of exclusion fence is most effective. For short-term activities (i.e. 1 to 6 months) such as minor road repairs, a light-duty geotextile fence is appropriate. Longer term or permanent fencing projects, however, require more durable materials such as – heavy-duty geotextile, wood, concrete, woven-wire, sheet metal, vinyl panels, or galvanized mesh.

GEOTEXTILE FENCES

Geotextile fences (e.g. silt fences) come in many types and qualities. They can be very effective for the temporary exclusion of reptiles and amphibians. For the purposes of this document, temporary use ranges from a few months up to 2-3 years. Winter weather is generally damaging to geotextile materials and the cost of maintenance over the long-term should be considered during the planning phase. Depending upon the quality, geotextile can be resistant to UV degradation and the bio-chemical soil environment.

Light-duty Geotextile Fencing:

Light-duty geotextile fencing is made of nylon material and is typically purchased with wooden stakes pre-attached at 2 m to 3 m intervals (Plate 1). It can also come without pre-attached stakes. Light-duty geotextiles are largely intended for projects with shorter durations of only a few months in duration and up to one season.

Geotextile fencing with nylon mesh lining should be avoided due to the risk of entanglement by snakes.

To use light-duty geotextile fencing:

- Fencing fabric is effective if attached to wooden, heavy plastic or metal stakes using heavy-duty wire staples or tie-wire (Figure 2).
- Secure the fence on posts that are placed at 2 m to 3 m apart. If using the greater recommended distance between posts, additional maintenance may be required to maintain effectiveness.
- Securely drive the stakes into the ground to a recommended depth of 30 cm. The fencing fabric should be buried to the recommended specifications in Table 1 and back-filled with soil.
- For snakes, supporting posts should be staked on the activity side (e.g. on the side facing the aggregate stock pile or the road - Figure 2).
- Light-duty geotextile fences are not effective where rocks or other hard surfaces prevent proper anchoring of fence posts and burial of the fence fabric.
- Light-duty geotextile fences are not effective where a large amount of concentrated run-off is likely or to cross streams, ditches or waterways without specific modifications.
- Contact your local MNR staff or experienced exclusion fencing contractor for advice and recommendations.
- See general best practices section below for additional details.

Generally, light-duty geotextile fences are not effective if they exceed 1 metre in height unless purposely manufactured for greater height (e.g. stakes placed at closer intervals or cross braces). If greater height is required consider using heavy duty geotextile, hardware cloth or other fencing materials.

Plate 1. Light-duty geotextile fencing with pre-attached wooden stakes used to exclude turtles from a road as seen on a regular maintenance check (photo credit: Brad Steinberg).

Heavy-duty Geotextile Fencing:

Heavy-duty geotextile fencing is typically constructed of a thick felt-like fabric. It may also be called 'double row' or 'trenched' fencing. For support, this fencing uses a woven wire fence (e.g. chain link) or some other structure (Plate 2). It is recommended that a minimum density of 270R or equivalent woven geotextile fabric is used.

Heavy-duty geotextile material can be effective for up to 2 or 3 years with proper maintenance. This type of fencing can be damaged by small mammals chewing through or torn by heavy debris (e.g. tree branches). Therefore, it may be best suited to turtles, which are less likely to take advantage of holes or tears in the fabric. If used to exclude snakes or other animals, more maintenance may be required.

Heavy-duty geotextile fencing:

- The wire fence should be installed on the activity side to prevent animals from leveraging and climbing into the exclusion area while allowing the animal to escape if they find themselves on the wrong side (Figure 2).
- Geotextile fences across streams, ditches or waterways should have case-specific modifications.
- Contact your local MNR staff or experienced exclusion fencing contractor for advice.
- See light-duty geotextile section above and general best practices below for additional details.

Plate 2. Example of a heavy-duty geotextile fencing used to exclude snake species (photo credit: Jeremy Rouse).

HARDWARE CLOTH FENCES

Hardware cloth (also known as galvanized mesh or Birdscreen) is durable, cost effective and useful for excluding reptiles and amphibians. The fence should be made of heavy galvanized hardware cloth with a ¼ inch mesh. For fences intended to exclude small snakes, a ⅛ inch mesh may be more effective. In contrast, fencing intended to exclude turtle species can have a larger mesh size (e.g. ½ inch). Larger mesh may have a longer lifespan as it is constructed from a thicker material compared to smaller mesh sizes.

To use hardware cloth fencing:

- Secure the fence on posts placed a recommended 2.5 m apart with the stakes on the activity side (Figure 2).
- Pull the mesh taught and staple or secure with screws and a metal stripping to prevent the mesh from being ripped when pressure is applied.
- Installing a top rail or folding the mesh over a taut smooth wire reduces tearing (Plates 3 and 4).
- An outward facing lip installed on the species side ensures that snakes and amphibians are unable to climb or jump over the fence (Figure 2; Plate 4)
- Tears can be mended with 18-gauge galvanized wire.
- See general best practices section below for additional details.

Plate 3. Example of a galvanized mesh fencing used for the long-term exclusion of snakes and turtles from the adjacent highway (photo credit: Megan Bonenfant).

Plate 4. Long-term to permanent exclusion fencing using galvanized mesh with over-hanging lip to prevent animals from climbing or jumping over (photo credit: Megan Bonenfant).

WOOD LATH SNOW FENCING

In certain circumstances, wood lath snow fencing can be effective at excluding turtles. This fencing is typically constructed from soft wood slats that have been woven together with 13-gauge wire and is then attached to steel fence posts which have been driven into the ground.

Wood lath fencing is cost effective and can easily be laid down during the winter to prevent damage. The durability of the material, however, is not meant for very long-term use (e.g. more than 3 years), unless regular maintenance occurs.

To use wood lath snow fencing:

- The fencing should be attached to heavy plastic or metal stakes using heavy-duty wire staples or tie-wire.
- The stakes are recommended to be placed at 2 to 3 m intervals and securely driven into the ground 30 cm or more.
- Wood lath snow fencing across streams, ditches or waterways should have case-specific modifications.
- Wood lath snow fencing lends itself well to being combined with other types of material to ensure complete exclusion.
- See general best practices section below for additional details.

Plate 5. Example of a wood lath snow fencing used to exclude turtles (photo credit: Karine Beriault).

EXCLUSION FENCING FOR GRAY RATSNAKE AND EASTERN FOXSNAKE

Gray Ratsnake and Eastern Foxsnake are the largest snakes in Ontario - reaching nearly 2 m in length. They are also excellent climbers. For this reason, fencing intended to exclude either of these species has additional recommended design specifications.

- The fence should be at least 2 m high.
- The material on the species side (Figure 2) should be smooth to prevent the snakes from climbing into the excluded area.
- Stakes should be on the activity side of the fence (Figure 2).
- Due to the increase in fence height, it is valuable to decrease the distance between posts or install diagonal braces.
- See general best practices section below for additional details.

CONCRETE, SHEET METAL & VINYL WALLS

Concrete, metal or vinyl walls can stand alone or be combined with woven wire or chain link fences. They are durable, require minimal maintenance and are effective in excluding target species from high risk areas and guiding them to crossing structures or other desired locations (Plates 6 and 7). This fence type is comprised of a continuous vertical face of concrete, metal or vinyl sheeting with no gaps. Concrete walls can be installed as either pre-cast sections or pour directly in place.

Plate 6. Stand-alone continuous concrete wall used to exclude salamander species installed as pre-cast forms (photo credit: Steven Roorda).

Plate 7. Pre-formed vinyl sheeting fence intended to exclude salamanders for a construction site (photo credit: Herpetosure Ltd.)

The wall height depends upon the target species, but they are usually between 45 and 60 cm tall and buried 25 cm. Concrete, metal or vinyl exclusion fencing is most appropriate for salamanders, skinks, small snakes, and small turtles. For large turtle species, a chain link fence can be installed directly on top of the concrete wall for complete exclusion.

HABITAT CONNECTIVITY

Habitat connectivity is the connectedness between patches of suitable habitat or the degree to which the landscape facilitates animal movement. Exclusion fencing installed along roads or other large projects can effectively reduce or eliminate habitat connectivity for animals. In these scenarios, exclusion fencing should be considered with eco-passages in order to maintain connectivity. Fencing in isolation should be viewed as a temporary method to reduce mortality until species movement can be restored. Where eco-passages are not feasible they should be identified for consideration with any future road work or development to improve connectivity.

During the installation of fencing with an eco-passage, it is important that the fencing sits flush with the passage to ensure that there are no gaps where animals can squeeze through.

Plate 7. A wood turtle travelling through a dry eco-passage. Ecopassages such as this help to ensure the long-term connectivity of seasonal habitat for this and other reptile and amphibian species (photo credit: Amy Mui).

GENERAL BEST PRACTICES:

- To deter digging, bury the fence 10 cm down with an additional 10 cm horizontal lip (Figure 2).
- Backfill and compact soil along the entire length on both sides of the fence (Figure 2).
- Once the fence is installed, a survey should be done to ensure that no individuals have been trapped inside (speak with MNR for survey advice).
- Exclusion fencing intended to exclude snakes should have the stakes installed on the activity side (opposite the normal requirement for sediment control fencing) to prevent snakes from using the stakes to maneuver over the fencing.
- For snakes and toads, the fence should have an overhanging lip on the species side (Figure 2).
- Fences should be inspected after spring thaw and at regular intervals throughout the active season, especially following heavy rain events. This is particularly important for geotextile fences. Any damage that affects the integrity of the fence (e.g. tears, loose edges, collapses, etc.) should be fixed promptly.
- Tall or woody vegetation on the species side of the fence should be managed if there is a risk that it may enable the animals to climb over. This is most important during spring and fall. Proceed cautiously to not harm animals protected plant species during vegetation removal.
- When installing an eco-passage, fencing or exclusion walls should be used as a guiding system to direct animals to passage openings.
- Natural screens such as trees or shrubs can help to reduce road access and can be combined with fencing to provide protection of individuals from predation.
- Install fences with a turn-around at the ends furthest from the wetland habitat and at any access areas to assist in redirecting animals away from any fence openings (Figure 1).
- Curving the ends of the fencing inward (i.e. away from the road or construction site) may help to reduce access to these locations. The ends may also be tied off to natural features on the landscape such as trees or rock cuts.

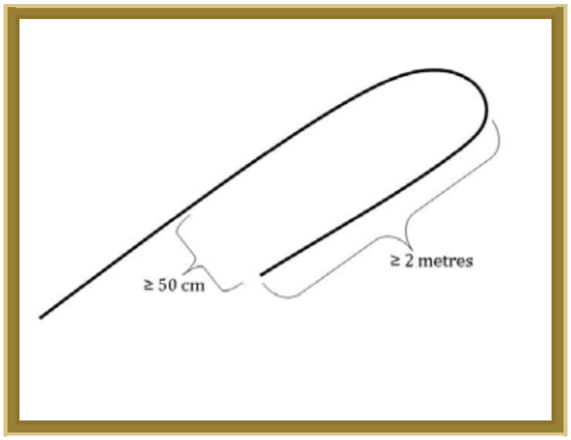


Figure 1. Diagram of the ends of the fence designed to curve inward in order to direct animals away from the area of exclusion.

WATER MOVEMENT & DRAINAGE

- In areas where surface water run-off may erode a soil-based backfill, consider using rocks or sand bags. Ensure these materials cannot be used by animals to climb over the fence.
- Where possible, minimize the number of water crossings: when necessary, it should occur where flow is minimal.
- Fence posts in waterways or areas prone to seasonal flooding should be driven rather than dug – unless following established best practices.
- Fencing should be placed above the high water mark anticipated for high water events such as spring freshet or periods of heavy or continuous rainfall.

TOPOGRAPHY:

- Fence posts should be closer together in undulating topography.
- Fences installed on slopes have a different effective height depending upon whether the animal will be approaching from the up or down slope. The fence height can be adjusted accordingly.

Improvements or questions regarding exclusion fencing can be brought to the local MNR Species at Risk Biologist or other MNR staff.

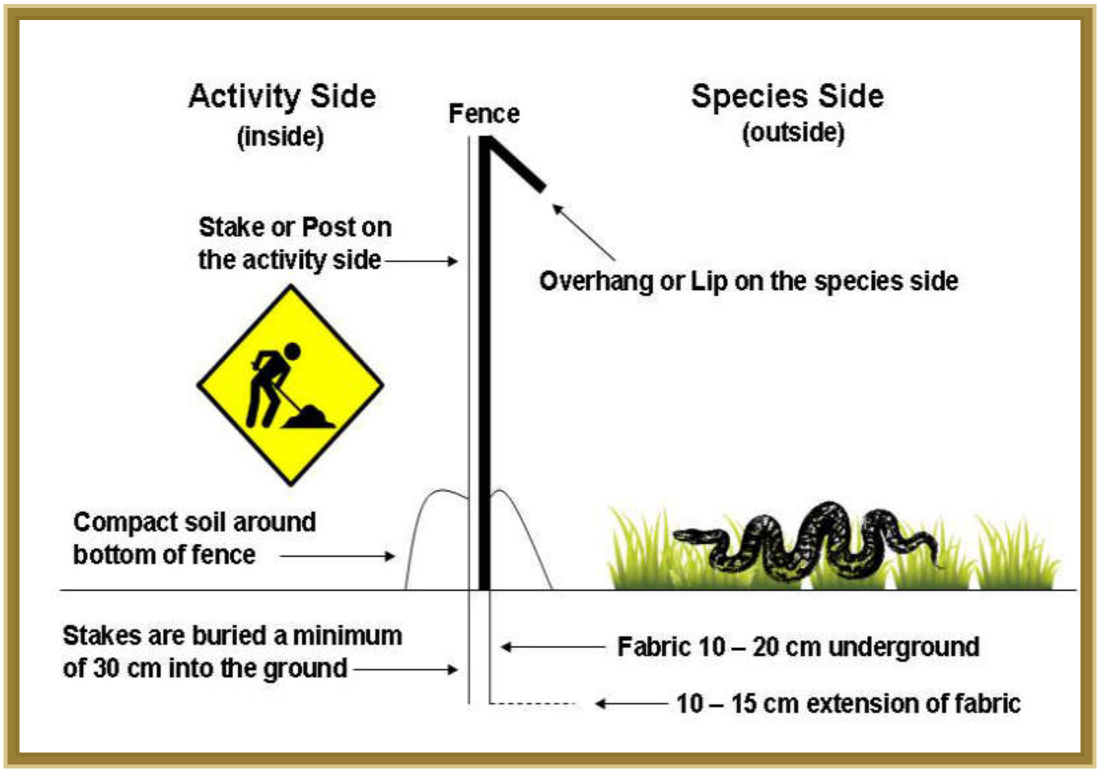


Figure 1. A side view of a basic exclusion fence including an overhang or flexible lip to deter animals from climbing or jumping over the fence. Placement of the stake on the Activity Side or on the inside of excluded area is also illustrated. This is particularly important for snake species which may use the stakes to maneuver over the fence.

RESOURCES:

ACO Systems Ltd., 2007. Wildlife fencing systems. Accessed July 2012. Available at: http://www.acocan.ca/wildlife/fence.htm.

Dodd, C.K, W.J. Barichivich, and L.L. Smith. 2004. Effectiveness of a barrier wall and culverts in reducing wildlife mortality on a heavily traveled highway in Florida. Biological Conservation 118: 619-631

Flat-tailed Horned Lizard Interagency Coordinating Committee. 2003. Flat-tailed horned lizard rangewide management strategy, 2003 revision. 80 pp., plus appendices.

Jochimsen, Denim M., Charles R. Peterson, Kimberly M. Andrews, and J. Whitfield Gibbons. 2004. A literature review of the effects of roads on amphibians and reptiles and the measures used to minimize those effects. USDA Forest Service.

KRCA, 2006. Silt Fence Installation and Maintenance. KRCA, Kawartha Region Conservation Authority Environmental Advisory Services, Port Hope, ON, 2 pp.

Long, K, and A. Robley, 2004. Cost Effective Feral Animal Exclusion Fencing for Areas of High Conservation Value in Australia. The Department of Environment and Heritage. Natural Heritage Trust, Victoria, Australia, 61 pp.

Queensland Department of Transport and Roads, 2010. Fauna Sensitive Road Design Manual, Volume 2: Preferred Practices. Chapter 9, Case Studies, Connecting Queensland, Road and Delivery Performance Division, Queensland Government, 134 pp.

Sarell, M, 2006. Living in Nature Series: How to Snake-proof you House and Yard. South Okanagan-Similkameen Stewardship

Program. The Land Conservancy of BC, Penticton, BC. 8 pp.

TWP Incorporated, Galvanzied Mesh for Snake Control. Accessed July 2012, Available at: http://www.twpinc.com.

For additional information:

Visit the species at risk website at
ontario.ca/speciesatrisk
Contact your MNR district office
Contact the Natural Resources
Information Centre
1-800-667-1940
TTY 1-866-686-6072
mnr.nric.mnr@ontario.ca
ontario.ca/mnr

Appendix J

MNRF SAR Handling Protocol

Table of Contents

2. Safe Handling of Snakes

2.1 Materials

a) The following personal protective equipment should be worn when working with Massasauga rattlesnakes:

- High-ankle hiking or rubber boots
- Thick pants (jeans) or baggy pants
- Leather work gloves

b) The following materials are required for the handling, capture, temporary safe keeping and transport of snakes:

- Pail, large garbage can or bucket (1 metre deep) with air holes in the lid. Ensure both the side of the container and the lid are well marked "live animal" or "caution rattlesnake".
- A snake bag (for non-venomous species only). A snake bag must be cloth. (A pillowcase works well.) Plastic and non-breathable materials are not appropriate. Ensure the bag is well marked "live animal".
- Broom or broom handle with small paint brush roller holder attached to end. Never use "snake pinchers".
- Thermometer
- SAR Notification/Contact Schedule
- SAR Encounter Reporting Form

c) Equipment must be maintained on each job site.

2.2 Safety considerations

a) **The Massasauga is the only venomous snake in Ontario.**

The venom is an adaptation for hunting and is used to kill prey (primarily small rodents).

As a defence mechanism, Massasaugas may also bite when threatened, at which time they may or may not release venom. Camouflage, rattling and retreating are their primary defensive strategies, and they generally bite as a last resort.

Their maximum striking distance is about half of their body length. Generally, your safety zone is yourheight plus 50 centimetres away from the snake. (This accounts for the snake's striking distance to you if you fall.)

A Massasauga bite is generally not deadly. Only two people have ever died from a Massasauga bite in Ontario. Neither person received medical attention, and both cases were almost 50 years ago.

If you are bitten by a Massasauga, remain calm and seek medical attention immediately. Do not apply a tourniquet or try to suck out the venom. Never try to capture the snake to take it to the hospital; if you were bitten by a venomous snake in Ontario, we know it was a Massasauga. Have someone else drive you safely.

b) **Never under any circumstances pick up a Massasauga rattlesnake.** Massasaugas occur in very specific regions of the province, and if you are well outside of those regions it should be safe to handle any native snake you find. If you are working within a region where Massasaugas may occur, never pick up a snake unless you are absolutely certain that it is not a Massasauga.

c) All other Ontario snakes are non-venomous and harmless. Despite being harmless, many of Ontario's snakes will put on defensive displays to intimidate potential predators. These include:

I. Rearing up, hissing and striking.

II. Eastern Hog-nosed Snakes will flatten out their necks like cobras, hiss loudly and pretend to strike (although their mouths remain closed).

III. Eastern Foxsnakes, Milksnakes, Gray Ratsnakes and Eastern Hog-nosed Snakes sometimes vibrate their tails to imitate a rattlesnake. If their tails come into contact with rocks, dry leaves, or some other medium, they can produce a buzzing sound like that of a rattlesnake. Combined with their blotchy pattern, this mimicry is often very effective at fooling humans.

d) Holding the snake properly (see section 2.4) will significantly reduce stress to the snake and the likelihood that it will try to bite in self-defence.

2.3 Capture and handling of the Massasauga rattlesnake

Safely move a Massasauga by following these steps:

a) Put on personal protective equipment (per section 2.1).

b) Clear the area of unnecessary bystanders to lessen the stress on the animal.

c) Determine your plan for capture to anticipate where the snake may move or retreat as well as any potential hazards you may encounter.

d) If capturing injured snakes, avoid touching or manipulating injured areas.

e) Tip the 1-metre-deep pail on its side.

f) Use the broom to position the snake near the pail.

g) Gently and slowly guide the snake into the pail, being careful not to push the snake too hard or lift if off the ground. Never pin a Massasauga or use tools that constrict or pinch the snake. Quick, abrupt movements are threatening to the snake and may also cause it to make quick movements in an attempt to escape.

h) Be patient and gentle with the snake. Gravid (pregnant) females are carrying live young, and rough handling may cause damage to the developing snakes.

i) Once the snake is in the pail, slowly tip the pail upright and secure the lid.

j) Snakes can be difficult to capture. If a snake escapes or heads for cover, let it disperse on its own, ensuring it is safe from harm before allowing activities to continue. If allowing activities to continue is not safe for the snake, postpone activities for up to 24 hours to allow the snake to disperse. If it is not possible to leave the area for 24 hours, have a Qualified Member relocate the individual. Do not disturb any natural cover under which the snake has retreated. If necessary, contact MNR for further direction using the SAR Notification/Contact Schedule.

2.4 Capture and handling of non-venomous snakes

a) If you are uncomfortable handling large, non-venomous snakes with your hands, you can use the above method for capturing venomous snakes (section 2.3). However, it is much easier to capture most non-venomous snakes using your hands. Some of the smaller species, such as the Butler's Gartersnake, are almost impossible to capture with a stick and a pail.

b) If you elect to use thick gloves, be very careful not to squeeze the snake too hard, as you can crush internal organs and kill it. Do not use gloves to capture small snakes, as the risk of accidentally crushing them is too high.

c) Clear the area of unnecessary bystanders to lessen the stress on the animal.

d) Determine your plan for capture to anticipate where the snake may move or retreat and to anticipate any potential hazards you may encounter.

e) Never grab the snake behind the head or grip the snake tightly in order to restrain it. This may injure or scare the snake, cause it to struggle and encourage it to bite in self-defence.

f) Always support the snake's body with both hands and never pick up a snake only by the tail. Holding a snake only by the tail can result in dislocated bones or other serious injury to the snake.

g) To capture a large snake (more than 30 centimetres in length):

I. Gently grab it by the back of the body to prevent it from getting away.

II. Holding the snake by the back end while it is still on the ground, slide your other hand underneath the snake to support its weight and lift it up. Do not lift if off the ground by the tail.

III. As soon as the snake is off the ground, continue to support its weight by keeping both hands under the snake, with one hand about a third of the way back and one hand about two thirds of the way back along the snake's body.

IV. As the snake tries to move forward, reposition the hand from the back of the snake to the front of the snake, and continue to rotate your hands between the front and back of the snake to allow it to continue to crawl through your hands. Calm and slow movements will help the snake relax and make it move more slowly.

V. Often a snake will stop moving once it no longer feels threatened. If the snake continues to move rapidly after a minute or so, you can try holding the back end of the snake more firmly to prevent it from continuing to move forward. Continue to support the unrestricted front half of the snake with your other hand.

h) To capture a small snake (less than 30 centimetres in length):

I. Grasp the snake gently but firmly with one or both hands. It may be necessary to gently restrain it against the ground with your hands initially to prevent it from escaping. Never use a stick, snake hook or any other object to pin a snake.

II. Hold the back end of the snake in one hand and support the front of the snake with your fingers or your second hand. Allowing the snake's front end to remain free helps the snake remain calm.

III. For very small snakes, hold the snake in the palm of your hand using your thumb or fingers to gently apply only enough pressure to prevent the snake from wiggling free.

i) Snakes can be difficult to capture. If a snake escapes or heads for cover, let it disperse on its own, ensuring it is safe from harm before allowing activities to continue. If continuing activities poses a threat to the snake, postpone activities for up to 24 hours to allow the snake to disperse. If it is not possible to leave the area for 24 hours, have a Qualified Member relocate the individual. Do not disturb any natural cover under which the snake has retreated. If necessary, contact MNR for further direction using the SAR Notification/ Contact Schedule.

2.5 Moving a snake out of harm's way (distances under 50 metres)

a) If it is necessary to move a snake more than 50 metres, refer to section 2.7 on snake relocation.

b) Snakes should only be moved when they are in imminent, unavoidable danger.

c) If possible, allow the snake to move on its own by walking toward the snake in the direction that you want it to move. If the snake does not move on its own, you will have to pick it up and move it (see section 2.4). Unlike most snake species, Massasaugas may not move away when you walk toward them. Rather, they often adopt a defensive position (coiled), hold their ground and rattle (asking you to go the other way). To encourage a Massasauga to move away on its own, give it lots of space and observe it from a distance (ideally so the snake cannot see you).

d) When moving a snake out of harm's way, such as across a road, move the snake in the direction that it was heading, regardless of what the habitat looks like. These animals often make intentional movements to specific areas, and if you put them back where they started they will simply turn around and start their journey again. If it is not clear which direction the snake was headed, move it to the closest habitat that will not be disturbed. In this case, suitable habitat includes a rock pile or other cover that the snake can retreat under, or the vegetation at the edge of the road allowance, disturbed area or clearing.

e) If possible, release the snake near a retreat site (somewhere the animal can seek shelter from the elements and avoid predators: loose rocks, logs, rock crevices or dense vegetation) to allow it to take cover upon release. Do not release the snake in the open where it could be exposed to inclement weather, extreme sunlight or predators.

2.6 Temporary safe keeping and transportation of snakes

a) You are responsible for this animal. Remember, once you have put it in a container, it depends on you to keep it safe and at the right temperature.

b) Always use a pail, large garbage can or bucket (at least 1 metre deep) with adequate air holes in the lid for Massasaugas. Ensure the lid is properly secured, and always create the air holes before putting the snake in the container.

c) If using a snake bag:

I. **Make sure it is properly closed.** To close the snake bag, gather the material at the opening together in one hand and run your other hand down the bag to ensure that the snake is in the bottom. Twist the neck of the bag and tie it into a tight knot. Never rely on a drawstring, as snakes can wiggle out of tight holes. When tying a snake bag, make sure the snake remains in the bottom of the bag so it does not get tangled in the part you are tying.

II. **Make sure it is in a secure location** where it cannot fall if the snake moves the bag. The movement of a snake within a bag can easily cause the bag to fall off of a table.

III. If transporting the snake or holding it for a longer time (over an hour), the closed snake bag should be placed in a well-ventilated hard container (such as plastic tub) for added protection.

d) It is extremely important to monitor the air temperature regularly in the container or around the snake bag to ensure it **never exceeds 30ºC or drops below 5ºC.** Never leave the container or snake bag in direct sunlight or in a closed vehicle parked in the sun, as this will cause the snake to overheat and could be fatal.

e) **Never leave the container or snake bag unattended** in an unsecured location (e.g., side of road).

f) Do not offer the snake any food. Snakes do not have to eat as often as mammals, and it is no problem for a snake in temporary captivity to go a few days without food.

2.7 Relocation of snakes

a) A snake should only be relocated if the destruction of its habitat is unavoidable or if it is not possible to release it at the capture location.

b) Snakes should not be relocated during their over-wintering season. This varies depending on the species and location, but is generally from October to May. If you are unsure whether you should relocate the snake or take it to a wildlife custodian, contact MNR for further direction using the SAR Notification/Contact Schedule.

c) If it is not possible to relocate the snake due to the time of year (October to May) or other conditions, transport the snake to a wildlife custodian per the SAR Notification/Contact Schedule.

d) Transport and release the snake within one hour of capture in order to minimize stress on the animal.

e) **Snakes should never be moved more than 250 metres** from the location where they were found. Only move a snake as far as necessary to avoid potential harm to the snake, and avoid moving snakes more than 125 metres unless absolutely necessary. If it is not possible to relocate the snake within 250 metres of the capture location, contact MNR for further direction using the SAR Notification/Contact Schedule.

f) Release the snake in the same type of natural habitat as the capture site. If this is not possible, contact MNR for further direction using the SAR Notification/Contact Schedule.

g) If possible, release the snake near a retreat site (somewhere the animal can seek shelter from the elements and avoid predators: loose rocks, logs, rock crevices or dense vegetation) to allow it to take cover upon release. Do not release the snake in the open where it could be exposed to inclement weather, extreme sunlight or predators.

h) To release the snake from a pail, gently tip the pail onto its side, remove the lid, back away from the pail and allow the snake to leave on its own. If necessary, use the broom to gently guide the snake out of the pail or gently tip the pail on an angle to slide the snake out of the pail.

i) To release a non-venomous snake from a bag, untie the bag, gently tip the bag by holding one of the bottom corners (make sure you are not holding the snake) and gently slide the snake onto the ground.

2.8 Injured snakes

a) If dealing with an injured Massasauga, ensure compliance with all instructions and safety considerations provided in sections 2.1-2.3.

b) If the methods of handling snakes that are outlined in section 2.3 or 2.4 are not applicable due to the snake's injuries, use a shovel or other flat object to pick up the snake. Ensure that any injured areas are supported.

c) Place the snake in a large plastic bin or bucket with a lid that has air holes (the darkness helps to reduce stress to the snake). You can place newspaper in the container to provide cover for the snake and help to reduce its stress. Do not place anything else in the container with the snake or offer it any food.

d) Thoroughly wash your hands after handling injured snakes.

e) Immediately transport the snake to a veterinarian or wildlife custodian per the SAR Notification/Contact Schedule, in order to increase its chances of survival.

6. Reporting Species at Risk Encounters

a) Contact MNR to report the occurrence (including dead animals) within the period of time set out in the permit or agreement, or within 24 hours if not stipulated. Report injured animals to MNR immediately.

b) Complete and submit the SAR Encounter Reporting Form, which includes the following information:

I. Name of Qualified Member

II. Contact number of Qualified Member

III. Date and time of the encounter

IV. Detailed location of the encounter (with lat-long or UTM coordinates, if possible). To obtain coordinates without a GPS, zoom into the area using Google Maps, right click on the location and select “what’s here?” from the right-click menu. The coordinates (in decimal degrees) will be provided to you in the Google Maps search bar.

V. Species encountered, with photo documentation, when possible. For assistance with species identification, see MNR’s *Ontario Species at Risk Quick Reference Guide*. Detailed species accounts can be found at **www.ontarionature.org/atlas** or the “Species Guides” at **www.torontozoo.com/AdoptAPond.**

VI. Action taken

7. Handling and Transporting Dead Animals

Dead species at risk that are encountered should be reported to the MNR as soon as possible. It is possible that the Ministry will request that the individual be stored and/or transported to the MNR.

Many researchers are currently studying the genetics of wild populations in Ontario, and genetic materials extracted from dead animals can make a valuable contribution to this research.

Examining a dead animal may provide important information about the cause of death or threats affecting the population.

If the MNR asks to see the species at risk and it is not possible to transport it on the same day it was found, the specimen should be stored in a freezer.

7.1 Materials

a) The following materials must be used for the handling and transport of dead species at risk:

I. A plastic resealable bag or plastic kitchen-style container with a tight lid with label “dead SAR for transport to MNR”

II. Permanent, water-resistant marker for labelling the bag or container with additional information, such as the date and location

III. Latex gloves or thick work gloves that can be washed

IV. Cooler with cold ice packs, if possible

V. SAR Notification/Contact Schedule

VI. SAR Encounter Reporting Form

7.2 Safety Considerations

Always wear gloves or wash your hands after handling any dead animal. Turtles (and many other animals) carry potentially harmful bacteria in their gut. Handling dead, rotting animals may also expose you to bacteria that can make you sick.

Handle a dead Massasauga with extreme caution

I. The snake’s venom is still a serious biohazard even after the snake is dead.

II. Never handle a dead Massasauga with your hands. Use a broom or sticks to place it into a container with a secure lid (not a bag).

III. Although unlikely, nerves can trigger the Massasauga’s bite reflex even after the snake is dead.

IV. In some situations, it can be very difficult to confirm that a snake is dead. For example, extreme shock can make a snake appear dead for several minutes until it slowly regains its senses. Unless you can confirm that the Massasauga is dead, always treat it as though it is alive and never place any part of your body within its potential strike range (approximately half of the snake’s body length).

7.3 Handling a dead animal

a) Always make sure that an animal is actually dead before handling or capturing it. In some situations, live animals can easily be mistaken for being dead:

I. Extreme shock can make a reptile or amphibian motionless and appear dead for several minutes until it slowly regains its senses.

II. Air temperature controls the metabolism, and therefore the activity level, of reptiles and amphibians. If an over-wintering snake or turtle is encountered, it will only be 4 or 5°C and may be so inactive that it will appear dead. Very cold animals in the spring or fall may also be very inactive and appear dead until closely examined.

III. Eastern Hog-nosed Snakes sometimes play dead as a defensive strategy to deter predators. This display includes rolling onto their back with their mouth gaping open and tongue hanging out, regurgitating food or defecating and emitting a foul smell. It is very difficult to determine if this species is actually dead without manipulating the snake and carefully inspecting it. If you flip the snake onto its belly, it will often roll back over and continue to play dead.

7.4 Temporary storage of dead animals

a) Place the dead animal in a plastic resealable bag or container with a tight lid that will not leak. Always use a thick container with a secure lid for Massasauga rattlesnakes.

b) Do not place anything else in the container with the animal.

c) Label the container with "dead SAR for transport to MNR" as well as the date, location and name of the observer.

d) Place the bag or container in a freezer as soon as possible. If a freezer is not immediately available, place it in a cool place, preferably a cooler with ice packs.

e) If the animal cannot be delivered to MNR on the same day that it was found, place it in a freezer until it can be delivered to MNR.

8 Appendices

Appendix I - Definitions

Species at Risk (SAR) Notification/Contact Schedule:
A contact list provided by the Ministry of Natural Resources District Office to be used when immediate guidance is required concerning species at risk (SAR) encounters. This list will include Ministry of Natural Resources staff as well as local veterinarians and wildlife custodians.

Species at Risk (SAR) Encounter Reporting Form:
A reporting form provided by Ministry of Natural Resources that must be completed any time that a species at risk (SAR) is encountered.

Qualified Member:
An individual who has received training by, in consultation with, or in a manner approved by Ministry of Natural Resources to capture, handle, move and relocate species at risk (SAR).

Appendix II - References

Ontario Ministry of Natural Resources, Parry Sound and Sudbury District. *Draft Turtle and Snake Capture and Relocation Protocol For Hwy 69/400 ESA Authorization Requirements.*
Revised January 19, 2011.

Parks Canada. *The Eastern Massasauga Rattlesnake Stewardship Guide: A Resource and Field Guide for Living with Rattlesnakes in Ontario*, Parks Canada, pp 84.

Karch, Mandy. 2008. *Standard Turtle Handling Practices and Protocols*. Prepared for the Ontario Ministry of Natural Resources and the Ontario Multi-species Turtles At Risk Recovery Team. 2008.

Unless otherwise noted, all photographs are credited to Jason Mortlock.

Appendix III - Equipment and Materials Checklist

The following materials must be acquired and maintained on each job site, and are required for the handling, capture, temporary safe keeping and transport of species at risk:

All Species (including for dead animals)

- ☐ Thermometer
- ☐ Plastic resealable bag or plastic kitchen-style container with a tight lid with label “dead SAR for transport to MNR”
- ☐ Permanent, water-resistant marker for labelling bag or container with additional information, such as the date and location
- ☐ Latex gloves or thick work gloves that can be washed
- ☐ SAR Notification/Contact Schedule (from MNR District Office – see Appendix IV)
- ☐ SAR Encounter Reporting Form (See Appendix V)

Additional Materials for Turtles

- ☐ Large plastic bin or bucket and lid with air holes, with both sides of the container and lid marked “live animal”
- ☐ Cloth/burlap bag with both sides marked “live animal”
- ☐ Broom or broom handle with small paint brush roller attached to end

Additional Materials for Snakes

- ☐ Pail, large garbage can or bucket with air holes in the lid, with side of the container and lid marked “live animal”
- ☐ A cloth snake bag (e.g., pillowcase) for non-venomous species only, marked “live animal”

For Massasaugas:

- ☐ Pail, large garbage can or bucket (1 metre deep) with air holes in the lid, with side of the container and lid marked “caution rattlesnake”
- ☐ Broom or broom handle with small paint brush roller holder attached to end

Additional Protective Gear to be Worn When Working in or near Massasauga Habitat

- ☐ High-ankle hiking or rubber boots
- ☐ Thick pants (jeans) or baggy pants
- ☐ Leather work gloves

Additional Material for Skinks

- ☐ Plastic kitchen-style container and lid with air holes, marked “live animal”

Additional Materials for Amphibians (Salamanders, Newts, Mudpuppies, Frogs, Toads)

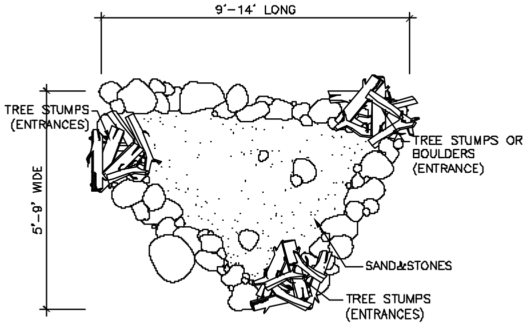
- ☐ Pail, bucket or large plastic bin with a lid that has air holes (for frogs), both side of container and lid marked “live animal”
- ☐ Plastic kitchen-style container and lid with air holes, marked “live animal”
- ☐ Paper towels (to be moistened and put in plastic kitchen-style container)
- ☐ Net (optional)

Additional Materials for Birds

- ☐ Sturdy cardboard box or large plastic bin and lid with air holes, with both sides of box/container and lid marked “live animal”
- ☐ Sheet or blanket large enough to cover a large bird
- ☐ Safety glasses
- ☐ Digital camera (optional)

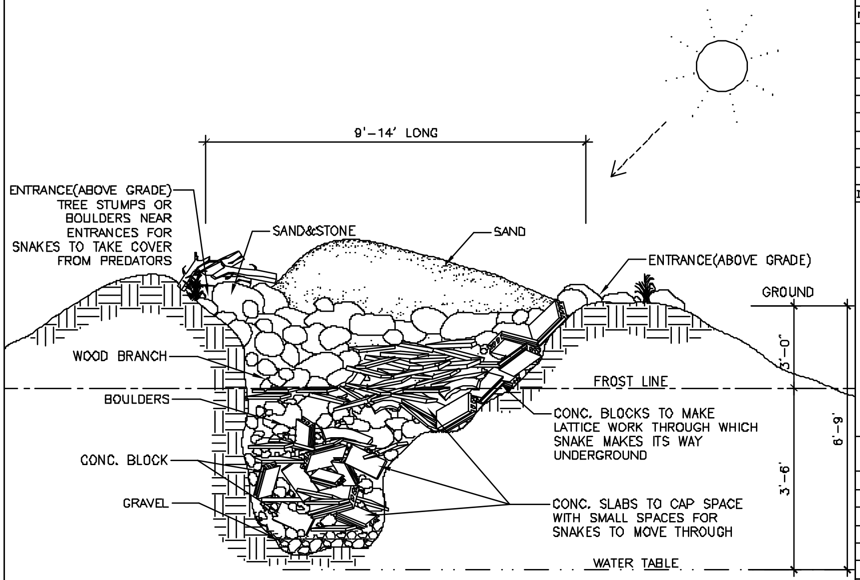
Appendix K

Toronto Zoo Snake Hibernaculum Drawing



1 SK1 TOP VIEW

SCALE : NTS



2 SK1 CROSS SECTION

SCALE : NTS

toronto ZOO

361A OLD FINCH AVE.
TORONTO, ON
M1B 5K7

NO	DESCRIPTION	DATE
NO	REVISION	DATE

SNAKE HIBERNACULUM

	APPROVED BY	
NO.	NAME	DATE

TOP VIEW
&
CROSS SECTION

PROJECT NO: -
DRAWN BY:JC
CHECKED BY:
LAST UPDATED: [illegible]
SCALE: NTS
DRAWING #:

SK-1

APPENDIX I

BIOLOGIC LETTER – ESSELTINE RESIDENTIAL TREE EVALUATION PROGRAM

BioLogic Incorporated
AQUATIC AND TERRESTRIAL ECOSYSTEM PLANNERS

Lou Zarlenga, P.Eng.,
RC Spencer Associates Inc.,
261 Shepherd Street East,
Windsor, Ontario ,
N8X 2K6

April 28, 2016

Dear Lou:

Re: Esseltine Drain Tree Compensation

We reviewed the trees the will require removal to accommodate the reconstructed Esseltine Drain from County Road 20 to the mouth at Lake Erie. According to my investigations 228 trees will be removed.

There are a number of standardized processes for tree valuation which can be used in many circumstances whereby tree removal affects property value. When circumstances are not reflected by the standardized methods, the protocol recommends the use of professional judgement to obtain a fair and equitable compensation. For this site, the proposed construction activities are designed to ultimately protect property value through bank stabilization. As a result, we have developed a compensation plan unique to this site.

Affected trees have been categorized according to general condition and/or size. Dead trees or trees showing greater than 60% canopy decline that are in the construction zone were not considered in the evaluation. Trees less than 25cm diameter at breast height (DBH) were deemed Category 1 trees. Trees 25cm DBH and greater were deemed Category 2 trees.

The proposed compensation plan is to replace Category 1 trees with 50mm caliper, wire basket condition landscape trees at a 1:1 ratio and Category 2 trees with 70mm caliper, wire basket condition landscape trees at a ratio of 2:1. For example if eight Category 1 trees, and thirteen Category 2 trees are being removed the calculated number of replacement trees will be eight 50mm cal. and twenty-six 70mm cal. trees for a total of 34 trees.

Trees will be planted on a 7.5m X 7.5m grid which equals 56.25m2 required per tree. Not all properties will have enough space to plant the allotted number of replacement trees. Continuing the above example, if the area of property impacted is 1000m2 and after construction of the new drain only 900m2 are available for planting, only 16 trees can be planted due to space requirements. There are then 18 trees remaining which cannot be planted. In this case the monetary value of the remaining trees will be paid out, less installation costs.

Sizing breakdown of replacement trees will be determined by the percentages of Category 1 and Category 2 trees that are to be removed. The example continues; of the 21 trees which are to be removed, 38% are Category 1 and 62% are Category 2. Therefore, of the new trees to be planted 38% (6 trees) will be 50mm cal. and 62% (10 trees) will be 70mm cal.. Of the remaining 18 trees to be paid out the cost breakdown will be for the value of 38% (7 trees) 50mm cal. and 62% (11 trees) 70mm cal.

The drain itself is the common element to properties on both sides of the drain however, an access road is to be constructed which largely affects properties on the north side of the drain only, resulting in a large, unplantable area. To remain fair to landowners on both sides of the drain, on properties where the access road is located the area of the access road will be valued as though it is plantable and will include installation costs in the compensation plan.

Tree values have been calculated based on M. Putzer Hornby Nursery Ltd., 2015 price list and are used as a guide only. Values may be adjusted to reflect actual availability and pricing of local nursery stock. The following prices were used:

50mm cal. wire basket stock: $175 unit cost
$350 installed
70mm cal. wire basket stock: $230 unit cost
$460 installed

The overall result of replacement tree planting is to emulate the existing woodland setting on site. Species composition of may be adjusted to accommodate individual preferences but species should be native to the area and non-invasive. Based on species found on site replacement ratios for the project should be considered as follows:

Sugar Maple	*Acer saccharum*	35%
Hackberry	*Celtis occidentalis*	10%
Tuliptree	*Liriodendron tulipifera*	15%
Red Oak	*Quercus rubra*	30%
Basswood	*Tilia americana*	10%.

An overall planting layout in may be developed prior to installation.

A detailed estimate table for individual properties and property ownership information is attached.

Please contact me if you should have any questions or concerns.

Yours truly,
BioLogic

Will Huys,
ISA Certified Arborist ON1183-A
Tree Replacement Esseltine Drain.wpd

Esseltine Drain Residential Tree Evaluation, Replacement Planting/Compensation

		A	B	C	D	E		G	H		J	J	K	K	L	M	N
	Property	Category 0 (Dead/Faulty)	Category 1 (10-25cm DBH)	% of Total	Category 2 (>25cmDBH)	% of Total	Total Trees for Removal	Area of Removals (m2)	Plantable Area (m2)	Replacement Trees	Planted Trees by Area (50mm)	Planted Trees by Area (70mm)	Unplanted Trees by Area (50mm)	Unplanted Trees by Area (70mm)	Estimated Cost of Installation	Estimated Payout to Landowner	**Total Project Cost**
1	1304 Whitewood Road	2	27	60%	18	40%	45	1962	1700	63	13	8	23	17	$8,730.00	$8,785.00	**$16,515.00**
2	1306 Whitewood Road	1	6	67%	3	33%	9	263	134	12	1	1	7	3	$810.00	$1,915.00	**$2,725.00**
3	1308 Whitewood Road+	2	12	60%	8	40%	20	1120	1120	28	8	6	8	6	$5,560.00	$2,780.00	**$8,340.00**
4	1310 Whitewood Road+	3	6	86%	1	17%	7	517	517	8	8	1	0	0	$3,260.00	$0.00	**$3,260.00**
5	1312 Whitewood Road	2	2	22%	7	78%	9	470	730	16	2	6	2	6	$3,460.00	$1,730.00	**$5,190.00**
6	1314 Whitewood Road	2	2	50%	2	50%	4	636	592	6	5	6	0	0	$4,510.00	$0.00	**$4,510.00**
7	1316 Whitewood Road	4	4	44%	5	56%	9	656	546	14	4	6	2	2	$4,160.00	$810.00	**$4,970.00**
8	1517 Brookview Drive+	5	18	55%	15	45%	33	1754	1358	48	5	4	21	18	$3,590.00	$7,815.00	**$11,405.00**
9	1518 Whitewood Road	2	2	33%	4	67%	6	400	400	10	2	5	1	2	$3,000.00	$635.00	**$3,635.00**
10	1519 Brookview Drive+	3	6	60%	4	40%	10	735	677	14	2	2	6	4	$1,670.00	$1,970.00	**$3,590.00**
11	1520 Whitewood Road	1	2	18%	9	82%	11	316	316	20	1	5	3	11	$2,630.00	$3,055.00	**$5,705.00**
12	1521 Brookview Drive+	1	8	62%	5	38%	13	708	635	18	7	3	7	4	$2,780.00	$2,145.00	**$4,925.00**
13	1522 Whitewood Road	0	4	80%	1	20%	5	349	292	6	7	1	1	0	$1,860.00	$175.00	**$2,035.00**
14	1523 Brookview Drive+	0	1	14%	6	86%	7	720	596	13	1	5	1	6	$2,630.00	$1,555.00	**$4,205.00**
15	1525 Brookview Drive+	3	2	22%	7	78%	9	1141	914	16	1	4	2	9	$2,190.00	$2,420.00	**$4,610.00**
16	1875 County Road 20+	10	9	29%	22	71%	31	2353	2193	53	4	9	12	28	$5,540.00	$8,540.00	**$14,080.00**
															$55,870.00	$43,830.00	**$99,700.00**

\+ properties with Access Road

C percentage of total reviewed trees within this size category
these percentages are used to calculate number of 50mm cal. replacement trees

E percentage of total reviewed trees within this size category
these percentages are used to calculate number of 70mm cal. replacement trees

F trees on property to be removed to accommodate construction

G area of property to be affected by construction

H area available for planting after construction of channel and access road
properties with access road will be paid out for area of access road including installation

I number of replacement trees calculated per property based on the following:
for Category 1 trees: 1 50mm caliper, wire basket tree
for Category 2 trees: 2 70mm caliper, wire basket trees

J number of trees which can be planted in the area remaining after construction
trees will be planted in a 7.5m X 7.5m on centre grid pattern

K number of replacement trees which cannot be planted in the area remaining after construction

L replacement cost based on M. Putzer Hornby Nursery Ltd. 2015 Price List
installation cost calculated as 200% of replacement cost
50mm cal., wire basket $350.00
70mm cal., wire basket $460.00

M value of trees that cannot be planted due to space restrictions without installation costs
50mm cal., wire basket $175.00
70mm cal., wire basket $230.00

APPENDIX J

ONTARIO MINISTRY OF AGRICULTURE, FOOD AND RURAL AFFAIRS

NATURAL WATERCOURSES

Ontario

MINISTRY OF AGRICULTURE, FOOD AND RURAL AFFAIRS

Drainage Conflict - Natural Watercourses

When responding to issues involving a natural watercourse, the courts often take the position that "water flows naturally and should be permitted thus to flow". If you own land on one or both sides of a natural watercourse, you are considered to be a riparian landowner. A non-riparian land owner does not have land abutting a natural watercourse. The following questions are addressed in this section:

- What is a natural watercourse?
- How do I know whether the area on my land would be considered a natural watercourse?
- What are the rights and responsibilities of a riparian land owner?
- What are some common problems or disputes involving natural watercourses?

What is a natural watercourse?

A natural watercourse is a natural channel where water flows between banks that are more or less defined. The flow of water does not need to be constant, but the channel must be a permanent landmark. The watercourse may also, at some point, spread over a level area without defined banks, before flowing again as a defined channel.

How do I know whether the area on my land would be considered a natural watercourse?

Only a judge can conclusively determine whether, under the law, a specific flow of water is a natural watercourse or not. Many people have opinions, and here are some guides or suggestions for evaluating the watercourse on your land:

1. The channel must be a permanent, natural feature on the land. A man-made ditch is not a natural watercourse. The courts may or may not consider a natural watercourse that has been modified in the past to still be considered a natural watercourse;
2. Water flows through a channel that has a bed and banks. If the water spreads out from the banks at some point, it must eventually flow back into a defined channel with banks and a bed;
3. The water flow in a natural watercourse does not have to be continuous, but must be significant. If water only flows after a heavy rain, it may not be a natural watercourse even if it has defined banks.

What are the rights and responsibilities of a riparian landowner?

The following is a general summary of the rights and responsibilities of riparian landowners.

The law concerning riparian rights and responsibilities is complex, and cannot be easily summarized. Please consult your lawyer where these rights and responsibilities affect your property or a neighbouring property.

Right of drainage

Riparian landowners have the right to drain their land into the natural watercourse, even if it causes damage to downstream property owners. Non-riparian property owners do not have the right to drain into natural watercourses, and the connecting non-riparian landowner could be liable for damages if downstream damages result.

Right to use water for domestic purposes

Riparian landowners have the right to use the water in a natural watercourse for domestic purposes, provided they only use a reasonable amount. They must not take all the water in the watercourse, depriving downstream riparian property owners of their right to use the water for their purposes. The Permit to Take Water process under the Ontario Water Resources Act may override this common law principle.

Can't interfere with the channel to the detriment of others

Riparian landowners can modify the channel of a natural watercourse provided it doesn't interfere with the general principle that "water flows naturally and should be permitted thus to flow". Any interference with this principle may be grounds for a lawsuit. However, there may also be legislation that regulates work in the channel of a natural watercourse. The local conservation authority and the Ministry of Natural Resources' offices are good starting places to find out what laws may apply.

Can't dam a natural watercourse

Blocking a natural watercourse is in direct conflict with the general principle for natural watercourses that "water flows naturally and should be permitted thus to flow".

Must accept the water

If water overflows a natural watercourse and floods your property, you must accept the results. If damage is caused by the actions of upstream non-riparian landowners, you don't have to accept the water and may have grounds for legal action. Rejecting water could involve an impervious wall, berm or dyke along the boundary of your land, and effectively dam the water back on the higher lands of the non-riparian owner.

What are some common problems or disputes involving natural watercourses?

1. Natural blockage
2. Artificial blockage
3. Increased flow

Natural Blockage

Naturally-occurring blockages in natural watercourses occur for a variety of reasons, including beaver dams, fallen timber, debris or sediment buildup. These blockages hold back water, flooding the adjoining land and even upstream land.

- My land is being flooded because of a natural blockage on my property. What am I allowed to do?
- There is a natural blockage along my edge of the watercourse that I want to remove. What can I do?
- My land is being flooded because of a beaver dam or other natural blockage on my neighbour's property. Isn't it the municipality's job to remove it? What about the conservation authority or the Ministry of Natural Resources?
- My upstream neighbor has advised me that there is flooding on their land because of blockages on the natural watercourse located on my land. They want to do some work on the natural watercourse. I am afraid that the extra water will hurt my land. Do I have to let them do the work?
- What options are available to me?

My land is being flooded because of a natural blockage on my property. What am I allowed

to do?

You may be able to remove the blockage yourself, but consider the following cautions.

- Check the environmental regulations that may apply – permits or authorizations may be required.
- If the blockage has been there for some time, your riparian neighbours may have come to rely on that blockage in the watercourse. If removing the blockage changes the amount or speed of water in the watercourse – and that causes damage to another riparian owner's property – that owner could take legal action against you for the property damage. Make certain these neighbours are consulted and involved in the process.

You have the right to petition your municipality to legally change the watercourse into a municipal drain.

- The Drainage Act process must be followed and the municipality has to comply with environmental regulations – changing a natural watercourse to a municipal drain may take some time.
- Once the natural watercourse becomes a municipal drain, the Drainage Act governs the management of the watercourse. The municipality has the responsibility to keep the drain maintained and free from blockages.

There is a natural blockage along my edge of the watercourse that I want to remove. What can I do?

There are a few options open to you.

- Remove the blockage yourself. Contact the Ministry of Natural Resources first to obtain proper permits for removing the obstruction from a watercourse. There may be a fee for these permits.
- Get the municipality to turn the watercourse into a municipal drain by petitioning under Section 4 of the Drainage Act. Once the watercourse is a municipal drain, the municipality has the duty to keep it clear from obstructions.

My land is being flooded because of a beaver dam or other natural blockage on my neighbour's property. Isn't it the municipality's job to remove it? What about the conservation authority or the Ministry of Natural Resources?

If the watercourse was a municipal drain, your municipality has the authority and responsibility to maintain the drain. But municipalities have no authority to remove blockages from a natural watercourse.

The conservation authority or Ministry of Natural Resources also has no authority to go onto private land to remove naturally-occurring blockages.

My upstream neighbor has advised me that there is flooding on their land because of blockages on the natural watercourse located on my land. They want to do some work on the natural watercourse. I am afraid that the extra water will hurt my land. Do I have to let them do the work?

If this is a natural blockage on a natural watercourse, you do not have to give your neighbour permission to perform the work. Talk to your neighbour to negotiate a solution. They may need to contact the Ministry of Natural Resources to find out whether a permit is necessary to remove the artificial blockage.

Please remember, if your neighbour is frustrated that they cannot resolve their flooding problem, they have the right to petition the municipality for a municipal drain.

What options are available to me?

If the blockage occurs on your neighbour's property, talk to them about getting permission to remove the blockage. Remember your neighbour does not necessarily have a responsibility to remove the blockage on your behalf. If your neighbour grants permission, you have to comply with all environmental regulations.

If negotiation fails, you have the right to petition your municipality under the Drainage Act to turn the watercourse into a municipal drain. The Drainage Act process must be followed and the municipality has to comply with environmental regulations. Changing a natural watercourse to a municipal drain may take some time.

Artificial blockage

A variety of actions could be considered an artificial blockage or dam on a natural watercourse, including small dams, undersized culverts or fences that run through a natural watercourse and collect branches and other debris which hold back water.

- My land is being flooded by an artificial blockage on a natural watercourse on my neighbour's property. What can I do?
- I want to build a dam on a natural watercourse on my property. What do I have to do?
- I am being deprived of water because of upstream blockage. What can I do?

My land is being flooded by an artificial blockage on a natural watercourse on my neighbour's property. What can I do?

Talk to your neighbour to negotiate a solution. Your neighbour may need to contact the Ministry of Natural Resources to determine if a permit is necessary to remove the artificial blockage.

Contact the Ministry of Natural Resources to see if your neighbour has built the artificial blockage in compliance with environmental regulations.

- As a riparian neighbour, you should have been consulted during your neighbour's process of obtaining a permit. If you were not consulted before they built the artificial blockage, your neighbour may not have gone through the proper legal channels;
- If your neighbour did not obtain the proper permits, the Ministry of Natural Resources may be able to enforce environmental regulations to resolve your problem;

Consult your lawyer and see what legal options are available to you. This may include initiating a legal action.

Petition your municipality to turn the watercourse into a municipal drain under the Drainage Act.

- If a blockage causes drainage problems, you can petition your local municipality to turn the watercourse into a drain, as set out by Section 4 of the Drainage Act;
- If the municipality determines a municipal drain is required, they have the right and duty to keep the drain maintained and free from blockages;
- The project has to comply with environmental regulations, and may take some time to reach completion.

I want to build a dam on a natural watercourse on my property. What do I have to do?

You may not alter a watercourse by building an artificial blockage. If you do, any affected owner along the watercourse can sue you for damages, or ask a judge for an injunction to force you to remove the dam.

Building a dam on a natural watercourse can interfere with the riparian rights of property owners both upstream and downstream.

I am being deprived of water because of upstream blockage. What can I do?

If the blockage is artificial, and the neighbour who built it refuses to remove it, you can apply to the courts for damages or an injunction. An injunction forces the person responsible for the blockage to remove it.

Contact the Ministry of Natural Resources <http://www.mnr.gov.on.ca/en/ContactUs/index.html> for assistance. If a person wants to build a blockage in a watercourse, they must get Ministry of National Resources' permits. During the permitting process, before your neighbour built the blockage, you and other landowners should have been consulted. If you were not, your neighbour may not have obtained proper permits.

Increased flow

- My upstream neighbour removed a beaver dam and now my field is being flooded. What can I do?
- The flow of the creek going through my property has increased due to land use change (e.g. new subdivision or quarry operation) in the upper part of the watershed and now my land floods. What do I do?

My upstream neighbour removed a beaver dam and now my field is being flooded. What can I do?

A person removing a beaver dam must comply with environmental regulations. Check with environmental agencies to see if this approval was received.

Consult your lawyer to see what legal options are available to you. This may include initiating a legal action.

The flow of the creek going through my property has increased due to land use change (e.g. new subdivision or quarry operation) in the upper part of the watershed and now my land floods. What do I do?

Petition your municipality to turn the watercourse into a municipal drain under the Drainage Act. The project will have to comply with environmental regulations.

Only riparian landowners have the right to drain into a natural watercourse. You could initiate legal action if your flooding is caused by non-riparian lands draining into the natural watercourse.

For more information:
Toll Free: 1-877-424-1300
E-mail: ag.info.omafra@ontario.ca