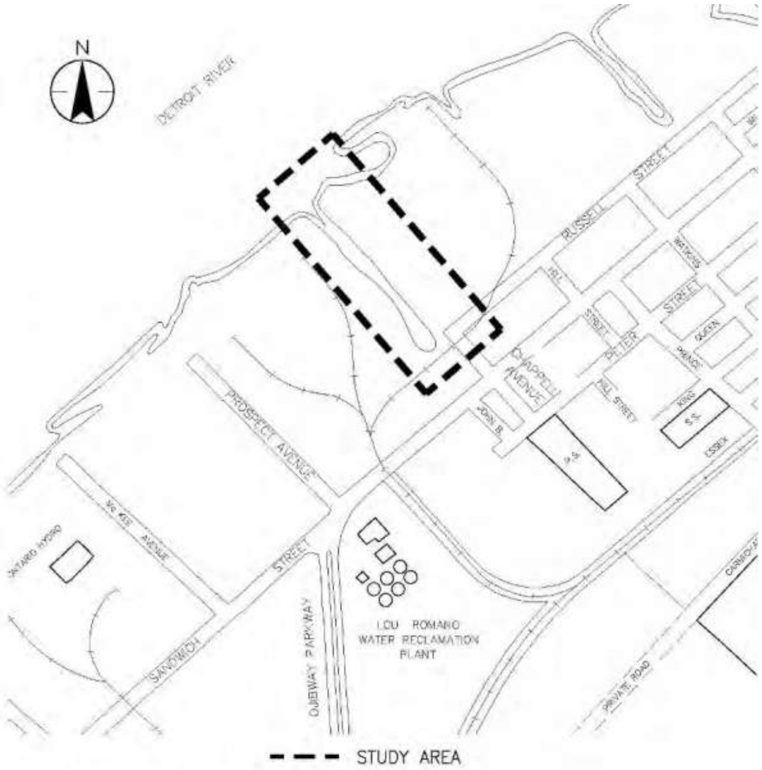
APPENDIX A

Consultation

Prince Road Storm Sewer Outlet
Schedule ‘C’ Municipal Class Environmental Assessment (Phases 3 & 4)
Notice of Study Commencement

The City of Windsor is initiating a Municipal Class Environmental Assessment (EA) study for the proposed storm sewer outlet at McKee Creek. The Study Area is defined to the west by the Detroit River, to the east by the west limit of the existing storm sewer along Chappell Avenue, and to the north and south on either side of McKee Creek by lands owned by Coco Paving Ltd. (see key map).



Phases 1 and 2 of the Class EA process are being documented as part of the Sewer & Coastal Flood Protection Master Plan (SCFPMP). The SCFPMP concludes that the preferred alternative solution for the Prince Road storm sewer outlet at Chappell Avenue is to outlet to McKee Creek. The purpose of this Class EA is to establish the preferred location and design of the outlet and the associated pumping station. This study will address Phases 3 and 4 of the Class EA Process. An Environmental Study Report will be prepared and made available for public review and comment.

The study is being conducted in accordance with the requirements of Schedule C projects as outlined in the Municipal Class EA document (2000, as amended in 2007, 2011 and 2015), which is approved under the Ontario Environmental Assessment Act.

Comments

If you are interested in participating and/or would like to be added to our mailing list, please contact a member of the study team below:

Ian Wilson, P. Eng.	Clarence Jubenville, P. Eng.
City of Windsor	Consultant Project Manager
Engineering Department	Stantec Consulting Ltd.
519-255-6100 extension 6369	519-966-2250
iwilson@citywindsor.ca	clarence.jubenville@stantec.com

Information collected will be used in accordance with the Freedom of Information and Protection of Privacy Act. With the exception of personal information, all comments will become part of the public record and may be included in project documentation.

This notice was first published on February 26, 2021.

Upper Little River

Agency	Title	First Name	Last Name	Department	Title	Address	City	Pr	Postal	Phone	Email	
Provincial												
Ministry of Natural Resources and Forestry		Karina	Cerniavskaja	Aylmer District	District Planner	615 John Street North	Aylmer	ON	N5H 2S8	519-200-2276	karina.cerniavskaja@ontario.ca	
Ministry of the Environment, Conservation and Parks		Anneleis	Eckert	Southwestern Region	Regional Environmental Assessment Coordina	733 Exeter Road	London	ON	N6E 1L3	519-827-6040	Anneleis.eckert@ontario.ca	
Ministry of the Environment, Conservation and Parks											eanotification.swregion@ontario.ca	Include "project information" e
Ministry of Heritage, Sport, Tourism and Culture Industries		Rosi	Zirger	Culture Services Unit	Heritage Planner	401 Bay Street, Suite 1700	Toronto	ON	M7A 0A7		rosi.zirger@ontario.ca	
Ministry of Transportation		Geddes	Mahabir	West	Manager, Highway Operations	659 Exeter Road, Exeter Road Complex	London	ON	N6E 1L3	226-268-9470	geddes.mahabir@ontario.ca	
Ministry of Transportation				West	Head, Planning and Design	659 Exeter Road, Exeter Road Complex	London	ON	N6E 1L3			
Ministry of Agriculture, Food, and Rural Affairs		David	Marriott	Land Use Policy & Stewardship	Rural Planner, Western Ontario	1 Stone Road West, Ontario Government Bldg	Guelph	ON	N1G 4Y2	519-766-5990	david.marriott@ontario.ca	
Ministry of Indigenous Affairs		Leslie	Brewer-Palhazi	Reconciliation, Ministry Partnerships Unit	Advisor	160 Bloor Street E, Suite 400	Toronto	ON	M7A 2E6	416-326-9755	leslie.brewer-palhazi@ontario.ca	
Federal												
Department of Fisheries and Oceans Canada		Lisa	Wren	Fisheries Protection Program	Senior Fisheries Protection Biologist	867 Lakeshore Drive, P.O. Box 5050	Burlington	ON	L7R 4A6	905-336-4535	lisa.wren@dfo-mpo.gc.ca	
Municipal												
Windsor Fire and Rescue Services	Chief	Stephen	Laforet		Fire Chief and Community Emergency Management Coordinator	815 Goyeau Street	Windsor	ON	N9A 1H7	519-253-3016 ext. 253	slaforet@citywindsor.ca	
Windsor Police Service	Chief	Pamela	Mizuno		Chief of Police	150 Goyeau Street, P.O. Box 60	Windsor	ON	N9A 6J5	519-255-6700	pmizuno@police.windsor.on.ca	
Essex-Windsor Emergency Medical Services	Chief	Bruce	Krauter		Chief of EMS	360 Fairview Avenue West	Essex	ON	N8M 1Y6	519-776-6441	bkrauter@countyofessex.on.ca	
Essex Region Conservation Authority		James	Bryant	Watershed Mangement Services	Interim Director	360 Fairview Avenue West, Suite 311	Essex	ON	N8M 1Y6	T: 519-776-5209 Ext. 246	jbryant@erca.org	
Essex Region Conservation Authority				General ERCA Planning Department		360 Fairview Avenue West, Suite 311	Essex	ON	N8M 1Y6		planning@erca.org	
Utilities												
Hydro One		Stan	Bulkiewicz	Hydro One Essex	Operations Manager	125 Irwin Avenue	Essex	ON	N8M 2T3		stan.bulkiewicz@hydroone.com	
Hydro One					Regulatory Affairs						Regulatory@HydroOne.com	
Enwin Utilities		Barbara	Peirce Marshall	Enwin Utilities Ltd.	Corportate Communications	4545 Rhodes Drive. P.O. Box 1625, Stn. A	Windsor	ON	N9A 5T7		bpeircemarshall@enwin.com	
Enwin Utilities		Rob	Spagnuolo	Enwin Utilities Ltd.	Customer Service Director	4545 Rhodes Drive. P.O. Box 1625, Stn. A	Windsor	ON	N8W 5T1	519-255-2888 ext 222	rspagnuolo@enwin.com	
Enbridge		Mike	Cincurak	Enbridge	Construction Project Manager	3840 Rhodes Drive, P.O. Box 700	Windsor	ON	N9A 6N7		mike.cincurak@enbridge.com	
Cogeco Cable		Bill	Sorrell		Regional Support Specialist	2525 Dougall Avenue	Windsor	ON	N8X 5A7		bill.sorrell@cogeco.com	
Bell Canada		David	Cowing	Bell Canada	Access Network Coordinator	1149 Goyeau Street, 1st floor	Windsor	ON	N9A 1H9		david.cowing@bell.ca	
Indigenous Communities												
Metis Nation of Ontario (MNO)		Margaret	Froh		President	311-75 Sherbourne Street	Toronto	ON	M5A 2P9		MargaretF@metisnation.org	
Metis Nation of Ontario (MNO)				Head Office	Metis Consultation Unit	66 Slater Street, Suite 1100	Ottawa	ON	K1P 5H1		consultations@metisnation.org	
Chippewas of the Thames First Nation	Chief	Jacqueline	French		Chief	320 Chippewa Road RR1	Muncey	ON	N0L 1Y0	519-289-5241	jfrench@cottfn.com	
Chippewas of the Thames First Nation		Fallon	Burch		Consultation Coordinator	320 Chippewa Road RR1	Muncey	ON	N0L 1Y0	519-289-5555 ext 251	fburch@cottfn.com	
Oneida Nation of the Thames	Chief	Adrian	Chrisjohn		Chief	2212 Elm Avenue	Southwold	ON	N0L 2G0	519-318-4598	adrian.chrisjohn@oneida.on.ca	
Munsee-Delaware Nation	Chief	Mark	Peters		Chief	289 Jubilee Road	Muncey	ON	N0L 1Y0	519-289-5396 Ext. 226	chief.peters@munsee.ca	
Delaware Nation	Chief	Denise	Stonefish		Chief	14760 School House Line RR #3	Thamesville	ON	N0P 2K0	519-692-3936	denise.stonefish@delawarenation.on.ca	
Bkejwanong Territory (Walpole Island)	Chief	Charles	Sampson		Chief	117 Tahgahoning Road RR #3	Wallaceburg	ON	N8A 4K9	519-627-1481 ext. 320	charles.sampson@wifn.org	
Bkejwanong Territory (Walpole Island)		Derek	Sands		Communications Coordinator	117 Tahgahoning Road RR #3	Wallaceburg	ON	N8A 4K9	519-627-1481 ext. 322	derek.sands@wifn.org	
Caldwell First Nation	Chief	Mary	Duckworth		Chief	14 Orange Street	Leamington	ON	N8H 1P5	519-322-1766	chief@caldwellfirstnation.ca	
Caldwell First Nation		Nikki	van Oirschot		Director of Operations	14 Orange Street	Leamington	ON	N8H 1P5	519-322-1766 ext. 1227	nikki.orosz@caldwellfirstnation.ca	
Chippewas of Kettle and Stony Point First Nation	Chief	Jason	Henry		Chief	6247 Indian Lane	Lambton Shore	ON	N0N 1J1	519-786-2125	jason.henry@kettlepoint.org	
Chippewas of Kettle and Stony Point First Nation		Valerie	George		Consultation Coordinator	6247 Indian Lane	Lambton Shore	ON	N0N 1J1	519-786-2125	valerie.george@kettlepoint.org	
Aamjiwnaang First Nation	Chief	Chris	Plain		Chief	978 Tashmoo Avenue	Sarnia	ON	N7T 7H5	519-336-8410 ext. 236	chief.plain@aamjiwnaang.ca	
Aamjiwnaang First Nation		Sharilyn	Johnston		Environment Coordinator	978 Tashmoo Avenue	Sarnia	ON	N7T 7H5	519-336-8410 ext. 245	sjohnston@aamjiwnaang.ca	

From: Hohner, Paula

Cc: karina.cerniavskaja@ontario.ca; rosi.zirger@ontario.ca; david.marriott@ontario.ca; leslie.brewer-palhazi@ontario.ca; lisa.wren@dfo-mpo.gc.ca; slaforet@citywindsor.ca; pmizuno@police.windsor.on.ca; bkrauter@countyofessex.on.ca; James Bryant; mnelson@erca.org; planning@erca.org; stan.bulkiewicz@hydroone.com; Regulatory@HydroOne.com; bpeircemarshall@enwin.com; rspagnuolo@enwin.com; mike.cincurak@enbridge.com; bill.sorrell@cogeco.com; david.cowing@bell.ca; Wilson, Ian; Mikhael, Fahd; Jubenville, Clarence; Godo, Anna

Subject: Prince Road Storm Sewer Outlet Schedule ‘C’ Municipal Class Environmental Assessment - Notice of Study Commencement

Date: Friday, February 26, 2021 3:51:48 PM

Attachments: Prince Rd SS Outfall - Notice of Study Commencement_Feb-26-2021.pdf

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Good afternoon,
On behalf of the City of Windsor and Stantec project team, please see the attached Notice of Study Commencement for the above-mentioned project.
Thank you,
Paula

Paula Hohner, MScPl, MCIP, RPP
Associate, Senior Environmental Planner
Environmental Team Lead - Transportation
Stantec
600-171 Queens Avenue London ON N6A 5J7
Phone: 519-675-6666
Mobile: 226-926-6682
paula.hohner@stantec.com

From: Wilson, Ian
To: [redacted]
Cc: ; Hohner, Paula
Subject: RE: Mailing List
Date: Friday, March 05, 2021 9:57:27 AM

Thank you for your interes[redacted] You will be added to the project mailing list.

Take care,

Ian Wilson, P. Eng., MASc. | Engineer II
Engineering Department
350 City Hall Square West | Suite 310 | Windsor, ON | N9A 6S1
https://can01.safelinks.protection.outlook.com/?
url=http%3A%2F%2Fwww.citywindsor.ca%2F&data=04%7C01%7Cpaula.hohner%40stantec.com%7Cf650e3c84ebf4d7a44e208d8dfe6fd2e%7C413c6f2c219a469297d3f2b4d80281e7%7C0%7C0%7C637505530469689188%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=WgDxrgNAJ9IcwW0BSTKRRmpsXR6zFA02mcODkgU5ImA%3D&reserved=0

-----Original Message-----
From[redacted]
Sent: Friday, March 5, 2021 7:57 AM
To: Wilson, Ian <IWilson@citywindsor.ca>
Subject: Mailing List

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi Ian:

Would you please put me on your mailing list for the proposed sewer outlet at McKee Creek.

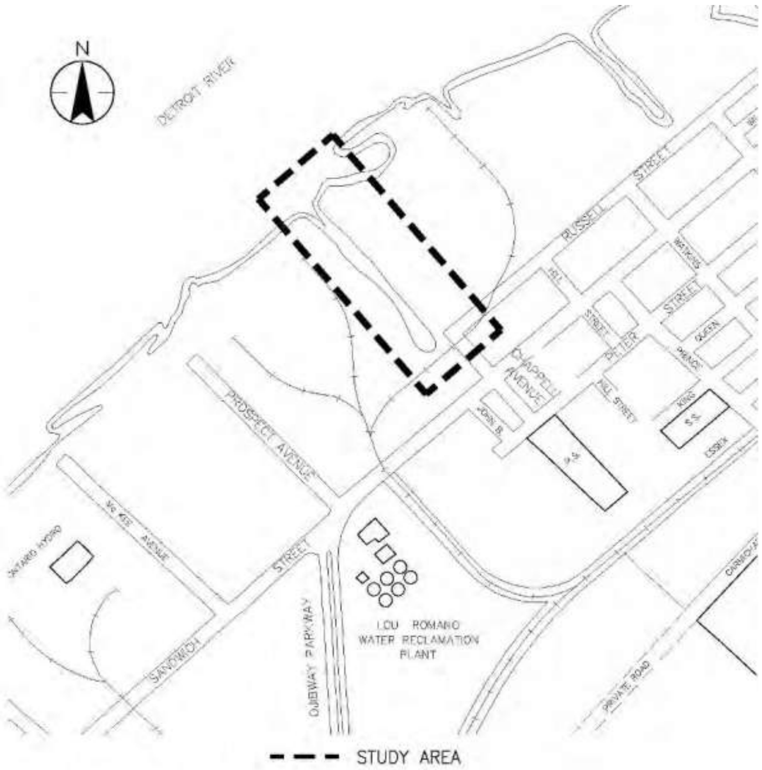
Best regards:
[redacted]

From: Hohner, Paula
To: "eanotification.swregion@ontario.ca"
Cc: Wilson, Ian; Mikhael, Fahd; Godo, Anna; Jubenville, Clarence
Subject: Prince Road Storm Sewer Outlet Schedule ‘C’ Municipal Class Environmental Assessment - Notice of Study Commencement
Date: Friday, February 26, 2021 3:50:00 PM
Attachments: Prince Rd SS Outfall - Notice of Study Commencement_Feb-26-2021.pdf
streamlined_ea_project_information_form_2_02262021.xlsx

Good afternoon,
On behalf of the City of Windsor and Stantec project team, please see the attached Notice of Study Commencement for the above-mentioned project and Project Information Form.
Thank you,
Paula

Paula Hohner, MScPl, MCIP, RPP
Associate, Senior Environmental Planner
Environmental Team Lead - Transportation
Stantec
600-171 Queens Avenue London ON N6A 5J7
Phone: 519-675-6666
Mobile: 226-926-6682
paula.hohner@stantec.com

Prince Road Storm Sewer Outlet
Schedule ‘C’ Municipal Class Environmental Assessment (Phases 3 & 4)
Notice of Study Commencement



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Comments

If you are interested in participating and/or would like to be added to our mailing list, please contact a member of the study team below:

Ian Wilson, P. Eng.
City of Windsor
Engineering Department
519-255-6100 extension 6369
iwilson@citywindsor.ca

Clarence Jubenville, P. Eng.
Consultant Project Manager
Stantec Consulting Ltd.
519-966-2250
clarence.jubenville@stantec.com

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This notice was first published on February 26, 2021.

From:	Hohner, Paula
To:	Lang, Sarah
Subject:	FW: Prince Road Storm Sewer Outlet Schedule ‘C’ Municipal Class Environmental Assessment - Notice of Study Commencement
Date:	Wednesday, April 21, 2021 4:42:04 PM
Attachments:	Acknowledgement Letter - Notice of Commencement - MCEA - Prince Road Storm Sewer Outlet.pdf Supporting Attachment - Species at Risk Proponents Guide to Preliminary Screening (Draft May 2019).pdf

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Paula Hohner, MScPl, MCIP, RPP
Associate, Senior Environmental Planner
Environmental Team Lead - Transportation
Stantec
600-171 Queens Avenue London ON N6A 5J7
Phone: 519-675-6666
Mobile: 226-926-6682
paula.hohner@stantec.com

From: Badali, Mark (MECP) <Mark.Badali1@ontario.ca>
Sent: Friday, April 16, 2021 5:26 PM
To: IWilson@citywindsor.ca; Hohner, Paula <Paula.Hohner@stantec.com>
Cc: Morrison, Sean (MECP) <Sean.Morrison@ontario.ca>; Bechard, Marc (MECP) <Marc.Bechard@ontario.ca>; Jubenville, Clarence <clarence.jubenville@stantec.com>; fmikhael@citywindsor.ca; agodo@citywindsor.ca
Subject: RE: Prince Road Storm Sewer Outlet Schedule ‘C’ Municipal Class Environmental Assessment - Notice of Study Commencement

Good afternoon,

Please find attached letter of acknowledgement and supporting attachments in response to the Notice of Commencement of this Municipal Class Environmental Assessment (Phases 3 & 4), Schedule C for the Prince Road Storm Sewer Outlet in the City of Windsor.

Best regards,

Mark Badali (he/him)
Environmental Resource Planner & EA Coordinator – Southwest Region
Project Review Unit | Environmental Assessment Branch
Ontario Ministry of the Environment, Conservation and Parks
Mark.Badali1@ontario.ca | (416) 457-2155

Ministry of the Environment,
Conservation and Parks

Environmental Assessment Branch

1st Floor
135 St. Clair Avenue W
Toronto ON M4V 1P5
Tel.: 416 314-8001
Fax.: 416 314-8452

Ministère de l'Environnement, de la
Protection de la nature et des Parcs

Direction des évaluations
environnementales

Rez-de-chaussée
135, avenue St. Clair Ouest
Toronto ON M4V 1P5
Tél. : 416 314-8001
Téléc. : 416 314-8452

Ontario

April 16, 2021

Ian Wilson, P. Eng.
City of Windsor

Re: **Prince Road Storm Sewer Outlet**
City of Windsor
Municipal Class EA (Phases 3 & 4)
Response to Notice of Commencement

Dear Ian Wilson,

This letter is in response to the Notice of Commencement for the above noted project. The Ministry of the Environment, Conservation and Parks (MECP) acknowledges that the City of Windsor (proponent) has indicated that the study is following the approved environmental planning process for a Schedule C project under the Municipal Class Environmental Assessment (Class EA).

The **updated (February 2021)** attached "Areas of Interest" document provides guidance regarding the ministry's interests with respect to the Class EA process. Please address all areas of interest in the EA documentation at an appropriate level for the EA study. Proponents who address all the applicable areas of interest can minimize potential delays to the project schedule. **Further information is provided at the end of the Areas of Interest document relating to recent changes to the Environmental Assessment Act through Bill 197, Covid-19 Economic Recovery Act 2020.**

The Crown has a legal duty to consult Aboriginal communities when it has knowledge, real or constructive, of the existence or potential existence of an Aboriginal or treaty right and contemplates conduct that may adversely impact that right. Before authorizing this project, the Crown must ensure that its duty to consult has been fulfilled, where such a duty is triggered. Although the duty to consult with Aboriginal peoples is a duty of the Crown, the Crown may delegate procedural aspects of this duty to project proponents while retaining oversight of the consultation process.

The proposed project may have the potential to affect Aboriginal or treaty rights protected under Section 35 of Canada's *Constitution Act* 1982. Where the Crown's duty to consult is triggered in relation to the proposed project**, the MECP is delegating the procedural aspects of rights-based consultation to the proponent through this letter.** The Crown intends to rely on the delegated consultation process in discharging its duty to consult and maintains the right to participate in the consultation process as it sees fit.

Based on information provided to date and the Crown`s preliminary assessment the proponent is required to consult with the following communities who have been identified as potentially affected by the proposed project:

- Aamjiwnaang First Nation
- Bkejwanong (Walpole Island)
- Caldwell First Nation
- Chippewas of Kettle and Stoney Point
- Chippewas of the Thames First Nation
- Oneida Nation of the Thames First

Steps that the proponent may need to take in relation to Aboriginal consultation for the proposed project are outlined in the "Code of Practice for Consultation in Ontario's Environmental Assessment Process". Additional information related to Ontario's Environmental Assessment Act is available online at: www.ontario.ca/environmentalassessments.

Please also refer to the attached document "A Proponent's Introduction to the Delegation of Procedural Aspects of consultation with Aboriginal Communities" for further information, including the MECP's expectations for EA report documentation related to consultation with communities.

The proponent must contact the Director of Environmental Assessment Branch (EABDirector@ontario.ca) under the following circumstances subsequent to initial discussions with the communities identified by MECP:

- Aboriginal or treaty rights impacts are identified to you by the communities
- You have reason to believe that your proposed project may adversely affect an Aboriginal or treaty right
- Consultation with Indigenous communities or other stakeholders has reached an impasse
- A Part II Order request is expected on the basis of impacts to Aboriginal or treaty rights

The MECP will then assess the extent of any Crown duty to consult for the circumstances and will consider whether additional steps should be taken, including what role you will be asked to play should additional steps and activities be required.

A draft copy of the report should be sent directly to me prior to the filing of the final report, allowing a minimum of 45 days for the ministry's technical reviewers to provide comments.

Please also ensure a copy of the final notice is sent to the ministry's Southwest Region EA notification email account (eanotification.swregion@ontario.ca) after the draft report is reviewed and finalized.

Should you or any members of your project team have any questions regarding the material above, please contact me at mark.badali1@ontario.ca.

Yours truly,

Mark Badali

Mark Badali
Regional Environmental Assessment Coordinator – Southwest Region

cc Sean Morrison, Manager, Sarnia District Office, MECP
Marc Bechard, Water Compliance Supervisor, Sarnia District Office, MECP
Clarence Jubenville, Project Manager, Stantec Consulting Ltd.

Attach: Areas of Interest
A Proponent's Introduction to the Delegation of Procedural Aspects of Consultation with Aboriginal Communities

AREAS OF INTEREST (v. February 2021)

It is suggested that you check off each section after you have considered / addressed it.

☐ **Planning and Policy**

- Projects located in MECP Central Region are subject to **A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2020).** Parts of the study area may also be subject to the Oak Ridges Moraine Conservation Plan (2017), Niagara Escarpment Plan (2017), Greenbelt Plan (2017) or Lake Simcoe Protection Plan (2014). Applicable plans and the applicable policies should be identified in the report, and the proponent should describe how the proposed project adheres to the relevant policies in these plans.

- The **Provincial Policy Statement (2020)** contains policies that protect Ontario's natural heritage and water resources. Applicable policies should be referenced in the report, and the proponent should describe how the proposed project is consistent with these policies.

- In addition to the provincial planning and policy level, the report should also discuss the planning context at the municipal and federal levels, as appropriate.

☐ **Source Water Protection**

The *Clean Water Act*, 2006 (CWA) aims to protect existing and future sources of drinking water. To achieve this, several types of vulnerable areas have been delineated around surface water intakes and wellheads for every municipal residential drinking water system that is located in a source protection area. These vulnerable areas are known as a Wellhead Protection Areas (WHPAs) and surface water Intake Protection Zones (IPZs). Other vulnerable areas that have been delineated under the CWA include Highly Vulnerable Aquifers (HVAs), Significant Groundwater Recharge Areas (SGRAs), Event-based modelling areas (EBAs), and Issues Contributing Areas (ICAs). Source protection plans have been developed that include policies to address existing and future risks to sources of municipal drinking water within these vulnerable areas.

Projects that are subject to the Environmental Assessment Act that fall under a Class EA, or one of the Regulations, have the potential to impact sources of drinking water if they occur in designated vulnerable areas or in the vicinity of other at-risk drinking water systems (i.e. systems that are not municipal residential systems). MEA Class EA projects may include activities that, if located in a vulnerable area, could be a threat to sources of drinking water (i.e. have the potential to adversely affect the quality or quantity of drinking water sources) and the activity could therefore be subject to policies in a source protection plan. Where an activity poses a risk to drinking water, policies in the local source protection plan may impact how or where that activity is undertaken. Policies may prohibit certain activities, or they may require risk management measures for these activities. Municipal Official Plans, planning decisions, Class EA projects (where the project includes an activity that is a threat to drinking water) and prescribed instruments must conform with policies that address significant risks to drinking water and must have regard for policies that address moderate or low risks.

- In October 2015, the MEA Parent Class EA document was amended to include reference to the Clean Water Act (Section A.2.10.6) and indicates that proponents undertaking a Municipal Class EA project must identify early in their process whether a project is or could potentially be occurring with a vulnerable area. **Given this requirement, please include a section in the report on source water protection.**
    - The proponent should identify the source protection area and should clearly document how the proximity of the project to sources of drinking water (municipal or other) and any delineated vulnerable areas was considered and assessed. Specifically, the report should discuss whether or not the project is located in a vulnerable area and provide applicable details about the area.

  - If located in a vulnerable area, proponents should document whether any project activities are prescribed drinking water threats and thus pose a risk to drinking water (this should be consulted on with the appropriate Source Protection Authority). Where an activity poses a risk to drinking water, the proponent must document and discuss in the report how the project adheres to or has regard to applicable policies in the local source protection plan. This section should then be used to inform and be reflected in other sections of the report, such as the identification of net positive/negative effects of alternatives, mitigation measures, evaluation of alternatives etc.

- While most source protection plans focused on including policies for significant drinking water threats in the WHPAs and IPZs it should be noted that even though source protection plan policies may not apply in HVAs, these are areas where aquifers are sensitive and at risk to impacts and within these areas, activities may impact the quality of sources of drinking water for systems other than municipal residential systems.

- In order to determine if this project is occurring within a vulnerable area, proponents can use this mapping tool: http://www.applications.ene.gov.on.ca/swp/en/index.php. Note that various layers (including WHPAs, WHPA-Q1 and WHPA-Q2, IPZs, HVAs, SGRAs, EBAs, ICAs) can be turned on through the “Map Legend” bar on the left. The mapping tool will also provide a link to the appropriate source protection plan in order to identify what policies may be applicable in the vulnerable area.

- For further information on the maps or source protection plan policies which may relate to their project, proponents must contact the appropriate source protection authority. **Please consult with the local source protection authority to discuss potential impacts on drinking water. Please document the results of that consultation within the report and include all communication documents/correspondence.**

More Information
For more information on the *Clean Water Act*, source protection areas and plans, including specific information on the vulnerable areas and drinking water threats, please refer to Conservation Ontario’s website where you will also find links to the local source protection plan/assessment report.

A list of the prescribed drinking water threats can be found in section 1.1 of Ontario Regulation 287/07 made under the *Clean Water Act*. In addition to prescribed drinking water threats, some source protection plans may include policies to address additional “local” threat activities, as approved by the MECP.

☐ Climate Change

The document "Considering Climate Change in the Environmental Assessment Process" (Guide) is now a part of the Environmental Assessment program's Guides and Codes of Practice. The Guide sets out the MECP's expectation for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes. The guide provides examples, approaches, resources, and references to assist proponents with consideration of climate change in EA. Proponents should review this Guide in detail.

- **The MECP expects proponents of Class EA projects to:**

  1. Consider during the assessment of alternative solutions and alternative designs, the following:
     a. the project's expected production of greenhouse gas emissions and impacts on carbon sinks (climate change mitigation); and
     b. resilience or vulnerability of the undertaking to changing climatic conditions (climate change adaptation).
  2. Include a discrete section in the report detailing how climate change was considered in the EA.

How climate change is considered can be qualitative or quantitative in nature and should be scaled to the project’s level of environmental effect. In all instances, both a project's impacts on climate change (mitigation) and impacts of climate change on a project (adaptation) should be considered.

- The MECP has also prepared another guide to support provincial land use planning direction related to the completion of energy and emission plans. The "Community Emissions Reduction Planning: A Guide for Municipalities" document is designed to educate stakeholders on the municipal opportunities to reduce energy and greenhouse gas emissions, and to provide guidance on methods and techniques to incorporate consideration of energy and greenhouse gas emissions into municipal activities of all types. We encourage you to review the Guide for information.

Air Quality, Dust and Noise

- If there are sensitive receptors in the surrounding area of this project, a quantitative air quality/odour impact assessment will be useful to evaluate alternatives, determine impacts and identify appropriate mitigation measures. The scope of the assessment can be determined based on the potential effects of the proposed alternatives, and typically includes source and receptor characterization and a quantification of local air quality impacts on the sensitive receptors and the environment in the study area. The assessment will compare to all applicable standards or guidelines for all contaminants of concern. **Please contact this office for further consultation on the level of Air Quality Impact Assessment required for this project if not already advised.**

- If a quantitative Air Quality Impact Assessment is not required for the project, the MECP expects that the report contain a qualitative assessment which includes:

    - A discussion of local air quality including existing activities/sources that significantly impact local air quality and how the project may impact existing conditions;
    - A discussion of the nearby sensitive receptors and the project's potential air quality impacts on present and future sensitive receptors;
    - A discussion of local air quality impacts that could arise from this project during both construction and operation; and
    - A discussion of potential mitigation measures.

- As a common practice, "air quality" should be used an evaluation criterion for all road projects.

- Dust and noise control measures should be addressed and included in the construction plans to ensure that nearby residential and other sensitive land uses within the study area are not adversely affected during construction activities.

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

- The report should consider the potential impacts of increased noise levels during the operation of the completed project. The proponent should explore all potential measures to mitigate significant noise impacts during the assessment of alternatives.

Ecosystem Protection and Restoration

- Any impacts to ecosystem form and function must be avoided where possible. The report should describe any proposed mitigation measures and how project planning will protect and enhance the local ecosystem.

- Natural heritage and hydrologic features should be identified and described in detail to assess potential impacts and to develop appropriate mitigation measures. The following sensitive environmental features may be located within or adjacent to the study area:
    - Key Natural Heritage Features: Habitat of endangered species and threatened species, fish habitat, wetlands, areas of natural and scientific interest (ANSIs), significant valleylands,

significant woodlands; significant wildlife habitat (including habitat of special concern species); sand barrens, savannahs, and tallgrass prairies; and alvars.

  - Key Hydrologic Features: Permanent streams, intermittent streams, inland lakes and their littoral zones, seepage areas and springs, and wetlands.
  - Other natural heritage features and areas such as: vegetation communities, rare species of flora or fauna, Environmentally Sensitive Areas, Environmentally Sensitive Policy Areas, federal and provincial parks and conservation reserves, Greenland systems etc.

We recommend consulting with the Ministry of Natural Resources and Forestry (MNRF), Fisheries and Oceans Canada (DFO) and your local conservation authority to determine if special measures or additional studies will be necessary to preserve and protect these sensitive features. In addition, you may consider the provisions of the Rouge Park Management Plan if applicable.

☐ **Species at Risk**

- The Ministry of the Environment, Conservation and Parks has now assumed responsibility of Ontario's Species at Risk program. Information, standards, guidelines, reference materials and technical resources to assist you are found at https://www.ontario.ca/page/species-risk.

- The Client's Guide to Preliminary Screening for Species at Risk (Draft May 2019) has been attached to the covering email for your reference and use. Please review this document for next steps.

- For any questions related to subsequent permit requirements, please contact SAROntario@ontario.ca.

☐ **Surface Water**

- The report must include enough information to demonstrate that there will be no negative impacts on the natural features or ecological functions of any watercourses within the study area. Measures should be included in the planning and design process to ensure that any impacts to watercourses from construction or operational activities (e.g. spills, erosion, pollution) are mitigated as part of the proposed undertaking.

- Additional stormwater runoff from new pavement can impact receiving watercourses and flood conditions. Quality and quantity control measures to treat stormwater runoff should be considered for all new impervious areas and, where possible, existing surfaces. The ministry's Stormwater Management Planning and Design Manual (2003) should be referenced in the report and utilized when designing stormwater control methods. **A Stormwater Management Plan should be prepared as part of the Class EA process** that includes:

  - Strategies to address potential water quantity and erosion impacts related to stormwater draining into streams or other sensitive environmental features, and to ensure that adequate (enhanced) water quality is maintained
  - Watershed information, drainage conditions, and other relevant background information
  - Future drainage conditions, stormwater management options, information on erosion and sediment control during construction, and other details of the proposed works
  - Information on maintenance and monitoring commitments.

- Ontario Regulation 60/08 under the *Ontario Water Resources Act* (OWRA) applies to the Lake Simcoe Basin, which encompasses Lake Simcoe and the lands from which surface water drains into Lake Simcoe. If the proposed sewage treatment plant is listed in Table 1 of the regulation, the report should describe how the proposed project and its mitigation measures are consistent with the requirements of this regulation and the OWRA.

- Any potential approval requirements for surface water taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, except for certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information. Additionally, an Environmental Compliance Approval under the OWRA is required for municipal stormwater management works.

☐ **Groundwater**

- The status of, and potential impacts to any well water supplies should be addressed. If the project involves groundwater takings or changes to drainage patterns, the quantity and quality of groundwater may be affected due to drawdown effects or the redirection of existing contamination flows. In addition, project activities may infringe on existing wells such that they must be reconstructed or sealed and abandoned. Appropriate information to define existing groundwater conditions should be included in the report.

- If the potential construction or decommissioning of water wells is identified as an issue, the report should refer to Ontario Regulation 903, Wells, under the OWRA.

- Potential impacts to groundwater-dependent natural features should be addressed. Any changes to groundwater flow or quality from groundwater taking may interfere with the ecological processes of streams, wetlands or other surficial features. In addition, discharging contaminated or high volumes of groundwater to these features may have direct impacts on their function. Any potential effects should be identified, and appropriate mitigation measures should be recommended. The level of detail required will be dependent on the significance of the potential impacts.

- Any potential approval requirements for groundwater taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, with the exception of certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information.

- Consultation with the railroad authorities is necessary wherever there is a plan to use construction dewatering in the vicinity of railroad lines or where the zone of influence of the construction dewatering potentially intercepts railroad lines.

☐ **Excess Materials Management**

- In December 2019, MECP released a new regulation under the Environmental Protection Act, titled "On-Site and Excess Soil Management" (O. Reg. 406/19) to support improved management of excess construction soil. This regulation is a key step to support proper management of excess soils, ensuring valuable resources don't go to waste and to provide clear rules on managing and reusing excess soil. New risk-based standards referenced by this regulation help to facilitate local beneficial reuse which in turn will reduce greenhouse gas emissions from soil transportation, while ensuring strong protection of human health and the environment. The new regulation is being phased in over time, with the first phase in effect on January 1, 2021. For more information, please visit https://www.ontario.ca/page/handling-excess-soil.

- The report should reference that activities involving the management of excess soil should be completed in accordance with O. Reg. 406/19 and the MECP's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014).

- All waste generated during construction must be disposed of in accordance with ministry requirements

☐ **Contaminated Sites**

- Any current or historical waste disposal sites should be identified in the report. The status of these sites should be determined to confirm whether approval pursuant to Section 46 of the EPA may be required for land uses on former disposal sites. We recommend referring to the MECP’s D-4 guideline for land use considerations near landfills and dumps.
    - Resources available may include regional/local municipal official plans and data; provincial data on large landfill sites and small landfill sites; Environmental Compliance Approval information for waste disposal sites on Access Environment.

- Other known contaminated sites (local, provincial, federal) in the study area should also be identified in the report (Note – information on federal contaminated sites is found on the Government of Canada’s website).

- The location of any underground storage tanks should be investigated in the report. Measures should be identified to ensure the integrity of these tanks and to ensure an appropriate response in the event of a spill. The ministry’s Spills Action Centre must be contacted in such an event.

- Since the removal or movement of soils may be required, appropriate tests to determine contaminant levels from previous land uses or dumping should be undertaken. If the soils are contaminated, you must determine how and where they are to be disposed of, consistent with *Part XV.1 of the Environmental Protection Act* (EPA) and Ontario Regulation 153/04, Records of Site Condition, which details the new requirements related to site assessment and clean up. Please contact the appropriate MECP District Office for further consultation if contaminated sites are present.

☐ **Servicing, Utilities and Facilities**

- The report should identify any above or underground utilities in the study area such as transmission lines, telephone/internet, oil/gas etc. The owners should be consulted to discuss impacts to this infrastructure, including potential spills.

- The report should identify any servicing infrastructure in the study area such as wastewater, water, stormwater that may potentially be impacted by the project.

- Any facility that releases emissions to the atmosphere, discharges contaminants to ground or surface water, provides potable water supplies, or stores, transports or disposes of waste must have an Environmental Compliance Approval (ECA) before it can operate lawfully. Please consult with MECP’s Environmental Permissions Branch to determine whether a new or amended ECA will be required for any proposed infrastructure.

- We recommend referring to the ministry’s environmental land use planning guides to ensure that any potential land use conflicts are considered when planning for any infrastructure or facilities related to wastewater, pipelines, landfills or industrial uses.

☐ **Mitigation and Monitoring**

- Contractors must be made aware of all environmental considerations so that all environmental standards and commitments for both construction and operation are met. Mitigation measures should be clearly referenced in the report and regularly monitored during the construction stage of the project. In addition, we encourage proponents to conduct post-construction monitoring to ensure all mitigation measures have been effective and are functioning properly.

- Design and construction reports and plans should be based on a best management approach that centres on the prevention of impacts, protection of the existing environment, and opportunities for rehabilitation and enhancement of any impacted areas.

- The proponent's construction and post-construction monitoring plans must be documented in the report, as outlined in Section A.2.5 and A.4.1 of the MEA Class EA parent document.

☐ **Consultation**

- The report must demonstrate how the consultation provisions of the Class EA have been fulfilled, including documentation of all stakeholder consultation efforts undertaken during the planning process. This includes a discussion in the report that identifies concerns that were raised and **describes how they have been addressed by the proponent** throughout the planning process. The report should also include copies of comments submitted on the project by interested stakeholders, and the proponent's responses to these comments (as directed by the Class EA to include full documentation).

- Please include the full stakeholder distribution/consultation list in the documentation.

☐ **Class EA Process**

- If this project is a Master Plan: there are several different approaches that can be used to conduct a Master Plan, examples of which are outlined in Appendix 4 of the Class EA. **The Master Plan should clearly indicate the selected approach for conducting the plan**, by identifying whether the levels of assessment, consultation and documentation are sufficient to fulfill the requirements for Schedule B or C projects. Please note that any Schedule B or C projects identified in the plan would be subject to Part II Order Requests under the Environmental Assessment Act, although the plan itself would not be. **Please include a description of the approach being undertaken (use Appendix 4 as a reference).**

- If this project is a Master Plan: Any identified projects should also include information on the MCEA schedule associated with the project.

- The report should provide clear and complete documentation of the planning process in order to allow for transparency in decision-making.

- The Class EA requires the consideration of the effects of each alternative on all aspects of the environment (including planning, natural, social, cultural, economic, technical). The report should include a level of detail (e.g. hydrogeological investigations, terrestrial and aquatic assessments, cultural heritage assessments) such that all potential impacts can be identified, and appropriate mitigation measures can be developed. Any supporting studies conducted during the Class EA process should be referenced and included as part of the report.

- Please include in the report a list of all subsequent permits or approvals that may be required for the implementation of the preferred alternative, including but not limited to, MECP's PTTW, EASR Registrations and ECAs, conservation authority permits, species at risk permits, MTO permits and approvals under the *Impact Assessment Act*, 2019.

- Ministry guidelines and other information related to the issues above are available at http://www.ontario.ca/environment-and-energy/environment-and-energy. We encourage you to review all the available guides and to reference any relevant information in the report.

Amendments to the EAA through the Covid-19 Economic Recovery Act, 2020

Once the EA Report is finalized, the proponent must issue a Notice of Completion providing a minimum 30-day period during which documentation may be reviewed and comment and input can be submitted to the proponent. The Notice of Completion must be sent to the appropriate MECP Regional Office email address (for projects in MECP Southwest Region, the email is eanotification.swregion@ontario.ca).

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

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

- a Part II Order request has been submitted to the ministry regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, or
- the Director has issued a Notice of Proposed order regarding the project.

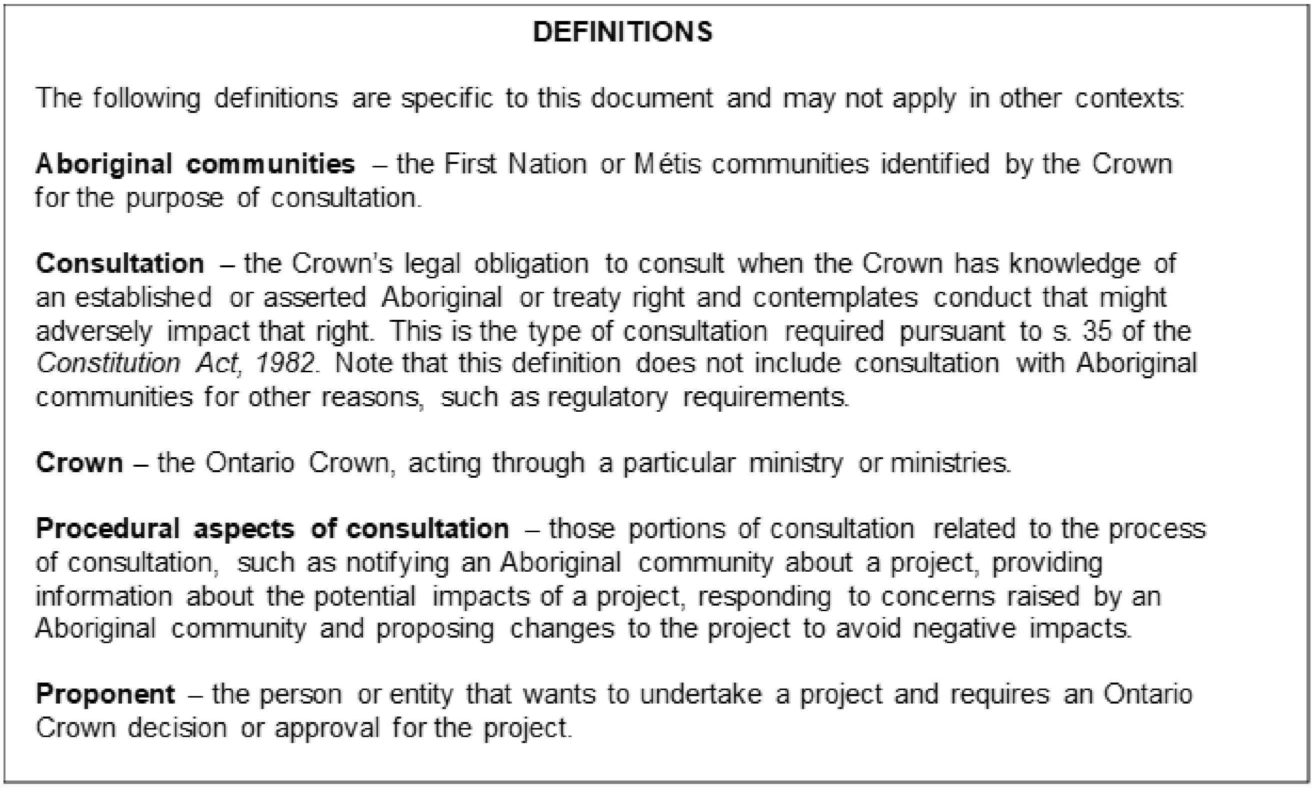
Please ensure that the Notice of Completion advises that outstanding concerns are to be directed to the proponent for a response, and that in the event there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, Part II Order requests on those matters should be addressed in writing to:

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

and

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

A PROPONENT'S INTRODUCTION TO THE DELEGATION OF PROCEDURAL ASPECTS OF CONSULTATION WITH ABORIGINAL COMMUNITIES



DEFINITIONS

The following definitions are specific to this document and may not apply in other contexts:

Aboriginal communities – the First Nation or Métis communities identified by the Crown for the purpose of consultation.

Consultation – the Crown's legal obligation to consult when the Crown has knowledge of an established or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. This is the type of consultation required pursuant to s. 35 of the *Constitution Act, 1982*. Note that this definition does not include consultation with Aboriginal communities for other reasons, such as regulatory requirements.

Crown – the Ontario Crown, acting through a particular ministry or ministries.

Procedural aspects of consultation – those portions of consultation related to the process of consultation, such as notifying an Aboriginal community about a project, providing information about the potential impacts of a project, responding to concerns raised by an Aboriginal community and proposing changes to the project to avoid negative impacts.

Proponent – the person or entity that wants to undertake a project and requires an Ontario Crown decision or approval for the project.

I. PURPOSE

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that may adversely impact that right. In outlining a framework for the duty to consult, the Supreme Court of Canada has stated that the Crown may delegate procedural aspects of consultation to third parties. This document provides general information about the Ontario Crown's approach to delegation of the procedural aspects of consultation to proponents.

This document is not intended to instruct a proponent about an individual project, and it does not constitute legal advice.

II. WHY IS IT NECESSARY TO CONSULT WITH ABORIGINAL COMMUNITIES?

The objective of the modern law of Aboriginal and treaty rights is the *reconciliation* of Aboriginal peoples and non-Aboriginal peoples and their respective rights, claims and interests. Consultation is an important component of the reconciliation process.

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. For example, the Crown's duty to consult is triggered when it considers issuing a permit, authorization or approval for a project which has the potential to adversely impact an Aboriginal right, such as the right to hunt, fish, or trap in a particular area.

The scope of consultation required in particular circumstances ranges across a spectrum depending on both the nature of the asserted or established right and the seriousness of the potential adverse impacts on that right.

Depending on the particular circumstances, the Crown may also need to take steps to accommodate the potentially impacted Aboriginal or treaty right. For example, the Crown may be required to avoid or minimize the potential adverse impacts of the project.

III. THE CROWN’S ROLE AND RESPONSIBILITIES IN THE DELEGATED CONSULTATION PROCESS

The Crown has the responsibility for ensuring that the duty to consult, and accommodate where appropriate, is met. However, the Crown may delegate the procedural aspects of consultation to a proponent.

There are different ways in which the Crown may delegate the procedural aspects of consultation to a proponent, including through a letter, a memorandum of understanding, legislation, regulation, policy and codes of practice.

If the Crown decides to delegate procedural aspects of consultation, the Crown will generally:

- Ensure that the delegation of procedural aspects of consultation and the responsibilities of the proponent are clearly communicated to the proponent;
- Identify which Aboriginal communities must be consulted;
- Provide contact information for the Aboriginal communities;
- Revise, as necessary, the list of Aboriginal communities to be consulted as new information becomes available and is assessed by the Crown;
- Assess the scope of consultation owed to the Aboriginal communities;
- Maintain appropriate oversight of the actions taken by the proponent in fulfilling the procedural aspects of consultation;
- Assess the adequacy of consultation that is undertaken and any accommodation that may be required;
- Provide a contact within any responsible ministry in case issues arise that require direction from the Crown; and
- Participate in the consultation process as necessary and as determined by the Crown.

IV. THE PROPONENT’S ROLE AND RESPONSIBILITIES IN THE DELEGATED CONSULTATION PROCESS

Where aspects of the consultation process have been delegated to a proponent, the Crown, in meeting its duty to consult, will rely on the proponent’s consultation activities and documentation of those activities. The consultation process informs the Crown’s decision of whether or not to approve a proposed project or activity.

A proponent’s role and responsibilities will vary depending on a variety of factors including the extent of consultation required in the circumstance and the procedural aspects of consultation the Crown has delegated to it. Proponents are often in a better position than the Crown to discuss a project and its potential impacts with Aboriginal communities and to determine ways to avoid or minimize the adverse impacts of a project.

A proponent can raise issues or questions with the Crown at any time during the consultation process. If issues or concerns arise during the consultation that cannot be addressed by the proponent, the proponent should contact the Crown.

a) What might a proponent be required to do in carrying out the procedural aspects of consultation?

Where the Crown delegates procedural aspects of consultation, it is often the proponent's responsibility to provide notice of the proposed project to the identified Aboriginal communities. The notice should indicate that the Crown has delegated the procedural aspects of consultation to the proponent and should include the following information:

- a description of the proposed project or activity;
- mapping;
- proposed timelines;
- details regarding anticipated environmental and other impacts;
- details regarding opportunities to comment; and
- any changes to the proposed project that have been made for seasonal conditions or other factors, where relevant.

Proponents should provide enough information and time to allow Aboriginal communities to provide meaningful feedback regarding the potential impacts of the project. Depending on the nature of consultation required for a project, a proponent also may be required to:

- provide the Crown with copies of any consultation plans prepared and an opportunity to review and comment;
- ensure that any necessary follow-up discussions with Aboriginal communities take place in a timely manner, including to confirm receipt of information, share and update information and to address questions or concerns that may arise;
- as appropriate, discuss with Aboriginal communities potential mitigation measures and/or changes to the project in response to concerns raised by Aboriginal communities;
- use language that is accessible and not overly technical, and translate material into Aboriginal languages where requested or appropriate;
- bear the reasonable costs associated with the consultation process such as, but not limited to, meeting hall rental, meal costs, document translation(s), or to address technical & capacity issues;
- provide the Crown with all the details about potential impacts on established or asserted Aboriginal or treaty rights, how these concerns have been considered and addressed by the proponent and the Aboriginal communities and any steps taken to mitigate the potential impacts;
- provide the Crown with complete and accurate documentation from these meetings and communications; and
- notify the Crown immediately if an Aboriginal community not identified by the Crown approaches the proponent seeking consultation opportunities.

b) What documentation and reporting does the Crown need from the proponent?

Proponents should keep records of all communications with the Aboriginal communities involved in the consultation process and any information provided to these Aboriginal communities.

As the Crown is required to assess the adequacy of consultation, it needs documentation to satisfy itself that the proponent has fulfilled the procedural aspects of consultation delegated to it. The documentation required would typically include:

- the date of meetings, the agendas, any materials distributed, those in attendance and copies of any minutes prepared;
- the description of the proposed project that was shared at the meeting;
- any and all concerns or other feedback provided by the communities;
- any information that was shared by a community in relation to its asserted or established Aboriginal or treaty rights and any potential adverse impacts of the proposed activity, approval or disposition on such rights;
- any proposed project changes or mitigation measures that were discussed, and feedback from Aboriginal communities about the proposed changes and measures;
- any commitments made by the proponent in response to any concerns raised, and feedback from Aboriginal communities on those commitments;
- copies of correspondence to or from Aboriginal communities, and any materials distributed electronically or by mail;
- information regarding any financial assistance provided by the proponent to enable participation by Aboriginal communities in the consultation;
- periodic consultation progress reports or copies of meeting notes if requested by the Crown;
- a summary of how the delegated aspects of consultation were carried out and the results; and
- a summary of issues raised by the Aboriginal communities, how the issues were addressed and any outstanding issues.

In certain circumstances, the Crown may share and discuss the proponent's consultation record with an Aboriginal community to ensure that it is an accurate reflection of the consultation process.

c) Will the Crown require a proponent to provide information about its commercial arrangements with Aboriginal communities?

The Crown may require a proponent to share information about aspects of commercial arrangements between the proponent and Aboriginal communities where the arrangements:

- include elements that are directed at mitigating or otherwise addressing impacts of the project;
- include securing an Aboriginal community's support for the project; or
- may potentially affect the obligations of the Crown to the Aboriginal communities.

The proponent should make every reasonable effort to exempt the Crown from confidentiality provisions in commercial arrangements with Aboriginal communities to the extent necessary to allow this information to be shared with the Crown.

The Crown cannot guarantee that information shared with the Crown will remain confidential. Confidential commercial information should not be provided to the Crown as part of the consultation record if it is not relevant to the duty to consult or otherwise required to be submitted to the Crown as part of the regulatory process.

V. WHAT ARE THE ROLES AND RESPONSIBILITIES OF ABORIGINAL COMMUNITIES' IN THE CONSULTATION PROCESS?

Like the Crown, Aboriginal communities are expected to engage in consultation in good faith. This includes:

- responding to the consultation notice;
- engaging in the proposed consultation process;
- providing relevant documentation;
- clearly articulating the potential impacts of the proposed project on Aboriginal or treaty rights; and
- discussing ways to mitigates any adverse impacts.

Some Aboriginal communities have developed tools, such as consultation protocols, policies or processes that provide guidance on how they would prefer to be consulted. Although not legally binding, proponents are encouraged to respect these community processes where it is reasonable to do so. Please note that there is no obligation for a proponent to pay a fee to an Aboriginal community in order to enter into a consultation process.

To ensure that the Crown is aware of existing community consultation protocols, proponents should contact the relevant Crown ministry when presented with a consultation protocol by an Aboriginal community or anyone purporting to be a representative of an Aboriginal community.

VI. WHAT IF MORE THAN ONE PROVINCIAL CROWN MINISTRY IS INVOLVED IN APPROVING A PROPONENT'S PROJECT?

Depending on the project and the required permits or approvals, one or more ministries may delegate procedural aspects of the Crown's duty to consult to the proponent. The proponent may contact individual ministries for guidance related to the delegation of procedural aspects of consultation for ministry-specific permits/approvals required for the project in question. Proponents are encouraged to seek input from all involved Crown ministries sooner rather than later.

Client's Guide to Preliminary Screening for Species at Risk

Ministry of the Environment, Conservation and Parks

Species at Risk Branch, Permissions and Compliance

DRAFT - May 2019

Table of Contents

1.0 Purpose, Scope, Background and Context

1.1 Purpose of this Guide

This guide has been created to:

- help clients better understand their obligation to gather information and complete a preliminary screening for species at risk before contacting the ministry,
- outline guidance and advice clients can expect to receive from the ministry at the preliminary screening stage,
- help clients understand how they can gather information about species at risk by accessing publicly available information housed by the Government of Ontario, and
- provide a list of other potential sources of species at risk information that exist outside the Government of Ontario.

It remains the client's responsibility to:

- carry out a preliminary screening for their projects,
- obtain best available information from all applicable information sources,
- conduct any necessary field studies or inventories to identify and confirm the presence or absence of species at risk or their habitat,
- consider any potential impacts to species at risk that a proposed activity might cause, and
- comply with the *Endangered Species Act* (ESA).

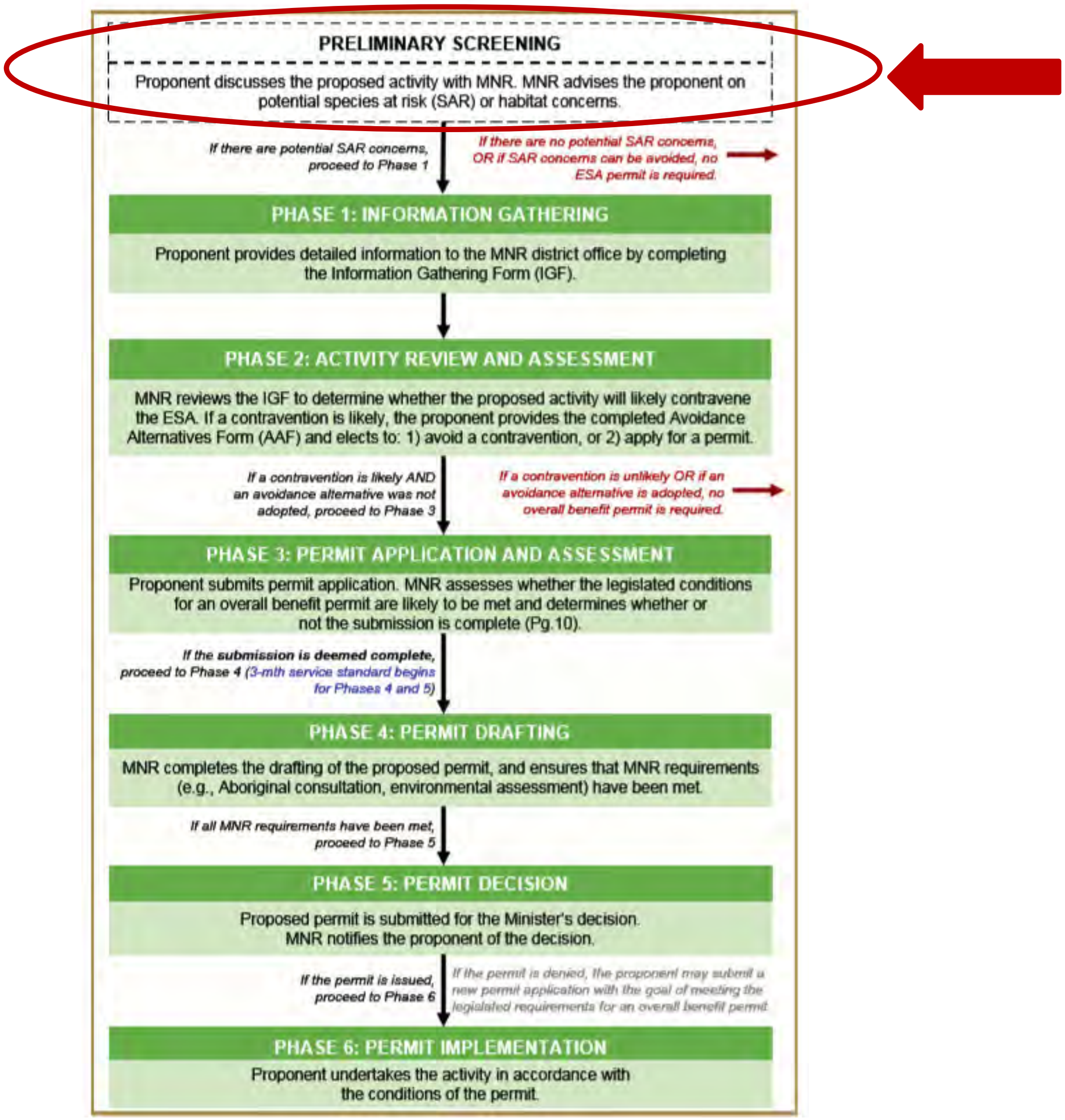
To provide the most efficient service, clients should initiate species at risk screenings and seek information from all applicable information sources identified in this guide, at a minimum, prior to contacting Government of Ontario ministry offices for further information or advice.

1.2 Scope

This guide is a resource for clients seeking to understand if their activity is likely to impact species at risk or if they are likely to trigger the need for an authorization under the ESA. It is not intended to circumvent any detailed site surveys that may be necessary to document species at risk or their habitat nor to circumvent the need to assess the impacts of a proposed activity on species at risk or their habitat. This guide is not an exhaustive list of available information sources for any given area as the availability of information on species at risk and their habitat varies across the province. This guide is intended to support projects and activities carried out on Crown and private land, by private landowners, businesses, other provincial ministries and agencies, or municipal government.

1.3 Background and Context

To receive advice on their proposed activity, clients <u>must first</u> determine whether any species at risk or their habitat exist or are likely to exist at or near their proposed activity, and whether their proposed activity is likely to contravene the ESA. Once this step is complete, clients may contact the ministry at SAROntario@ontario.ca to discuss the main purpose, general methods, timing and location of their proposed activity as well as information obtained about species at risk and their habitat at, or near, the site. At this stage, the ministry can provide advice and guidance to the client about potential species at risk or habitat concerns, measures that the client is considering to avoid adverse effects on species at risk or their habitat and whether additional field surveys are advisable. This is referred to as the “Preliminary Screening” stage. For more information on additional phases in the diagram below, please refer to the *Endangered Species Act Submission Standards for Activity Review and 17(2)(c) Overall Benefit Permits* policy available online at https://www.ontario.ca/page/species-risk-overall-benefit-permits



PRELIMINARY SCREENING

Proponent discusses the proposed activity with MNR. MNR advises the proponent on potential species at risk (SAR) or habitat concerns.

If there are potential SAR concerns, proceed to Phase 1

If there are no potential SAR concerns, OR if SAR concerns can be avoided, no ESA permit is required.

PHASE 1: INFORMATION GATHERING

Proponent provides detailed information to the MNR district office by completing the Information Gathering Form (IGF).

PHASE 2: ACTIVITY REVIEW AND ASSESSMENT

MNR reviews the IGF to determine whether the proposed activity will likely contravene the ESA. If a contravention is likely, the proponent provides the completed Avoidance Alternatives Form (AAF) and elects to: 1) avoid a contravention, or 2) apply for a permit.

If a contravention is likely AND an avoidance alternative was not adopted, proceed to Phase 3

If a contravention is unlikely OR if an avoidance alternative is adopted, no overall benefit permit is required.

PHASE 3: PERMIT APPLICATION AND ASSESSMENT

Proponent submits permit application. MNR assesses whether the legislated conditions for an overall benefit permit are likely to be met and determines whether or not the submission is complete (Pg.10).

*If the **submission is deemed complete**, proceed to Phase 4 (3-mth service standard begins for Phases 4 and 5)*

PHASE 4: PERMIT DRAFTING

MNR completes the drafting of the proposed permit, and ensures that MNR requirements (e.g., Aboriginal consultation, environmental assessment) have been met.

If all MNR requirements have been met, proceed to Phase 5

PHASE 5: PERMIT DECISION

Proposed permit is submitted for the Minister's decision. MNR notifies the proponent of the decision.

If the permit is issued, proceed to Phase 6

If the permit is denied, the proponent may submit a new permit application with the goal of meeting the legislated requirements for an overall benefit permit.

PHASE 6: PERMIT IMPLEMENTATION

Proponent undertakes the activity in accordance with the conditions of the permit.

2.0 Roles and Responsibilities

To provide the most efficient service, clients should initiate species at risk screenings and seek information from all applicable information sources identified in this guide prior to contacting Government of Ontario ministry offices for further information or advice.

Step 1: Client seeks information regarding species at risk or their habitat that exist, or are likely to exist, at or near their proposed activity by referring to all applicable information sources identified in this guide.

Step 2: Client reviews and consider guidance on whether their proposed activity is likely to contravene the ESA (see section 3.4 of this guide for guidance on what to consider).

Step 3: Client gathers information identified in the checklist in section 4 of this guide.

Step 4: Client contacts the ministry at SAROntario@ontario.ca to discuss their preliminary screening. Ministry staff will ask the client questions about the main purpose, general methods, timing and location of their proposed activity as well as information obtained about species at risk and their habitat at, or near, the site. Ministry staff will also ask the client for their interpretation of the impacts of their activity on species at risk or their habitat as well as measures the client has considered to avoid any adverse impacts.

Step 5: Ministry staff will provide advice on next steps.

Option A: Ministry staff may advise the client they can proceed with their activity without an authorization under the ESA where the ministry is confident that:

- no protected species at risk or habitats are likely to be present at or near the proposed location of the activity; or
- protected species at risk or habitats are known to be present but the activity is not likely to contravene the ESA; or
- through the adoption of avoidance measures, the modified activity is not likely to contravene the ESA.

Option B: Ministry staff may advise the client to proceed to Phase 1 of the overall benefit permitting process (i.e. Information Gathering in the previous diagram), where:

- there is uncertainty as to whether any protected species at risk or habitats are present at or near the proposed location of the activity; or
- the potential impacts of the proposed activity are uncertain; or
- ministry staff anticipate the proposed activity is likely to contravene the ESA.

3.0 Information Sources

Land Information Ontario (LIO) and the Natural Heritage Information Centre (NHIC) maintain and provide information about species at risk, as well as related information about fisheries, wildlife, crown lands, protected lands and more. This information is made available to organizations, private individuals, consultants, and developers through online sources and is often considered under various pieces of legislation or as part of regulatory approvals and planning processes.

The information available from LIO or NHIC and the sources listed in this guide should not be considered as a substitute for site visits and appropriate field surveys. Generally, this information can be regarded as a starting point from which to conduct further field surveys, if needed. While this data represents best available current information, it is important to note that a lack of information for a site does not mean that species at risk or their habitat are not present. There are many areas where the Government of Ontario does not currently have information, especially in more remote parts of the province. The absence of species at risk location data at or near your site does not necessarily mean no species at risk are present at that location. On-site assessments can better verify site conditions, identify and confirm presence of species at risk and/or their habitats.

Information on the location (i.e. observations and occurrences) of species at risk is considered sensitive and therefore publicly available only on a 1km square grid as opposed to as a detailed point on a map. This generalized information can help you understand which species at risk are in the general vicinity of your proposed activity and can help inform field level studies you may want to undertake to confirm the presence, or absence of species at risk at or near your site.

Should you require specific and detailed information pertaining to species at risk observations and occurrences at or near your site on a finer geographic scale; you will be required to demonstrate your need to access this information, to complete data sensitivity training and to obtain a Sensitive Data Use License from the NHIC. Information on how to obtain a license can be found online at https://www.ontario.ca/page/get-natural-heritage-information.

Many organizations (e.g. other Ontario ministries, municipalities, conservation authorities) have ongoing licensing to access this data so be sure to check if your organization has this access and consult this data as part of your preliminary screening if your organization already has a license.

3.1 Make a Map: Natural Heritage Areas

The Make a Natural Heritage Area Map (available online at http://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US provides public access to natural heritage information, including species at risk, without the user needing to have Geographic Information System (GIS) capability. It allows users to view and identify generalized species at risk information, mark areas of interest, and create and print a custom map directly from the web application. The tool also shows topographic information such as roads, rivers, contours and municipal boundaries.

Users are advised that sensitive information has been removed from the natural areas dataset and the occurrences of species at risk has been generalized to a 1-kilometre grid to mitigate the risks to the species (e.g. illegal harvest, habitat disturbance, poaching).

The web-based mapping tool displays natural heritage data, including:

- Generalized Species at risk occurrence data (based on a 1-km square grid),
- Natural Heritage Information Centre data.

Data cannot be downloaded directly from this web map; however, information included in this application is available digitally through Land Information Ontario (LIO) at https://www.ontario.ca/page/land-information-ontario.

3.2 Land Information Ontario (LIO)

Most natural heritage data is publicly available. This data is managed in a large provincial corporate database called the LIO Warehouse and can be accessed online through the LIO Metadata Management Tool at https://www.javacoeapp.lrc.gov.on.ca/geonetwork/srv/en/main.home. This tool provides descriptive information about the characteristics, quality and context of the data. Publicly available geospatial data can be downloaded directly from this site.

While most data are publicly available, some data may be considered highly sensitive (i.e. nursery areas for fish, species at risk observations) and as such, access to some data maybe restricted.

3.3 Additional Species at Risk Information Sources

- The Breeding Bird Atlas can be accessed online at http://www.birdsontario.org/atlas/index.jsp?lang=en
- eBird can be accessed online at https://ebird.org/home
- iNaturalist can be accessed online at https://www.inaturalist.org/
- The Ontario Reptile and Amphibian Atlas can be accessed online at https://ontarionature.org/programs/citizen-science/reptile-amphibian-atlas
- Your local Conservation Authority. Information to help you find your local Conservation Authority can be accessed online at https://conservationontario.ca/conservation-authorities/find-a-conservation-authority/

  Local naturalist groups or other similar community-based organizations
- Local Indigenous communities
- Local land trusts or other similar Environmental Non-Government Organizations
- Field level studies to identify if species at risk, or their habitat, are likely present or absent at or near the site.
- When an activity is proposed within one of the continuous caribou ranges, please be sure to consider the caribou Range Management Policy. This policy includes figures and maps of the continuous caribou range, can be found online at https://www.ontario.ca/page/range-management-policy-support-woodland-caribou-conservation-and-recovery

3.4 Information Sources to Support Impact Assessments

- Guidance to help you understand if your activity is likely to adversely impact species at risk or their habitat can be found online at https://www.ontario.ca/page/policy-guidance-harm-and-harass-under-endangered-species-act and https://www.ontario.ca/page/categorizing-and-protecting-habitat-under-endangered-species-act
- A list of species at risk in Ontario is available online at https://www.ontario.ca/page/species-risk-ontario. On this webpage, you can find out more about each species, including where is lives, what threatens it and any specific habitat protections that apply to it by clicking on the photo of the species.

4.0 Check-List

Please feel free to use the check list below to help you confirm you have explored all applicable information sources and to support your discussion with Ministry staff at the preliminary screening stage.

- ✓ Land Information Ontario (LIO)
- ✓ Natural Heritage Information Centre (NHIC)
- ✓ The Breeding Bird Atlas
- ✓ eBird
- ✓ iNaturalist
- ✓ Ontario Reptile and Amphibian Atlas
- ✓ List Conservation Authorities you contacted:____________________________________

  ____
- ✓ List local naturalist groups you contacted:______________________________________

  ____
- ✓ List local Indigenous communities you contacted:________________________________

  ____
- ✓ List any other local land trusts or Environmental Non-Government Organizations you contacted:____

  ____
- ✓ List and field studies that were conducted to identify species at risk, or their habitat, likely to be present or absent at or near the site: _____________________________________

  ____
- ✓ List what you think the likely impacts of your activity are on species at risk and their habitat (e.g. damage or destruction of habitat, killing, harming or harassing species at risk):____

  ____

From: Barboza, Karla (MHSTCI)
To: Hohner, Paula
Cc: Harvey, Joseph (MHSTCI); Wilson, Ian; Mikhael, Fahd; Jubenville, Clarence; agodo@citywindsor.ca
Subject: FW: Prince Road Storm Sewer Outlet Schedule ‘C’ Municipal Class Environmental Assessment - Notice of Study Commencement
Date: Friday, February 26, 2021 4:31:37 PM
Attachments: Prince Rd SS Outfall - Notice of Study Commencement_Feb-26-2021.pdf

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Hi Paula,

I hope this email finds you well.

Thanks for sending the notice of commencement for the Prince Road Storm Sewer Outlet project to the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) .

Please note that there has been some changes in our unit (see full MHSTCI contact below). For this project, (MHSTCI File 0013773), please continue to send any notices and/or information to Joseph Harvey, MHSTCI Heritage Planner, and me. Joseph will review and provide preliminary comments by March 31. You may also want to contact the Ministry of the Environment, Conservation and Parks for an updated Government Review Team List at 416-314-8001 or 1-800-461-6290.

In the meantime, please let us know if you have any questions.

Regards,
Karla

Karla Barboza MCIP, RPP, CAHP | (A) Team Lead, Heritage
Ministry of Heritage, Sport, Tourism and Culture Industries
Heritage, Tourism and Culture Division | Programs and Services Branch | Heritage Planning Unit
T. 416.314.7120 | Email: karla.barboza@ontario.ca

<table>
<tr><th colspan="4">Ministry of Heritage, Sport, Tourism and Culture Industries</th></tr>
<tr><th colspan="4">Heritage, Tourism and Culture Division</th></tr>
<tr><th>Name, Position, Agency and Address</th><th>Document Form</th><th>Phone, Fax and Email</th><th>Types of EA Projects to be Circulated</th></tr>
<tr><td>Karla Barboza, Team Lead(A), Heritage
Heritage Planning Unit
Programs and Services Branch
Ministry of Heritage, Sport, Tourism and Culture Industries
401 Bay Street, Suite 1700
Toronto ON M7A 0A7</td><td>1 electronic/ email copy each (preferred)</td><td>T: 416-314 7120
karla.barboza@ontario.ca</td><td>Receives the initial circulations for all individual and site-specific Class EAs for all regions of the province. The Team Lead will assign to a Heritage Planner for review.

EA matters of province-wide significance (including Parent Class EAs and Environmental Assessment policies and guidelines).</td></tr>
<tr><td colspan="4">Heritage Planners: Site-specific individual and Class EA projects – Heritage Planners review</td></tr>
</table>

site-specific EAs impacts on cultural heritage resources.			
Katherine Kirzati, Heritage Planner Heritage Planning Unit Programs and Services Branch Ministry of Heritage, Sport, Tourism and Culture Industries 401 Bay Street, Suite 1700 Toronto ON M7A 0A7	1 electronic/ email copy each (preferred)	T: 416-728-3494 katherine.kirzati@ontario.ca	Contact Karla Barboza as initial step prior to circulating documents. All individual and site-specific Class EAs for South-western Ontario which covers upper- and single-tier municipalities from Grey, Wellington, Waterloo, Brant and Norfolk, westward, plus Northern Ontario (Kenora, Rainy River, Thunder Bay, Cochrane Algoma).
Laura Hatcher, Heritage Planner Heritage Planning Unit Programs and Services Branch Ministry of Heritage, Sport, Tourism and Culture Industries 401 Bay Street, Suite 1700 Toronto ON M7A 0A7	1 electronic/ email copy each (preferred)	T: 437-239-3404 laura.e.hatcher@ontario.ca	Contact Karla Barboza as initial step prior to circulating documents. All individual and site-specific Class EAs in Central Ontario, which covers upper- and single-tier municipalities of: Hamilton, Halton, Niagara, Peel, Dufferin; Durham, York, Toronto, Simcoe, Muskoka, Kawartha Lakes, Haliburton, Peterborough and Northumberland.
Dan Minkin, Heritage Planner Heritage Planning Unit Programs and Services Branch Ministry of Heritage, Sport, Tourism and Culture Industries 401 Bay Street, Suite 1700 Toronto ON M7A 0A7	1 electronic/ email copy each (preferred)	T: 416-786-7553 dan.minkin@ontario.ca	Contact Karla Barboza as initial step prior to circulating documents. All individual and site-specific Class EAs in Central Ontario, which covers upper- and single-tier municipalities of: Hamilton, Halton, Niagara, Peel, Dufferin; Durham, York, Toronto, Simcoe, Muskoka, Kawartha Lakes, Haliburton, Peterborough and Northumberland.
Joseph Harvey, Heritage Planner(A) Heritage Program Unit Programs and Services Branch Ministry of Heritage, Sport, Tourism and Culture Industries	1 electronic/ email copy each (preferred)	T. 613-242-3743 joseph.harvey@ontario.ca	Contact Karla Barboza as initial step prior to circulating documents.

401 Bay Street, Suite 1700 Toronto ON M7A 0A7			

From: Hohner, Paula <Paula.Hohner@stantec.com>
Sent: February 26, 2021 3:51 PM
Cc: Cerniavskaja, Karina (MNRF) <Karina.Cerniavskaja@ontario.ca>; Zirger, Rosi (MHSTCI) <Rosi.Zirger@ontario.ca>; Marriott, David (OMAFRA) <David.Marriott@ontario.ca>; Brewer-Palhazi, Leslie (IAO) <Leslie.Brewer-Palhazi@ontario.ca>; lisa.wren@dfo-mpo.gc.ca; slaforet@citywindsor.ca; pmizuno@police.windsor.on.ca; Krauter, Bruce (Essex) <bkrauter@countyofessex.on.ca>; James Bryant <jbryant@erca.org>; mnelson@erca.org; planning@erca.org; stan.bulkiewicz@hydroone.com; Regulatory@HydroOne.com; bpeircemarshall@enwin.com; rspagnuolo@enwin.com; mike.cincurak@enbridge.com; bill.sorrell@cogeco.com; david.cowing@bell.ca; Wilson, Ian <IWilson@citywindsor.ca>; Mikhael, Fahd <fmikhael@citywindsor.ca>; Jubenville, Clarence <clarence.jubenville@stantec.com>; Godo, Anna <agodo@citywindsor.ca>
Subject: Prince Road Storm Sewer Outlet Schedule 'C' Municipal Class Environmental Assessment - Notice of Study Commencement

Good afternoon,
On behalf of the City of Windsor and Stantec project team, please see the attached Notice of Study Commencement for the above-mentioned project.
Thank you,
Paula

Paula Hohner, MScPl, MCIP, RPP
Associate, Senior Environmental Planner
Environmental Team Lead - Transportation
Stantec
600-171 Queens Avenue London ON N6A 5J7
Phone: 519-675-6666
Mobile: 226-926-6682
paula.hohner@stantec.com

Ministry of Heritage, Sport,
Tourism and Culture Industries

Programs and Services Branch
401 Bay Street, Suite 1700
Toronto, ON M7A 0A7
Tel: 613.242.3743

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

Direction des programmes et des services
401, rue Bay, Bureau 1700
Toronto, ON M7A 0A7
Tél: 613.242.3743

March 26, 2021 EMAIL ONLY

Clarence Jubenville, P. Eng.
Consultant Project Manager
Stantec Consulting Ltd.
clarence.jubenville@stantec.com

MHSTCI File : 0013773
Proponent : The City of Windsor
Subject : Notice of Study Commencement - Schedule 'C' MCEA
Project : Prince Road Storm Sewer Outlet
Location : The City of Windsor

Dear Clarence Jubenville:

Thank you for providing the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) with the Notice of Study Commencement for the above-referenced project. MHSTCI's interest in this Environmental Assessment (EA) project relates to its mandate of conserving Ontario's cultural heritage.

Under the EA process, the proponent is required to determine a project's potential impact on cultural heritage resources.

Project Summary
The City of Windsor is initiating a Municipal Class Environmental Assessment (EA) study for the proposed storm sewer outlet at McKee Creek. The study is being conducted in accordance with the requirements of Schedule C projects as outlined in the Municipal Class EA document (2000, as amended in 2007, 2011 and 2015), which is approved under the Ontario Environmental Assessment Act.

Identifying Cultural Heritage Resources
While some cultural heritage resources may have already been formally identified, others may be identified through screening and evaluation. Indigenous communities may have knowledge that can contribute to the identification of cultural heritage resources, and we suggest that any engagement with Indigenous communities includes a discussion about known or potential cultural heritage resources that are of value to these communities. Municipal Heritage Committees, historical societies and other local heritage organizations may also have knowledge that contributes to the identification of cultural heritage resources.

Archaeological Resources

This EA project may impact archaeological resources and should be screened using the MHSTCI *Criteria for Evaluating Archaeological Potential* to determine if an archaeological assessment is needed. MHSTCI archaeological sites data are available at *archaeology@ontario.ca*. If the EA project area exhibits archaeological potential, then an archaeological assessment (AA) should be undertaken by an archaeologist licenced under the *OHA*, who is responsible for submitting the report directly to MHSTCI for review.

Built Heritage Resources and Cultural Heritage Landscapes

The MHSTCI *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes* should be completed to help determine whether this EA project may impact cultural heritage resources. If potential or known heritage resources exist, MHSTCI recommends that a Heritage Impact Assessment (HIA), prepared by a qualified consultant, should be completed to assess potential project impacts. Our Ministry's *Info Sheet #5: Heritage Impact Assessments and Conservation Plans* outlines the scope of HIAs. Please send the HIA to for review and make it available to local organizations or individuals who have expressed interest in review.

Environmental Assessment Reporting

All technical cultural heritage studies and their recommendations are to be addressed and incorporated into EA projects. Please advise MHSTCI whether any technical cultural heritage studies will be completed for this EA project, and provide them to MHSTCI before issuing a Notice of Completion or commencing any work on the site. If screening has identified no known or potential cultural heritage resources, or no impacts to these resources, please include the completed checklists and supporting documentation in the EA report or file.

Thank you for consulting MHSTCI on this project and please continue to do so throughout the EA process. If you have any questions or require clarification, do not hesitate to contact me.

Sincerely,

Joseph Harvey
Heritage Planner
joseph.harvey@Ontario.ca

Copied to: Paula Hohner, Associate Senior Environmental Planner, Stantec
Ian Wilson, Engineering Department, City of Windsor

It is the sole responsibility of proponents to ensure that any information and documentation submitted as part of their EA report or file is accurate. MHSTCI makes no representation or warranty as to the completeness, accuracy or quality of the any checklists, reports or supporting documentation submitted as part of the EA process, and in no way shall MHSTCI be liable for any harm, damages, costs, expenses, losses, claims or actions that may result if any checklists, reports or supporting documents are discovered to be inaccurate, incomplete, misleading or fraudulent.

Please notify MHSTCI if archaeological resources are impacted by EA project work. All activities impacting archaeological resources must cease immediately, and a licensed archaeologist is required to carry out an archaeological assessment in accordance with the *Ontario Heritage Act* and the *Standards and Guidelines for Consultant Archaeologists*.

If human remains are encountered, all activities must cease immediately and the local police as well as the Registrar, Burials of the Ministry of Government and Consumer Services (416-326-8800) must be contacted. In situations where human remains are associated with archaeological resources, MHSTCI should also be notified to ensure that the site is not subject to unlicensed alterations which would be a contravention of the *Ontario Heritage Act*.

APPENDIX A

Essex Region Conservation Authority Consultation

From:	Hohner, Paula
To:	Lang, Sarah
Subject:	FW: Prince Road Storm Sewer Outlet Schedule ‘C’ Municipal Class Environmental Assessment - Notice of Study Commencement
Date:	Wednesday, July 7, 2021 10:22:15 AM
Attachments:	Prince Rd SS Outfall - Notice of Study Commencement_Feb-26-2021.pdf Prince Rd Storm Sewer Outlet - ERCA.pdf image006.png

---

FYI and filing

Paula Hohner, MScPl, MCIP, RPP
Associate, Senior Environmental Planner
Environmental Team Lead - Transportation
Stantec
600-171 Queens Avenue London ON N6A 5J7
Phone: 519-675-6666
Mobile: 226-926-6682
paula.hohner@stantec.com

From: Wilson, Ian <IWilson@citywindsor.ca>
Sent: Tuesday, July 06, 2021 4:27 PM
To: 'regs@erca.org' <regs@erca.org>
Cc: James Bryant <jbryant@erca.org>; 'Tian Martin' <TMartin@erca.org>; Jubenville, Clarence <clarence.jubenville@stantec.com>; Hohner, Paula <Paula.Hohner@stantec.com>
Subject: FW: Prince Road Storm Sewer Outlet Schedule ‘C’ Municipal Class Environmental Assessment - Notice of Study Commencement

Hi James and Tian,

We would like to setup a meeting to consult with ERCA for the Prince Rd Storm Sewer Outlet Schedule C MCEA. The meeting would likely be an hour and **we ask that you provide a few available openings in the next 3 to 4 weeks**. Stantec will then send out an invite with virtual meeting information. Thank you,

At the meeting we will go over the project in detail covering:

- Study Area
- Problems & Opportunities
- Municipal Class EA Process & Key Activities
- Site Constraints/Design Considerations
- Alternative Design Options
- Project Schedule & Next Steps

Attach are:

- Project notice of commencement.
- Alternatives being considered for the outlet.

Ian Wilson, P. Eng., MASc. | Engineer II

Engineering Department
350 City Hall Square West | Suite 310 | Windsor, ON | N9A 6S1
To reach me by phone, please call my cell.
(C): 519-791-2706
www.citywindsor.ca

From: Hohner, Paula
Sent: Tuesday, May 18, 2021 11:11 AM
To: jbryant@erca.org
Cc: Wilson, Ian <IWilson@citywindsor.ca>; Jubenville, Clarence <clarence.jubenville@stantec.com>; Godo, Anna <agodo@citywindsor.ca>; Lang, Sarah <Sarah.Lang@stantec.com>
Subject: FW: Prince Road Storm Sewer Outlet Schedule ‘C’ Municipal Class Environmental Assessment - Notice of Study Commencement

Good morning James,
I am working with the City of Windsor on the above-referenced Class EA for the Prince Road storm sewer outlet. The project team would like to arrange a teleconference with you to provide you with an overview of the project, status of the EA project and discuss any questions or comments you may have. We are looking at the following potential dates for approximately an hour:

- June 21 – after 2pm
- June 22 – morning
- June 23 – morning

Please let me know if any of the dates noted above will work for you.
Thank you
Paula

Paula Hohner, MScPl, MCIP, RPP
Associate, Senior Environmental Planner
Environmental Team Lead - Transportation
Stantec
600-171 Queens Avenue London ON N6A 5J7
Phone: 519-675-6666
Mobile: 226-926-6682
paula.hohner@stantec.com

[redacted]http://www.stantec.com/" style='position:absolute;margin-left:0;margin-top:0;width:75pt;height:20.25pt;z-index:251661312;visibility:visible;mso-wrap-style:square;mso-width-percent:0;mso-height-percent:0;mso-wrap-distance-left:0;mso-wrap-distance-top:0;mso-wrap-distance-right:0;mso-wrap-distance-bottom:0;mso-position-horizontal:left;mso-position-horizontal-relative:text;mso-position-vertical:absolute;mso-position-vertical-relative:line;mso-width-percent:0;mso-height-percent:0;mso-width-relative:page;mso-height-relative:page' o:allowoverlap="f" o:button="t"> http://www.stantec.com/content/dam/stantec/images/esignature/stantec.png" />

From: Hohner, Paula
Sent: Friday, February 26, 2021 3:51 PM
Cc:
Subject: Prince Road Storm Sewer Outlet Schedule ‘C’ Municipal Class Environmental Assessment - Notice of Study Commencement

Good afternoon,
On behalf of the City of Windsor and Stantec project team, please see the attached Notice of Study Commencement for the above-mentioned project.
Thank you,
Paula

Paula Hohner, MScPl, MCIP, RPP
Associate, Senior Environmental Planner
Environmental Team Lead - Transportation
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[redacted] http://www.stantec.com/" style='position:absolute;margin-left:0;margin-top:0;width:75pt;height:20.25pt;z-index:251659264;visibility:visible;mso-wrap-style:square;mso-width-percent:0;mso-height-percent:0;mso-wrap-distance-left:0;mso-wrap-distance-top:0;mso-wrap-distance-right:0;mso-wrap-distance-bottom:0;mso-position-horizontal:left;mso-position-horizontal-relative:text;mso-position-vertical:absolute;mso-position-vertical-relative:line;mso-width-percent:0;mso-height-percent:0;mso-width-relative:page;mso-height-relative:page' o:allowoverlap="f" o:button="t"> http://www.stantec.com/content/dam/stantec/images/esignature/stantec.png" />

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2021-4-23 09:25am BY: kfox

Stantec

Stantec
100-2555 Ouellette Avenue
Windsor ON Canada N8X 1L9
Tel: 519.966.2250
www.stantec.com

Legend

Notes

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

File Name: 165620224_EXISTING	K.F.F.	C.R.G.J.	C.R.G.J.	2021.03.05
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit/Seal

**PRELIMINARY
NOT FOR
CONSTRUCTION**

Not for permits, pricing or other official purposes. This document has not been completed or checked and is for general information or comment only.

Client/Project
CORPORATION OF THE CITY OF WINDSOR

PRINCE ROAD SEWER SYSTEM
PHASES 9B

City of Windsor, Ontario

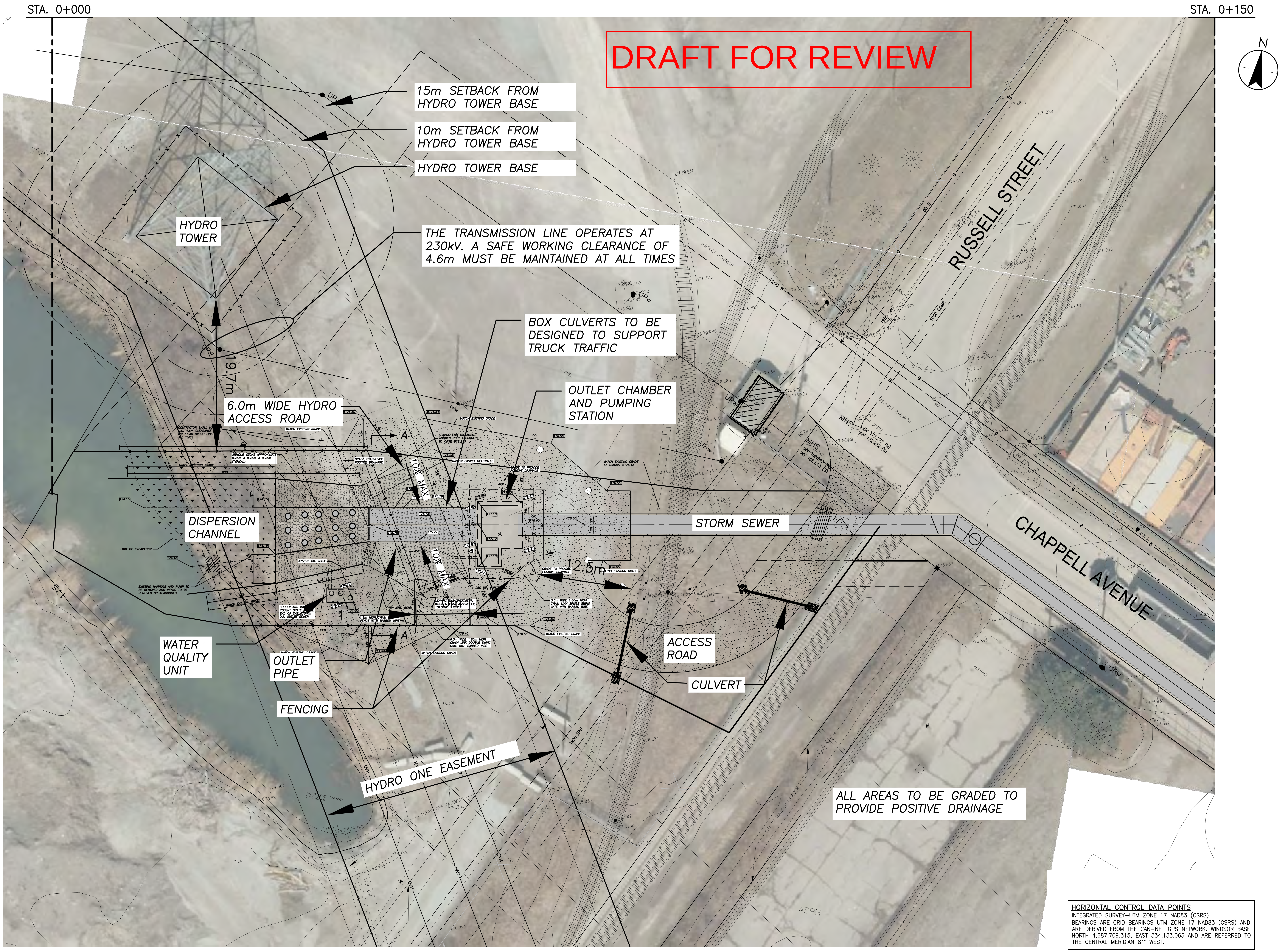
Title
EXISTING CONDITIONS

Project No.
165620224

Scale
1:250

Revision

Drawing No.
EX



HORIZONTAL CONTROL DATA POINTS
INTEGRATED SURVEY–UTM ZONE 17 NAD83 (CSRS)
BEARINGS ARE GRID BEARINGS UTM ZONE 17 NAD83 (CSRS) AND ARE DERIVED FROM THE CAN–NET GPS NETWORK. WINDSOR BASE NORTH 4,687,709.315, EAST 334,133.063 AND ARE REFERRED TO THE CENTRAL MERIDIAN 81° WEST.

TOTAL PIPE LENGTH ON PRIVATE PROPERTY
OUTLET PIPE – 14.0m
STORM SEWER – 56.0m

TOTAL EASEMENT LAND AREAS	*PERMANENT*	*TEMPORARY*
ETR	*0.002 ha*	*0.004 ha*
COCO PAVING	*0.159 ha*	*0.123 ha*
HYDRO ONE EASEMENT	*0.074 ha*	*0.130 ha*
(COCO PAVING)		

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2021-4-27 03:04pm BY: kfox

Stantec

Stantec
100-2555 Ouellette Avenue
Windsor ON Canada N8X 1L9
Tel: 519.966.2250
www.stantec.com

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176.56	PROPOSED FINISHED GRADE

Notes

Revision	By	Appd.	YY.MM.DD

Issued	By	Appd.	YY.MM.DD

File Name: 165620224_OPTION_1	K.F.F.	C.R.G.J.	C.R.G.J.	2021.03.05
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit/Seal

PRELIMINARY
NOT FOR
CONSTRUCTION

Not for permits, pricing or other official purposes. This document has not been completed or checked and is for general information or comment only.

Client/Project
CORPORATION OF THE CITY OF WINDSOR

PRINCE ROAD SEWER SYSTEM
PHASES 9B

City of Windsor, Ontario

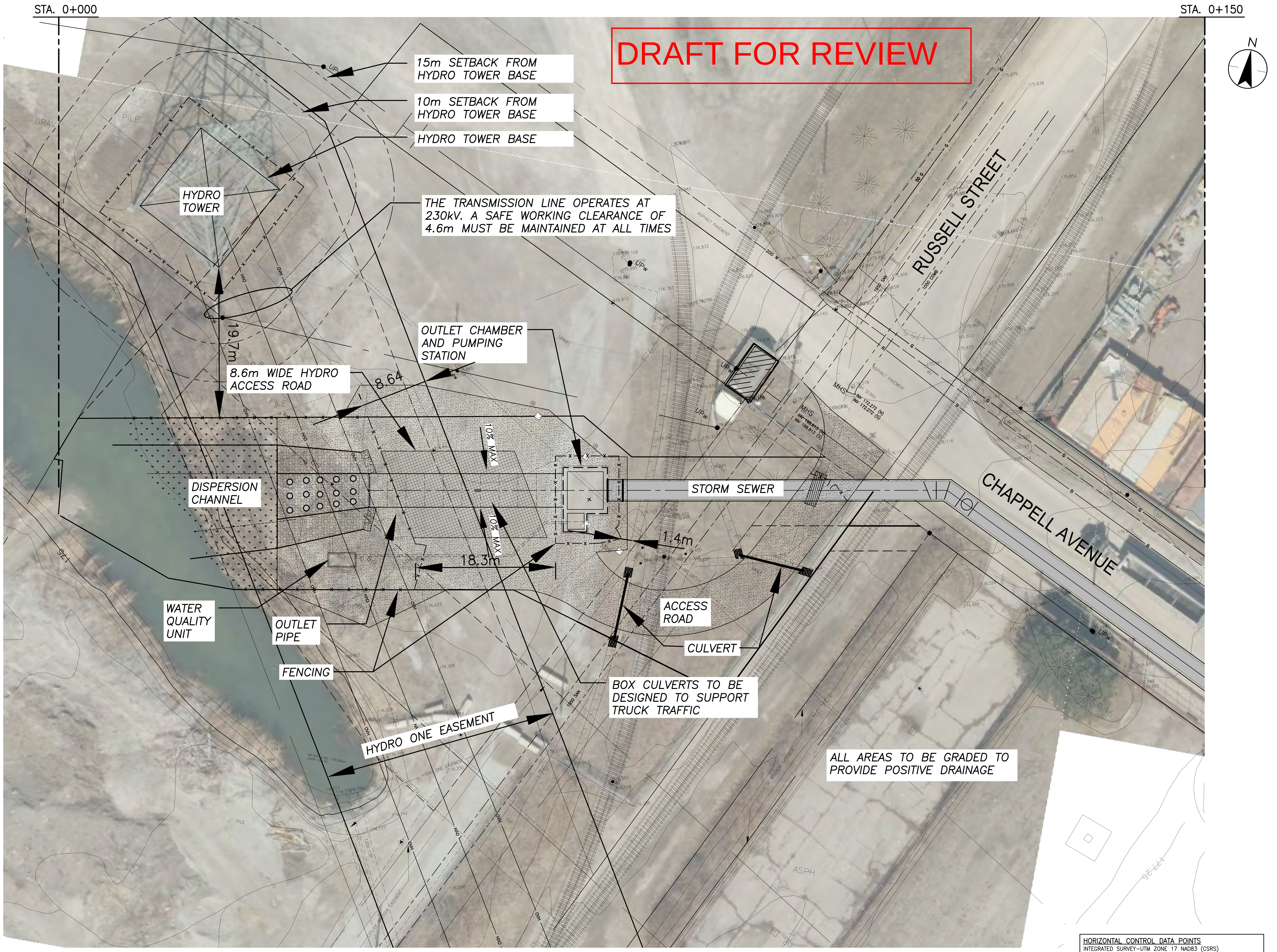
Title
OPTION 1
ALIGNMENT MIDWAY BETWEEN HYDRO TOWER & EAST END OF CREEK WITH P.S. CLOSE TO HYDRO EASEMENT

Project No.
165620224

Scale
1:250

Revision

Drawing No.
OP-1



TOTAL PIPE LENGTH ON PRIVATE PROPERTY
OUTLET PIPE – 25.5m
STORM SEWER – 45.0m

TOTAL EASEMENT LAND AREAS	*PERMANENT*	*TEMPORARY*
ETR	0.002 ha	0.004 ha
COCO PAVING	0.163 ha	0.123 ha
HYDRO ONE EASEMENT (COCO PAVING)	0.074 ha	0.130 ha

HORIZONTAL CONTROL DATA POINTS
INTEGRATED SURVEY–UTM ZONE 17 NAD83 (CSRS)
BEARINGS ARE GRID BEARINGS UTM ZONE 17 NAD83 (CSRS) AND ARE DERIVED FROM THE CAN–NET GPS NETWORK. WINDSOR BASE NORTH 4,687,709.315, EAST 334,133.063 AND ARE REFERRED TO THE CENTRAL MERIDIAN 81° WEST.

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2021–4–27 03:01pm BY: kfox

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Legend

Notes

Revision | By | Appd. | YY.MM.DD

Issued | By | Appd. | YY.MM.DD

File Name: 165620224_OPTION_2	K.F.F.	C.R.G.J.	C.R.G.J.	2021.03.05
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit/Seal

PRELIMINARY
NOT FOR
CONSTRUCTION
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Client/Project
CORPORATION OF THE CITY OF WINDSOR

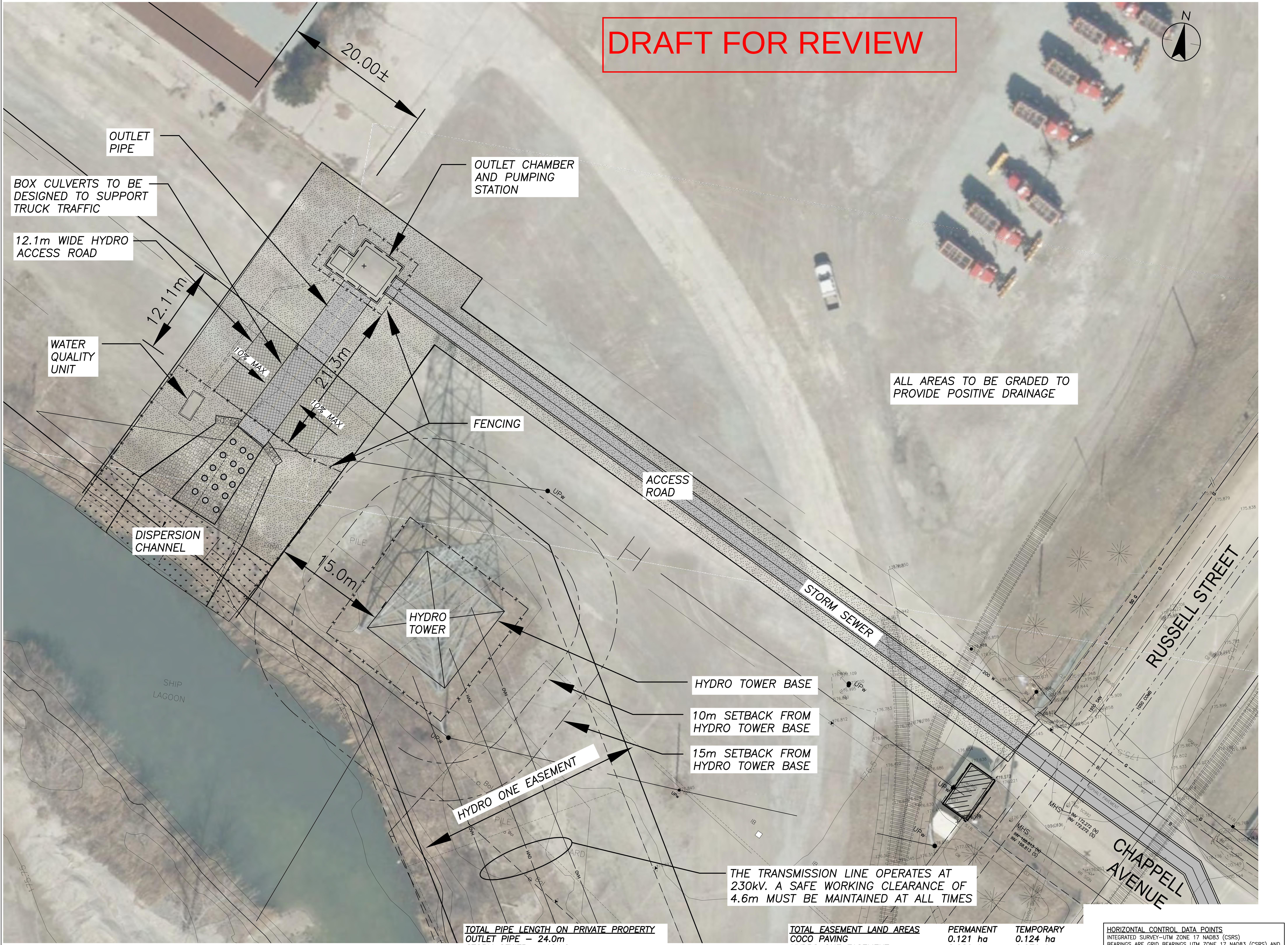
PRINCE ROAD SEWER SYSTEM
PHASES 9B

City of Windsor, Ontario

Title
OPTION 2
ALIGNMENT MIDWAY BETWEEN HYDRO TOWER & EAST END OF CREEK WITH P.S. CLOSE TO RAILWAY

Project No. 165620224
Scale 1:250

Revision
Drawing No. **OP-2**



<u>TOTAL PIPE LENGTH ON PRIVATE PROPERTY</u>
OUTLET PIPE – 24.0m
STORM SEWER – 104.0m

<u>TOTAL EASEMENT LAND AREAS</u>	PERMANENT	TEMPORARY
COCO PAVING	0.121 ha	0.124 ha
HYDRO ONE EASEMENT (COCO PAVING)	0.080 ha	0.079 ha

<u>HORIZONTAL CONTROL DATA POINTS</u>
INTEGRATED SURVEY–UTM ZONE 17 NAD83 (CSRS)
BEARINGS ARE GRID BEARINGS UTM ZONE 17 NAD83 (CSRS) AND ARE DERIVED FROM THE CAN–NET GPS NETWORK. WINDSOR BASE NORTH 4,687,709.315, EAST 334,133.063 AND ARE REFERRED TO THE CENTRAL MERIDIAN 81° WEST.

\\cd1223-f01\work_group\01656\active\165620224\design\drawing\civil\165620224_OPTION_3.dwg
2021-4-27 02:57pm BY: kfox

Stantec

Stantec
100-2555 Ouellette Avenue
Windsor ON Canada N8X 1L9
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www.stantec.com

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Legend

Notes

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Issued	By	Appd.	YY.MM.DD

File Name: 165620224_OPTION_3	K.F.F.	C.R.G.J.	C.R.G.J.	2021.03.05
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

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Client/Project
CORPORATION OF THE CITY OF WINDSOR

PRINCE ROAD SEWER SYSTEM
PHASES 9B

City of Windsor, Ontario

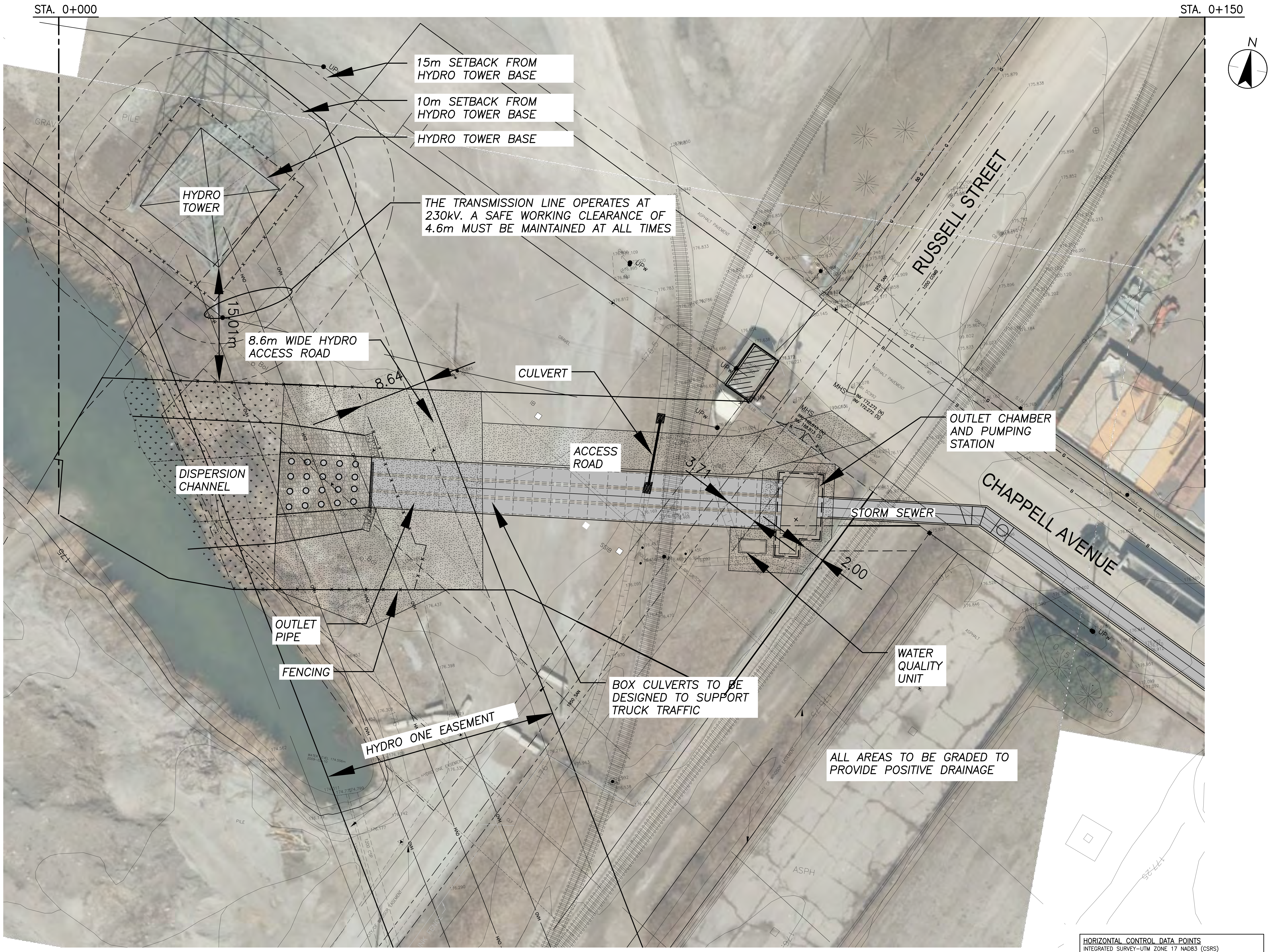
Title
OPTION 3
ALIGNMENT JUST NORTH OF HYDRO TOWER
WITH P.S. CLOSE TO EXISTING BUILDING

Project No.
165620224

Scale
1:250

Revision

Drawing No.
OP-3



HORIZONTAL CONTROL DATA POINTS
INTEGRATED SURVEY–UTM ZONE 17 NAD83 (CSRS)
BEARINGS ARE GRID BEARINGS UTM ZONE 17 NAD83 (CSRS) AND ARE DERIVED FROM THE CAN–NET GPS NETWORK. WINDSOR BASE NORTH 4,687,709.315, EAST 334,133.063 AND ARE REFERRED TO THE CENTRAL MERIDIAN 81° WEST.

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Notes

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Issued	By	Appd.	YY.MM.DD
File Name: 165620224_OPTION_4	K.F.F.	C.R.G.J.	C.R.G.J.	2021.03.05
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit/Seal

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Client/Project
CORPORATION OF THE CITY OF WINDSOR

PRINCE ROAD SEWER SYSTEM
PHASES 9B

City of Windsor, Ontario

Title
OPTION 4
ALIGNMENT MIDWAY BETWEEN HYDRO
TOWER & EAST END OF CREEK WITH
P.S. CLOSE TO CHAPPELL AVENUE

Project No.
165620224

Scale
1:250

Revision

Drawing No.
OP-4

Meeting Notes

Stakeholder Meeting #1 – Essex Region Conservation Authority (ERCA)

Prince Road Storm Sewer Outlet Municipal Class Environmental Assessment / 165620224

Date/Time:	July 28, 2021 / 11:00 AM
Place:	Microsoft Teams
Attendees:	Tian Martin, ERCA James Bryant, ERCA Ian Wilson, City of Windsor Anna Godo, City of Windsor Clarence Jubenville, Stantec Consulting Ltd. Paula Hohner, Stantec Consulting Ltd.
Distribution:	Attendees

Item: **Action:**

Introductions & Presentation

Attendees introduced themselves and provided an overview of the project team. Stantec provided a brief slide presentation of the project, including background information, and previous studies completed. In addition, four alternative designs were presented for the preferred alternative solution.

Background Information

In 2001, the City completed the Prince Road Sewer Study which was the guiding document for the design of the separation of the combined sanitary/storm sewer system in the Prince Road sewershed. The study recommended construction of the Prince Road trunk sewer to its current location on Chappell Avenue between Sandwich Street and Russell Street.

In 2020, the City of Windsor completed Sewer & Coastal Flood Protection Master Plan to understand the cause of widespread floods throughout the City and to identify and evaluate short and long-term solutions to mitigate the issue.

The Master Plan recommended that the Prince Road storm sewer at Chappell Avenue is to outlet to McKee Creek.

Purpose of Municipal Class EA Study

A New Outlet and Dewatering Pump Station would be completed through the installation of approximately 140m of new storm sewer west of the intersection of Chappell Avenue and Sandwich Street, to a new outfall to the McKee Creek. A dewatering pump station would be required to drawdown the storm system after a rain event.

The purpose of this Schedule C Municipal Class Environmental Assessment study is to establish a preferred location and design of the outlet and the associated pumping station. The 2020 Master Plan completed Phase 1

Item: **Action:**

(Identification of the Problems & Opportunities and review of existing conditions) and Phase 2 (Development and Assessment of Alternative Solutions). This study will complete Phase 3 (Development and Assessment of Alternative Designs) and Phase 4 (Summary of the EA process and Preferred Design in an Environmental Study Report).

Alternative Designs

Four design options were presented and discussed.

Option 1 - Outlet chamber close to hydro easement

The existing 2400 mm dia. concrete storm sewer to be extended westerly with a 2700 mm dia. sewer along Chappell Ave, across ETR and along Coco Paving property to a new outlet chamber and pumping station.

From the outlet structure, a twinned gravity sewer (2 – 1800 mm x 1200 mm concrete box sewers) will outlet to a dispersion channel and ultimately to the existing McKee Creek. During severe storm events, flows may also pass through emergency overflow openings in the top of the outlet chamber overland to the dispersion channel.

The sewer system will be dewatered with the pumping station discharging flows through a water quality unit and ultimately to the dispersion channel.
A permanent easement would be required across ETR property, Coco Paving property and Coco Paving property subject to a Hydro One easement. An access road with drainage culverts across the properties would be required to access the infrastructure.

A temporary easement would be required across ETR property, Coco Paving property and Coco Paving property subject to a Hydro One easement, north and south of the permanent easements to facilitate construction.

Access for a permanent easement would be from Coco Paving lands just west of the ETR property from Chappell Ave / Russell St intersection. A lockable gate would be required at this location. Fencing is also proposed around the outlet chamber / pumping station and around the dispersion channel.

In this option, the outlet chamber and pumping station is located as close to the Hydro One easement as possible to still maintain access to Hydro One along their easement.

Option 2 - Outlet chamber close to rail line

The existing 2400 mm dia. concrete storm sewer to be extended westerly with a 2700 mm dia. sewer along Chappell Ave, across ETR and along Coco Paving property to a new outlet chamber and pumping station.

From the outlet structure, a twinned gravity sewer (2 – 1800 mm x 1200 mm concrete box sewers) will outlet to a dispersion channel and ultimately to the existing McKee Creek. During severe storm events, flows may also pass

Item: **Action:**

through emergency overflow openings in the top of the outlet chamber overland to the dispersion channel.

The sewer system will be dewatered with the pumping station discharging flows through a water quality unit and ultimately to the dispersion channel.

A permanent easement would be required across ETR property, Coco Paving property and Coco Paving property subject to a Hydro One easement. An access road with drainage culverts across the properties would be required to access the infrastructure.

A temporary easement would be required across ETR property, Coco Paving property and Coco Paving property subject to a Hydro One easement, north and south of the permanent easements to facilitate construction.

Access for a permanent easement would be from Coco Paving lands just west of the ETR property from Chappell Ave / Russell St intersection. A lockable gate would be required at this location. Fencing is also proposed around the outlet chamber / pumping station and around the dispersion channel.

In this option, the outlet chamber and pumping station is located as close to the ETR Property as possible.

Option 3 - Outlet chamber close to existing office building

In this option, the outlet chamber and pumping station is located northwest of the existing hydro tower close to the existing building.

This option was screened out after discussing with the property owner due to potential impacts to existing business operations.

Option 4 – Outlet chamber at intersection of Chappell Ave / Russell St intersection

The existing 2400 mm dia. concrete storm sewer to be extended westerly with a 2700 mm dia. sewer along Chappell Ave, across ETR and along Coco Paving property to a new outlet chamber and pumping station located between ETR and the private railway spur line at the Coco Paving property.

From the outlet structure, three gravity sewers (3 – 1800 mm x 1200 mm concrete box sewers) will outlet to a dispersion channel and ultimately to the existing McKee Creek.

The sewer system will be dewatered with the pumping station discharging flows through a water quality unit and ultimately to one of the 1800 mm x 1200 mm concrete box sewers.

A permanent easement would be required across the ETR property, Coco Paving property and Coco Paving property subject to a Hydro One easement. An access road with drainage culverts across the properties would be required to access the infrastructure.

Item:	**Action:**
A temporary easement would be required across the ETR property, Coco Paving property and Coco Paving property subject to a Hydro One easement, north and south of the permanent easements to facilitate construction. Access for a permanent easement would be from Coco Paving lands just west of the ETR property from Chappell Ave / Russell St intersection. A lockable gate would be required at this location. Fencing is also proposed around the outlet chamber / pumping station and around the dispersion channel. With this option, the outlet chamber would have to be larger than Options 1 or 2 to accommodate a third box sewer outlet to the McKee Creek. This option is similar to the other options but accommodates extra flow underground and has minimal impacts to the Coco Paving operations.	
Environmental Field Review	
Stantec reported that aquatic and terrestrial habitat assessments were completed on July 9th, 2021. Habitat along McKee Creek is appropriate for Foxsnake (species at risk), and project is within regulated habitat area for the species – an Information Gathering Form will be required during Detailed Design. Barn Swallow were noted foraging in the area. Potential for nesting Barn Swallow (species at risk) in area – no structures to be impacted by project. Fish habitat is confirmed in McKee Creek and species at risk habitat is documented by DFO – a Request for Review may be required. A Stage 1 Archaeological Assessment was completed on July 9th, 2021, and draft report is pending. No further archaeological assessment anticipated to be required.	
Discussion & Questions	
ERCA shared the following comments: • Option 4 accommodates extra flow with minimal impacts and there is no real downstream impact associated with the project. • Approvals will be required through ERCA during detailed design, prior to construction. • The water quality unit is required as per the previously reviewed design from 2011. It is acceptable to use whatever size is reasonable that fits in the location. • Erosion and velocity control through the dispersion channel meets ERCA's requirements.	

Item:	**Action:**
• Circulate draft Environmental Study Report to ERCA for review prior to the 30-day public review period.	Stantec/City

The meeting adjourned at 11:40 AM

The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

Stantec Consulting Ltd.

Paula Hohner MScPl, MCIP, RPP
Senior Environmental Planner
Phone: 519-675-6666
paula.hohner@stantec.com

Attachment: presentation

City of Windsor
Prince Road Storm Sewer Outlet Schedule 'C' Municipal Class Environmental Assessment

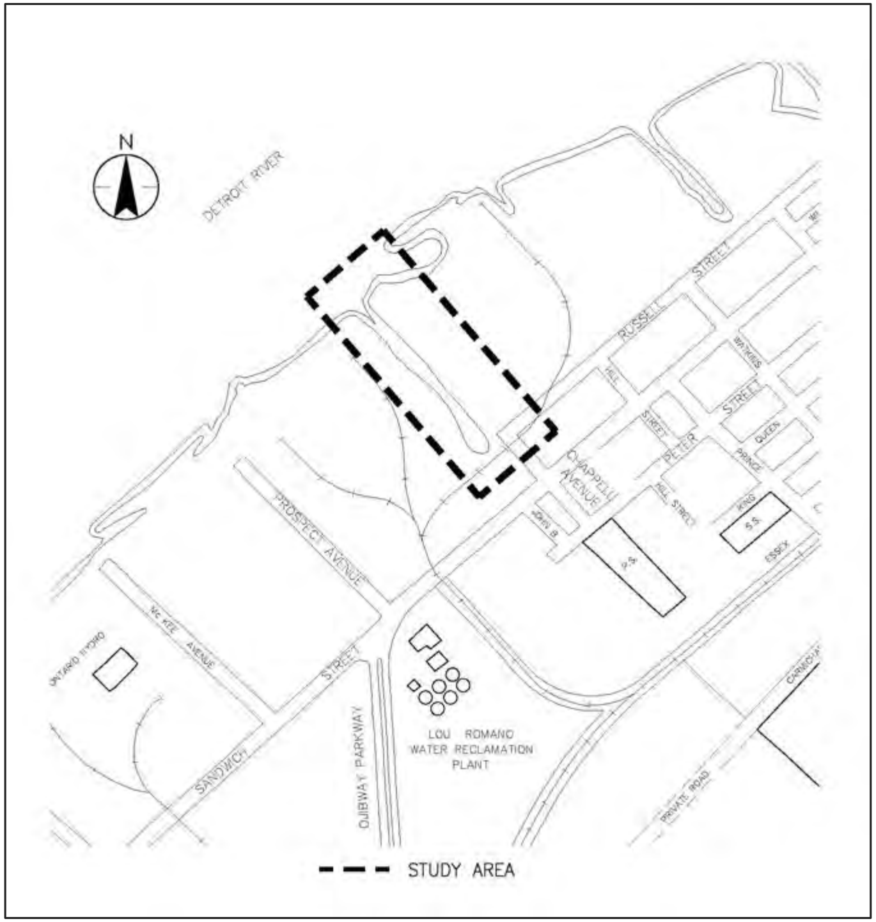
ERCA Meeting
#1

Agenda

1. Study Area
2. Problems & Opportunities
3. Background Studies
4. Municipal Class EA Process & Key Activities
5. Site Constraints/Design Considerations
6. Alternative Design Options
7. Project Schedule & Next Steps

Study Area

The study area is defined to the west by the Detroit River, to the east by the west limit of the existing storm sewer along Chappell Avenue, and to the north and south on either side of McKee Creek by lands owned by Coco Paving Ltd.



Problems & Opportunities

The following problems have been identified within the existing drainage system:

Capacity – Exceedances of flow capacity in storm, sanitary and combined sewers due to the excess rainwater entering the municipal drainage system.

Public Health – Issues of nuisance, potential health risks, and environmental degradation from flooding conditions.

Overland Flow – Issues of surface water directed towards habitable structures.

Transportation Access – Issues of limiting access due to coastal flooding and stormwater ponding impacting roads.

Future Development Capacity – Limited sewer capacity reducing opportunities for new development.

The following opportunity was identified to address key issues:

Make improvements to reduce the flooding risks in the existing drainage systems and improve conveyance of flows during severe rain events.

Background Studies

The Prince Road Sewer Study (2001) was the guiding document for the design of this sewershed's combined sewer separation. The study recommended construction of the Prince Road trunk sewer to its current location on Chappell Avenue between Sandwich Street and Russell Street.

In 2020, City of Windsor completed Sewer & Coastal Flood Protection Master Plan (SCFPMP) to understand the cause of widespread floods throughout the City and to identify and evaluate short-term and long-term solutions to mitigate the issue.

The Master Plan recommended that the Prince Road storm sewer at Chappell Avenue is to outlet to McKee Creek.

Recommended Solution

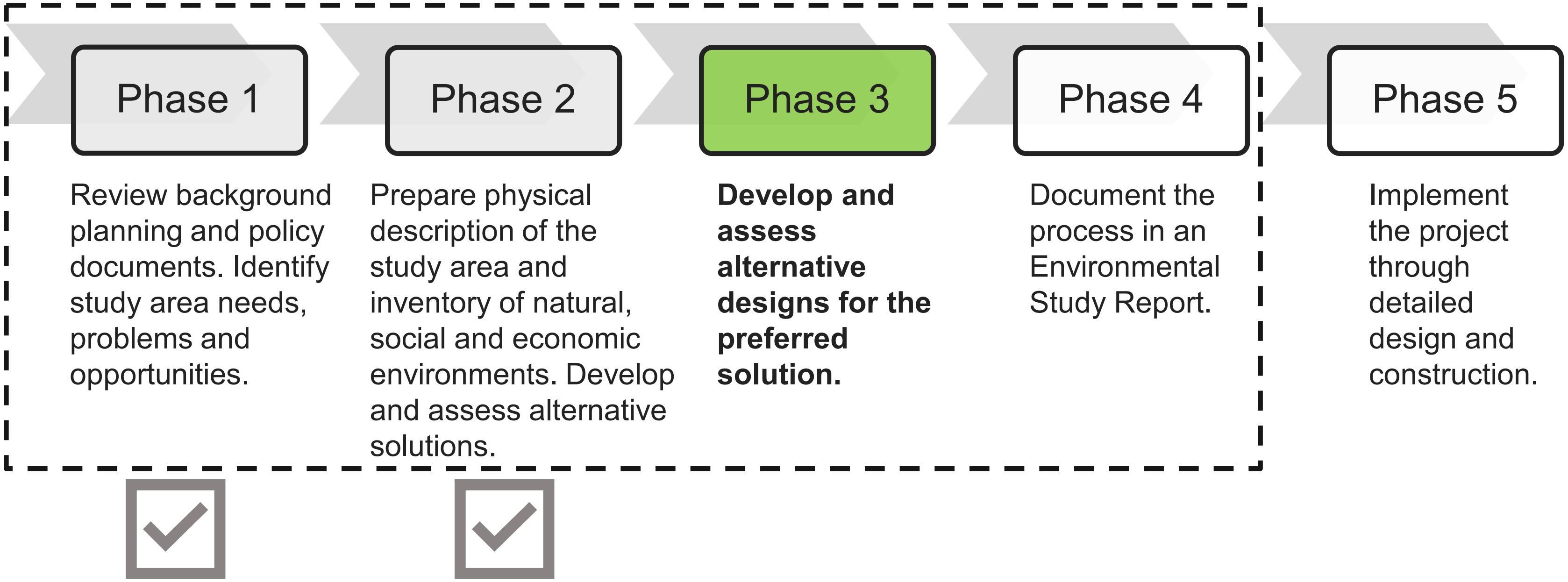
from the Sewer & Coastal Flood Protection Master Plan (SCFPMP), 2020

The Master Plan recommended a New Outlet and Dewatering Pump Station for the existing separated storm system serving the Prince Road drainage area. This would include the installation of approximately 140m of new storm sewer west of the intersection of Chappell Avenue and Sandwich Street, to a new outfall to the McKee Creek. A dewatering pump station will be required to drawdown the storm system after a rain event.

Municipal Class EA Process

The purpose of this Schedule C Class EA study is to establish a preferred location and design of the outlet and the associated pumping station.

The Master Plan completed Phase 1 and 2 of the Class EA study process. This study will complete Phase 3 and 4:



Phase 1

Review background planning and policy documents. Identify study area needs, problems and opportunities.

☑

Phase 2

Prepare physical description of the study area and inventory of natural, social and economic environments. Develop and assess alternative solutions.

☑

Phase 3

Develop and assess alternative designs for the preferred solution.

Phase 4

Document the process in an Environmental Study Report.

Phase 5

Implement the project through detailed design and construction.

Class EA – Key Activities

- Developing and evaluating design alternatives
- Selecting a recommended design alternative
- Presenting to public and agencies for comment
- Documenting the decision-making process in an Environmental Study Report (ESR)
- Circulating the draft ESR to agencies for review
- Publishing a Notice of Study Completion & 30 day review period

Site Constraints/Design Considerations

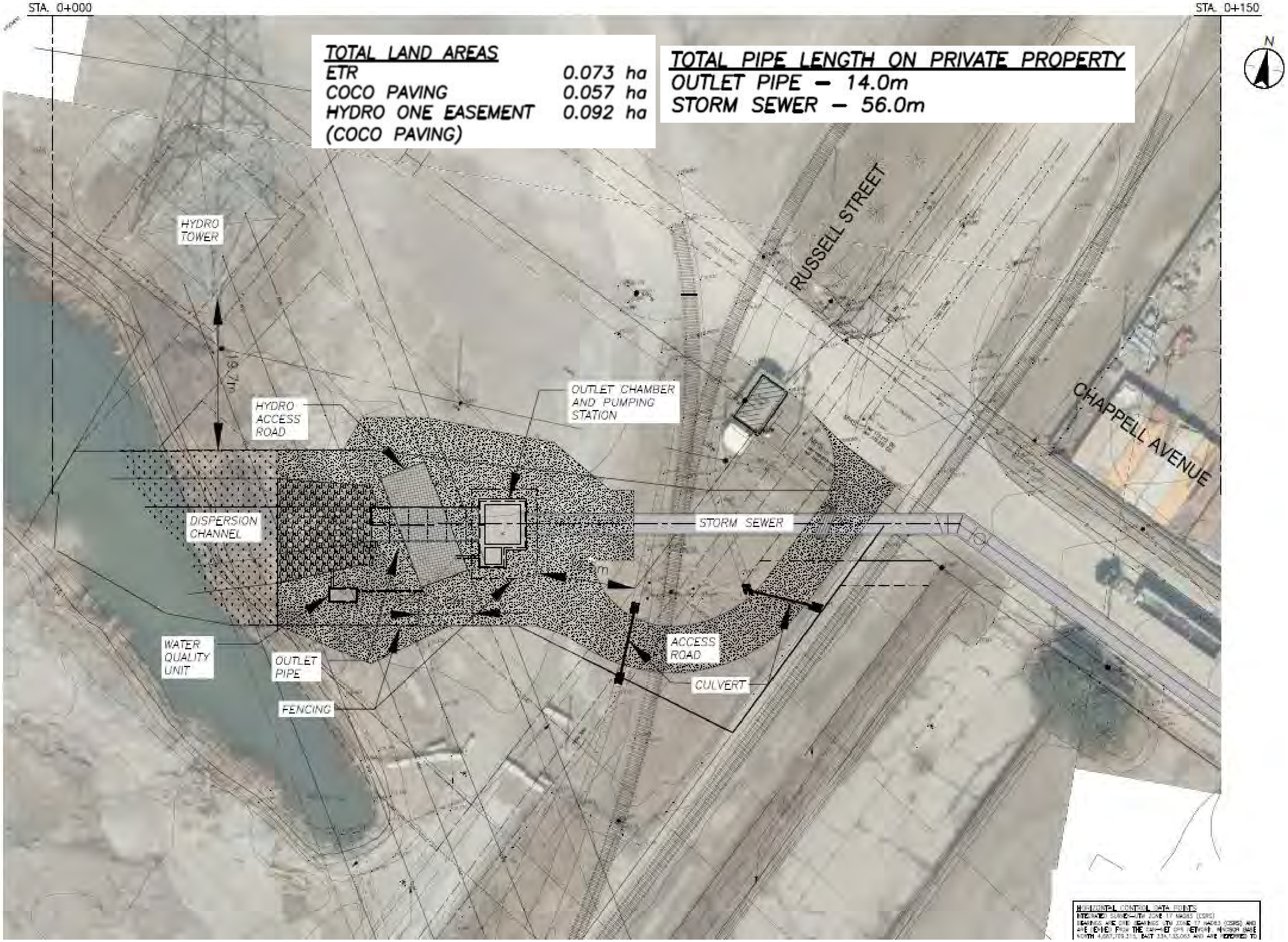
The following considerations have been included in the development of design alternatives:

- Outlet Chamber and Pump Station footprint requirements
- Culvert locations
- Dispersion channel location
- Access – during and post construction
- Permanent and temporary easement requirements

Four design alternatives were developed, including:

- Option 1: Outlet chamber close to hydro easement
- Option 2: Outlet chamber close to rail line
- Option 3: Outlet chamber close to existing office building
- Option 4: Outlet chamber close to Chappell Ave

Option 1:
Outlet chamber close to hydro easement



TOTAL LAND AREAS

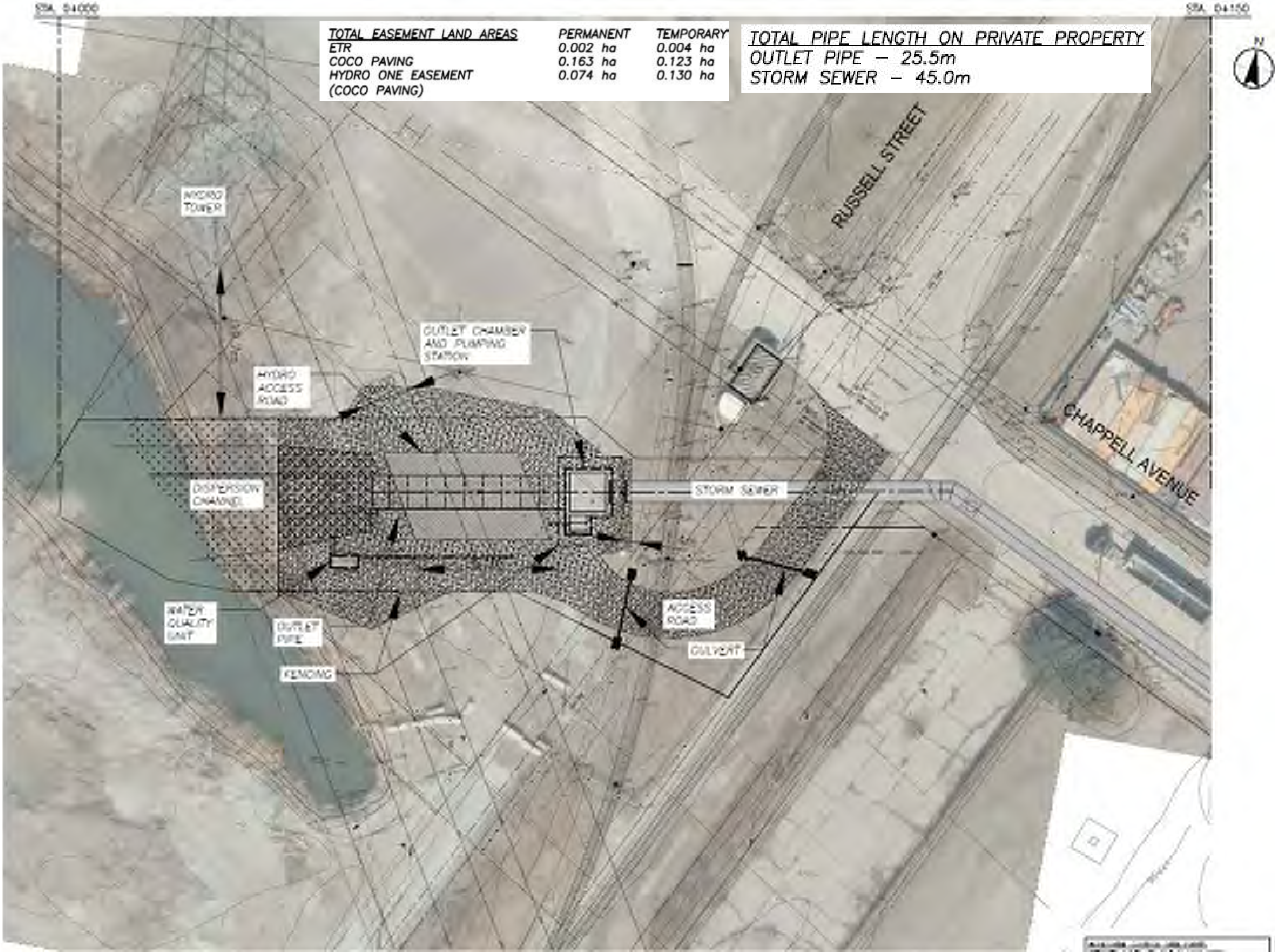
ETR	0.073 ha
COCO PAVING	0.057 ha
HYDRO ONE EASEMENT (COCO PAVING)	0.092 ha

TOTAL PIPE LENGTH ON PRIVATE PROPERTY

OUTLET PIPE – 14.0m

STORM SEWER – 56.0m

Option 2:
Outlet chamber close to rail line



TOTAL EASEMENT LAND AREAS	PERMANENT	TEMPORARY
ETR	0.002 ha	0.004 ha
COCO PAVING	0.163 ha	0.123 ha
HYDRO ONE EASEMENT (COCO PAVING)	0.074 ha	0.130 ha

TOTAL PIPE LENGTH ON PRIVATE PROPERTY
OUTLET PIPE – 25.5m
STORM SEWER – 45.0m

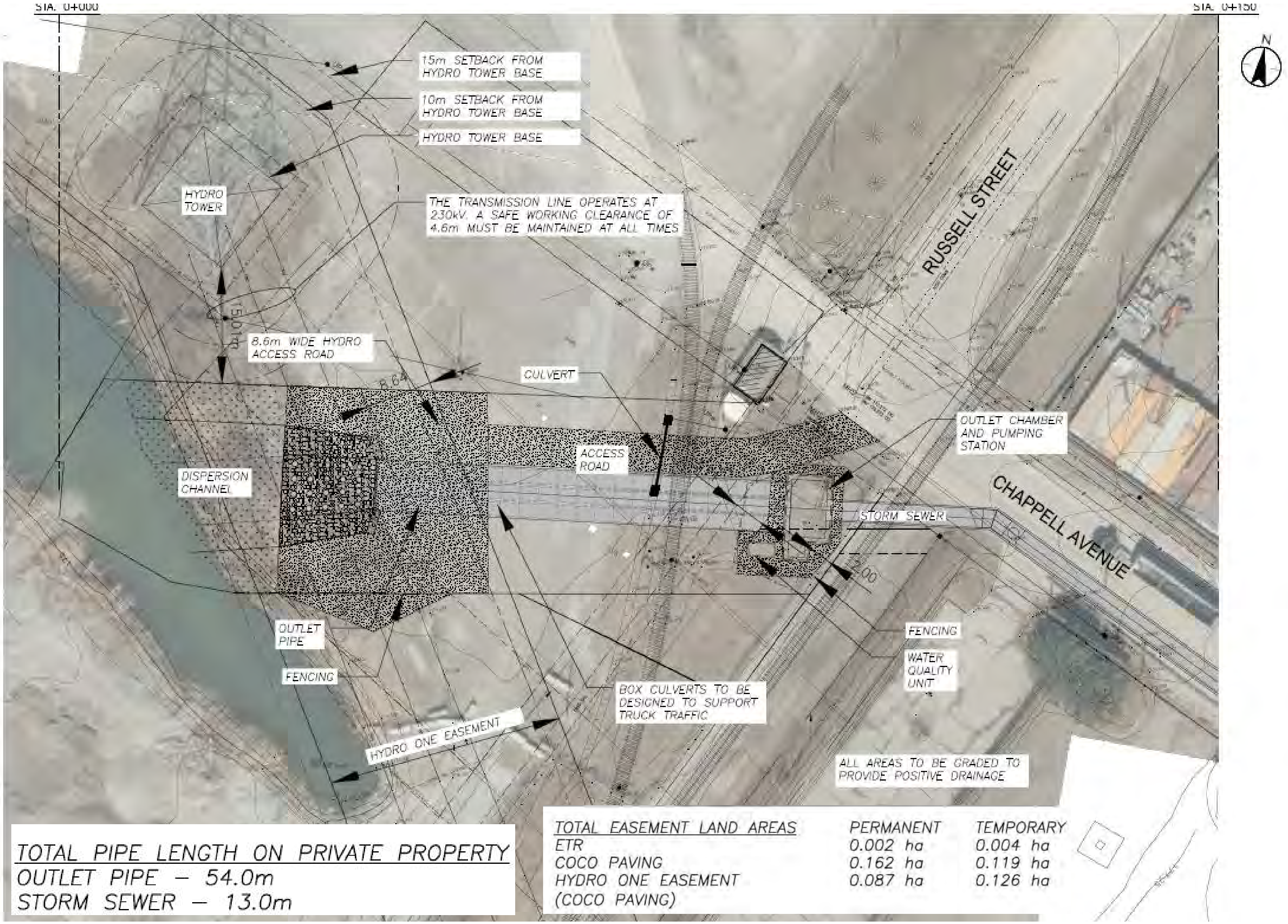
Option 3:
Outlet chamber close to existing office building

TOTAL EASEMENT LAND AREAS	PERMANENT	TEMPORARY
COCO PAVING	0.121 ha	0.124 ha
HYDRO ONE EASEMENT (COCO PAVING)	0.080 ha	0.079 ha

TOTAL PIPE LENGTH ON PRIVATE PROPERTY
OUTLET PIPE – 24.0m
STORM SEWER – 104.0m

Screened out from further consideration due to property concerns.

Option 4:
Outlet chamber at Chappell Ave./Russell St. Intersection



THE TRANSMISSION LINE OPERATES AT 230kV. A SAFE WORKING CLEARANCE OF 4.6m MUST BE MAINTAINED AT ALL TIMES

BOX CULVERTS TO BE DESIGNED TO SUPPORT TRUCK TRAFFIC

ALL AREAS TO BE GRADED TO PROVIDE POSITIVE DRAINAGE

TOTAL PIPE LENGTH ON PRIVATE PROPERTY
OUTLET PIPE – 54.0m
STORM SEWER – 13.0m

TOTAL EASEMENT LAND AREAS	PERMANENT	TEMPORARY
ETR	0.002 ha	0.004 ha
COCO PAVING	0.162 ha	0.119 ha
HYDRO ONE EASEMENT (COCO PAVING)	0.087 ha	0.126 ha

Discussion of Pros & Cons

<table>
<tr><th></th><th>Option 1
Outlet chamber close to hydro easement</th><th>Option 2
Outlet chamber close to rail line</th><th>Option 4
Outlet chamber close to intersection</th></tr>
<tr><td rowspan="2">Coco Property Access</td><td colspan="3">City will have separate entrance from Coco’s main entrance therefore no impact to Coco’s operations (during and post construction).</td></tr>
<tr><td>Chamber may impact access to north and south properties.</td><td>Pushes chamber closer to railway to avoid impacting access to north and south properties.</td><td>Pushes chamber away from access and between rail lines to avoid impacts to active site.</td></tr>
<tr><td>Road Access</td><td colspan="2">Potential to leave at least one lane open during construction to allow access.</td><td>Closure of Russell Street and Chappell Avenue briefly during construction</td></tr>
<tr><td>Rail Access</td><td colspan="3">Temporary closure of rail line during construction for 1-2 weeks. Requires open cut across rail lines.</td></tr>
<tr><td>Hydro Access</td><td colspan="3">Access impacted temporarily during construction. Permanently reduced access due to dispersion channel (as shown on plan).</td></tr>
</table>

Environmental Field Work

Aquatic and terrestrial habitat assessments were completed on July 9th

- Habitat along McKee Creek is appropriate for Foxsnake (species at risk), and project is within regulated habitat area for the species – an Information Gathering Form will be required during Detailed Design
- Barn Swallow were noted foraging in the area. Potential for nesting Barn Swallow (species at risk) in area – no structures to be impacted by project
- Fish habitat is confirmed in McKee Creek and species at risk habitat is documented by DFO – a Request for Review may be required during Detailed Design

Stage 1 Archaeological Assessment completed on July 9th, and draft report is pending

- No further archaeological assessment anticipated to be required


Area of Disturbance


Conditions within 120m of Area of Disturbance


McKee Creek

Project Schedule & Next Steps

Natural Environment/Archaeological Field Reviews	July 2021
Assessment of Alternative Designs	June/July 2021
Select Preferred Design Alternative	July 2021
Draft Environmental Study Report	September 2021
Notice of Study Completion & 30-day Review Period	October 2021

Contact Information

Ian Wilson, P. Eng
Project Manager
City of Windsor
Phone: 519-255-6100 ext. 6369
Email: iwilson@citywindsor.ca

Clarence Jubenville, P. Eng
Consultant Project Manager
Stantec Consulting Ltd.
Phone: 519-966-2250 ext. 241
Email: clarence.jubenville@stantec.com

Thank you!

APPENDIX A
Hydro One Consultation

From:	Hohner, Paula
To:	Lang, Sarah
Subject:	FW: Prince Road Storm Sewer Outlet MCEA - minutes from meeting
Date:	Wednesday, July 14, 2021 11:00:51 AM
Attachments:	image005.png

Paula Hohner, MScPl, MCIP, RPP
Associate, Senior Environmental Planner
Environmental Team Lead - Transportation
Stantec
600-171 Queens Avenue London ON N6A 5J7
Phone: 519-675-6666
Mobile: 226-926-6682
paula.hohner@stantec.com

From: Wilson, Ian <IWilson@citywindsor.ca>
Sent: Thursday, June 24, 2021 1:52 PM
To: 'Jim.Oriotis@HydroOne.com' <Jim.Oriotis@HydroOne.com>
Cc: julie.liu@HydroOne.com; Hohner, Paula <Paula.Hohner@stantec.com>; Jubenville, Clarence <clarence.jubenville@stantec.com>
Subject: RE: Prince Road Storm Sewer Outlet MCEA - minutes from meeting

Hi Jim,

Hope things are well and thank you for the follow up. There has been additional discussions with the affected land owner and following the outcome of these meetings, we are anticipating to make refinements to the design package. When completing the update, we will continue to use the input provided at our meeting and per the Hydro One guideline document.

As the submission package nears completion, we will give you advanced notice.

We appreciate your support on this file,

Ian Wilson, P. Eng., MASc. | Engineer II

THE CITY OF WINDSOR
ONTARIO, CANADA

Engineering Department
350 City Hall Square West | Suite 310 | Windsor, ON | N9A 6S1
To reach me by phone, please call my cell.
(C): 519-791-2706
www.citywindsor.ca

From: Jim.Oriotis@HydroOne.com <Jim.Oriotis@HydroOne.com>
Sent: Thursday, June 24, 2021 11:41 AM
To: Wilson, Ian <IWilson@citywindsor.ca>
Cc: julie.liu@HydroOne.com; Paula.Hohner@stantec.com
Subject: RE: Prince Road Storm Sewer Outlet MCEA - minutes from meeting

Hello Ian,

Further to our recent telephone discussion, please provide relevant drawing options at your earliest opportunity.

Thank you,

Jim

Jim Oriotis
Senior Real Estate Coordinator
Southwest Ontario & Niagara Region
Hydro **One** Networks Inc.
185 Clegg Road
Markham, ON L6G 1B7
Tel: 905.946.6261
Cell: 647.938.6261
Fax: 905.946.6242
Email: jim.oriotis@hydroone.com

From: Wilson, Ian <IWilson@citywindsor.ca>
Sent: Monday, April 26, 2021 2:03 PM
To: ORIOTIS Jim <Jim.Oriotis@HydroOne.com>

Subject: RE: Prince Road Storm Sewer Outlet MCEA - minutes from meeting

Hi Jim, Following up with my voicemail, it was discussed at our meeting, but wanted to confirm that a preliminary review of the project's three options was something that could be completed by Hydro One, in a quicker timeframe, opposed to the "normal" scenario where a detailed design review would take 12-16 weeks.

We have started preparing the package for Hydro One's review including drawings that incorporate your feedback from the meeting.

Please respond to this email or give me a call to discuss further, thank you,

Ian Wilson, P. Eng., MASc. | Engineer II

Engineering Department
350 City Hall Square West | Suite 310 | Windsor, ON | N9A 6S1
To reach me by phone, please call my cell.
(C): 519-791-2706
www.citywindsor.ca

From: Hohner, Paula <Paula.Hohner@stantec.com>
Sent: Wednesday, April 21, 2021 12:22 PM
To: Jim.Oriotis@HydroOne.com
Cc: Wilson, Ian <IWilson@citywindsor.ca>; Jubenville, Clarence <clarence.jubenville@stantec.com>; Godo, Anna <agodo@citywindsor.ca>; Mikhael, Fahd <fmikhael@citywindsor.ca>
Subject: Prince Road Storm Sewer Outlet MCEA - minutes from meeting

Good afternoon,
Please see the attached minutes from our meeting held on April 8, 2021. Also attached are the design options as separate files so you can see the detail a little easier outside of the presentation. The 2011 Hydro One Agreement is also attached as discussed.

Revised drawings will follow in a separate email when available.

Thank you,
Paula

Paula Hohner, MScPl, MCIP, RPP
Associate, Senior Environmental Planner

Environmental Team Lead - Transportation
Stantec
600-171 Queens Avenue London ON N6A 5J7
Phone: 519-675-6666
Mobile: 226-926-6682
paula.hohner@stantec.com

" />

Stantec

Meeting Notes

Stakeholder Meeting #1 – Hydro One

Prince Road Storm Sewer Outlet Municipal Class Environmental Assessment / 165620224

Date/Time:	April 8, 2021 / 2:00 PM
Place:	Microsoft Teams
Attendees:	Jim Oriotis, Hydro One Ian Wilson, City of Windsor Anna Godo, City of Windsor Clarence Jubenville, Stantec Consulting Ltd. Paula Hohner, Stantec Consulting Ltd.
Regrets:	Fahd Mikhael, City of Windsor
Distribution:	Attendees

Item: **Action:**

Introductions & Presentation

Attendees introduced themselves and provided an overview of the project team. Stantec provided a brief slide presentation of the project, including background information, and previous studies completed. In addition, three alternative designs were presented for the preferred alternative solution.

Background Information

In 2001, the City completed the Prince Road Sewer Study which was the guiding document for the design of the separation of the combined sanitary/storm sewer system in the Prince Road sewershed. The study recommended construction of the Prince Road trunk sewer to its current location on Chappell Avenue between Sandwich Street and Russell Street.

In 2020, City of Windsor completed Sewer & Coastal Flood Protection Master Plan to understand the cause of widespread floods throughout the City and to identify and evaluate short and long-term solutions to mitigate the issue.

The Master Plan recommended that the Prince Road storm sewer at Chappell Avenue is to outlet to McKee Creek.

Purpose of Municipal Class EA Study

A New Outlet and Dewatering Pump Station would be completed through the installation of approximately 140m of new storm sewer west of the intersection of Chappell Avenue and Sandwich Street, to a new outfall to the McKee Creek. A dewatering pump station would be required to drawdown the storm system after a rain event.

The purpose of this Schedule C Municipal Class Environmental Assessment study is to establish a preferred location and design of the outlet and the associated pumping station. The 2020 Master Plan completed Phase 1

Item: **Action:**

(Identification of the Problems & Opportunities and review of existing conditions) and Phase 2 (Development and Assessment of Alternative Solutions). This study will complete Phase 3 (Development and Assessment of Alternative Designs) and Phase 4 (summary of the EA process and Preferred Design in an Environmental Study Report).

Alternative Designs

Three design options were presented and discussed.

Option 1 - Outlet chamber close to hydro easement

The existing 2400 mm dia. concrete storm sewer to be extended westerly along Chappell Ave, across ETR and along Coco Paving property to a new outlet chamber and pumping station.

From the outlet structure, a twinned gravity sewer (2 – 1800 mm x 1200 mm concrete box sewers) will outlet to a dispersion channel and ultimately to the existing McKee Creek. During severe storm events, flows may also pass through emergency overflow openings in the top of the outlet chamber overland to the dispersion channel.

The sewer system will be dewatered with the pumping station discharging flows through a water quality unit and ultimately to the dispersion channel.
A permanent easement would be required across ETR property, Coco Paving property and Coco Paving property subject to a Hydro One easement. An access road with drainage culverts across the properties would be required to access the infrastructure.

A temporary easement would be required across ETR property, Coco Paving property and Coco Paving property subject to a Hydro One easement, north and south of the permanent easements to facilitate construction.

Access for a permanent easement would be from Coco Paving lands just west of the ETR property from Chappell Ave / Russell St intersection. A lockable gate would be required at this location. Fencing is also proposed around the outlet chamber / pumping station and around the dispersion channel.

In this option, the outlet chamber and pumping station is located as close to the Hydro One easement as possible to still maintain access to Hydro One along their easement.

Option 2 - Outlet chamber close to rail line

The existing 2400 mm dia. concrete storm sewer to be extended westerly along Chappell Ave, across ETR and along Coco Paving property to a new outlet chamber and pumping station.

From the outlet structure, a twinned gravity sewer (2 – 1800 mm x 1200 mm concrete box sewers) will outlet to a dispersion channel and ultimately to the existing McKee Creek. During severe storm events, flows may also pass

Item: **Action:**

through emergency overflow openings in the top of the outlet chamber overland to the dispersion channel.

The sewer system will be dewatered with the pumping station discharging flows through a water quality unit and ultimately to the dispersion channel.

A permanent easement would be required across ETR property, Coco Paving property and Coco Paving property subject to a Hydro One easement. An access road with drainage culverts across the properties would be required to access the infrastructure.

A temporary easement would be required across ETR property, Coco Paving property and Coco Paving property subject to a Hydro One easement, north and south of the permanent easements to facilitate construction.

Access for a permanent easement would be from Coco Paving lands just west of the ETR property from Chappell Ave / Russell St intersection. A lockable gate would be required at this location. Fencing is also proposed around the outlet chamber / pumping station and around the dispersion channel.

In this option, the outlet chamber and pumping station is located as close to the ETR Property as possible.

Option 3 - Outlet chamber close to existing office building

The existing 2400 mm dia. concrete storm sewer to be extended westerly along Chappell Ave, across ETR (along Chappell Ave) and along Coco Paving property to a new outlet chamber and pumping station.

From the outlet structure, a twinned gravity sewer (2 – 1800 mm x 1200 mm concrete box sewers) will outlet to a dispersion channel and ultimately to the existing McKee Creek. During severe storm events, flows may also pass through emergency overflow openings in the top of the outlet chamber overland to the dispersion channel.

The sewer system will be dewatered with the pumping station discharging flows through a water quality unit and ultimately to the dispersion channel.

A permanent easement would be required across Coco Paving property and Coco Paving property subject to a Hydro One easement. Access to the site would be through the existing Coco Paving gate at Chappell Ave / Russell St.

A temporary easement would be required across Coco Paving property and Coco Paving property subject to a Hydro One easement, north, south and west of the permanent easements to facilitate construction.

Access for a permanent easement would be at Coco Paving's current entrance. A lockable gate would be required at this location. Fencing is also proposed around the outlet chamber / pumping station and around the dispersion channel.

Item: **Action:**

In this option, the outlet chamber and pumping station is located northwest of the existing hydro tower close to the existing building.

Construction is planned for late 2022 or early 2023. Land acquisition is planned for 2022, following this EA study.

Discussion & Questions

1. It was noted that Hydro One normally comments on 80-90% complete detailed design drawings rather than at the EA stage of a project. However, Hydro One agreed to circulate the three design options presented to ensure there were no "show-stoppers" in terms of the proposed site layouts. Hydro One requested that the drawings be updated to include the following: Stantec

   - Fully label/colour code easements
   - 10m and 15m radius shown around hydro tower base
   - Minimum 7m wide access road (designed for Hydro One vehicles)
   - Alternative access to Hydro One tower if access will be closure during construction; include approximate timing of this closure on drawing
   - Existing and proposed grades across the easement area (preferred grade within easement is <10%)

   Hydro One requested that the previous drawing submission and draft agreement be provided with redlines to highlight the changes and assist with the review process.

2. Hydro One will circulate the submission to Planning, Asset Optimization, Land Use Agents, etc. It was suggested that if the project team could reduce the number of options prior to submission, that would be preferred but will attempt to get comments on all three options if needed. Stantec/City
3. Hydro One noted there is a fee for review ($1,500.00 plus HST) but is not required immediately. A "Technical Review" form is to be completed with a covering memo.

   It was noted that 12-16 weeks is required for Hydro One's review of detailed design drawings following the EA. The construction agreement review process is approximately 4 weeks in duration and is valid for 12 months.
4. It was noted that Coco Paving is the property owner, and a meeting has been held with them to discuss the options. Hydro One indicated that an access agreement may be required.
5. Hydro One shared the following regarding general interests and concerns relating to tower infrastructure:

Item:	**Action:**
• General methods of construction – it was noted this would be confirmed later in detailed design	
• Vibration impacts – it was noted that sheet piles with vibration monitoring will be installed regardless of option.	
• Longitudinal access along tower is preferred	Hydro One
• 24/7 unencumbered access is required, including during construction	Hydro One
• Water ponding at based of tower is to be avoided	
• Vertical heights of construction equipment and safety clearances be adhered to **–** Hydro One will provide guidance	
• Voltage of transmission line – to be confirmed by Hydro One	

The meeting adjourned at 2:50 PM

The foregoing is considered to be a true and accurate record of all items discussed. If any discrepancies or inconsistencies are noted, please contact the writer immediately.

Stantec Consulting Ltd.

Paula Hohner MScPl, MCIP, RPP
Senior Environmental Planner
Phone: 519-675-6666
paula.hohner@stantec.com

Attachment: presentation, design options

From: Hohner, Paula
To: Jubenville, Clarence
Cc: Wilson, Ian; Lang, Sarah
Subject: FW: Prince Road Storm Sewer - HONI File No. 635.06-7905
Date: Friday, January 28, 2022 9:44:57 AM
Attachments: image004.png

Paula Hohner, MScPl, MCIP, RPP
Associate, Senior Environmental Planner
Environmental Team Lead - Transportation
Stantec
600-171 Queens Avenue London ON N6A 5J7
Phone: 519-675-6666
Mobile: 226-926-6682
paula.hohner@stantec.com

From: Wilson, Ian <IWilson@citywindsor.ca>
Sent: Monday, December 6, 2021 9:53 AM
To: Jubenville, Clarence <clarence.jubenville@stantec.com>; Hohner, Paula <Paula.Hohner@stantec.com>
Subject: FW: Prince Road Storm Sewer - HONI File No. 635.06-7905

Good Morning Clarence and Paula,

Hydro One is transitioning a new Real Estate Coordinator to this area (Ray Nepomuceno). Had a quick meeting to get Ray up to speed last week. Hydro One has not reviewed any of the material provided in June/July 2021. Can the material be re-forwarded with a few tweaks, removing option 1 & 2 in appendix B and noting in the cover letter only Option 4 is the only included for review. I'd like to get Hydro One up to speed on this file and identify any concerns sooner than later.

Following up with my voicemails last week, could you provide a project update? Is there anything needed from the City?

Thank you,

Ian Wilson, P. Eng., MASc. | Engineer II

THE CITY OF WINDSOR
ONTARIO, CANADA

Engineering Department
350 City Hall Square West | Suite 310 | Windsor, ON | N9A 6S1
To reach me by phone, please call my cell.

(C): 519-791-2706
www.citywindsor.ca

From: Wilson, Ian
Sent: Monday, December 6, 2021 9:41 AM
To: 'Raymond.Nepomuceno@hydroone.com' <Raymond.Nepomuceno@hydroone.com>; Jim.Oriotis@HydroOne.com
Subject: RE: Prince Road Storm Sewer - HONI File No. 635.06-7905

Good Morning Ray and Jim,

Please see meeting notes below, advise of errors or omissions within 2 weeks. Thank you and take care,

Prince Rd Trunk Storm Sewer Outlet – Class EA Meeting – Hydro One Consultation – Meeting Notes

Date: December 2, 2021, 1:30pm

Attendees: Jim Oriotis – Hydro One, Ray Nepomuceno – Hydro One, Ian Wilson – City of Windsor

HONI File No. 635.06-7905

Discussion:

- *Introductions and project background. PDFs provided by city of project, including past meeting minutes and alternatives being considered for new storm sewer outlet.*
- *It was noted the project ESR is nearly finalized for MECP draft comments.*
    - *Although, the project is not finalized. Option 4 is likely to be recommended as the preferred alternative.*
- *City to send Hydro One review documents, to screen for showstoppers with Option 4.*
- *Options should not negatively affect drainage within the corridor.*
- *It was noted the figures with colour coding identify permanent and temporary (construction working) easements.*
- *Hydro One identified a construction agreement, may be adequate for the City's short-term (construction) and long-term maintenance needs. Hydro One to send sample for City's review (legal, engineering, etc.).*

Post Meeting:

- *Note: previous Hydro One file number was Windsor 635.06-3761*

Ian Wilson, P. Eng., MASc. | Engineer II

THE CITY OF WINDSOR
ONTARIO, CANADA

Engineering Department
350 City Hall Square West | Suite 310 | Windsor, ON | N9A 6S1
To reach me by phone, please call my cell.
(C): 519-791-2706
www.citywindsor.ca

-----Original Appointment-----
From: Raymond.Nepomuceno@hydroone.com <Raymond.Nepomuceno@hydroone.com>

Sent: Monday, November 29, 2021 9:14 AM
To: Raymond.Nepomuceno@hydroone.com; Wilson, Ian; Jim.Oriotis@HydroOne.com
Subject: Prince Road Storm Sewer - HONI File No. 635.06-7905
When: Thursday, December 2, 2021 1:30 PM-2:00 PM (UTC-05:00) Eastern Time (US & Canada).
Where: Webex

Thanks, Ian. Let's meet this Thursday at 1:30PM.

Regards,
Ray

From: Wilson, Ian <IWilson@citywindsor.ca>
Sent: Friday, November 26, 2021 4:10 PM
To: NEPOMUCENO Raymond <Raymond.Nepomuceno@hydroone.com>
Subject: RE: Prince Road Storm Sewer - HONI File No. 635.06-7905

Good afternoon Raymond, It was a pleasure to meet you as well. In terms of my availability for a meeting:

- Wednesday December 1st; any time 9am to 12pm or after 3pm
- Thursday December 2nd; any time after 1pm
- Friday December 3rd; any time between 8:30 am to 1pm

My thought is we can review the presentation material, related to the proposed improvements. We can then determine the next step in the consultant process.

Attached are a copy of earlier meeting minutes with Jim and the options we are reviewing as part of the Environmental Assessment.

Take care and have a nice weekend,

Ian Wilson, P. Eng., MASc. | Engineer II

THE CITY OF WINDSOR ONTARIO, CANADA

Engineering Department

350 City Hall Square West | Suite 310 | Windsor, ON | N9A 6S1
To reach me by phone, please call my cell.
(C): 519-791-2706
www.citywindsor.ca

From: Raymond.Nepomuceno@hydroone.com <Raymond.Nepomuceno@hydroone.com>
Sent: Friday, November 26, 2021 3:28 PM
To: Wilson, Ian <IWilson@citywindsor.ca>
Subject: Prince Road Storm Sewer - HONI File No. 635.06-7905

Hi Ian,

Thanks for the brief chat and pleasure to meet you. As mentioned, let's set some time up for mid to late next week to further discuss your project. Please let me know some dates and times that work for you and I'll coordinate a Webex meeting.

Kind regards,
Ray

Ray Nepomuceno
Sr. Real Estate Coordinator
Facilities & Real Estate

Hydro One Networks Inc. | 185 Clegg Road | Markham, ON | L6G 1B7
D: 647-613-9642 | E: raymond.nepomuceno@HydroOne.com | W: HydroOne.com

-- Do not delete or change any of the following text. --

Ray Nepomuceno is inviting you to a Webex Personal Room meeting.

Join meeting

More ways to join:

Join from the meeting link
https://hydroone.webex.com/join/raymond.nepomucenohydroone.com

Join by meeting number

Meeting number (access code): 180 276 4969

Tap to join from a mobile device (attendees only)
+1-855-699-3239,,1802764969## CANADA/US TOLL FREE
+1-647-798-0132,,1802764969## TORONTO LOCAL

Join by phone
+1-855-699-3239 CANADA/US TOLL FREE
+1-647-798-0132 TORONTO LOCAL
Access code: 180 276 4969
Global call-in numbers | Toll-free calling restrictions

Join from a video conferencing system or application
Dial raymond.nepomucenohydroone.com@hydroone.webex.com
You can also dial 173.243.2.68 and enter your meeting number.
If you are the host, you can also enter your host PIN in your video conferencing system or application to start the meeting.

Need help? Go to https://help.webex.com

APPENDIX A

SAR Ontario Consultation

From:	Hohner, Paula
To:	Lang, Sarah
Subject:	FW: Prince Road Storm Outlet - Information Gathering Form - Stantec Consulting Ltd.
Date:	Tuesday, February 22, 2022 4:43:56 PM
Attachments:	doc_165620224_Prince Road Storm Outlet_IGF_20211112_fin.pdf MECP response_Prince Road_Fwd_ Information Request for Schedule 'C' Municipal Class Environmental Assessment .pdf

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From: Geddes, Sean <Sean.Geddes@stantec.com>
Sent: Friday, November 12, 2021 2:48 PM
To: SAROntario@ontario.ca
Cc: Ellah, Mitch <Mitch.Ellah@stantec.com>; Hohner, Paula <Paula.Hohner@stantec.com>; Ellis, Kayla <Kayla.Ellis@stantec.com>
Subject: Prince Road Storm Outlet - Information Gathering Form - Stantec Consulting Ltd.

Good afternoon,

Please find attached a completed Information Gathering Form (IGF) for the Prince Road Storm Outlet project located in Windsor, Ontario. The Ministry of Environment, Conservation and Parks (MECP) was previously contacted by Stantec with an Information Request (IR) for this project on February 23, 2021. A response to the IR was provided by **Kathryn Markham**, Management Biologist, of MECP on June 14, 2021. Correspondence from **Kathryn Markham** is also attached for your reference.

The IGF is being submitted on behalf of Mitch Ellah, Biologist with Stantec, who will act as the primary contact on behalf of the City of Windsor, as detailed in the IGF.

Please do not hesitate to contact Mitch Ellah or me should you have any questions regarding this IGF submission.

We look forward to your response to the submitted IGF.

Regards,

Sean

Sean Geddes
Senior Aquatic Biologist

~~Direct: 519 780-8116~~
Mobile: 519 400-9837

Fax: 519 836-2493
Sean.Geddes@stantec.com

Stantec
1-70 Southgate Drive
Guelph ON N1G 4P5

From: Ellah, Mitch
To: Geddes, Sean; Hohner, Paula
Subject: Fwd: Information Request for Schedule ‘C’ Municipal Class Environmental Assessment
Date: Tuesday, June 15, 2021 9:29:46 AM

Hi Paula and Sean,

The MECP got back to us regarding their SAR Screening for the McKee Creek EA. See below.

Mitch
Get Outlook for iOS

From: Species at Risk (MECP) <SAROntario@ontario.ca>
Sent: Monday, June 14, 2021 4:32 PM
To: Ellah, Mitch
Subject: RE: Information Request for Schedule ‘C’ Municipal Class Environmental Assessment

Hello Mitch,

RE: Municipal Class Environmental Assessment – Storm Sewer Outlet in McKee Creek, City of Windsor and the *Endangered Species Act, 2007*

I apologize for the delay in response. The Ministry of the Environment, Conservation and Parks (MECP) understands that Stantec is conducting an environmental assessment for the proposed storm sewer outlet in McKee Creek, City of Windsor, as identified in the information provided.

As requested, an initial species at risk (SAR) information screening has been completed under the *Endangered Species Act, 2007* (ESA) by MECP’s Species at Risk Branch (SARB) for the above-noted project location with respect to endangered and threated species in Ontario. There are known occurrences of the following SAR (in addition to the list provided by Stantec) in the general area with potential to also occur at the project location:

- Eastern Foxsnake (endangered) – receives species and regulated habitat protection. **The project location falls within regulated habitat for this species.**
- Bank Swallow (threatened) – receives species and general habitat protection
- Chimney Swift (threatened) – receives species and general habitat protection

Please note that this is an initial screening for endangered and threatened SAR and the absence of an element occurrence does not indicate the absence of species. The province has not been surveyed comprehensively for the presence or absence of SAR and Ontario’s data relies on observers to report sightings of SAR. Field assessments by a qualified professional may be necessary if there is a high likelihood for SAR species and/or habitat to occur within the project footprint and potentially be impacted.

The position of SARB is based on the information that has been provided by you on behalf of the proponent. Should information not have been made available and considered in our review, or new information comes to light, or if on-site conditions and circumstances change, please contact SARB as soon as possible (SAROntario@ontario.ca) to discuss next steps.

Regards,

Kathryn Markham
Management Biologist
Permissions and Compliance Section, Species at Risk Branch
Ministry of the Environment, Conservation and Parks

From: Ellah, Mitch <Mitch.Ellah@stantec.com>
Sent: February 23, 2021 9:44 AM
To: Webb, Jason (MNRF) <Jason.Webb@ontario.ca>; Species at Risk (MECP) <SAROntario@ontario.ca>
Cc: Waite, Janice (MNRF) <Janice.Waite@ontario.ca>; Cameron, Melissa <Melissa.Cameron@stantec.com>; Hohner, Paula <Paula.Hohner@stantec.com>
Subject: Information Request for Schedule 'C' Municipal Class Environmental Assessment

CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

Hello Mr. Webb and the Ministry of Environment, Conservation and Parks,

Stantec Consulting has been retained by the City of Windsor to complete a Schedule 'C' Municipal Class Environmental Assessment (MCEA) for a proposed storm sewer outlet into McKee Creek in Windsor, Ontario. To support the MCEA, a natural environment study will be undertaken to describe aquatic and terrestrial features and functions in the Study Area and provide input to the assessment of alternative solutions. As part of our involvement, we have begun a natural heritage data review for the Study Area. Our results are based on a variety of publicly available natural heritage data. Can you please review our findings and provide to us any other information you may have for the Study Area? Please find the letter attached which provides more information on the project, our current knowledge of natural heritage and SAR in the Study Area and our request for information. This letter was also provided to the Essex Region Conservation Authority.

Please contact me if you have questions regarding my request.

Thank you,

Mitch Ellah B.Sc.
Ecologist

Direct: 519-993-2218
mitch.ellah@stantec.com

Stantec
600-171 Queens Avenue
London ON N6A 5J7

APPENDIX A

Indigenous Communities Consultation

City of Windsor – Prince Road EA
Municipal Class Environmental Assessment Study
Indigenous Communication Log

Contact	Date	Comment	Draft Response/ Status
Indigenous			
Métis Nation of Ontario (MNO) consultations@metisnation.org	March 1, 2021 Email NOSC	No comments received	No response required
	Notice of Completion		
Chippewas of the Thames First Nation Chief Jacqueline French jfrench@cottfn.com Fallon Burch Consultation Coordinator consultation@cottfn.com	March 1, 2021 Email NOSC	No comments received	No response required
	Notice of Completion		
Oneida Nation of the Thames Chief Adrian Chrisjohn Adrian.chrisjohn@oneida.on.ca	March 1, 2021 Email NOSC	No comments received	No response required
	Notice of Completion		
Munsee-Delaware Nation Chief Mark Peters Chief.peteres@munsee.ca	March 1, 2021 Email NOSC	No comments received	No response required
	Notice of Completion		
Delaware Nation Chief Denise Stonefish Denise.stonefish@delawarenation.on.ca	March 1, 2021 Email	No comments received	No response required

	NOSC		
	Notice of Completion		
Bkejwanong Territory (Walpole Island) Chief Charles Sampson Charles.sampson@wifn.org Derek Sands – Communications Coordinator Derek.sands@wifn.org	March 1, 2021 Email NOSC	No comments received	No response required
	Notice of Completion		
Caldwell First Nation Chief@caldwellfirstnation.ca Nikki Van Oirschot – Director of Operations Nikki.orosz@caldwellfirstnation.ca	March 1, 2021 Email NOSC	No comments received	No response required
	Notice of Completion		
Chippewas of Kettle and Stony Point First Nation Chief Jason Henry Jason.henry@kettlepoint.org Valerie George – Consultation Coordinator Valerie.george@kettlepoint.org	March 1, 2021 Email NOSC	No comments received	No response required
	Notice of Completion		
Aamjiwnaang First Nation Chief Chris Plain Chief.plain@aamjuwnaang.ca Sharilyn Johnston – Environment coordinator sjohnston@aamjiwnaang.ca	March 1, 2021 Email NOSC	No comments received	No response required
	Notice of Completion		

Stantec
Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 1, 2021
File: 165620224

Attention: Fallon Burch, Consultation Coordinator
Chippewas of the Thames First Nation
320 Chippewa Road RR1
Muncey, ON N0L 1Y0

Dear, Fallon Burch

Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet
Schedule 'C' Municipal Class Environmental Assessment (Phases 3 & 4)

The City of Windsor (the City) has initiated a Municipal Class Environmental Assessment (Class EA) study to establish the preferred location of the Prince Road storm sewer outlet to McKee Creek and the associated pumping station.

This project is being conducted in accordance with the requirements for a Schedule 'C' project, as outlined in the *Municipal Class Environmental Assessment* document (October 2000, as amended), approved under the Ontario Environmental Assessment Act. This study will address Phases 3 and 4 of the Class EA Process. Phases 1 and 2 of the Class EA process are being documented as part of the Sewer & Coastal Flood Protection Master Plan (SCFPMP).

In Spring 2021, a Stage 1 Archaeological Assessment will be completed, as well as a single day field investigation by natural environment specialists where property access is permitted. The purpose of the field investigation is to ground-truth existing background information and identify natural features in the study area. A copy of the draft Stage 1 Archaeological Assessment and draft Natural Heritage summary report will be provided to you for review when available.

The purpose of this letter is to introduce the project, to seek your input on the existing conditions within the study area, and to identify any issues or concerns that you may have.

March 1, 2021
Fallon Burch
Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet Schedule ‘C’ Municipal Class Environmental Assessment
(Phases 3 & 4)

To provide comments or request additional information, please contact the undersigned. If you would prefer a meeting with the project team, that can also be arranged. Please contact the undersigned at your earliest convenience if you are interested in such a meeting.

Regards,

Stantec Consulting Ltd.

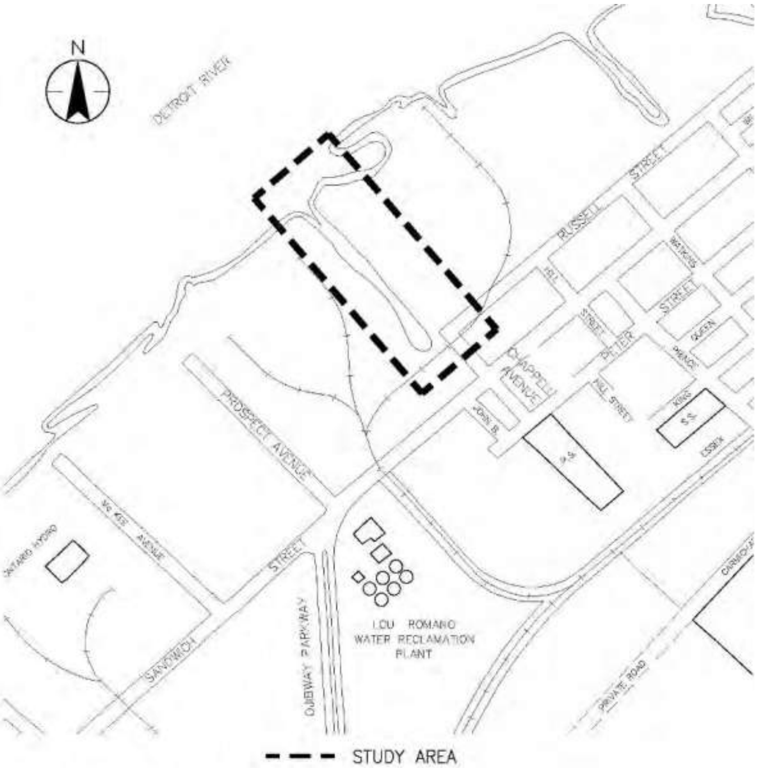
Paula Hohner

Paula Hohner M.Sc.Pl, MCIP, RPP
Senior Environmental Planner
Phone: 226-926-6682
Paula.Hohner@stantec.com

Attachment: Notice of Study Commencement

c. Ian Wilson, City of Windsor
Clarence Jubenville, Stantec Consulting Ltd.

Prince Road Storm Sewer Outlet
Schedule ‘C’ Municipal Class Environmental Assessment (Phases 3 & 4)
Notice of Study Commencement



The City of Windsor is initiating a Municipal Class Environmental Assessment (EA) study for the proposed storm sewer outlet at McKee Creek. The Study Area is defined to the west by the Detroit River, to the east by the west limit of the existing storm sewer along Chappell Avenue, and to the north and south on either side of McKee Creek by lands owned by Coco Paving Ltd. (see key map).

Phases 1 and 2 of the Class EA process are being documented as part of the Sewer & Coastal Flood Protection Master Plan (SCFPMP). The SCFPMP concludes that the preferred alternative solution for the Prince Road storm sewer outlet at Chappell Avenue is to outlet to McKee Creek. The purpose of this Class EA is to establish the preferred location and design of the outlet and the associated pumping station. This study will address Phases 3 and 4 of the Class EA Process. An Environmental Study Report will be prepared and made available for public review and comment.

The study is being conducted in accordance with the requirements of Schedule C projects as outlined in the Municipal Class EA document (2000, as amended in 2007, 2011 and 2015), which is approved under the Ontario Environmental Assessment Act.

Comments

If you are interested in participating and/or would like to be added to our mailing list, please contact a member of the study team below:

Ian Wilson, P. Eng.
City of Windsor
Engineering Department
519-255-6100 extension 6369
iwilson@citywindsor.ca

Clarence Jubenville, P. Eng.
Consultant Project Manager
Stantec Consulting Ltd.
519-966-2250
clarence.jubenville@stantec.com

Information collected will be used in accordance with the Freedom of Information and Protection of Privacy Act. With the exception of personal information, all comments will become part of the public record and may be included in project documentation.

This notice was first published on February 26, 2021.

Stantec
Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 1, 2021
File: 165620224

Attention: Chief Adrian Chrisjohn
Oneida Nation of the Thames
2212 Elm Avenue
Southwold, ON N0L 2G0

Dear, Chief Adrian Chrisjohn

Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet
Schedule 'C' Municipal Class Environmental Assessment (Phases 3 & 4)

The City of Windsor (the City) has initiated a Municipal Class Environmental Assessment (Class EA) study to establish the preferred location of the Prince Road storm sewer outlet to McKee Creek and the associated pumping station.

This project is being conducted in accordance with the requirements for a Schedule 'C' project, as outlined in the *Municipal Class Environmental Assessment* document (October 2000, as amended), approved under the Ontario Environmental Assessment Act. This study will address Phases 3 and 4 of the Class EA Process. Phases 1 and 2 of the Class EA process are being documented as part of the Sewer & Coastal Flood Protection Master Plan (SCFPMP).

In Spring 2021, a Stage 1 Archaeological Assessment will be completed, as well as a single day field investigation by natural environment specialists where property access is permitted. The purpose of the field investigation is to ground-truth existing background information and identify natural features in the study area. A copy of the draft Stage 1 Archaeological Assessment and draft Natural Heritage summary report will be provided to you for review when available.

The purpose of this letter is to introduce the project, to seek your input on the existing conditions within the study area, and to identify any issues or concerns that you may have.

To provide comments or request additional information, please contact the undersigned. If you would prefer a meeting with the project team, that can also be arranged. Please contact the undersigned at your earliest convenience if you are interested in such a meeting.

Regards,

Stantec Consulting Ltd.

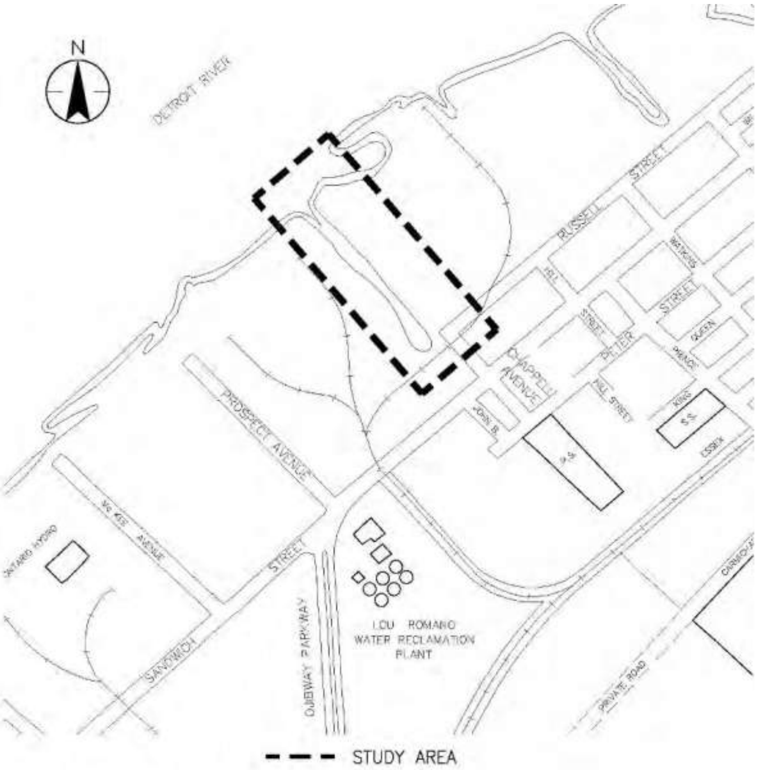
Paula Hohner

Paula Hohner M.Sc.Pl, MCIP, RPP
Senior Environmental Planner
Phone: 226-926-6682
Paula.Hohner@stantec.com

Attachment: Notice of Study Commencement

c. Ian Wilson, City of Windsor
Clarence Jubenville, Stantec Consulting Ltd.

Prince Road Storm Sewer Outlet
Schedule ‘C’ Municipal Class Environmental Assessment
(Phases 3 & 4)
Notice of Study Commencement



The City of Windsor is initiating a Municipal Class Environmental Assessment (EA) study for the proposed storm sewer outlet at McKee Creek. The Study Area is defined to the west by the Detroit River, to the east by the west limit of the existing storm sewer along Chappell Avenue, and to the north and south on either side of McKee Creek by lands owned by Coco Paving Ltd. (see key map).

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Comments

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Ian Wilson, P. Eng.	Clarence Jubenville, P. Eng.
City of Windsor	Consultant Project Manager
Engineering Department	Stantec Consulting Ltd.
519-255-6100 extension 6369	519-966-2250
iwilson@citywindsor.ca	clarence.jubenville@stantec.com

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This notice was first published on February 26, 2021.

Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 1, 2021
File: 165620224

Attention: Chief Mary Duckworth
Caldwell First Nation
14 Orange Street
Leamington, ON N8H 1P5

Dear, Chief Mary Duckworth

Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet
Schedule ‘C’ Municipal Class Environmental Assessment (Phases 3 & 4)

The City of Windsor (the City) has initiated a Municipal Class Environmental Assessment (Class EA) study to establish the preferred location of the Prince Road storm sewer outlet to McKee Creek and the associated pumping station.

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Regards,

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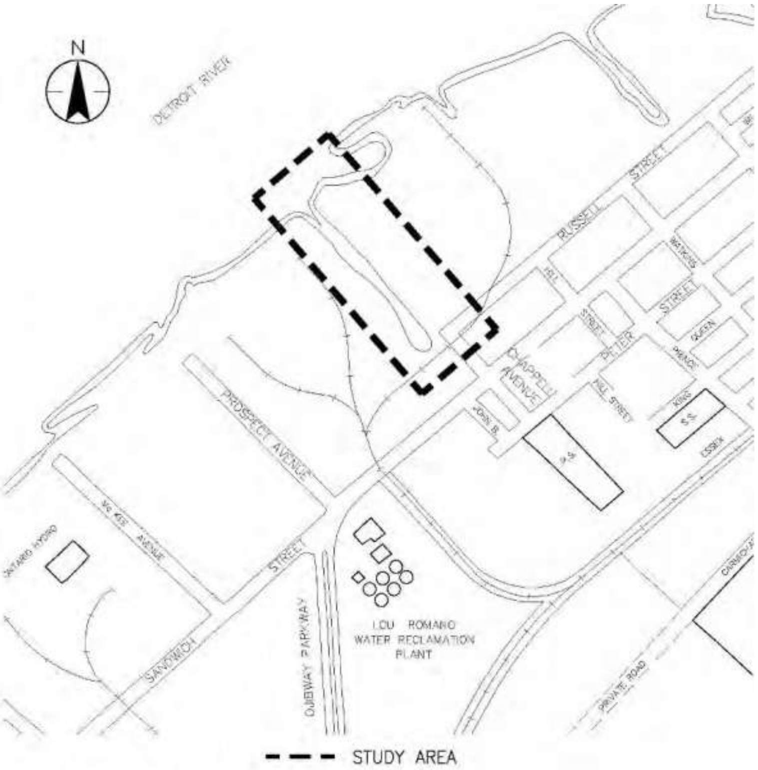
Paula Hohner M.Sc.Pl, MCIP, RPP
Senior Environmental Planner
Phone: 226-926-6682
Paula.Hohner@stantec.com

Attachment: Notice of Study Commencement

c. Ian Wilson, City of Windsor
Clarence Jubenville, Stantec Consulting Ltd.

Prince Road Storm Sewer Outlet
Schedule 'C' Municipal Class Environmental Assessment (Phases 3 & 4)
Notice of Study Commencement



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iwilson@citywindsor.ca

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Stantec
Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 1, 2021
File: 165620224

Attention: Chief Jacqueline French
Chippewas of the Thames First Nation
320 Chippewa Road RR1
Muncey, ON N0L 1Y0

Dear, Chief Jacqueline French

Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet
Schedule ‘C’ Municipal Class Environmental Assessment (Phases 3 & 4)

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Paula Hohner

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Phone: 226-926-6682
Paula.Hohner@stantec.com

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Clarence Jubenville, Stantec Consulting Ltd.

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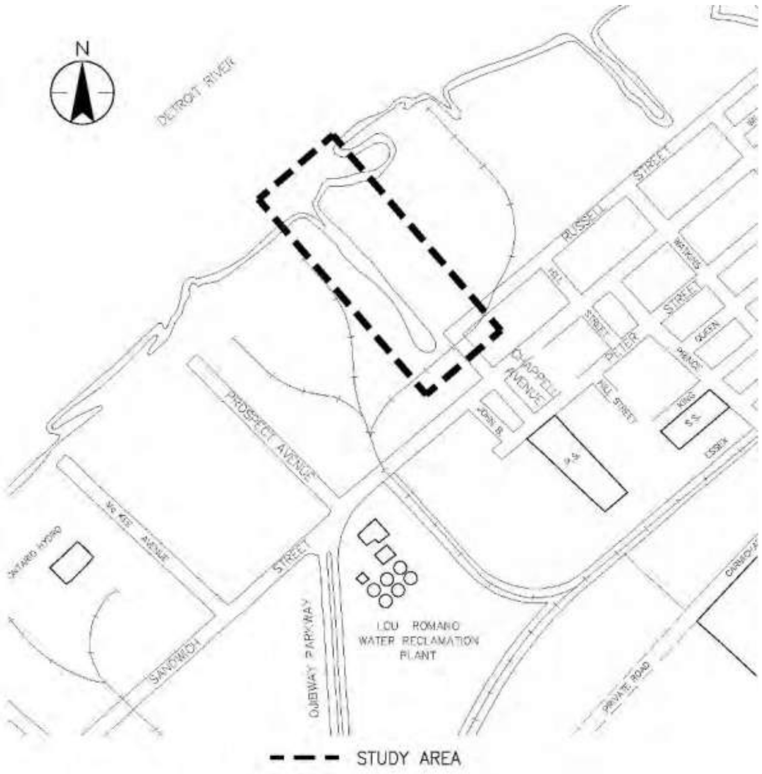

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iwilson@citywindsor.ca

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Stantec
Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 1, 2021
File: 165620224

Attention: Margaret Froh, President
Metis Nation of Ontario (MNO)
311-75 Sherbourne Street
Toronto, ON M5A 2P9

Dear, Margaret Froh

Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet
Schedule ‘C’ Municipal Class Environmental Assessment (Phases 3 & 4)

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Paula Hohner M.Sc.Pl, MCIP, RPP
Senior Environmental Planner
Phone: 226-926-6682
Paula.Hohner@stantec.com

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Clarence Jubenville, Stantec Consulting Ltd.

Prince Road Storm Sewer Outlet
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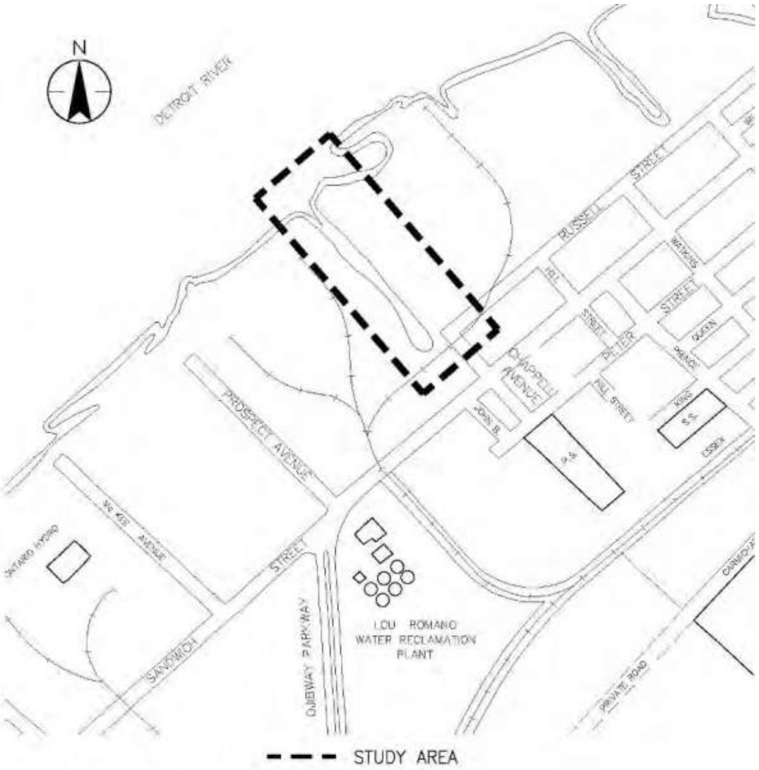

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iwilson@citywindsor.ca

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Stantec
Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 1, 2021
File: 165620224

Attention: Valerie George, Consultation Coordinator
Chippewas of Kettle and Stony Point First Nation
6247 Indian Lane
Lambton Shores, ON N0N 1J1

Dear, Valerie George

Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet
Schedule 'C' Municipal Class Environmental Assessment (Phases 3 & 4)

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March 1, 2021
Valerie George
Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet Schedule ‘C’ Municipal Class Environmental Assessment (Phases 3 & 4)

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Regards,

Stantec Consulting Ltd.

Paula Hohner M.Sc.Pl, MCIP, RPP
Senior Environmental Planner
Phone: 226-926-6682
Paula.Hohner@stantec.com

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Clarence Jubenville, Stantec Consulting Ltd.

Prince Road Storm Sewer Outlet
Schedule ‘C’ Municipal Class Environmental Assessment (Phases 3 & 4)
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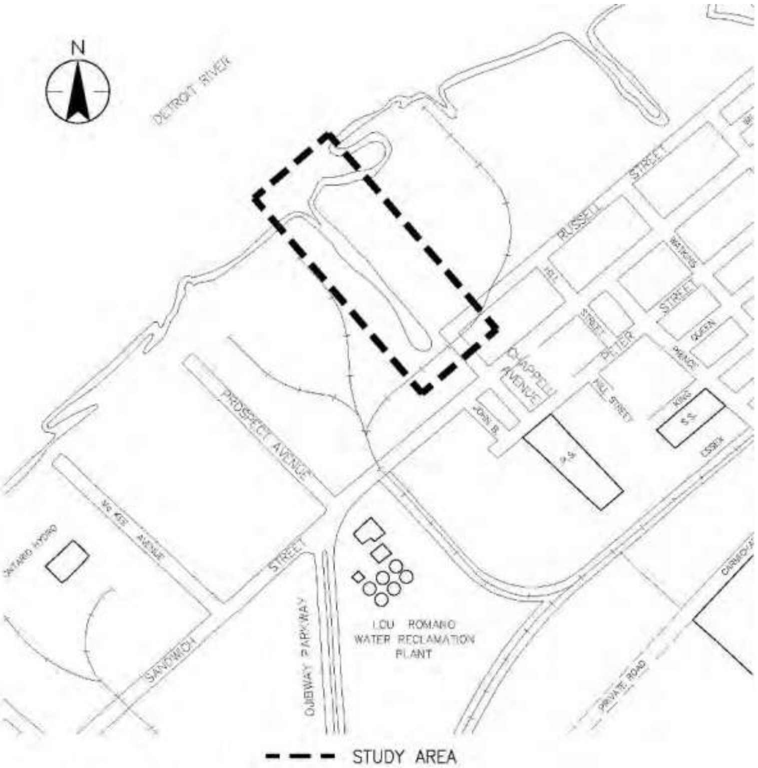

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519-255-6100 extension 6369
iwilson@citywindsor.ca

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Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 1, 2021
File: 165620224

Attention: Chief Jason Henry
Chippewas of Kettle and Stony Point First Nation
6247 Indian Lane
Lambton Shores, ON N0N 1J1

Dear, Chief Jason Henry

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Paula.Hohner@stantec.com

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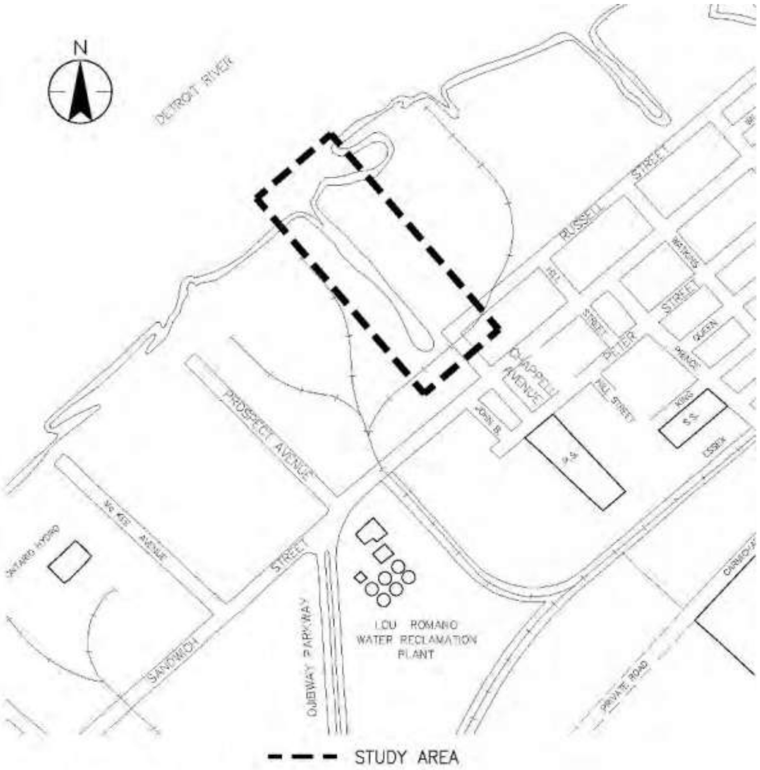

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Stantec
Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 1, 2021
File: 165620224

Attention: Sharilyn Johnston, Environment Coordinator
Aamjiwnaang First Nation
978 Tashmoo Avenue
Sarnia, ON N7T 7H5

Dear, Sharilyn Johnston

Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet
Schedule ‘C’ Municipal Class Environmental Assessment (Phases 3 & 4)

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March 1, 2021
Sharilyn Johnston
Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet Schedule ‘C’ Municipal Class Environmental Assessment
(Phases 3 & 4)

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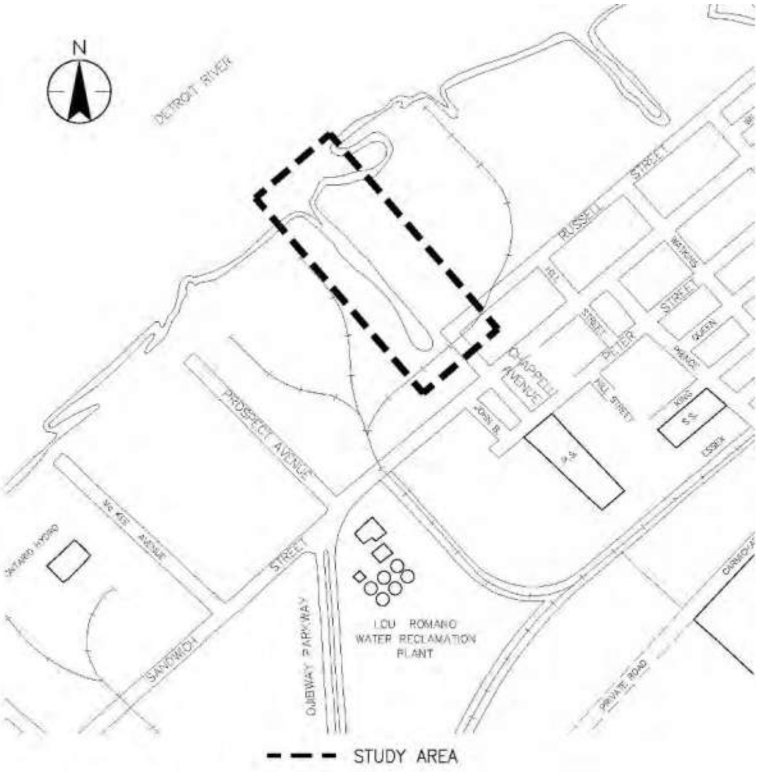

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Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 1, 2021
File: 165620224

Attention: **Metis Consultation Unit**
Metis Nation of Ontario (MNO)
66 Slater Street, Suite 1100
Ottawa, ON K1P 5H1

Good day,

Reference: NOTICE OF STUDY COMMENCEMENT
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Phone: 226-926-6682
Paula.Hohner@stantec.com

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Clarence Jubenville, Stantec Consulting Ltd.

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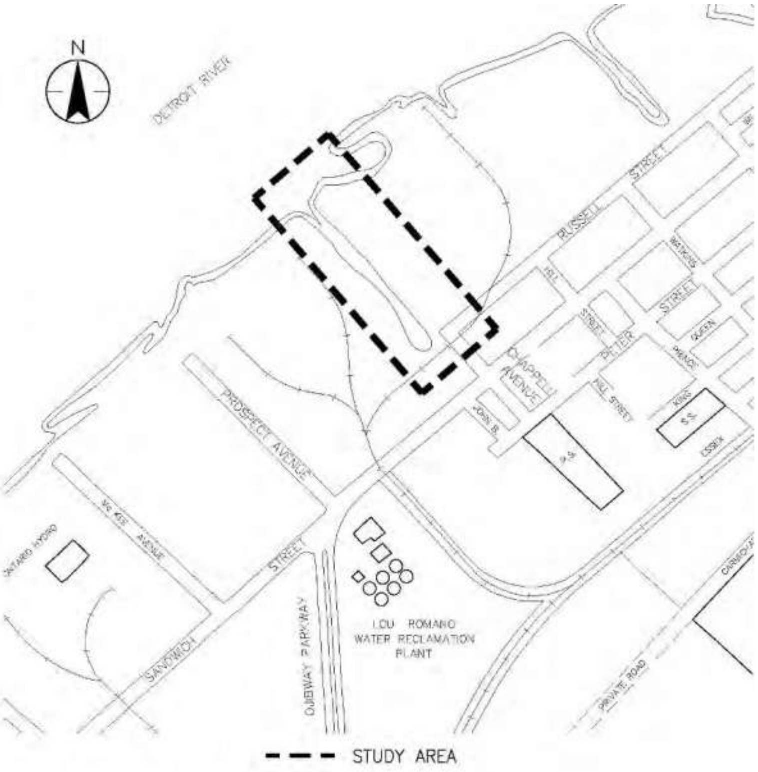

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Comments

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Ian Wilson, P. Eng.
City of Windsor
Engineering Department
519-255-6100 extension 6369
iwilson@citywindsor.ca

Clarence Jubenville, P. Eng.
Consultant Project Manager
Stantec Consulting Ltd.
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This notice was first published on February 26, 2021.

Stantec

Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 1, 2021
File: 165620224

Attention: Chief Mark Peters
Munsee-Delaware Nation
289 Jubilee Road
Muncey, ON N0L 1Y0

Dear, Chief Mark Peters

Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet
Schedule ‘C’ Municipal Class Environmental Assessment (Phases 3 & 4)

The City of Windsor (the City) has initiated a Municipal Class Environmental Assessment (Class EA) study to establish the preferred location of the Prince Road storm sewer outlet to McKee Creek and the associated pumping station.

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Regards,

Stantec Consulting Ltd.

Paula Hohner M.Sc.Pl, MCIP, RPP
Senior Environmental Planner
Phone: 226-926-6682
Paula.Hohner@stantec.com

Attachment: Notice of Study Commencement

c. Ian Wilson, City of Windsor
Clarence Jubenville, Stantec Consulting Ltd.

Prince Road Storm Sewer Outlet
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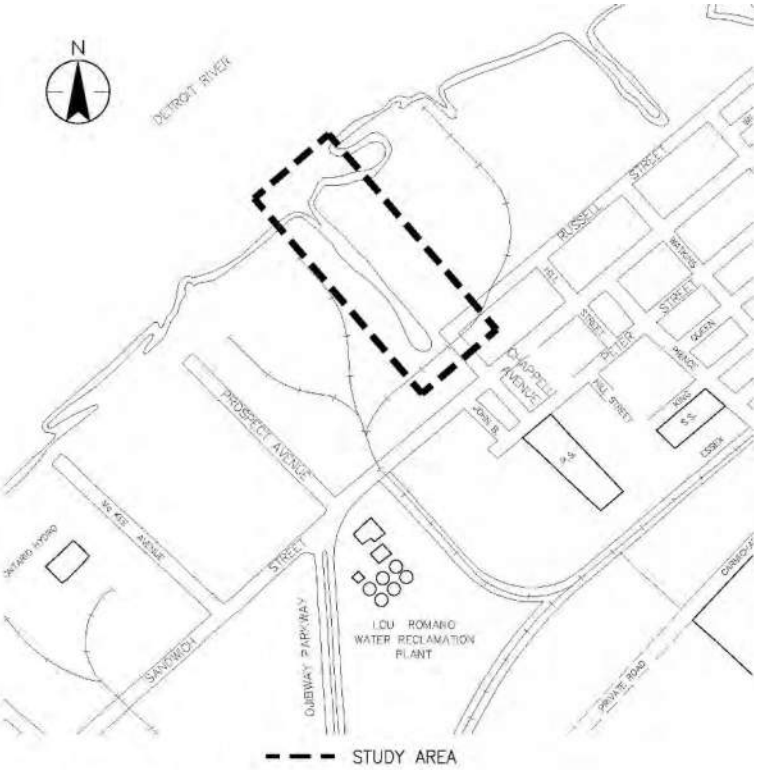

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Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 1, 2021
File: 165620224

Attention: Chief Chris Plain
Aamjiwnaang First Nation
978 Tashmoo Avenue
Sarnia, ON N7T 7H5

Dear, Chief Chris Plain

Reference: NOTICE OF STUDY COMMENCEMENT
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Schedule 'C' Municipal Class Environmental Assessment (Phases 3 & 4)

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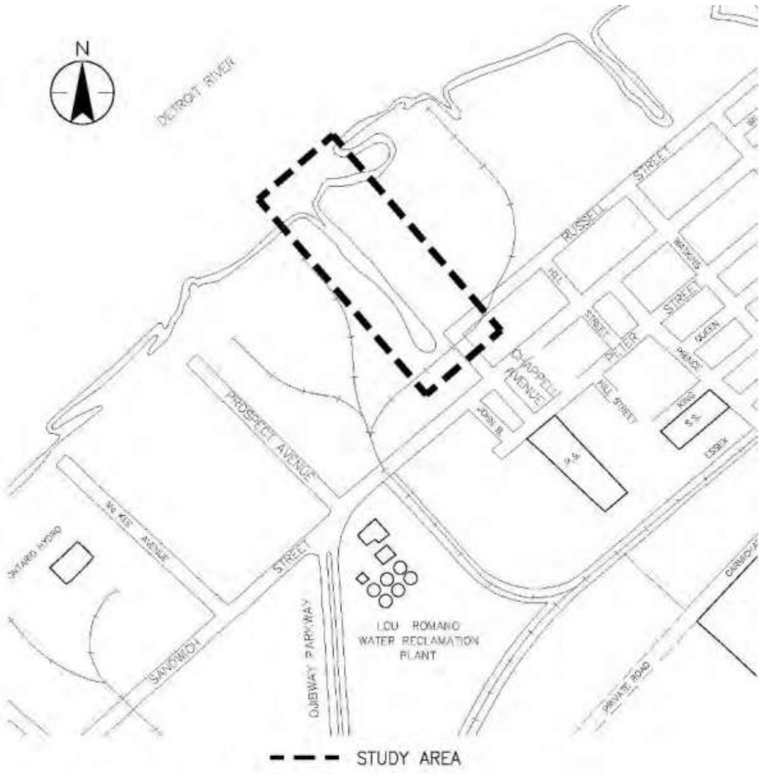

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City of Windsor	Consultant Project Manager
Engineering Department	Stantec Consulting Ltd.
519-255-6100 extension 6369	519-966-2250
iwilson@citywindsor.ca	clarence.jubenville@stantec.com

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Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 1, 2021
File: 165620224

Attention: Chief Charles Sampson
Bkejwanong Territory (Walpole Island)
117 Tahgahoning Road RR #3
Wallaceburg, ON N8A 4K9

Dear, Chief Charles Sampson

Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet
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Stantec Consulting Ltd.

Paula Hohner

Paula Hohner M.Sc.Pl, MCIP, RPP
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Paula.Hohner@stantec.com

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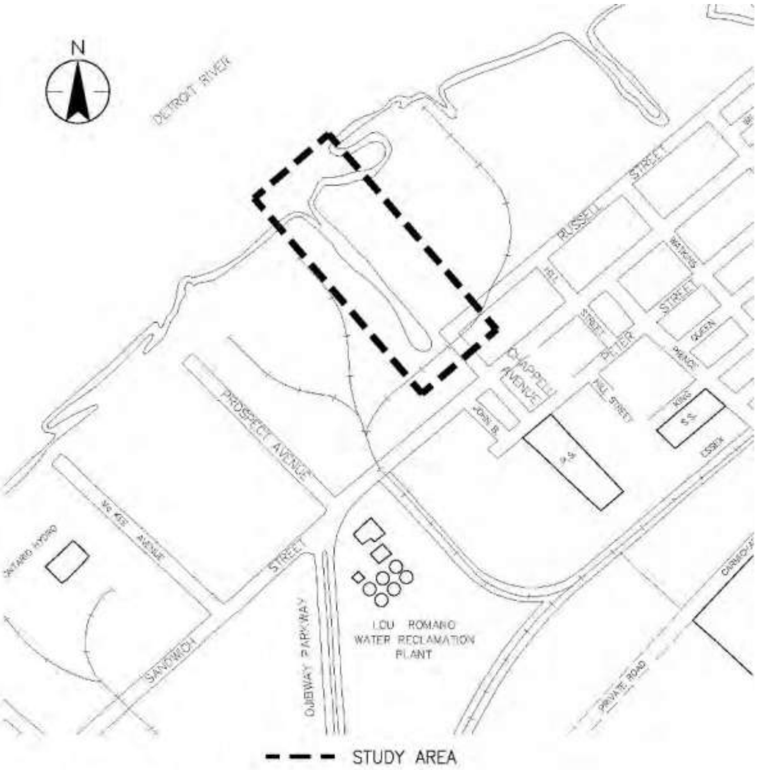

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Ian Wilson, P. Eng. City of Windsor Engineering Department 519-255-6100 extension 6369 iwilson@citywindsor.ca	Clarence Jubenville, P. Eng. Consultant Project Manager Stantec Consulting Ltd. 519-966-2250 clarence.jubenville@stantec.com

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Stantec
Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 1, 2021
File: 165620224

Attention: Derek Sands, Communications Coordinator
Bkejwanong Territory (Walpole Island)
117 Tahgahoning Road RR #3
Wallaceburg, ON N8A 4K9

Dear, Derek Sands

Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet
Schedule 'C' Municipal Class Environmental Assessment (Phases 3 & 4)

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March 1, 2021
Derek Sands
Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet Schedule ‘C’ Municipal Class Environmental Assessment (Phases 3 & 4)

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Regards,

Stantec Consulting Ltd.

Paula Hohner M.Sc.Pl, MCIP, RPP
Senior Environmental Planner
Phone: 226-926-6682
Paula.Hohner@stantec.com

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Clarence Jubenville, Stantec Consulting Ltd.

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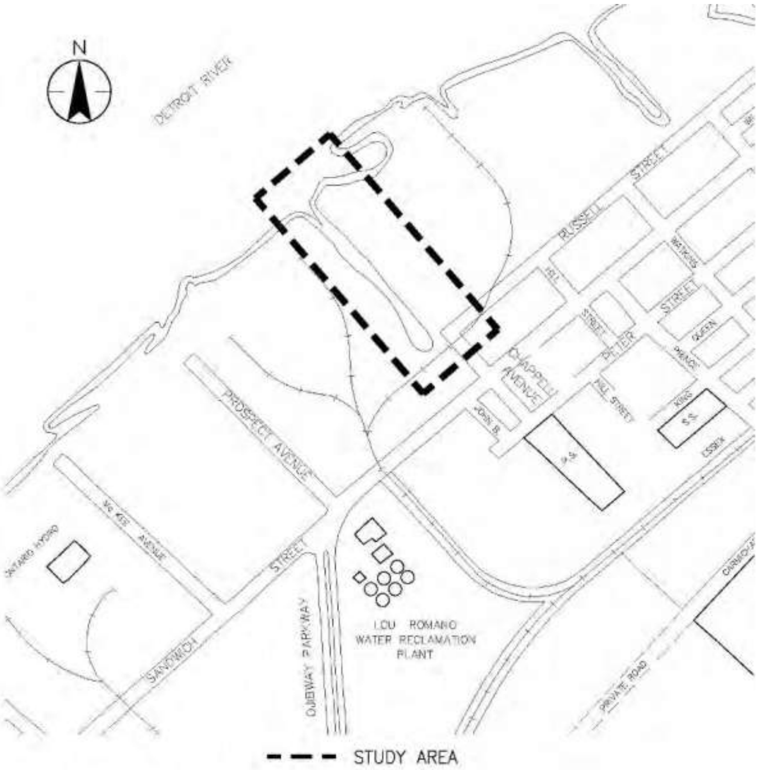

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Stantec
Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 1, 2021
File: 165620224

Attention: Chief Denise Stonefish
Delaware Nation
14760 School House Line RR #3
Thamesville, ON N0P 2K0

Dear, Chief Denise Stonefish

Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet
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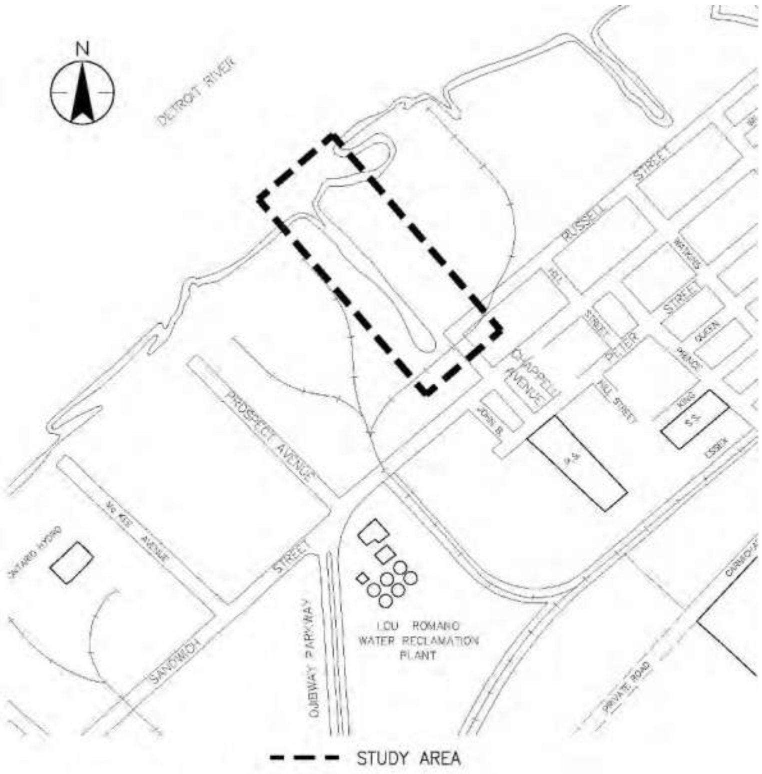

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Stantec Consulting Ltd.
200-835 Paramount Drive, Stoney Creek ON L8J 0B4

March 1, 2021
File: 165620224

Attention: Nikki van Oirschot, Director of Operations
Caldwell First Nation
14 Orange Street
Leamington, ON N8H 1P5

Dear, Nikki van Oirschot

Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet
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March 1, 2021
Nikki van Oirschot
Reference: NOTICE OF STUDY COMMENCEMENT
Prince Road Storm Sewer Outlet Schedule ‘C’ Municipal Class Environmental Assessment (Phases 3 & 4)

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Paula Hohner

Paula Hohner M.Sc.Pl, MCIP, RPP
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Paula.Hohner@stantec.com

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Clarence Jubenville, Stantec Consulting Ltd.

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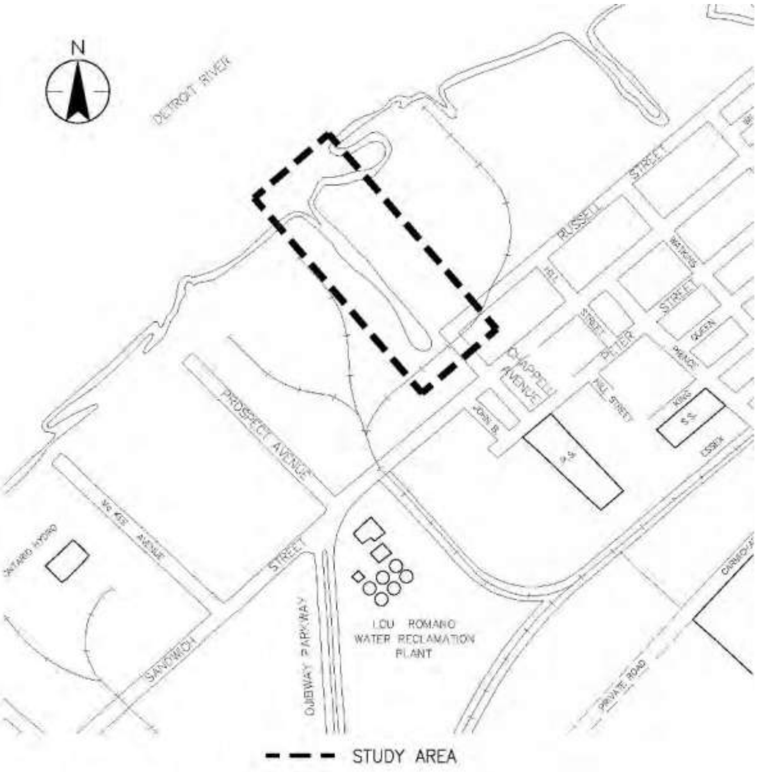

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APPENDIX B

Natural Environment Reports

Gerry Waldron M.Sc.
Consulting Ecologists

A Biological Assessment of the McKee Drain with Particular Reference to Species at Risk and Habitat Evaluation (Draft)

Date: January 31, 2010

Project Personnel:
Project Manager/Ecologist: *G. Waldron, B.Sc., M.Sc.*
Aquatic Biologist: *T. Leadley, B.Sc., M.Sc.*
Field Assistant: *P.J. Hurst, B.Sc.*

* * *

Table of Contents

Introduction

In order to address street and basement flooding following severe storms in the Prince Road Sewer System Study Area, The City of Windsor, following completion of previous phases of construction, has now proposed to complete the final phase of the Prince Road storm sewer outlet. In keeping with the recommendations of the Prince Road Sewer Study (2001), the proposed works will involve the construction of a storm sewer along Peter Street and Chappell Avenue, including crossings at Sandwich and Russell Streets as well as the Essex Terminal Railway. A final outlet to the Mckee Creek that includes the construction of a new storm pump station at the outlet is proposed.

The McKee Creek is a small (approximately 1000 m) intermittent tributary of the Detroit River that drains light industrial lands and nearby municipal roadways (Plate 1). The downstream reach of the McKee Creek (lower 460 m) is a permanent water course (constructed channel) with water levels primarily influenced by water levels in the Detroit River. This creek is designated as Fish Habitat and map overlays of current Department of Fisheries and Oceans (DFO) mapping for Species at Risk (SAR) (ERCA DFO map 2008) suggest the potential for fish SAR to occur in the area of the proposed works.

The Federal Fisheries Act, Subsection 35(1) is a general prohibition of harmful alteration, disruption or destruction (HADD) of fish habitat. Any activity that results in HADD is a contravention of Subsection 35(1) (Minister of Justice, Fisheries Act 2009). The Act defines fish habitat as "spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly to carry out their life processes." The habitat protection provisions of the Act outline powers and authorities to protect the unobstructed passage of fish, provide sufficient flow for fish, prevent fish mortality and prohibit the harmful alteration, disruption or destruction of fish habitat without an authorization from Fisheries and Oceans Canada (Minister of Justice, Fisheries Act 2009).

Plate 1: The McKee Creek (highlighted) and surrounding area (Windsor, ON).

The proposed extension and final connection of the Prince Road storm sewer with the McKee Creek as the final effluent carrier has been determined to result in a detrimental impact on fish habitat (HADD) existing within the lower reach of this Detroit River tributary.

In order to address the Provincial and Federal policy requirements with respect to the proposed project activities impacting on fish habitat, an aquatic assessment of the McKee Creek as well as areas immediately downstream in the Detroit River were required. The aim of the assessment was to qualitatively describe the natural heritage features, characterize significant fish habitat, identify the presence of species at risk (SAR) within the creek and to provide mitigation and compensation recommendations in accordance with the No Net Loss Policy for the Management of Fish Habitat (Department of fisheries and Oceans 1986).

Aquatic SAR information for the Detroit River by the Department of Fisheries and Oceans Canada 2007 has delineated the Detroit River aquatic habitat adjacent to the project site as Species at Risk habitat. A total of 16 species of fish have been designated by The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as threatened, endangered or of special concern in the Detroit River including associated tributaries (Table 1 and Table 2).

Table 1: Fish species protected under SARA (Schedule1) (Fisheries and Oceans 2007).

Common Name	**Fish Species**	**COSEWIC (Schedule 1)**
Channel Darter	*Percina copelandi*	Threaterned
Eastern Sand Darter	*Ammocrypta pellucida*	Threaterned
Lake Chubsucker	*Erimyzon sucetta*	Threaterned
Northern Madtom	*Noturus stigmosus*	Endangered
Pugnose Shiner	*Notropis anogenus*	Endangered
Lake Sturgeon	*Acipensor fulvescens*	Threaterned
Spotted Gar	*Lepidisosteus oculatus*	Threaterned

Table 2: Fish species protected under SAR (Schedule 1, 3 and newly listed species) (Oceans and Fisheries 2007) Detroit River, Lake Erie and associated tributaries (Fisheries and Oceans 2007).

Common Name	**Fish Species**	**COSEWIC**
American Eel	*Anguilla rostrata*	Special Concern
Bigmouth Buffalo	*Ictiobus cyprinellus*	Special Concern
Grass Pickerel	*Esox americanus vermiculatus*	Special Concern
Northern Brook Lamprey	*Ichthyomyzon fossor*	Special Concern
Orangespotted Sunfish	*Lepomis humilis*	Special Concern
Pugnose minnow	*Opsopoeodus emiliae*	Special Concern
Silver Chub	*Macrhybopsis storeriana*	Special Concern
Spotted Sucker	*Minytrema melanops*	Special Concern
Warmouth	*Lepomis gulosus*	Special Concern

Under the Ontario Endangered Species Act 2007, an aquatic species designated by COSEWIC as an endangered or threatened species is protected and qualifies for legal protection and recovery under SARA. This essentially prohibits damaging or destroying the habitat of listed species. Fish habitat is defined as spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes (OMNR 2007, Fisheries and Oceans Canada Fact Sheet 2007).

1.0 Aquatic Assessment

1.1 *Sampling Methods and Location*

A three season sampling approach was conducted in order to more accurately reflect species that may temporarily use the creek/channel habitat for activities such as breeding and foraging. Original sampling design for the McKee Creek was based on both wadeable and non-wadeable waters. A preliminary site visit determined that although the creek is a shallow water course, bottom substrate is composed of very soft and deep sediments preventing safe wading and adequate sampling.

As a result, the survey was conducted using a combination of both electrofishing (vessel) and small fish traps. The electrofishing survey was conducted using a ~ 5 metre, single boom electrofishing vessel equipped with a 5 KW generator. Electrofishing techniques have been demonstrated to be a more effective gear type for sampling aquatic fish species at risk (Poos *et al.*, 2007).The overall sampling effort (three season, three events per season) consisted of a total of 18,000 shocking seconds at 7-8 amps (70%: 50 – 500 voltage range). Sampling was generally conducted in a transect pattern throughout the channel. All nearshore shallow areas were accessible using this sampling technique. Two netters were used to retrieve stunned fish as they appeared and the fish were transferred to live wells for identification. The fish sampling protocols and procedures follow the Ontario Ministry of Natural Resources (OMNR) Electrofishing Policy Guidelines and Procedures, Watershed Science Centre, 2006 Manual.

In addition to the electrofishing survey, a total of 30 small fish traps were also used throughout the creek and nearshore areas at the confluence with the Detroit River in order to collect benthic species of fish (e.g. *Noturus*) that are more difficult to collect using electrofishing techniques. Traps were baited with a combination of chicken organs and commercial Trout chow. Traps were set overnight and retrieved the following morning, following a set period of 12 -15 hours.

Sampling events were conducted in the months of May, June, August, October and November of 2009. A total of three sampling event were conducted per season that also included night time survey events. Fish traps were set once per each seasonal sampling event.

In order to assess general water quality conditions within the channel at the time of sampling, basic water chemistry was measured *in situ* using a Hydrolab Surveyor 3/ Reporter Multiprobe Multiparameter Water Quality Logging System (results provided in General Observations).

1.2 *General Observations and Physical Characteristics*

The McKee Creek, as previously noted is a small tributary of the Detroit River located in Windsor, ON (N 42˚17’ 25.91” , W 083˚ 05’ 27.53”). The downstream reach of the McKee Creek is considered a permanent water course with water levels determined by Detroit River water levels. The downstream reach is approximately 460 meters in length and averages 25 meters in width. The upper reach of the McKee (west of the Sandwich Street) is classified as intermittent and does not represent fish habitat as it remains dry throughout most of the year. A culvert under the rail line connects the downstream permanent channel to the upstream reach. The creek reach between the culvert and Sandwich Street does contain water (pooling) and fish but this area will be is unaffected by the proposed works.

The McKee Creek in its present form can be considered a shallow water channel (embayment) of the Detroit River. Water depths in the channel range from less than one meter in the littoral embayment at the northeast end to a slightly deeper mid channel depth of 2-3 meters at the confluence with the Detroit River. Table 3 shows the results of five depth soundings measured on August 11, 2009, beginning at the Detroit River entrance through to the channel (culvert) termination near the Essex Terminal Railway.

Water levels in the Detroit River, recorded on November 1 2009 was 174.590 metric units relative to I.G.L.D. Amherstburg – CHS Stage-IGLD85 Meters Canadian Hydrographic Service (Great Lakes Information Network, measured at the Amherstburg Gauge) US Army Corp. of Engineers (2010).

Table 3. McKee Creek approximate channel depths starting Detroit River and ending at the inland end of the creek channel.

GPS Co-ordinates	Channel Depth
N 42 17' 25.91" W 83 05' 27.53"	2.5 m (8')
N 42 17' 25.01" W 83 05' 25.42"	1.5 m (5')
N 42 17' 23.98" W 83 05' 22.88"	1 m (3')
N 42 17' 23.22" W 83 05' 20.65"	1 m (3')
N 42 17' 19.20" W 83 05' 11.11"	< 1 m (<3 ')

Basic water quality measurements were collected during each seasonal survey (Table 4). Temperature (°C), pH, conductivity (µS/cm), oxidation-reduction potential (mvolts), and dissolved oxygen (mg/L) were measured *in situ* using a Hydrolab Surveyor 3/ Reporter Multiprobe Multiparameter Water Quality Logging System. Measurements were collected approximately 50 cm below the surface.

Table 4: Water quality results for the McKee Creek (spring, summer and fall 2009). Results represent single time point measurements.

PARAMETER	***MAY 15 2009**		**AUGUST 11 2009**		**NOVEMBER 01 2009**	
	UPSTREAM	DOWNSTREAM	UPSTREAM	DOWNSTREAM	UPSTREAM	DOWNSTREAM
Temperature (°c)	14	14	22.84	24.37	8.63	10.36
Specific Condcutivity (mS/cm)	1.166	0.24	0.874	0.605	1.253	0.262
Dissolved Oxygen (mg/L)	6.47	10.22	2.77	8.55	5.4	9.86
pH	7.55	7.9	7.35	7.91	7.12	7.66
Oxidation-Reduction Potential (mvolts)	235	227	448	410	215	210

* Measurements collected following rainfall event

Water quality for the parameters measured in the lower reach of the McKee Creek was considered satisfactory and well within wildlife guidelines deemed safe for aquatic life. The relatively wide entrance of the creek to the Detroit River provides an adequate mixing zone to improve water quality in the immediate vicinity. Moderate exposure to wind and wave action in this area of the creek help improve water quality conditions through increased aeration and mixing. The upper reaches of the creek reflect more quiescent conditions where low dissolved oxygen concentrations were observed during the summer and fall seasons, well below guideline levels of 5 mg/L (e.g. DO = 2.77 mg/L, August 11, 2009). This area of the channel is shallow and densely vegetated with only minor amounts of mixing occurring with downstream water. Keeping in mind that this creek only flows during wet events, the low dissolved oxygen concentrations observed likely reflect the diurnal oxygen cycle typical of heavily vegetated water bodies and most commonly observed in ponds. All measurements were conducted during the morning hours when low DO concentrations under these habitat conditions would not be unexpected.

Poor water clarity (elevated suspended solids concentrations) was commonly observed in the McKee Creek during most sampling events. The channel's soft sediment substrate are easily disturbed and re-suspended from both natural sources (e.g. numerous foraging Common Carp as well as other species) and periodic flow from upstream drainage that occurs during rain events. In addition, the creek receives silt laden runoff during precipitation events from the adjacent gravel yard to the south and industrial lands to the north contributing to the already turbid channel. .

Channel substrates were characterized as primarily a combination of soft sediments (fine grained-silts/clays and detritus) sand, stones and cobble and broken concrete slabs. The lower creek banks are lined with rock, gravel and broken concrete slabs overgrown with Common Reed Grass (*Phragmites sp.).*

Plate 2: The McKee Creek upstream channel (east view). Note turbid water conditions.

The shallow water channel was characterized as a low gradient depositional environment where the diversity and abundance of aquatic flora and fauna in the study area were typical of this type of habitat. Dense macrophyte beds consisting primarily of *Myriophyllum spicatum*, *Vallisneria americana*, *Elodea canadensis*, *Ceratophyllum demersum* and *Potamogeton spp*. were abundant throughout the channel. The submersed aquatic plant beds were populated by both forage and predatory fish species (see fish results).

The protection of fish by materials in the water medium is termed in-stream cover (Dodge *et al*. 1984). These are areas of shelter in the channel that provide protection from predation, current, and spawning habitat; examples may include logs, trees, rocks and organic cover such as aquatic plants. Visible in-stream cover in the project area was classified as dense, provided mainly by the abundant aquatic plant population. Submersed tree branches, and concrete slabs along the banks provided additional cover on the north shoreline of the channel.

Stream canopy cover is defined as canopy closure provided by stream side riparian vegetation that projects over the stream and is higher than 1 m above the water surface (BC Fisheries Information Branch 2001). Littoral cover in this assessment was limited to onshore shrub and overhanging weedy species (e.g. *Phragmites*). On proportional basis, the majority (>90%) of the channel is considered exposed (See Plate 1).

1.3 *Fish Survey Results*

The McKee Creek supports a relatively diverse and abundant assemblage of fish that include both large predatory species (e.g. Bass) and forage fish species (e.g. Cyprinids). In addition, numerous Young of the Year (YOY) (e.g. Largemouth Bass and Yellow Perch) were also collected and or observed throughout the channel clearly indicating that the channel not only serves as foraging area, but also serves as spawning habitat for many of the fish species.

Results from the 2009 three season qualitative fish survey identified a total 17 species of fish from 11 families, comprised of Minnows and Carps (Cyprinidae), Bass and Sunfish (Centrarchidae), Percids (Percidae), Gobies (Gobiidae), Shad (Clupeidae), Suckers (Catostomidae), Gars (Lepisosteidae), Temperate Bass (Moronidae), Drums (Sciaenidae), Catfish (Ictaluridae) and Pike (Esocidae). A total of 15 species of fish were collected during the spring 2009 survey, 17 species of fish during the summer survey and 16 species collected during the fall survey. Survey results are provided below.

Survey results indicated a spatial variation in species distribution within the creek as well as a slight temporal variation in the species observed. White Bass, Freshwater Drum, Smallmouth Bass, Northern Pike and Spotted Suckers as well as some cyprinids (e.g. Emerald Shiner) were more abundant in the spring and summer sampling surveys and also more common near the mouth of the creek at the confluence with the Detroit River. Species such Bullheads and Sunfish, more tolerant of periodic low dissolved oxygen levels and elevated turbidity, were collected throughout the channel but were observed to be more abundant in the heavily vegetated areas further inland.

Table 2. The McKee Creek (Channel) electrofishing Spring sampling results (May 15th, 20th and June 10th 2009).

Approximate sampling area co-ordinates: Starting Area: **N** 42˚17`26.62`` **W** 083˚05` 28.84``
Finishing Area: **N** 42˚17.700 **W** 083˚04.944

Labidesthes sicculus (Brook Silverside)
Pimephales notatus (Bluntnose Minnow)
Notropis atherinoides (Emerald Shiner)
Microptereus salmoides (Largemouth Bass)
*Per*ca *flavescens* (Yellow Perch)
Cyprinus carpio (Common Carp)
Neogobius melanostomus (Round Goby)
Dorosoma cepedianum (Gizzard Shad)
Minytrema melanops (Spotted Sucker)
Esox lucius (Northern Pike)
Ameiurus nebulosus (Brown Bullhead)
Lepisosteus osseus (Longnose Gar)
Morone chrysops (White Bass)
Lepomis macrochirus (Bluegill Sunfish)
Lepomis gibbosus (Pumpkinseed Sunfish)

Table 3. The McKee Creek (Channel Slip) electrofishing summer season sampling results (August 12th, 14th and 15th 2009).

Approximate sampling area co-ordinates: Starting Area: **N** 42˚17.776 **W** 083˚05.169
Finishing Area: **N** 42˚17.700 **W** 083˚04.944

Notropis atherinoides (Emerald Shiner)
Notropis volucellus (Mimic Shiner)
Pimephales notatus (Bluntnose Minnow)
Labidesthes sicculus (Brook Silverside)
Microptereus salmoides (Largemouth Bass)
Morone chrysops (White Bass)
Lepomis gibbosus (Pumpkinseed Sunfish)
Lepomis macrochirus (Bluegill Sunfish)
Minytrema melanops (Spotted Sucker)
Esox lucius (Northern Pike)
Perca flavescens (Yellow Perch)
Cyprinus carpio (Common Carp)
Ictiobus sp. (Buffalo *sp*.)
Neogobius melanostomus (Round Goby)

Table 3. Continued

Dorosoma cepedianum (Gizzard Shad)
*Catostomus commersonii*n (White sucker)
Minytrema melanops (Spotted Sucker)

Table 4. The McKee Creek (Channel) electrofishing fall season sampling results (October 24th, 27th, and November 1st 2009).

Approximate sampling area co-ordinates:	Starting Area: **N** 42˚17.776 **W** 083˚05.169
	Finishing Area: **N** 42˚17.700 **W** 083˚04.944

Notropis atherinoides (Emerald Shiner)
Micropterеus salmoides (Largemouth Bass)
Morone chrysops (White Bass)
Lepomis gibbosus (Pumpkinseed Sunfish)
Lepomis macrochirus (Bluegill Sunfish)
Minytrema melanops (Spotted Sucker)
Esox lucius (Northern Pike)
Ameiurus nebulosus (Brown Bullhead)
Ameiurus natalis (Yellow Bullhead)
*Per*ca *flavescens* (Yellow Perch)
Cyprinus carpio (Common Carp)
Aplodinotus grunniens (Freshwater Drum)
Neogobius melanostomus (Round Goby)
Micropterеus salmoides (Largemouth Bass)
Micropterus dolomieu (Smallmouth Bass)
Ambloplites rupestris (Rockbass)

The McKee Creek fish assessment results are not considered comprehensive. There are limiting factors that affect the efficiency of electrofishing as a productive sampling technique although it remains one of the most effective types of fish sampling techniques for SAR ((Poos *et al.*, 2007). Some factors that affect electrofishing sampling efficiency may include fish size, anatomy, and habitat preference as well as fish behaviour and water clarity. Many benthic fish species such as Gobies and Darters characteristically roll over upon entering the electrical field of the vessel. The failure to reach the surface or visual range for netting results in the exclusion of these species from the catch results. This situation can be exacerbated when sampling in turbid waters. Although small traps were used in an attempt to collect benthic species that may have avoided detection through electrofishing surveys used in this study, trap results provided no additional species that were not already collected through electrofishing techniques.

In regard to water clarity, it should be noted that although McKee Creek is a relatively turbid body of water and water clarity at the sampling site was characterized as moderate at best, during the majority of the sampling events. Water clarity was deemed acceptable to sample when the bottom substrate was visible.

Based on the repetitive sampling procedure it is believed that a good representation of fish species occupying this area was demonstrated, although given the open connection to the Detroit River, the species occupying the McKee Creek at any given time may be considered as diverse as other reaches of the Detroit River.

The 2009 survey results identified the occurrence of a Species at Risk in the project area. The Spotted Sucker (*Minytrema melanops*) was collected in all fish inventories conducted within the channel. This fish species is designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as a Species of Special Concern (November 2001) and SARA Status as a Species of Special Concern (June 2003). A total of 3-4 Spotted Suckers were collected at each sampling event.

1.4 *Summary and Discussion*

Both fish and invertebrate diversity in the Detroit River has been well documented in the literature (USEPA 1988). More than 300 species of macro-benthic invertebrates and over 65 species of natural and introduced fish have been identified in the Detroit River ecosystem. A total of 32 of those fish species have been known to spawn near the islands and mainland shoreline of the Detroit River (Goodyear *et al*. 1982, UGLCCS 1988, Detroit River RAP Report 1991, International Association for Great Lakes Research 1999-2008).

Faunal diversity and abundance are known to be greater in the shallow depositional zones of the Detroit River particularly in the lower reaches of the river, where this type of habitat predominates (Goodyear et al. 1982, UGLCCS, 1988). Because natural shoreline areas in the mid to upstream reaches of the Detroit River (near the cities of Windsor, Ontario and Detroit, Michigan have been lost to development over time, the protection and improvement of productive fish habitat has been the focus of both the U.S. and Canadian border communities. The Detroit River is designated as a Great Lakes Area of Concern (AOC) (International Association for Great Lakes Research 1999-2008) and the loss of fish and wildlife habitat" is just one of the many impaired uses supporting this AOC designation (US EPA www.epa.gov/grtlakes/aoc/detroit.html 2008).

The results of this assessment confirm that the McKee Creek (channel) provides suitable habitat for a relatively diverse population of forage and predatory fish species. The study site's significance as fish habitat relates primarily to the channel providing a calm water embayment adjacent to the swift current of the Detroit River. The site also provides areas of shallow water with extensive beds of aquatic vegetation providing substrate, cover and forage for a wide variety of invertebrate fauna, forage fish and consequently predator fish species.

Additional significance to this site is attributed to the occurrence of the Spotted Sucker, a SARA species of Special Concern. As such this species has the general protection given by the habitat protection provisions sections of the Fisheries Act (Fisheries and Oceans Canada, 2004).

The rank of **Special Concern (SC)** (formerly Vulnerable, VUL) is assigned by the Committee on the Status of Endangered Wildlife and Canada (COSEWIC) and is defined as **Any indigenous species that is particularly at risk because of low or declining numbers, occurrence at the fringe of its range or in restricted areas, or for some other reason but is not a threatened species.**

In Canada the Spotted Sucker (*Minytrema melanops*) is limited to southwestern Ontario, where it occurs in Lake St. Clair, the western basin of Lake Erie, and in the Thames and East Sydenham Rivers. The Spotted Sucker is occasionally found in the southern portion of Michigan, where its abundance is unknown (Michigan's Wildlife Action Plan SGCN Status & Species-Specific Issues 2005). Records for the occurrence of the Spotted Sucker in the Detroit River exist for the time period of 1993-2003 (COSEWIC 2005). The limited population is suspected to be at its northern limits for the species, and as such may have always been a relatively rare species in this region. It should noted that the occurrence of the species has also been recorded less than a kilometre upstream from the McKee Creek in the Detroit River at the Sterling Fuel's Channel in 2008.

The Spotted Sucker normally prefers small to medium-sized rivers over clay, sand or gravel substrates, although this species has also been collected from other habitats including large rivers, oxbows and backwater areas, impoundments and small turbid creeks (COSEWIC 2005).

1.5 *Aquatic Mitigation and Compensation Recommendations*

- As result of the proposed stormwater sewer connection and a resulting increase in effluent discharge to the creek through this connection, efforts to reduce contamination and sediment loading to the creek should be incorporated. A sediment forebay is recommended to be located near the inlet of the creek. The forebay should be design to act as an initial storage area to trap sediment and pollutants before reaching the creek channel.

- The incorporation of a forebay would also provide flow protection by dissipating peak flow velocity during wet events, preventing excessive sediment re-suspension in the channel of the McKee Creek.
- All works at the site where machinery, materials or silt laden runoff may impact the aquatic habitat (McKee and Detroit River) are to be scheduled for times outside the fish breeding period from March 15 to June 30. Works conducted within the breeding period will only be of a nature that does not alter or destroy aquatic habitat or organisms.
- Efforts should be made to prevent turbid runoff from entering the creek and eventually the river and as a result of stored dredge and or excavated materials in the construction area (e.g. containment). Dredge material may also contain some potential inorganic and organic compounds that could potentially water impact the quality of the water if no mitigative measures are taken.
- A silt curtain will be erected between the excavation area and the creek and adjacent construction site to intercept the movement of unconsolidated soils into the river.
- Fish habitat can be improved by incorporating small fully and partially submerged boulder clusters to increase habitat complexity and spawning areas in the littoral zone of the channel. Rocks clusters of various size quarry stone should be used in order to create numerous cavities.
- Incorporate roots wads into boulder clusters in shallow littoral areas to create instream cover and increase spatial habitat diversity in this channel. Instream cover, usually in the form of woody debris or boulder clusters as suggested provide habitat for invertebrates, predation refuge, and attachment sites for adhesive fish eggs. In-stream cover is an important component of most lotic habitat and generally the more in-stream cover the more species diversity.
- All large rocks, stumps, large logs and woody material existing on the present shoreline and dredging zone should be retained and reinstalled within the “deeper” water areas if deemed beneficial fish habitat material (e.g. deadheads).

2.0 Terrestrial Assessment

2.1 *Discussion*

A narrow band of vegetation grows along the canal banks in the lower reach of McKee Creek. This provides some shade to the canal waters and limited buffering from the adjacent industrial activities. The canal banks are composed entirely of fill with armouring of broken concrete. Most of the shoreline is dominated by thick stands of Common Reed, *Phragmites australis*. Scattered young trees of various species including the native Cottonwood, *Populus deltoides*, and several exotic species grow on the bank. Weedy meadow vegetation is found along the north side near the mouth and in the southeast corner. A species list for this area is provided in Appendix 1.

Seventy-one plant species in total were documented for this site with 39 or 55% being exotic (non-native) species. This is a very high percentage; most sites in the Essex region have an exotic component of 25 – 30%. High percentages of non-native species are indicators of high disturbance of which filled lands are a good illustration. Such lands have a low natural heritage value.

At the east end of the canal, McKee Creek is covered by a roadway crossing then is uncovered for a short distance before again being covered by a culvert beneath a railway. After this there is an open channel approximately 225 metres in length to another road crossing near Sandwich Street. This upper reach appears less disturbed than the lower canal reach but the banks through this reach are also composed of fill and no native soils are evident. The vegetation reflects this disturbance being composed of 57% exotic (non-native) species. The floral species list for this section is provided in Appendix 2.

In this study, Species at Risk are defined as species with the following designations: S1, S2, S3, Endangered, Threatened or Special Concern.

Provincial rarity ranks (S-ranks) are assigned by the Ontario Natural Heritage Information Centre of MNR as follows:

S1	**Extremely rare** in Ontario; usually 5 or fewer occurrences in the province or very few remaining individuals; often especially vulnerable to extirpation.
S2	**Very rare** in Ontario; usually between 5 and 20 occurrences in the province or with many individuals in fewer occurrences; often susceptible to extirpation.
S3	**Rare to uncommon** in Ontario; usually between 20 and 100 occurrences in the province; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.
S4	**Common** and apparently secure in Ontario; usually with more than 100 occurrences in the province.
S5	**Very common** and demonstrably secure in Ontario.

The rank of **Special Concern (SC)** (formerly Vulnerable, VUL) is assigned by the Committee on the Status of Endangered Wildlife and Canada (COSEWIC) and the Committee on the Status of Species at Risk in Ontario (COSSARO) and is defined as **Any indigenous species that is particularly at risk because of low or declining numbers, occurrence at the fringe of its range or in restricted areas, or for some other reason but is not a threatened species.**

The rank of **Threatened (THR)** is assigned to **Any indigenous species of fauna or flora that is likely to become endangered in Canada if the factors affecting its vulnerability do not become reversed.**

Endangered (END) Species are defined as **Any indigenous species of fauna or flora that, on the basis of the best available scientific evidence, is indicated to be threatened with immediate extinction throughout all or a significant portion of its Ontario range.**

Both Threatened and Endangered species are covered by the Endangered Species Act of Ontario, which prohibits destruction of the organism or its habitat.

In this study, no terrestrial floral or faunal Species at Risk were observed. On each visit, although no cover boards were established on-site, the existing debris was lifted and examined. No snakes were encountered. No other reptiles, amphibians or mammals were seen. Only tracks of common mammals such as White-tailed Deer and Racoons were noted. A family of Mallard Ducks occupied the canal and common species of birds nested in the cover provided by the vegetation along McKee Creek. Nearby sites, both upstream and downstream of this site are known to support populations of Eastern Foxsnake and Butler's Gartersnake. Blanding's Turtles and Queen Snakes may also use the aquatic portions of the site.

Scientific Name	**Common Name**	**SRANK**	**COSEWIC**	**COSSARO**
Elaphe gloydi	Eastern Foxsnake	S3	END	THR
Emydoidea blandingii	Blanding's Turtle	S3	THR	THR
Regina septemvittata	Queen Snake	S2	THR	THR
Thamnophis butleri	Butler's Gartersnake	S2	THR	THR

Although none of the above species were documented for the site, a precautionary approach justifies the retention or expansion of habitat suitable for these species. Also, the proposed works present an opportunity to create additional and improved wildlife habitat within the Detroit River Area of Concern.

2.2 *Terrestrial Mitigation Recommendations*

- Retain the existing habitat in the upper reach. The creek channel and adjacent lands east of the railway and west of Sandwich Street, although disturbed, provide wildlife habitat of increasing value.
- A sediment forebay should be buffered with natural vegetation to the greatest extent possible while allowing access for periodic maintenance. Shade producing native trees should be included in this landscape where possible.
- All riparian vegetation that is not within the active construction zone is to be left untouched. Access to the site by land should be limited to existing disturbed areas.
- Any logs, brush or woody debris created by construction activities should be left in the area and allowed to decay.

* * *

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4.0 Appendices

Appendix 1: Plant Species Observed on Study Site – Canal Portion

Field Dates: May 11, June 29, & July 28, 2009
N = Native Species; E = Exotic (non-native) Species
Number of species = 71 Number of exotic species = 39 (55% of total)

Acer negundo	Manitoba Maple	E
Achillea millefolium	Yarrow	E
Agrostis gigantea	Redtop	N
Ailanthus altissima	Tree-of-heaven	E
Ambrosia trifida	Giant Ragweed	N

Apocynum cannabinum	Hemp Dogbane	N
Arctium minus	Burdock	E
Artemisia vulgaris	Mugwort	E
Asclepias syrica	Common Milkweed	N
Asparagus officinalis	Asparagus `	E
Aster lanceolatus	Lance-leaved Aster	N
Aster pilosus	Hairy Aster	N
Bromus tectorum	Downy Brome	E
Calystegia sepium	Hedge Bindweed	N
Celtis occidentalis	Hackberry	N
Cichorium intybus	Chicory	E
Cirsium arvense	Canada Thistle	E
Cirsium vulgare	Bull Thistle	E
Convolvulus arvensis	Field Bindweed	E
Conyza canadensis	Horseweed	N
Cornus drummondii	Rough-leaved Dogwood	N
Dactylis glomerata	Orchard Grass	E
Daucus carota	Wild Carrot	E
Dipsacus fullonum	Teasel	E
Eleagnus angustifolia	Russian Olive	E
Elymus repens	Quack Grass	E
Equisetum arvense	Field Horsetail	N
Erigeron philadelphicus	Philadelphia Fleabane	N
Eupatorium altissimum	Tall Boneset	N
Euthamia graminifolia	Grass-leaved Goldenrod	N
Erysium cheiranthoides	Wormseed Mustard	E
Fraxinus pennsylvanica	Red Ash	N
Geum canadense	White Avens	N
Helianthus tuberosus	Jerusalem Artichoke	E
Hordeum jubatum	Foxtail Barley	E
Hypericum punctatum	Spotted St. John’s-wort	N
Impatiens capensis	Jewel Weed	N
Lathyrus latifolius	Everlasting Pea	E
Linaria vulgaris	Butter-and-eggs	E

Lonicera tatarica	Tartarian Honeysuckle	E
Lotus corniculata	Bird’s-foot Trefoil	E
Lythrum salicaria	Purple Loosestrife	E
Medicago lupulina	Black Medic	E
Melilotus alba	White Sweet Clover	E
Melilotus officinalis	Yellow Sweet Clover	E
Morus alba	White Mulberry	E
Oenothera biennis	Evening Primrose	N
Parthenocissus inserta	Virginia Creeper	N
Phalaris arundinacea	Reed Canary Grass	N
Phragmites australis	Reed Grass	N/E
Plantago lanceolata	Narrow-leaved Plantain	E
Poa pratensis	Kentucky Bluegrass	E
Poa compressa	Canada Bluegrass	N
Populus deltoides	Eastern Cottonwood	N
Rhus glabra	Smooth Sumac	N
Rhus typhina	Staghorn Sumac	N
Rosa eglanteria	Sweet Briar Rose	E
Rumex crispus	Curly Dock	E
Salix exigua	Sandbar Willow	N
Solanum dulcamara	Bittersweet	E
Solidago altissima	Tall Goldenrod	N
Solidago canadensis	Canada Goldenrod	N
Solidago sempervirens	Seaside Goldenrod	E
Sonchus arvensis	Perennial Sow-thistle	E
Sonchus asper	Prickly Sow Thistle	E
Taraxacum officinale	Dandelion	E
Trifolium pratense	Red Clover	E
Ulmus americana	White Elm	N
Ulmus pumila	Siberian Elm	E
Vitis riparia	Riverbank Grape	N

Appendix 2: Plant Species Observed on Study Site – Upper Reach

N = Native Species; E = Exotic (non-native) Species
Number of species = 90   Number of exotic species = 51 (57% of total)

Acer negundo	Manitoba Maple	E
Achillea millefolium	Yarrow	E
Agrostis gigantea	Redtop	N
Alliaria petiolata	Garlic Mustard	E
Ambrosia artemisiifolia	Common Ragweed	N
Ambrosia trifida	Giant Ragweed	N
Apocynum cannabinum	Hemp Dogbane	N
Arctium minus	Burdock	E
Artemisia vulgaris	Mugwort	E
Asclepias syrica	Common Milkweed	N
Aster ericoides	Heath Aster	N
Aster lanceolatus	Lance-leaved Aster	N
Aster pilosus	Hairy Aster	N
Bromus inermis	Smooth Brome	E
Bromus tectorum	Downy Brome	E
Calystegia sepium	Hedge Bindweed	N
Centaurea maculosa	Spotted Knapweed	E
Centaurium pulchellum	Branching Centaury	E
Ceratophyllum demersum	Spiny Hornwort	N
Chenopodium album	Lamb’s Quarters	E
Cichorium intybus	Chicory	E
Cirsium arvense	Canada Thistle	E
Cirsium vulgare	Bull Thistle	E
Convolvulus arvensis	Field Bindweed	E
Cornus drummondii	Rough-leaved Dogwood	N
Dactylis glomerata	Orchard Grass	E
Daucus carota	Wild Carrot	E
Diplotaxus tenuifolia	Sand Rocket	E
Eleagnus angustifolia	Russian Olive	E
Elodea canadensis	Wild Celery	N
Elymus repens	Quack Grass	E

Equisetum arvense	Field Horsetail	N
Erigeron philadelphicus	Philadelphia Fleabane	N
Eupatorium altissimum	Tall Boneset	N
Euthamia graminifolia	Grass-leaved Goldenrod	N
Erysium cheiranthoides	Wormseed Mustard	E
Festuca arundinacea	Tall Fescue	E
Fraxinus americana	White Ash	N
Geranium carolinianum	Carolina Crane’s-bill	N
Geum canadense	White Avens	N
Hackelia virginiana	Beggar’s Lice	N
Helianthus tuberosus	Jerusalem Artichoke	E
Hemerocallis fulva	Orange Daylily	E
Hordeum jubatum	Foxtail Barley	E
Hypericum perforatum	Common St. John’s-wort	E
Impatiens capensis	Jewel Weed	N
Juniperus virginiana	Red Cedar	N
Lappula squarrosa	Two-row Stickseed	E
Lathyrus latifolius	Everlasting Pea	E
Linaria vulgaris	Butter-and-eggs	E
Lonicera tatarica	Tartarian Honeysuckle	E
Lotus corniculata	Bird’s-foot Trefoil	E
Lythrum salicaria	Purple Loosestrife	E
Melilotus officinalis	Yellow Sweet Clover	E
Morus alba	White Mulberry	E
Oenothera biennis	Evening Primrose	N
Parthenocissus inserta	Virginia Creeper	N
Pastinaca sativa	Wild Parsnip	E
Phalaris arundinacea	Reed Canary Grass	N
Phleum pratense	Timothy	E
Phragmites australis	Reed Grass	N/E
Plantago lanceolata	Narrow-leaved Plantain	E
Poa pratensis	Kentucky Bluegrass	E
Poa compressa	Canada Bluegrass	N
Populus deltoides	Eastern Cottonwood	N

Portulaca oleracea	Purslane	N
Potamogeton crispus	Curly Pondweed	E
Potamogeton pectinatus	Sago Pondweed	N
Potentilla anserina	Silverweed	N
Prunus serotina	Black Cherry	N
Rhamnus cathartica	Common Buckthorn	E
Rhus glabra	Smooth Sumac	N
Rhus radicans	Poison Ivy	N
Rosa multiflora	Multiflora Rose	E
Rumex crispus	Curly Dock	E
Salix alba	White Willow	E
Salix exigua	Sandbar Willow	N
Sambucus canadensis	Black Elderberry	N
Saponaria officinalis	Bouncing Bet	E
Solanum dulcamara	Bittersweet	E
Solidago altissima	Tall Goldenrod	N
Solidago canadensis	Canada Goldenrod	N
Solidago sempervirens	Seaside Goldenrod	E
Sonchus arvensis	Perennial Sow-thistle	E
Sonchus asper	Prickly Sow Thistle	E
Taraxacum officinale	Dandelion	E
Tilia cordata	Little-leaf Linden	E
Tragopogon dubius	Goat’s Beard	E
Vicia cracca	Bird Vetch	E
Vitis riparia	Riverbank Grape	N

Prince Road Storm Sewer Outlet Natural Environment Technical Report, Windsor, Ontario

Schedule ‘C’ Municipal Class Environmental Assessment

March 25, 2022

FINAL REPORT

Prepared for:

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PRINCE ROAD STORM SEWER OUTLET NATURAL ENVIRONMENT TECHNICAL REPORT, WINDSOR, ONTARIO

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1.0 INTRODUCTION

Stantec was retained by the City of Windsor to complete the Municipal Schedule C Class Environmental Assessment (Class EA) study for the proposed Prince Road storm sewer outlet at McKee Creek. The Study Area is defined to the west by the Detroit River, to the east by the west limit of the existing storm sewer along Chappell Avenue, and to the north and south on either side of McKee Creek by lands owned by Coco Paving Ltd.

The City of Windsor fronts along the south shoreline of the outlet of Lake St. Clair and the Detroit River. Several significant storm/rainfall events in recent years have caused widespread floods, increased strain on the municipal sewer system, and risks to property owners in coastal and low-lying areas.

The City of Windsor has three types of existing drainage systems: sanitary, storm and combined sewer systems. The sanitary sewer conveys domestic sewage via local service connections from residential, commercial, industrial, institutional and other land uses to a wastewater treatment plant where it is filtered, treated and discharged. Storm sewers collect and convey rainwater to open watercourses such as the Detroit River. Rainwater enters the storm system at various sources, including catch basins and private storm connections (drainage from foundation drains, rear yard catch basins and roof downspouts). Combined sewers convey stormwater runoff, sanitary sewage, and industrial wastewater in a single pipe. Under dry-weather conditions, all flows are conveyed to the downstream treatment plant. Under wet weather conditions, stormwater runoff sometimes exceeds the combined sewer's capacity, which results in overflow to the Detroit River or other waterways.

In November 2020, the City of Windsor completed the Sewer and Coastal Flood Protection Master Plan (SCFPMP) to understand the causes of flooding, identify and evaluate short-term and long-term solutions, complete high-level design and cost estimates for proposed infrastructure improvements, and to provide an implementation strategy for the recommended solutions. The SCFPMP concluded the preferred solution for the Prince Road storm sewer outlet at Chappell Avenue was to provide an outlet to McKee Creek (the Project).

The EA study is being completed in accordance with the requirements of Schedule C projects, as outlined in the Municipal Class EA document (October 2000, as amended in 2007, 2011 and 2015), which is approved under the Ontario Environmental Assessment Act.

As part of the Class EA study, Stantec completed a natural heritage and species at risk (SAR) assessment in the Study Area (proposed development location + 120 m), which included a natural heritage background review, consultation with regulatory agencies and a site investigation to identify natural heritage and determine the potential presence of SAR and/or their habitats.

2.0 EXISTING CONDITIONS

Existing conditions were described by reviewing natural heritage background data and completing a site investigation to document natural heritage features and SAR or their habitats. The Study Area and general background information are shown on **Figure 1, Appendix A**.

2.1 METHODS

2.1.1 Natural Heritage Background Data Review

The natural heritage background data review was completed to identify potential SAR or species of conservation concern (SOCC) that may occur in the Study Area. SAR are species which are listed as Threatened (THR) or Endangered (END) under the provincial *Endangered Species Act* or federal *Species at Risk Act* (SARA). Threatened and Endangered species are afforded individual and habitat protection under the acts.

SOCC are species that are listed as Special Concern (SC) under the ESA or SARA. Special Concern species do not receive individual or habitat protections under these acts. SOCC are those species designated S1, S2, or S3 under the provincial NHIC. S-Rank species are not afforded protection; however, the designations provide an interpretation of how rare the species is in Ontario. S-Rank of species includes the following:

- S1: Extremely rare in Ontario, 5 or fewer occurrences in the province, vulnerable to extirpation
- S2: Very rare in Ontario, 5 and 20 occurrences in the province, susceptible to extirpation
- S3: Vulnerable—Vulnerable in the province, relatively few populations (often 80 or fewer)

Data were collected from the following sources:

- Fisheries and Oceans Canada (DFO) Aquatic Species at Risk Maps (DFO 2019)
- Natural Heritage Information Centre (NHIC) Database (MNRF 2020b)
- Land Information Ontario (LIO) Database (MNRF 2020a)
- Atlas of the Mammals of Ontario (Dobbyn 1994)
- eBird (eBird 2021)
- iNaturalist (iNaturalist 2021)
- Aerial Imagery (Google Earth 2021)

- Ontario Breeding Bird Atlas (Cadman et al. 2007)
- Ontario Reptile and Amphibian Atlas (Ontario Nature 2020)
- Ontario Butterfly Atlas (OBA 2021)
- Request for Information from Ministry of Conservation and Parks (MECP), February 23, 2021.
- Request for Information from Ministry of Natural Resources and Forestry (MNRF), February 23, 2021.
- A Biological Assessment of the McKee Drain with Particular Reference to Species at Risk and Habitat Evaluation (Draft) (Waldron 2010).

Information requests were sent to the MNRF and MECP to obtain any data that may be present for the Study Area, in addition to that obtained through the review of online databases and publications.

2.1.2 Field Investigation

A single visit was completed on July 9, 2021 to examine the future location of the proposed storm outlet and describe the characteristics of the natural environment within a scoped field study area (see Figures 1 and 2, Appendix A for the scoped study area). The location of the proposed Prince Road storm outlet is on private lands owned by Coco Paving Ltd. where they abut the McKee Creek outlet cut to the Detroit River. The Coco Paving Ltd. property is an active aggregate storage, processing and administration property with daily vehicular and construction traffic. Due to safety considerations on the site, the field investigation study area was scoped to the area immediate to the location of the proposed outfall and encompassing an area of approximately 0.39 ha. The field investigation was completed to document terrestrial and aquatic natural heritage features in the scoped Study Area and confirm if SAR or SOCC identified in the background review or their habitat was present. . Field investigations examined aquatic and terrestrial habitats in the Study Area.

2.1.2.1 Aquatic Habitat Assessment

An aquatic habitat assessment was completed for McKee Creek, which will be the receiver for flow from the Prince Road storm outlet. The McKee Creek channel was examined in the shoreline area associated with the proposed storm flow outlet.

During the aquatic habitat assessment, the following data were recorded:

- Channel width and depth
- water clarity
- substrate type
- presence of aquatic vegetation

- riparian habitat and connectivity to other aquatic habitat

2.1.2.2 Terrestrial Habitat Assessment

During the terrestrial habitat assessment, the Study Area was searched for any rare plants or plant SAR plant species, and vegetation communities within the Study Area were documented using Ecological Land Classification (ELC) protocols. Terrestrial habitats were also examined for their suitability to support wildlife SAR.

Identification and mapping of ELC vegetation communities followed the protocols in the ELC field guide for Southern Ontario (Lee et al., 1998). Updates to vegetation community names and codes followed the 2008 catalogue of ELC vegetation communities.

2.1.2.3 Wildlife SAR Assessment

The primary focus of the wildlife SAR Assessment was to search for and document SOCC or SAR or their habitat within the Study Area, however all wildlife species observed were documented. The survey was completed by walking the site and observing habitat features or species.

All surveys included a photographic record of site conditions and observations of natural heritage and observed SOCC and/or SAR.

2.1.2.4 Incidental Wildlife Surveys

Incidental wildlife observations were recorded during the site visit.

2.2 RESULTS

2.2.1 Natural Heritage Background Data Review

There were recent (1990 to present) records of 29 rare or at-risk species that could potentially be present in the Study Area. This included one (1) bird, six (6) reptiles, two (2) plants, four (4) insects, eight (8) mussels and eight (8) fish. Eighteen species are listed as Threatened or Endangered under either SARA or the ESA. One SOCC (Spotted Sucker) was confirmed within McKee Creek (Gerry Waldron Consulting Ecologists 2010).

A habitat assessment was completed for the 29 SAR identified in the background review (**Table 1, Appendix B**). The assessment includes habitat descriptions for each species and an assessment of the likelihood that the Study Area provides habitat to support the species. The habitat assessment was completed using aerial imagery and results from the site investigation.

Results of the SAR/SOCC habitat assessment showed that there is potentially suitable habitat in the Study Area for 7 of the 29 species identified in the background review, outlined below on Table 1.

Table 1: Species at Risk and Species of Conservation that are Potentially Present in the Study Area

Common Name	Latin Name	Provincial S-rank	SARO Status	SARA Schedule 1	Source / Record Year *
Birds					
Barn Swallow	*Hirundo rustica*	S4B	THR	THR	NHIC/2016
Reptiles					
Butler's Gartersnake	*Thamnophis butleri*	S2	END	END	NHIC/2010 ORAA/2019
Eastern Foxsnake Carolinian pop'n	*Pantherophis gloydi*	S3	END	END	NHIC/ ORAA/2019
Snapping Turtle	*Chelydra serpentina*	S3	SC	SC	ORAA/2019
Insects					
Monarch	*Danaus plexippus*	S2N, S4B	SC	SC	OBA/2019
Fish and Mussels					
Eastern Pondmussel	*Ligumia nasuta*	S1	END	SC	NHIC/1992
Spotted Sucker	*Minytrema melanops*	S2	SC	SC	DFO Waldron/2010

*Year of record provided if available from database.

THR – Threatened - a species that is at risk of becoming endangered
END – Endangered – a species that is at risk of becoming extirpated or extinct
SC - Special Concern - a species with characteristics that make it sensitive to human activities or natural events
S1: Extremely rare in Ontario, 5 or fewer occurrences in the province, vulnerable to extirpation
S2: Very rare in Ontario, 5 and 20 occurrences in the province, susceptible to extirpation
S3: Vulnerable—Vulnerable in the province, relatively few populations (often 80 or fewer)
S4: Apparently Secure—Uncommon but not rare
S#B- Breeding status rank
S#N- Non-Breeding status rank

In response to submitted information requests, MECP completed an initial SAR screening and indicated that there are known occurrences of the following SAR in the general area with potential to also occur in the Study Area:

- Eastern Foxsnake (endangered) – receives species and regulated habitat protection.
- Bank Swallow (threatened) – receives species and general habitat protection
- Chimney Swift (threatened) – receives species and general habitat protection

The MECP further noted that the Study Area falls within the regulated habitat area for Eastern Foxsnake.

The habitat regulation for Eastern Foxsnake (Carolinian population) protects sites used for nesting, hibernation, and communal shedding and basking, as well as areas within 1500 metres (m) of an Eastern Foxsnake (Carolinian population) that are suitable for it to carry out its life processes (e.g., foraging and thermoregulation). The regulation applies where the snake occurs in the following areas: the City of Windsor; the counties of Essex, Haldimand, Lambton, and Norfolk; the Municipality of Chatham-Kent; the geographic Township of Pelee within the County of Essex; and the Municipality of Bayham and West Elgin Township within the County of Elgin. The regulation is provided to a broad area associated with where the species is found, and it is the responsibility of the proponent to carry out additional work to determine if the species was present or if suitable habitat is present.

McKee Creek was previously assessed for aquatic habitat and fish community composition by Gerry Waldron Consulting Ecologists in 2010. Waldron (2010) described McKee Creek as a small tributary of the Detroit River that is intermittent in its upper reaches, but which exhibits permanent flow in a constructed channel in its lower reaches, with water levels influenced by the water levels in the Detroit River.

Background data showed that there were 21 fish species that use habitat in McKee Creek (MNRF 2020a, Gerry Waldron Consulting Ecologists 2010). The documented fish community in McKee Creek includes the following species:

- Brook Silverside (*Labidesthes sicculus)*
- Bluntnose Minnow (*Pimephales notatus*)
- Emerald Shiner (Notropis atherinoides)
- Mimic Shiner *(Notropis volucellus)*
- Largemouth Bass *(Microptereus salmoides*)
- Yellow Perch *(Perca flavescens*)
- Common Carp (*Cyprinus carpio*)
- Round Goby (*Neogobius melanostomus*)
- Gizzard Shad (*Dorosoma cepedianum)*
- Spotted Sucker (*Minytrema melanops*)
- Northern Pike (*Esox lucius*)
- Brown Bullhead (*Ameiurus nebulosus*)
- Black Bullhead (*Ameiurus melas)*

- Longnose Gar (*Lepisosteus osseus*)
- White Bass (*Morone chrysops*)
- Rock Bass (*Ambloplites rupestris*)
- Bluegill Sunfish (*Lepomis macrochirus*)
- Pumpkinseed Sunfish (*Lepomis gibbosus*)
- Buffalo sp. (*Ictiobus sp.*)
- White Sucker (*Catostomus commersoniin*)
- Freshwater Drum (*Aplodinotus grunniens*).

Spotted Sucker, a Special Concern species, was the only SAR/SOCC species caught in McKee Creek by Waldron (2010).

The Detroit River was the only Natural Area listed in the NHIC database.

2.2.2 Field Investigation

A field investigation was completed on July 9, 2021. On the day of the assessment the weather was 19 °C, with light wind and 50% cloud cover.

2.2.2.1 Aquatic Habitat Assessment

The east end of the McKee Creek shoreline was examined from the hydro tower eastward to the Coco Paving driveway crossing of the creek (see Figure 2, Appendix A). The channel at this location was approximately 10 m wide with a 15 m bankfull width. Flow movement was imperceptible, and the habitat appeared as an extensive pool estimated at approximately 1 to 2 m deep. Substrates were not visible due to water depth, lack of clarity and floating vegetation, however they are expected to consist of soft and deep fine sediment, consisting of fine-grained silts, clays and detritus, as well as sand, with occasional cobbles and broken concrete slabs as noted by Waldron (2010).

Dense aquatic vegetation was noted in the channel and included bladderwort (*Utricularia sp.*), coontail (*Ceratophyllum demersum*) and fragrant water lily (*Nymphaea odorata*). Waldron (2010) also noted the presence of dense beds of Eurasian watermilfoil *(Myriophyllum spicatum)*, wild celery or tape grass (*Vallisneria americana)*, waterweed (*Elodea canadensis)*, and pondweed (*Potamogeton spp.*) during detailed boat electrofisher surveys in 2010.

The quiescent conditions in this area of the channel and thick growths of aquatic vegetation can result in large diurnal fluctuations in dissolved oxygen. Low levels of dissolved oxygen were measured by Waldron (2010) and were thought to be influenced by relatively shallow depths, dense aquatic vegetation and limited mixing of waters other than during runoff events when periodic flow contributions arrive from upstream reaches of the creek (Waldron 2010).

The majority of the channel has an open canopy cover; however, some overhead cover is provided along the shore margins by overhanging phragmites. An approximate 10 m wide band of riparian vegetation surrounding the creek channel is dominated by dense phragmites with herbaceous species intermixed. The shrub layer consists of scattered staghorn sumac, box elder, autumn olive and sandbar willow. A few individual cottonwood trees are also present along the channel.

2.2.2.2 Terrestrial Habitat Assessment

Much of the Study Area is developed as heavy industrial associated with Coco Paving operations. The limited natural area in this scoped area of investigation is primarily associated with the riparian band of McKee Creek. ELC communities observed in the Study Area are shown on **Figure 1, Appendix A**.

Heavy industry (CVC_3), transportation (CVI_1) and business sector (CVC_1) classifications did not provide natural habitat and no plant SAR or rare plants were observed in these ELC communities.

Natural or semi-natural habitat within the Study Area included the following ELC communities:

Mixed Shallow Aquatic (SAM): This community comprises the McKee Creek channel. The vegetation community is dominated by the following species: bladderwort, hornwort (*Ceratophyllum* sp.), fragrant water-lily (*Nymphaea odorata*), and duckweed (*Lemna* sp.). Green Heron and Wood Duck were observed foraging in this community and likely take refuge in the adjacent MAMM1-12 community. No plant SOCC or SAR were observed in this community.

Common Reed Graminoid Mineral Meadow Marsh Type (MAMM1-12): This community surrounds McKee Creek. The vegetation community is dominated by European reed (*Phragmites australis australis*), and to a lesser extent staghorn sumac (*Rhus typhina*), sandbar willow (*Salix interior*), field thistle (*Cirsium arvense*) and common wormwood (*Artemisia vulgaris*). Portions of this area are highly disturbed and primarily composed of exotic and invasive species. No plant SOCC or SAR were observed in this community.

Dry-Fresh Mixed Meadow Ecosite (MEMM3): This vegetation community flanks the east side of the Coco Paving internal driveway and surrounds the Essex Terminal Rail (ETR) spur line. The community is maintained by mowing and is dominated by the following species: Kentucky bluegrass (*Poa pratensis*), garden bird’s-foot trefoil (*Lotus corniculatus*) and European Reed. No plant SOCC or SAR were observed in this community. Monarch and Barn Swallow were observed foraging in this area.

Fresh-Moist Mixed Meadow Ecosite (MEMM4): This community is located to the east side of the Coco Paving internal driveway and surrounds the ETR spur line. The vegetation community is dominated by European reed and to a lesser extent, goldenrod (*Solidago* spp.). The area is also disturbed by mowing along the Coco Paving driveway on the west side of the fenceline associated with the ETR spur line. No SOCC or SAR plants were observed in this community. Monarch was observed foraging in this area.

A list of plant species observed during the site investigation is provided in Table 2, Appendix B.

2.2.2.3 Incidental Wildlife Survey

Incidental wildlife observations included Green Heron (*Butorides virescens*), Wood Duck (Aix sponsa), Red-winged Blackbird (*Agelaius phoeniceus*), American Goldfinch (*Spinus tristis*), American Robin (*Turdus migratorius*), Eastern Kingbird (*Tyrannus tyrannus*), European Starling (*Sturnus vulgaris*), Song Sparrow (*Melospiza melodia*), Barn Swallow and Green Frog (*Lithobates clamitans*). Other than Barn Swallow (discussed in Section 2.2.2.4), none of these species are considered SOCC or SAR.

2.2.2.4 Species at Risk

During the site investigation, efforts were made to search for SAR and SOCC species that were identified as potentially occurring in the area based on the background information review.

Neither Bank Swallow nor Chimney Swift, or their habitats were observed in the Study Area.

The incidental wildlife survey identified one SOCC and one SAR within the Study Area, the Monarch and Barn Swallow, respectively.

Monarchs (3 individuals) were observed foraging in the MEMM3 community to the east of the Coco Paving Access Road where it crosses McKee Creek. Monarch is listed as Special Concern under the ESA and SARA. Monarch caterpillars are dependent on milkweed plant species for survival as milkweed is the only source of food for the caterpillars. No extensive areas of milkweed were observed in the area.

Barn Swallow (3 individuals) was observed flying in the area, likely foraging on insects. No nesting areas are available in the scoped Study Area, however nesting opportunities may be available in structures in the surrounding area. Barn Swallow is listed as Threatened under the ESA and SARA.

Potential foraging habitat for Eastern Foxsnake and Butler's Gartersnake was noted in the area associated with the McKee Creek riparian area, however no reptiles were observed in the area. No habitat structures that could potentially provide hibernacula for these species were observed in the scoped investigation area.

3.0 PROJECT DESCRIPTION

The Project includes the examination of design alternatives for site layouts and property footprint requirements to accommodate the following:

- outlet chamber and pump station
- locations of culverts
- a dispersion channel from the headwall to McKee Creek
- access requirements for during construction and post construction maintenance
- permanent and temporary easement requirements

Alternative design concepts were developed for the location and design of a pumping station and outlet at McKee Creek. From a natural heritage perspective, all design alternatives have similar footprints, and the dispersion channel at McKee Creek is identical for all alternatives that were examined.

The preferred alternative consists of underground construction to tie in to the existing 2400 mm dia. concrete storm sewer with a 2700 mm dia. sewer that will extend westerly along Chappell Ave, across the ETR and along Coco Paving property to a new outlet chamber and pumping station. The proposed pumping station is located between the ETR rail and a (privately owned) rail spur line. The preferred alternative is shown on **Figure 2, Appendix A.**

From the outlet structure, twinned gravity sewers (2 – 1800 mm x 1200 mm concrete box sewers) will outlet to a dispersion channel and ultimately to McKee Creek. During severe storm events, flows may also pass through emergency overflow openings in the top of the outlet chamber overland to the dispersion channel. The sewer system will be dewatered and the pumping station will discharge flows through a water quality unit and ultimately to the dispersion channel. The 13.5m wide dispersion channel will consist of a 300 mm layer of rip rap upon which numerous 0.75 m armour stones will be placed. The portion of the dispersion channel containing the armour stones will terminate approximately 11m from the edge of McKee Creek. The dispersion channel will outlet to McKee Creek.

4.0 POTENTIAL IMPACTS AND MITIGATION

4.1 AQUATIC HABITAT

There is no in-water work in McKee Creek associated with the construction of the Project. The 13.5 m wide dispersion channel will be constructed using a 300 mm layer of rip rap on a geotextile base, with the placement of 0.75 m diameter (approximately) armour stones on the rip rap layer to provide energy dissipation of outlet flows. The portion of the dispersion channel containing the armour stones will terminate approximately 11 m from the edge of McKee Creek at its closest point, to 14 m at its furthest away from the creek. The remainder of the area between the dispersion channel and the edge of McKee Creek will be graded to create a level flow path and topped with rip rap on geotextile. The banks of the dispersion channel will be topsoiled and stabilized with a vegetation blanket and using an appropriate native seed mix. It is expected that water levels in the dispersion channel will be dictated by water levels in McKee Creek, which are dictated by those of the Detroit River, and that some backwatering will occur from McKee Creek into the dispersion channel.

With the incorporation of a water quality unit into the storm sewer treatment train, the quality of discharge water to McKee Creek will improve, which is a positive effect.

No impacts to any SOCC or SAR fish are anticipated given the lack of in-water work and the overall improvement to the quality of storm discharge that is proposed.

To protect aquatic environments and associated fish communities, grading immediately adjacent to McKee Creek should be avoided between March 15 and July 15. While no in-water work is planned, this timing window provides preventative measures in case a severe precipitation event occurs during construction with the potential to deliver sediment-laden runoff to McKee Creek.

Development of a sediment and erosion control plan is recommended to isolate the work area and deter sediment transport towards McKee Creek.

4.2 TERRESTRIAL HABITAT

Most of the construction associated with The Project will be underground through areas that are already highly disturbed by existing transportation and heavy industry infrastructure. Approximately 293 m^2 of the MEMM3 community will be permanently removed by construction and resurfacing with an additional 423 m^2 impacted on a temporary basis for construction (**Figure 2, Appendix A**). In the area of proposed construction, this vegetation community is weedy and highly disturbed by regular maintenance (i.e., cutting) and therefore provides very limited ecological value. The temporary disturbance area will be restored following construction.

The hard components (headwall, rip rap and armour stone apron) of the dispersion channel construction will encroach into the MAMM1-12 community flanking McKee Creek, and vegetation removal will be required up to the edge of McKee Creek to provide a level, barrier-free flow pathway for treated storm discharge to outlet to the creek. It is predicted that approximately 220 m^2 of the MAMM1-12 will be removed and an additional 281 m^2 impacted by the construction of the outlet dispersion channel. Permanent vegetation removal associated with the hardened dispersion channel includes the outer fringe of MAMM1-12, which is frequently maintained by cutting. The unmanicured portion of this unit is dominated by Phragmites, with some shrub growth. Phragmites is a non-native invasive species, and its removal is a positive impact.

Clearing of any vegetation within the MAMM1-12 community should not be completed during the breeding bird season. Breeding birds and their nests are protected under the *Migratory Bird Convention Act, 1994* (MBCA). Environment and Climate Change Canada identify nesting zones and associated nesting periods. The Project is within the C1 nesting zone, which has a regional nesting period from late March to late August (ECCC 2018). Major vegetation removals should be planned outside of the breeding bird window (e.g., late fall, winter).

If clearing is proposed during the breeding bird nesting window or two weeks prior to or after the nesting period, a bird nest sweep in small areas and easy to survey habitat by a qualified professional is recommended to comply with the MBCA. Once an area has been surveyed and determined to not have nesting breeding birds, the vegetation can be cleared. A bird nest sweep is valid for seven (7) days and if vegetation is not cleared within that time, another nest sweep is required.

4.3 SPECIES AT RISK

The primary areas of impact associated with the construction of the pumping station chamber, outfall pipes and dispersion channel are in the Coco Paving driveway and the maintained portion of MEMM3. A portion of the MAMM1-12 will be disturbed during construction and replaced with a layer of rip rap in the bottom of the dispersion channel.

Potential foraging habitat for Eastern Foxsnake. as well as Butler’s Gartersnake may be present in the McKee Creek riparian area, however no snakes were observed in the area during the site investigation. In Essex County, habitat for the Eastern Foxsnake is described as unforested, early successional (old field, prairie, marsh) habitat, hedgerows bordering farm fields and riparian zones along drainage canals (COSEWIC 2008). Butler’s Gartersnake habitat is described as open prairie-like areas with dense grasses, along drainage swales, and seasonally dry marshes (COSEWIC 2010). Butler’s Garternsnake are often found in abandoned sites in urban areas and old fields that have become overgrown with shrubs and saplings (COSEWIC 2010). No habitat structures that could potentially provide hibernacula for these species were observed in the Study Area.

The dense vegetation in the riparian zone of McKee Creek provides habitat that meets the requirements of Eastern Foxsnake and Butler’s Gartersnake, as described by COSEWIC. Potential habitat adjacent to McKee Creek will be removed to allow for grading of a positive draining flow path and changed to a rip rap dispersion channel with vegetated banks. The rock structure may encourage use by snakes because it will provide areas for hiding and basking. Typical prey items for these snakes may also use the rock area for hiding and would be hunted by these snake species.

The following mitigation is recommended to reduce the likelihood of impacts to Butler's Garternsnake and Eastern Foxsnake:

- Snake exclusion fencing around the entire area proposed for construction and access. The exclusion fence should follow guidance provided in Species at Risk Branch Best Practices Technical Note. Reptile and Amphibian Exclusion Fencing. (MNR 2013).
- Complete a snake search prior to and during vegetation clearing, including inspection of machinery for snakes. If snakes are encountered in the work area, they should be allowed to leave the area on their own.
- Provide education and awareness training on snake SAR to all persons working on the site.

Further consultation with MECP will determine if permits are needed for the construction of the preferred alternative. This process has been initiated through the preparation of an Information Gathering Form (IGF).

5.0 SUMMARY AND CONCLUSIONS

The City of Windsor is completing a Schedule C Class EA for the Prince Road storm outlet. Future construction of the outlet will occur through lands owned by Coco Paving Ltd. The construction will largely impact existing driveway and disturbed areas, however some small areas of natural habitat, particularly associated with McKee Creek will be impacted by the construction of the outlet headwall, and hardened dispersion channel proposed for The Project. No in-water construction in McKee Creek is planned at this time.

No plant SAR or SOC were found in the Study Area. Wildlife SAR/SOCC that were observed in the Study Area were using the site for foraging, and no breeding or overwintering habitat was observed in the Study Area. The Study Area is located in an area that is regulated habitat for Eastern Foxsnake. No snakes were observed in the Study Area, however potentially suitable habitat for foraging and movement is present along the McKee Creek riparian zone. Further consultation with MECP is recommended prior to detailed design, and an IGF is currently being prepared to start the consultation process.

With the implementation of mitigation and timing windows, no residual negative impacts are anticipated from the project. Some positive ecological impacts of the project include the improvement of storm discharge water quality using a treatment train prior to outlet, removal of non-native invasive Phragmites and bank re-vegetation with a native seed mix, and the installation of the rock and armour stone dispersion channel that may provide habitat for snakes for hiding, basking and hunting.

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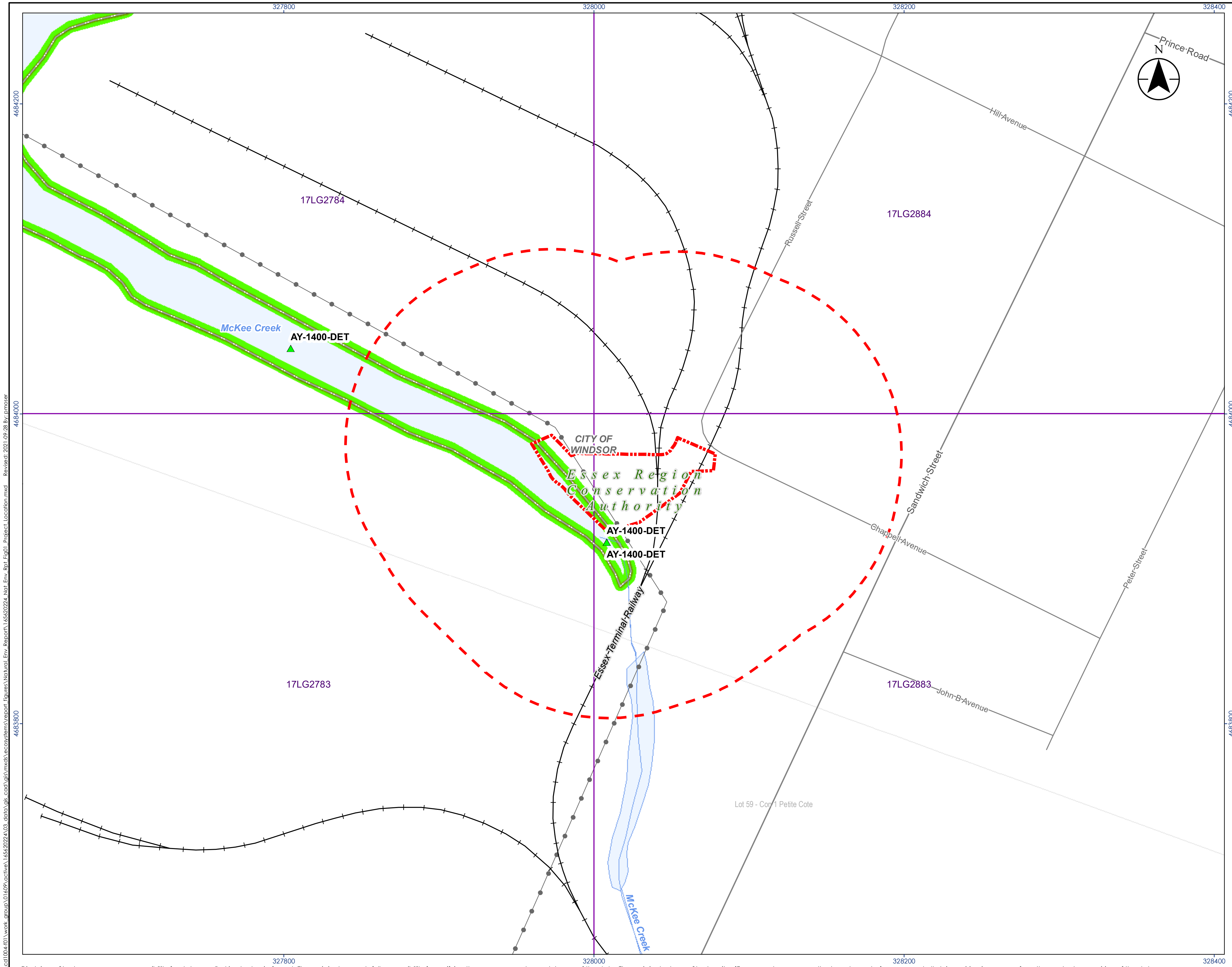
APPENDIX A:

Figures



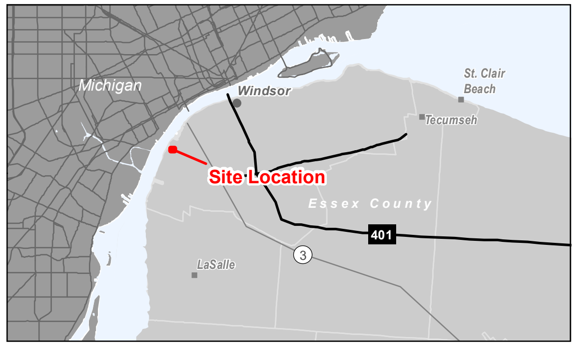
Stantec

Legend
- 🟥 Study Area (Approximate)
- 🟥 Study Area (Buffer 120m)
- ▲ Fish Survey Point (ARA)
- — Major Road
- — Minor Road
- ┼ Railway
- ● Hydro Line
- — Constructed Drain
- — Watercourse (Permanent)
- ▢ Waterbody
- ▢ Conservation Area Administrative Boundary
- 🟩 Aquatic Species at Risk Distribution
- ▢ Lot
- ▢ Municipal Boundary, Lower
- ▢ 1 km UTM Grid

0 50 100 Meters

1:2,500 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.



Project Location
Windsor, ON

165620224 REV4
Prepared by PRM on 2021-09-28
Technical Review by SG on 2021-09-28

Client/Project
CITY OF WINDSOR
PRINCE ROAD STORM OUTLET CLASS EA
NATURAL ENVIRONMENT TECHNICAL REPORT

Figure No.
1

Title
Project Location and Background Data

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Stantec

Legend

- 🟥 Study Area (Approximate)
- ─ Site Layout
- ┼ Railway

Habitat Removal

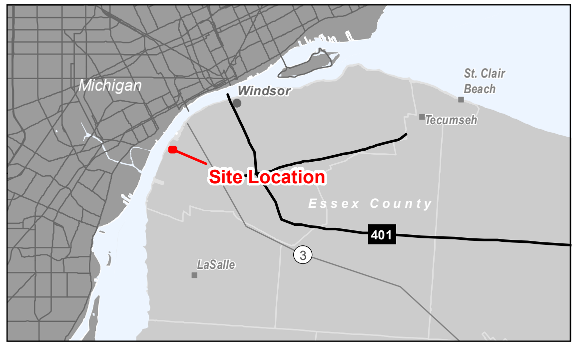
- 🟧 Permanent Disturbance Area
- 🟩 Temporary Disturbance Area
- 🟨 ELC Boundary
- **CVC_1** - Business Sector
- **CVC_3** - Heavy Industry
- **CVI_1** - Transportation
- **MAMM1-12** - Common Reed Graminoid Mineral Meadow Marsh Type
- **MEMM3** - Dry - Fresh Mixed Meadow
- **MEMM4** -Fresh - Moist Mixed Meadow
- **SAM** - Mixed Shallow Aquatic

0 25 50 Meters

1:750 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Orthoimagery © First Base Solutions, 2021. Imagery flown in 2019.



Project Location
Windsor, ON

165620224 REV4
Prepared by PRM on 2022-03-24
Technical Review by SL on 2022-03-24

Client/Project
CITY OF WINDSOR
PRINCE ROAD STORM OUTLET CLASS EA
NATURAL ENVIRONMENT TECHNICAL REPORT

Figure No.
2

Title
Proposed Storm Outlet Layout

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APPENDIX B:

Sar/Socc Screening Table
Study Area Plant List

Table 1 (Appendix B): Screening of Species at Risk and Species of Conservation Concern Identified as Potentially Occurring within the Prince Road Storm Outlet Study Area

Group	Species	Scientific Name	SARA	ESA	S-Rank	Species Habitat Description	Habitat Observed in the Study Area (Y/N)	Likelihood of the Project to Impact SAR
Birds	Barn Swallow	*Hirundo rustica*	THR	THR	S4B	The Barn Swallow commonly nests on walls or ledges of barns, bridges, culverts or other man-made structures. Where suitable nesting structures occur, Barn Swallow often form small colonies, sometimes mixed with other swallow species. The Barn Swallow feeds on aerial insects while foraging over a variety of open habitats such as pastures, lawns, meadows and fields. It will also frequently forage in woodland clearings, over wetland habitats or open water where insect prey are abundant (COSEWIC 2011).	Yes - suitable foraging habitat was observed in the Study Area. Individuals were observed foraging. No nesting areas are present in the impact area.	Nil - no works will impact potential Barn Swallow nesting habitat.
Fish	Channel Darter	*Percina copelandi*	THR	THR	S3	Pools and margins of riffles and small to medium sized rivers and sand and gravel beaches of lake shores where wave action/current is slow. Spawn in gravel or rubble substrate. Benthic feeder. Generally found in shallow (< 1.0 m) depths (Phelps and Francis 2002).	No - suitable habitat is not available in McKee Creek. Species was not found in previous electrofishing of channel. The Detroit River may provide suitable habitat	Nil - no suitable habitat
	Eastern Sand Darter	*Ammocrypta pellucida*	THR	THR	S2	Preferred habitat is sand bottom areas of streams and rivers and sandy shoals in lakes. Spawns in sand and gravel substrates. Benthic insectivores feeding primarily on midges (COSEWIC 2009).	No - suitable habitat is not available in McKee Creek. The Detroit River may provide suitable habitat.	Nil - no suitable habitat
	Lake Sturgeon (Great Lakes – Upper St. Lawrence River Pop.	*Acipenser fulvescens)*	-	THR	S2	The Lake Sturgeon lives almost exclusively in freshwater lakes and rivers with soft bottoms of mud, sand or gravel. They are usually found at depths of five to 20 metres (MECP 2021).	No - suitable habitat is not available in McKee Creek. Species was not found in previous electrofishing of channel. The Detroit River may provide suitable habitat	Nil - no suitable habitat
	Northern Madtom	*Noturus stigmosus*	END	END	S1	Found in lakes and small and large rivers, prefers coarse substrates of sand, gravel and rocks with less proportion of silt, detritus and debris. In lakes, it lives near a river source with noticable current. Feeds on benthic invertebrates and small fishes (COSEWIC 2012b).	No - suitable habitat is not available in McKee Creek. Species was not found in previous electrofishing of channel. The Detroit River provides suitable habitat	Nil - no suitable habitat
	Silver Chub	*Macrhybopsis storeriana*	SC	THR	S2	Silver chub 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 and Lake St Clair (MECP 2021).	No - suitable habitat is not available in McKee Creek. Species was not found in previous electrofishing of channel. The Detroit River may provide suitable habitat	Nil - no suitable habitat
	Chestnut Lamprey	*Ichthyomyzon castaneus pop. 1*	-	DD	SU	The Chestnut Lamprey spends its entire life cycle in fresh water. In Michigan, the larvae live buried preferentially in streams with moderate current (about 30-60 cm/s), in a substrate of firm sand and silt and a little growth of the macroalga Chara, but may also be found in areas with consolidated black mud and silt, supported by a rather dense stand of Chara or other vegetation (COSEWIC,2010).	No - suitable habitat is not available in McKee Creek. Species was not found in previous electrofishing of channel. The Detroit River may provide suitable habitat	Nil - no suitable habitat
	Silver Lamprey (Great Lakes - Upper St. Lawrence populations)	*Ichthyomyzon unicuspis pop. 1*	SC	SC	S3	Silver lampreys require clear water so they can find fish hosts, relatively clean stream beds of sand and organic debris for larvae to live in, and unrestricted migration routes for spawning. Their use of different kinds of habitat throughout their lives (rivers for spawning and early development, and lakes for adults) makes them vulnerable to changes in their environment (MECP 2021).	No - suitable habitat is not available in McKee Creek. Species was not found in previous electrofishing of channel. The Detroit River provides suitable habitat	Nil - no suitable habitat
	Spotted Sucker	*Minytrema melanops*	SC	SC	S2	The Spotted sucker usually inhabits clear creeks and small to moderate sized rivers with sand, gravel or hard-clay bottoms, usually free of silt (MECP 2021).	No - suitable habitat as defined by MECP is not present in McKee Creek near the Project area. The species was caught during previous electrofishing, however.	Low - project does not involve work within McKee Creek.
Insect	Monarch	*Danaus plexippus*	SC	SC	S2N,S4B	Adult Monarchs feed on nectar from wildflowers in a variety of habitats, while larvae are confined to meadows and open areas with Milkweed plants (COSEWIC 2016a).	Yes - wildflowers including milkweed were observed in the MEMM3 and MEMM4 areas.	Low - project involves disturbance only in the maintained area of MEMM3.
	Cicada Killer	*Sphecius speciosus*	-	-	S1S2	A large, ground-burrowing digger wasp that is extremely rare in Ontario. Preys on cicadas which they take back to their burrow to lay eggs upon and provide food provision to hatching young.	Unknown - no individuals noted during site investigation. Surrounding terrain may limit the presence of cicadas, their key food source.	Nil
	Mottled Duskywing	*Erynnis martialis*	-	END	S2	The mottled duskywing tends to live in dry habitats with sparse vegetation. These include open barrens, sandy patches among woodlands, and alvars. (Alvars are areas of limestone with shallow soil and sparse vegetation of grasses, shrubs, and wildflowers.) In Ontario, the mottled duskywing will only deposit their eggs on two closely-related plants: New Jersey tea and prairie redroot (COSEWIC 2012c)	No - neither habitat nor host plants were observed in the Study Area.	Nil - no suitable habitat
	Cobra Clubtail	*Gomphurus vastus*	-	-	S1	Cobra Clubtails inhabit large, sandy bottomed rivers and large, wind-swept lakes.	No. More likely to be associated with the Detroit River based on habitat preferences.	Nil

Table 1 (Appendix B): Screening of Species at Risk and Species of Conservation Concern Identified as Potentially Occurring within the Prince Road Storm Outlet Study Area

Group	Species	Scientific Name	SARA	ESA	S-Rank	Species Habitat Description	Habitat Observed in the Study Area (Y/N)	Likelihood of the Project to Impact SAR
Mussel	Northern Riffleshell	*Epioblasma rangiana*	END	END	S1	The Northern Riffleshell is found in riffle areas within rivers or streams with rocky, sand, or gravel bottoms (MECP 2021).	No - McKee Creek lacks current and suitable substrate. The Detroit River provides adequate habitat conditions.	Nil - no suitable habitat
	Snuffbox	*Epioblasma triquetra*	END	END	S1	The Snuffbox is typically found in small to medium-sized rivers in shallow riffle areas. They prefer clean, clear, swift-flowing water and firm rocky, gravel or sand river bottoms (MECP 2021).	No - McKee Creek lacks current and suitable substrate. The Detroit River may provide adequate habitat conditions.	Nil - no suitable habitat
	Eastern Pondmussel	*Ligumia nasuta*	SC	END	S1	The Eastern Pondmussel is typically found in sheltered areas of lakes and in slow-moving areas of rivers and canals with sand or mud bottoms (MECP 2021).	Yes - McKee Creek provides slow moving water with a fine sediment bottom. Species presence is unknown, but it is known from the Detroit River.	Low - no in-water work is required. The upgrade to the storm outlet will improve discharge water quality to McKee Creek.
	Threehorn Wartyback	*Obliquaria reflexa*	THR	THR	S1	The mussel is found in large rivers with moderate current and stable substrates of gravel, sand and mud (MECP 2021).	No - McKee Creek lacks current and suitable substrate. The Detroit River provides adequate habitat conditions.	Nil - no suitable habitat
	Round Hickorynut	*Obovaria subrotunda*	END	END	S1	The Round hickorynut is mainly found in rivers with clay, sand, or gravel bottoms. It also lives in shallow areas of lakes with firm sand. It prefers moderately fast moving water (MECP2021).	No - McKee Creek lacks current and suitable substrate. The Detroit River provides adequate habitat conditions.	Nil - no suitable habitat
	Round Pigtoe	*Pleurobema sintoxia*	END	END	S1	The Round pigtoe is usually found in rivers of various sizes with deep water and sandy, rocky, or mud bottoms (MECP 2021).	No - McKee Creek is too shallow and generally has unsuitable substrate at the Project Location	Nil - no suitable habitat
	Kidneyshell	*Ptychobranchus fasciolaris*	END	END	S1	The Kidneyshell is typically found in small to medium sized rivers, and prefers shallow, clear, swift-moving water with gravel and sand (MECP 2021).	No - McKee Creek lacks current and suitable substrate.	Nil - no suitable habitat
	Fawnsfoot	*Truncilla donaciformis*	END	END	S1	The Fawnsfoot inhabits medium and large rivers with moderate to slow flowing water.It usually inhabits shallow waters (one to five metres deep) with gravel, sand or muddy bottoms (MECP 2021).	Potentially suitable substrate and depth available in McKee Creek, but more likely to be associated with the Detroit River for its flow and quality substrate	Nil - no suitable habitat
Plant	Dense Blazing-star	*Liatris spicata*	THR	THR	S2	Dense Blazing Star 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 (MECP 2021).	No - habitat was not observed in the Study Area.	Nil - no suitable habitat
	Tall Nutrush	*Scleria triglomerata*	-	-	S1	Also know as Whip nutrush.	Not observed in the impact area or immediate surroundings.	Nil
	Eastern Foxnsnake (Carolinian population)	*Pantherophis gloydi*	END	END	S2	Populations in Essex-Kent use mainly unforested, early successional vegetation communities (old field, prairie, marsh, dune shoreline). Riparian areas along drainage canals are also used (COSEWIC 2008a).	Yes - suitable habitat was observed in the McKee Creek cut.	Moderate - potential to encounter Eastern Foxsnake during construction activities and potential to impact Eastern foxsnake habitat with clearing of vegetation for the dispersion channel and vegetated outlet to McKee Creek.
	Snapping Turtle	*Chelydra serpentina*	SC	SC	S4	Prefers slow moving water with soft mud bottom and dense aquatic vegetation. Can be found in ponds, shallow bays, river edges, general wetland habitats (COSEWIC 2008b).	Yes - suitable habitat is available in McKee Creek. No turtles were observed during the site investigation.	Low - project does not involve work within McKee Creek.
	Blanding's Turtle	*Emydoidea blandingii*		THR	S3	Blanding’s Turtles live in shallow water, usually in large wetlands and shallow lakes with lots of water plants (MECP 2021).	No - suitable habitat is not available in McKee Creek.	Nil - no suitable habitat
	Northern Map Turtle	*Graptemys geographica*	SC	SC	S3	The Northern Map Turtle inhabits rivers and lakeshores where it basks on emergent rocks and fallen trees throughout the spring and summer. In winter, the turtles hibernate on the bottom of deep, slow-moving sections of river. They require high-quality water that supports the female’s mollusc prey. Their habitat must contain suitable basking sites, such as rocks and deadheads, with an unobstructed view from which a turtle can drop immediately into the water if startled (MECP 2021).	No - suitable habitat is not available in McKee Creek. Habitat may be available in portions of the Detroit River.	Nil - no suitable habitat
	Eastern Musk Turtle	*Sternotherus odoratus*	SC	SC	S3	Eastern Musk Turtles are found in ponds, lakes, marshes and rivers that are generally slow-moving have abundant emergent vegetation and muddy bottoms that they burrow into for winter hibernation (MECP 2021).	Potentially suitable habitat exists in McKee Creek, however no turtles were observed during the site investigaiton.	Low - project does not involve work within McKee Creek.
	Butler's Gartersnake	*Thamnophis butleri*	END	END	S2	Old fields, disturbed sites, urban and industrial sites and tallgrass prairie. Dense grasses with heavy thatch layer and earthworms for prey is important (COSEWIC 2010)	Yes - suitable habitat was observed in the McKee Creek cut.	Moderate - potential to encounter Butler's gartersnake during construction activities and potential to impact habitat with clearing of vegetation for the dispersion channel and vegetated outlet to McKee Creek.

Table 1 (Appendix B): Screening of Species at Risk and Species of Conservation Concern Identified as Potentially Occurring within the Prince Road Storm Outlet Study Area

Group	Species	Scientific Name	SARA	ESA	S-Rank	Species Habitat Description	Habitat Observed in the Study Area (Y/N)	Likelihood of the Project to Impact SAR

Notes:

END – Endangered - a species facing imminent extinction or extirpation
THR – Threatened - a species that is at risk of becoming endangered
SC - Special Concern - a species with characteristics that make it sensitive to human activities or natural events
DD - Data deficient
S1: Critically Imperiled—Critically imperiled in the province (often 5 or fewer occurrences)
S2: Imperiled—Imperiled in the province, few populations (often 20 or fewer)
S3: Vulnerable—Vulnerable in the province, relatively few populations (often 80 or fewer)
S4: Apparently Secure—Uncommon but not rare
S? – Rank Uncertain
SH: Possibly Extirpated (Historical)
S#B- Breeding status rank
S#N- Non Breeding status rank
SU - Unrankable - Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

Habitat Data References

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VASCULAR PLANT LIST - Prince Road at McKee Drain

Plant Species Observed on July 9, 2021

SCIENTIFIC NAME	COMMON NAME	PROVINCIAL STATUS (S-RANK)	SARO STATUS	COSEWIC STATUS	COEFFICIENT OF CONSERVATISM	COEFFICIENT OF WETNESS
ANGIOSPERMS (Dicots)						
Acer negundo	Manitoba Maple	S5			0	0
Achillea millefolium	Common Yarrow	SE5?				3
Ambrosia artemisiifolia	Common Ragweed	S5			0	3
Artemisia vulgaris	Common Wormwood	SE5				5
Asclepias syriaca	Common Milkweed	S5			0	5
Ceratophyllum sp.	Hornwort					
Cichorium intybus	Wild Chicory	SE5				5
Cirsium arvense	Canada Thistle	SE5				3
Cornus racemosa	Grey Dogwood	S5			2	0
Cornus sericea	Red-osier Dogwood	S5			2	-3
Daucus carota	Wild Carrot	SE5				5
Dianthus armeria	Deptford Pink	SE5				5
Elaeagnus umbellata	Autumn Olive	SE3				3
Erigeron annuus	Annual Fleabane	S5			0	3
Helianthus sp.	Sunflower sp.					
Hypericum perforatum	Common St. John's-wort	SE5				5
Lonicera sp.	Honeysuckle Species					
Lotus corniculatus	Garden Bird's-foot Trefoil	SE5				3
Melilotus albus	White Sweet-clover	SE5				3
Melilotus officinalis	Yellow Sweet-clover	SE5				3
Morus alba	White Mulberry	SE5				0
Nepeta cataria	Catnip	SE5				3
Nymphaea odorata	Fragrant Water-lily	S5			5	-5
Oenothera sp.	Evening-primrose					
Parthenocissus vitacea	Thicket Creeper	S5			4	3
Physalis sp.	Ground-cherry					
Plantago lanceolata	English Plantain	SE5				3
Populus deltoides	Eastern Cottonwood	S5			4	0
Rhamnus cathartica	European Buckthorn	SE5				0
Rhus typhina	Staghorn Sumac	S5			1	3
Rumex crispus	Curled Dock	SE5				0

VASCULAR PLANT LIST - Prince Road at McKee Drain

Plant Species Observed on July 9, 2021

SCIENTIFIC NAME	COMMON NAME	PROVINCIAL STATUS (S-RANK)	SARO STATUS	COSEWIC STATUS	COEFFICIENT OF CONSERVATISM	COEFFICIENT OF WETNESS
Rumex sp.	Dock Species					
Salix interior	Sandbar Willow	S5			1	-3
Solidago juncea	Early Goldenrod	S5			3	5
Solidago spp.	Goldenrods					
Taraxacum officinale	Common Dandelion	SE5				3
Trifolium repens	White Clover	SE5				3
Utricularia sp.	Bladderwort Species					
Verbascum thapsus	Common Mullein	SE5				5
Verbena urticifolia	White Vervain	S5			4	0
Vitis riparia	Riverbank Grape	S5			0	0
ANGIOSPERMS (Monocots)						
Dactylis glomerata	Orchard Grass	SE5				3
Lemna sp.	Duckweed Species					
Phragmites australis ssp. australis	European Reed	SE5				-3
Poa pratensis	Kentucky Bluegrass	S5			0	3
Setaria pumila	Yellow Foxtail	SE5				0

FLORISTIC SUMMARY	TOTAL
Total Species	37
Native Species	15
Introduced (exotic) species	22
Species at Risk in Ontario (END, THR or SC)	0
Species at Riskin Canada (END, THR or SC)	0
Rare in Ontario (S1, S2 or S3)	0
Uncommon to common in Ontario (S4)	0
Common to very common in Ontario (S5)	15
Highly sensitive plant species with C value of 8, 9 or 10	0
Wetland Plant Species (-5, -4 or -3)	4

APPENDIX C

Geotechnical Reports

May 2010

CELEBRATING 50 YEARS in 2010

GEOTECHNICAL DESIGN REPORT

Prince Road Storm Sewer Outlet
Prince Road Sewer, Phase 9
Outlet to Detroit River
City of Windsor, Ontario

Submitted to:
Mr. Mike Jones
Stantec Consulting Ltd.
140 Ouellette Place, Suite 100
Windsor, Ontario
N8X 1L9

REPORT

Report Number: 09-1140-W025-R01

Distribution:

4 Copies - Stantec Consulting Ltd.

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1.0 INTRODUCTION

This report presents the results of geotechnical explorations and testing carried out at the site of the proposed Prince Road Storm Sewer Outlet, Prince Road Sewer, Phase 9, Outlet to Detroit River in the City of Windsor, Ontario. The approximate location of the site is shown on the Key Plan, Figure 1. The purpose of the work completed for this report was to explore the subsurface soil and groundwater conditions at the site and to provide geotechnical engineering recommendations for the design of the proposed works.

2.0 TERMS OF REFERENCE

The field work was carried out and this report was prepared in general accordance with Golder Associates Ltd. (Golder) proposal P14-4393 dated October 31, 2008. Authorization to proceed with the work was received from Mr. Mike Jones of Stantec Consulting Ltd. (Stantec), on February 19, 2009. Shortly thereafter Golder was instructed to suspend work until further notice. The project was reactivated in November, 2009.

Our professional services for this assignment address only the geotechnical (physical) aspects of the subsurface conditions at this site. The geo-environmental (chemical) aspects, including the consequences 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 report and have not been investigated or addressed. Use of this report is subject to important limitations provided following the text of this report.

3.0 PROJECT DESCRIPTION

It is understood that the Corporation of the City of Windsor plans to construct Phase 9 of Prince Road Storm Sewer, Outlet to Detroit River. Based on the project terms of reference and information provided, the proposed project will comprise the following:

- installation of some 640 metres (m) of 2400 millimetre (mm) diameter gravity storm sewer below Peter Street (south of Hill Street) and Chappell Avenue (between Peter Street and Russell Street) and extending south west of the intersection of Chappell Avenue and Russell Street to the planned McKee Creek outlet;
- construction of a new storm sewer pump station at the McKee Creek outlet;
- decommissioning of an existing pump station on Peter Street at Hill Street; and
- reconstruction of those portions of the road(s) disturbed by storm sewer construction.

The new pump station is to be constructed at the outlet to McKee Creek and will likely be a precast system about 3 metres in diameter with the invert of the wet well being located at about elevation 171.9 m or about 4.5 metres below existing grade.

The invert of the new gravity sewers will range from about elevation 171.9 m to 172.7 m, or approximately 3.7 to 8.2 metres below present grade. It is anticipated that the deeper portion of the new storm sewer, along Peter and part of Chappell Streets, will be constructed using tunnelling techniques while the shallower portion of the sewer, along the western part of Chappell Avenue and towards the outlet, will likely be installed using conventional cut and cover techniques. It is assumed that the new storm sewer below the two Essex Terminal Rail crossings (sidings) can be installed using open cut excavation techniques rather than using trenchless technologies.

4.0 INVESTIGATION PROCEDURES

Golder carried out a number of earlier investigations in the general vicinity of the site and was involved with the previous phases of the Prince Road Storm Sewer Works. The locations of boreholes and testing completed as part of this assignment together with relevant previous boreholes completed by Golder during the earlier assignments are shown on the Location Plan, Figure 1. The Record of Borehole Sheets for all explorations are included in Appendix 'A' following the text of this report. A listing of some of the earlier geotechnical assignments is presented below:

- Golder Associates Limited Report Number 041-140044 entitled "***Geotechnical Investigation, Proposed Prince Road Sewer System, Phase 5, Montcalm Street to Huron Church Road, Windsor, Ontario***", dated April 2004.
- Golder Associates Limited Report Number 764111/1 entitled "***Geotechnical Investigation, Proposed Prince Road Storm Sewer, Windsor, Ontario***", dated November 1979.
- Golder Associates Limited Report Number 764111 entitled "***Preliminary Geotechnical Investigation, Proposed Prince Road Sewer, Windsor, Ontario***", dated November 1976.

The stratigraphic boundaries shown on the Record of Borehole sheets and Figure 1 are generally inferred from non-continuous sampling, observations of drilling progress, and the results of Standard Penetration Tests (SPTs) and Cone Penetration Testing (CPTs). These boundaries, therefore, will represent gradational transitions from one soil type to another rather than exact planes of geological change. Furthermore, subsurface conditions will vary between and beyond the boreholes, samples and CPT locations.

4.1 Drilling and Sampling

Subsurface explorations completed in preparation of this report were carried out between November 25 and 27, 2009. During this time, three (3) sampled boreholes (numbered 1 to 3) were advanced along the route of the proposed sewer works. In addition, cone penetration tests (CPT) were completed adjacent to each of the three new boreholes and three of the relevant earlier boreholes, and these tests were numbered CPT1 to CPT6. The locations of the boreholes and CPTs are shown on Figure 1. The boreholes and CPTs were completed using truck and/or track mounted drilling equipment supplied and operated by specialist drilling contractors.

The field work for this investigation was supervised on a full-time basis by members of Golder's staff who also located the boreholes and CPTs in the field, directed the drilling, sampling and in situ testing operations, logged the boreholes and cared for the soil samples. The ground surface elevations at the borehole and CPT locations were inferred from spot elevations, referenced to geodetic datum, shown on project drawings provided by Stantec.

The boreholes completed as part of this assignment were advanced using hollow stem augers. The sampled boreholes were advanced to depths ranging from about 9.8 to 15.7 metres below the existing ground surface.

Soil samples were obtained using 50 millimetres outside diameter split-spoon samplers in accordance with the Standard Penetration Test (SPT) procedures (ASTM D1586). The Standard Penetration Test was conducted using an automatic hammer for two boreholes (boreholes 1 and 2) and a conventional rope and cat-head hammer in the remaining new borehole (borehole 3) and previous explorations referenced in this report.

Record of Borehole sheets are provided in Appendix ‘A’ following the text of this report. The soil samples were identified in the field, placed in individually labelled containers and transported to Golder’s Windsor laboratory for further examination and testing. The results of the laboratory testing are also shown on the Record of Borehole sheets and figures following the text of this report.

Water levels were observed in the open boreholes throughout the drilling operations. Standpipe observation wells were installed in two boreholes, numbered BH1 and BH3 to observe the groundwater level(s) at the site. The annular space around the screened portion of each standpipe was backfilled with sand and then sealed near the surface using a bentonite pellet backfill. Details of the installations and water level measurements taken are described on the respective Record of Borehole sheets and Figure 1. The boreholes and observation wells were abandoned in accordance with current regulatory requirements on January 18 and 19, 2010.

4.2 Field Vane Shear Tests

In situ vane shear strength testing was carried out in the boreholes using a field vane shear test device conventional to practice in Ontario where the device is inserted into the ground at depth intervals, where appropriate, from within a conventional borehole. These tests were carried out using standard vanes turned with a calibrated torque wrench at shear rates such that the times to failure typically ranged from 25 to 120 seconds. The results of the in situ vane tests are shown on the Record of Borehole sheets.

4.3 In Situ Cone Penetration Tests

Six CPTs were conducted along the route of the proposed sewer. Where necessary, shallow boreholes were advanced through the surface soils using solid stem augers or hollow stem augers to depths ranging from 1.2 to 3.1 metres below present grade to facilitate start of the CPTs.

The CPT is an in situ testing technique for site characterization studies. The CPT consists of a special cone tip equipped with electronic sensing elements to continuously measure tip resistance, local side friction on a steel sleeve behind the conical tip, and porewater pressure. It is pushed at a constant rate into the ground using a drill rig (ASTM D5778). A nearly continuous stratigraphic profile together with engineering properties, such as undrained shear strength, can be inferred from the results of the CPT.

The CPT equipment was advanced using the hydraulic ram system on the drill rigs. The CPTs were advanced to depths ranging from about 15.3 to 31.6 metres below ground surface. The CPT depths are listed in the Table 1, below, and shown on Figure 1.

Table 1: Depths of CPT Penetration.

CPT Number	Ground Surface Elevation (m)	Depth of CPT (m)	CPT Tip Elevation (m)
CPT 1	180.42	28.08	152.34
CPT 2	179.87	29.68	150.19
CPT 3	180.10	15.36	164.74
CPT 4	180.15	31.64	148.51
CPT 5	176.87	15.32	161.55
CPT 6	176.45	23.80	152.65

Record of Cone Penetration Test results are included in Appendix 'B'. Profiles of tip resistance, pore water pressure during pushing and sleeve-friction are presented on these records. Figures 4 and 5, following the text of this report, provide interpreted profiles of undrained shear strength inferred from this testing.

4.4 Laboratory Testing

Upon return of the samples to the Windsor laboratory, the following tests were completed:

- Natural water content of soil (ASTM D2216) determinations were completed on 39 samples obtained from the boreholes drilled at the site;
- Atterberg Limit determinations (ASTM D4318) were completed on 3 samples; and
- Mechanical sieve analyses were carried out on 3 samples in accordance with ASTM D422.

The results of the laboratory testing are shown on the Record of Borehole sheets, and Figures 2 and 3.

5.0 PREVIOUS SEWER CONSTRUCTION IN PRINCE ROAD VICINITY

The previous phases of Prince Road Sewer works were constructed between 1976 and 2002 along Prince Road between Sandwich Street and Matchette Road. The sewer diameter ranged between about 1.8 and 2.3 m diameter. Along the western section of this sewer, constructed in the 1970s in the general area between College Avenue and Sandwich Street, the undrained shear strength of the clayey silt to silty clay was variable and tunnelling methods were used in some areas, beneath the Essex Terminal Railway tracks for instance, while cut and cover methods were used in others. A combination of tunnelling methods and open cut excavation were used east of College Avenue, depending on the undrained shear strength of the soils. Tunnelling work carried out in the 1970s was generally completed using a tunnelling shield and compressed air for face support. The cut and cover sections in the central part of the project required more than 2 m of general site excavation, extending up to 5 m in width on both sides of the excavation, to unload the ground surrounding the sewer excavation so as to maintain excavation stability. For shaft construction in an area of softer ground, significant ground losses and displacements occurred causing damage to a watermain. For a section that was tunnelled in the early 1980s, significant ground losses occurred, but these were not noticed until the rigid concrete road pavement collapsed and subsided some 200 mm or more. This particular part of the sewer construction was completed using hand mining at the face within a shield with pipe jacked into place directly behind the shield. Squeezing of the ground at the face coupled with an overcut to limit friction or adhesion along the pipe both contributed to the excessive settlements and collapse of the roadway pavements. Steel sheet piling was used for support of the shaft excavations.

In 1970, a sewer was constructed along South Street, two blocks north of the current planned tunnel construction. The sewer was constructed at a depth of about 7.8 m below the original ground surface using cut and cover methods. The sewer was constructed in a vertical excavation with steel sheet piling support system. The sheeting was not appropriately interlocked and there were open spaces between the sheet piles in some areas. The sheet piles were unsupported (i.e. no waler) from a depth of 3 m to the bottom of excavation and embedded into the underlying clayey silt to silty clay by about 1 m below the excavation. After cracks/settlements developed in nearby houses at the Sandwich Street-South Street intersection and in ground near trench, the area surrounding the excavation was unloaded by excavation to a depth of about 1.5 m with a width of 3 m outside of the sheet piles on both sides of the trench as an emergency procedure. Settlement of soil outside of the sewer trench and damage to another house at Peter Street-South Street intersection occurred. Following additional investigation, it was concluded that squeezing of plastic clay between the open spaces of unlocked sheeting and inadequate bracing combined with inadequate depth of penetration of the sheeting below the trench bottom resulted in the damaging ground movements.

6.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

6.1 Site Geology

The study area is located in the physiographic region of Southwestern Ontario known as the St. Clair Clay Plains. Within this region, Essex County and the south western part of Kent County are normally discussed as a subregion known as the Essex Clay Plain. The clay plain was deposited during the retreat of ice sheets (late Pleistocene) when a series of glacial lakes inundated the area. In general, the ice sheets deposited materials with a glacial-till-like gradation in the area of Windsor and Detroit. Depending on the locations of the glacial ice sheets and depths of water in the ice-contact glacial lakes, the till may have been directly deposited at the contact between the ice sheet and the bedrock or, as the lake levels rose and the ice sheets retreated and floated, the soil and rock debris within and at the base of the ice were deposited through the lake water (lacustrine depositional environment). Glacial till, in its common usage, often indicates a very dense or hard composition resulting from consolidation and densification under the weight of the ice sheet and the mineral soil particles typically have a distribution of grain sizes ranging from cobbles to clay. In many areas of Windsor and Detroit, however, the majority of the soils described as “glacial till” were deposited through water and have a soft to firm consistency below a “crust” that has since become stiff to hard through weathering and desiccation.

The major soil stratum in the study area, consisting primarily of clayey silt to silty clay, typically ranging in thickness from about 30 to 35 metres, exhibits a till-like structure exemplified by a random distribution of coarser particles within the primarily fine-grained silt and clay deposit (also called “diamict”). For the purposes of this report, these soils are not described as glacial till. In most of the eastern and northern parts of the Windsor metropolitan area below frost depth, the near-surface clayey soils are generally firm to hard and brown. Underlying this “crust”, the soil becomes grey-brown and firm to stiff in consistency. Below the groundwater level, the soil becomes soft to firm, particularly in the western and southern areas of metropolitan Windsor.

Surficial layers or pockets of more typical layered lacustrine (lake-deposited) silty clay, silt or sand may be encountered overlying and/or interbedded within the extensive stratum of “till-like” (in terms of gradation) clayey silt to silty clay. A relatively thin stratum, on the order of 1 to 6 metres in thickness, of very dense or hard basal glacial till or dense silty sand may be found directly overlying the bedrock surface in some locations.

6.2 Site Stratigraphy

The detailed subsurface soil and groundwater conditions encountered in the boreholes, and inferred from the CPTs, together with the results of the field and laboratory testing carried out, are shown on the Record of Borehole and Cone Penetration Test sheets and Figure 1.

In summary, the materials encountered in the boreholes and CPTs completed along the proposed sewer alignment generally consisted of the existing pavement structure and varying thicknesses of heterogeneous fill materials overlying extensive strata of clayey silt to silty clay (cohesive soils). The clayey silt to silty clay is occasionally overlain by and/or interbedded with granular soils.

6.2.1 Existing Pavement Structures and Fill Materials

Borehole 1 and earlier boreholes 5, 203, 204, and 205 were drilled through the existing pavement on Peter Street, and boreholes 2 and 3 were drilled through existing pavements on Chappell Avenue. These boreholes encountered some 50 to 180 millimetres of asphaltic concrete pavement at the ground surface. Beneath this surface pavement layer in current boreholes 1 (drilled between Hill Avenue and Chappell Avenue) and 3 (drilled between Sandwich Street and Russell Street), and boreholes 5, 203, 204, and 205, some 150 to 250 millimetres of Portland cement concrete pavement was found. Below the concrete in boreholes 1 and 3, and borehole 5, and the asphalt pavement in borehole 2, approximately 50 to 330 millimetres of granular road base materials were encountered.

Underlying the existing pavement structure in borehole 1 and earlier borehole 5, and at the ground surface in borehole 103, cohesive and granular fill materials were encountered. The thickness of the fill materials was about 200 to 1500 millimetres at the borehole location. The water content of the samples of the fill materials tested was about 4 to 16 per cent.

6.2.2 Surficial Granular Deposits

Beneath the fill materials in borehole 1 and borehole 103, granular road base material in boreholes 2 and 3, and concrete in boreholes 203, 204 and 205, native granular soils were encountered. These granular soils varied in gradation from sand to silty sand. The thickness of the granular deposits varied between about 0.9 and 3.8 metres at the borehole locations. Measured Standard Penetration Test ‘N’ values obtained in the granular soils ranged from 1 to 21 blows per 0.3 metres. The water content of the granular soils tested varied from about 6 to 30 per cent. A number of the CPTs encountered a layer of inferred surficial granular deposits. The inferred gradation of these surficial granular deposits varied from sand to sandy silt.

6.2.3 Alluvial Deposits

Borehole 201 was drilled in February 1978, near the west bank of McKee Creek through the frozen creek ice, near the proposed pump station location. In this borehole, alluvial deposits were encountered consisting of soft and very loose, silty clay and sand with organics. The alluvial deposits were about 3.7 metres in total thickness. Measured ‘N’ values in these alluvial deposits were 2 to 3 blows per 0.3 metres. The water content of the alluvial deposits tested varied from about 29 to 84 per cent. The organic content of a sample of these alluvial deposits was about 12 per cent.

6.2.4 Brown or Brown to Grey Clayey Silt to Silty Clay Deposits

A deposit of clayey silt to silty clay was found in all boreholes completed in preparation of this report and the relevant boreholes completed during earlier assignments. The upper weathered portion of the cohesive deposits between about elevations 174.8 and 178.3 m characteristically consisted of clayey silt to silty clay soils having a brown or brown to grey colour in boreholes 1, 2 and 3, and earlier borehole 5. Measured ‘N’ values obtained in the brown and brown to grey cohesive soils ranged from 2 to 11 blows per 0.3 metres, indicating a very soft to stiff consistency. The water content of the brown and brown to grey clayey silt to silty clay samples tested varied from about 23 to 30 per cent.

The upper brown zone, and a transition zone within the grey portion of the deposit represents a “crust” in which weathering processes during and following deposition have resulted in this material being generally stronger than the underlying deposit. However, weathering processes including seasonal freezing, drying and wetting, have produced natural fissures within the clayey silt to silty clay crust. These fissures typically reduce the mass strength of the soils when compared to small intact samples.

6.2.5 Grey Silty Clay to Clayey Silt Deposits

Underlying the brown and brown to grey silty clay deposits in boreholes 1, 2 and 3, and borehole 5, native sand in boreholes 103, 203, 204 and 205, and alluvial deposits in borehole 201, grey clayey silt to silty clay containing silt and/or fine sand partings/seams with fine gravel was encountered. The clayey silt to silty clay deposit is generally grey below the static groundwater level. All of the boreholes completed along the alignment were terminated in the grey clay deposits. Standard penetration testing carried out in the grey silty clay to clayey silt yielded ‘N’ values ranging from zero (weight of hammer) to 10 blows per 0.3 metres with the values generally decreasing with increasing depth. In situ field vane testing carried out in the boreholes indicated the grey silty clay to clayey silt to have an undisturbed undrained shear strength ranging from about 10 to 84 kiloPascals (kPa).

The water content of the grey clayey silt to silty clay samples tested varied between about 19 and 51 per cent. Atterberg limit determinations carried out on selected samples of the grey clayey silt to silty clay yielded plastic limits ranging from about 17 to 19 per cent, liquid limits ranging from about 32 to 42 per cent and plasticity indices from about 15 to 24 per cent. Grain size distribution curves for samples of the grey silty clay to clayey silt soils obtained are shown on Figures 2 and 3. These unweathered soils of the clayey silt to silty clay deposit are characterised as low-sensitivity (undisturbed divided by remoulded field vane shear strength) materials with an average sensitivity of about 2.0. Minimum and maximum sensitivity values ranged from about 1.4 to 3.0.

6.2.6 Interbedded Granular Deposits

A layer of interbedded granular deposits of silty sand was encountered at a depth of 4.4 metres in borehole 5. The thickness of the interbedded granular deposits was about 0.8 metres at the borehole location. A single measured ‘N’ value in this granular deposit was zero (weight of hammer) blows per 0.3 metres. The single sample of this material had a tested water content of about 17 per cent.

Multiple CPTs encountered layers inferred to consist of granular soils underlying and interbedded within the clayey silt to silty clay between about elevations 151.7 and 154.1 m with an inferred gradation from sand to sandy silt. Cone Penetration Test 6 was terminated in these materials. Based on the CPT testing, the inferred thickness of the interbedded granular deposits between elevations 151.7 and 154.1 m varied between about 0.1 and 0.3 m at the CPT locations. In addition, this seams of granular soils (typically less than 0.1 m thick) were also encountered throughout the clayey silt to silty clay deposit at intervals on the order of 1 to 5 m.

6.3 Groundwater Conditions

Groundwater observations and water level measurements were recorded during the course of the field work. Water levels were also measured in the standpipes installed in selected boreholes. Details of the standpipe installations and the groundwater level measurements are summarized on the Record of Borehole sheets following the text of the report and summarized on Figure 1. A summary of the groundwater levels measured in the boreholes/standpipes is presented in the following Table 2:

Table 2: Summay of the Groundwater Levels.

Borehole	Ground Surface Elevation (m)	Encountered Groundwater Elevation (m)	Installation	Measured Groundwater Elevation (m)	
				November 26, 2009	November 27, 2009
1	179.85	177.79	Standpipe	177.79	177.84
2	180.45	Dry	Open Hole	-	-
3	176.90	Dry	Standpipe	Dry	Dry
103	175.56	174.04	Open Hole	-	-
201	175.05	174.59	Open Hole	-	-
203	179.74	178.89	Standpipe	-	-
204	180.33	Dry	Open Hole	-	-
205	180.41	Dry	Standpipe	-	-
5	-	4.6 m (depth)	Open Hole	-	-

Groundwater conditions along the project site and as summarized in the above table are influenced by several factors summarized below:

- During drilling, the low permeability of the cohesive clayey silt to silty clay will have inhibited seepage of groundwater into the borehole and, therefore, observations at the time of drilling will not be representative of stable pore water pressures at the borehole location.
- Where granular soils or fills overly low permeability cohesive clayey silt to silty clay, groundwater will be largely influenced by the water level of the nearby Detroit River, or by the difference between infiltration of storm water (precipitation) and seepage into the underlying cohesive soils.
- The levels below which the cohesive clayey silt to silty clay soils remain saturated may be best characterised by the elevation of the transition in soil colour from brown or mottled brown and grey to grey. Within the overlying mottled brown to grey and brown soils, the degree of saturation will vary seasonally and will depend on local precipitation events and local soil permeability.

Based on the available data, it is anticipated that the soils typically remain saturated below about elevation 178.0 m from near Peter Street and Hill Avenue (in the vicinity of borehole 205) through to near the intersection of Chappell Avenue and Sandwich Street (vicinity of borehole 2). For the purposes of this project, porewater pressures within all deposits can be considered equivalent to a static water pressure head, or groundwater level, equal to about elevation 178.0 m in this area. Between Sandwich Street and McKee Creek the groundwater level declines to meet the elevation of the Detroit River surface at McKee Creek. It should be noted that groundwater levels (and pore water pressures within the cohesive soils) will vary seasonally and with precipitation or spring thaw events and, therefore, groundwater conditions at other times may vary from those described in this report.

7.0 DISCUSSION AND RECOMMENDATIONS

7.1 General

This section of the report presents our interpretation of the factual information obtained from the investigation and is intended only for use by the design engineer. Where comments are made on construction, they are provided only in order to highlight aspects of construction which could potentially affect the design of the project. Contractors bidding on or undertaking any work at the site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like.

7.2 Interpreted Engineering Parameters of Clayey Silt to Silty Clay

This section of the report summarizes geotechnical engineering parameters used as a basis for design recommendations provided in this report. It is considered that the geotechnical engineering properties of the clayey silt to silty clay deposit may dominate the behaviour of the ground with respect to tunnels and cut and cover excavations. The geotechnical engineering parameter values summarized in this report section were based on interpretation of the field and laboratory test results compiled for this project supplemented by published and unpublished information where relevant. The parameters as provided in this report are considered appropriate for the in situ condition of the ground. The influence of construction methods, equipment, materials and sequencing on the engineering performance of the soil and water have only been interpreted as needed for the provision of recommendations related to design and development of contract specifications as included in this report.

Determination of the undrained shear strength of the clayey silt to silty clay was achieved during explorations carried out for this project using the conventional field vane shear test and the CPT. A vane shear testing device conventional to practice in Ontario was used for this project. Based on the range of plasticity index values a correction factor was not applied to the field vane shear test results. The CPT was also used because of the relatively constant rate of strain during the test, its repeatability among operators and CPT systems, and since it also provides a nearly continuous profile of data through the test.

A site-specific correlation between the corrected CPT tip resistance (q_c) and undrained shear strength was developed considering the field vane shear test results completed for this project as well as regional data as follows:

$s_{u(CPT)} = q_c / N_c$

where: $s_{u(CPT)}$ = undrained shear strength as derived from the CPT (kPa)

q_c = tip resistance (kPa)

N_c = cone factor

While other published correlations between undrained shear strength and tip resistance were examined, it was considered that the above relationship provided suitable estimates for this project. Based on the field vane shear tests and a comparison of project specific data with other data in the Windsor area, a cone factor of N_c = 16, was applied for this project. For the purposes of design, it was considered that the in situ undrained shear strength for design for the low-plasticity clayey silt and silty clay may be considered approximately equal to the undrained shear strength interpreted from the CPT test.

Figures 4 and 5 illustrate interpreted profiles of undrained shear strength. These figures illustrate variable undrained shear strength profiles, considered characteristic of the conditions in the west part of the City of Windsor, particularly near the riverfront. For purposes of comparison, data from multiple CPTs have been depicted together on Figures 4 and 5. A profile of design undrained strengths for the proposed tunnelling works is shown on Figure 4 and a second profile for the proposed open cut excavations is shown on Figure 5.

For design purposes, the “preconsolidation pressure” has been determined based on the undrained shear strength values, as determined from the CPT test results as described above, using the approach as follows (after Mesri 1975[1]):

$S_{u(ref)} = 0.22\sigma'_p$ or for the preconsolidation pressure, $\sigma'_p = S_{u(ref)} / 0.22$

where: $S_{u(ref)}$ = reference undrained shear strength (kPa), considered equal to $s_{u(CPT)}$

σ'_p = preconsolidation pressure

Determination of the stress-strain properties of the soils was accomplished using other laboratory test results from Golder files, and comparison of site-specific CPT and laboratory index testing data to published correlations and theoretical relationships. The following correlations have been considered applicable for this project:

Virgin Compression Index: $C_c = 0.0086w_n - 0.0086$
Recompression Index: $C_r = 0.11C_c$
Where w_n represents the natural water content expressed as a per cent

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[1] Mesri, G. (1975). New Design Procedure for Stability of Soft Clays: Discussion. Journal of the Geotechnical Engineering Division, ASCE 101(4), 409 – 411.

For this project, deformation modulus at various levels of strain have been estimated based on testing carried out for this project as well as testing completed on Windsor soils for other projects. Deformation moduli were developed for three positions within the stress strain curve: (1) an approximate of the initial undrained tangent modulus, E_{uit}, consistent with strains in the range of about 0.1 per cent to 0.2 per cent; (2) secant undrained modulus at 50 percent failure stress, E_{us50}, corresponding to a strain range of 1 per cent to 3 per cent; and (3) unload-reload modulus, E_{ur}, assessed based on an unload-reload cycle typically carried out between these strain levels. The approximate correlations listed below were used for this project.

E_{uit} = $290S_{u(ref)}$

E_{ur} = $1.65E_{uit}$

E_{us50} = $0.44E_{uit}$

E’ = $0.9E_u$, where E’ represents the drained deformation modulus and E_u represents the undrained deformation modulus for any of the strain levels identified above.

The deformation moduli as summarized above are considered to represent the stress-strain response of the soils as related to strain rates typical for the laboratory testing methods used to derive these parameters (e.g. typical average rate of strain of approximately 0.5% per hour for triaxial tests). These deformation moduli, therefore, do not represent the long-term, time-dependent low strain-rate behaviour.

Estimation of the Mohr-Coulomb strength parameters of effective internal angle of soil friction, ϕ’, and effective cohesion intercept, c’, was based on the results of the laboratory triaxial testing carried out on soils obtained during earlier investigations completed in the vicinity of the site and comparisons of site specific and nearby CPT testing. The corresponding effective angle of internal friction for an assumption of an effective cohesion intercept of zero was estimated to be between about 27 and 30 degrees. These values are generally consistent with published correlations for similar soil types. For design purposes, the effective cohesion intercept has been assumed equal to zero and the peak effective angle of internal friction has been assumed equal to about 27 degrees and the residual angle of internal friction has been assumed equal to 25 to 27 degrees.

For the purposes of design, the value for the ratio of in situ horizontal to vertical stresses, K_o, been taken to be between the two relationships of $K_o = (1\text{-}\sin\phi')$ and $K_o = (1\text{-}\sin\phi')OCR^{\sin\phi'}$ with a maximum $K_o = 1$ for soils below the crust, and a maximum value in the crust equal to the lower of either maximum value calculated for the soils immediately below the crust or in any event, not greater than 1.5.

The coefficient of permeability or hydraulic conductivity, k, of the clayey silt to silty clay materials was inferred from laboratory testing carried out for other projects in Windsor. For design purposes, the estimated in situ mass permeability in the vertical direction for the clayey silt to silty clay deposit is estimated to be about $5x10^{-10}$ m/s with the value in the horizontal direction has been assumed to be about twice this value.

7.3 Sewer Construction Using Cut and Cover Methods

7.3.1 Sewer Trench Excavations, Stations 0+000 to 0+192

It is anticipated that the new gravity sewer, between approximately Stations 0+000 and 0+192 will be installed using conventional cut and cover techniques. It is further assumed that where the new storm sewer passes below the two Essex Terminal Rail spur lines crossings it will also be installed using cut and cover techniques.

Construction of the proposed sanitary sewer will require excavations of between about 3.7 and 5.5 m deep below the existing ground surface. It is recommended that the existing composite pavement be saw cut before construction to facilitate removal of the existing pavement structure and to limit disturbance to those sections of the roadway located away from the utility works.

Where fill and granular materials are encountered above groundwater levels, these soils may be classified as “Type 3” under the Occupational Health and Safety Act (OHSA). Native undisturbed silty clay and clayey silt soils may also be classified as “Type 3” soils, where these are encountered above the groundwater level. Below the groundwater level, all granular soils are expected to flow if not completely supported or dewatered prior to excavation. Further, all the clayey silt to silty clay soils are expected to be relative sensitive to disturbance and, depending on the depth of the excavation and location along the alignment, may be characteristic of “squeezing” ground. Therefore, all soils below the anticipated groundwater levels (fully saturated soils) should be considered classified as “Type 4” soils in accordance with the OHSA.

Based on the results of the explorations and testing completed for this project, the base of the sewer excavations will transition from within the native grey clayey silt to silty clay near Station 0+192 to very loose to loose grey sand at the western limit of the work. This transition may be gradual and may occur between the stations of approximately 0+150 and 0+075. Design and construction planning for the excavations in this area should plan on both of these conditions being present along the sewer alignment.

The sewer excavations will extend below groundwater levels in all areas. Uncontrolled excavation below the groundwater level will result in caving of the excavation side slopes and flowing of any granular soils in the trench sides. To facilitate construction of the sewers, it will be necessary to provide some form of positive groundwater control or full support of the excavation walls (e.g., driven sheeting) prior to excavation in this area. Given the proximity of McKee Creek and the Detroit River and the local soil conditions, it is anticipated that dewatering for the pumping station and sewer excavation between McKee Creek and Russell Street using well points or educators may not be effective. Use of deep wells will likely also not be effective due to the limited depth of granular soils below the base of the excavation. Therefore, it is recommended that groundwater control for the pump station and cut and cover sewer excavation between McKee Creek and Russell Street be accomplished by cutting off groundwater using continuous interlocking steel sheet piling extending sufficiently into the underlying cohesive soils. In areas that include saturated surficial granular soils or fill it may be feasible to excavate shallow interceptor trenches into the underlying cohesive soils and then using properly filtered sumps and pumps to control water that might otherwise enter the excavations. It may be necessary to blanket such cut slopes with a free draining granular material to minimize loss of ground.

Regardless of the support system used, the work should be carried out quickly and the length of longitudinal open sections of the trench(s) should be kept to a minimum. It is recommended that a public dig be carried out during the tender stage to enable prospective contractors to view the soil, and particularly the groundwater conditions near McKee Creek, for themselves and to assess the dewatering and ground support requirements. The location and depth of the test pits should cover the full extent of the cut and cover excavation works. The test pits should not be completed in areas that may jeopardize the stability of the future sewer excavations and should be backfilled with unshrinkable fill.

The results of field vane shear testing carried out in the boreholes and the CPTs indicate that at and just below the anticipated pipe founding level, the native silty clay soils have an undrained shear strength ranging between about 15 and 20 kilopascals. The factor of safety calculated against basal instability for excavations can be assessed using the following equations:

$$N_s = (\gamma H)/S_u$$

$$FS = \frac{N_b}{N_s}$$

where:

FS = factor of safety

S_u = undrained shear strength (kPa)

N_s = stability number

N_b = bearing capacity factor

γ = total unit weight (kN/m^3)

H = depth of excavation (m)

Table 3, below, summarizes assessed base stability factors of safety for the excavations along the cut and cover excavation areas.

Table 3: Summary of Base Stability for Cut and Cover Construction, Stations 0+000 to 0+192.

Location	Approximate Depth of Excavation (m)	Approximate Sewer Invert Elevation (m)	Approximate S_U (kPa)	Stability Number	Calculated Factor of Safety
Near Pump Station and Outfall Structures	5.0	171.9	15	7.0	1.0
MH 2	4.2	172.0	20	4.4	1.6
Near Tunnel Shaft at Station 0+192	6.0	172.2	20	6.3	1.1
Essex Terminal Rail Crossings	4.3	172.0	20	4.5	1.5

Note: Size of the excavation was assumed, width = 3 metres and length = more than 3 times the excavation width.

The factor of safety calculated against basal instability ranges from about 1.0 to 1.6. Where this factor of safety is less than 1.5 the potential for bottom instability exists and heave of the excavation base and excessive movement of the ground surrounding the excavation should be anticipated. To increase the factor of safety to an acceptable level it is recommended that ground surrounding the excavation be unloaded and/or the depth of penetration of the support system in this area be extended below the base of the excavation. The unloading should extend either side of the trench a distance greater than 75 per cent of the excavation depth and, in the case of the sewer lengths between MH 2 and Station 0+192, this unloading should be between 1 and 1.5 m deep to improve the base stability conditions. In the area of the tunnel access shaft, near Station 0+192, and the pump station and outfall structures, the base stability factor of safety indicates that it will be necessary to have the excavation support system penetrate well below the excavation base. Discussions and recommendations related to support systems penetration depth are outlined in Section 7.3.3.

7.3.2 Outfall and Pump Station Structures

It is anticipated that an outfall structure will be constructed at McKee Creek. The type or dimensions of this structure had not been determined at the time of this report, but it is anticipated that it may be a pre-cast reinforced concrete structure. A new pump station is also proposed to be constructed near the McKee Creek outlet. It is understood that the new pump station will be an approximately 3 metre diameter pre-cast reinforced concrete structure approximately 4.5 metres deep with a planned base elevation near elevation 171.0 m.

The subsurface conditions encountered in the vicinity of the planned outfall and pump station structure locations consist of highly variable conditions within the top 2.5 m including very loose to loose sand to silty sand to soft black silty clay with both of these general soil types including peat and organics, typified by their black colour extending to approximately elevation 172.5 m. These variable materials overly very loose fine to medium sand found below about elevation 172.5 m. Peat layers were also noted within the granular soils at the location of borehole 201. These organic materials are considered unsuitable for support of the new outfall and pump station. It is therefore recommended that the bases for these structures be constructed to bear on the native soft to firm grey silty clay, found below elevations ranging from about 170.8 to 171.2 m.

It is anticipated that, because of the unloading caused by excavation, bearing capacity and settlement will not govern design of these structures. However, if bearing pressures are required for design purposes, preliminary design of the foundations for these structures may be based on a geotechnical reaction at Serviceability Limit States (SLS) of 35 kilopascals and factored geotechnical resistance at Ultimate Limit States (ULS) of 50 kilopascals. Displacement performance of these structures will likely be governed by the condition of the subgrade after excavation.

The structural design of the pump station and outfall structures should be based on a soil total unit weight of 21 kN/m^3 where the native and backfill soils are above the groundwater level, a buoyant unit weight of 11.2 kN/m^3 for soils or backfill below the groundwater level, and a lateral earth pressure coefficient of 0.5. The structures should also be checked to ensure that they are of sufficient weight to withstand buoyancy corresponding to a water level at or above the ground surface, consistent with design flood conditions. For conditions in which the pumping station or outlet structures will be unwatered during initial construction and later maintenance, it is recommended that the structures be designed with a factor of safety of 1.1 against buoyancy considering only the dead weight of the structure and a groundwater level equivalent to the ground surface elevation at the structure location.

The fine granular founding soils are considered susceptible to disturbance, especially in the presence of water. It is therefore recommended that immediately following excavation and after approval of the base by the geotechnical engineer, a protective layer of lean concrete be placed as soon as possible to preserve the integrity of the exposed fine sand at the design founding elevation. Provided all softened and loosened materials are removed prior to placing the protective layer, settlement of the pumping station is expected to be within normal construction tolerances.

The layered and variable conditions, including mixed cohesive, granular, and organic materials, found above approximately elevation 171 m will likely preclude the use of dewatering techniques such as well points or educators. The limited thickness of granular materials will also preclude the use of deep wells for dewatering. Given these conditions, it is recommended that the excavations for the pump station and outfall structures be constructed within excavations supported by steel sheet piles driven into the underlying cohesive soils to assist in cutting off groundwater flow into the excavation. While interlocking steel sheet piles will assist in minimizing the flow of water into the excavation, leakage should be anticipated. Surface water runoff should also be positively diverted away from the open excavation.

The excavations made for the outfall and pump station structures are anticipated to be deeper than those made for the sewer in this area and, as a consequence, the base stability factors of safety are generally insufficient.

Recommendations for excavation support and measures to address unsatisfactory base stability are provided in Section 7.3.3 of this report.

7.3.3 Access Shafts and Manholes, Stations 0+192 to 0+633

Vertical access shafts will be required at several locations along the new sewer. The shafts will be used to facilitate construction of the tunnelled sections, for manholes, and for construction of connections between the new and existing sewer systems. Due to the depth of the excavations, groundwater levels, pipe invert, soil type, proximity to rights-of-way and adjacent structures, vertical shoring will be required for the shafts. Recommendations are provided in this report to assist with developing appropriate designs and specifications for construction.

For excavations made for the access shafts, manholes, cut and cover sewer (described previously), outlet structure and pump station (described previously), the stability of the excavation bottom will be governed by the undrained shear strength of the low to intermediate plasticity cohesive soils. The stability of the low to intermediate plasticity clayey silt or silty clay can be assessed using the method previously described in Section 7.3.1. Table 4, below, summarizes calculated base stability factors of safety for the various anticipated shafts and manholes along the route of the proposed tunnelling.

Table 4: Summary of Base Stability for Cut and Cover Construction, Stations 0+192 to 0+633.

Location	Approximate Depth of Excavation (m)	Approximate Sewer Invert Elevation (m)	Approximate S_U (kPa)	Stability Number	Calculated Factor of Safety
Tunnel Shaft at Station 0+633	8.8	172.8	20	9.2	0.8
Tunnel Shaft at Station 0+388	8.6	172.4	27	6.7	1.1
Tunnel Shaft at Station 0+192	6.5	172.2	20	6.8	1.0
MH 3	9.2	172.3	25	7.7	1.1
MH 4	8.6	172.4	27	6.7	1.3
MH 5	8.6	172.7	25	7.2	1.2

Notes: 1. Size of tunnel shafts at Stations 0+633 and 0+192 was assumed to be about 8x12 metres.
2. Size of tunnel shaft at Station 0+388 was assumed to be about 12x12 metres.
3. Size of manhole shaft was assumed to be about 4x4 metres.

The factor of safety calculated against basal instability ranges from less than one to 1.3. Where this factor of safety is less than about 1.3 to 1.5 the potential for bottom instability exists and heave of the excavation base and excessive movement of the ground surrounding the excavation should be anticipated. These low factors of safety will likely be observed as:

- Squeezing of cohesive soils through openings in support systems (e.g., the tunnelling “eye” through which the tunnelling work will commence or conclude, gaps between sheet piles or lagging);
- Excessive ground displacements surrounding the excavation; and
- Base instability and excessive deformation of excavation support systems.

To increase the factors of safety to an acceptable condition for these excavations it is recommended that ground surrounding the excavation be unloaded and the depth of penetration of the support system in these shaft areas be extended well below the base of the excavation. Unloading, achieved by excavation and removal of fill and earth materials, should extend away from all sides of the access shaft excavations a distance greater than 75 per cent of the excavation depth and be at least 1 m deep. Where the shaft excavations are the deepest, near Station 0+633 for example, unloading by 1.5 m may be necessary. It is recommended that the excavation support systems also extend to a tip penetration depth equal to about 50% of the full excavation depth (as measured from the original ground surface rather than the surface after unloading). Extending the penetration of the support systems to these depths should assist in minimizing ground displacements and increase the overall stability of the excavation by taking advantage of the greater strength of the soils below the excavation base.

Shoring construction methods might include the use of soldier-piles and lagging, interlocking steel sheet piles or contiguous drilled-shafts (secant piles). Based on the anticipated depths of the excavations, it will likely be necessary to support the shoring systems using struts or ring beams. In general, where the stability number is equal to or greater than about 6 soldier-pile and lagging excavation support systems are not recommended as squeezing of the cohesive soils could load the lagging excessively, result in difficulties during excavation and lagging installation, and lead to loss of ground. Interlocking steel sheet pile walls could be selected in order to meet ground support, groundwater control, and ground displacement control requirements. Both lagging and steel sheeting should be designed to be sufficiently stable to permit construction of an “eye” in the lagging and sheeting through which the tunnelling can pass. If the access shaft is supported by a continuous perimeter of steel sheet piles, or by soldier-pile and lagging walls, alternative ground support will be required behind the steel sheets or timber lagging to prevent squeezing and loss of ground when the wall is cut to allow passage of tunnelling equipment. The shoring systems should also be designed and constructed consistent with the requirements for shaft abandonment and backfilling around or over the new structures.

Geotechnical design parameters are provided in the Table 5, below, and on Figure 6 based on a horizontal ground surface behind the retaining structure. These parameters are provided to assist with preliminary design of excavation support systems. Active earth pressure coefficients are not provided within Table 5 since recommended minimum lateral pressures for excavation support systems are provided on Figure 6. Where the area surrounding excavations is unloaded, the excavation support design should be based on the original ground surface elevation and not the reduced level of the ground after unloading.

Table 5: General Geotechnical Design Parameters.

Generalized Soil Stratigraphy	Recommended Geotechnical Design Parameters
Fill Materials	γ = 20.5 kN/m^3, K$_p$ = 2.56
Brown Clayey Silt to Silty Clay	γ = 21.5 kN/m^3, γ'= 11.7 kPa, K$_p$ = 2.7
Grey Clayey Silt to Silty Clay	γ = 21.0 kN/m^3, γ' = 11.2 kN/m³, K$_p$ = 2.7
Notes: γ = total saturated soil unit weight; γ' = buoyant soil unit weight; K$_p$ = passive earth pressure coefficient	

If soldier piles are to be utilized, the maximum passive resistance should be taken as the lesser of the passive resistance calculated for a continuous wall applied to the centre-to-centre pile spacing or by using an effective width of the soldier pile three times the width of the installed pile. Figure 6 illustrates the minimum net horizontal pressure that should be used for design of the excavation support systems. Below the base of the excavation, this figure accounts for the limited passive resistance from the soils near the base of the excavation as well as the penetration required to assist in maintaining a stable excavation base. For the purposes of excavation support wall design, the point of zero net pressure on this diagram may be considered equivalent to a hinged connection.

7.3.4 Pipe Bedding

The bedding material for the new sewer pipe should consist of an approved granular material, consistent with the type and class of pipe to be used. Granular ‘A’ is considered to be an appropriate bedding material for the site. The bedding should extend from about 150 millimetres below the sewer pipe to at least 300 millimetres above the pipe. The pipe bedding should be uniformly compacted to 95 per cent of the standard Proctor maximum dry density. Hand tamping around the pipe may be required to ensure that no voids are present below the spring line of the pipe. It is also important to provide a well compacted granular bedding within the approach zone of the pipe(s) at the manholes. Difficulties may be encountered when attempting to adequately compact granular pipe bedding within the bottom of the trench made in the soft to firm clay, particularly if the base of the trench is wet. Consideration could also be given to the use of a graded clear stone material placed up to the spring line of the pipe. It is recommended that any clear stone material be fully enveloped in a non-woven geotextile meeting the requirements of OPSS 1860 for Type II geotextile to minimize the potential for migration of granular trench backfill or native soils into the stone material.

7.3.5 Backfill of Trenches and Structure Excavations

The native cohesive soils encountered at the site are not considered to be suitable for backfill. The water content of the native cohesive soils is expected to be above the optimum water content for compaction purposes. The near surface granular soils are considered acceptable for reuse as general trench backfill provided that the water content is adequately controlled. Where these materials are encountered below the water table, they will be in a saturated condition and will, therefore, be too wet for immediate handling and effective compaction. However, the granular materials should be relatively free draining and if stockpiled for a period of time, the water content should reduce to a value appropriate for mechanical compaction provided the materials are protected from rainfall and other water sources.

Provided that the placement water content of the native materials is within about 4 per cent of the optimum water content for compaction, the trench backfill material should be compacted to at least 95 per cent of standard Proctor maximum dry density. Materials with water contents in excess of about 4 percent of the optimum water content for compaction should be dried prior to use as adequate compaction control will not be achievable with such materials. Material that is dry of the optimum water content should be wetted during compaction to minimize post construction settlement.

Where imported materials are necessary to backfill excavations an approved borrow material such OPSS Select Granular A or B or an appropriate unshrinkable fill could be utilized. Unshrinkable fill is considered a manufactured fill composed of sand, Portland cement and water with an unconfined compression strength on the order of 0.4 MPa or greater, a slump of 150 to 200 mm, and an air content no greater than 5 percent. Granular trench backfill should be placed in loose lifts not exceeding 200 millimetres in thickness. Where the upper one metre of the trench backfill forms a roadway subgrade, it should be uniformly compacted to at least 98 per cent of standard Proctor maximum dry density. Topsoil, rubble, organic and any other deleterious material should not be used in the backfill and disposed of according to regulatory requirements. All oversized cobbles and boulders should be removed from the backfill. Backfilling operations during cold weather should prohibit inclusion of frozen lumps of material, snow and ice.

In areas where surface settlement or lateral movement are of concern, such as beneath roadways, approved granular backfill or unshrinkable fill material should be used for backfill. For the section of sewer immediately beneath the Essex Terminal Railway tracks unshrinkable fill should be used to facilitate rapid sewer construction and reinstatement of the tracks.

If unshrinkable fill is not used, normal post-construction settlement of the compacted trench backfill should be anticipated with the majority of such settlement taking place within about 6 months following the completion of trench backfilling operations. This settlement will be reflected by some subsidence of the ground surface and may require local repairs to overlying pavements. Settlement may be compensated for, where necessary, by placing additional granular material, placing an added thickness of binder asphalt or by padding, prior to placement of the hot mix asphalt surface. It is recommended that the final surface course asphalt not be placed over the binder for at least 12 months after construction, if possible.

7.4 Sewer Construction Using Tunnelling Techniques

The new storm sewers between about Stations 0+192 and 0+633 (along Peter and part of Chappell Streets) will likely be constructed using tunnelling techniques. The invert of the new gravity sewers will be located between about elevations 172.2 and 172.7 m, or some 5.5 to 8.2 m below present grade. Based on the the borehole information, the tunnel will generally be constructed through soft to firm clayey silt to silty clay. Granular interbeds within this cohesive deposit may also be encountered. It is anticipated that tunnelling could be carried out using conventional tunnelling techniques using a tunnel boring machine (TBM) equipped with a suitable shield, provided that appropriate tunnelling face pressure control is undertaken as recommended in this report.

The softer clayey silt to silty clay along the tunnel alignment will tend to "squeeze" into the tunnel face or around the tunnelling equipment and lining. The behaviour of cohesive soils in the tunnel face can be assessed through the stability number, N_s, (see Section 7.3.1 for referenced calculation method) as follows:

$N_s < 2$	small ground movement and shield tunnelling not required;
$2 < N_s < 4$	shield generally used to restrain ground movements;
$4 < N_s < 6$	increasing ground movement even with shield tunnelling;
$6 < N_s$	face may be unstable and face support is required.

A summary of calculated stability number at various locations along the tunnel is provided in Table 6, below.

Table 6: Summary of Face Stability for Tunnel Construction.

Location	Approximate Depth of Excavation (m)	Approximate Sewer Invert Elevation (m)	Approximate S_U (kPa)	Stability Number, N_s
Tunnel Shaft at Station 0+633	8.8	172.8	20	9.2
Tunnel Shaft at Station 0+388	8.6	172.4	27	6.7
Tunnel Shaft at Station 0+192	6.5	172.2	20	6.8
MH 3	9.2	172.3	25	7.7
MH 4	8.6	172.4	27	6.7
MH 5	8.6	172.7	25	7.2

The calculated stability numbers range from about 6.7 to 9.2. Therefore, it is anticipated that face of the tunnel may be unstable and positive face pressure will be needed for all tunnelling operations. It is noted that these stability numbers are consistent with the observed excessive ground displacements experienced during earlier phases of tunnelling on the Prince Road sewer project completed in the 1980s.

7.4.1 Hand-Mining and Pipe Jacking Techniques

Pipe jacking techniques used in conjunction with hand mining have been used to advance earlier phases of the Prince Road trunk storm sewer. As noted in this report, the combination of squeezing ground at the face of the tunnel and overcuts used to facilitate pipe jacking caused excessive settlements and damage to the overlying pavements. Some of the pavement areas collapsed suddenly after tunneling had been completed. Earlier sections of the Prince Road Sewer tunneling were completed using hand mining in which compressed air was also used to maintain face support to avoid such problems. Based on this prior experience with these techniques in the immediate vicinity of the proposed project, the use of hand mining without compressed air and pipe jacking should not be permitted.

7.4.2 Construction Using Tunnel Boring Machines

It is understood that the diameter of the new storm sewer will be about 2.4 metres. The soil conditions anticipated to be exposed in the face of the tunnel in this area will likely consist of soft to firm clayey silt to silty clay with granular interbeds. Therefore, the tunnelling method used for this project should be capable of providing a controlled face pressure to balance the soil and water pressure to avoid excessive settlement, ground losses. It is anticipated that the tunnel could be constructed using pipe-jacking techniques or primary and secondary permanent linings with a full-face tunnel boring machine (TBM) that provides continuous and controllable support to the tunnel face. Due to the squeezing nature of the cohesive soils at tunnel level, open face tunnelling, large diameter jack-and-bore methods, or open rotating cutter head machines should not be used for this project. Discussion and recommendations on selection and operation of tunnelling machines is provided below for guidance in developing the contract documents. While Ontario Provincial Standard Specifications 415 and 416 may be referenced, these typical specifications are considered generally not sufficient for this project and should be modified according to the recommendations provide in this report.

It is anticipated that, due to the variably soft to firm nature of the clayey silt to silty clay, problems with maintaining line and grade may be encountered using machine mining and pipe jacking techniques due to the tendency of the machine to “dive” or gradually sink during excavation. Counteraction of this tendency by forcing “look-up”, or an inclined attitude of the machine, may result in overexcavation and additional ground subsidence. Although not encountered in the boreholes drilled along the alignment, occasional cobbles and boulders are known to exist within the cohesive strata in the Windsor area. In addition, the cohesive soils also contain saturated interbedded granular soils. The selected tunnelling equipment and methods should be selected to address all of these potential difficulties. Further recommendations regarding different types of tunnelling systems are provided below.

7.4.2.1 Slurry and Earth Pressure Balance Machine Tunnelling

The tunnelled sections should be excavated using a TBM capable of providing positive face support pressure. Earth Pressure Balance (EPB) machines and Slurry Pressure Balance (SPB) machines both can provide positive face support. In EPB machines, the excavated soil in the forward chamber is the medium though which pressure from the machine is transmitted to the face of the tunnel. In SPB machines, the pressure within the forward chamber is maintained through a viscous fluid often composed of clay minerals (bentonite) suspended in water, with or without polymer additives. Tunnelling machines without a forward chamber that can be filled with soil and/or slurry under a controlled discharge pressure should not be permitted.

Two general types of earth pressure balance (EPB) are typically available, each with different pressure and spoil control/removal systems. True EPB systems utilize a screw conveyor to extract the spoil from the front chamber onto the conveyor belt system. Forward chamber pressures and face pressures are maintained through the combination of: thrust, screw rotation rate, and discharge gate openings. To maintain face stability during excavation and avoid ground loss at the face it is essential that the forward chamber remain full of soil and that the chamber pressure is maintained within an acceptable range. It will also be essential to control extraction of materials from the forward chamber relative to the advance rate to minimize the potential for ground losses and over excavation.

Some older EPB-type TBMs are equipped with a “mucking ring” within the forward chamber to mix and transport the soil toward the chamber’s rear bulkhead. At the bulkhead, gates that open at a pre-set load discharge the spoil onto a conveyor belt system below the gates. Control of face pressures is maintained through the pre-set gate discharge loads and the forward thrust. Maintaining consistent face pressures in these machines is typically more difficult than for EPB machines fitted with screw conveyors.

Typically, both EPB systems permit closure of the cutting face using sliding “doors” to cover the face openings. Use of a relatively small EPB TBM with a screw conveyor may be somewhat problematic depending on the design of cutting tools and other measures undertaken to routinely remove cobbles and boulders. Some of the older EPB-type machines often are capable of passing boulders through the face and the pressure or load-controlled discharge gates. The relative advantages and disadvantages of each type of machine should be considered by the contractor in coordination with any other methods selected to manage cobbles and boulders.

Some TBMs, particularly older models, are promoted as providing “full face support” or as being EPB machines on account of the TBMs being fitted with face doors even though the machines do not include a second bulkhead within the TBM that has a controlled pressure opening. Such machines should not be permitted for this project.

In general, SPB machines transport the excavated soil from the face to the surface using a system of pipes whereby the soil is suspended in the slurry. At the surface, the spoils are typically separated from the slurry using a system of screens and centrifugal “de-sanding” units. The slurry is then recycled to the TBM for pressurized face support and further spoil transport. Slurry design should consider the low to intermediate plasticity and variably soft to firm cohesive soil through which the tunnel will pass. While use of a slurry pressure balance machine for tunnelling in the anticipated ground conditions is feasible, control of the slurry design, pressures, and inflow/outflow rates will be critical for maintaining face stability and control of ground losses.

Although the use of an SPB machine is technically feasible for the anticipated physical behaviour of the ground, the requirements for removal of cobbles and boulders, should they be encountered, as well as management and disposal of fluid materials could render use of SPB tunnelling methods impractical from cost or technical aspects depending on the equipment, operations, and spoil disposal options the contractor chooses.

7.4.2.2 Tunnel Face Pressure

While face pressures will require adjustment based on field conditions and anticipated ground settlement performance, for planning purposes the minimum and maximum face pressures to be maintained during machine tunnelling may be calculated using the method described below. For tunnels constructed in cohesive soils, the minimum face pressure at the tunnel crown required to avoid collapse of the face of the tunnel in cohesive soils can be calculated based on the following approach:

P_{EPB} = Total overburden pressure – $s_u N_{TC}$

where N_{TC} is the stability number at collapse. Total overburden pressure in this case is defined as the depth from the ground surface to the individual pressure sensor mounted on the TBM multiplied by the saturated unit weight of the soil above this sensor.

The value for N_{TC} varies based on the ratios C/D (C = the thickness of the cover of soil over the tunnel and D = diameter of the tunnel) and P/D, with P being the length of the unsupported heading. For EPB or SPB tunnelling with the TBM face in contact with the ground, the length of the unsupported heading can be taken as zero. If there is sufficient movement, the ground will close around the TBM skin, so that the ground will be fully supported except at the face. For this project, the stability number at collapse can be estimated based on:

$N_{TC} = 2 + 5\mathit{ln}(C/D+1)$

For the depths of the planned Prince Road tunnel, and an anticipated cut diameter of about 3.0 metres, N_{TC} ranges between about 6 and 7.

The target pressure is then:

Minimum P_{EPB} = Total overburden pressure – $s_u N_{TC}$, or 0, whichever is greater

Target P_{EPB} = Minimum P_{EPB} + v

where, v, a recommended allowance for variation in pressure, is +/-20 kPa.

Maximum Target P_{EPB} = Total overburden pressure – $s_u N_{TC}$ + 2v or 1.1 times the total overburden pressure, whichever is less.

Based on the undrained shear strength of the cohesive soils along the alignment, and the typical C/D ratios target face pressures defined using the approach described above will be low and suggest that operating in open mode may be suitable. While the minimum face pressure required to maintain stability in the cohesive soils may be small, the soils are expected to be squeezing at the tunnel depth and face pressure will be necessary to control ground settlement. This result is consistent with past experience in which controlled pressure was not applied at the face and, while the tunnel did not collapse, excessive settlements occurred. Therefore, it is recommended that a minimum pressure of 50 kPa be maintained at the axis (mid-height) level of the machine, with pressures above and below this level dependent on the vertical distance above or below this level and the unit weight of the spoil within a full forward chamber. Higher operating pressures may be necessary to limit displacements to acceptable magnitudes.

Variation in forward operating pressures should be anticipated, as noted above. However, during EPB or SPB tunnelling, operator inattention, difficulties during excavation or subsequent liner installation (segmental rings of plates or segments, rib expansion and lagging installation or jacked pipe) may result in pressures periodically being lower than the target minimum pressure. In such cases, ground losses arising from excess excavation associated with squeezing ground may occur and result in unacceptable surface settlement. The contract documents should include requirement that the face pressures be maintained at all times between the target minimum and maximum values and provisions should be included for monitoring face pressures throughout the excavation and liner construction phases of tunnel advance.

7.4.2.3 Pipe Jacking

Difficulties associated with squeezing of clayey silt to silty clay around the pipe should be anticipated if pipe jacking methods are selected for sewer construction. Adhesion developed around the pipe due to the squeezing of the soft to firm cohesive soils may be sufficient to restrict the length of pipe which may be jacked. Since the capacity of jacking systems will vary from contractor to contractor and will depend on the available reaction from the jacking frame and thrust blocks, the influence of the shear stresses on the lining that will develop due to squeezing ground, as it relates to the feasibility of the operation, should be assessed by the individual contractors tendering the project. For analysis, it is recommended that an undrained shear strength of about 15 kiloPascals (kPa) be used for disturbed silty clay in contact with the pipe. It may be possible to reduce the adhesion along the pipe by continuously lubricating the annular space between the cut diameter and the outside pipe diameter with bentonite slurry as the pipe is advanced.

Jacking forces required to advance pipes behind the TBM are dependent upon a number of factors directly related to construction equipment and methodology, including:

- the size of the TBM overcut (difference between cut diameter and outside pipe diameter);
- the use of lubricants and the timing and location of lubricant injection;
- alignment maintained during jacking;
- rate of mining actually achieved;
- face pressures applied to maintain face stability and control ground losses and displacements; and
- the frequency and duration of work stoppages.

For these reasons and considering the natural variability of the ground, it is not possible to predict actual jacking forces prior to construction. All of the above factors noted above are dependent upon the contractor's choice of means and methods and rate of progress.

In order to advance the pipe by jacking, the contractor will have to design a thrust block with sufficient passive resistance to withstand the jacking forces. It is recommended that the design of the reaction system as it relates to subsurface conditions be reviewed by the geotechnical engineer prior to construction.

The contractor should be responsible for estimated jacking loads given that the ground is anticipated to exhibit squeezing behaviour as discussed in this report. Because of this squeezing behaviour, it is cautioned that low-viscosity lubricants will not be effective in providing support to the ground and reducing adhesion along the pipe. Squeezing ground will significantly increase jacking loads. Provisions should be made to monitor jacking loads and install intermediate jacking stations as necessary. Total lengths between shafts may therefore be limited by pipe jacking loads.

Thrust blocks used for pipe jacking may be sized in accordance with the passive resistance pressure calculated using the following equation:

$$p_p = \alpha S_u$$

Where:

p_p = passive pressure (kPa);

S_u = undrained shear strength of the soil;

α = factor depending on the ratio of thrust block height, h, to depth of the bottom of the thrust block below the ground surface, H

Typical values for α are provided in the Table 7, below.

Table 7: Typical α Values for Thrust Block Design.

α	**h/H**
2	1.00
3	0.50
4	0.33
5	0.25

7.4.2.4 Temporary Lining Design

The primary lining system should be designed by the contractor to suit the anticipated ground conditions, the chosen method of tunnelling and the tunnelling equipment. Primary lining systems, such as stiffened and closefitting or gasketed steel liner plates, expanded steel ribs and timber lagging (with geotextile backing), pre-cast reinforced concrete pipe (specially designed for jacking) or oversized steel pipe should be feasible in these conditions. Grouting around the primary lining should be carried out to reduce water flow, fill voids, and to avoid non-uniform loading on the linings. For an expanded ribs and lagging lining, it will be necessary to use a non-woven geotextile behind the lagging to minimize the potential for flow of fine granular soils through the gaps in the lagging. The secondary lining, constructed after the primary lining is in place, could consist of installing and grouting concrete pipe within the primary lining, or a cast-in-place concrete permanent lining.

It is recommended that the temporary lining and other sewer pipes be designed to support the total vertical overburden stress as follows:

$$p_v = \gamma C + q$$

and the horizontal stress at the tunnel spring-line, or vertical axis, given by:

$$p_h = \left(p_v + \frac{\gamma d}{2} + q \right) K$$

Where:

C = depth of soil cover above the pipe crown (m);

d = pipe outside diameter (m);

γ = total unit weight of soil (kN/m^3);

K = lateral earth pressure coefficient (m).

q = surcharge load (kPa);

The horizontal earth pressure coefficient is dependent on a number of factors, including the timing and completeness of grout placement between the pipe and soil. As such, the pipe design should be checked for a range of earth pressure coefficients between 0.35 and 0.5.

The stresses given above are representative of unfactored pressures. Therefore, appropriate load factors and resistance should be applied to these pressures for the temporary condition. Furthermore, the lining design will also need to include construction loads from TBM or pipe thrusts, concentrated loads at jacking points, curing stresses, and erection stresses.

7.5 Ground Displacements

7.5.1 Cut and Cover Excavations

Construction of the cut and cover excavations for the sewers, pump station, outfall, and tunnel shafts will induce displacements in the shoring systems as well as the surrounding ground. Such displacements will depend on the total depth of the excavation and a number of other factors including:

Base stability	Structural stiffness of wall
Soil type	Horizontal and vertical spacing of supports
Dewatering-induced consolidation	Construction procedures & workmanship
Wall type ■ Sheet piles ■ Soldier piles and lagging ■ Soil mixed walls ■ Secant / tangent piles (“contiguous caissons) ■ Concrete diaphragm walls	Horizontal support types ■ Rakers ■ Struts ■ Anchors (soil anchors/tie-backs) ■ Dead-man anchors ■ Corner braces

A useful guide to the displacements associated with supported excavations is the relative stiffness of the wall in which the non-dimensional relative stiffness, S_r, is defined as:

$S_r = (EI)/(\gamma h^4 s)$

Where:

E I = elastic modulus and internal moment of inertia of vertical element of wall (e.g. sheet pile, secant pile);

γ = total unit weight of soil;

h = average vertical height between supports (bottom of excavation, struts, braces, tie-backs, etc.);

s = horizontal spacing between vertical structural elements of wall (e.g. horizontal spacing of soldier piles, or, in the case of sheet piles or a diaphragm wall, s = 1)

Very flexible walls, such as some soldier pile and lagging systems, may have relative stiffness values as low as 5 to 10, provided that they also satisfy design against ultimate failure. The relative stiffness of secant pile walls (contiguous caissons), may range from as low as about 50 to over 100. Steel sheet pile walls typically fall between these two ranges.

For this project, it is recommended that a preliminary non-dimensional stiffness of at least 50 be used for sizing the vertical structural elements of wall systems for which close control of displacements are required. The final shoring system stiffness will be dependent upon the level of displacement control required to avoid damaging sensitive facilities. For other walls a minimum non-dimensional relative stiffness of about 10 should be used for sizing the vertical structural elements provided that ground displacements are not a concern in these areas, unless structural requirements needed to resist the acting earth, water, and surcharge pressures result in a more robust wall.

Without taking additional precautionary measures during construction, vertical ground surface displacements could be on the order of 2% of the excavation depth (H) for an excavation supported by soldier piles and lagging or steel sheet piles with a relative stiffness on the order of about 10 to 20. Settlements may be about one-quarter to one-half of this amount if a stiff sheet pile wall with close vertical spacing of supports or a secant pile wall system with a relative stiffness of 50 or more is used for support. It is anticipated that the maximum displacement may occur at a distance of about 0.2H to 0.5H from the back of the wall and diminish toward little or no displacement at a distance of about 2H as illustrated on Figure 7. Lateral displacements will be similar in magnitude as for the vertical settlements with the maximum lateral movement occurring near the middle of the support system wall or bottom of the excavation. Horizontal movements at the ground surface may be assumed to be approximately equal to the vertical movements. Construction workmanship and design details can have a significant influence on final displacements. The effect of these displacements on surrounding utilities and roadways should be examined in detail. If the movements are found to be intolerable, additional measures will have to be undertaken during design and construction to limit the potential for ground and structure displacement.

Displacements associated with “trench box” or other pre-fabricated support systems are much often greater than these values and are directly associated with the speed of installation, and the experience and skill of the particular crews. Prefabricated “slide-rail” systems may provide better performance than “trench box” systems; however, control of displacements is also highly dependent upon speed of installation, workmanship and experience.

7.6 Tunnelling-Induced Ground Displacements

Settlement and lateral movements will occur as a result of the tunnelling operations. Potential sources for ground movements may include:

- losses at the tunnel face;
- losses along the machine, due to closure or partial closure of the gap caused by the difference in the excavated diameter and the diameter of the TBM tail skin;
- convergence of the earth into the mined openings before lining and grout are in place (i.e., the difference between the diameters of the TBM tail skin and lining);
- convergence or other movements of initial linings; and
- long term movements due to consolidation of compressible soils and loads developed in the lining.

A simplified approach to estimating settlement is recommended using the assumptions listed below.

- Ground movement due to each stage of tunnelling will result in a settlement trough having the shape of a normal distribution curve.
- The tunnelling machine is designed and operated to balance the in-situ pressures, so that loss of ground at the face and squeezing of ground toward the face is limited.
- The gap between the excavated diameter and the outside diameter of the lining can be considered a single continuous gap. The rate/magnitude of gap closure is a complex phenomenon and cannot be readily estimated by conventional analytical methods and is a function of the soil type, pore water pressures, state of stress/stability at the tunnel face, grout injection control, and time delay during tunnelling. For this project, it is considered that full gap closure will occur due to the squeezing nature of the ground.

To estimate the distribution of surface settlements perpendicular to the tunnel centreline, the surface settlement trough can then be assumed to follow a normal distribution function,

$$\delta_v = \delta_{v\,\max} e^{-\left(\frac{x^2}{2i^2}\right)}$$

where: δ_v and δ_{vmax} are the vertical settlement and maximum settlement, respectively

X is the horizontal central distance

i is the centre distance to the point of inflection

and

$$\delta_{vmax} = V_l/(2.5i)$$

The inflection point in the settlement trough curve, i, depends on the depth to the tunnel axis, Z_o, and the excavated tunnel radius, R_o, or diameter, D, and the character of the ground above the tunnel. For preliminary settlement assessments for this project, it is recommended that the width of the settlement trough be considered to equal to:

$$i = kZ_o$$

Using this expression, a k value of about 0.5 is considered suitable for the soil profile along the planned tunnel.

Horizontal strains at the ground surface (along the settlement trough) may be estimated based on a simplified relationship with horizontal strains proportional to the vertical strains since ground deflection vectors will theoretically be directed toward the tunnel axis. Therefore:

$$\delta_h = \delta_v(X/Z)$$

where: δ_h=horizontal deflection;

δ_v=vertical settlement;

X=distance from tunnel centreline; and

Z=depth to tunnel axis.

Figure 7 illustrates settlement patterns for typical depths of cover and equivalent volume losses as described above. Assuming that:

- tunnelling is carried out while maintaining face pressures in accordance with the recommendations in this report;
- lining installation and grouting are completed with good workmanship;
- a tunnelling machine with a cut diameter of 2.5 to 3 m is used with a maximum gap (cut diameter to outside diameter of lining) of 100 mm; and
- rapid grouting of the annular gap between the maximum excavated diameter and the outside diameter of the pipe or primary lining.

Based on these assumptions, the majority of ground surface settlements along the alignment centreline should be less than about 60 to 70 mm, equivalent to a surface settlement trough with a volume equal to about 2 to 2.5 percent of the tunnel volume per metre of tunnel length. It should be noted that these settlement and relative settlement trough volume estimates will be sensitive to workmanship and controlling the closure of the gap between the maximum excavated diameter and outside diameter of the lining.

7.6.1 Protection of Existing Structures and Utilities

It is recommended that the alignment and depths of existing utilities be checked relative to the proposed sewer trench(s). Figure 7 illustrates typical ground displacement patterns adjacent to supported excavations that may be used for preliminary design and an initial assessment of the potential effects of the work on adjacent facilities. Figure 7 also illustrates three different zones of displacement that may be used to facilitate design and planning. Zone 1, generally defined by a 1 horizontal to 2 vertical slope, projected up from a point 2 m below the base of the excavation, is where the most severe ground displacements will occur. If structure foundations or utilities fall within this zone, a detailed examination of possible displacements and their effects should be undertaken and protection measures included in the design. Protection could include such measures such as mandatory use of a relatively stiff shoring system installed prior to excavation (e.g., heavy steel sheet piles with close vertical and horizontal spacing of internal braces) or some form of underpinning. Reliance upon underpinning should be considered carefully since some forms of underpinning may cause greater displacements and damage than a carefully designed and constructed excavation support system. Further, ground displacements occurring beyond the underpinning may induce damage at the junction between underpinned and non-underpinned sections of the facility. Displacements occurring in Zone II, shown on Figure 7, are generally less severe than those in Zone I; however, the magnitude may still be sufficient to cause unacceptable displacements and/or damage to adjacent facilities. As with Zone I, any facilities falling within this zone should be examined in greater detail to ascertain their sensitivity to ground displacements. The pattern of ground surface displacements illustrated in Figure 7 may be used in conjunction with the three zones also indicated on this figure to provide a preliminary indication of the vertical displacements below the ground surface. Vertical and lateral displacements below the ground surface will generally diminish to negligible values close to the limit indicated by the outer boundary of Zone III. However, it is noted that lateral displacements may be at their maximum value at a depth of about 2/3 of the excavation depth from the ground surface, depending on the type of excavation support system in use. Because of the complexities involved in assessing ground displacement patterns and their effects on neighbouring facilities, it is recommended that this office be consulted should any particularly sensitive facilities fall within the aforementioned Zones I or II.

A number of existing utility lines will cross the proposed alignment. Where existing services are exposed during the excavation, suitable temporary or permanent support of these services should be provided consistent with the requirements of the respective utility company. It is also prudent to providing suitable protective measures against vibrations generated by sheet pile driving or compaction equipment and to minimizing its impact on the adjacent utilities and structures. In general, it is recommended that a preconstruction condition survey of adjacent structures and utilities be undertaken. Such preconstruction condition surveys can assist in determining the degree to which construction activities may have affected these structures and can provide a baseline against which any claims of damage can be compared.

7.7 Road Rehabilitation

It is understood that the portions of the existing roadways disturbed by sewer construction will be restored to a condition resembling the original condition using a flexible pavement. Prior to commencing pavement construction and/or reconstruction, existing fill and otherwise deleterious materials, should be removed from within the limits of the proposed pavement areas. The exposed subgrade should be heavily proofrolled with a non-vibratory steel wheel roller under the direction of the geotechnical engineer. Any excessively softened areas identified during this operation should be subexcavated and backfilled with an approved granular material and be uniformly compacted to at least 98 per cent of standard Proctor maximum dry density. Granular base materials should also be uniformly compacted to 98 per cent of standard Proctor maximum dry density.

Asphaltic concrete pavement materials should comprise both binder and surface course layers, and be produced and placed in accordance with OPSS requirements. In order to minimize the inevitable effects of trench settlement, it is recommended that the placement of the asphaltic concrete surface course be delayed at least one year following placement of the binder course.

Effective drainage is an important aspect in the life expectancy and performance of any pavement structure. In this regard, perforated continuous subdrains should be installed along the edge of the pavement. The drains should be installed below the subgrade level, completely surrounded by an approved granular material and connected to the roadside catchbasins. The pavement subgrade should be properly shaped and graded to provide adequate cross fall. Any water that finds its way into the granular base would then be directed to the subdrains.

8.0 INSTRUMENTATION AND MONITORING

Instrumentation and monitoring of the tunnelling and excavation work should be completed to:

- assist with maintaining safety for construction crews and the public;
- ascertain whether design assumptions are appropriate for actual field conditions;
- assist with developing design and construction modifications if necessary to suit field conditions;
- avoid unacceptable displacements of overlying structures, facilities, or other features;
- assist in assuring construction is carried out to an acceptable degree of workmanship;
- assist with defence against claims for damages by third parties; and
- to evaluate conditions or mechanisms leading to poor performance if such should occur.

Recommendations are provided below with respect to instrumentation and monitoring for this project.

In general, all monitoring instruments should be measured at least three times prior to any excavation or tunnelling within about 25 m of the instrument location. During tunnelling and excavation, measurements should be undertaken two to three times weekly, and at more frequent intervals as tunnelling approaches major crossing utilities. Following completion of excavation and tunnelling, measurements should be taken monthly until at least two months following completion of construction (permanent lining) and backfilling of the excavations.

8.1.1 Control of Excavated Volumes

Control of excavation volumes will be critical to successful construction of the project. Monitoring the amount of materials removed during tunnelling will encourage good practice and limit the potential for adverse performance. While controlling face pressures will assist in limiting the potential for excess excavation, it is recommended that the amount of materials excavated be monitored for each advance of the TBM – typically recorded for each liner ring, each pipe section, or smaller distance. In no case, should the excavated volumes be measured and monitored at frequencies for tunnel advances greater than 3 m. Some modern TBMs include the capacity to measure the weight of materials discharged onto the conveyor belt. However, these systems can and have failed on past projects. It is therefore recommended that target volumes of spoil be estimated for each advance length based on reasonable assessments of bulking and added conditioning agents (if any), and the volume of each muck car be manually observed and recorded for each liner ring during EPB tunnelling. For SPB methods of tunnelling, the contractor should provide a means to measure, either by weight or volume depending on the materials handling system, the amount of earth materials removed for every 3 m or less of tunnel advance. Monitoring of actual spoil volumes compared to target volumes will assist in minimizing the risk of excess excavation or, should it occur, permit rapid responses and mitigation measures to be implemented if and as necessary.

8.1.2 Ground and Structure Displacements

Lateral displacement of the shoring should be monitored with inclinometers installed prior to construction that extend below the base of the excavation at least 5 m below the lowest point (deepest penetration) of excavation support systems at the following locations:

- At least one inclinometer should be installed at each tunnel entry (launch) and exit (retrieval) shaft between the excavation support system and the nearest major utility, roadway, or structure. These inclinometers should be installed within about 1 metre of the support system and at the approximate longitudinal mid-point of the of the excavation support system.

Ground displacements should be monitored with devices that are not susceptible to frost movement, that penetrate through pavement structures, and are protected from construction traffic or vandalism. It is recommended that ground displacements be measured using precision surveying methods (to +/- 2 millimetres) at the following locations:

- At least two ground monitoring points should be installed at each tunnel entry and exit shaft (one on each side) between the shaft and any existing major utility or nearby structure.
- Ground monitoring points should also be installed at 20 m intervals along all excavation support systems for new sewer trenches where the excavation will be deeper than 5 metres from pre-construction ground surface elevations and these monitoring points should be located within about 1 metre of the excavation support system.
- Ground monitoring points should be located at 20 m intervals along the centreline of the tunnel alignment. These monitoring points will permit evaluation of the surface effects of tunnelling control prior to and after passing beneath existing facilities. Given past construction problems in which excessive settlements were temporarily masked by overlying rigid concrete pavements, frequent monitoring points along the centreline will be critical to maintaining the roadways in an acceptable condition and to avoid sudden and unpredictable collapse or settlements of the roadways.
- It is recommended that additional centreline monitoring points be installed 5 m in advance of any major utility that crosses the alignment as a check on tunnelling performance in the immediate vicinity of the utility. If the utility is shallow, it may be beneficial to expose and monitor the utility as the tunnel passes beneath. The ground monitoring points installed in advance of each utility should be designed and installed such that they monitor ground movements at the same elevation as the invert of the crossing utility/sewer.
- It is recommended that four ground monitoring points be installed at 5 m intervals perpendicular to the tunnel alignment (called an “array”), in addition to the centreline monitoring point, to permit evaluation of the lateral extent of surface settlements at the following locations:
    - One half array (at centreline, and at 5 m and 10 m from centreline) should be installed at the northern intersection of Hill Avenue and Peter Street (running westward along Hill Avenue);

- One half array should be installed at the southern intersection of Hill Avenue and Peter Street (running eastward along Hill Avenue;
- One full array (to the extent that property access is available) should be installed between Stations 0+400 and 0+500;
- One full array (to the extent that property access is available) should be installed between manholes 3 and 4;

It is also recommended that any gas or water lines, particularly cast iron or ductile iron pipes, within a distance equal to the depth of excavation be exposed and monitored throughout construction. Monitoring of these lines may be achieved by attaching a series of monitoring points on top of the line and measuring using precise surveying techniques for both horizontal and vertical movements. These points should be checked on a daily basis during excavation. The survey data should provide information on the rate and amount of movement these utilities may experience during construction and also potentially provide an early warning in case excessive movements are detected.

Any buildings within a distance approximately equal to 1.5 times the depth to the tunnel axis or 2 times the depth of cut and cover excavations should be monitored using precision surveying techniques. Each structure should be provided with at least four monitoring points around the perimeter of the building. Other facilities within these distances along the route that also may be sensitive to settlement should be similarly monitored using precision surveying methods.

9.0 CLOSURE

This office should be given an opportunity to review the final design drawings to ensure that they are consistent with the recommendations contained within this report and to determine the scope of any additional geotechnical work that is required, such as for the proposed trenchless work, prior to proceeding with construction.

To ensure that construction is carried out in a manner consistent with the intent of the recommendations set forth in this report, a program of geotechnical inspection and testing should be developed and implemented throughout the construction phase. In addition, related laboratory testing should be carried out in conjunction with the field work to monitor compliance with the various material and project specifications.

The factual data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation, or if the project is not initiated within twelve months of the date of the report, Golder Associates Ltd. should be given an opportunity to confirm that the recommendations are still valid.

We trust this report contains sufficient geotechnical information for you to proceed with the design of the proposed work. If any point requires further clarification, do not hesitate to contact this office.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED

Nazmur Rahman, M.A.Sc., P. Eng.

ORIGINAL SIGNED

Storer Boone, Ph.D., P. Eng.
Associate

NR/HD/SB/nr/dw

n:\active\2009\1140 geotechnical\09-1140-w000\09-1140-w025 stantec prince road ph 9\reports\091140w025-r01-may 6 2010 - geo investigation prince road storm sewer outlet-sjb-nr-dw.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.

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT (cont'd)

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.

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, 60º 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
Δ	change in, e.g. in stress: $\Delta\ \sigma$
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
$\sigma_1, \sigma_2, \sigma_3$	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
l_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)

APPENDIX A

Record of Boreholes 1, 2 and 3 (Current).
Record of Borehole 5 (Earlier Golder Report No. 041-140044).
Record of Boreholes 103, 201, 203, 204 and 205 (Earlier Golder Report Nos. 764111 and 764111/1).

PROJECT: 09-1140-W025

RECORD OF BOREHOLE 1

SHEET 1 OF 2

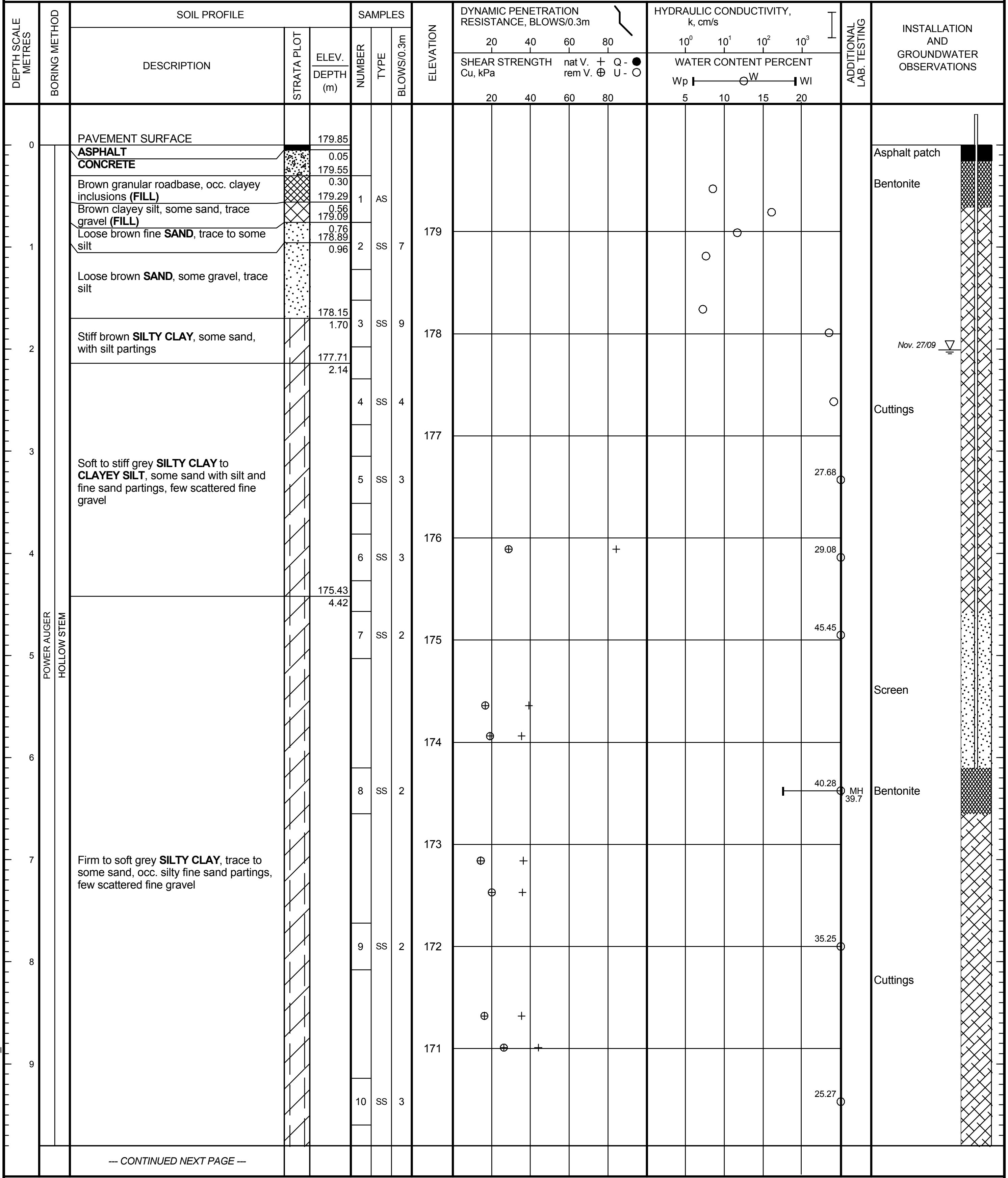
LOCATION: SEE LOCATION PLAN

BORING DATE: November 26, 2009

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm



SOIL PROFILE

DESCRIPTION	ELEV. DEPTH (m)
PAVEMENT SURFACE	179.85
ASPHALT	0.05
CONCRETE	179.55 0.30
Brown granular roadbase, occ. clayey inclusions **(FILL)**	179.29 0.56
Brown clayey silt, some sand, trace gravel **(FILL)**	179.09 0.76
Loose brown fine **SAND**, trace to some silt	178.89 0.96
Loose brown **SAND**, some gravel, trace silt	178.15 1.70
Stiff brown **SILTY CLAY**, some sand, with silt partings	177.71 2.14
Soft to stiff grey **SILTY CLAY** to **CLAYEY SILT**, some sand with silt and fine sand partings, few scattered fine gravel	175.43 4.42
Firm to soft grey **SILTY CLAY**, trace to some sand, occ. silty fine sand partings, few scattered fine gravel	

SAMPLES

NUMBER	TYPE	BLOWS/0.3m
1	AS	
2	SS	7
3	SS	9
4	SS	4
5	SS	3
6	SS	3
7	SS	2
8	SS	2
9	SS	2
10	SS	3

--- CONTINUED NEXT PAGE ---

LDN_BHS_02 09-1140-W025.GPJ GLDR_LON.GDT 3/3/10 DATA INPUT: DMB

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: SM
CHECKED:

PROJECT: 09-1140-W025

RECORD OF BOREHOLE 1

SHEET 2 OF 2

LOCATION: SEE LOCATION PLAN

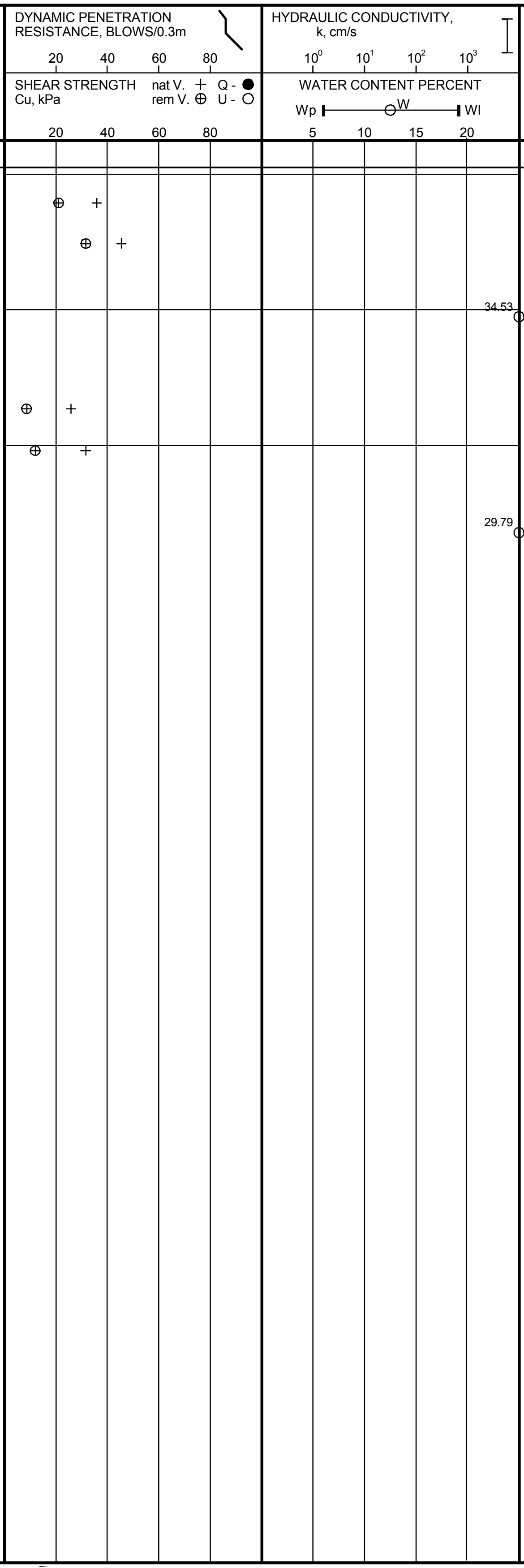
BORING DATE: November 26, 2009

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

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
		--- CONTINUED FROM PREVIOUS PAGE ---							
10							170		
11	POWER AUGER HOLLOW STEM	Firm to soft grey **SILTY CLAY**, trace to some sand, occ. silty fine sand partings, few scattered fine gravel		11	SS	2	169		Cuttings
12				12	SS	2	168		
			167.05 12.80						
13		END OF BOREHOLE							Borehole dry during drilling on November 26, 2009. Water level in standpipe at about elev. 177.8m on November 27, 2009.
14									
15									
16									
17									
18									
19									



DEPTH SCALE

1 : 50

LOGGED: SM

CHECKED:

PROJECT: 09-1140-W025

RECORD OF BOREHOLE 2

SHEET 1 OF 2

LOCATION: SEE LOCATION PLAN

BORING DATE: November 26, 2009

DATUM: GEODETIC

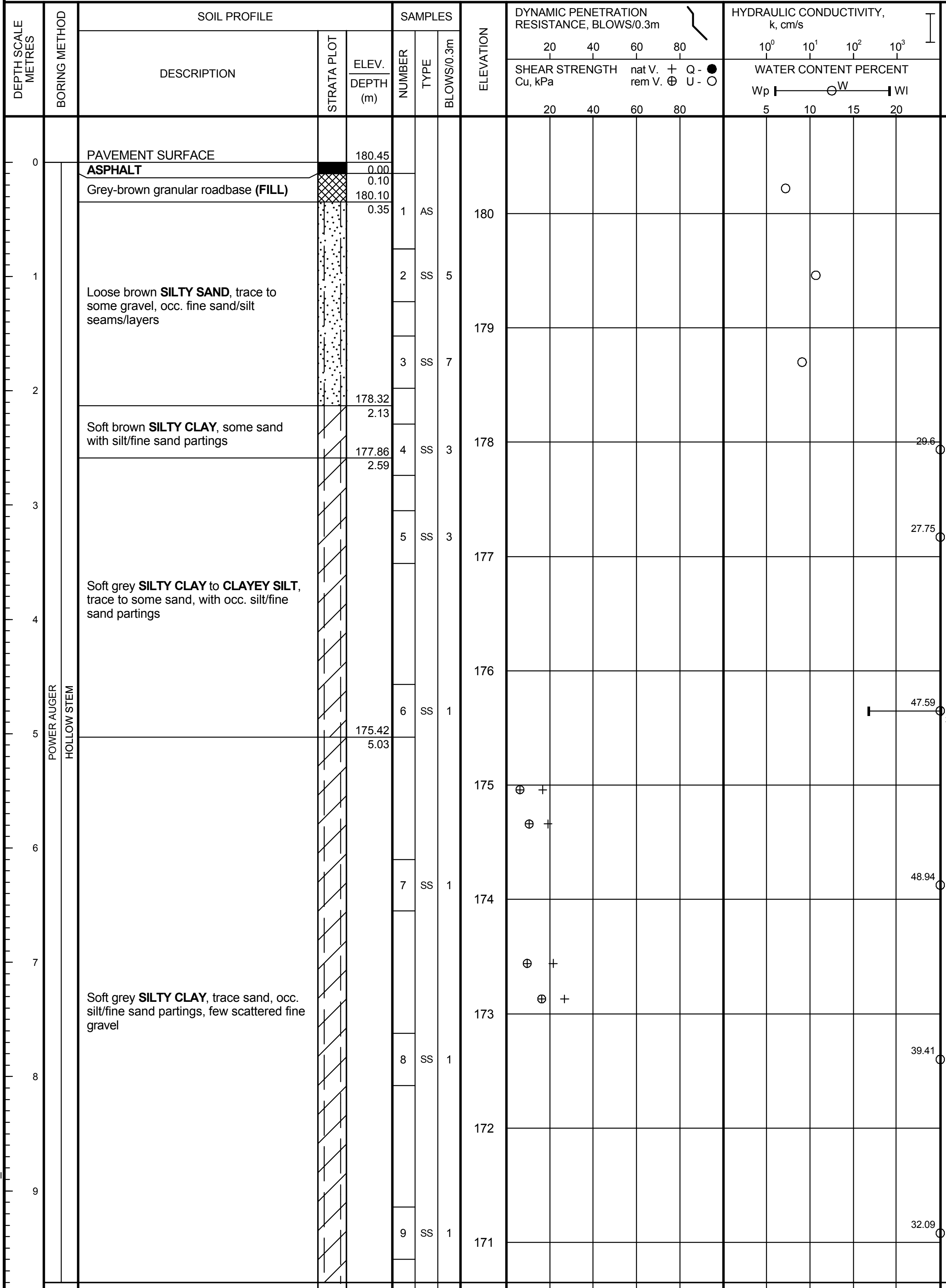
SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

BORING METHOD: POWER AUGER HOLLOW STEM

SOIL PROFILE: DESCRIPTION	ELEV. / DEPTH (m)
PAVEMENT SURFACE	180.45
ASPHALT	0.00
Grey-brown granular roadbase **(FILL)**	0.10 180.10 0.35
Loose brown **SILTY SAND**, trace to some gravel, occ. fine sand/silt seams/layers	178.32 2.13
Soft brown **SILTY CLAY**, some sand with silt/fine sand partings	177.86 2.59
Soft grey **SILTY CLAY** to **CLAYEY SILT**, trace to some sand, with occ. silt/fine sand partings	175.42 5.03
Soft grey **SILTY CLAY**, trace sand, occ. silt/fine sand partings, few scattered fine gravel	
--- CONTINUED NEXT PAGE ---	

SAMPLES: NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT PERCENT (labelled)	ADDITIONAL LAB. TESTING
1	AS			
2	SS	5		
3	SS	7		
4	SS	3	29.6	
5	SS	3	27.75	
6	SS	1	47.59	MH 35.3
7	SS	1	48.94	
8	SS	1	39.41	
9	SS	1	32.09	



INSTALLATION AND GROUNDWATER OBSERVATIONS: Borehole dry during drilling on November 26, 2009.

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: SM

CHECKED:

LDN_BHS_02 09-1140-W025.GPJ GLDR_LON.GDT 3/3/10 DATA INPUT: DMB

PROJECT: 09-1140-W025

RECORD OF BOREHOLE 2

SHEET 2 OF 2

LOCATION: SEE LOCATION PLAN

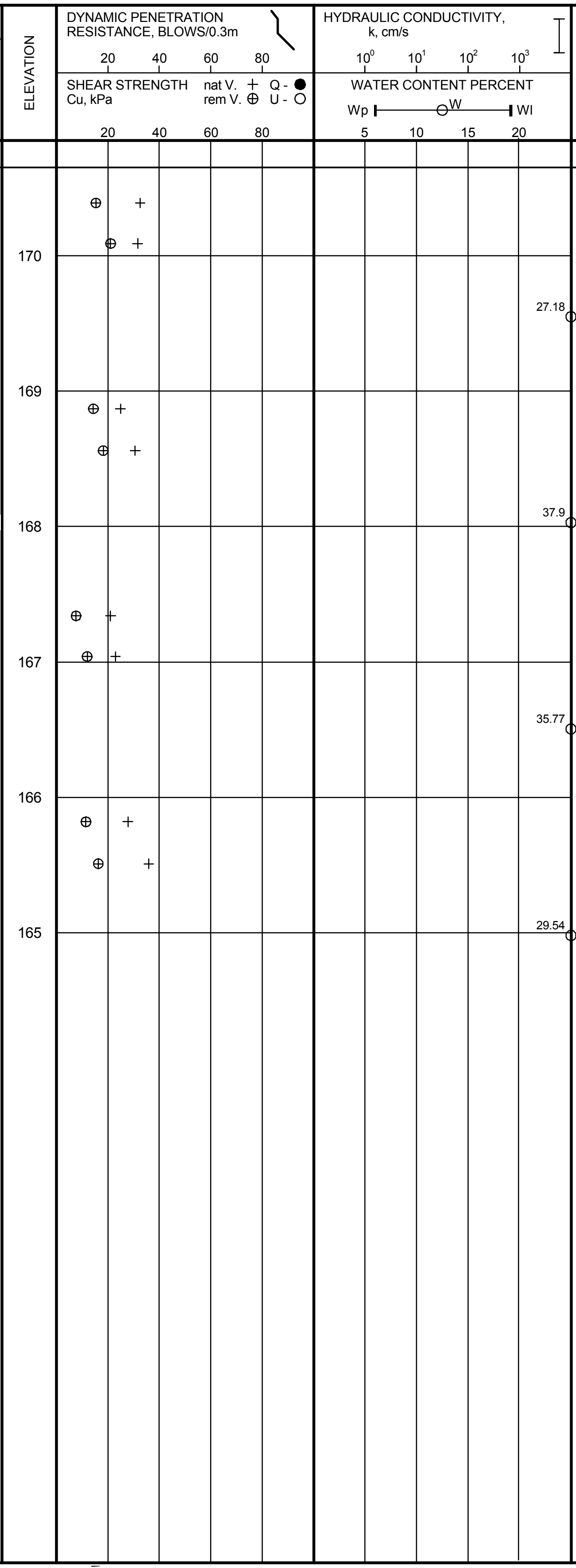
BORING DATE: November 26, 2009

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m
		--- CONTINUED FROM PREVIOUS PAGE ---				
10	POWER AUGER HOLLOW STEM	Firm to soft grey **SILTY CLAY**, trace sand, occ. silt/fine sand partings, few scattered fine gravel	170.55 9.90			
11				10	SS	1
12				11	SS	WH
13						
14				12	SS	1
15				13	SS	2
		END OF BOREHOLE	164.75 15.70			
16						
17						
18						
19						



ADDITIONAL LAB. TESTING

INSTALLATION AND GROUNDWATER OBSERVATIONS

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: SM
CHECKED:

PROJECT: 09-1140-W025

RECORD OF BOREHOLE 3

SHEET 1 OF 2

LOCATION: SEE LOCATION PLAN

BORING DATE: November 25, 2009

DATUM: GEODETIC

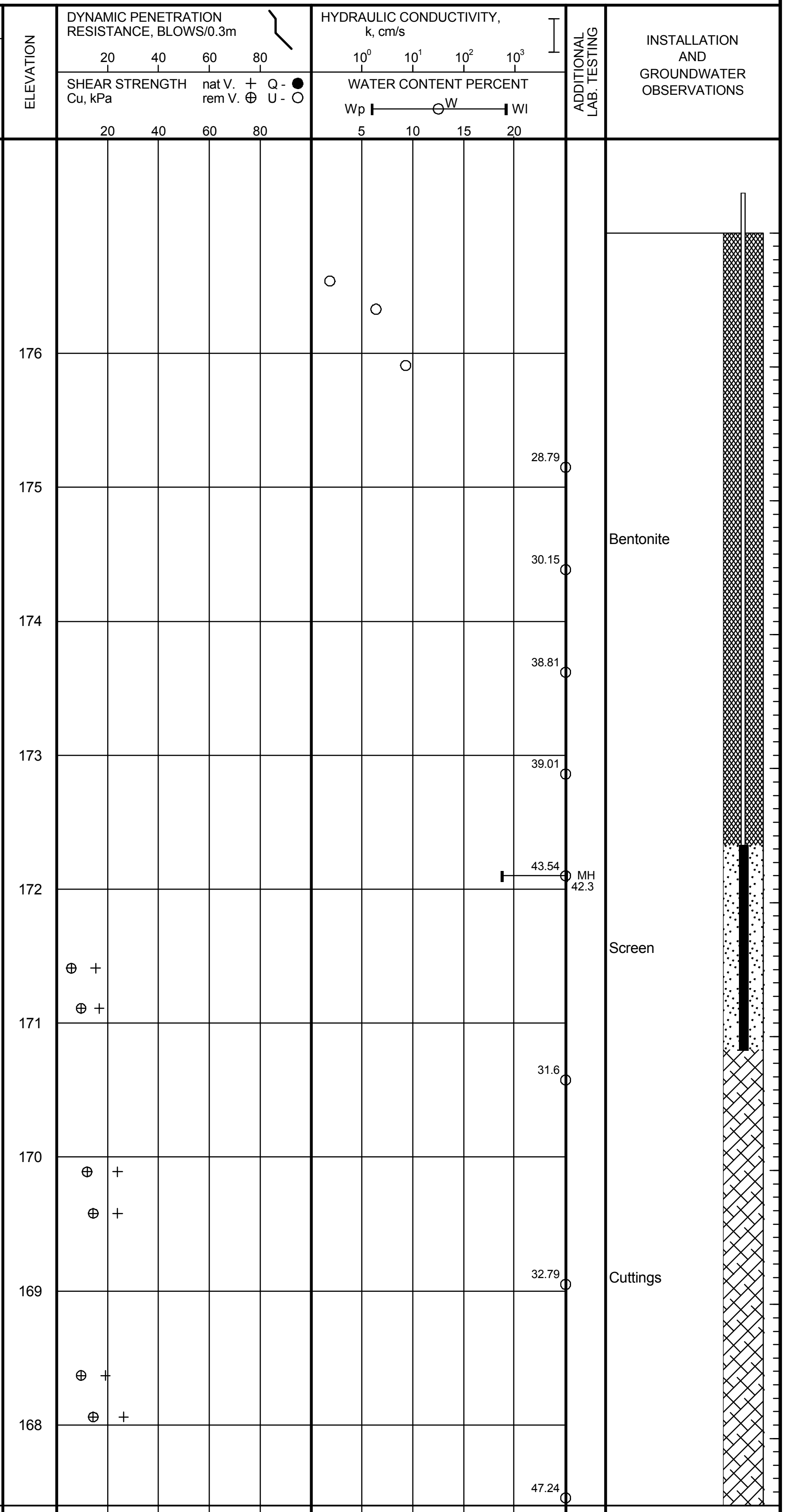
SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

BORING METHOD: POWER AUGER HOLLOW STEM

SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)
PAVEMENT SURFACE	176.90
ASPHALT	0.00 176.72
CONCRETE	0.18
Grey-brown granular roadbase**(FILL)**	0.38
Compact brown fine **SAND**, trace to some silt	175.53 1.37
Stiff brown and grey **SILTY CLAY**, trace to some sand, occ. silt partings, fissured	174.77 2.13
Stiff grey **SILTY CLAY**, trace to some sand and gravel	174.00 2.90
Firm soft grey **SILTY CLAY**, trace sand, few scattered fine gravel	

SAMPLES NUMBER	TYPE	BLOWS/0.3m	WATER CONTENT PERCENT	ADDITIONAL LAB. TESTING
1	AS			
2	SS	17		
3	SS	11	28.79	
4	SS	9	30.15	
5	SS	6	38.81	
6	SS	2	39.01	
7	SS	2	43.54	MH 42.3
8	SS	2	31.6	
9	SS	2	32.79	
10	SS	2	47.24	



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DEPTH SCALE 1 : 50

LOGGED: TA

CHECKED:

PROJECT: 09-1140-W025

RECORD OF BOREHOLE 3

SHEET 2 OF 2

LOCATION: SEE LOCATION PLAN

BORING DATE: November 25, 2009

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	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 10^0 10^1 10^2 10^3 WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl 5 10 15 20	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
		--- CONTINUED FROM PREVIOUS PAGE ---										
				167.15	10	SS	2					Cuttings ▨
		END OF BOREHOLE		9.75				167				Borehole dry after drilling on November 25, 2009. Standpipe dry on November 27, 2009.
10												
11												
12												
13												
14												
15												
16												
17												
18												
19												

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TA
CHECKED:

PROJECT: 041-140044

RECORD OF BOREHOLE 5

SHEET 1 OF 2

LOCATION: SEE LOCATION PLAN

BORING DATE: MARCH 23 & 25, 2004

DATUM:

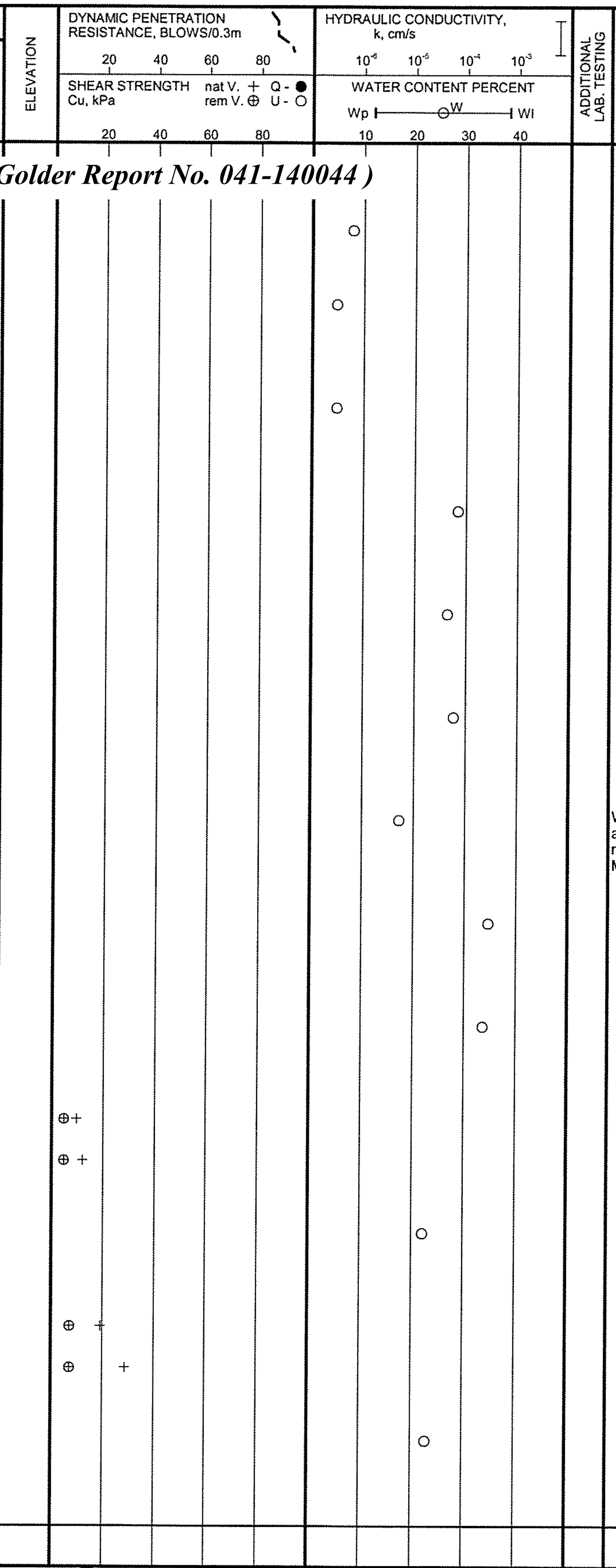
SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

(Golder Report No. 041-140044)

BORING METHOD: POWER AUGER, SOLID STEM

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m
0	PAVEMENT SURFACE				
	ASPHALT	0.00			
	CONCRETE	0.10			
	Granular road base (**FILL**)	0.28	1	AS	-
1	Loose brown, sand, trace to some gravel (**FILL**)	0.61	2	50 DO	4
			3	50 DO	5
2	Very soft to soft, brown, **SILTY CLAY**, trace sand and gravel, some silt partings	2.13	4	50 DO	2
3	Soft, grey, **SILTY CLAY**, occ. to some silt partings	2.90	5	50 DO	1
4			6	50 DO	2
	Very loose, grey, **SILTY SAND**, trace to some gravel, trace clay	4.42	7	50 DO	WH
5	Very soft to firm, grey, **SILTY CLAY**, trace to some sand, trace gravel (**TILL**)	5.18	8	50 DO	1
6			9	50 DO	1
8			10	50 DO	1
9			11	50 DO	3
10					



INSTALLATION AND GROUNDWATER OBSERVATIONS

Water level in borehole at a depth of about 4.6 m during drilling on March 25, 2004

— CONTINUED NEXT PAGE —

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: A.B.
CHECKED: AB

PROJECT: 041-140044

RECORD OF BOREHOLE 5

SHEET 2 OF 2

LOCATION: SEE LOCATION PLAN

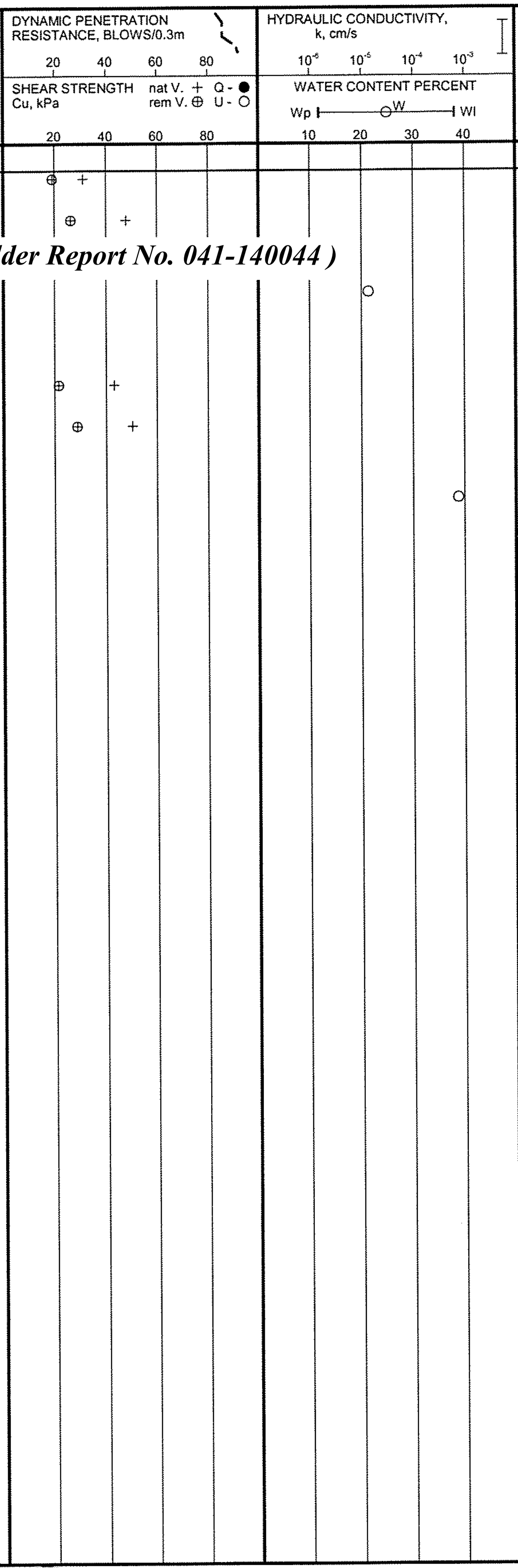
BORING DATE: MARCH 23 & 25, 2004

DATUM:

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	ELEVATION	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
		— CONTINUED FROM PREVIOUS PAGE —							
10	POWER AUGER SOLID STEM	Firm, grey, **SILTY CLAY**, trace to some sand and gravel (**TILL**)	10.06						
11				12	50 DO	7			
12				13	50 DO	5			
		END OF BOREHOLE	12.65						
13									
14									
15									
16									
17									
18									
19									
20									



(Golder Report No. 041-140044)

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: A.B.
CHECKED: AB

Form G.A.-D-1

Project No. 764111

RECORD OF BOREHOLE 103

LOCATION See Figure I BORING DATE OCT. 5, 1976 DATUM GEODETIC

SAMPLER HAMMER WEIGHT 140 LB., DROP 30 IN. PENETRATION TEST HAMMER WEIGHT 140 LB., DROP 30 IN.

(Golder Report No. 764111)

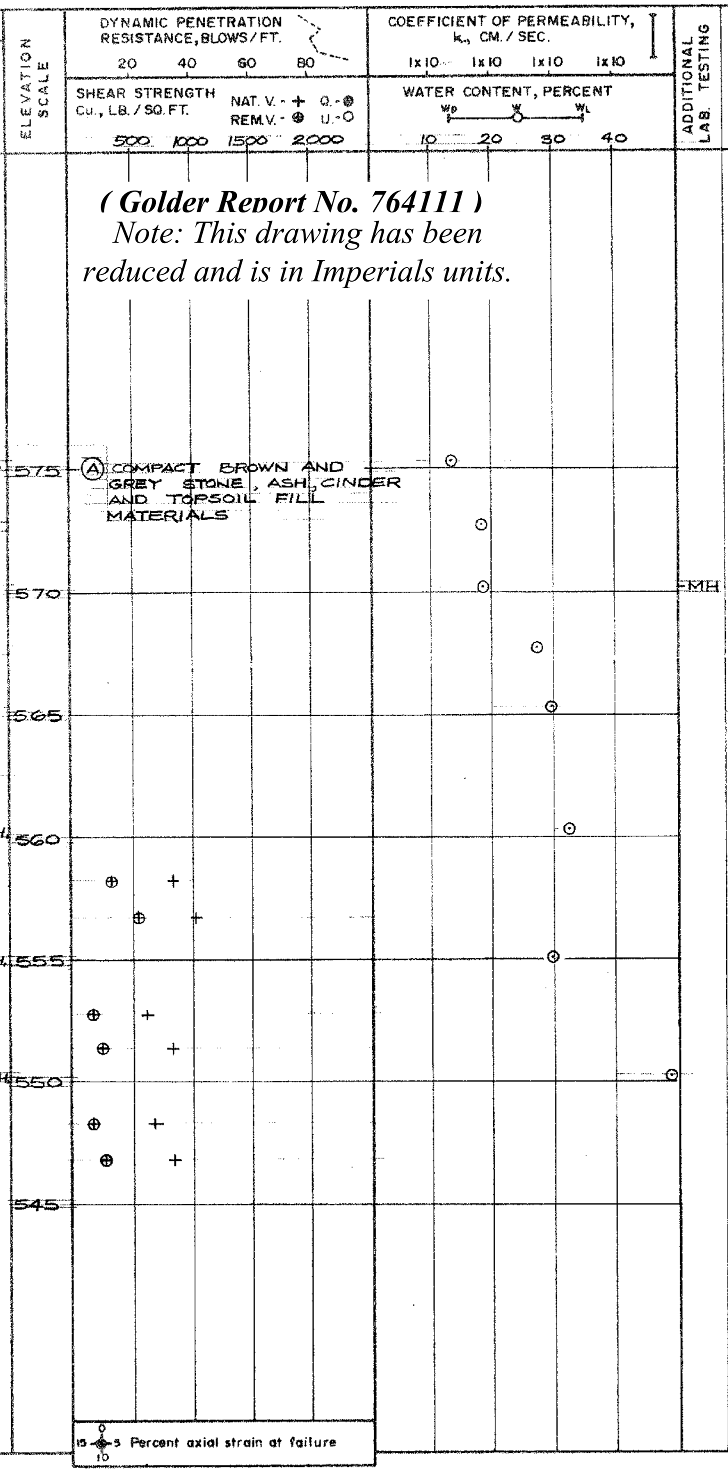
Note: This drawing has been reduced and is in Imperials units.

BORING METHOD: POWER AUGER 7.5" DIA. HOLLOW STEM

SOIL PROFILE ELEV'N DEPTH	DESCRIPTION	STRAT. PLOT
576.0	GROUND SURFACE	
0.0	Ⓐ	
574.0 2.0	VERY LOOSE GREY TO BLACK SILTY SAND TRACE CLAY AND ORGANICS	
566.0 10.0	VERY LOOSE GREY FINE TO MEDIUM GRAINED SAND TRACE TO SOME SILT	
561.5 14.5	FIRM GREY WITH RED FLECKS SILTY CLAY SOME SAND TRACE FINE GRAVEL (TILL-LIKE)	
546.5 29.5	END OF HOLE	

SAMPLES NUMBER	TYPE	BLOWS/FT.
1	2" D.O.	18
2	"	5
3	"	3
4	"	3
5	"	1
6	"	1
7	"	W.H.
8	3" T.O.	P.H.
9	2" D.O.	W.H.

Ⓐ COMPACT BROWN AND GREY STONE, ASH, CINDER AND TOPSOIL FILL MATERIALS



PIEZOMETER OR STANDPIPE INSTALLATION

WATER LEVEL AT ELEVATION 571.0 ON COMPLETION OF DRILLING OCTOBER 5, 1977

VERTICAL SCALE
1 IN. TO 5 FT.

Golder Associates

DRAWN A.V.D.
CHECKED Will

RECORD OF BOREHOLE 201

LOCATION See Figure 2 BORING DATE FEB. 23, 1978 DATUM GEODETIC

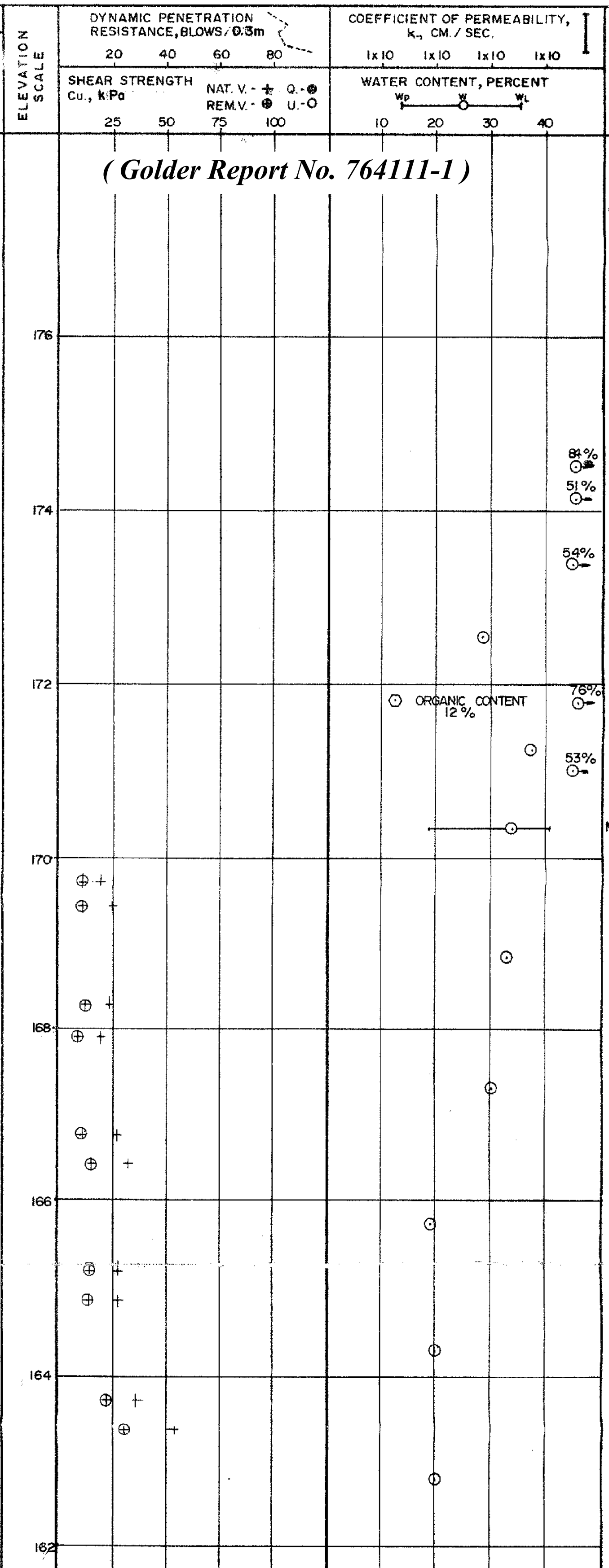
SAMPLER HAMMER WEIGHT 64 kg DROP 0.75 m PENETRATION TEST HAMMER WEIGHT 64 kg DROP 0.75m.

BORING METHOD: POWER AUGER 19 cm O.D HOLLOW STEM AUGERS

ELEV'N. / DEPTH (m)	DESCRIPTION
175.05	ICE SURFACE
0.0	**ICE**
174.59 / 0.46	SOFT BLACK **SILTY CLAY** LAYERS OF PEAT AND ORGANICS **(ALLUVIUM.)**
172.76 / 2.29	VERY LOOSE GREY FINE TO MEDIUM **SAND** SOME PEAT LAYERS **(ALLUVIUM)**
170.94 / 4.11	SOFT TO **STIFF** GREY **SILTY CLAY** OCC GRAVEL SOME SAND
162.40 / 12.65	END OF BOREHOLE

NUMBER	TYPE	BLOWS/0.3m
1	5cm D.O.	2
2	"	2
3	"	2
4	"	3
5	"	2
6	"	2
7	"	WH.
8	"	WH
9	"	WH
10	"	WH
11	"	WH
12	"	8

(Golder Report No. 764111-1)



ADDITIONAL LAB. TESTING: M.H.

PIEZOMETER OR STANDPIPE INSTALLATION: WATER LEVEL IN BOREHOLE AT ELEV. 174.59 DURING DRILLING FEB. 23, 1978.

RECORD OF BOREHOLE 203

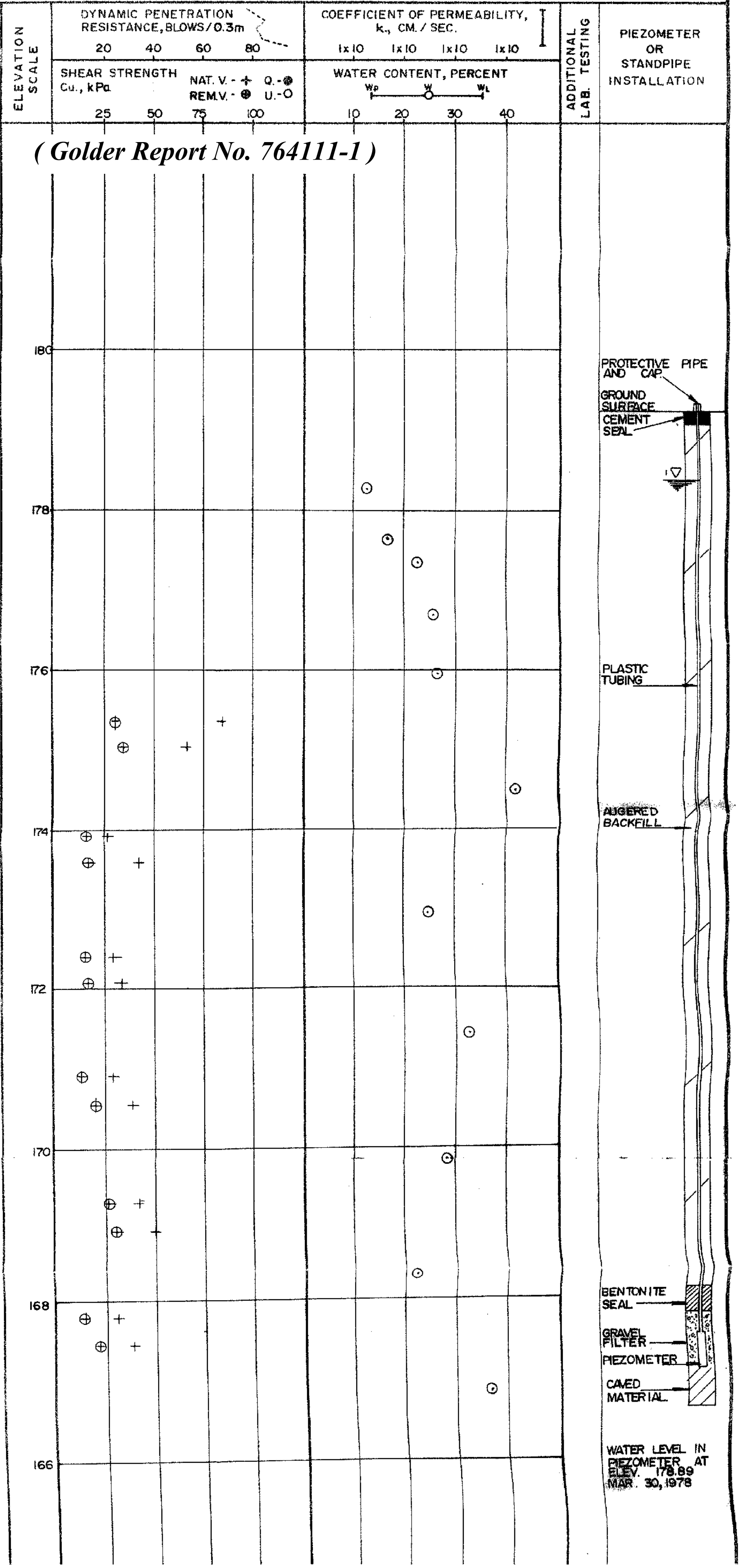
LOCATION See Figure 2　BORING DATE MAR. 15, 1978.　DATUM GEODETIC

SAMPLER HAMMER WEIGHT 64 kg DROP 0.75m　PENETRATION TEST HAMMER WEIGHT 64 kg DROP 0.75m

(Golder Report No. 764111-1)

BORING METHOD	ELEV'N. DEPTH (m)	SOIL PROFILE DESCRIPTION
		ASPHALT GRANULAR ROADBASE
	179.74	GROUND SURFACE
POWER AUGER 11cm SOLID STEMS (UNCASED)	0.06	CONCRETE ROADBASE
	0.24	LOOSE BROWN FINE TO COARSE SAND OCC GRAVEL TRACE SILT TRACE CLAY
	177.91 1.83	SOFT TO FIRM GREY SILTY CLAY SOME THIN SEAMS OF FINE SAND AND SILT
POWER AUGER 19 c.m HOLLOW STEMS (UNCASED)	175.78 3.96	STIFF TO FIRM GREY SILTY CLAY SOME SAND OCC. GRAVEL
	167.09 12.65	END OF BOREHOLE.

SAMPLES NUMBER	TYPE	BLOWS/0.3m
1	5cm D.O.	7
2	"	10
3	"	4
4	"	6
5	"	4
6	"	2
7	"	2
8	"	4
9	"	3
10	"	4

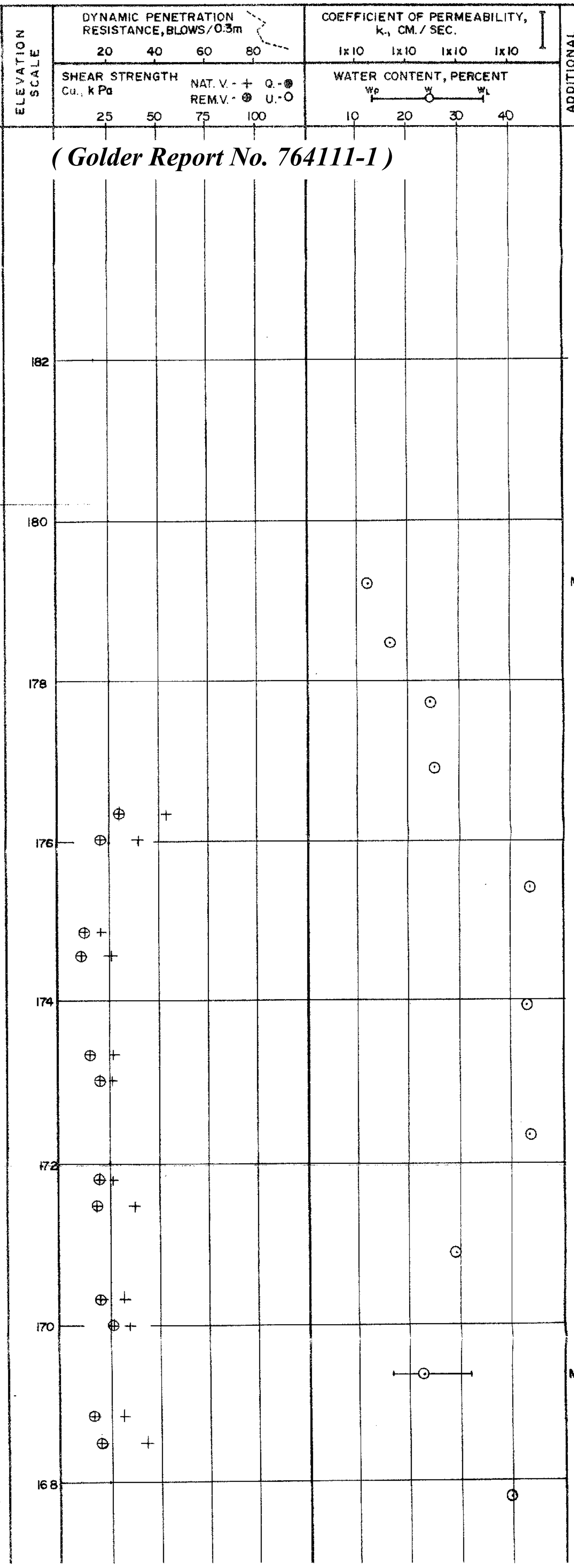


RECORD OF BOREHOLE 204

LOCATION See Figure 2 BORING DATE MAR. 16, 1978 DATUM GEODETIC

SAMPLER HAMMER WEIGHT 64 kg DROP 0.75 m PENETRATION TEST HAMMER WEIGHT 64 kg DROP 0.75 m

BORING METHOD	ELEV'N. DEPTH (m)	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
	180.33	ROAD SURFACE **ASPHALT**						
POWER AUGER SOLID STEMS (UNCASED)	0.06	**CONCRETE** ROADBASE						
	0.26	LOOSE TO COMPACT BROWN FINE TO COARSE **SAND** OCC. GRAVEL OCC. SANDY SILT LAYER TRACE SILT		1	5cm D.O	5	M.	
				2	"	21		
	178.20 2.13	FIRM GREY **SILTY CLAY** SOME THIN SEAMS OF FINE SAND AND SILT		3	"	5		
				4	"	5		
	176.37 3.96	SOFT TO FIRM GREY **SILTY CLAY** SOME SAND OCC. GRAVEL		5	"	2		
				6	"	1		
				7	"	1		
				8	"	1		
				9	"	4	M.H.	
				10	"	3		
	167.68 12.65	END OF BOREHOLE						



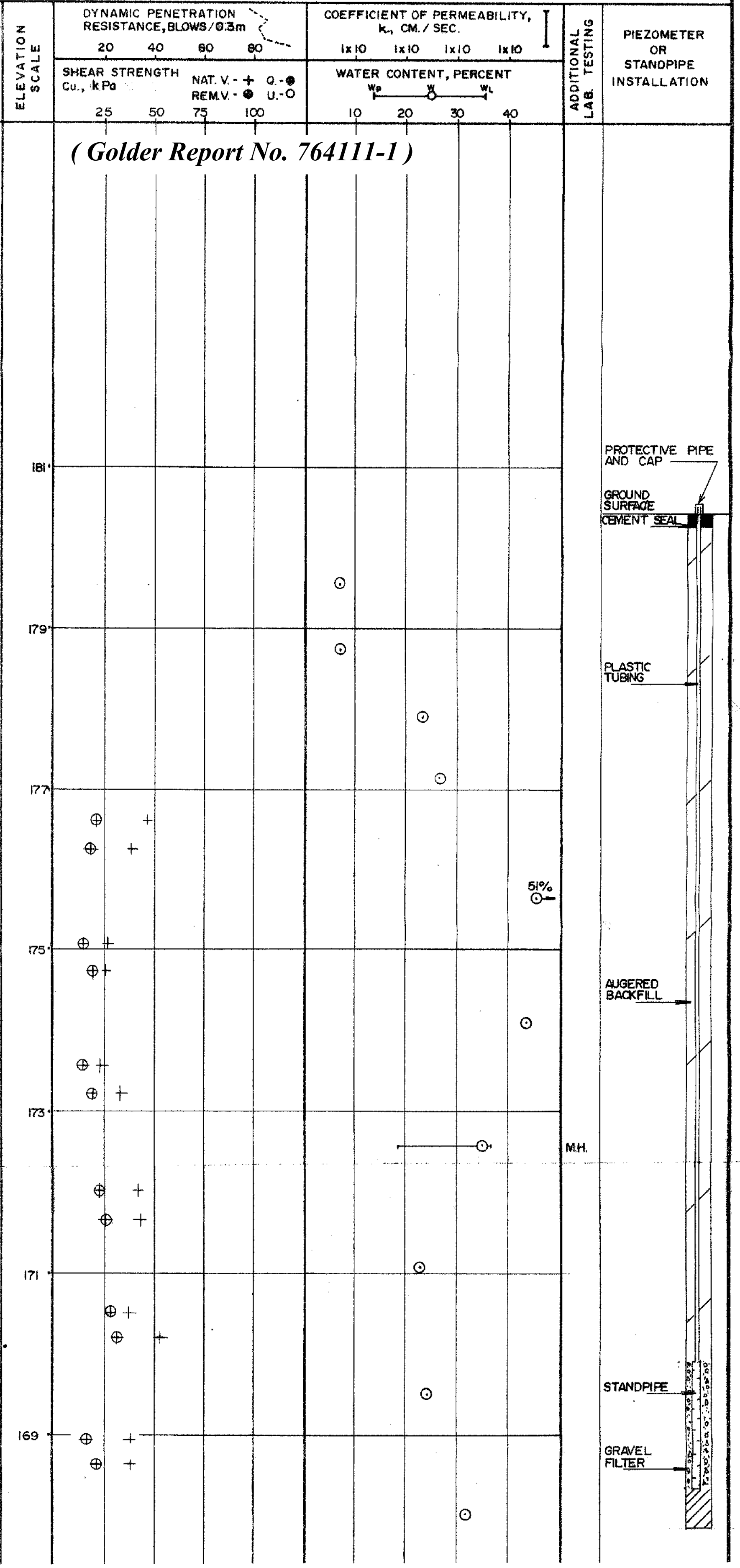
RECORD OF BOREHOLE 205

LOCATION See Figure 2 BORING DATE MAR. 16, 1978 DATUM GEODETIC

SAMPLER HAMMER WEIGHT 64 kg DROP 0.75 m PENETRATION TEST HAMMER WEIGHT 64 kg DROP 0.75 m

BORING METHOD	SOIL PROFILE			SAMPLES		
	ELEV'N DEPTH (m)	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/0.3m
	180.41	ASPHALT ROAD SURFACE				
POWER AUGER 11c.m. SOLID STEMS (UNCASED)	0.06	CONCRETE ROADBASE				
	0.26	COMPACT BROWN FINE TO COARSE **SAND** TRACE SILT OCC. GRAVEL		1	5cm D.O.	11
				2	"	13
	178.28 2.13	FIRM GREY **SILTY CLAY** SOME THIN SEAMS OF FINE SAND AND SILT		3	"	6
				4	"	4
	176.45 3.96	SOFT TO STIFF GREY **SILTY CLAY** SOME SAND OCC. GRAVEL		5	"	2
				6	"	2
				7	"	2
				8	"	3
				9	"	3
				10	"	3
	167.76 12.65	END OF BOREHOLE				

(Golder Report No. 764111-1)



APPENDIX B

Record of Cone Penetration Tests 1 to 6 (Current).

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 1

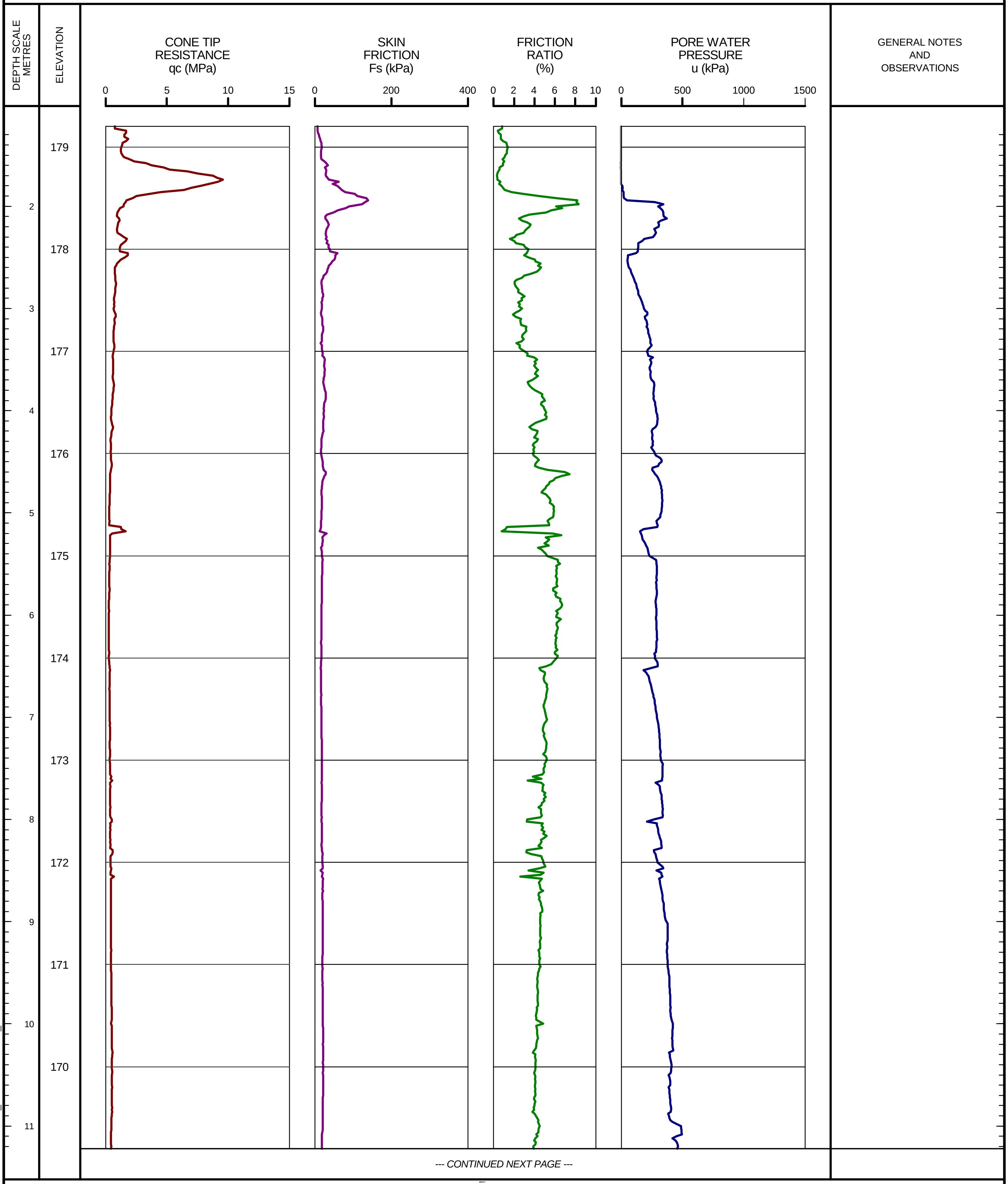
SHEET 1 OF 3

LOCATION: SEE LOCATION PLAN

TEST DATE: November 27, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 180.42m PREDRILL DEPTH: 1.22m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



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DEPTH SCALE

1 : 50

Golder Associates

OPERATOR: CC

CHECKED:

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 1

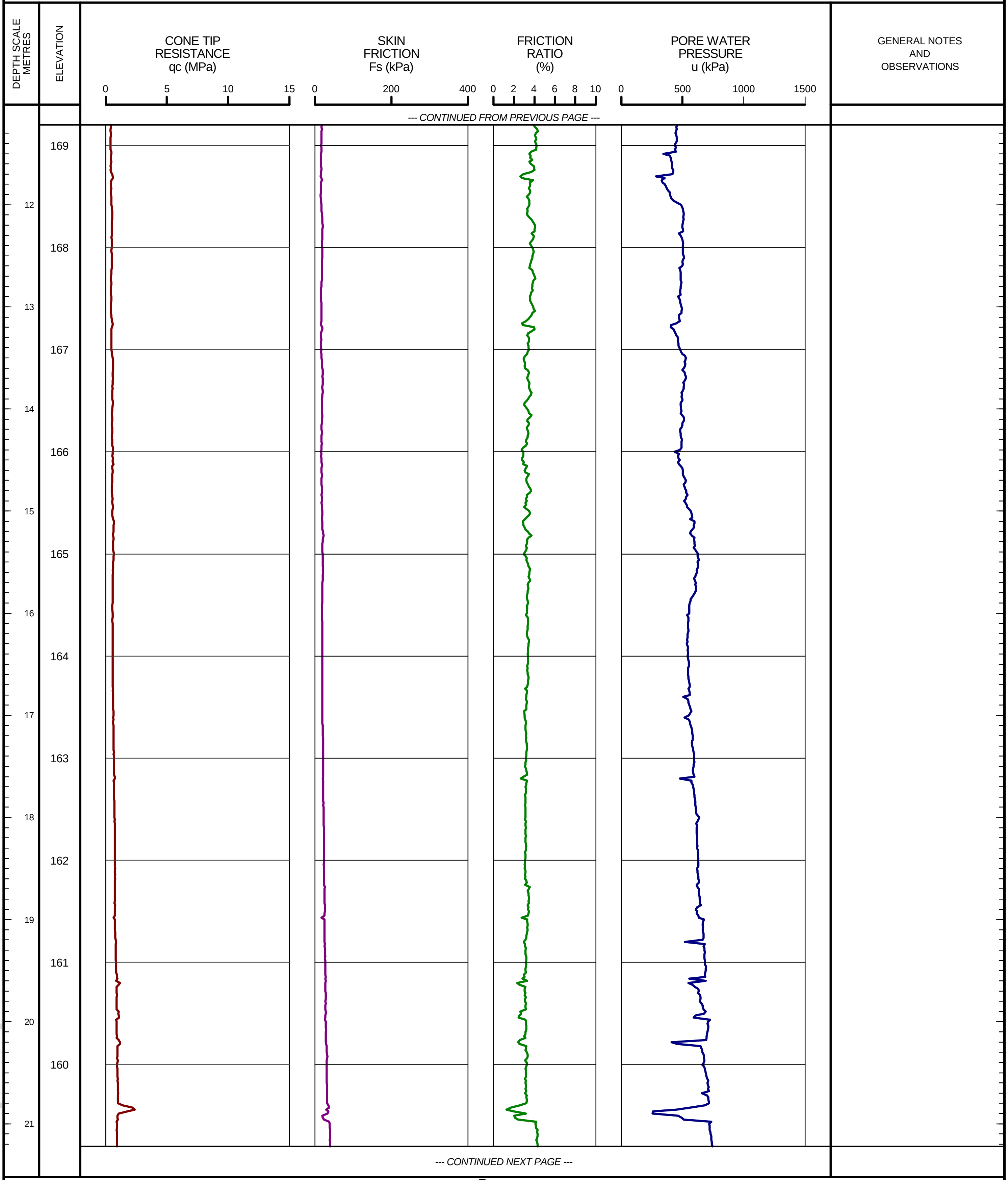
SHEET 2 OF 3

LOCATION: SEE LOCATION PLAN

TEST DATE: November 27, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 180.42m PREDRILL DEPTH: 1.22m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



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DEPTH SCALE

1 : 50

Golder Associates

OPERATOR: CC

CHECKED:

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 1

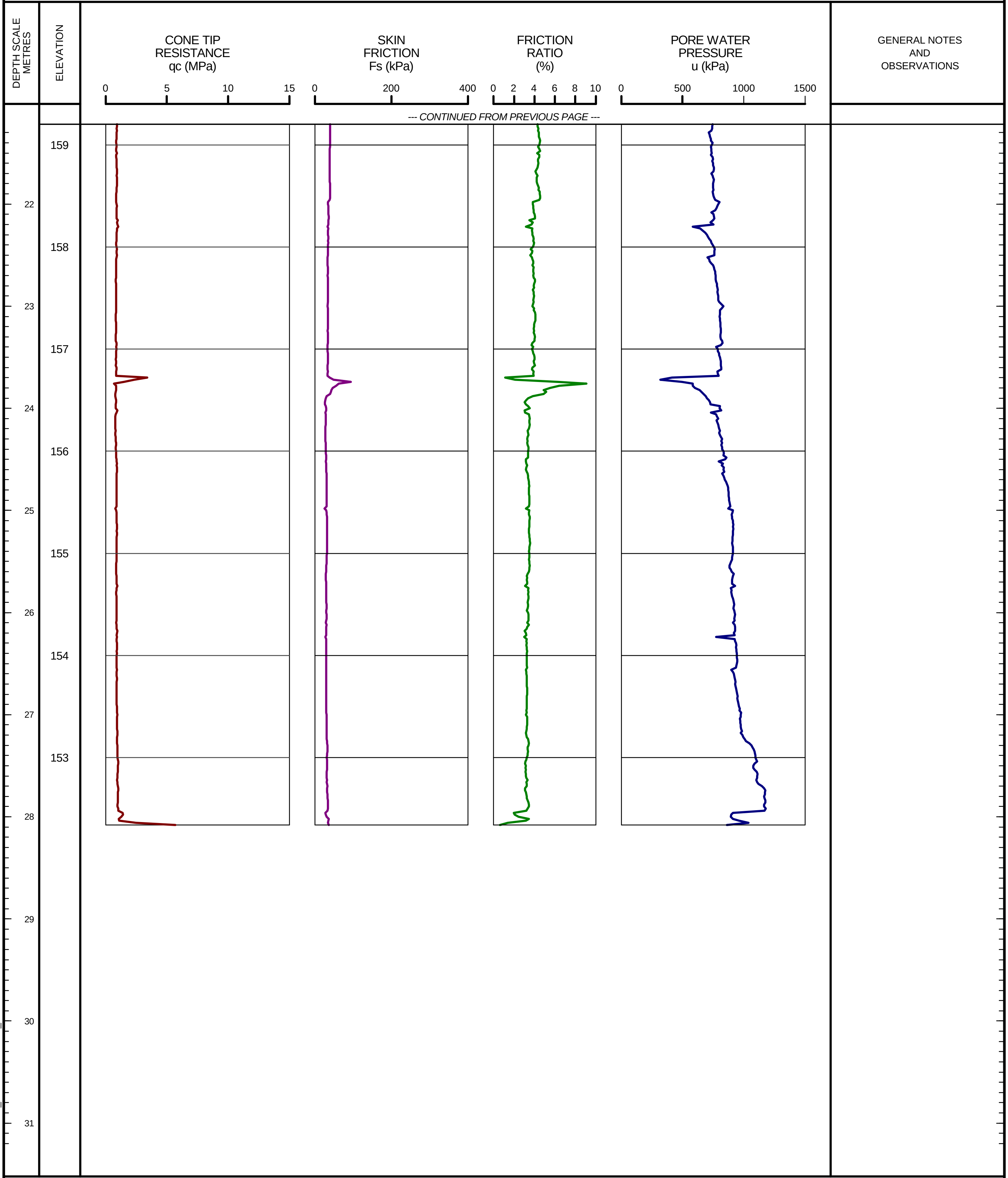
SHEET 3 OF 3

LOCATION: SEE LOCATION PLAN

TEST DATE: November 27, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 180.42m PREDRILL DEPTH: 1.22m CORRECTION FACTOR A: 0.6 CORRECTION FACTOR B: 0.013



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DEPTH SCALE

1 : 50

Golder Associates

OPERATOR: CC

CHECKED:

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 2

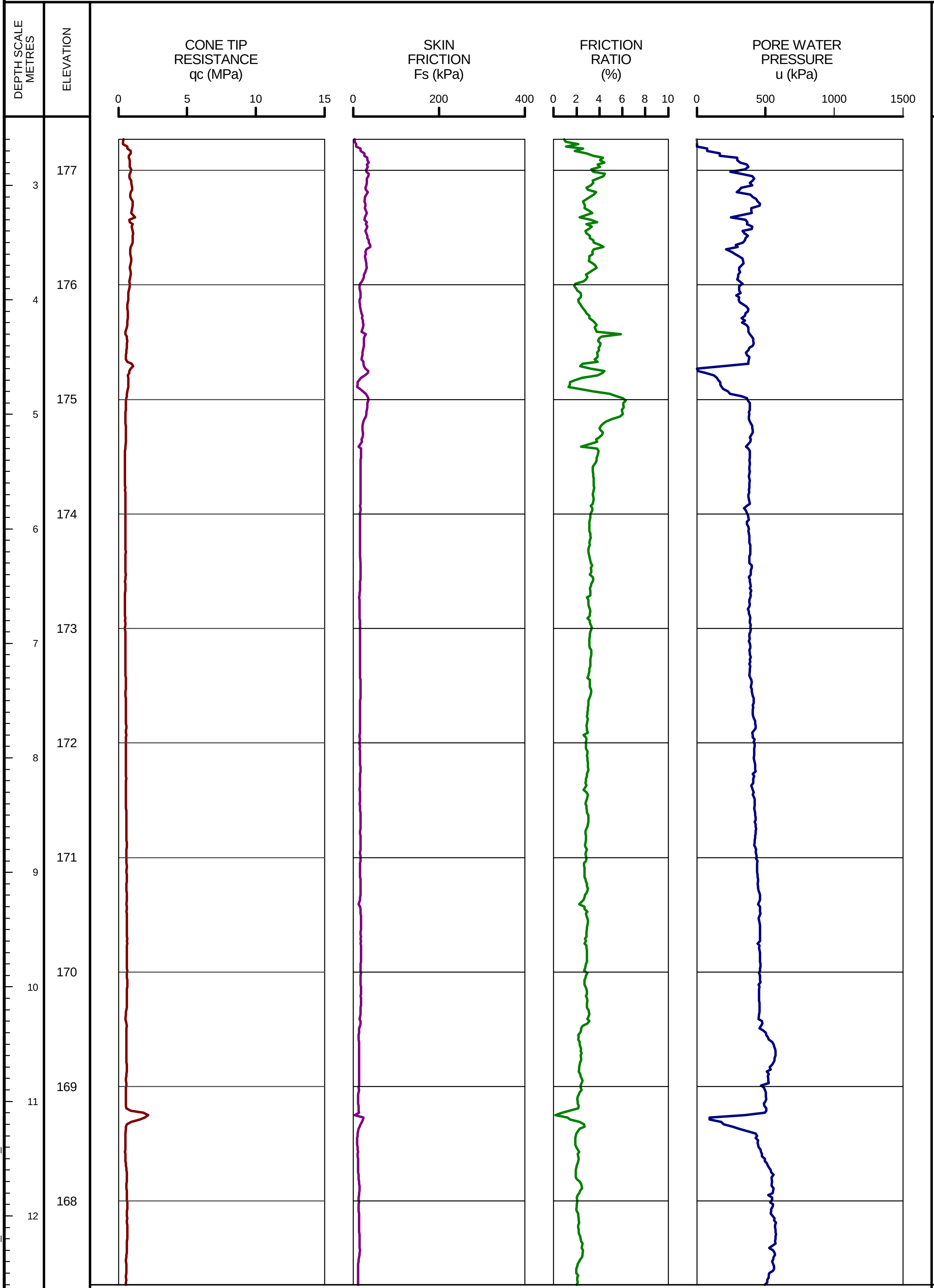
SHEET 1 OF 3

LOCATION: SEE LOCATION PLAN

TEST DATE: November 26, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 179.87m PREDRILL DEPTH: 2.60m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



GENERAL NOTES AND OBSERVATIONS

--- CONTINUED NEXT PAGE ---

DEPTH SCALE

1 : 50

OPERATOR: CC

CHECKED:

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 2

SHEET 2 OF 3

LOCATION: SEE LOCATION PLAN

TEST DATE: November 26, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 179.87m PREDRILL DEPTH: 2.60m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012

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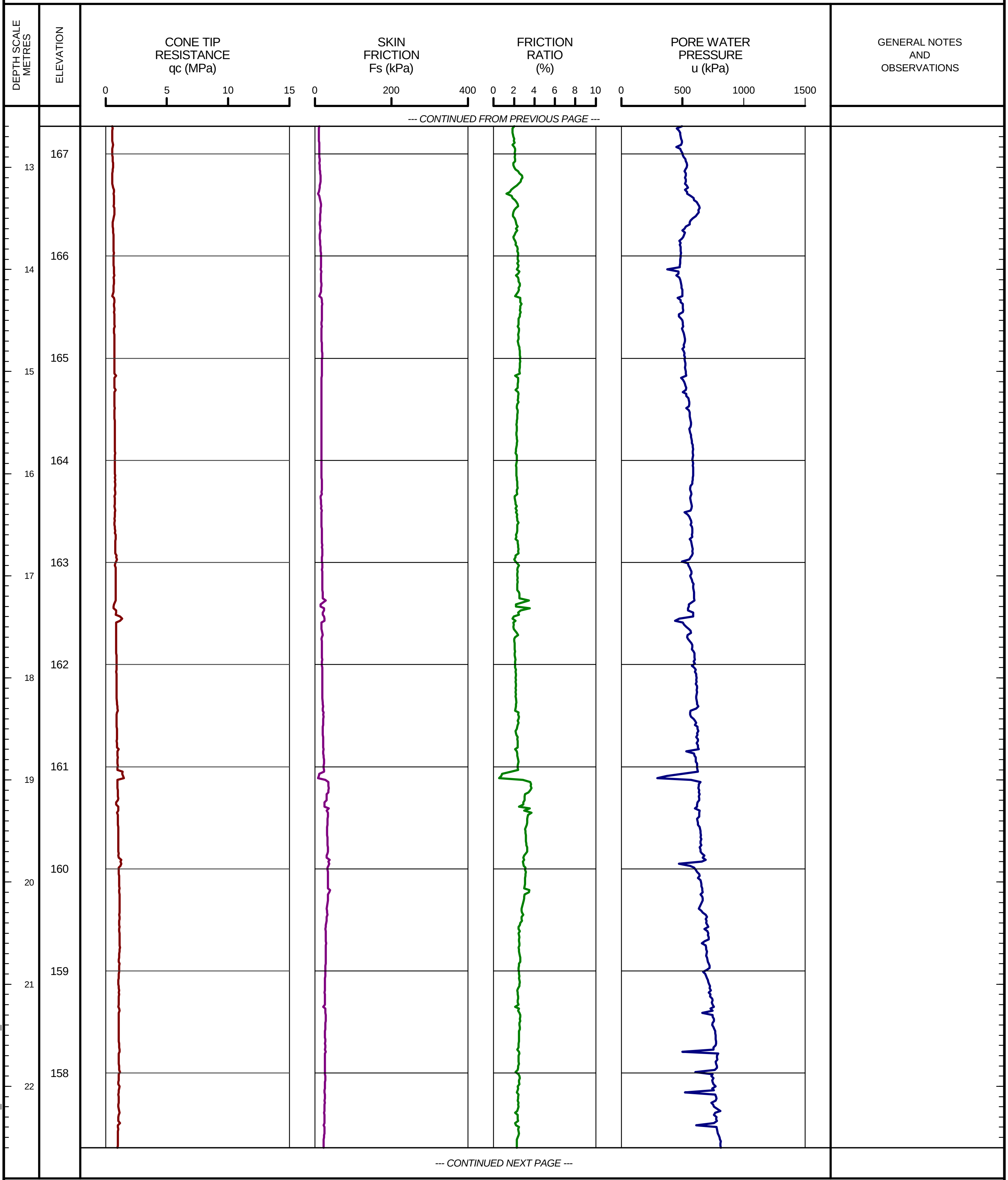

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DEPTH SCALE
1 : 50

Golder Associates

OPERATOR: CC

CHECKED:

LDN_CPT_01 09-1140-W025_CPT.GPJ GLDR_LON.GDT 5/6/10 DATA INPUT: DMB

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 2

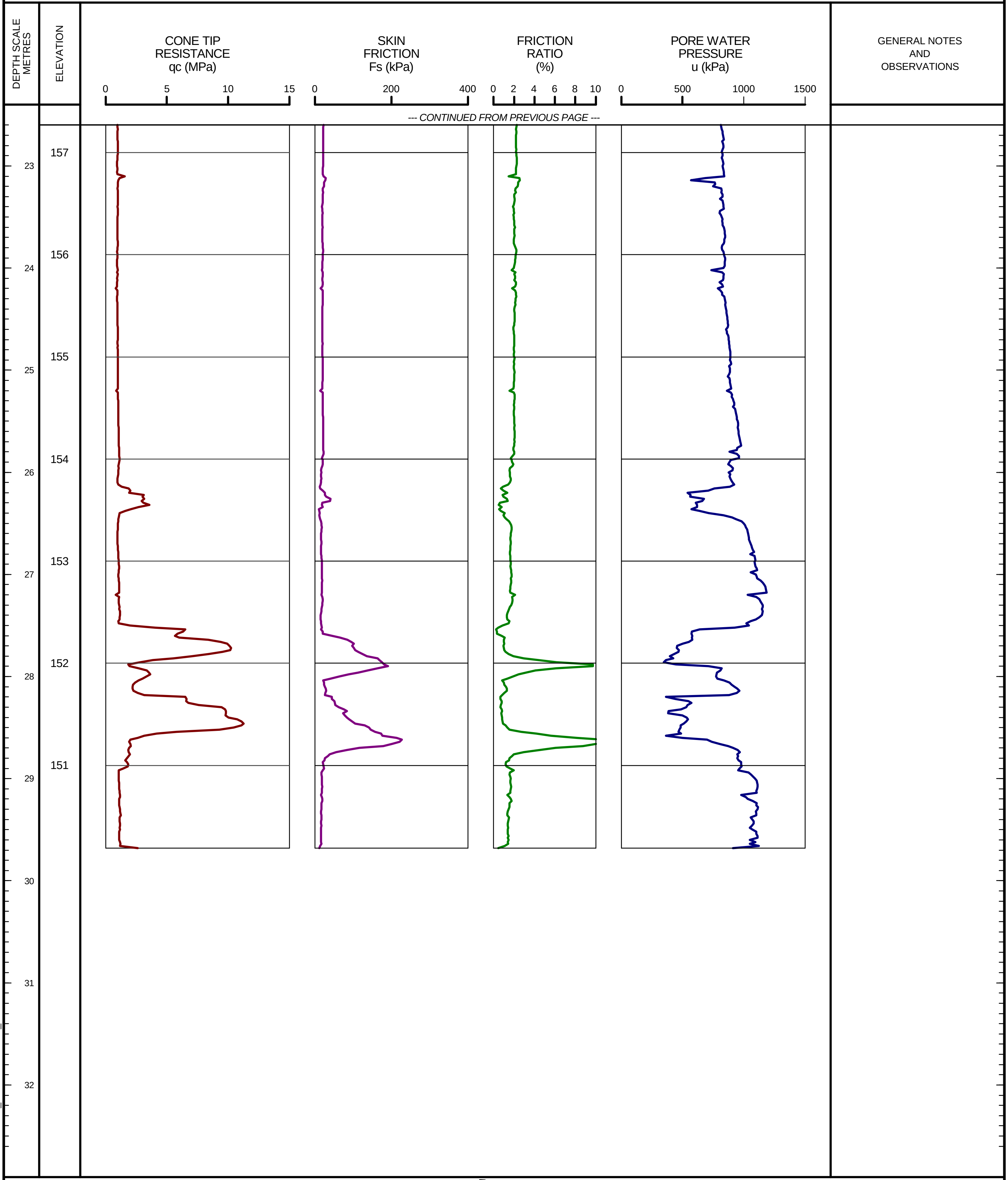
SHEET 3 OF 3

LOCATION: SEE LOCATION PLAN

TEST DATE: November 26, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 179.87m PREDRILL DEPTH: 2.60m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



DEPTH SCALE

1 : 50

Golder Associates

OPERATOR: CC

CHECKED:

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 3

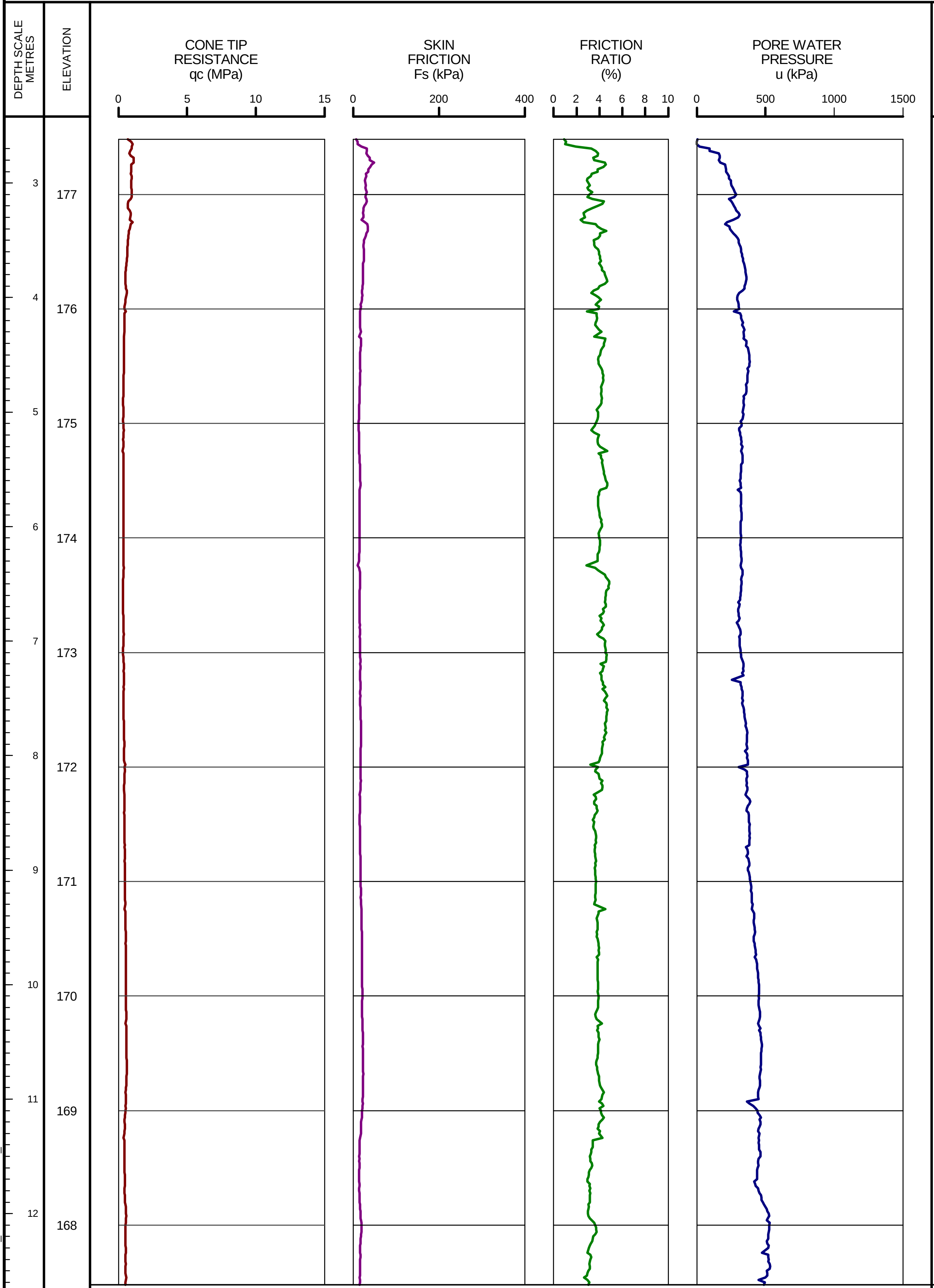
SHEET 1 OF 2

LOCATION: SEE LOCATION PLAN

TEST DATE: November 26, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 180.10m PREDRILL DEPTH: 2.62m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



GENERAL NOTES AND OBSERVATIONS

--- CONTINUED NEXT PAGE ---

DEPTH SCALE

1 : 50

Golder Associates

OPERATOR: CC

CHECKED:

LDN_CPT_01 09-1140-W025_CPT.GPJ GLDR_LON.GDT 5/6/10 DATA INPUT: DMB

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 3

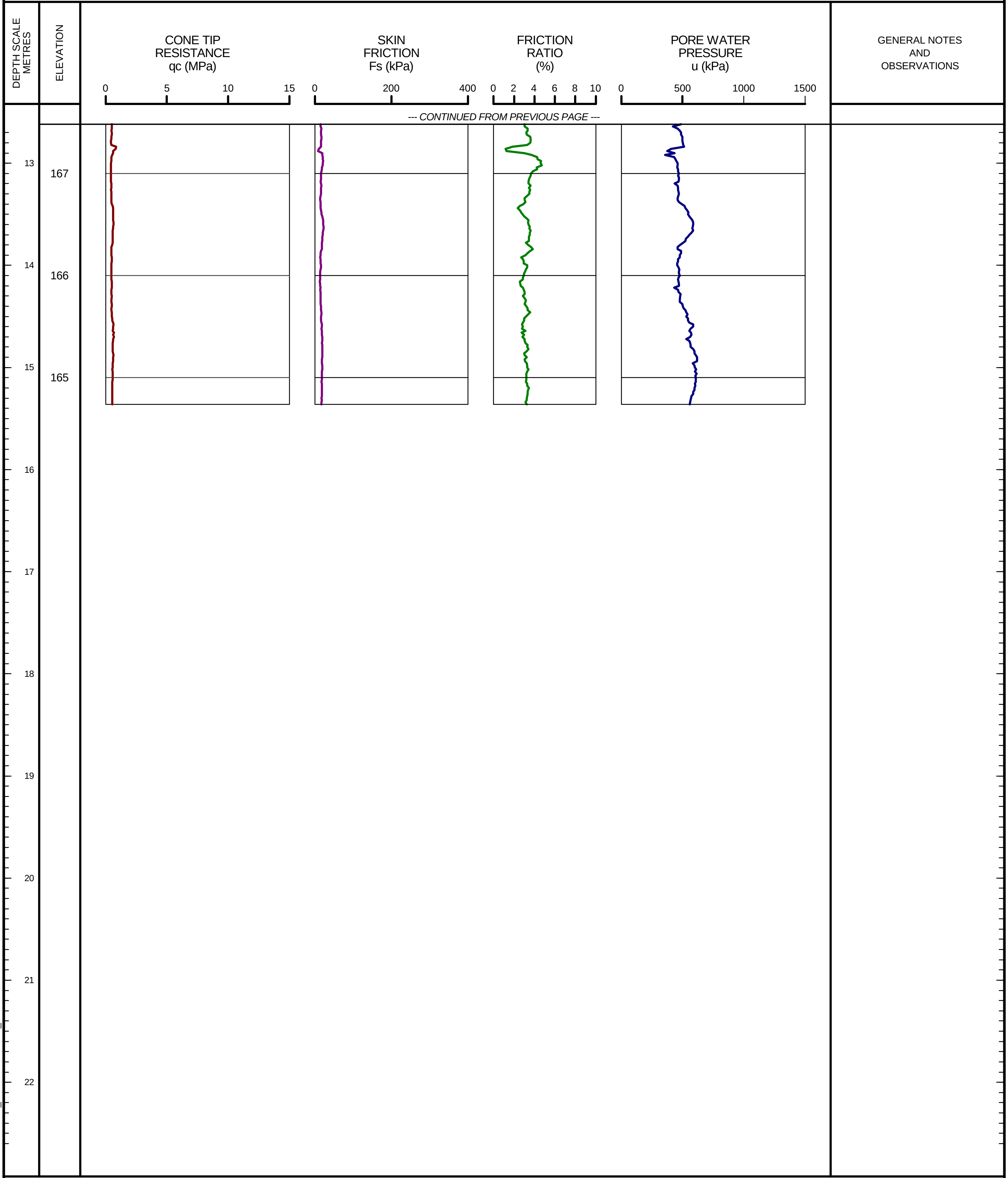
SHEET 2 OF 2

LOCATION: SEE LOCATION PLAN

TEST DATE: November 26, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 180.10m PREDRILL DEPTH: 2.62m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



DEPTH SCALE

1 : 50

Golder Associates

OPERATOR: CC

CHECKED:

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 4

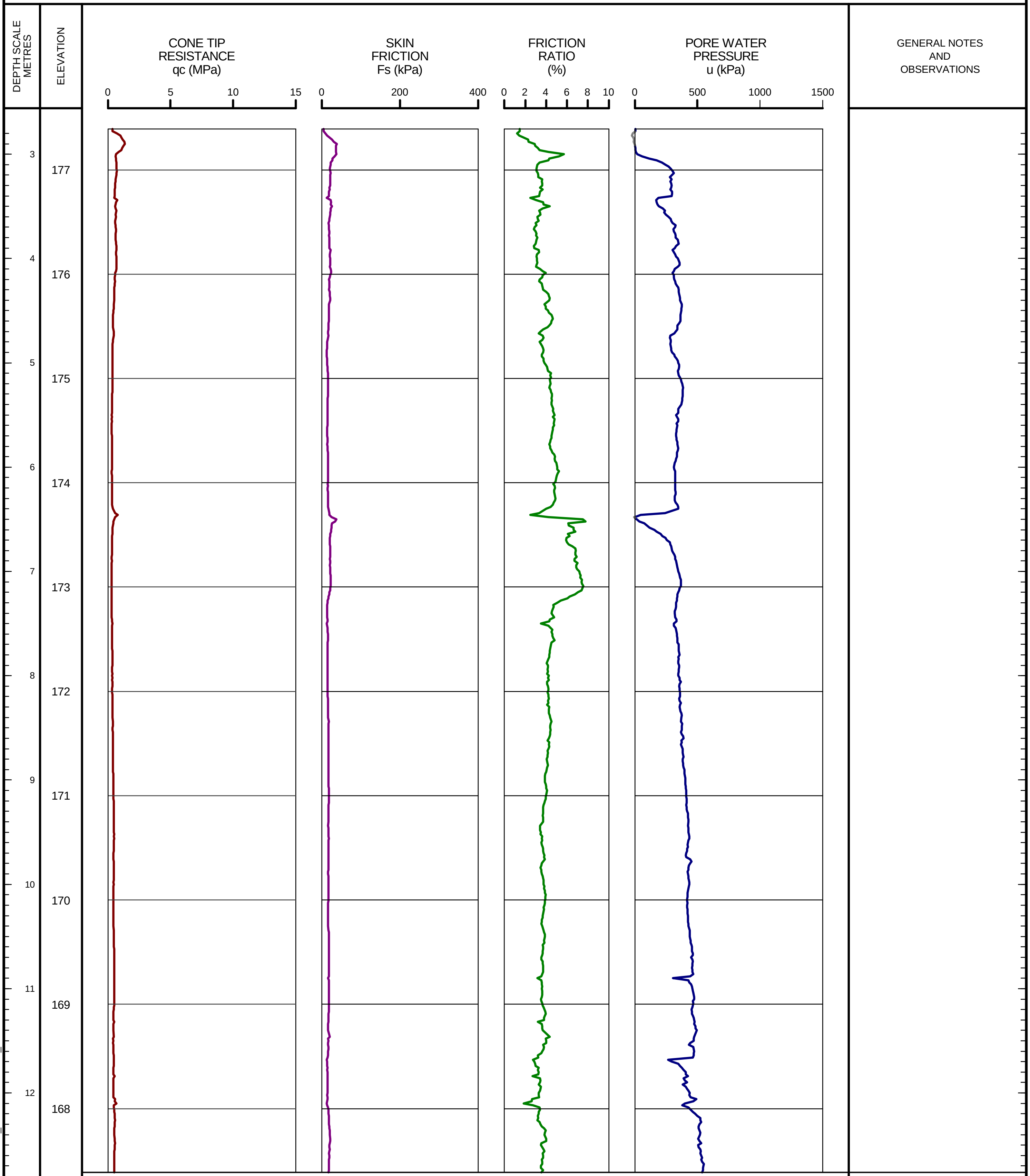
SHEET 1 OF 3

LOCATION: SEE LOCATION PLAN

TEST DATE: November 26, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 180.15m PREDRILL DEPTH: 2.76m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



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DEPTH SCALE

1 : 50

Golder Associates

OPERATOR: CC

CHECKED:

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 4

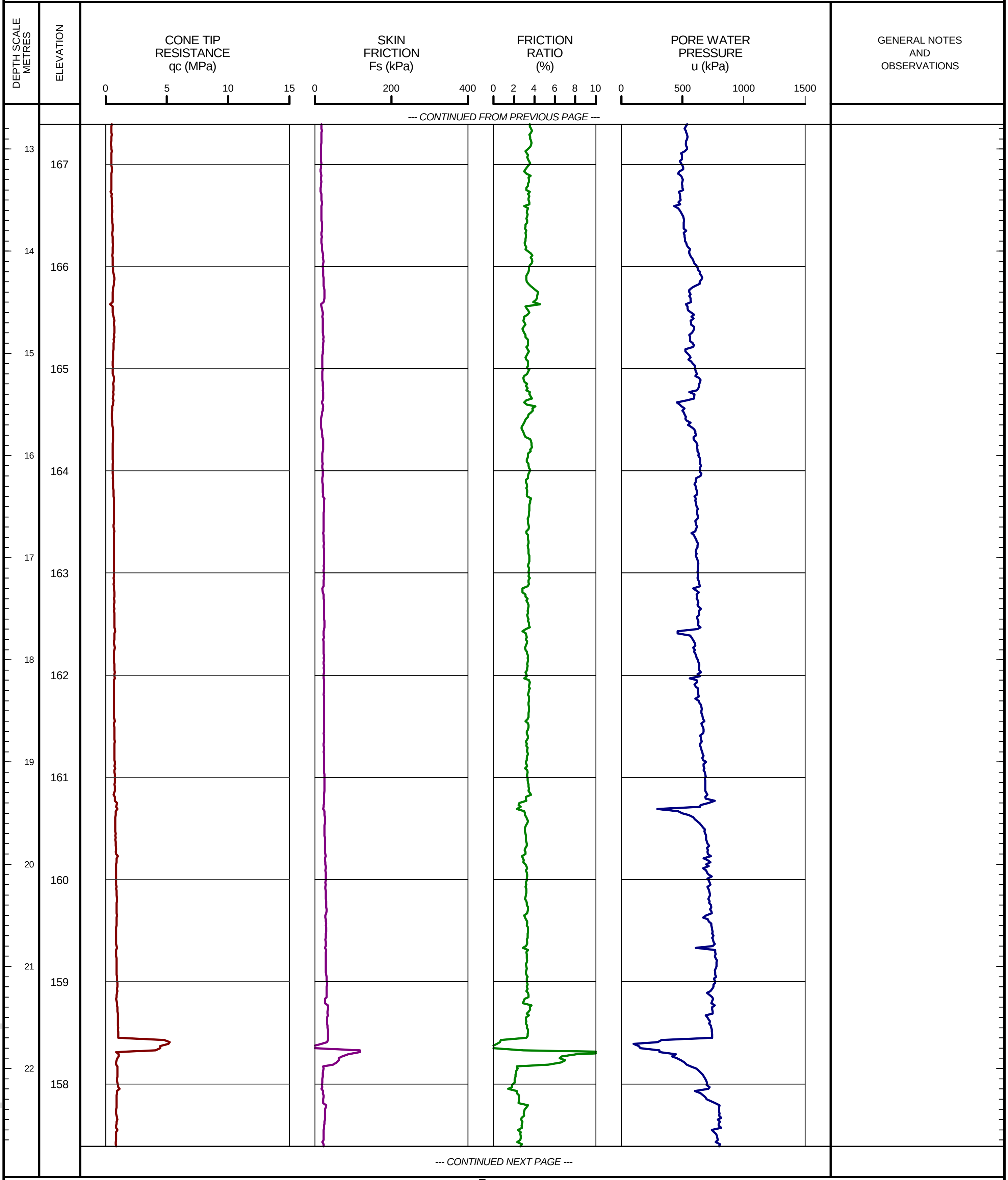
SHEET 2 OF 3

LOCATION: SEE LOCATION PLAN

TEST DATE: November 26, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 180.15m PREDRILL DEPTH: 2.76m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



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DEPTH SCALE

1 : 50

Golder Associates

OPERATOR: CC

CHECKED:

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 4

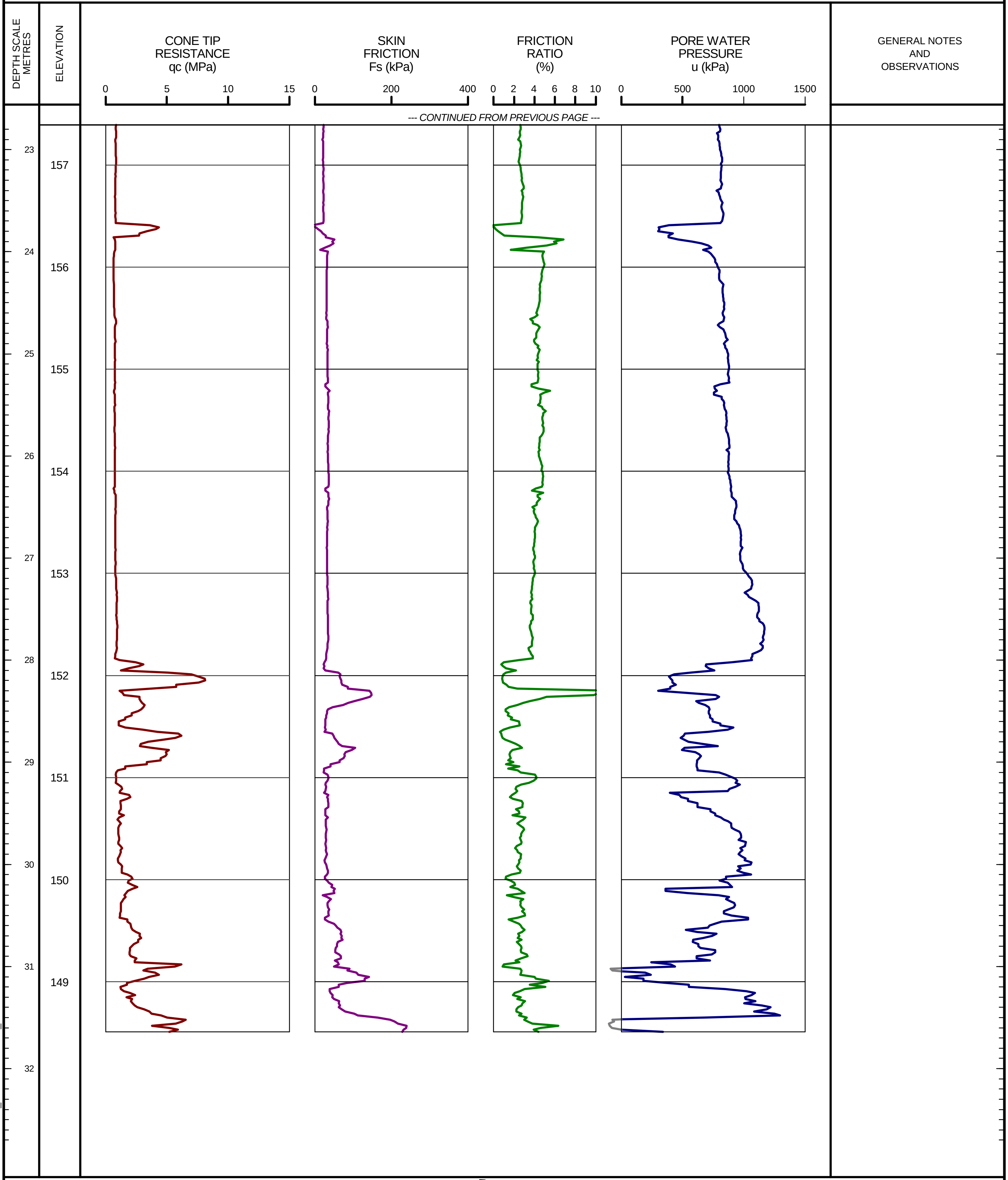
SHEET 3 OF 3

LOCATION: SEE LOCATION PLAN

TEST DATE: November 26, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 180.15m PREDRILL DEPTH: 2.76m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



DEPTH SCALE

1 : 50

Golder Associates

OPERATOR: CC

CHECKED:

LDN_CPT_01 09-1140-W025_CPT.GPJ GLDR_LON.GDT 5/6/10 DATA INPUT: DMB

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 5

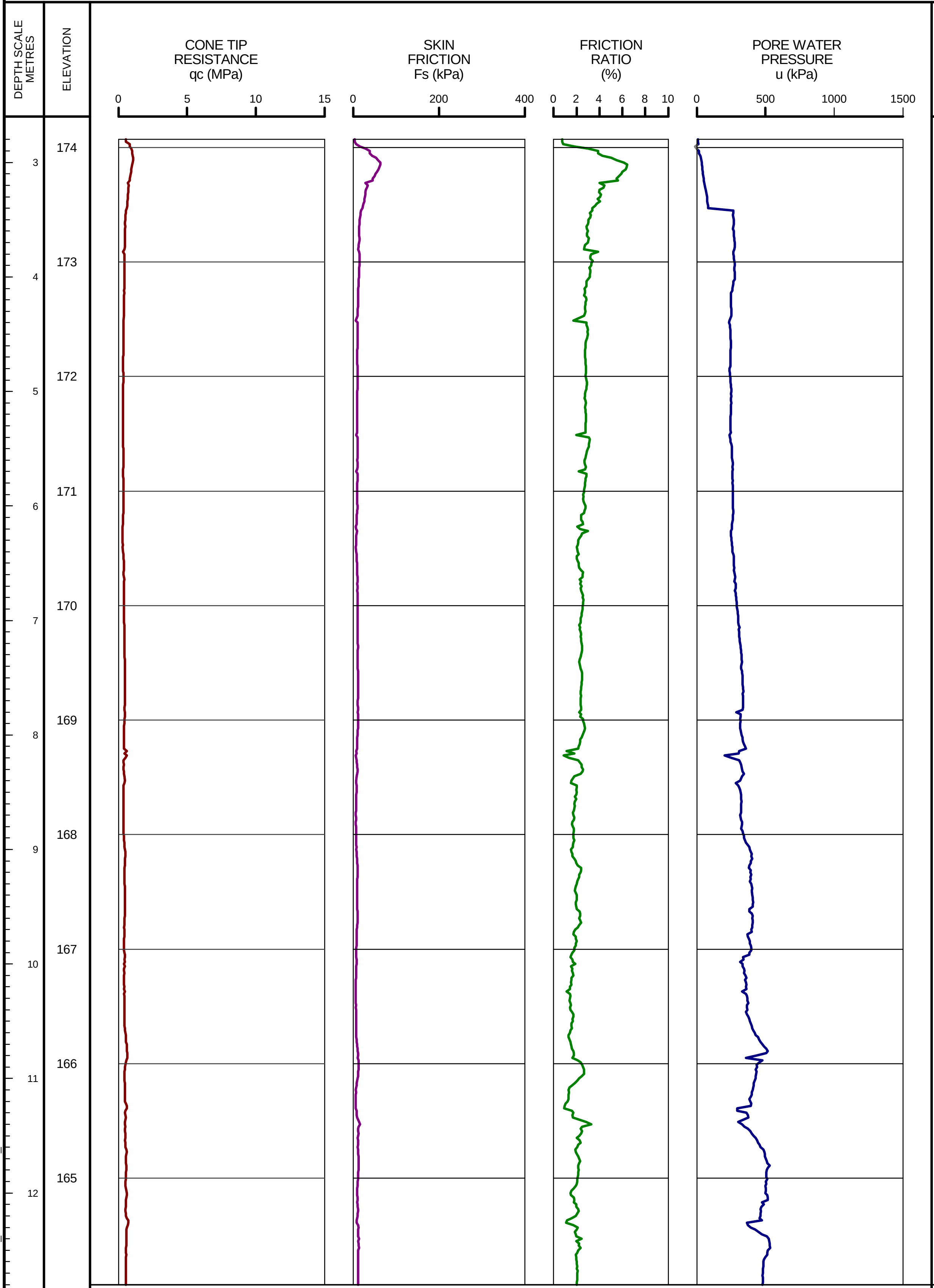
SHEET 1 OF 2

LOCATION: SEE LOCATION PLAN

TEST DATE: November 26, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 176.87m PREDRILL DEPTH: 2.80m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



GENERAL NOTES AND OBSERVATIONS

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DEPTH SCALE

1 : 50

Golder Associates

OPERATOR: CC

CHECKED:

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 5

SHEET 2 OF 2

LOCATION: SEE LOCATION PLAN

TEST DATE: November 26, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 176.87m PREDRILL DEPTH: 2.80m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012

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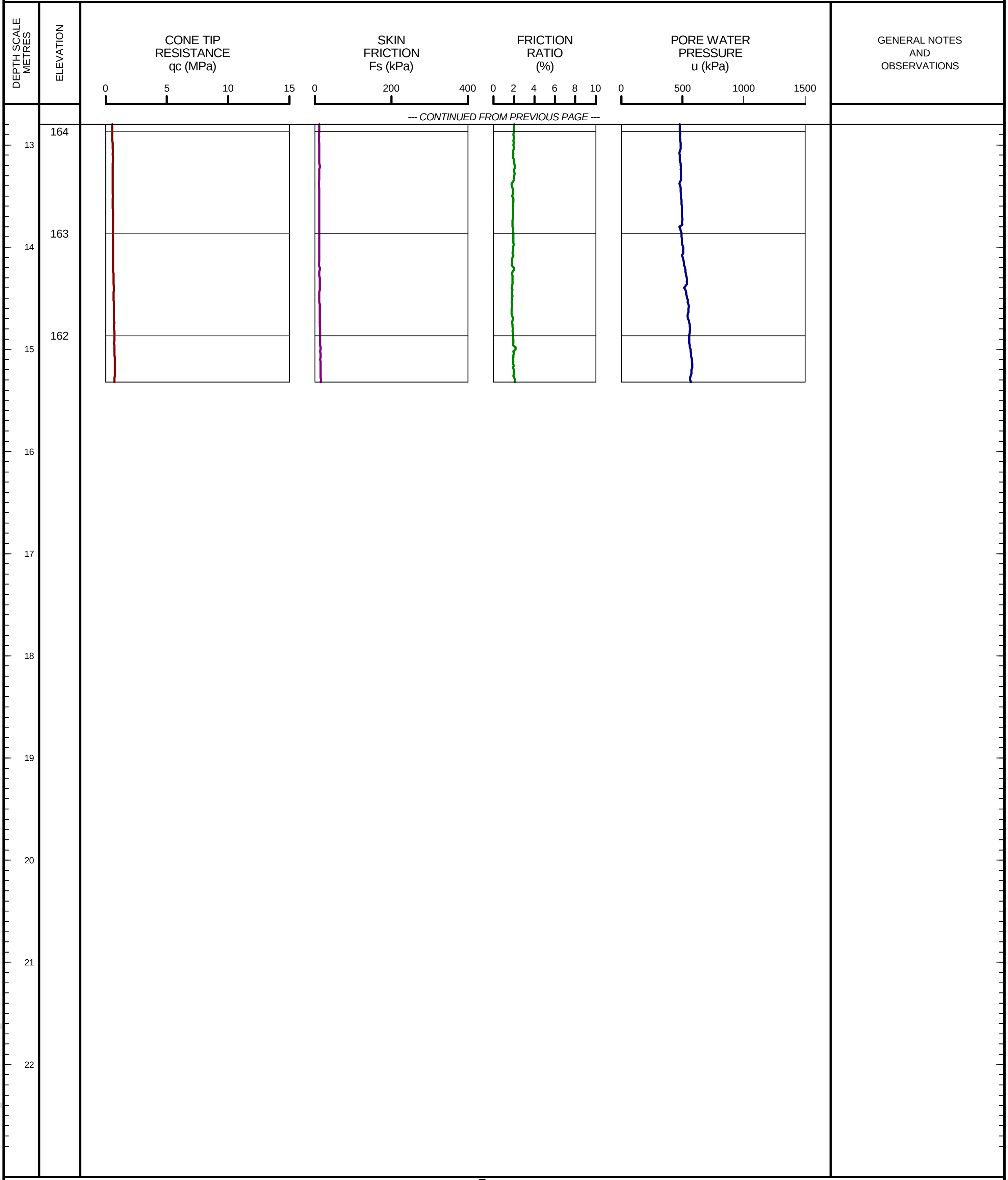


DEPTH SCALE

1 : 50

Golder Associates

OPERATOR: CC

CHECKED:

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 6

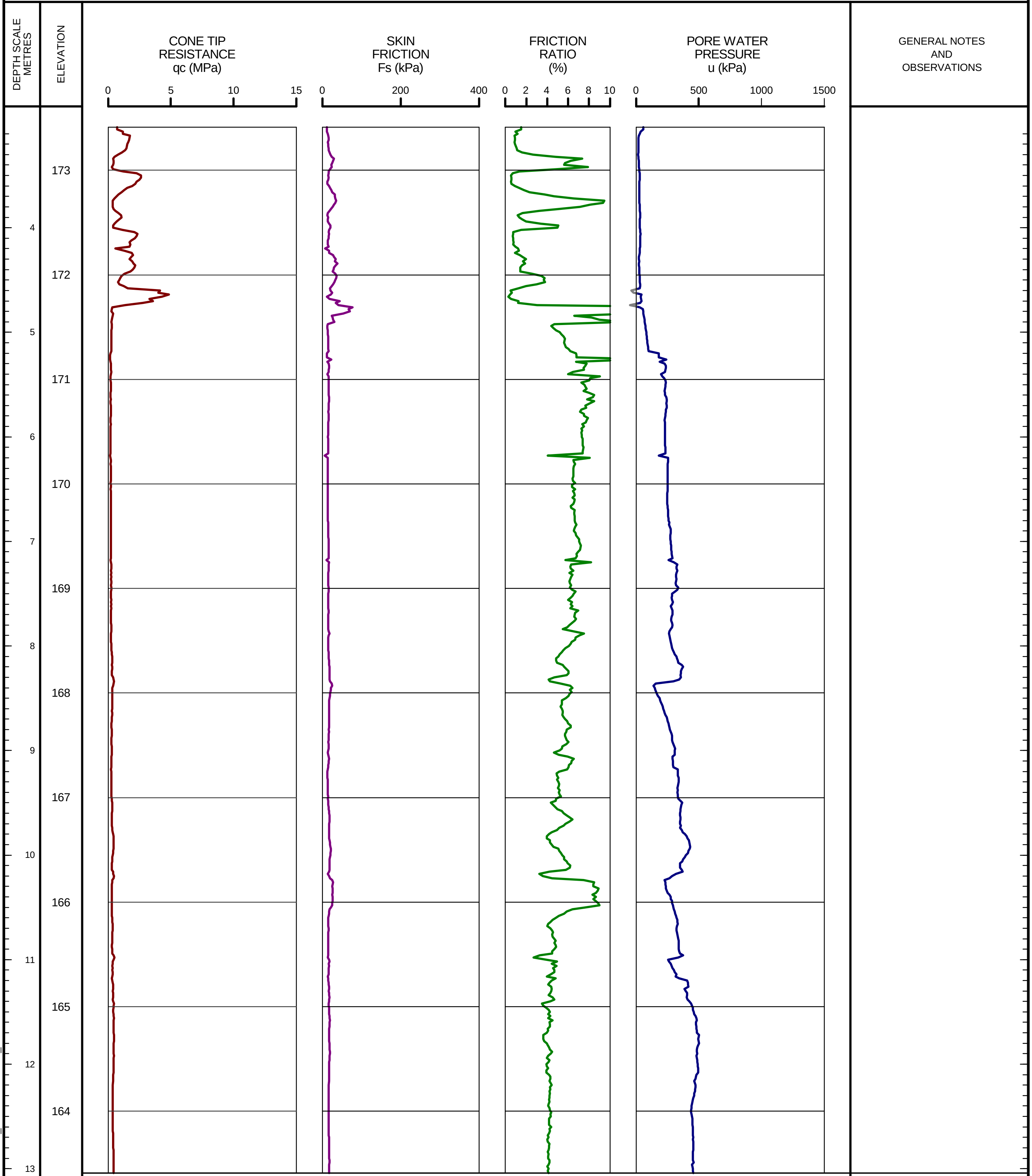
SHEET 1 OF 3

LOCATION: SEE LOCATION PLAN

TEST DATE: November 27, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 176.45m PREDRILL DEPTH: 3.04m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



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DEPTH SCALE

1 : 50

OPERATOR: CC

CHECKED:

LDN_CPT_01 09-1140-W025_CPT.GPJ GLDR_LON.GDT 5/6/10 DATA INPUT: DMB

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 6

SHEET 2 OF 3

LOCATION: SEE LOCATION PLAN

TEST DATE: November 27, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 176.45m PREDRILL DEPTH: 3.04m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012

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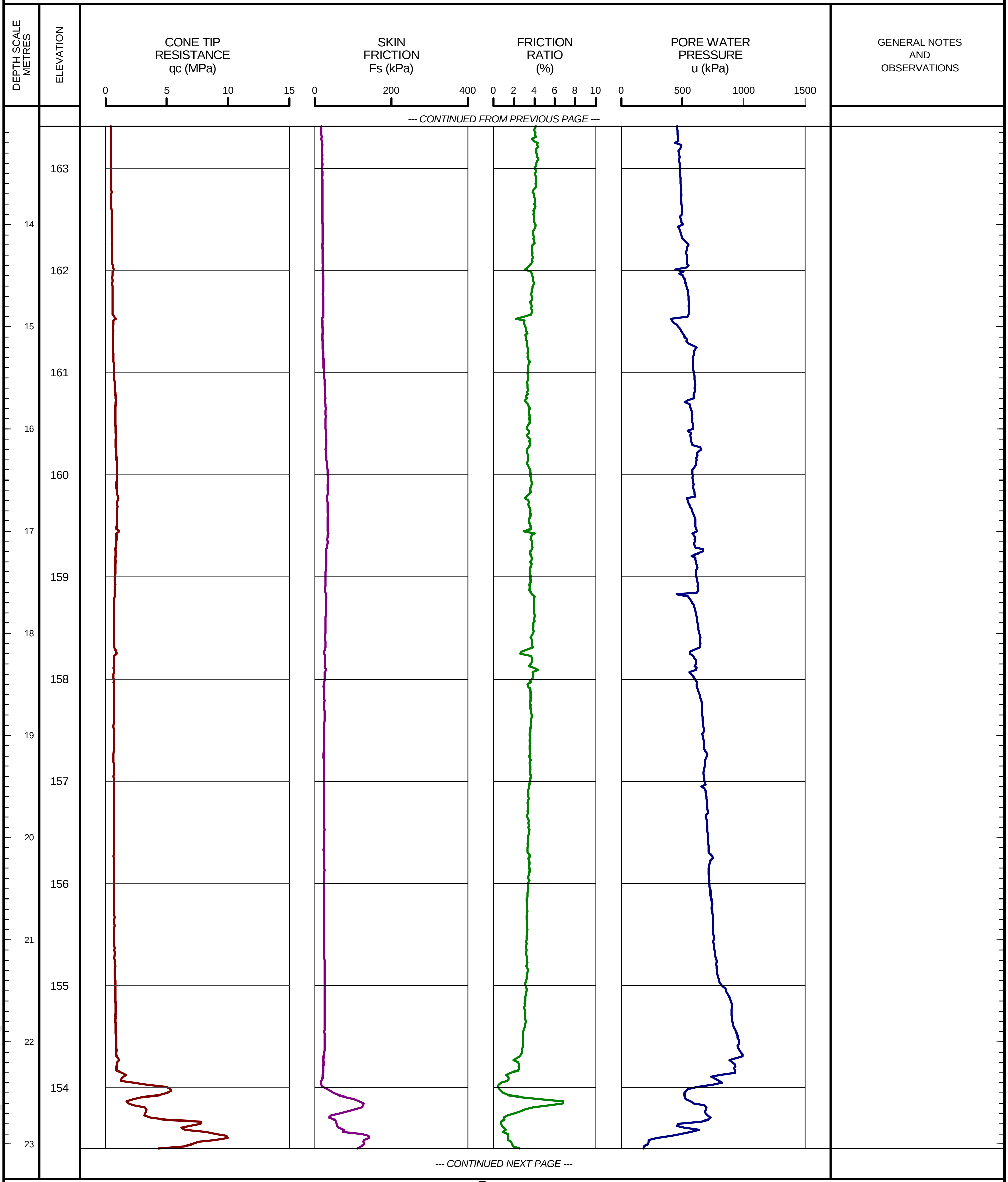

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DEPTH SCALE

1 : 50

Golder Associates

OPERATOR: CC

CHECKED:

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 6

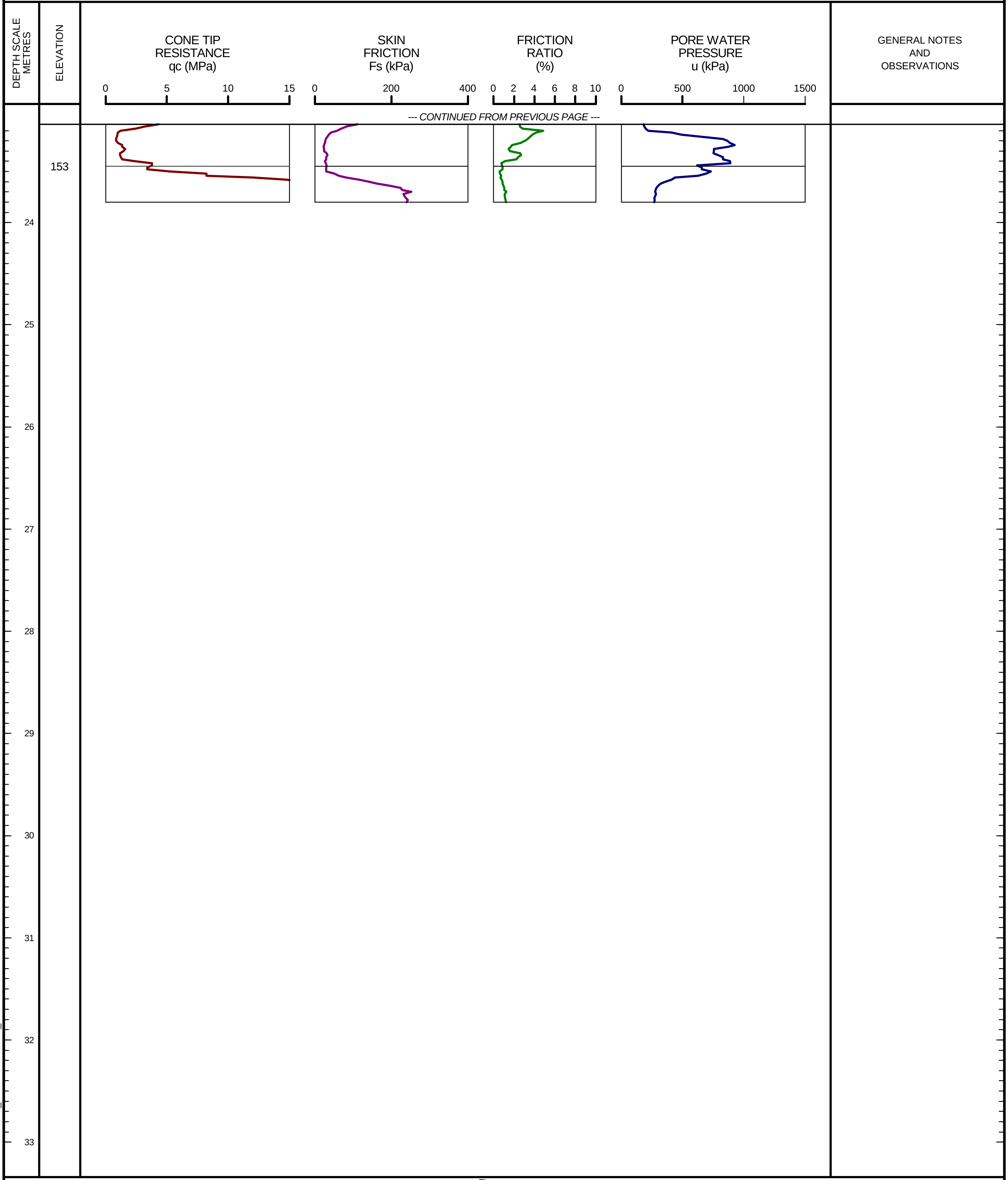
SHEET 3 OF 3

LOCATION: SEE LOCATION PLAN

TEST DATE: November 27, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 176.45m PREDRILL DEPTH: 3.04m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012

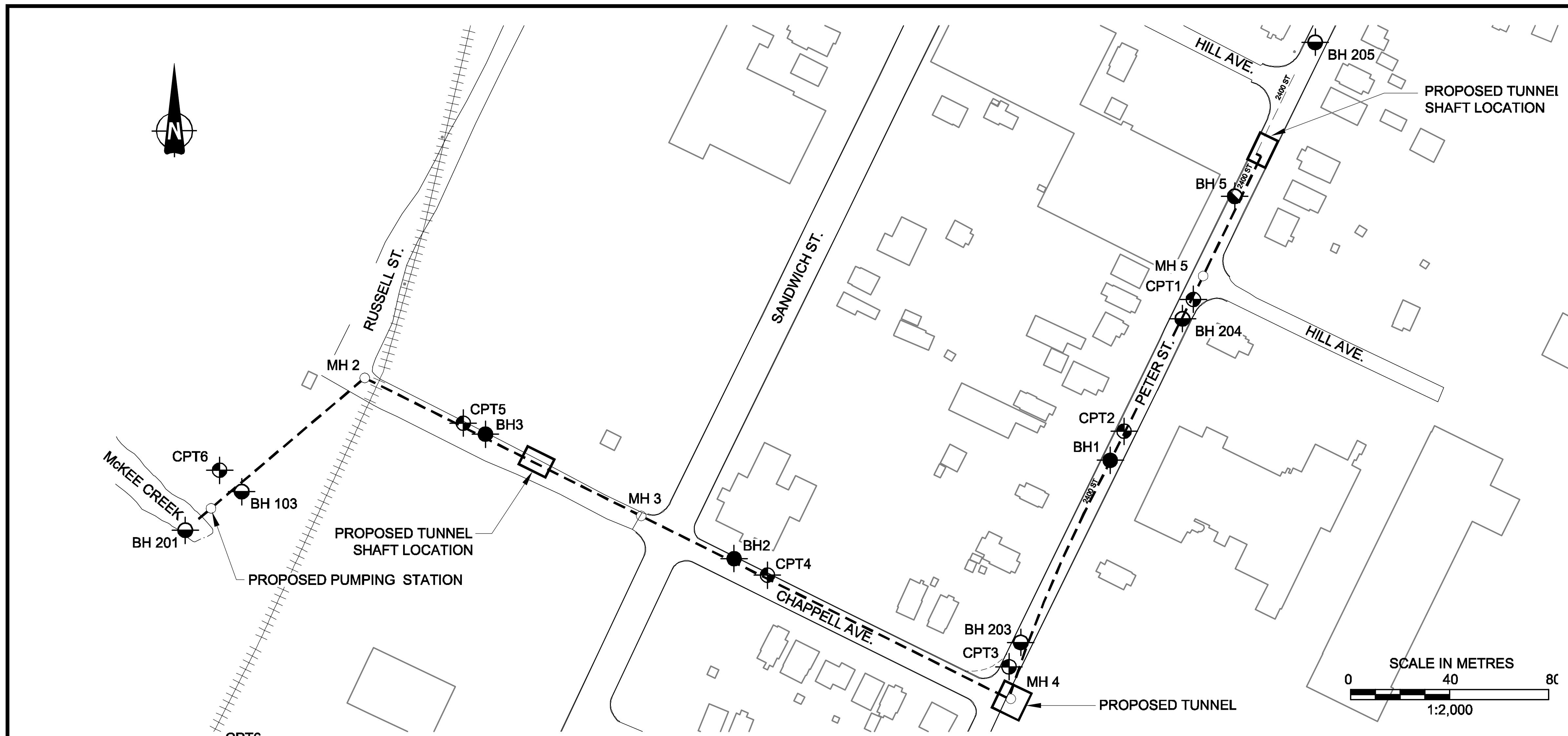


DEPTH SCALE

1 : 50

OPERATOR: CC

CHECKED:



LEGEND

- ● BOREHOLE LOCATION (Current Investigation)
- ⊘ BOREHOLE LOCATION (Previous Investigation 041-140044)
- ◒ BOREHOLE LOCATION (Previous Investigation 764111 & 764111/1)
- ◑ CONE PENETRATION TEST

8 — PENETRATION RESISTANCE (Blows/0.3m)

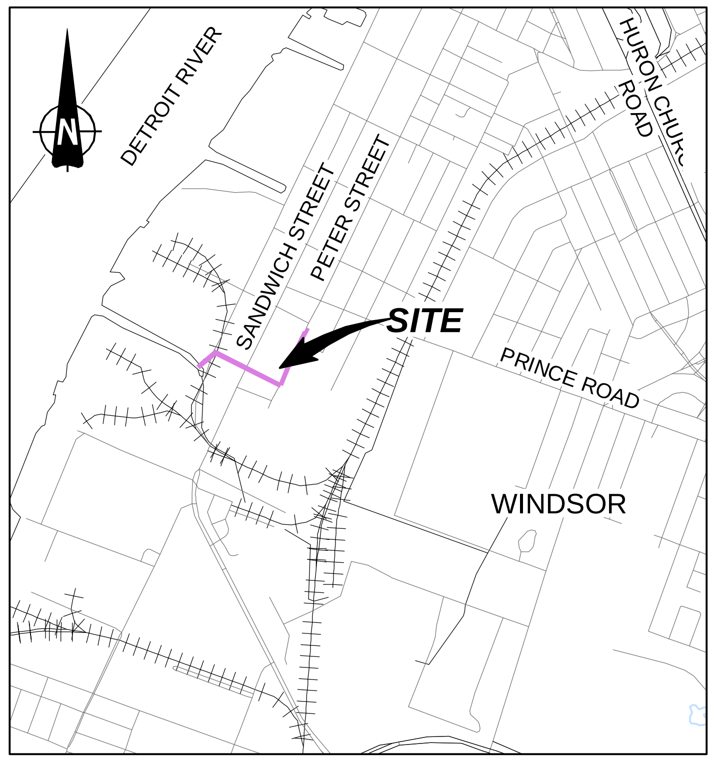
WATER LEVEL
STRATA PLOT
FOR DETAILS REFER TO RECORD OF BOREHOLES

INSTRUMENTATION

DRY — BOREHOLE DRY DURING DRILLING

CONE PENETRATION TIP RESISTANCE

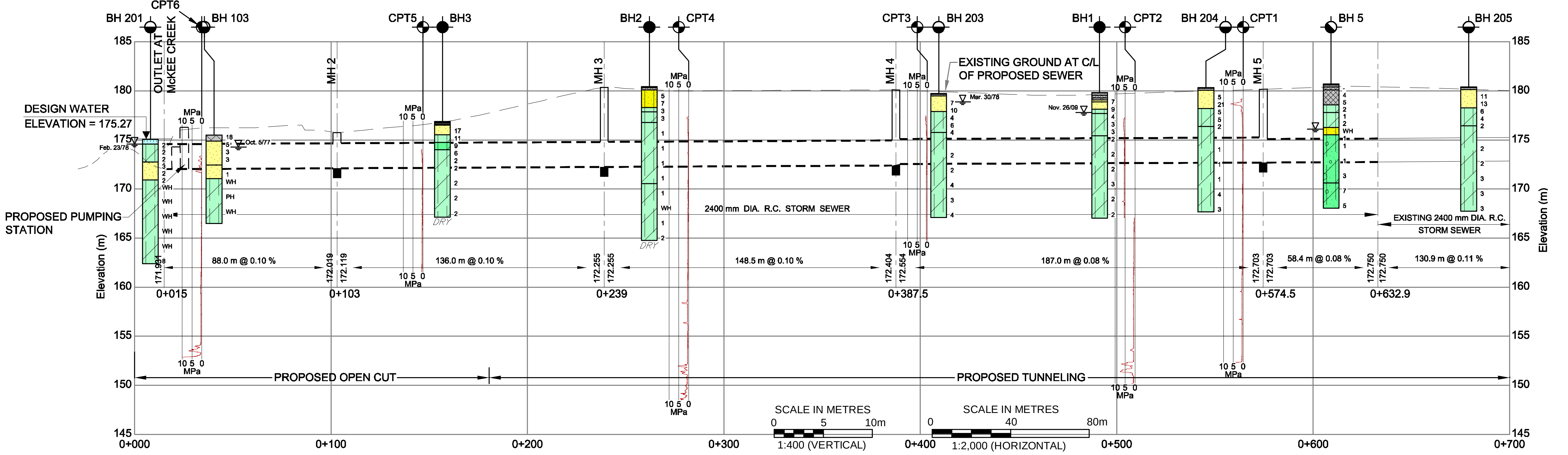
MPa 10 5 0



KEY PLAN

SIMPLIFIED STRATIGRAPHY

■	ASPHALT	🟨	SILTY SAND
▒	CONCRETE	🟩	SILTY CLAY
▩	FILL	🟩	SILTY CLAY TILL
🟨	SAND	▦	ICE



REFERENCE

DRAWING BASED ON CANMAP STREETFILES V2008.4;
AND INFORMATION PROVIDED BY CLIENT.

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

ALL LOCATIONS ARE APPROXIMATE.

PROJECT
STANTEC CONSULTING LTD.
PRINCE ROAD SEWER PHASE 9 OUTLET TO DETROIT RIVER
WINDSOR, ONTARIO

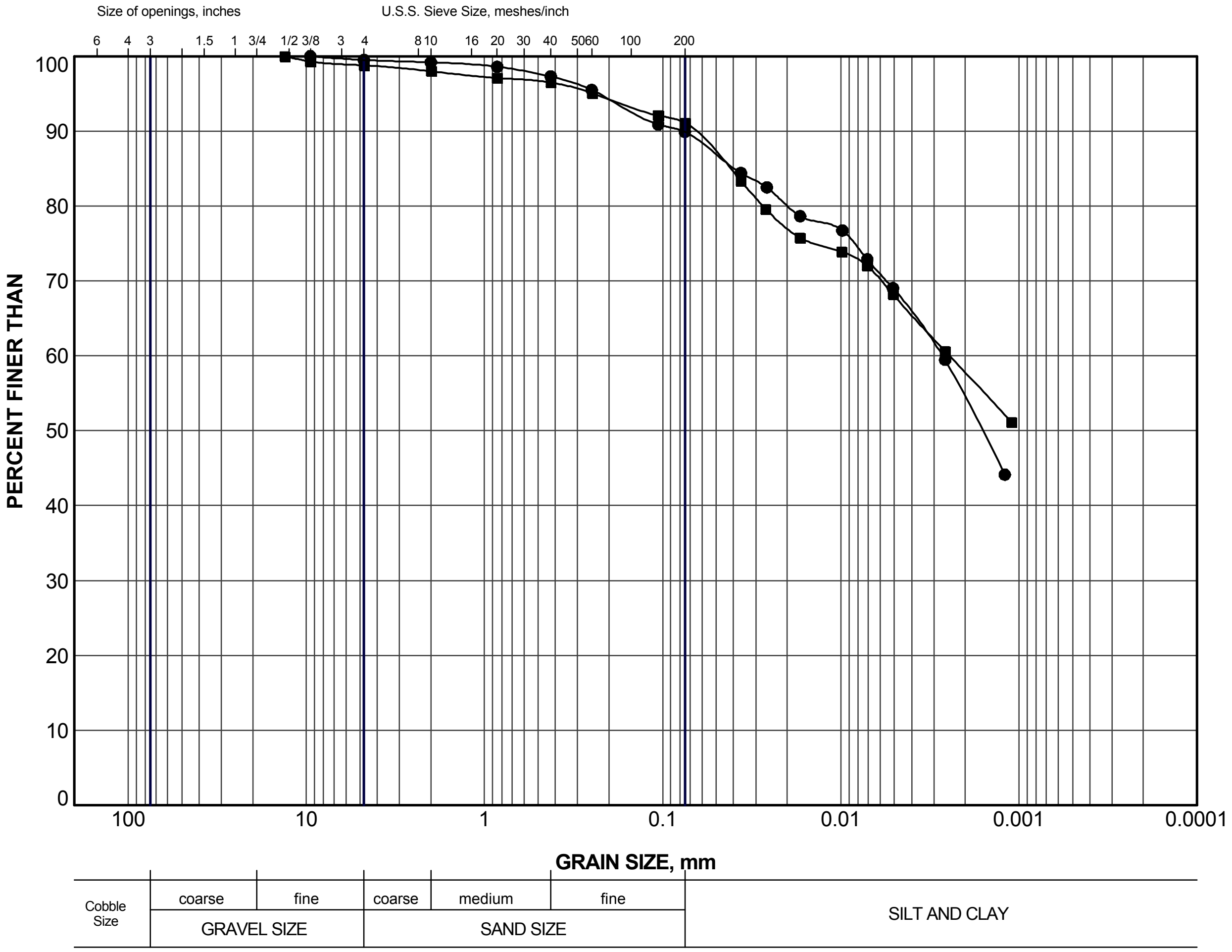
TITLE
LOCATION PLAN AND SIMPLIFIED SUB-SURFACE PROFILE

Golder Associates
WINDSOR, ONTARIO

PROJECT No. 09-1140-W025			FILE No.	091140W025-R01001
			SCALE AS SHOWN	REV.
CADD	DMB	Jan. 15/10		
CHECK				

FIGURE 1

Drawing file: 091140W025-R01001.dwg Apr 06, 2010 – 1:38pm



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	1	8	173.5
■	3	7	172.1

PROJECT

STANTEC CONSULTING LTD.
PRINCE ROAD SEWER PHASE 9 OUTLET TO DETROIT RIVER
WINDSOR, ONTARIO

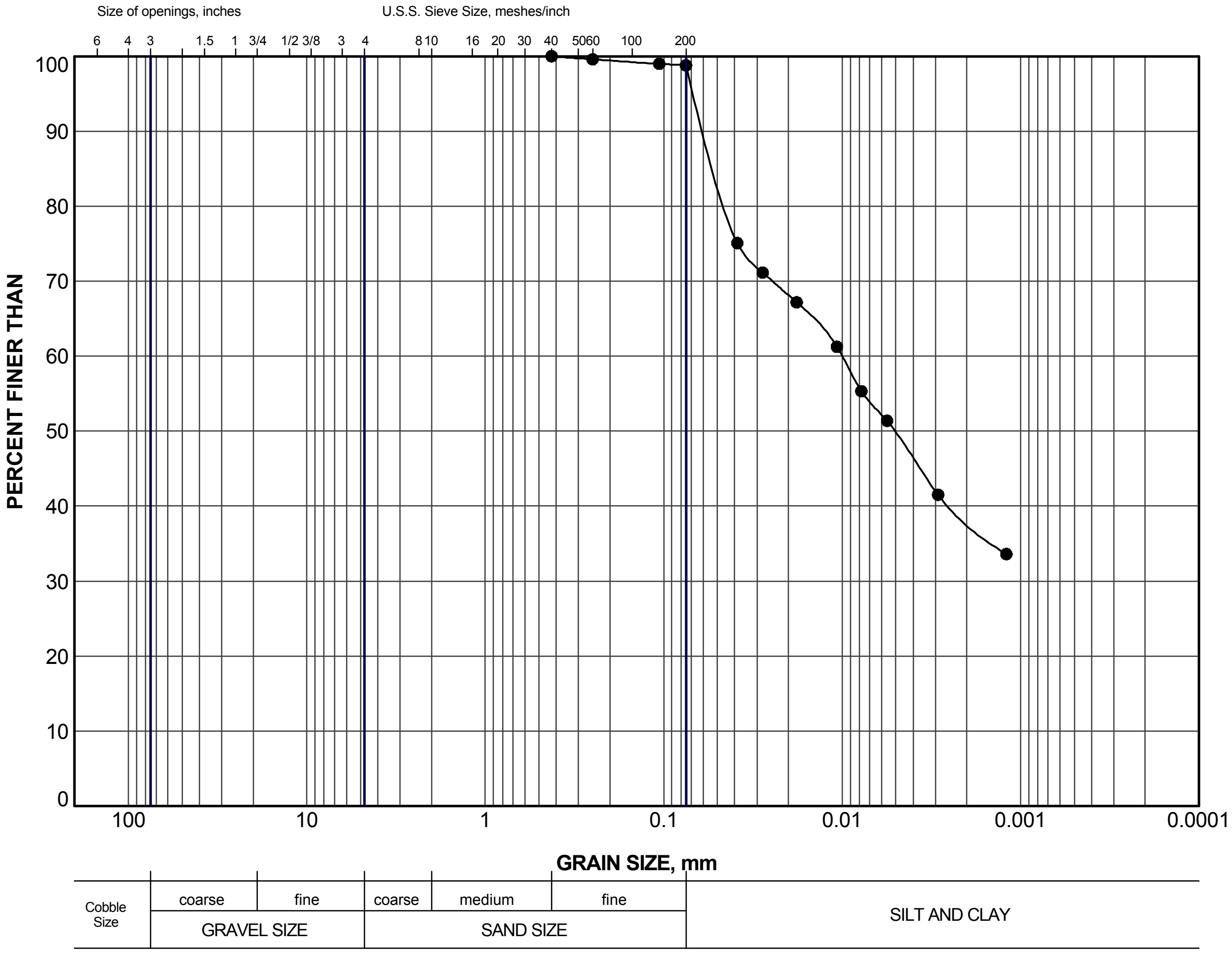
TITLE

GRAIN SIZE DISTRIBUTION

Grey **SILTY CLAY**

Golder Associates
WINDSOR, ONTARIO

PROJECT No.	09-1140-W025		FILE No.	09-1140-W025.GPJ
			SCALE N/A	REV.
DRAWN	SJL	FEB. 25/10	**FIGURE 2**	
CHECK				



LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	2	6	175.7

PROJECT

STANTEC CONSULTING LTD.
PRINCE ROAD SEWER PHASE 9 OUTLET TO DETROIT RIVER
WINDSOR, ONTARIO

TITLE

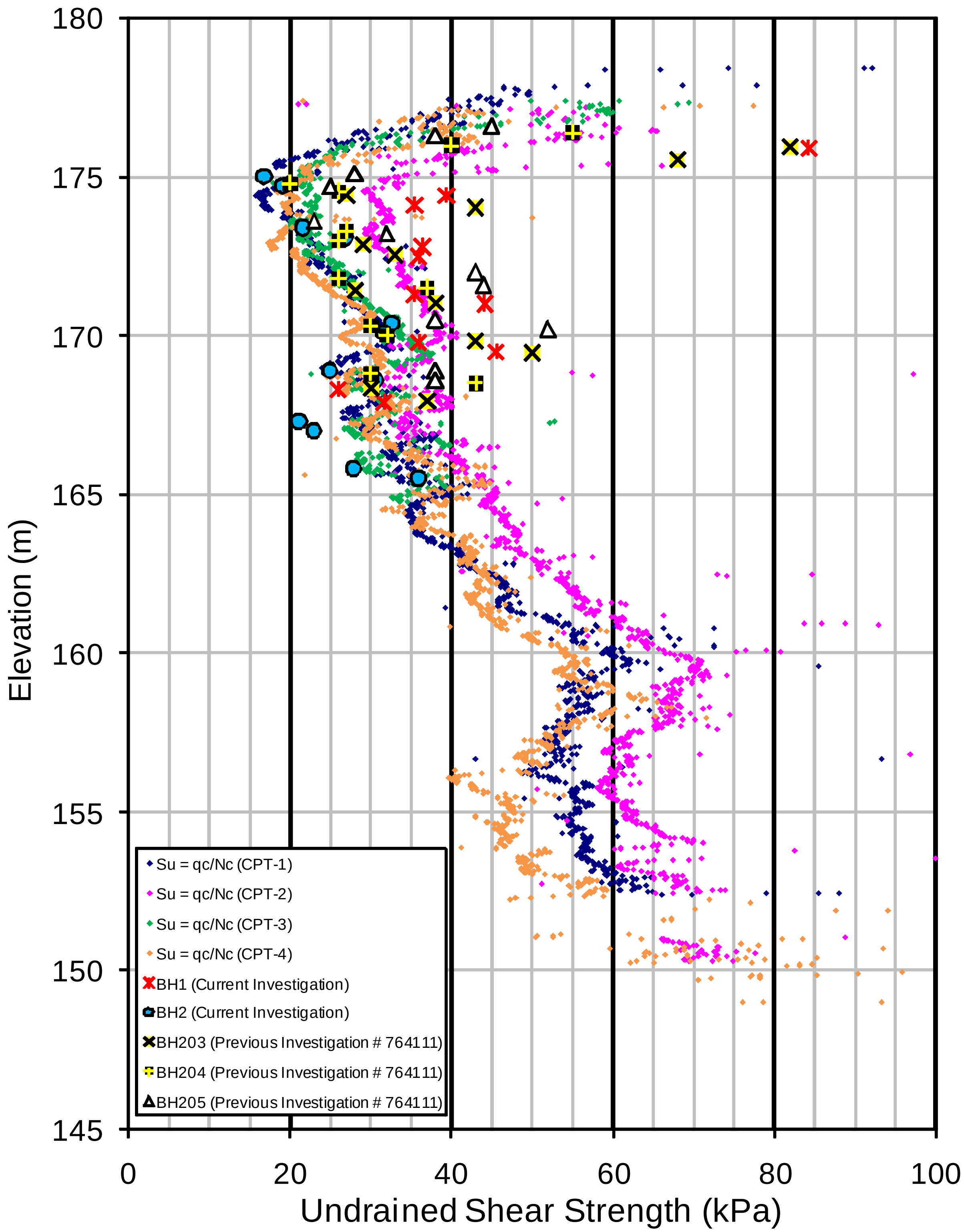
GRAIN SIZE DISTRIBUTION

Grey **CLAYEY SILT**

Golder Associates
WINDSOR, ONTARIO

PROJECT No.		09-1140-W025	FILE No.	09-1140-W025.GPJ	
			SCALE	N/A	REV.
DRAWN	SJL	FEB. 25/10	**FIGURE 3**		
CHECK					

LDN_GSD GLDR_LDN.GDT



Drawing file: 091140W025-R01004.dwg May 06, 2010 - 5:33pm

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PROJECT

STANTEC CONSULTING LTD.
PRINCE ROAD SEWER PHASE 9 OUTLET TO DETROIT RIVER
WINDSOR, ONTARIO

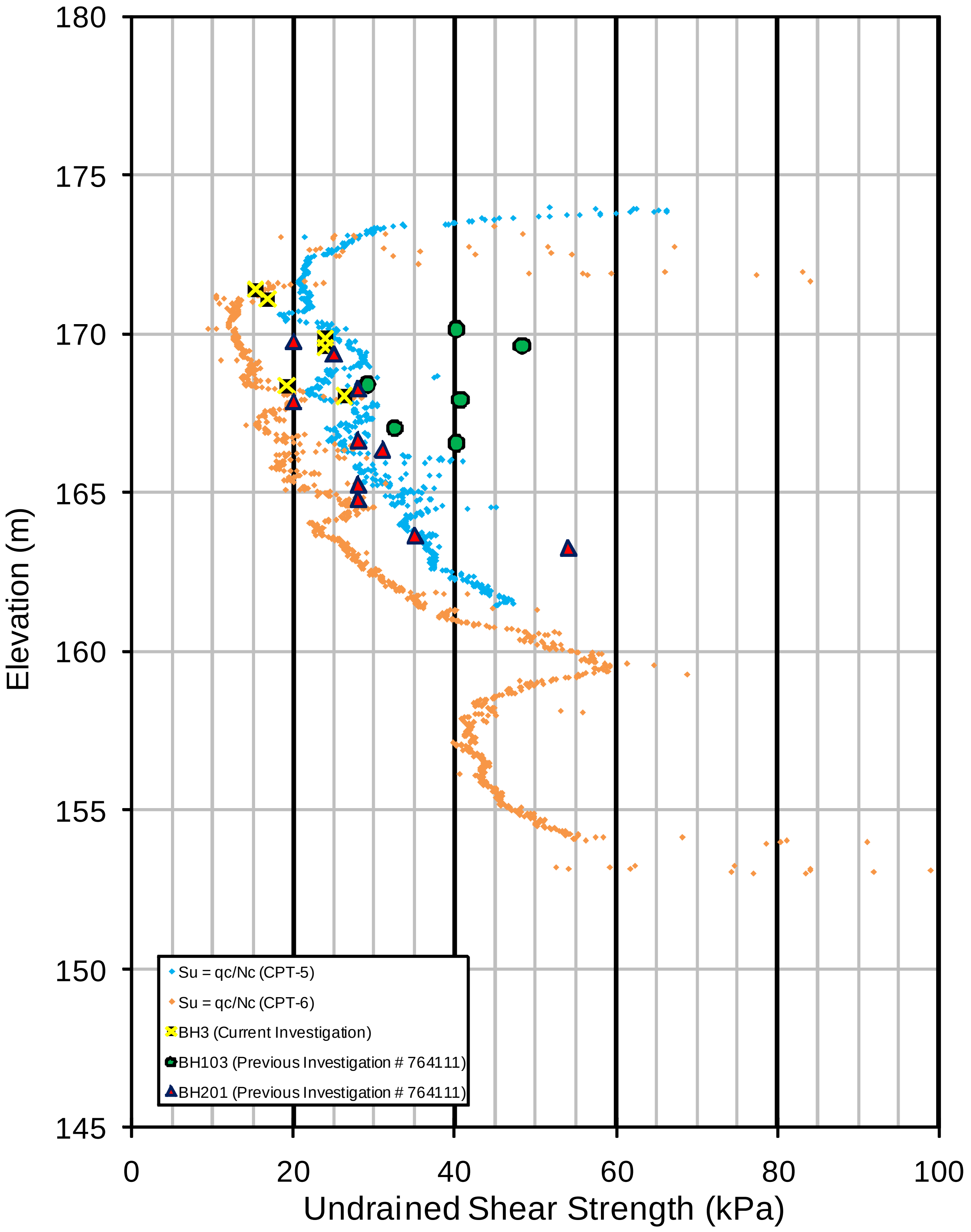
TITLE

UNDRAINED SHEAR STRENGTH PROFILE
STATION 0+192 to 0+633

Golder Associates
WINDSOR, ONTARIO

PROJECT No.	09-1140-W025	FILE No.	091140W025-R01004
		SCALE	AS SHOWN
CADD	SJL	FEB. 25/10	REV.
CHECK			

FIGURE 4



NOTES

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PROJECT

STANTEC CONSULTING LTD.
PRINCE ROAD SEWER PHASE 9 OUTLET TO DETROIT RIVER
WINDSOR, ONTARIO

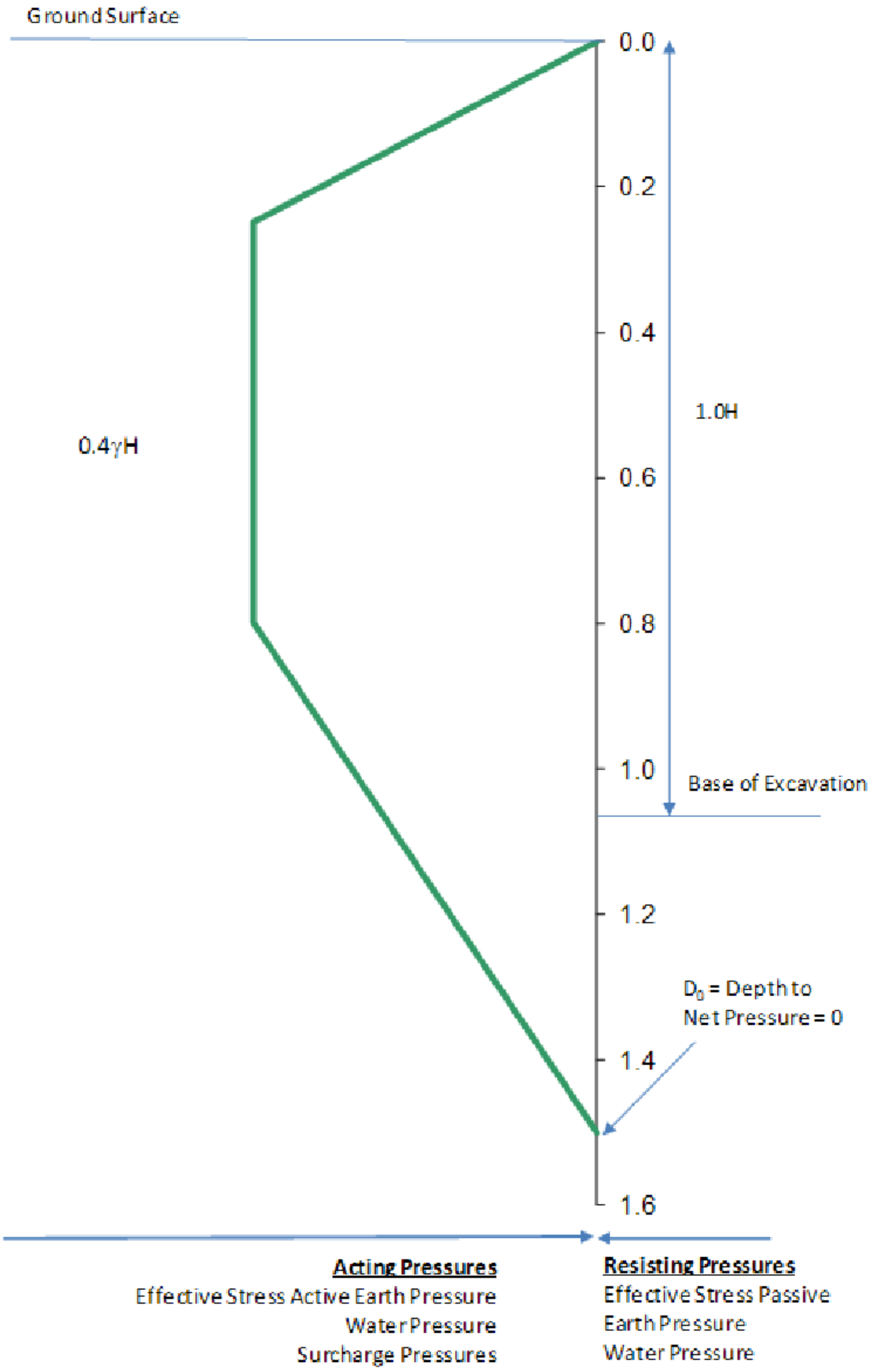
TITLE

UNDRAINED SHEAR STRENGTH PROFILE
STATION 0+000 to 0+192

Golder Associates
WINDSOR, ONTARIO

PROJECT No.	09–1140–W025		FILE No.	091140W025–R01005
			SCALE	AS SHOWN REV.
CADD	SJL	FEB. 25/10	**FIGURE 5**	
CHECK				

Drawing file: 091140W025–R01005.dwg May 06, 2010 – 5:35pm



APPARENT EARTH PRESSURES

NOTE

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PROJECT

STANTEC CONSULTING LTD.
PRINCE ROAD SEWER PHASE 9 OUTLET TO DETROIT RIVER
WINDSOR, ONTARIO

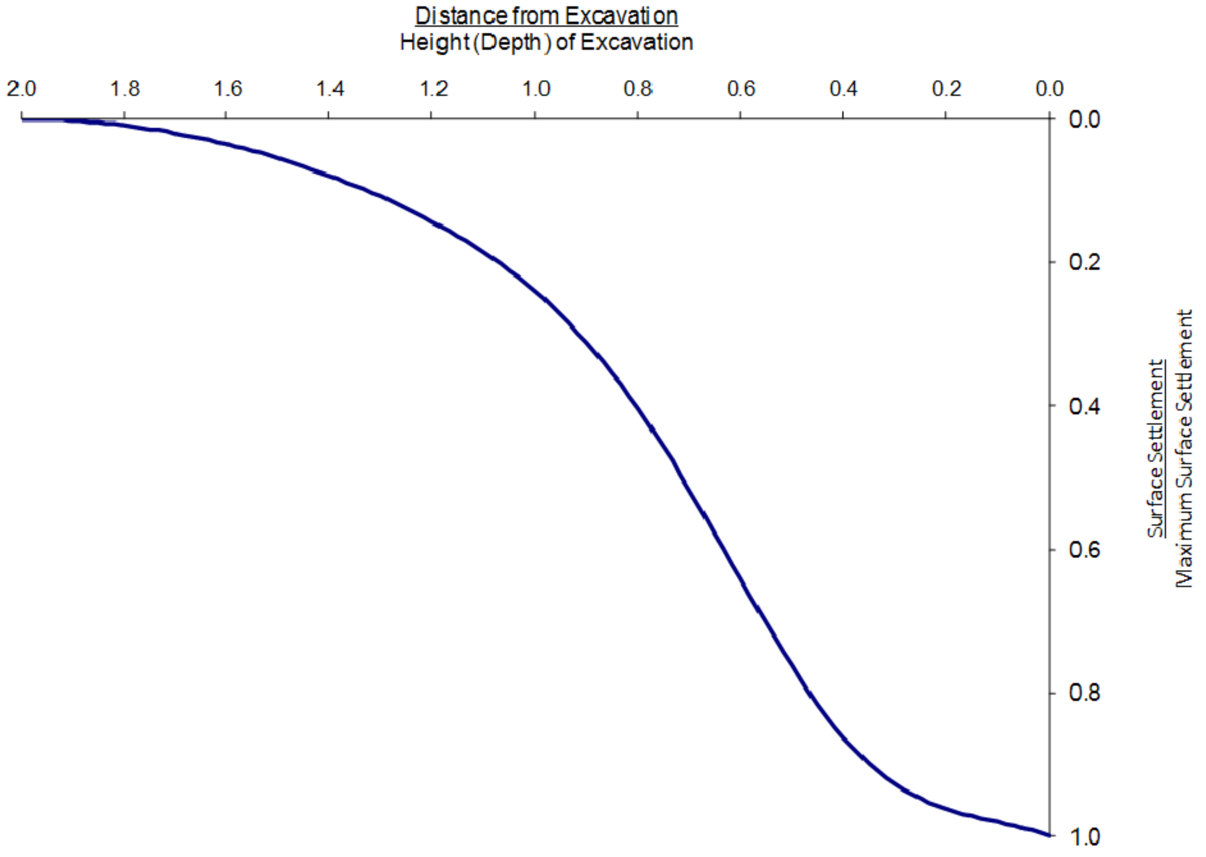
TITLE

MINIMUM LATERAL PRESSURES ON EXCAVATION SUPPORT SYSTEMS

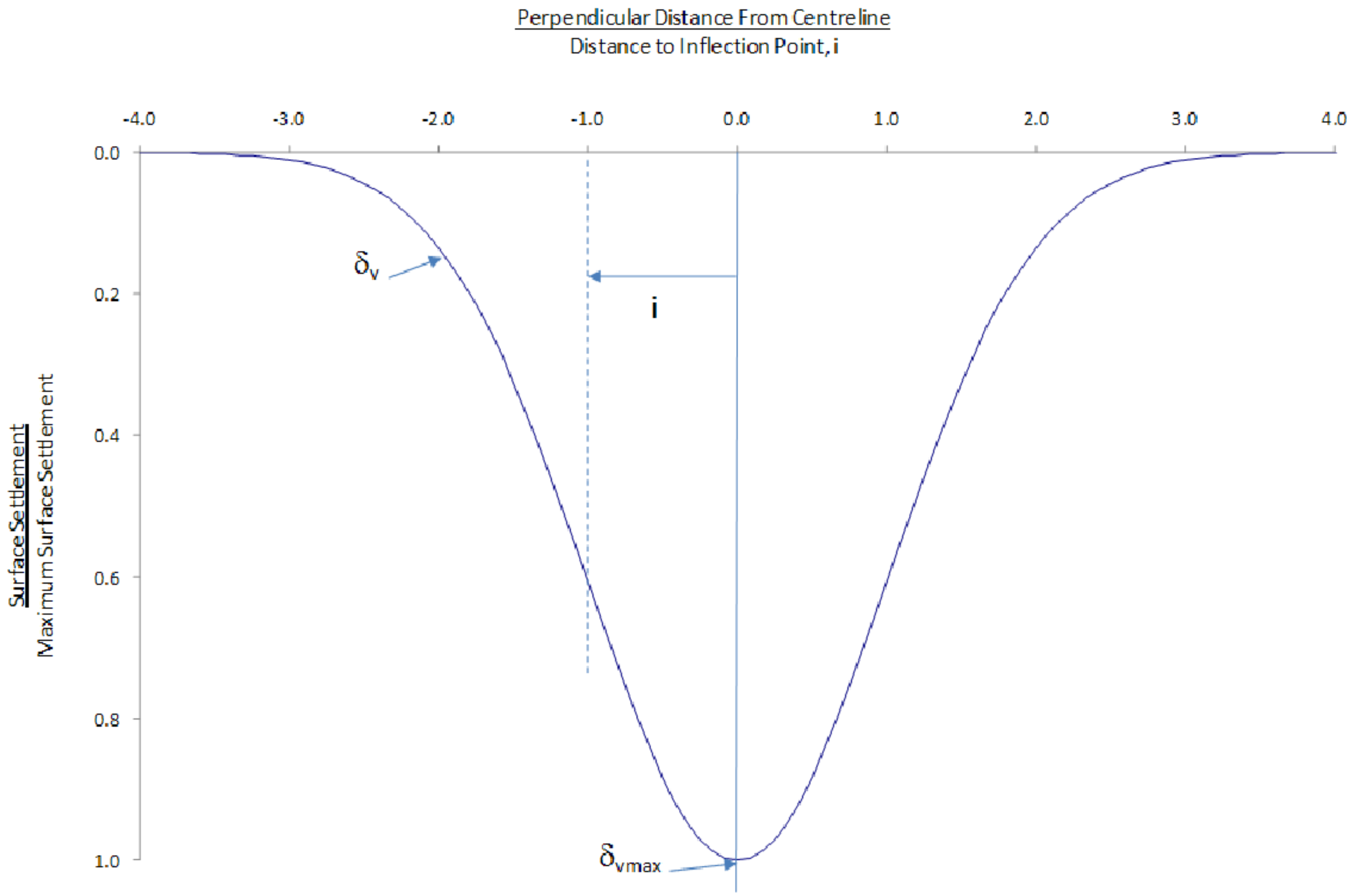
Golder Associates
WINDSOR, ONTARIO

PROJECT No	09-1140-W025		FILE No.	091140W025-R01006
			SCALE AS SHOWN	REV.
CADD	SJL	MAY 6/10		
CHECK				

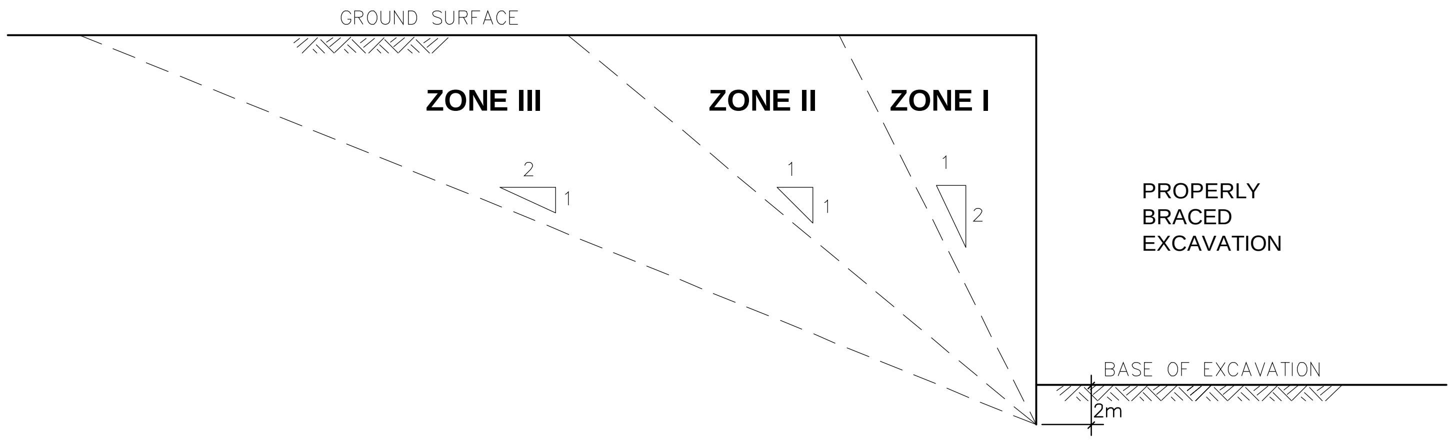
FIGURE 6



GROUND SURFACE DISPLACEMENTS FROM CUT AND COVER EXCAVATIONS



GROUND SURFACE DISPLACEMENTS FROM TUNNELING



NOTE

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PROJECT

STANTEC CONSULTING LTD.
PRINCE ROAD SEWER PHASE 9 OUTLET TO DETROIT RIVER
WINDSOR, ONTARIO

TITLE

GROUND DISPLACEMENTS FROM EXCAVATIONS AND TUNNELS

Golder Associates
WINDSOR, ONTARIO

PROJECT No 09–1140–W025
CADD SJL MAY 6/10
CHECK

FILE No. 091140W025–R01006
SCALE AS SHOWN REV.

FIGURE 7

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June 2011

SUPPLEMENTARY GEOTECHNICAL INVESTIGATION

Storm Sewer Outlet
Prince Road Sewer, Phase 9B
City of Windsor, Ontario

Submitted to:
Mr. Don Joudrey, P.Eng.
Stantec Consulting Ltd.
140 Ouellette Place, Suite 100
Windsor, Ontario
N8X 1L9

REPORT

Report Number: 09-1140-W025 Ph2000 R01

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June 6, 2011 Project No. 09-1140-W025 Ph2000 R01

Stantec Consulting Ltd.
140 Ouellette Place, Suite 100
Windsor, Ontario
N8X 1L9

Attention: Mr. Don Joudrey, P.Eng.

SUPPLEMENTARY GEOTECHNICAL INVESTIGATION
STORM SEWER OUTLET
PRINCE ROAD SEWER, PHASE 9B
CITY OF WINDSOR, ONTARIO

Dear Mr. Joudrey:

This report presents the results of a supplementary geotechnical investigation carried out for the design of the currently proposed Prince Road Storm Sewer Outlet Works (revised alignment), Phase 9B in the City of Windsor, Ontario. The approximate location of the site is shown on the Key Plan, Figure 1. The explorations and testing were carried out to supplement earlier work completed by Golder Associates Ltd. (Golder) for the Prince Road Sewer, Phase 9, as documented in the following report:

- Golder Associates Ltd. Report Number 09-1140-W025-R01 entitled "Prince Road Storm Sewer Outlet, Prince Road Sewer Phase 9, Outlet to Detroit River, City of Windsor, Ontario", dated May 2010.

The work described in this supplementary investigation was prompted by changes to the design alignment, location, and depth that have occurred since issuance of the report referenced above.

1.0 PROJECT DESCRIPTION

Golder previously carried out a geotechnical investigation for this project, the results of which were presented in Golder Report Number 09-1140-W025-R01 dated May 2010. In addition, Golder has performed environmental sampling and testing of sediments in McKee Creek, the results of which were reported in Golder Report Number 09-1140-W025-1000-R01 dated September 2010.

The project has changed since issuance of the above reports. The changes have included a new horizontal alignment of the Prince Road Sewer between the western end of Chappell Avenue and McKee Creek. The pumping station has also been deepened compared to the original design.

Based on recent drawings supplied to us, the proposed 2,400 millimetre diameter storm sewer will now be directed south from about MH 5R3611 at the western limit of Chappell Avenue (just prior to Russell Street), pass parallel to and be located just east of the Essex Terminal Railway (ETR) tracks up to MH 5R3610 (for a distance of about 65 metres) and then head west for about 45 metres where it will enter the new pumping station. From the pumping station the new outfall sewer will extend a further approximately 20 metres west to discharge in McKee Creek.

The invert of the proposed storm sewer is to be founded at about elevation 172.0 metres (or some 3.8 to 4.4 metres below existing grade) where it is to enter the new pumping station. Several configurations have been considered for the proposed pumping station. The first option considered included an essentially “L” shaped (about 9.3 metres in size) pumping station with a detached, approximately 4.4 metre diameter precast concrete oil/grit separator constructed adjacent to and east of the new pump station, with both of these founded at about elevation 166.6 metres. Therefore, the excavation bottom may then be some 11 metres below existing grade. The bottom of the oil/grit separator for this configuration could be founded at and/or slightly above the base of the new pump station. For constructability reasons, a second configuration was considered in which the pumping station and oil/grit separator are both included within a circular cofferdam with the base of these both near elevation 166.6 metres. The diameter of the circular cofferdam could be as much as 15 metres, depending on the final geometry and arrangement components.

2.0 TERMS OF REFERENCE

The purpose of this supplementary investigation was to determine the subsurface soil and groundwater conditions at the deepened pump station location and along the revised storm sewer outfall alignment. The subsurface information obtained together with project details supplied to Golder has been used to provide geotechnical engineering recommendations for the design of the currently proposed storm sewer outfall works.

The field work was carried out, and this report prepared, in general accordance with our proposal letter 09-1140-W025/A-L01, dated March 17, 2011. Authorization to proceed with the work was provided in the City of Windsor “revised” Purchase Order Number 0000009982 dated March 25, 2011.

3.0 INVESTIGATION PROCEDURES

The field work for this investigation was carried out on April 4 and 5, 2011, on which dates, three (3) boreholes were advanced at the site. The approximate locations of the current and relevant earlier boreholes drilled by Golder are shown on the appended Location Plan, Figure 1. The current boreholes were advanced to depths of about 8.2 and 20.3 metres below the current ground surface, using a truck mounted drilling rig supplied and operated by a specialist drilling contractor.

During the investigation, standard penetration testing and soil sampling was carried out at selected intervals of depth in the boreholes using standard 35 millimetres, inside-diameter, split spoon sampling equipment in accordance with the Standard Penetration Test (SPT) procedures (ASTM D1586). The Standard Penetration Test was conducted using an automatic hammer. In situ field vane shear strength testing was also carried out in the boreholes to estimate the undrained shear strength of the softer cohesive soils encountered. Dynamic cone penetration testing was also carried out adjacent to one of the boreholes to better define the compactness of the fine grained granular soils encountered. The soil samples obtained were examined in the field, placed in individually labelled containers and brought to our Windsor office for further examination and laboratory testing.

The soil stratigraphy encountered in the boreholes, as well as the results of field and laboratory testing, are shown in detail on the Record of Borehole sheets and on Figures 1, 2 and 3, following the text of this report.

The boreholes were monitored for groundwater seepage during and immediately following the drilling operations. The measured water levels are shown on the respective borehole logs. The boreholes were abandoned in conformance with current regulatory requirements.

Additionally, in conjunction with the geotechnical sampling procedures noted above, soil samples were obtained for the purpose of analytical chemistry testing as described in Section 5.0 and the results are discussed in Section 6.11 and presented in Appendix A.

The field work for this investigation was supervised throughout by experienced members of our geotechnical and environmental engineering staff who also located the boreholes in the field, obtained underground utility locates, directed the drilling and sampling operations, logged the boreholes, surveyed the boreholes and cared for the soil samples obtained.

The ground surface elevation at each of the borehole locations has been referenced to a temporary benchmark provided by Stantec Consulting Ltd. The benchmark is described as “the top of manhole MH 5C992, located in the intersection of Russell Street and Chappell Avenue”. The benchmark is understood to have an elevation of 176.078 metres referenced to geodetic datum.

Piezocone penetration tests (CPTs) were conducted along the route of the proposed sewer during previous phases of exploration and testing. Where necessary, shallow boreholes were advanced through the surface soils using solid stem augers or hollow stem augers to depths ranging from 1.2 to 3.1 metres below present grade to facilitate start of the CPTs. Two CPTs, CPT-5 and CPT-6, from previous explorations are relevant to this section of sewer.

The CPT is an in situ testing technique for site characterization studies. The CPT consists of a special cone tip equipped with electronic sensing elements to continuously measure tip resistance, local side friction on a steel sleeve behind the conical tip, and pore water pressure. It is pushed at a constant rate into the ground using a drill rig (ASTM D5778). A nearly continuous stratigraphic profile together with engineering properties, such as undrained shear strength, can be inferred from the results of the CPT.

The CPT equipment was advanced using the hydraulic ram system on the drill rig. The CPTs relevant to the section of sewer addressed in this report were advanced to depths ranging from about 15.3 to 23.8 metres below ground surface. Record of Cone Penetration Test results are included in Appendix B. Profiles of tip resistance, pore water pressure during pushing and sleeve-friction are presented on these records. Figure 3, following the text of this report, provides interpreted profiles of undrained shear strength of the clayey silt to silty clay soils as inferred from this testing.

4.0 SUBSURFACE CONDITIONS

4.1 General

The subsurface soil and groundwater conditions encountered in the boreholes drilled for this supplementary investigation are shown on the attached Record of Borehole sheets and on Figure 1. It should be noted that the soil boundaries indicated have generally been inferred from non-continuous sampling and observations of drilling resistance. The boundaries typically represent a transition from one soil type to another and are not intended to define exact planes of geological change. Further, the subsurface conditions are established only at the borehole locations and may vary between and beyond the borehole locations.

The subsurface conditions encountered in the recently completed boreholes drilled at the site generally consisted of some 1.5 to 3.7 metres of fill and organic materials and about 2.7 to 4.1 metres of loose to compact sand to silty sand overlying extensive deposits of soft to very stiff clayey silt to silty clay.

4.2 Fill and Organic Materials

Boreholes 101 and 102 were advanced on the west side of the ETR rail tracks in the Van De Hogen Group Inc. yard, southwest of Chappell Ave and encountered some 685 and 305 millimetres (mm) of grey crushed sand and gravel fill below the ground surface respectively. Two measured SPT ‘N’ values obtained from standard penetration testing carried out in the sand and gravel fill materials were 21 and 27 blows per 0.3 metres. The average water content of samples of the sand and gravel fill material samples was about 5 per cent.

Underlying the sand and gravel in boreholes 101 and 102, and below the ground surface in borehole 103, uncontrolled fill materials were encountered varying in composition from silty clay to silty sand with occasional to some gravel, pieces of concrete clay tile and slag. The fill materials extended to between about 1.5 and 3.0 metres below the ground surface at the borehole locations. Measured ‘N’ values obtained in the fill materials ranged from zero (weight of hammer) to 20 blows for 13 millimetre penetration. The measured water content of samples of the fill materials varied from about 10 to 46 per cent.

Underlying the fill materials in boreholes 101 and 102 some 0.4 to 0.8 metres of black organic clayey silt was encountered in one or more interbedded layers. Measured ‘N’ values obtained in the organic material ranged from 2 to 6 blows per 0.3 metres. The measured water content of samples of the organic material varied from about 41 to 65 per cent.

4.3 Fine Sand and Silty Sand

Between the layers of black organic clayey silt in borehole 101, and underlying the organic clayey silt in borehole 102 and the lower layer of organic soils in borehole 101, layers of fine grained granular soils, ranging in composition from fine sand to silty fine sand were encountered. These soils extended to depths of between about 4.2 and 7.0 metres below the existing grade at the borehole locations. On the basis of standard penetration and dynamic cone penetration test results, the fine grained granular soils are characteristically described as being in a loose to compact state. The measured water content of samples of the sands varied between about 18 to 36 per cent.

An approximately 0.4 metre thick layer of silty sand was encountered at depth in borehole 101. This soil had a single measured N value of 6 blows per 0.3 metre and a water content of about 11 per cent.

The results of laboratory grain size distribution analyses performed on a sample of the fine sand recovered in borehole 103 are presented graphically on Figure 2.

4.4 Clayey Silt to Silty Clay

Underlying the sand and silty sand layers, the boreholes encountered extensive deposits of soft to very stiff grey clayey silt to silty clay containing occasional fine sand seams/partings at depth. Measured ‘N’ values obtained in the silty clay typically ranged from zero (weight of hammer) to 2 blows per 0.3 metres down to about elevation 160.4 metres (or about 16 metres below grade). The measured N values obtained in borehole 101 below this elevation typically ranged from 6 to 7 blows per 0.3 metres. In situ field vane shear testing carried out in the boreholes indicated the grey clayey silt to silty clay, down to about elevation 160.4 metres, to have an undrained shear strength ranging from about 16 to 55 kilopascals (kPa) with an average of about 29 kPa. Between about elevations 156.3 and 160.4 metres the measured undrained shear strength of these soils varied between about 64 and greater than 96 kPa with an average of about 85 kPa. Interpreted undrained shear strength values at exploration and testing locations relevant to this section of the project are illustrated on Figure 3. The water content of samples of the grey silty clay obtained varied from about 21 to 51 per cent.

Atterberg limit determinations carried out on a sample of grey silty clay obtained in borehole 101 yielded liquid and plastic limits of about 41 and 19 per cent, respectively, with a plasticity index of about 22. The results of laboratory grain size distribution analyses performed on a sample of grey silty clay obtained in borehole 101 are presented graphically on Figure 4.

4.5 Groundwater Conditions

Groundwater seepage into boreholes 101, 102 and 103 was observed during drilling emanating from the fill materials and sands between about elevations 171.4 and 174.8 metres (or some 1.5 to 4.6 metres below existing grade). The water level measured in the temporary standpipe installed in borehole 103 about 2 hours after completion of drilling was at about elevation 174.6 metres or some 1.2 metres below grade, consistent with the nearby McKee Creek water surface elevation. Groundwater elevations in the materials above about elevation 165 m will likely reflect the surface elevation of the Detroit River which typically varies between 174.5 and 175.5 metres. Groundwater conditions along the project site and as summarized above are influenced by several factors summarized below:

- During drilling, the low permeability of the cohesive clayey silt to silty clay will have inhibited seepage of groundwater into the borehole and, therefore, observations at the time of drilling will not be representative of stable pore water pressures at the borehole location.
- Where granular soils or fills overly low permeability cohesive clayey silt to silty clay, groundwater will be largely influenced by the water level of the nearby Detroit River, or by the difference between infiltration of storm water (precipitation) and seepage into the underlying cohesive soils.

Based on the available data, it is anticipated that the soils typically remain saturated below about elevation 175.0 metres from near the intersection of Chappell Avenue and Russell Street to McKee Creek. It should be noted that groundwater levels (and pore water pressures within the cohesive soils) will vary seasonally and with precipitation or spring thaw events and, therefore, groundwater conditions at other times may vary from those described in this report

5.0 ENVIRONMENTAL SOIL SAMPLING AND OBSERVATIONS

Concurrent with the geotechnical investigation, environmental soil samples were collected from the three boreholes (BH-101 through BH-103) to assess the chemical quality of the subsurface soil and fill materials at the general location of the proposed sewer line, to identify potential environmental conditions which may affect the anticipated construction activities and to assist in the evaluation of off-Site management and disposal alternatives for any excess soil generated during the anticipated construction activities.

Soil samples were logged in the field for observations of major soil types and evidence of chemical impacts (e.g., odour, staining). Selected samples were subsequently placed in 1-litre sealable plastic bags for headspace combustible vapour testing using an RKI Eagle 101 combustible vapour detector (RKI Eagle), calibrated to a hexane standard and configured to eliminate methane. Concentrations were recorded as parts per million (ppm) by volume on the Record of Borehole sheets, provided in Appendix A. Separate sub-samples were retained in glass jars, supplied by the analytical laboratory, for possible chemical analysis. These samples were kept on ice until they were brought to our office and kept refrigerated prior to submission to the analytical laboratory. Selected soil samples submitted for chemical analysis were placed in a cooler with ice and shipped under chain-of-custody procedures to AGAT Laboratories (AGAT) in Mississauga, Ontario, for chemical analysis.

The samples submitted for laboratory analysis were selected based on visual and/or olfactory evidence of chemical impact, headspace combustible vapour concentrations, borehole location and/or sample depth. A total of six soil samples were collected from the three boreholes and submitted for metals/inorganics, benzene, toluene, ethylbenzene and xylenes (BTEX) and petroleum hydrocarbons (PH F1-F4) fractions. Three of the collected samples were also analyzed for polyaromatic hydrocarbons (PAHs) and two samples were analyzed for polychlorinated biphenyls (PCBs). In addition, two composite soil samples were collected from the fill and native materials encountered in the three boreholes and submitted for chemical analysis of metals, BTEX, PCBs and benzo(a)pyrene (BaP) using Toxicity characteristic leaching procedure (TCLP) to characterize the materials for potential off-Site disposal.

Slight to strong odours were noted in the fill materials encountered in borehole BH-101. The measured headspace combustible vapour concentrations of the samples collected from boreholes BH-101 through BH-103 ranged from below detection to 35 ppm. The measured combustible vapour concentrations in the headspace of the borehole soil samples are recorded on the Record of Borehole sheets (Appendix A).

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 General

This section of the report presents our interpretation of the factual information obtained from the explorations and testing and is intended only for use by the design engineer. Where comments are made on construction, they are provided only in order to highlight aspects of construction which could potentially affect the design of the project. Contractors bidding on or undertaking any work at the site should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction and make their own interpretation of the factual data as it affects their proposed construction techniques, schedule, equipment capabilities, costs, sequencing and the like.

As indicated previously, it is proposed to construct a 2,400 millimetre diameter storm sewer which will be directed south from about MH 5R3611 at the western limit of Chappell Avenue (just prior to Russell Street), pass parallel to and be located about 9 metres east of the ETR tracks (centreline to centreline) to MH 5R3610 (for a distance of about 65 metres) and then head west for about 45 metres, beneath the ETR tracks where it will enter the new pumping station. From here the new outfall sewer will extend a further approximately 20 metres west to discharge in McKee Creek.

The invert of the proposed storm sewer is to be founded at about elevation 172.0 metres (or some 3.8 to 4.4 metres below existing grade). The bottom of the excavation(s) made for the new pump station and oil/grit separator may be some 11 metres below existing grade. The excavation for construction of the pumping station and oil/grit separator may be as large as 15 metre diameter if the work is carried out within one circular excavation, depending on the final geometry and arrangement components.

6.2 Sewer Construction Using Cut and Cover Installation Methods

It is understood that the new gravity storm sewer, between McKee Creek and the tunnel exit shaft on Chappell Avenue (referred to as being between approximately Stations 0+000 and 0+192 in our previous report) will be installed using conventional cut and cover techniques. It is further understood that where the new storm sewer passes below the Essex Terminal Rail, it will also be installed using cut and cover techniques.

6.2.1 Sewer Trench Excavations

Construction of the proposed storm sewer along the revised alignment will require excavations of between about 4.0 and 4.6 metres below the existing ground surface. It is recommended that the existing composite pavement on Chappell Avenue be saw-cut before construction commences to facilitate removal of the existing pavement structure and to limit disturbance to those sections of the roadway located away from the utility works.

Where fill and granular materials are encountered above the prevailing groundwater level, these soils may be classified as “Type 3” under the Occupational Health and Safety Act (OHSA). Native undisturbed silty clay and clayey silt soils may also be classified as “Type 3” soils, where these are encountered above the groundwater level. Below the groundwater level, the granular soils are expected to flow if not completely supported and/or dewatered prior to excavation. Further, the clayey silt to silty clay soils are expected to be relative sensitive to disturbance and, depending on the depth of the excavation and location along the alignment, may be characteristic of “squeezing” ground. Therefore, soils removed from below the anticipated groundwater level (fully saturated soils) should be classified as “Type 4” soils in accordance with the OHSA.

Based on the results of the current and earlier explorations and testing completed for this project, the base of the sewer excavations are expected to transition from native grey clayey silt to silty clay near the proposed exit tunnel (on Chappell Avenue approximately midway between Russell Street and Sandwich Street) to very loose to loose grey sand at the western limit of the work. This can be clearly viewed on the simplified sub-surface profile on Figure 1. Localized areas such as near our boreholes 101 and 102 may encounter some organic matter and/or organic clayey silt at the anticipated founding level. In these areas some limited deepening of the sewer founding level will be required to ensure that the new service is founded on competent native ground. The transition from the cohesive to granular founding soils may be gradual and may occur between approximately our earlier borehole 3 and the location of the proposed tunnel exit shaft. Design and construction for the excavations in this area should plan on both of these conditions being present along the sewer alignment.

As stated previously, the sewer excavations west of Chappell Avenue are expected to extend below the groundwater level in this area. Uncontrolled excavation below the groundwater level will result in caving of the excavation side slopes and flowing of granular soils in the trench sides. To facilitate construction of the sewers, it will be necessary to provide some form of positive groundwater control and/or full support of the excavation walls (e.g., driven sheeting) prior to excavating in this area. Given the proximity of McKee Creek and the Detroit River and the local soil conditions, it is anticipated that dewatering for the pumping station and sewer excavation between McKee Creek and Russell Street using well points or eductors may not be effective. Use of deep wells will likely also not be effective due to the limited depth of granular soils below the base of the excavation. Therefore, it is recommended that groundwater control for the pump station and cut and cover sewer excavation between McKee Creek and Russell Street be accomplished by cutting off groundwater. For the cut and cover sewer excavations, it may be practicable to utilize continuous interlocking steel sheet piling extending sufficiently into the underlying cohesive soils. In areas that include saturated surficial granular soils or fill material it may be feasible to excavate shallow interceptor trenches into the underlying cohesive soils and then using properly filtered sumps and pumps to control water that might otherwise enter the excavations. It may also be necessary to blanket such cut slopes with a free draining granular material to minimize loss of ground.

It is recommended that a public dig be carried out during the tender stage to enable prospective contractors to view the soil, and particularly the groundwater conditions along the rail corridor at and near McKee Creek for themselves. This is so the individual contractors may assess the dewatering and ground support requirements as part of their bid submission. The location and depth of the test pits should cover the full extent of the cut and cover excavation works. The test pits should not be completed in areas that may jeopardize the stability of the future sewer excavations and should be backfilled with unshrinkable fill.

The results of field vane shear testing carried out in the current and earlier boreholes and the results of Cone Penetration Testing (CPT) completed in the previous boreholes indicate that at and just below the anticipated pipe founding level, the native cohesive soils have an undrained shear strength typically ranging between about 15 and 20 kilopascals. The factor of safety calculated against basal instability for excavations can be assessed using the following equations:

$$N_s = (\gamma H)/S_u$$

$$FS = \frac{N_b}{N_s}$$

where:

FS = factor of safety

S_u = undrained shear strength (kPa)

N_s = stability number

N_b = bearing capacity factor

γ = total unit weight (kN/m^3)

H = depth of excavation (m)

The table below, summarizes assessed base stability factors of safety for the excavations along the cut and cover excavation areas.

Summary of Base Stability for Cut and Cover Construction, McKee Creek to Tunnel Exit Shaft.

Location	Approximate Depth of Excavation (m)	Approximate Sewer Invert Elevation (m)	Approximate S_U (kPa)	Stability Number	Calculated Factor of Safety
Near Proposed Tunnel Shaft on Chappell Avenue (approx midway between Russell Street and Sandwich Street)	6.0	172.2	20	6.3	1.2
At MH 5R3611	4.2	172.1	20	4.4	1.6
At MH 5R3610	4.3	172.0	20	4.5	1.6
Essex Terminal Rail Crossings	4.3	172.0	20	4.5	1.6
Near Pump Station	4.4	171.9	15	6.2	1.2

Note: Size of the excavation was assumed, width = 3 metres and length = more than 3 times the excavation width.

The factor of safety calculated against basal instability ranges from about 1.2 to 1.6. Where the factor of safety is less than 1.5 the potential for bottom instability exists and heave of the excavation base and excessive movement of the ground surrounding the excavation should be anticipated. To locally increase the factor of safety to an acceptable level it is recommended that the ground surrounding the excavation be unloaded and/or the depth of penetration of the support system in this area be extended below the base of the excavation. The unloading should extend either side of the trench a distance greater than 75 per cent of the excavation depth and, in the case of the sewer lengths between MH 5R3611 and the proposed tunnel exit shaft on Chappell Avenue (approximately midway between Russell Street and Sandwich Street), this unloading should be between 1 and 1.5 metres deep to improve the base stability conditions. Based on the depth of fill materials, the depth of the existing sewer, and past construction experience on prior sections of the Prince Road Sewer (constructed in the 1970s and 1980s) it is likely that the area adjacent to the excavations made for the existing sewer were similarly off-loaded to minimize the potential for excavation instability. In the area of the proposed tunnel exit shaft and the pump station and outfall structure, the base stability factor of safety indicates that it will be necessary to have the excavation support system penetrate well below the excavation base. Additional discussions and recommendations related to support systems penetration depth are outlined in subsequent sections of this report.

The use of interlocking steel sheet piling to control the water influx and to maintain the stability of the excavation is generally considered to be the preferred approach for the construction of the section of new storm sewer to be installed parallel to and about 9 metres to the east of the existing ETR rail lines (i.e., between about MH's 5R3610 and 5R3611). Because of the relatively soft ground and limited space for unloading of the ground adjacent to the ETR, the relatively soft ground conditions and proximity of the ETR will not be conducive to use of trench box or slide rail excavation support systems as displacements from such systems will likely not be controlled within acceptable limits. Particular attention and care will also be required for the portion of the new storm sewer to be installed above an existing 1,950 millimetre diameter concrete sanitary sewer located approximately midway between the ETR tracks and the new pumping station and oil/grit separator area. Based on drawings and project information provided to Golder the obvert of the existing sewer is located at about elevation 170.9 metres or about 1.1 metres below the invert of the new storm sewer. Close attention will be required to avoid driving the interlocking sheet piling in this area too deep which could potentially cause damage to the existing service. In view of the preceding, vacuum well points may also be necessary as it may not be possible to drive the sheeting sufficiently deep to ensure they penetrate into the clayey silt and silty clay to effectively cut off the water inflow. Further, sheet pile driving could damage the existing sewer and, in this area, it will also likely be necessary to off-load the ground surrounding the plan intersection of these two sewers to permit safe and stable excavations where the excavation support can not penetrate sufficiently below the excavation bottom due to the presence of the existing sewer.

Regardless of the support system used, the work should be carried out quickly and the length of longitudinal open sections of the trench(s) should be kept to a minimum. Where existing services are exposed during the excavation, suitable temporary or permanent support of these services should be provided consistent with the requirements of the respective utility company.

6.2.2 Pipe Bedding

The bedding material for the new sewer pipe should consist of an approved granular material, consistent with the type and class of pipe to be used. Granular 'A' may be an appropriate bedding material for the site. The bedding should extend from about 150 millimetres below the sewer pipe to at least 300 millimetres above the pipe. The pipe bedding should be uniformly compacted to 95 per cent of the standard Proctor maximum dry density. Hand tamping around the pipe may be required to ensure that no voids are present below the spring line of the pipe. It is also important to provide a well-compacted granular bedding within the approach zone of the pipe(s) at the manholes. Difficulties may be encountered when attempting to adequately compact granular pipe bedding within the bottom of the trench made in the soft to firm silty clay and/or loose sand, particularly if the base of the trench is wet. Consideration could also be given to the use of a graded clear stone or crushed stone bedding material (crushed, washed, and graded aggregate with a maximum particle dimension of about 10 mm) placed up to the spring line of the pipe. It is recommended that any such clear stone or aggregate bedding materials be fully enveloped in a non-woven geotextile meeting the requirements of OPSS 1860 for Type II geotextile to minimize the potential for migration of granular trench backfill or native soils into the stone material.

6.2.3 Backfill of Trenches

The native cohesive soils encountered at the site are not considered to be suitable for backfill. The water content of the native cohesive soils is expected to be above the optimum water content for compaction purposes. The near surface granular soils are considered acceptable for reuse as general trench backfill provided that the water content is adequately controlled. Where these materials are encountered below the water table, they will be in a saturated condition and will, therefore, be too wet for immediate handling and effective compaction. However, the granular materials should be relatively free draining and if stockpiled for a period of time, the water content should reduce to a value appropriate for mechanical compaction provided the materials are protected from rainfall and other water sources.

Provided that the placement water content of the native materials is within about 4 per cent of the optimum water content for compaction, the trench backfill material should be compacted to at least 95 per cent of standard Proctor maximum dry density. Materials with water contents in excess of about 4 per cent of the optimum water content for compaction should be dried prior to use as adequate compaction control will not be achievable with such materials. Material that is dry of the optimum water content should be wetted during compaction to minimize post construction settlement.

Where imported materials are necessary to backfill excavations an approved borrow material such OPSS Granular A or B or an appropriate unshrinkable fill could be utilized. Unshrinkable fill is considered a manufactured fill composed of sand, Portland cement and water with an unconfined compressive strength no greater than 0.7 MPa, a slump of 150 to 200 millimetres, and an air content no greater than 5 per cent. Granular trench backfill should be placed in loose lifts not exceeding 200 millimetres in thickness. Where the upper one metre of the trench backfill forms a roadway subgrade, it should be uniformly compacted to at least 98 per cent of standard Proctor maximum dry density. Topsoil, rubble, organic and any other deleterious material should not be used in the backfill and disposed of according to regulatory requirements. All oversized cobbles and boulders should be removed from the backfill. Backfilling operations during cold weather should prohibit inclusion of frozen lumps of material, snow and ice.

In areas where surface settlement or lateral movement are of concern, such as beneath roadways and within the zone of influence of the ETR rail tracks, approved, well compacted granular backfill or unshrinkable fill material should be used for backfill. For the section of sewer immediately beneath the Essex Terminal Railway tracks unshrinkable fill should be considered to facilitate rapid sewer construction and reinstatement of the tracks.

If unshrinkable fill is not used, normal post-construction settlement of the compacted trench backfill should be anticipated with the majority of such settlement taking place within about 6 months following the completion of trench backfilling operations. This settlement will be reflected by some subsidence of the ground surface and may require local repairs to overlying pavements. Settlement may be compensated for, where necessary, by placing additional granular material, placing an added thickness of binder asphalt or by padding, prior to placement of the hot mix asphalt surface. It is recommended that the final surface course asphalt not be placed over the binder for at least 12 months after construction, if possible.

6.3 Protection of Existing Structures and Utilities

It is recommended that the alignment and depths of existing utilities be checked relative to the proposed sewer trench(s). Figure 5 illustrates typical ground displacement patterns adjacent to supported excavations that may be used for preliminary design and an initial assessment of the potential effects of the work on adjacent facilities. Figure 5 also illustrates three different zones of displacement that may be used to facilitate design and planning. Zone 1, generally defined by a 1 horizontal to 2 vertical slope, projected up from a point 2 metres below the base of the excavation, is where the most severe ground displacements will occur. If structure foundations or utilities fall within this zone, a detailed examination of possible displacements and their effects should be undertaken and protection measures included in the design. Protection could include such measures such as mandatory use of a relatively stiff shoring system installed prior to excavation (e.g., heavy steel sheet piles with close vertical and horizontal spacing of internal braces) or some form of underpinning. Reliance upon underpinning should be considered carefully since some forms of underpinning may cause greater displacements and damage than a carefully designed and constructed excavation support system. Further, ground displacements occurring beyond the underpinning may induce damage at the junction between underpinned and non-underpinned sections of the facility.

Displacements occurring in Zone II, shown on Figure 5, are generally less severe than those in Zone I; however, the magnitude may still be sufficient to cause unacceptable displacements and/or damage to adjacent facilities. As with Zone I, any facilities falling within this zone should be examined in greater detail to ascertain their sensitivity to ground displacements. The pattern of ground surface displacements illustrated in Figure 5 may be used in conjunction with the three zones also indicated on this figure to provide a preliminary indication of the vertical displacements below the ground surface. Vertical and lateral displacements below the ground surface will generally diminish to negligible values close to the limit indicated by the outer boundary of Zone III. However, it is noted that lateral displacements may be at their maximum value at a depth of about 2/3 of the excavation depth from the ground surface, depending on the type of excavation support system in use. Because of the complexities involved in assessing ground displacement patterns and their effects on neighbouring facilities, it is recommended that this office be consulted should any particularly sensitive facilities fall within the aforementioned Zones I or II.

A number of existing utility lines may cross the proposed alignment. Where existing services are exposed during the excavation, suitable temporary or permanent support of these services should be provided consistent with the requirements of the respective utility company. It would also be prudent to provide suitable protective measures against vibrations generated by sheet pile driving or compaction equipment and to minimizing its impact on the adjacent utilities and structures. In general, it is recommended that a preconstruction condition survey of adjacent structures and utilities be undertaken. Such preconstruction condition surveys can assist in determining the degree to which construction activities may affect these structures and can provide a baseline against which any claims of damage can be compared.

It should be noted that installation of excavation support might be undertaken using vibratory pile driving equipment. The sensitivity of nearby structures and utilities to pile-driving-induced vibrations should be examined in detail. In general, it is recommended that vibration levels not exceed a peak particle velocity approximately 12 mm/second (resultant of three orthogonal directions). Further, even if peak particle velocities are below this threshold value, vibrations can also cause densification of the relatively loose and saturated granular soils in the vicinity of the new sewer alignment. Any settlement sensitive structures or utilities within approximately 3 to 6 metres of the location of vibratory sheet pile driving should be evaluated in detail and protected, if necessary, or alternative means (non-vibratory driving) of sheet pile installation should be used.

In general, where sheet piles are installed near displacement sensitive structures, utilities, or near the ETR, they should not be removed following excavation and backfilling. If slide rail or trench box shoring systems are used outside of such areas, backfill should be placed as the shoring is removed to assist in filling the space and supporting the soils previously occupied by the trench support. Otherwise, excessive displacements may occur.

6.4 Road Rehabilitation

It is understood that the portion of Chappell Avenue disturbed by sewer construction will be restored to a condition resembling the original condition using a flexible pavement. Prior to commencing pavement construction and/or reconstruction, the existing fill and otherwise deleterious materials, should be removed from within the limits of the proposed pavement areas. The exposed subgrade should subsequently be heavily proofrolled with a non-vibratory steel wheel roller under the direction of the geotechnical engineer. Any excessively softened areas identified during this operation should be subexcavated and backfilled with an approved granular material and be uniformly compacted to at least 98 per cent of standard Proctor maximum dry density. The Granular road base materials should be uniformly compacted to 100 per cent of standard Proctor maximum dry density.

Asphaltic concrete pavement materials should comprise both binder and surface course layers, and be produced and placed in accordance with OPSS requirements. In order to minimize the inevitable effects of trench settlement, it is recommended that the placement of the asphaltic concrete surface course be delayed at least one year following placement of the binder course.

6.5 Pump Station and Precast Concrete Oil/Grit Separator Excavation

The results of the current borehole 101 and relevant earlier explorations in the immediate area indicate that, at the projected founding levels, the soils will chiefly comprise soft to firm grey silty clay. The grey silty clay extends to the 20.3 metre depth investigated in borehole 101 and occasionally contains layers / seams of fine grained granular soils. Other explorations in the general area also indicate that the silty clay extends to about 24 metres below grade and is underlain by some 4 metres of loose to very dense fine grained granular soils overlying bedrock.

It is anticipated that, because of the unloading caused by excavation, bearing capacity and settlement will not govern design of the pump chamber and oil/grit separator structures. However, if bearing pressures are required for design purposes, preliminary design of the foundations for these structures may be based on a geotechnical reaction at Serviceability Limit States (SLS) of 35 kilopascals and factored geotechnical resistance at Ultimate

Limit States (ULS) of 50 kilopascals. Displacement performance of these structures will likely be governed by the condition of the subgrade during and after excavation.

The structural design of the pump station and oil/grit separator structures should be based on a soil total unit weight of 21 kN/m^3 where the native and backfill soils are above the groundwater level, a buoyant unit weight of 11.2 kN/m^3 for soils or backfill below the groundwater level, and a lateral earth pressure coefficient of 0.5. The structures should also be checked to ensure that they are of sufficient weight to withstand buoyancy corresponding to a water level at or above the ground surface, consistent with design flood conditions. For conditions in which the pumping station or oil/grit separator structures will be unwatered during initial construction and later maintenance, it is recommended that the structures be designed with a factor of safety of 1.1 against buoyancy considering only the dead weight of the structure and a groundwater level equivalent to the ground surface elevation at the structure location. If sufficient shear connection can be established between the permanent and temporary excavation support structures, consideration of the dead weight of the temporary excavation support may also assist with optimizing the design of the permanent works.

The silty clay founding soils are considered highly susceptible to disturbance, especially in the presence of water. During the last 0.5 metres of excavation, the soils should be excavated using an excavator or clam-shell bucket with a smooth cutting edge (plate covering teeth) to minimize creation of gouges that will promote softening and disturbance of the soils. Provided all softened and loosened materials are removed prior to placing foundation and excavation base slab concrete, settlement of the pumping station and oil/grit separator structures is expected to be within normal construction tolerances.

For excavations made for the pump station and oil/grit separator structures, the stability of the excavation bottom will be governed by the undrained shear strength of the low to intermediate plasticity cohesive soils. The stability of the low to intermediate plasticity silty clay can be assessed using the method previously described in Section 6.2.1. Based on the anticipated shape, size and founding level of the structures and available soils information, the calculated base stability factors of safety for the pump station and oil/grit separator structures are both less than unity. This indicates that successful design and construction of the planned pump station and oil/grit separator will require special measures to be undertaken.

Where the factor of safety is less than about 1.3 to 1.5 the potential for bottom instability exists and heave of the excavation base and excessive movement of the ground surrounding the excavation should be anticipated. These low factors of safety will likely be observed as:

- Squeezing of cohesive soils through openings in support systems (e.g., the “eye” through which the sewer pipe may penetrate the excavation support system, gaps between sheet piles or lagging, gaps within secant pile walls);
- Excessive ground displacements surrounding the excavation; and
- Base instability and excessive deformation of excavation support systems.

To increase the factors of safety to an acceptable condition for these excavations it is recommended that the ground surrounding the excavation be unloaded to the extent practicable (likely on the order of 2 metres) and the depth of penetration of the support system be extended well below the base of the excavation. Unloading, achieved by excavation and removal of fill and earth materials, should extend away from all sides of the excavations a distance greater than 75 per cent of the excavation depth. It is recommended that the excavation support systems also extend to a tip penetration depth equal to at least 50% of the full excavation depth (as measured from the original ground surface rather than the surface after unloading) beyond the excavation bottom. Extending the penetration of the support systems to these depths should assist in minimizing ground displacements and increase the overall stability of the excavation by taking advantage of the greater strength of the soils below the excavation base. In general, it is also recommended that the excavation depth and plan dimensions be reduced to the extent possible.

To construct the pump station and oil/grit separator excavations it will likely be necessary to install the excavation support system prior to excavation by:

- excavating underwater below approximately elevation 171 metres (assuming a water level at about or above elevation 174.5 metres) using clam-shell bucket equipment or other suitable method;
- installing bracing at intermediate levels during excavation (this may be facilitated using prefabricated bracing sets installed underwater);
- place a concrete base slab on the order of 1.0 metres thick underwater using tremie placement techniques; and
- removing the water to continue construction in the dry.

The pump station and oil/grit separator could be constructed within a circular cofferdam(s) built using secant pile wall construction techniques. The secant piles (drilled and cast-in-place concrete shafts that overlap) can form a ring around the excavation and, by virtue of ring-compression stresses, may not require intermediate braces. While driven sheet piles arranged as a circular cofferdam might also be suitable for support of this excavation the intermediate levels of support (ring beams) may interfere with excavation and cleaning of the undulating sheet pile perimeter for suitable contact with the base slab may be difficult. In general, such ring-shaped shoring systems also require a cap beam to assure integral ring behaviour of the shoring.

The tremie-placed base slab should act as the lowest strut level and will also act to resist upward pressures caused by the tendency for the soils to squeeze inward and upward from at and below the excavation base elevation. Therefore, it may be necessary to reinforce this base slab against uplift pressure. For preliminary purposes, an upward pressure of about 50 kPa may be used for design of the base slab. The final design pressure will depend on the degree to which compression forces and shear connections to the perimeter wall system can assist in uplift resistance.

If a secant pile wall is chosen for support of this excavation, drilling of the secant piles using open-hole methods should be clearly prohibited by the contract documents. In addition, it will not be sufficient to drill the secant pile holes using only a temporary casing since the clayey silt and silty clay will squeeze toward the bottom of the casing, disturbing the bottom of the secant piles and, potentially result in poor performance of the excavation support system and permanent works. Any secant piles should be drilled using a temporary casing, at least to penetrate through the upper fill, sand, silt, and organic soils, and properly designed, controlled-density slurry. The slurry should be designed to suspend the cut soil particles and facilitate their removal from the excavated hole. Prior to concrete placement, the bottom of each secant pile should be checked for disturbed materials or soils that have settled out of suspension. It may be necessary, depending on the contractors selected methods and materials, to re-circulate clean slurry to remove such materials.

6.6 Lateral Earth Pressures for Design of Excavation Support

An earth pressure diagram for the preliminary design of the temporary shoring systems is shown on Figure 6. The earth pressures on the shoring will depend on the structural stiffness of the retaining system and the earth pressures provided on Figure 6 is based on general ranges for steel sheet piles and for secant pile walls. Final design parameters and earth pressures should be reviewed and revised as necessary once the conceptual support system(s) are chosen and preliminary designs based on these diagrams are completed. The pressure diagram illustrated on Figure 6 represents net pressure, where below the base of the excavation, passive pressure resistance has been taken into account. For the purposes of preliminary design, however, it should not be assumed that the excavation support is fixed at a depth of 1.5 times the excavation depth. At and below this point, it is expected that significant displacement of flexible retaining structures may be required in order to develop passive resistance. Surcharges (e.g., excavated soils) within a distance equal to 1.5 times the excavation depth should not be permitted as surcharge pressures will compromise excavation stability.

6.7 Ground Displacements Associated with Excavations

Construction of the deep excavations for the sewer trench, pump station and oil/grit separator will induce displacements in the shoring systems, as well as, in the surrounding ground. Displacements of the shoring system and surrounding ground will depend on a number of factors including:

- Base stability
- Soil type
- Consolidation of loose sands and soft clays
- Wall type
    - Sheet piles
    - Soldier piles and lagging
    - Soil mixed walls
    - Secant / tangent piles
    - Concrete diaphragm walls
- Structural stiffness of wall
- Horizontal and vertical spacing of supports
- Construction procedures & workmanship
- Horizontal support types
    - Rakers
    - Struts
    - Anchors

Without taking additional precautionary measures during construction, vertical ground surface displacements could be on the order of 1% to 2% of the excavation depth (H) for the sewer trench excavations supported by steel sheet piles, and about one-quarter to one-half of this amount if a secant pile wall system is used for support. It is anticipated that the maximum displacement may occur at a distance of about 0.3H to 0.5H from the back of the wall and diminish toward little or no displacement at a distance of about 1.5H to 2H. It is further anticipated that the excavation will remain open for a period of less than about 6 months and, therefore, consolidation settlements induced by water pressure changes within the soft silty clay should be limited. Should the excavation remain open for a greater period of time, consolidation settlements should be anticipated and could be on the order of 100 to 200 millimetres. Lateral displacements will be similar in magnitude as for the vertical settlements with the maximum lateral movement occurring near the middle or the bottom of the support system wall. Horizontal movements at the ground surface may be about half of the vertical movements.

If base stability is maintained with a factor of safety of about 1.3 or more, the displacements may be on the order of half the values estimated above. Maintaining base stability factor of safety at 1.3 or better will require use of underwater construction techniques, penetration of support systems well below the base of the excavation, and placement of relatively thick base slabs using tremie techniques as discussed in this report.

The effect of these displacements on surrounding utilities and roadways should be examined in detail. If the movements are found to be intolerable, additional measures will have to be undertaken during design and construction to limit the potential for ground and structure displacement.

6.8 Instrumentation and Monitoring

Instrumentation and monitoring of the excavation work should be completed to:

- assist with maintaining safety for construction crews and the public;
- ascertain whether design assumptions are appropriate for actual field conditions;
- assist with developing design and construction modifications if necessary to suit field conditions;
- avoid unacceptable displacements of adjacent/overlying structural elements, facilities, or other features;
- assist in assuring construction is carried out to an acceptable degree of workmanship;
- assist with defence against claims for damages by third parties; and
- to evaluate conditions or mechanisms leading to poor performance if such should occur.

Recommendations are provided below with respect to instrumentation and monitoring for this project.

Lateral displacement of the shoring parallel to the ETR should be monitored with inclinometers installed prior to construction that extend below the base of the excavation a distance equal to at least the excavation depth provided that precision monitoring is carried out of the horizontal position of the inclinometer top for each monitoring event. Otherwise, the inclinometers should extend below the base of the excavation a distance equal to twice the excavation depth. At least three inclinometers should be located equidistant along the length of sewer parallel to the tracks and these should be located as close to the railway right-of-way while still maintaining safe work spaces to carry out monitoring independent of rail traffic. Inclinometers should be measured twice per week during excavation parallel to the ETR tracks, once weekly during backfilling, and twice again prior to completion of the contract.

Vertical ground displacements should be monitored with devices that are not susceptible to frost movements and are protected from construction traffic. It is recommended that ground displacements be measured using precision surveying methods (to +/- 2 millimetres) at least 6 points along the length of the excavation parallel to the ETR tracks. These ground displacement monitoring points should be located in a line with the inclinometers described above. In addition, three monitoring points located equidistantly, should be located within 2 metres of the western edge of the excavation made in the area of the ETR. Monitoring of the rails will not be sufficient to assess displacements of concern as the stiffness of steel rails and ties can mask movements of the underlying ground until the rails are loaded by a train. Discovering that the ground has displaced beneath the rails at such a time would be unacceptable. These ground displacement monitoring points should be measured at least three times prior to any excavation or pile installation on site to establish a measurement baseline.

Any buildings within a distance approximately equal to 2 times the depth of cut and cover excavations should be monitored using precision surveying techniques as described above for the ground monitoring points. Each structure should be provided with at least four monitoring points around the perimeter of the building. Other facilities within these distances along the route that also may be sensitive to settlement should be similarly monitored using precision surveying methods.

It is also recommended that any existing utilities within a distance equal to the depth of excavation be exposed and monitored throughout construction. Monitoring of these utilities may be achieved by attaching a series of monitoring points on top of the utility and measuring, using precise surveying techniques, for both horizontal and vertical movements.

During sheet pile or secant pile installation and all excavation and backfilling activities, measurements of vertical ground, structure, and utility displacement points in the vicinity of the ETR, buildings, or other settlement sensitive facilities should be undertaken daily. Following completion of excavation, measurements should be taken weekly until completion of construction. The survey data should provide information on the rate and amount of movement the facilities may experience during construction and also provide early indications of potential excessive movements. Any required remedial measures can then be taken in order to maintain the integrity of the utilities or other facilities prior to displacements becoming excessive.

6.9 Anticipated Groundwater Flow Rates

If the excavations for the pump station and oil/grit separator are carried out inside closed driven sheet pile or secant pile supported excavations, significant volumes of groundwater inflow or seepage are not anticipated. Water seepage into the excavations through the interlocks of the sheeting or in any gaps in secant piles should be expected. It is expected that such seepage volumes can be adequately controlled by a network of shallow swales constructed around the periphery and bottom of the excavation. The swales should be connected to a centrally located sump pump station.

6.10 Outfall Construction

Although no design information is currently available, it is anticipated that construction of the sewer outfall and possibly some structural features such as a headwall and the like, will be carried out within a braced and sheeted excavation (i.e., cofferdam). To maintain excavation stability and minimize disturbance of the fine grained founding soils, it is recommended that the sheet piles be driven to a sufficient depth into the native silty clay (at least below elevation 170.0 metres) and at least 1.5 times the depth of excavation. This is to prevent upward water flow through the base of the excavation (i.e., piping) which would, without some form of effective ground water control, cause excessive disturbance to the founding soils.

Construction of the storm sewer outfall into McKee Creek will require excavations extending some 4.5 metres below existing grade and some 2.2 metres below the present creek bottom. Based on the results of the earlier borehole 201 (764111/1), the base of the outfall sewer excavation is expected to be located in the loose to very loose sand containing occasional organic (peaty) layers. Depending on the actual conditions exposed, some preparatory work and/or localized lowering of the founding grade may be required to remove and replace the organic materials from below the zone of influence of the new pipe. Design of excavation support systems should plan on additional excavation of as much as 1 metre below the planned excavation bottom to allow removal of organic materials if they are encountered. Provided the natural, inorganic founding soils are not disturbed during construction, they are considered to be suitably competent for pipe support.

Assuming the integrity of the founding soils is maintained during construction, then they should also be competent for the support of the foundations for the sewer outfall structure. The design of the outfall structure base, founded on undisturbed clayey silt to silty clay and/or native sand to silty sand may be designed using a geotechnical reaction at Serviceability Limit States (SLS) of 35 kilopascals and factored geotechnical resistance at Ultimate Limit States (ULS) of 50 kilopascals.

The design of the sheeted and braced excavation should be carried out using the earth pressure diagram shown on Figure 6. Water pressures above the soil or sediment line should be added to this diagram where the cofferdam will extend into McKee Creek.

All excavations should be carried out in general accordance with the requirements outlined in the current Occupational Heath and Safety Act.

In general, it is recommended that any backfill required to fill spaces between the cofferdam and the permanent structure consist of unshrinkable fill as described above.

6.11 Evaluation of Chemical Analysis

6.11.1 Discussion of Applicable Environmental Standards

Current environmental standards for soil and groundwater are identified in the Ministry of the Environment (MOE) document: “Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act” (March 2004) (MOE Standards). Based on the provisions of Ontario Regulation (O. Reg.) 153/04, the background site condition standards (Table 1) are considered appropriate for the assessment of portions of the Site located within 30 metres of a surface water body, as defined in the regulation. With the exception of the portion of the Site located within 30 metres of the Detroit River and/or associated creeks, the MOE standards considered to be consistent with the current use and location of this property were the criteria for soil and groundwater at an industrial/commercial/community site with a non-potable groundwater condition (Table 3 in the MOE Standards). A municipal water supply which does not rely on groundwater is readily available in the area of the Site. In December 2009, a new set of standards were legislated in Ontario and will come into effect on July 1, 2011. The 2009 Tables 1 and 3 Standards are included in the summary tables for comparison purposes.

Since the objective is to assist in the evaluation of off-Site management and disposal alternatives for any excess soil generated during the anticipated construction activities, the results of soil analysis were also compared to (background) standards provided in 2004 Table 1 of the MOE Standards which are used by some receivers, such as aggregate pits, as acceptance criteria for excess soils. In this respect, it is interpreted that soils with parameter concentrations meeting Table 1 and otherwise not indicating evidence of impact would be suitable for characterization as “inert fill” under the provisions of Ontario Regulation 347 (O. Reg. 347) and not subject to any restrictions on reuse or disposal. Similarly, soils with parameter concentrations above Table 1 but below Table 3 (with the exception of values for sodium adsorption ratio and electrical conductivity, which are largely exempt by the regulatory policies governing aggregate pits), and otherwise not indicating other evidence of significant impact are interpreted to be suitable for reuse on Site but would likely be subject to disposal restrictions if removed from the Site for disposal. Soils with parameter concentrations exceeding the Table 3 standards (with the exception of values for sodium adsorption ratio and electrical conductivity) and/or indicating evidence of significant impact are interpreted to not be suitable for reuse on Site and requiring management and off-Site disposals as waste, subject to the results of the waste characterization analysis.

6.11.2 Analytical Results for Soil Samples

A total of six soil samples were collected from the three boreholes and submitted for metals/inorganics, BTEX and PH F1-F4 analysis. Three of the collected samples were also analyzed for PAHs and two samples were analyzed for PCBs analysis.

The laboratory results for the selected soil samples and the applicable 2004 Table 3 Standards are summarized in Tables I, II, III and IV. Copies of the laboratory certificates of analysis are provided in Appendix A.

Based on the analytical results, the detected concentrations of selected metals and/or inorganics and SVOCs in the fill samples BH-101-4A and BH-102-3 exceeded the 2004 Table 1 Standards. The reported BTEX concentrations were below the method detection limits. PH F1 to F4 were detected in the fill sample BH-101-24 at concentration above the reported method detection limits but below the 2004 Table 3 Standards. However, there are no 2004 Table 1 Standards for PH F1-F4. The reported method detection limit for PCBs was slightly above the 2004 Table 1 Standard due to matrix interference (detected concentrations of PH F2 and F3).

Also and based on the analytical results, boron (hot water extractable) was detected in the fill sample BH-101-4A and BH-103-2B at concentrations of 2.03 and 2.16 microgram per gram (ug/g), respectively, slightly above the 2004 Table 3 Standard of 2.0 ug/g. Electrical conductivity (EC) was detected in the native soil sample BH-101-8 at a concentration of 1.51 millisiemen per centimeter (mS/cm) slightly above the 2004 Table 3 Standard of 1.4 mS/cm. PH F2 and F3 were detected in fill sample BH-102-3 at concentrations of 310 and 4,100 ug/g, respectively, exceeding the 2004 Table 3 Standards of 150 and 1,700 ug/g. In addition, several SVOC parameters were detected in the fill sample BH-101-4A at concentration exceeding the 2004 Table 3 Standards.

In addition, two composite soil samples were collected from the fill and native materials encountered in the three boreholes and submitted for chemical analysis of metals, BTEX, PCBs and BaP using **TCLP.** The laboratory results for the two composite soil samples and the applicable Standards are summarized in Table V. Copies of the laboratory certificates of analysis are provided in Appendix A. Based on the analytical results of the two composite samples, the reported TCLP results were below the reported method detection limits or the applicable MOE Leachate Quality Criteria presented in Schedule 4 of O. Reg. 347. Therefore, the soils represented by these samples would not be characterised as hazardous (characteristic) waste as defined in O. Reg. 347 and could be disposed of at a licensed non-hazardous waste landfill.

6.11.3 Conclusions and Recommendations

Based on the findings of the subsurface investigation, the following can be concluded from the completed investigation at the Site:

- Based on the analytical results, boron, PHC F2 and F3 and selected SVOCs were detected in the fill samples collected from boreholes BH-101 and BH-102 at concentrations exceeding the 2004 MOE Table 3 Standards for industrial/commercial/community property use. Slight to strong odours were also noted in the fill materials encountered in borehole BH-101. Materials with parameter concentrations exceeding the 2004 MOE Table 3 Standards and/or indicating evidence of impact (odour and staining) are interpreted to not be suitable for reuse on Site and require management and off-Site disposal as waste. Consequently, the excess fill materials that will be excavated from the general locations of these boreholes (BH-101 and BH-102) during the anticipated construction activities will require proper handling and off-Site disposal.

- Based on a review of the available data, the upper fill materials is underlying the surface materials and above the native soil. The fill materials exhibited odour and concentrations of contaminants exceeding the 2004 MOE Table 3 standards at the locations of boreholes BH-101 and BH-102 at varying depths. It should be noted that elevated concentrations of selected inorganics were also detected at concentrations exceeding the 2004 Table 1 Standards but below the 2004 Table 3 Standards in the native soil in boreholes BH-101 and BH-102 with the exception of EC in borehole BH-101 that was slightly above the 2004 Table 3 Standard. The thickness of these impacted materials will vary between locations and should be verified in the field based on visual observations during the anticipated excavation activities. Segregation of these materials may be possible during the excavation activities based on visual observations and available analytical results.

Based on the analytical results and field observations, the soil/fill materials encountered in the three boreholes would not be considered inert fill under the provisions of Reg. 347, as amended, and therefore is characterized as materials with chemicals of concern (impact) for management and off-Site disposal purposes. However based on the TCLP analytical results, it is interpreted that the soils represented by the two composite samples would not be characterized as hazardous (characteristic) waste as defined in Reg. 347 and could be disposed of at a non-hazardous solid waste landfill licensed or certified (whichever is applicable) by the responsible regulatory authority in the Province of Ontario. Additional sampling and analysis may be requested by the selected disposal facility for profiling and approval purposes. Proper documentation of off-Site disposal work will be required. Field monitoring of excavation activities is also recommended.

Soil/fill materials with parameter concentrations below the MOE Table 3 Standards and without evidence of impact (odour and staining) are interpreted to be suitable for reuse on Site at a distance of 30 metres of a surface water body. However, these materials would not be considered inert fill under the provisions of Reg. 347, as amended.

6.11.4 LIMITATIONS

This report was prepared for Stantec Consulting Limited and is intended to provide an assessment of current environmental conditions in association with the proposed storm sewer outlet near Prince Road in Windsor, Ontario. Golder will not be responsible for any use of this report by any other party or for the consequences thereof.

This report is based on data and information collected during the limited subsurface investigation by Golder personnel. There is no warranty, expressed or implied, by Golder that this assessment identified all potential contaminants at the Site or that the Site is free from any and all contamination from past or current practices other than that noted, nor that all issues of environmental compliance have been addressed. The assessment of environmental conditions and potential hazards at the Site has been made using available Site information and the results of chemical analysis of soil and groundwater samples collected on the dates identified. No assurance is made regarding changes in conditions subsequent to the time of investigation.

The Site conditions have been inferred based on conditions observed at a limited number of sampling locations in accessible areas; however, it should be noted that conditions between and beyond sampling locations may vary. In addition, the assessment is dependent upon the accuracy of the analytical data generated through sample analysis and is limited to determining the presence of contaminants for which analyses have been conducted.

In evaluating the Site, Golder has relied in good faith on information provided by individuals and companies noted in this report. We assume that the information provided is factual and accurate. We accept no responsibility for any deficiency, misstatements or inaccuracies contained in this report as a result of omissions, misinterpretations or fraudulent acts of the person(s) contacted.

Where references have been made to regulatory guidelines and documents, it should be noted that regulatory statutes and guidelines are subject to interpretation and these guidelines and documents and their interpretations may be subject to change over time.

It is our understanding that this report and the completed activities will not be required for preparation of a Record of Site Condition (RSC) as described in Ontario Regulation 153/04, as amended. If preparation of a RSC is required in the future, additional environmental investigation may be recommended and carried out at the Site at that time.

Golder accepts no responsibility for the consequential effects of this factual report on the real or perceived property value of the subject property, on its saleability, or on the ability to gain financing. If new information is discovered during future work, including excavations, borings or other studies, Golder should be requested to re-evaluate the conclusions presented in this report and to provide amendments as required.

The results of analytical testing have been summarized in the attached Tables I through IV.

7.0 CLOSURE

This office should be given an opportunity to review the final design drawings to ensure that they are consistent with the recommendations contained within this report.

To ensure that construction is carried out in a manner consistent with the intent of the recommendations set forth in this report, a program of geotechnical inspection and testing should be developed and implemented throughout the construction phase. In addition, related laboratory testing should be carried out in conjunction with the field work to monitor compliance with the various material and project specifications.

The factual data, interpretation and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation, or if the project is not initiated within twelve months of the date of the report, Golder should be given an opportunity to confirm that the recommendations are still valid.

Please refer to the “Important Information and Limitations of This Report” which follows the text, but forms an integral part of this document.

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.

ORIGINAL SIGNED

ORIGINAL SIGNED

Henry Dielemans, P.Eng.
Associate

Storer J. Boone, Ph.D., P.Eng.
Associate

HD/SJB/JDR/RT/hd/dw

Attachments:

- Limitations
- List of Abbreviations
- List of Symbols
- Records of Boreholes 101, 102 and 103 (current investigation)
- Record of Borehole 3 (previous investigation 09-1140-W025)
- Records of Boreholes 103 and 201 (previous investigation 764111 and 764111/1)
- Figures 1 to 6
- Tables I to V
- Appendix A (Certificate of Analysis)
- Appendix B (CPT Results)

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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.

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT (cont'd)

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.

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, 60º 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
Δ	change in, e.g. in stress: $\Delta\ \sigma$
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_1	liquid limit
w_p	plastic limit
l_p	plasticity index = $(w_1 - w_p)$
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p)/I_p$
I_C	consistency index = $(w_1 - w)/I_p$
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: 09-1140-W025-2000

RECORD OF BOREHOLE 101

SHEET 1 OF 3

LOCATION: SEE LOCATION PLAN

BORING DATE: April 4, 2011

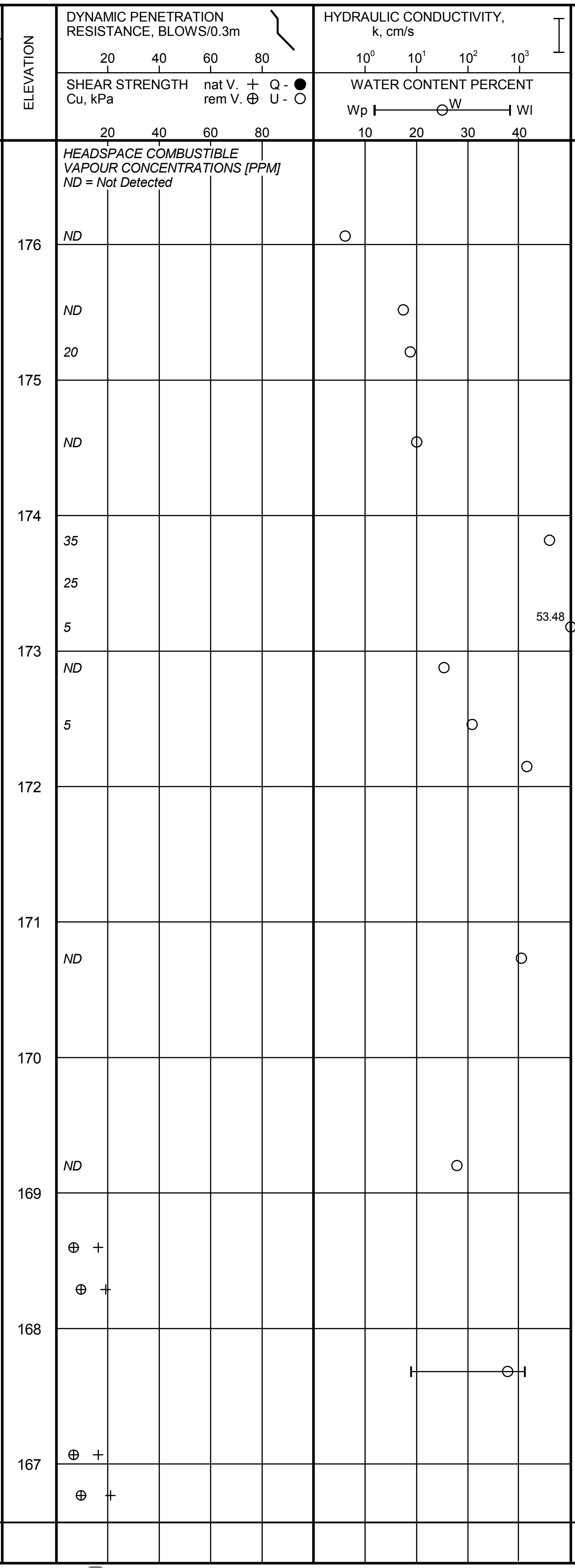
DATUM: GEODETIC

SAMPLER HAMMER, 63.5 kg; DROP, 760 mm

PENETRATION TEST HAMMER, 63.5 kg; DROP, 760 mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)
0	POWER AUGER 114mm OD SOLID STEM	GROUND SURFACE	176.37
		Compact, grey crushed sand and gravel **(FILL)**	0.00
1	WASH BORING UNCASED	Very stiff, mottled brown and grey to black silty clay, with gravel, occasional concrete and clay tile fragments **(FILL)**	175.68 0.69
		Loose, grey black sand and gravel, some silt **(FILL)** *(Noticeable odours)*	174.92 1.45
2		Very soft, dark grey to blackish grey clayey silt, trace sand **(FILL)** *(Strong odours)*	174.16 2.21
		Loose, black silty sand, trace clay **(FILL)**	173.55 2.82
3		Firm, black **ORGANIC CLAYEY SILT**	2.97
		Loose, grey brown **FINE SAND**, trace silt	173.04 3.33
4		Very soft, black **ORGANIC CLAYEY SILT**, occasional wood fibres	172.36 4.01
5–6		Very loose, dark grey **FINE SAND**, trace to some silt	171.95 4.42
7–9		Soft to firm, grey **SILTY CLAY**, trace to some sand, occasional gravel	169.97 6.40
		--- *CONTINUED NEXT PAGE* ---	

SAMPLE NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING
1	SS	27	
2	SS	16	
3	SS	10	
4	SS	WH	
5	SS	6	
6	SS	2	
7	SS	1	
8	SS	WH	
9	SS	WH	MH



INSTALLATION AND GROUNDWATER OBSERVATIONS

Seepage ▼

Groundwater seepage encountered at about elevation 174.8m during drilling on April 4, 2011.

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: NG

CHECKED:

PROJECT: 09-1140-W025-2000

RECORD OF BOREHOLE 101

SHEET 2 OF 3

LOCATION: SEE LOCATION PLAN

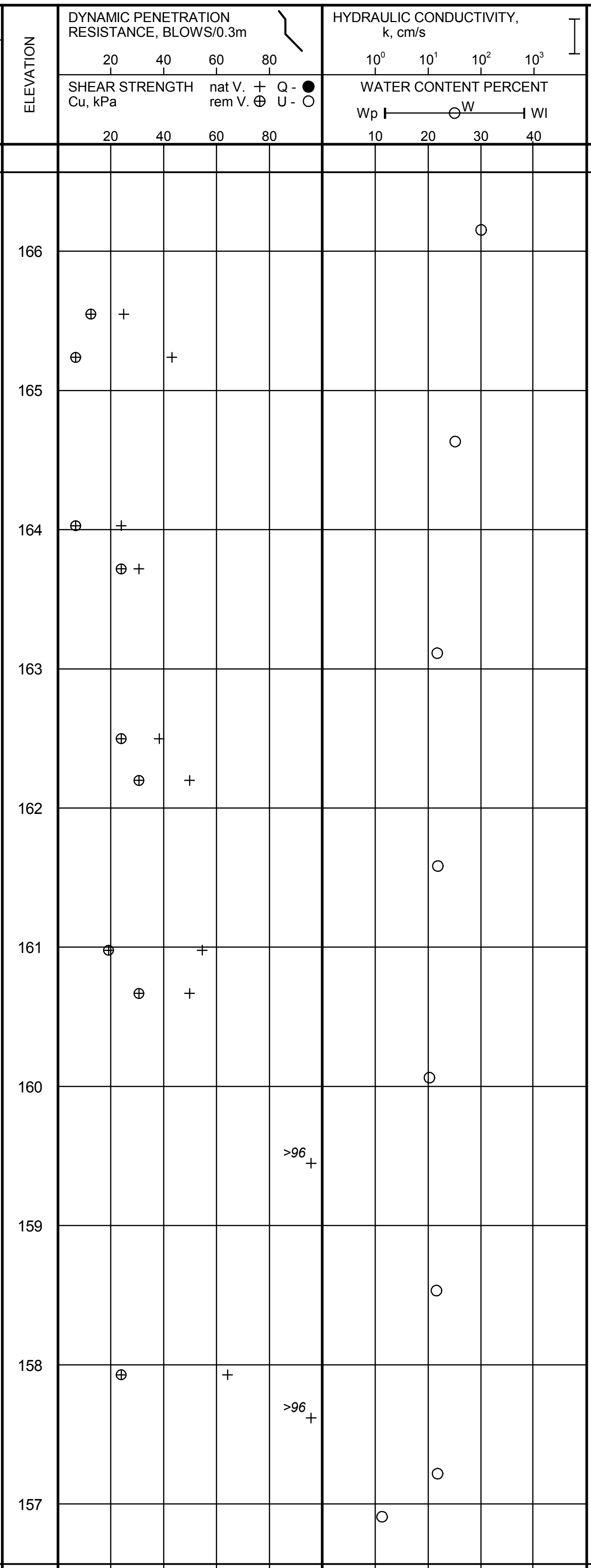
BORING DATE: April 4, 2011

DATUM: GEODETIC

SAMPLER HAMMER, 63.5 kg; DROP, 760 mm

PENETRATION TEST HAMMER, 63.5 kg; DROP, 760 mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
		--- CONTINUED FROM PREVIOUS PAGE ---							
10	WASH BORING UNCASED	Soft to firm, grey **SILTY CLAY**, trace to some sand, occasional gravel			10	SS	WH		
11					11	SS	WH		
12–13					12	SS	WH		
14–15					13	SS	WH		
16		Stiff to very stiff, grey **SILTY CLAY**, some sand, trace gravel, occasional fine sand seams/partings at depth		160.37 16.00	14	SS	6		
17–18					15	SS	7		
19		Loose, grey **SILTY SAND**, some clay, trace gravel		157.12 19.25	16	SS	6		
				156.71 19.66	17	SS	7		
		--- CONTINUED NEXT PAGE ---							



DEPTH SCALE

1 : 50

LOGGED: NG

CHECKED:

LDN_BHS_02 091140W025-2000.GPJ 06/06/11 DATA INPUT: SJL

PROJECT: 09-1140-W025-2000

RECORD OF BOREHOLE 101

SHEET 3 OF 3

LOCATION: SEE LOCATION PLAN

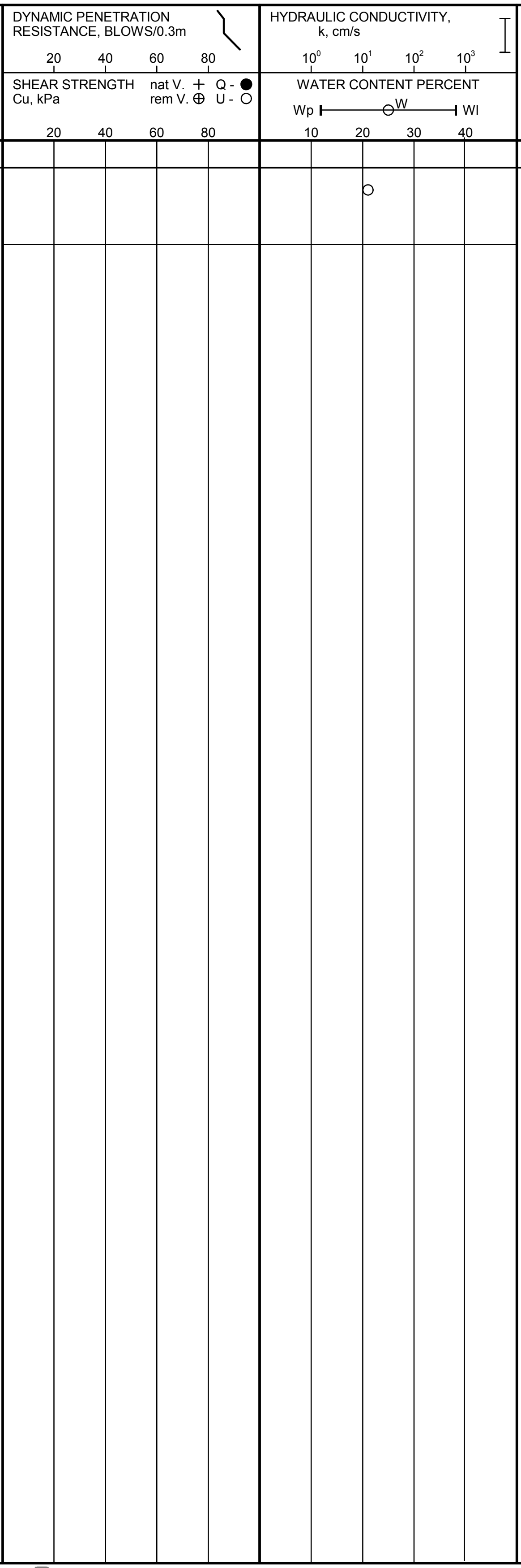
BORING DATE: April 4, 2011

DATUM: GEODETIC

SAMPLER HAMMER, 63.5 kg; DROP, 760 mm

PENETRATION TEST HAMMER, 63.5 kg; DROP, 760 mm

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
		--- *CONTINUED FROM PREVIOUS PAGE* ---								
20	UNCASED	Stiff, grey **SILTY CLAY**, some sand, trace gravel, occasional sand lenses		156.10 20.27	17	SS	7			
		END OF BOREHOLE						156		
21										
22										
23										
24										
25										
26										
27										
28										
29										



DEPTH SCALE

1 : 50

LOGGED: NG

CHECKED:

PROJECT: 09-1140-W025-2000

RECORD OF BOREHOLE 102

SHEET 1 OF 1

LOCATION: SEE LOCATION PLAN

BORING DATE: April 5, 2011

DATUM: GEODETIC

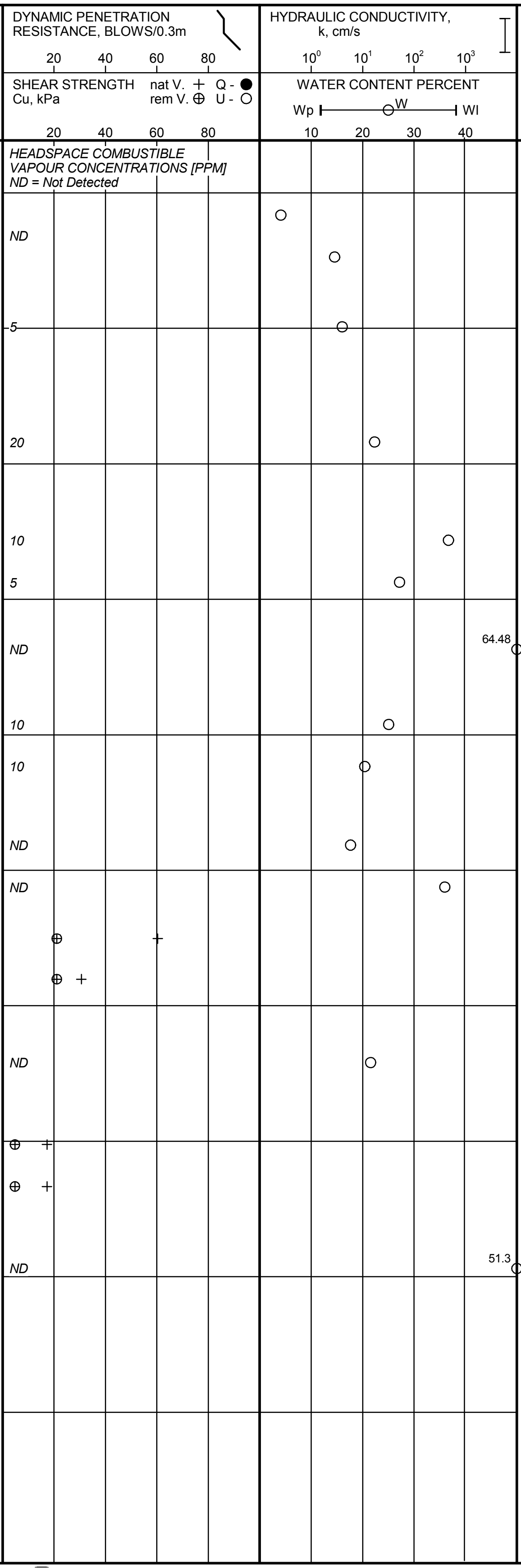
SAMPLER HAMMER, 63.5 kg; DROP, 760 mm

PENETRATION TEST HAMMER, 63.5 kg; DROP, 760 mm

BORING METHOD: POWER AUGER, 108mm ID HOLLOW STEM

SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)
GROUND SURFACE	175.99
Compact, grey brown crushed sand and gravel **(FILL)**	0.00
Stiff to soft, brown to black silty clay, some sand, numerous glass, wood, and clay tile fragments with black fine to medium sand, pockets/seams **(FILL)**	175.69 0.30
Soft, grey black **ORGANIC CLAYEY SILT**, numerous wood fragments, occasional pieces of slag	173.02 2.97
Loose, black **FINE SILTY SAND**, trace clay, trace gravel, occasional wood fragments	172.26 3.73
Loose, brown **FINE SAND**, trace silt	171.98 4.01
Loose, grey **FINE SAND**, trace silt	171.49 4.50
Stiff, grey **SILTY CLAY**, some sand, trace gravel	170.96 5.03
Very loose, grey **FINE SAND**, trace silt, occasional fine gravel	170.35 5.64
Soft, grey **SILTY CLAY**, trace to some sand, occasional gravel	168.98 7.01
END OF BOREHOLE	167.76 8.23

SAMPLES NUMBER	TYPE	BLOWS/0.3m	HEADSPACE COMBUSTIBLE VAPOUR CONCENTRATIONS [PPM] ND = Not Detected
1	SS	21	ND
2	SS	20/0.13m	5
3	SS	4	20
4	SS	WH	10 5
5	SS	3	ND
6	SS	4	10 10
7	SS	3	ND ND
8	SS	WH	ND
9	SS	2	ND



INSTALLATION AND GROUNDWATER OBSERVATIONS

Seepage ▼

Groundwater seepage encountered at about elevation 171.4m during drilling on April 5, 2011.

LDN_BHS_02 091140W025-2000.GPJ 06/06/11 DATA INPUT: SJL

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: NG

CHECKED:

PROJECT: 09-1140-W025-2000

RECORD OF BOREHOLE 103

SHEET 1 OF 1

LOCATION: SEE LOCATION PLAN

BORING DATE: April 5, 2011

DATUM: GEODETIC

SAMPLER HAMMER, 63.5 kg; DROP, 760 mm

PENETRATION TEST HAMMER, 63.5 kg; DROP, 760 mm

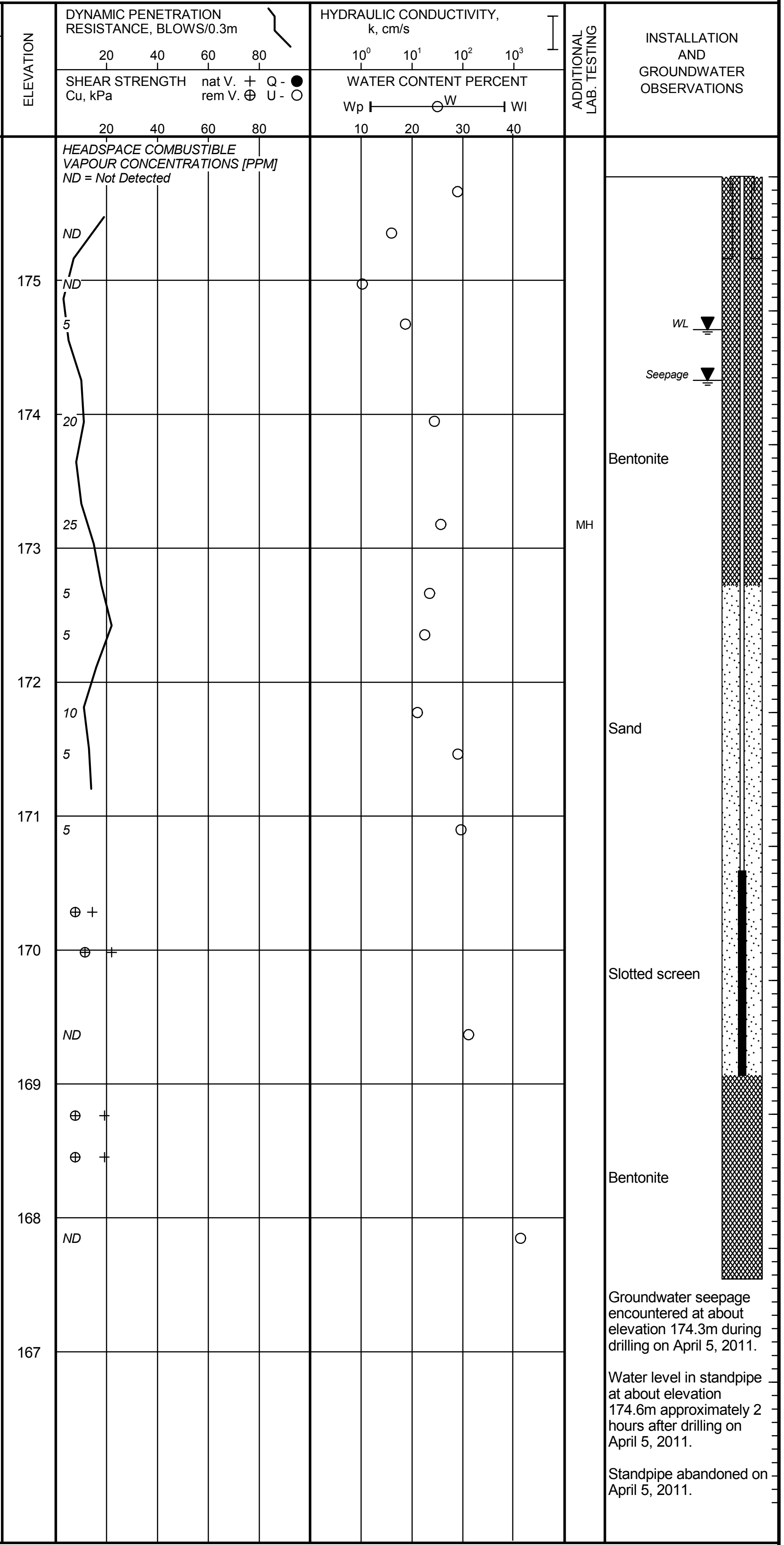
BORING METHOD: POWER AUGER, 108mm ID HOLLOW STEM

SOIL PROFILE

DESCRIPTION	ELEV.	DEPTH (m)
GROUND SURFACE	175.77	0.00
Soft, brown grey silty clay, some sand **(FILL)**		
Very stiff, brown and black laminated silty clay, some sand, some gravel **(FILL)**	175.54	0.23
Firm, brown silty clay, some sand, trace gravel, occasional topsoil inclusions **(FILL)**	175.08	0.69
Loose, black silty sand, trace clay, trace organics **(FILL)**		0.84
Compact, brown **FINE SAND**, trace to some silt, occasional brown silty clay pockets	174.32	1.45
Compact, grey **FINE SAND**, trace silt, occasional fine gravel	172.59	3.18
Soft, grey **SILTY CLAY**, trace to some sand, occasional gravel	171.58	4.19
END OF BOREHOLE	167.54	8.23

SAMPLES

NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING
1	SS	16	
2	SS	5	
3	SS	7	
4	SS	2	MH
5	SS	13	
6	SS	1	
7	SS	WH	
8	SS	WH	
9	SS	WH	



Groundwater seepage encountered at about elevation 174.3m during drilling on April 5, 2011.

Water level in standpipe at about elevation 174.6m approximately 2 hours after drilling on April 5, 2011.

Standpipe abandoned on April 5, 2011.

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: NG
CHECKED:

PROJECT: 09-1140-W025

RECORD OF BOREHOLE 3

SHEET 1 OF 2

LOCATION: SEE LOCATION PLAN

BORING DATE: November 25, 2009

DATUM: GEODETIC

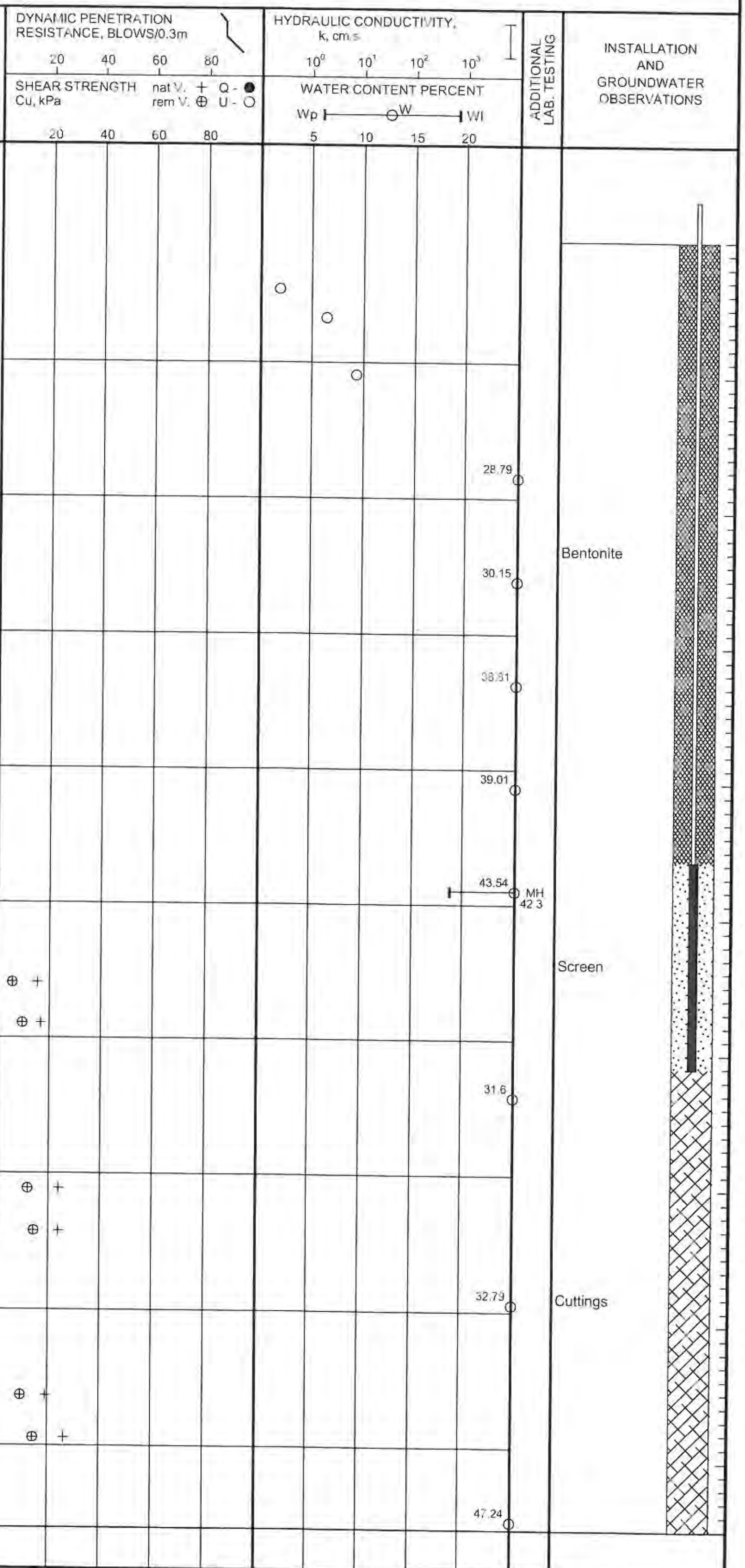
SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

BORING METHOD: POWER AUGER HOLLOW STEM

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)
0	PAVEMENT SURFACE	176.90
	ASPHALT	0.00 176.72
	CONCRETE	0.18
	Grey-brown granular roadbase(**FILL**)	0.38
1	Compact brown fine **SAND**, trace to some silt	175.53 1.37
2	Stiff brown and grey **SILTY CLAY**, trace to some sand, occ. silt partings, fissured	174.77 2.13
	Stiff grey **SILTY CLAY**, trace to some sand and gravel	174.00 2.90
3–9	Firm soft grey **SILTY CLAY**, trace sand, few scattered fine gravel	

SAMPLES NUMBER	TYPE	BLOWS/0.3m
1	AS	
2	SS	17
3	SS	11
4	SS	9
5	SS	6
6	SS	2
7	SS	2
8	SS	2
9	SS	2
10	SS	2



— CONTINUED NEXT PAGE —

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: TA

CHECKED: NR

PROJECT: 09-1140-W025

RECORD OF BOREHOLE 3

SHEET 2 OF 2

LOCATION: SEE LOCATION PLAN

BORING DATE: November 25, 2009

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES			ELEVATION	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m 20 40 60 80 SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ 20 40 60 30	HYDRAULIC CONDUCTIVITY, k, cm/s 10^{-6} 10^{-5} 10^{-4} 10^{-3} WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl 5 10 15 20	ADDITIONAL LAB. TESTING	INSTALLATION AND GROUNDWATER OBSERVATIONS
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m					
		--- CONTINUED FROM PREVIOUS PAGE ---										
				167.15	10	SS	2					Cuttings ▨
10		END OF BOREHOLE		9.75				167				Borehole dry after drilling on November 25, 2009. Standpipe dry on November 27, 2009.
11												
12												
13												
14												
15												
16												
17												
18												
19												

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: TA

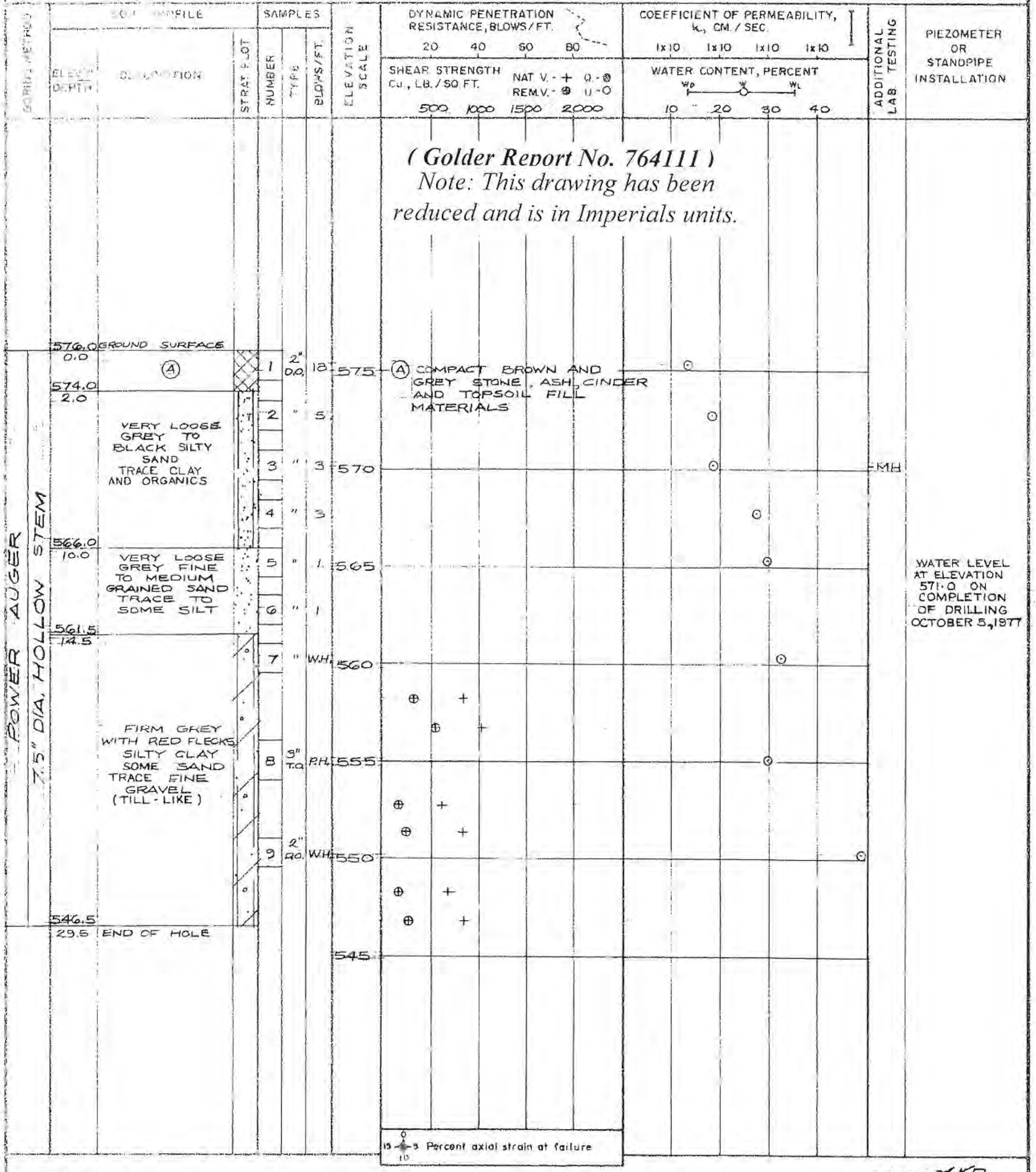
CHECKED: NR

Project No. 764111

RECORD OF BOREHOLE 703

LOCATION See Figure 1 BORING DATE OCT. 5, 1976 DATUM GEODETIC

SAMPLER HAMMER WEIGHT 140 LB., DROP 30 IN PENETRATION TEST HAMMER WEIGHT 140 LB., DROP 30 IN



(Golder Report No. 764111)

Note: This drawing has been reduced and is in Imperials units.

ELEV. DEPTH	DESCRIPTION
576.0 0.0	GROUND SURFACE (A)
574.0 2.0	VERY LOOSE GREY TO BLACK SILTY SAND TRACE CLAY AND ORGANICS
566.0 10.0	VERY LOOSE GREY FINE TO MEDIUM GRAINED SAND TRACE TO SOME SILT
561.5 14.5	FIRM GREY WITH RED FLECKS SILTY CLAY SOME SAND TRACE FINE GRAVEL (TILL-LIKE)
546.5 29.5	END OF HOLE

NUMBER	TYPE	BLOWS/FT.
1	2" O.D.	18
2	"	5
3	"	3
4	"	3
5	"	1
6	"	1
7	"	W.H.
8	3" T.O.	P.H.
9	2" O.D.	W.H.

(A) COMPACT BROWN AND GREY STONE, ASH, CINDER AND TOPSOIL FILL MATERIALS

WATER LEVEL AT ELEVATION 571.0 ON COMPLETION OF DRILLING OCTOBER 5, 1977

Percent axial strain at failure

VERTICAL SCALE
1 IN. TO 5 FT.

Golder Associates

DRAWN A.K.D.
CHECKED Will

NOT TO SCALE

RECORD OF BOREHOLE 201

LOCATION See Figure 2 BORING DATE FEB. 23, 1978 DATUM GEODETIC

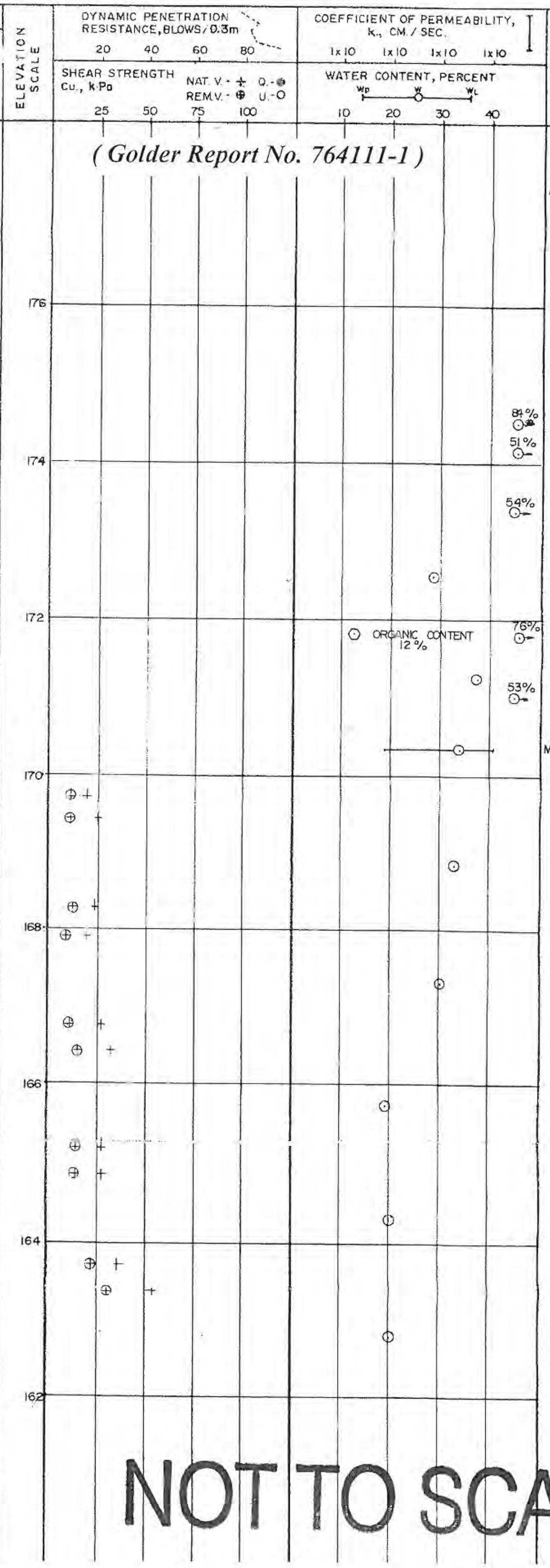
SAMPLER HAMMER WEIGHT 64 kg DROP 0.75 m PENETRATION TEST HAMMER WEIGHT 64 kg DROP 0.75m.

BORING METHOD: POWER AUGER 19 cm. O.D. HOLLOW STEM AUGERS

ELEV'N DEPTH (m)	SOIL PROFILE DESCRIPTION
175.05	ICE SURFACE
0.0	**ICE**
174.59 0.46	SOFT BLACK **SILTY CLAY** LAYERS OF PEAT AND ORGANICS (ALLUVIUM.)
172.76 2.29	VERY LOOSE GREY FINE TO MEDIUM **SAND** SOME PEAT LAYERS (ALLUVIUM)
170.94 4.11	SOFT TO STIFF GREY **SILTY CLAY** OCC GRAVEL SOME SAND
162.40 12.65	END OF BOREHOLE

SAMPLES NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB. TESTING
1	5cm D.O.	2	
2	"	2	
3	"	2	
4	"	3	
5	"	2	
6	"	2	
7	"	W.H.	M.H
8	"	WH	
9	"	WH	
10	"	WH	
11	"	W.H	
12	"	8	

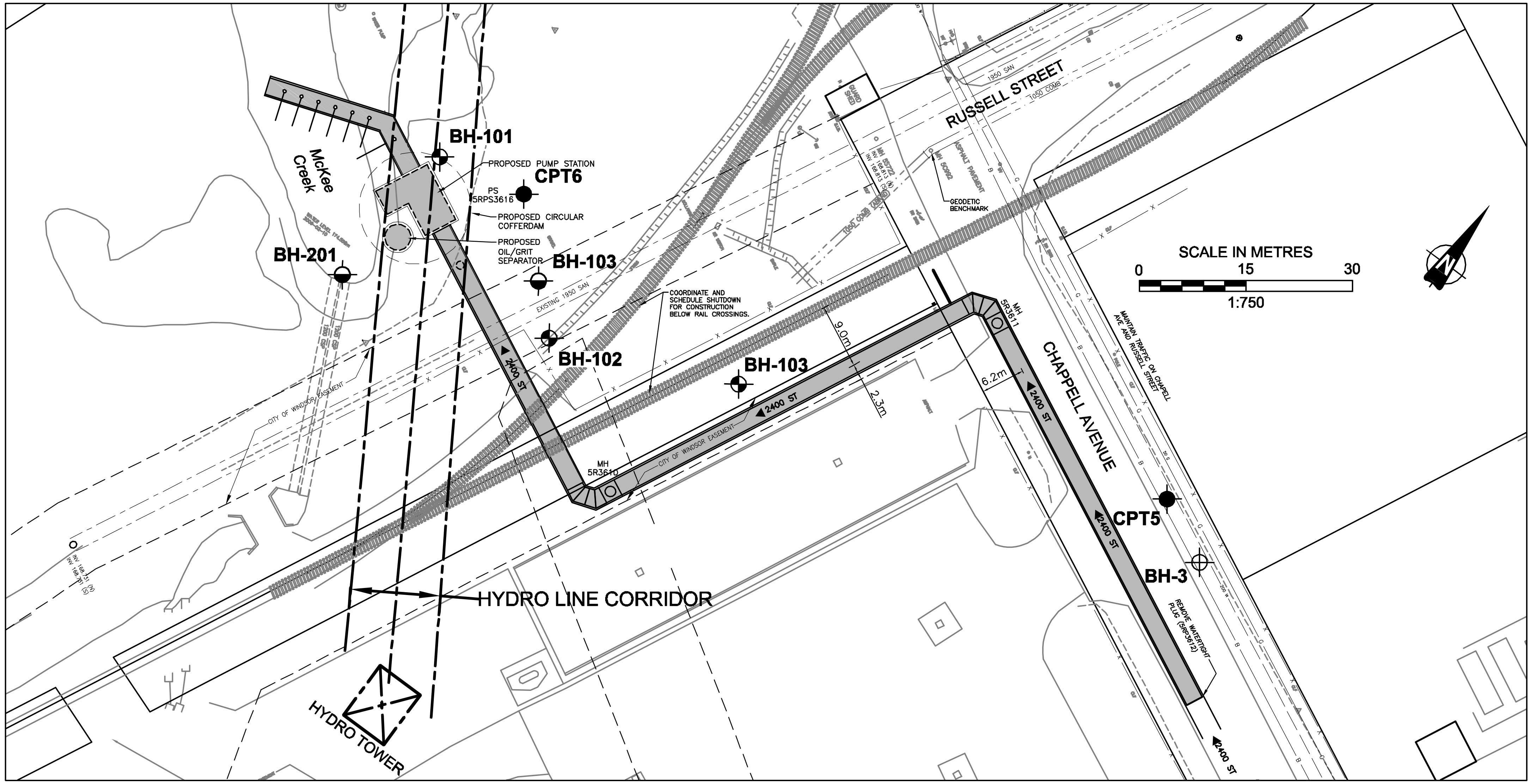
(Golder Report No. 764111-1)

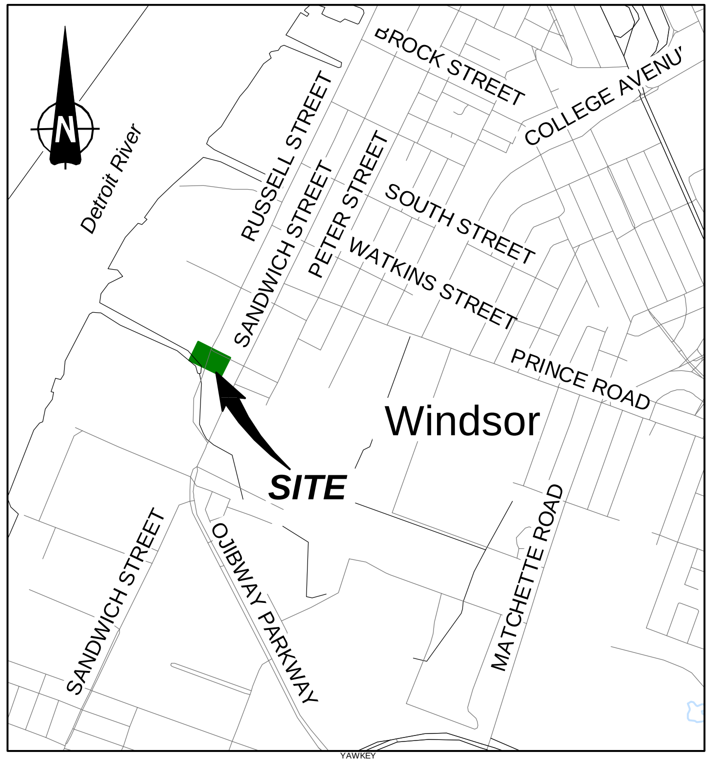


PIEZOMETER OR STANDPIPE INSTALLATION

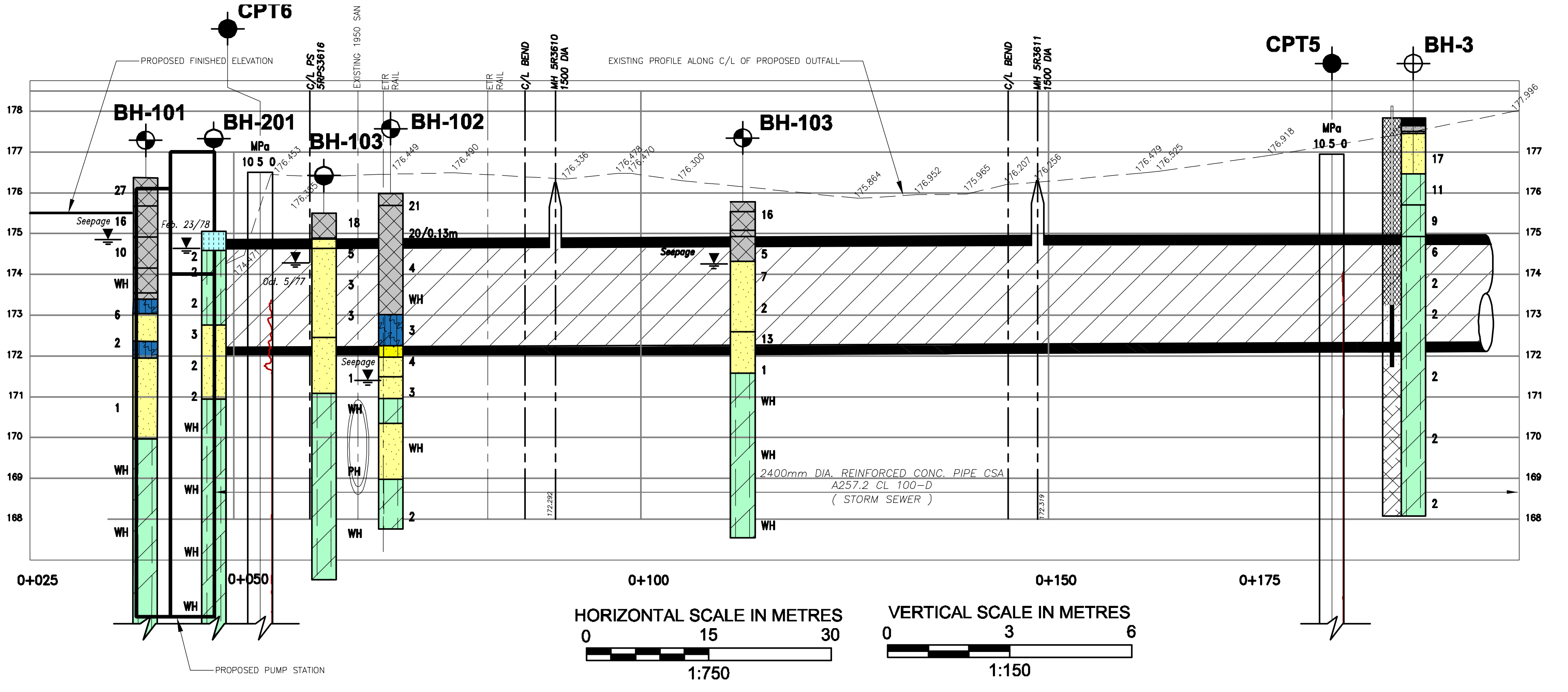
WATER LEVEL IN BOREHOLE AT ELEV. 174.59 DURING DRILLING FEB. 23, 1978.

NOT TO SCALE





KEY PLAN



LEGEND

- ◓ BOREHOLE LOCATION (CURRENT INVESTIGATION)
- ⊕ BOREHOLE LOCATION (PREVIOUS INVESTIGATION REPORT # 09-1140-W025)
- ◒ BOREHOLE LOCATION (PREVIOUS INVESTIGATION REPORT # 764111 & 764111/1)
- ● CONE PENETRATION TEST (PREVIOUS INVESTIGATION REPORT # 09-1140-W025)

8 PENETRATION RESISTANCE (Blows/0.3m)
WATER LEVEL
STRATA PLOT
FOR DETAILS REFER TO RECORD OF BOREHOLES
INSTRUMENTATION
DRY BOREHOLE DRY DURING DRILLING

SIMPLIFIED STRATIGRAPHY

- ▨ FILL
- ▨ SILTY CLAY
- ▨ SILTY SAND
- ▨ SAND
- ▨ ORGANIC CLAYEY SILT
- ▨ ICE
- ■ ASPHALT
- ▨ CONCRETE

REFERENCE

DRAWING BASED O N DRAWING PROVIDED BY STANTEC, "PRINCE ROAD SEWER SYSTEM - PHASE 9B, OUTLET SEWER, STA 0+025 TO STA 0+175", PROJECT No. 165601130, DRAWING No. C-101, AUGUST 20, 2010; CANMAP STREETFILES V2008.4

NOTES

THIS DRAWING IS SCHEMATIC ONLY AND IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT. ALL LOCATIONS ARE APPROXIMATE.

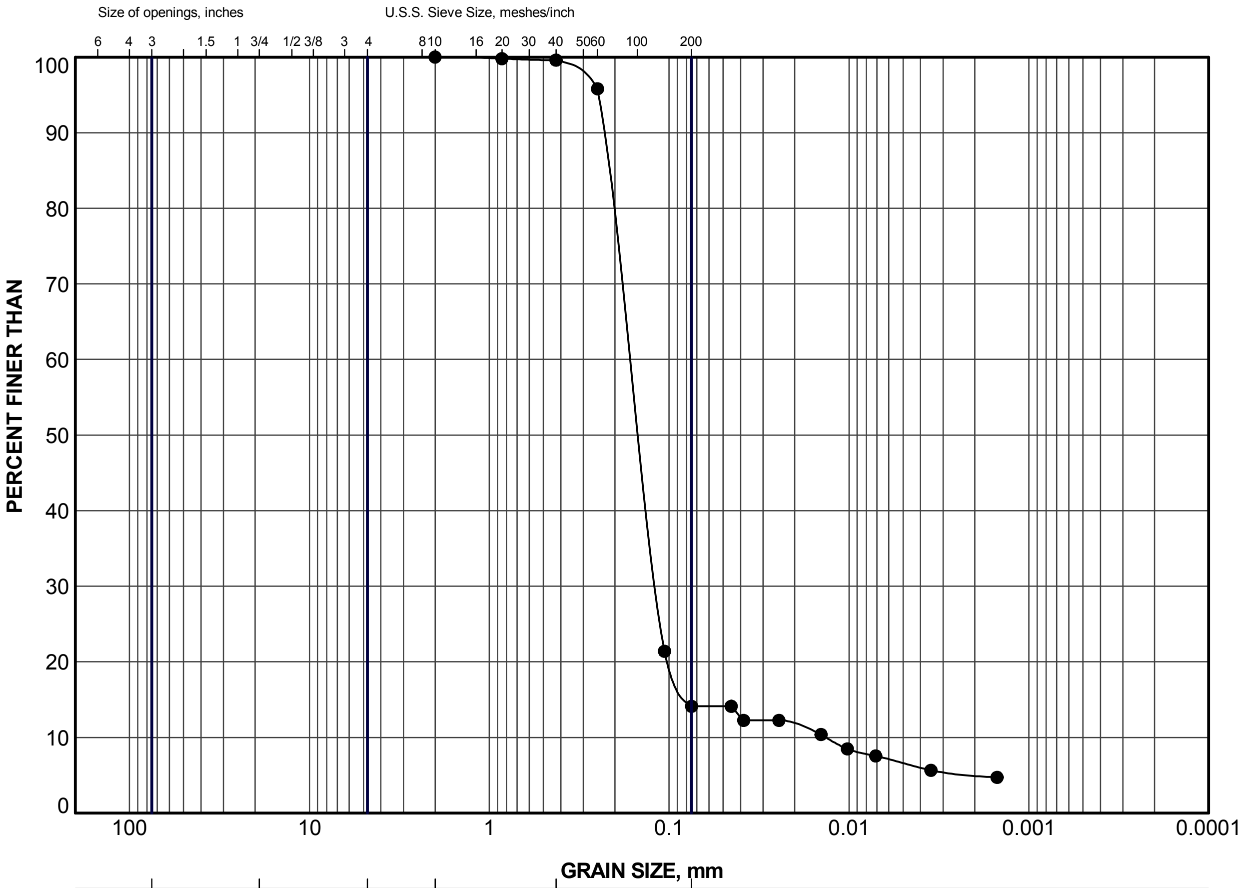
PROJECT
SUPPLEMENTARY GEOTECHNICAL INVESTIGATION
PRINCE ROAD STORM SEWER OUTLET, PHASE 9B
WINDSOR, ONTARIO

TITLE
LOCATION PLAN AND SIMPLIFIED SUB-SURFACE PROFILE

Golder Associates
WINDSOR, ONTARIO

PROJECT No. 09-1140-W025-PH2000			FILE No. 091140W025-2000-R01001
			SCALE AS SHOWN	REV.
CADD	SJL	APR. 26/11	FIGURE 1
CHECK			

Drawing file: 091140W025-2000-R01001.dwg Jun 06, 2011 - 2:40pm



Cobble Size	coarse	fine	coarse	medium	fine	SILT AND CLAY
	GRAVEL SIZE		SAND SIZE			

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	103	4	173.2

PROJECT
SUPPLEMENTARY GEOTECHNICAL INVESTIGATION
PRINCE ROAD STORM SEWER OUTLET, PHASE 9B
WINDSOR, ONTARIO

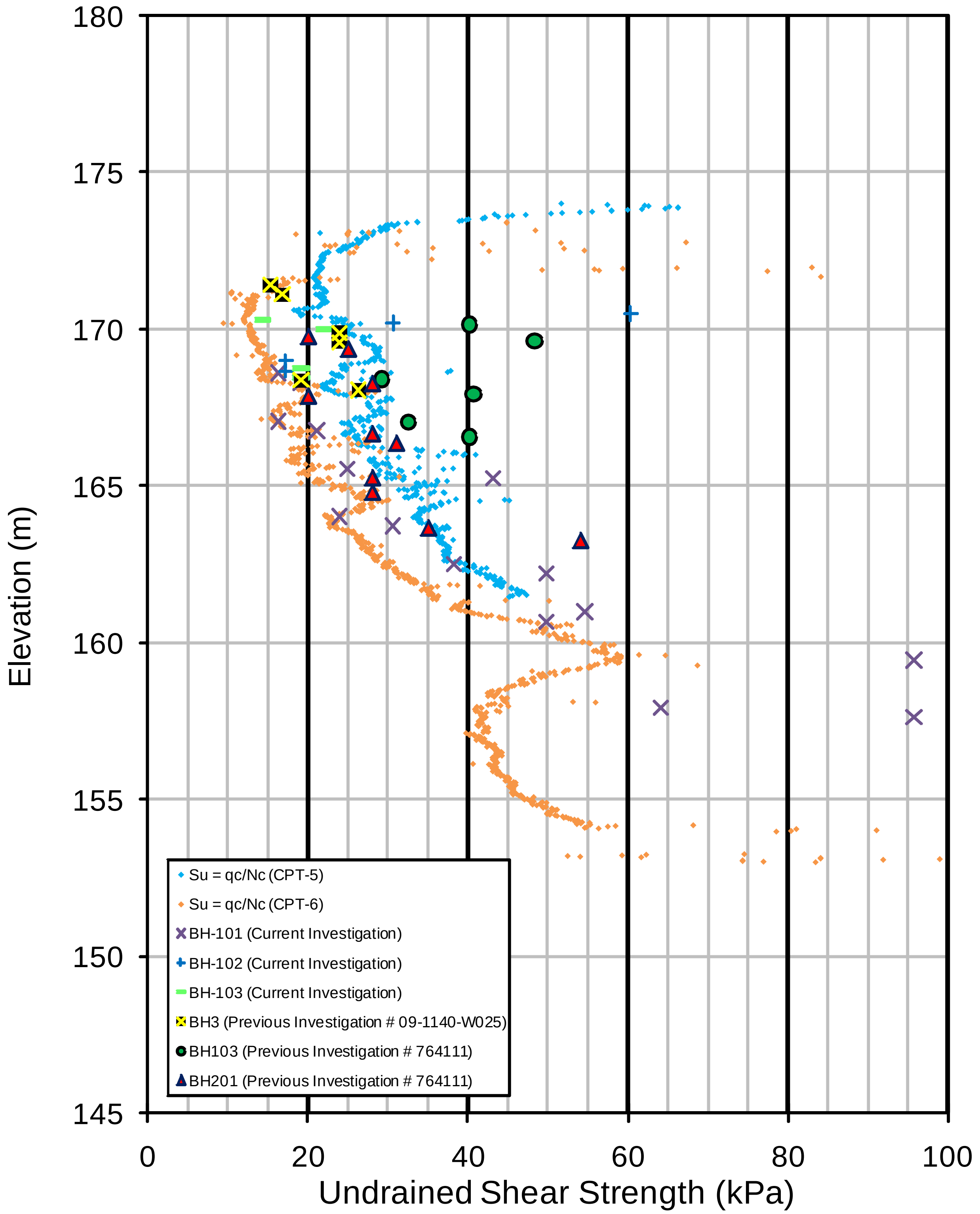
TITLE

GRAIN SIZE DISTRIBUTION

Brown **FINE SAND,** trace to some silt

Golder Associates
WINDSOR, ONTARIO

PROJECT No.	09-1140-W025-2000		FILE No.	091140W025-2000.GPJ
			SCALE N/A	REV.
DRAWN	SJL	APR. 26/11	**FIGURE 2**	
CHECK				



PROJECT
SUPPLEMENTARY GEOTECHNICAL INVESTIGATION
PRINCE ROAD STORM SEWER OUTLET, PHASE 9B
WINDSOR, ONTARIO

TITLE
UNDRAINED SHEAR STRENGTH PROFILE
McKEE CREEK TO SANDWICH STREET

Golder Associates
WINDSOR, ONTARIO

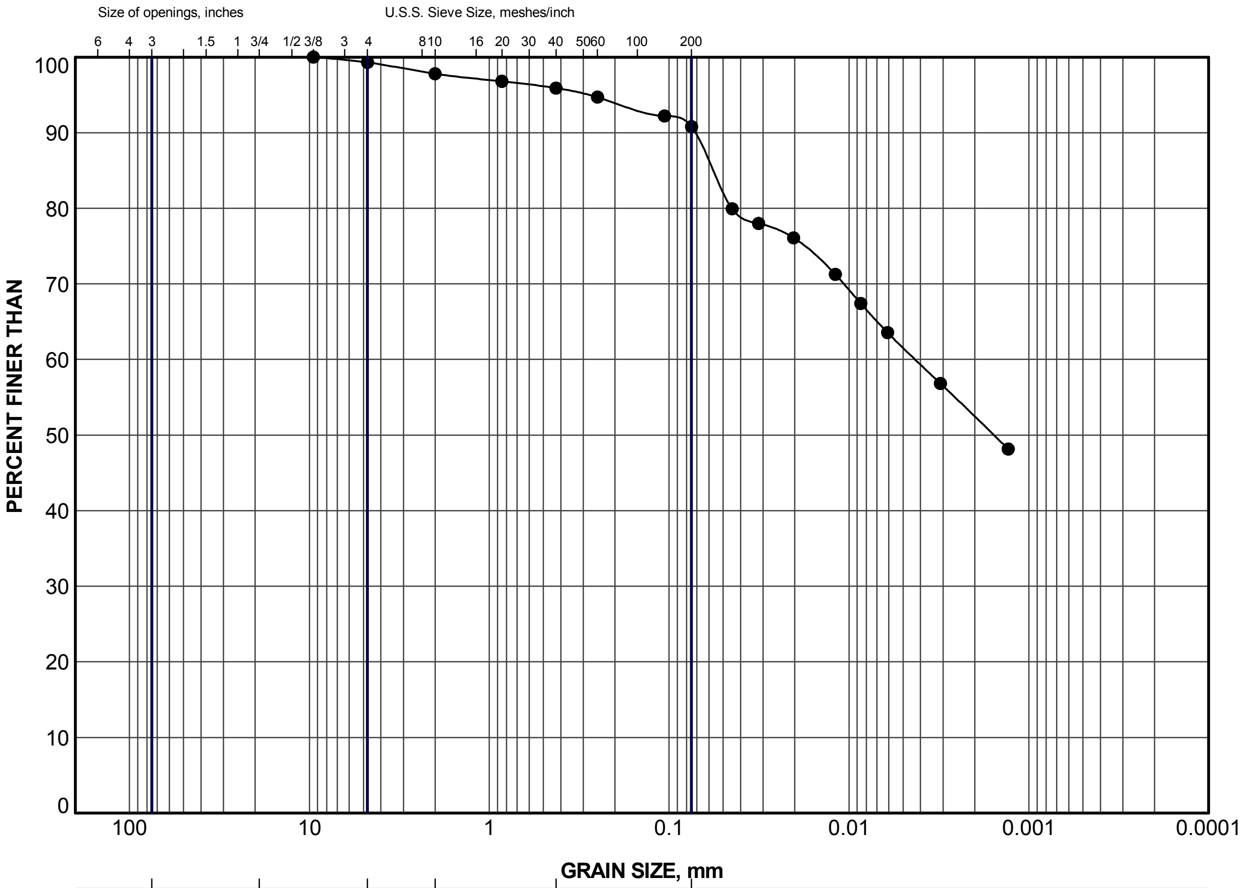
PROJECT No. 09-1140-W025-PH2000
FILE No. 091140W025-2000-R01003
SCALE AS SHOWN
REV.
CADD SJL APR. 26/11
CHECK

FIGURE 3

NOTES

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ACCOMPANYING TEXT.

Drawing file: 091140W025-2000-R01003.dwg Jun 06, 2011 - 3:09pm



Cobble Size	coarse	fine	coarse	medium	fine	SILT AND CLAY
	GRAVEL SIZE		SAND SIZE			

LEGEND

SYMBOL	BOREHOLE	SAMPLE	ELEV (m)
●	101	9	167.7

PROJECT

SUPPLEMENTARY GEOTECHNICAL INVESTIGATION
PRINCE ROAD STORM SEWER OUTLET, PHASE 9B
WINDSOR, ONTARIO

TITLE

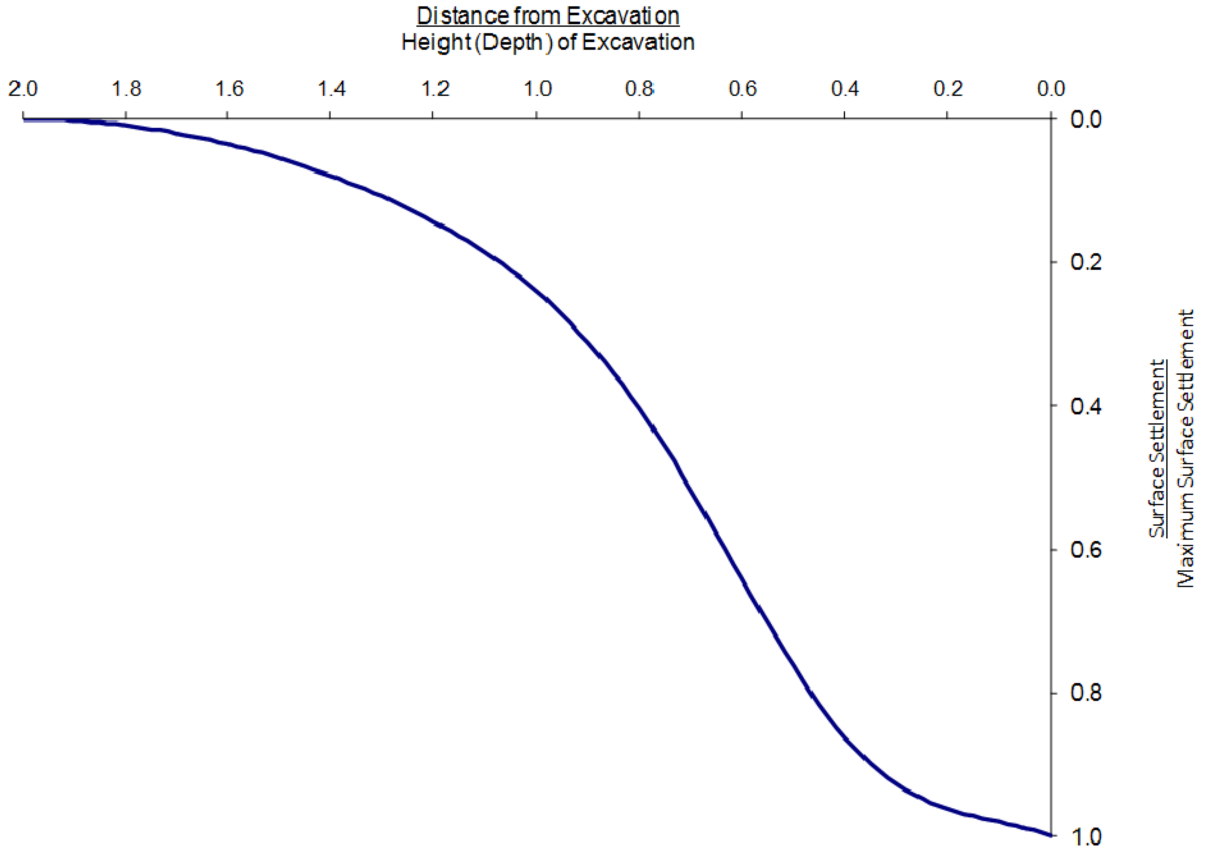
GRAIN SIZE DISTRIBUTION

Grey **SILTY CLAY,** trace to some sand

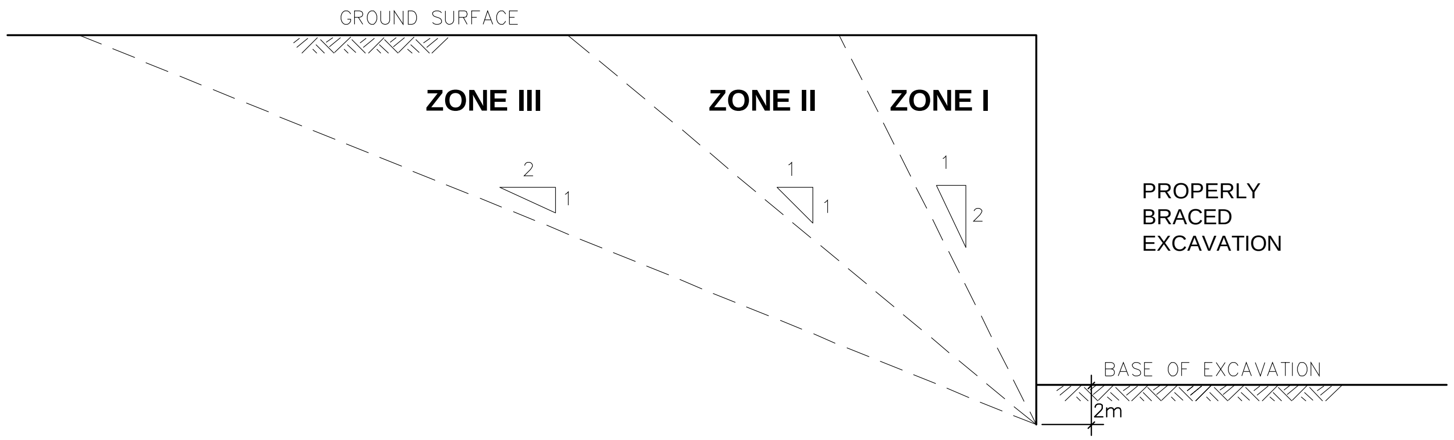
Golder Associates
WINDSOR, ONTARIO

PROJECT No.	09-1140-W025-2000		FILE No.	091140W025-2000.GPJ
			SCALE N/A	REV.
DRAWN	SJL	APR. 26/11	**FIGURE 4**	
CHECK				

LDN_GSD GLDR_LDN.GDT



GROUND SURFACE DISPLACEMENTS FROM CUT AND COVER EXCAVATIONS



NOTE

THIS DRAWING IS APPROXIMATE ONLY AND IS TO BE READ WITH ACCOMPANYING REPORT.

PROJECT

SUPPLEMENTARY GEOTECHNICAL INVESTIGATION
PRINCE ROAD STORM SEWER OUTLET, PHASE 9B
WINDSOR, ONTARIO

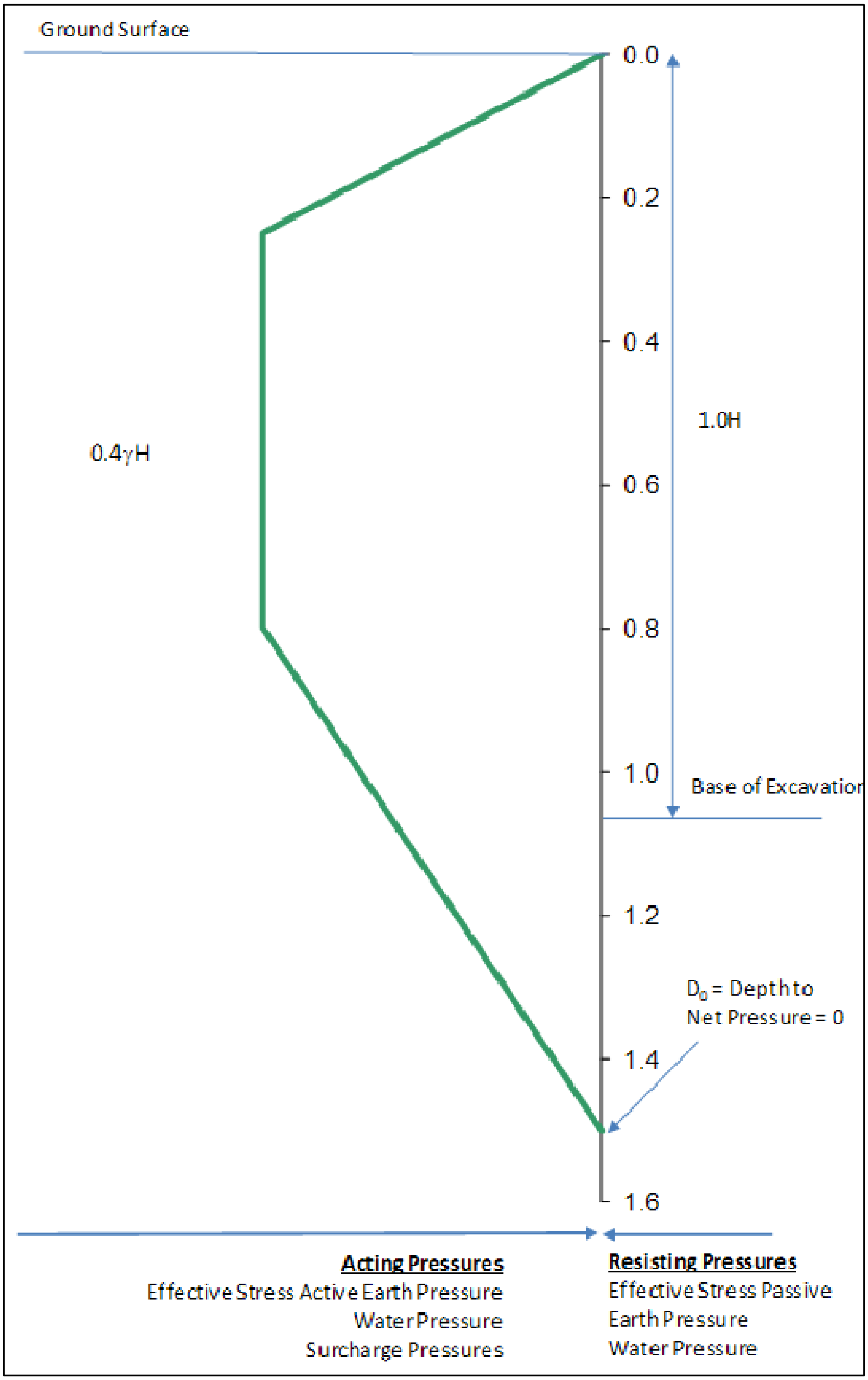
TITLE

GROUND DISPLACEMENTS FROM EXCAVATIONS

Golder Associates
WINDSOR, ONTARIO

PROJECT No. 09-1140-W025-PH2000
FILE No. 091140W025-2000-R01005
SCALE AS SHOWN
REV.
CADD SJL APR. 26/11
CHECK

FIGURE 5



APPARENT EARTH PRESSURES

NOTE

THIS DRAWING IS APPROXIMATE ONLY AND IS TO BE READ WITH ACCOMPANYING REPORT.

PROJECT

SUPPLEMENTARY GEOTECHNICAL INVESTIGATION
PRINCE ROAD STORM SEWER OUTLET, PHASE 9B
WINDSOR, ONTARIO

TITLE

MINIMUM LATERAL PRESSURES ON EXCAVATION SUPPORT SYSTEMS

Golder Associates
WINDSOR, ONTARIO

PROJECT No. 09-1140-W025-PH2000
FILE 09-1140W025-2000-R01006
SCALE AS SHOWN
REV.
CADD SJL APR. 26/11
CHECK

FIGURE 6

TABLE I

ANALYTICAL RESULTS FOR METALS AND INORGANICS IN SOIL SAMPLES

Summary of Analytical Results, Environmental Soil Sampling
Stantec Consulting Ltd.
Storm Sewer Outlet, Prince Road, Windsor, Ontario

	RESULTS[1]						MOE STANDARDS			
Sample Identification:	**BH-101-4A**	**BH-101-8**	**BH-102-3**	**BH-102-7**	**BH- 103-2B**	**BH- 103-5**				
Depth (mbgs)[2]:	**2.29-2.83**	**6.86-7.47**	**1.52-2.13**	**4.57-5.18**	**0.84-1.37**	**3.05-3.66**				
Soil Type:	**Silty Clay (Fill)**	**Silty Clay (Native)**	**Sand (Fill)**	**Sand (Native)**	**Sand (Fill)**	**Sand (Native)**	**2004**		**2009**	
Sampling Date[3]:	**4/4/2011**	**4/4/2011**	**4/5/2011**	**4/5/2011**	**4/5/2011**	**4/5/2011**	**TABLE 1[4]**	**TABLE 3[5]**	**TABLE 1[6]**	**TABLE 3[7]**
PARAMETER										
Antimony	1.4	<0.8	1.1	<0.8	<0.8	<0.8	1	(44) 40	1.3	(50) 40
Arsenic	12	7	5	4	5	3	17	(50) 40	18	18
Barium	300	69	57	27	45	7	210	(2000) 1500	220	670
Beryllium	0.8	0.6	<0.5	<0.5	<0.5	<0.5	1.2	1.2	2.5	8
Boron	12	16	6	7	6	<5	NV	NV	36	120
Boron (Hot Water Extractable)	**2.03**	1.34	0.52	0.3	**2.16**	0.11	NV	2	NV	2
Cadmium	1.1	<0.5	<0.5	<0.5	<0.5	<0.5	1	12	1.2	1.9
Chromium (Total)	54	22	21	11	11	5	71	(1000) 750	70	160
Cobalt	9	9.7	3.9	4.4	2.9	2.3	21	(100) 80	21	(100) 80
Copper	59	17	22	12	17	5	85	(300) 225	92	(300) 230
Lead	144	9	54	9	29	4	120	1000	120	120
Molybdenum	2.3	2.4	2.7	1.4	0.8	0.7	2.5	40	2	40
Nickel	34	24	18	11	8	5	43	(200) 150	82	(340) 270
Selenium	0.8	<0.4	0.5	0.7	0.7	<0.4	1.9	10	1.5	5.5
Silver	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	0.42	(50) 40	0.5	(50) 40
Thallium	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	2.5	32	1	3.3
Uranium	1.1	1.1	0.6	0.9	0.9	<0.5	NV	NV	2.5	33
Vanadium	34	32	16	19	20	11	91	(250) 200	86	86
Zinc	239	53	79	52	64	17	160	(800) 600	290	340
Chromium (VI)	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	2.5	8	0.66	8
Cyanide, Free	<0.05	<0.05	<0.05	<0.05	0.08	<0.05	0.12	100	0.051	0.051
Mercury	0.49	0.02	0.27	0.01	0.1	<0.01	0.23	10	0.27	(20) 3.9
Electrical Conductivity (mS/cm)	0.944	**1.51**	0.284	0.826	1.05	0.364	0.57	1.4	0.57	1.4
Sodium Adsorption Ratio (2:1)	10.9	4.7	0.396	2.59	3.67	0.922	2.4	12	2.4	12
pH, (pH Units)	7.17	7.74	7.05	7.34	6.81	7.51	NV	NV	NV	NV
Choride	205	674	45	376	403	102	330	NV	NV	NV
Nitrate + Nitrite	<1	<1	<1	<1	<1	<1	61	NV	NV	NV

NOTES:

1. All concentrations expressed as micrograms per gram (ug/g) unless noted
2. mbgs - metres below ground surface. NV = No Value Available
3. day/month/year.
4. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (March 2004). Table 1 Standard is for All Other Types of Property Uses.
5. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (March 2004). Table 3 Standard is for a non-potable groundwater situation for industrial/commercial/community property use. Values in brackets apply to medium and fine textured soils; non-bracketed values apply to coarse-textured soils.
6. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (July 2009). Table 1 Standard is for All Other Types of Property Uses.
7. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (July 2009). Table 3 Standard is for a non-potable groundwater situation for industrial/commercial/community property use. Values in brackets apply to medium and fine textured soils; non-bracketed values apply to coarse-textured soils.
8. '<' Below method detection limit.
9. Values shown in underline exceed the applicable 2004 MOE Table 1 Standard; values **bold** indicate exceedance of applicable 2004 MOE Table 3 Standards.
10. Table to be read in conjunction with accompanying report.

Prepared By: CS
Checked By: KE

TABLE II

ANALYTICAL RESULTS FOR PETROLEUM HYDROCARBONS AND BTEX IN SOIL SAMPLES

Summary of Analytical Results, Environmental Soil Sampling
Stantec Consulting Ltd.
Storm Sewer Outlet, Prince Road, Windsor, Ontario

	RESULTS[1]						MOE STANDARDS			
Sample Identification:	**BH-101-4A**	**BH-101-8**	**BH-102-3**	**BH-102-7**	**BH- 103-2B**	**BH- 103-5**				
Depth (mbgs)[2]:	**2.29-2.83**	**6.86-7.47**	**1.52-2.13**	**4.57-5.18**	**0.84-1.37**	**3.05-3.66**				
Soil Type:	**Silty Clay (Fill)**	**Silty Clay (Native)**	**Sand (Fill)**	**Sand (Native)**	**Sand (Fill)**	**Sand (Native)**	**2004**		**2009**	
Sampling Date[3]:	**4/4/2011**	**4/4/2011**	**4/5/2011**	**4/5/2011**	**4/5/2011**	**4/5/2011**	**TABLE 1[4]**	**TABLE 3[5]**	**TABLE 1[6]**	**TABLE 3[7]**
PARAMETER										
Benzene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	(25) 5.3	0.02	(0.4) 0.32
Toluene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	(150) 34	0.02	(78) 68
Ethylbenzene	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	(1000) 290	0.05	(19) 9.5
Total Xylenes[8]	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	(210) 34	0.05	(30) 26
PH F1 (C_{6-10})[9]	7	<5	<5	<5	<5	<5	NV	(660) 230	10	(65) 55
PH F2 ($C_{>10-16}$)	56	<10	**310**	<10	<10	<10	NV	(1500) 150	10	(250) 230
PH F3 ($C_{>16-34}$)	660	<50	**4100**	<50	<50	<50	NV	(2500) 1700	50	(2500) 1700
PH F4 ($C_{>34}$)	120	<50	390	<50	<50	<50	NV	(6600) 3300	50	(6600) 3300

NOTES:

1. All concentrations expressed as micrograms per gram (ug/g).
2. mbgs - metres below ground surface. NV = No Value Available
3. day/month/year.
4. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (March 2004). Table 1 Standard is for All Other Types of Property Uses.
5. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (March 2004). Table 3 Standard is for a non-potable groundwater situation for industrial/commercial/community property use. Values in brackets apply to medium and fine textured soils; non-bracketed values apply to coarse-textured soils.
6. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (July 2009). Table 1 Standard is for All Other Types of Property Uses.
7. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (July 2009). Table 3 Standard is for a non-potable groundwater situation for industrial/commercial/community property use. Values in brackets apply to medium and fine textured soils; non-bracketed values apply to coarse-
8. Total for all xylene isomers.
9. PH F1 concentration recorded does not include BTEX.
10. '<' Below method detection limit.
11. Values shown in underline exceed the applicable 2004 MOE Table 1 Standard; values **bold** indicate exceedance of applicable 2004 MOE Table 3 Standards.
12. Table to be read in conjunction with accompanying report.

Prepared By: CS
Checked By: KE

TABLE III

ANALYTICAL RESULTS FOR POLYCYCLIC AROMATIC HYDROCARBONS IN SOIL

Summary of Analytical Results, Environmental Soil Sampling
Stantec Consulting Ltd.
Storm Sewer Outlet, Prince Road, Windsor, Ontario

	RESULTS[1]			MOE STANDARDS			
Sample Identification:	**BH-101-4A**	**BH-102-3**	**BH- 103-2B**				
Depth (mbgs)[2]:	**2.29-2.83**	**1.52-2.13**	**0.84-1.37**				
Soil Type:	**Silty Clay (Fill)**	**Sand (Fill)**	**Sand (Fill)**	**2004**		**2009**	
Sample Date[3]:	**4/4/2011**	**4/5/2011**	**4/5/2011**	**TABLE 1[4]**	**TABLE 3[5]**	**TABLE 1[6]**	**TABLE 3[7]**
PARAMETER							
Naphthalene	0.97	0.67	0.06	0.09	40	0.09	(28) 9.6
Acenaphthylene	0.24	0.17	<0.02	0.08	840	0.093	(0.17) 0.15
Acenaphthene	3.8	0.28	<0.03	0.07	1300	0.072	96
Fluorene	6.3	1.7	<0.02	0.12	350	0.12	(69) 62
Phenanthrene	**44**	0.81	0.03	0.69	40	0.69	(16) 12
Anthracene	15	0.2	<0.02	0.16	28	0.16	(0.74) 0.67
Fluoranthene	**44**	0.17	0.02	1.1	40	0.56	9.6
Pyrene	37	0.12	0.03	1	250	1	96
Benzo(a)anthracene	23	0.03	<0.02	0.74	40	0.36	0.96
Chrysene	18	0.07	0.02	0.69	19	2.8	9.6
Benzo(b)fluoranthene	17	0.24	0.02	0.47	19	0.47	0.96
Benzo(k)fluoranthene	7.4	0.05	<0.02	0.48	19	0.48	0.96
Benzo(a)pyrene	**16**	0.12	<0.02	0.49	1.9	0.3	0.3
Indeno(1,2,3-cd)pyrene	6.3	0.39	<0.02	0.38	19	0.23	(0.95) 0.76
Dibenz(a,h)anthracene	**2.2**	0.08	<0.02	0.16	1.9	0.1	0.1
Benzo(g,h,i)perylene	5.4	0.61	0.02	0.68	40	0.68	9.6
2-and 1-methyl Naphthalene	3.9	5	0.05	NV	(1600) 280	0.59	(85) 76

NOTES:
1. All concentrations expressed as micrograms per gram (ug/g).
2. mbgs - metres below ground surface. NV = No Value Available
3. day/month/year.
4. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (March 2004). Table 1 Standard is for All Other Types of Property Uses.
5. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (March 2004). Table 3 Standard is for a non-potable groundwater situation for industrial/commercial/community property use. Values in brackets apply to medium and fine textured soils; non-bracketed values apply to coarse-textured soils.
6. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (July 2009). Table 1 Standard is for All Other Types of Property Uses.
7. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (July 2009). Table 3 Standard is for a non-potable groundwater situation for industrial/commercial/community property use. Values in brackets apply to medium and fine textured soils; non-bracketed values apply to coarse-textured soils.
8. Values shown in underline exceed the applicable 2004 MOE Table 1 Standard; values **bold** indicate exceedance of applicable 2004 MOE Table 3 Standards.
9. Table to be read in conjunction with accompanying report.

Prepared By: CS

TABLE IV

ANALYTICAL RESULTS FOR POLYCHLORINATED BIPHENYLS IN SOIL

Summary of Analytical Results, Environmental Soil Sampling
Stantec Consulting Ltd.
Storm Sewer Outlet, Prince Road, Windsor, Ontario

	RESULTS[1]		MOE STANDARDS			
Sample Identification:	**BH-101-4A**	**BH-102-3**				
Depth (mbgs)[2]:	**2.29-2.83**	**1.52-2.13**				
Soil Type:	**Silty Clay (Fill)**	**Sand (Fill)**	**2004**		**2009**	
Sample Date[3]:	**4/4/2011**	**4/5/2011**	**TABLE 1[4]**	**TABLE 3[5]**	**TABLE 1[6]**	**TABLE 3[7]**
PARAMETER						
PCBs	<0.5 (10)	<0.5 (10)	0.3	25	0.3	1.1

NOTES:
1. All concentrations expressed as micrograms per gram (ug/g).
2. mbgs - metres below ground surface. NV = No Value Available
3. day/month/year.
4. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (March 2004). Table 1 Standard is for All Other Types of Property Uses.
5. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (March 2004). Table 3 Standard is for a non-potable groundwater situation for industrial/commercial/community property use. Values in brackets apply to medium and fine textured soils; non-bracketed values apply to coarse-textured soils.
6. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (July 2009). Table 1 Standard is for All Other Types of Property Uses.
7. MOE Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the Environmental Protection Act' (July 2009). Table 3 Standard is for a non-potable groundwater situation for industrial/commercial/community property use. Values in brackets apply to medium and fine textured soils; non-bracketed values apply to coarse-textured soils.
8. Values shown in underline exceed the applicable 2004 MOE Table 1 Standard; values **bold** indicate exceedance of applicable 2004 MOE Table 3 Standards.
9. Reported method detection limit exceeded 2004 MOE Table 1 Standards.
10. '<' Below method detection limit. Samples were diluted and Reporting Detection Limit raised due to chromatographic interference.
11. Table to be read in conjunction with accompanying report.

Prepared By: CS
Checked By: KE

TABLE V

ANALYTICAL RESULTS FOR TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP)

Summary of Analytical Results, Environmental Soil Sampling
Stantec Consulting Ltd.
Storm Sewer Outlet, Prince Road, Windsor, Ontario

	RESULTS[1]		MOE STANDARDS
Sample Identification:	**SS-Comp. Native**	**SS-Comp. Fill**	
Depth (mbgs)[2]:	**Composite of 2.97 - 8.99**	**Composite of 0 - 2.97**	
Soil Type:	**Soil (Native)**	**Soil (Fill)**	
Sampling Date[3]:	**04/04/2011 and 05/04/2011**	**04/04/2011 and 05/04/2011**	**SCHEDULE 4[4]**
PARAMETER			
METALS & INORGANICS			
Arsenic	<0.010	0.041	2.5
Barium	0.615	0.945	100
Boron	0.086	0.129	500
Cadmium	<0.010	<0.010	0.5
Chromium	0.01	0.072	5
Lead	0.038	2.49	5
Mercury	<0.005	<0.005	0.1
Selenium	<0.010	<0.010	1
Silver	<0.010	<0.010	5
Uranium	<0.050	<0.050	10
BTEX			
Benzene	<0.020	<0.020	0.5
Toluene	<0.020	<0.020	NV
Ethylbenzene	<0.010	<0.010	NV
Total Xylenes[5]	<0.020	<0.020	NV
Benzo(a)pyrene	<0.001	<0.001	0.001
Polychlorinated Biphenyls	<0.005	<0.005	0.3

NOTES:

1. All concentrations expressed as milligrams per litre (mg/L TCLP).
2. mbgs - metres below ground surface. NV = No Value Available
3. day/month/year.
4. Leachate Quality Criteria, as listed in Schedule 4 of O. Reg. 347 *General Waste Management, as amended by O.*
5. Total for all xylene isomers.
6. '<' Below method detection limit.
7. Values shown in **bold** exceed their applicable MOE Standard.
8. Table to be read in conjunction with accompanying report.

Prepared By:CS
Checked By: KE

APPENDIX A

Certificate of Analysis

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME:	**GOLDER ASSOCIATES LTD. 1825 PROVINCIAL ROAD WINDSOR, ON N8W5V7**
ATTENTION TO:	**Radwan Tamr**
PROJECT NO:	**09-1140-WO25-2000**
AGAT WORK ORDER:	**11T484279**
SOIL ANALYSIS REVIEWED BY:	**Anthony Dapaah, Inorganic Lab Supervisor**
TRACE ORGANICS REVIEWED BY:	**Jacky Takeuchi, BScH (Chem Eng), BSc (Bio), C.Chem, Laboratory Manager**
DATE REPORTED:	**Apr 14, 2011**
PAGES (INCLUDING COVER):	**19**
VERSION*:	**1**

Should you require any information regarding this analysis please contact your client services representative at (905) 712 5100, or at 1-800-856-6261

NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Certificate of Analysis

AGAT WORK ORDER: 11T484279

PROJECT NO: 09-1140-WO25-2000

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FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD. **ATTENTION TO: Radwan Tamr**

O. Reg. 153 Metals & Inorganics in Soil - Table 1

DATE SAMPLED: Apr 04, 2011 **DATE RECEIVED: Apr 07, 2011** **DATE REPORTED: Apr 14, 2011** **SAMPLE TYPE: Soil**

Parameter	Unit	G / S	RDL	BH-101-4A 2340861	BH-101-8 2340875	BH-102-3 2340879	BH-102-7 2340882	BH-103-2B 2340888	BH-103-5 2340904
Antimony	µg/g	1.0	0.8	**1.4**	<0.8	**1.1**	<0.8	<0.8	<0.8
Arsenic	µg/g	17	1	12	7	5	4	5	3
Barium	µg/g	210	2	**300**	69	57	27	45	7
Beryllium	µg/g	1.2	0.5	0.8	0.6	<0.5	<0.5	<0.5	<0.5
Boron	µg/g		5	12	16	6	7	6	<5
Boron (Hot Water Extractable)	µg/g		0.10	2.03	1.34	0.52	0.30	2.16	0.11
Cadmium	µg/g	1.0	0.5	**1.1**	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g	71	2	54	22	21	11	11	5
Cobalt	µg/g	21	0.5	9.0	9.7	3.9	4.4	2.9	2.3
Copper	µg/g	85	1	59	17	22	12	17	5
Lead	µg/g	120	1	**144**	9	54	9	29	4
Molybdenum	µg/g	2.5	0.5	2.3	2.4	**2.7**	1.4	0.8	0.7
Nickel	µg/g	43	1	34	24	18	11	8	5
Selenium	µg/g	1.9	0.4	0.8	<0.4	0.5	0.7	0.7	<0.4
Silver	µg/g	0.42	0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/g	2.5	0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Uranium	ug/g		0.5	1.1	1.1	0.6	0.9	0.9	<0.5
Vanadium	µg/g	91	1	34	32	16	19	20	11
Zinc	µg/g	160	5	**239**	53	79	52	64	17
Chromium, Hexavalent	µg/g	2.5	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cyanide, Free	µg/g	0.12	0.05	<0.05	<0.05	<0.05	<0.05	0.08	<0.05
Mercury	µg/g	0.23	0.01	**0.49**	0.02	**0.27**	0.01	0.10	<0.01
Electrical Conductivity (2:1)	mS/cm	0.57	0.002	**0.944**	**1.51**	0.284	**0.826**	**1.05**	0.364
Sodium Adsorption Ratio (2:1)	N/A	2.4	N/A	**10.9**	**4.70**	0.396	**2.59**	**3.67**	0.922
pH, 2:1 CaCl2 Extraction	pH Units			7.17	7.74	7.05	7.34	6.81	7.51
Chloride (2:1)	µg/g	330	2	205	**674**	45	**376**	**403**	102
Nitrate + Nitrite	µg/g	61	1	<1	<1	<1	<1	<1	<1

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T1(All)

2340861-2340904 EC, SAR, Chloride & Nitrate/Nitrite were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil).
pH was determined on the extract obtained from the 2:1 leaching procedure (2 parts 0.01M CaCl2:1 part soil).

Certified By:

Certificate of Analysis

AGAT WORK ORDER: 11T484279

PROJECT NO: 09-1140-WO25-2000

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Radwan Tamr

O. Reg. 558 Metals

DATE SAMPLED: Apr 05, 2011 **DATE RECEIVED: Apr 07, 2011** **DATE REPORTED: Apr 14, 2011** **SAMPLE TYPE: Soil**

Parameter	Unit	G / S	RDL	SS-Comp. Native 2340906	SS-Comp. Fill 2340917
Arsenic Leachate	mg/L	2.5	0.010	<0.010	0.041
Barium Leachate	mg/L	100	0.100	0.615	0.945
Boron Leachate	mg/L	500	0.050	0.086	0.129
Cadmium Leachate	mg/L	0.5	0.010	<0.010	<0.010
Chromium Leachate	mg/L	5.0	0.010	0.010	0.072
Lead Leachate	mg/L	5.0	0.010	0.038	2.49
Mercury Leachate	mg/L	0.1	0.005	<0.005	<0.005
Selenium Leachate	mg/L	1.0	0.010	<0.010	<0.010
Silver Leachate	mg/L	5.0	0.010	<0.010	<0.010
Uranium Leachate	mg/L	10.0	0.050	<0.050	<0.050

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Regulation 558

Certified By:

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 11T484279
PROJECT NO: 09-1140-WO25-2000

CLIENT NAME: GOLDER ASSOCIATES LTD.
ATTENTION TO: Radwan Tamr

(P & T) BTEX - Soil (GC/MS)

DATE SAMPLED: Apr 04, 2011 **DATE RECEIVED: Apr 07, 2011** **DATE REPORTED: Apr 14, 2011** **SAMPLE TYPE: Soil**

Parameter	Unit	G / S	RDL	BH-101-4A 2340861	BH-101-8 2340875	BH-102-3 2340879	BH-102-7 2340882	BH-103-2B 2340888	BH-103-5 2340904
Benzene	µg/g	0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Toluene	µg/g	0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Ethylbenzene	µg/g	0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
m & p-Xylene	µg/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
o-Xylene	µg/g		0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Xylene Mixture (Total)	µg/g	0.002	0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Surrogate	**Unit**	**Acceptable Limits**							
Toluene-d8	% Recovery	60-130		111	115	98	116	100	121
4-Bromofluorobenzene	% Recovery	70-130		115	104	112	98	99	111

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T1(All)
2340861-2340904 Results are based on the dry weight of the soil.

Certified By:

Certificate of Analysis

AGAT WORK ORDER: 11T484279

PROJECT NO: 09-1140-WO25-2000

5835 COOPERS AVENUE
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CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Radwan Tamr

O. Reg. 153 - PAHs in Soil

DATE SAMPLED: Apr 04, 2011 **DATE RECEIVED: Apr 07, 2011** **DATE REPORTED: Apr 14, 2011** **SAMPLE TYPE: Soil**

Parameter	Unit	G / S	RDL	BH-101-4A 2340861	BH-102-3 2340879	BH-103-2B 2340888
Naphthalene	µg/g	0.09	0.03	**0.97**	**0.67**	0.06
Acenaphthylene	µg/g	0.08	0.02	**0.24**	**0.17**	<0.02
Acenaphthene	µg/g	0.07	0.03	**3.8**	**0.28**	<0.03
Fluorene	µg/g	0.12	0.02	**6.3**	**1.7**	<0.02
Phenanthrene	µg/g	0.69	0.02	**44**	**0.81**	0.03
Anthracene	µg/g	0.16	0.02	**15**	**0.20**	<0.02
Fluoranthene	µg/g	1.1	0.02	**44**	0.17	0.02
Pyrene	µg/g	1.0	0.02	**37**	0.12	0.03
Benzo(a)anthracene	µg/g	0.74	0.02	**23**	0.03	<0.02
Chrysene	µg/g	0.69	0.02	**18**	0.07	0.02
Benzo(b)fluoranthene	µg/g	0.47	0.02	**17**	0.24	0.02
Benzo(k)fluoranthene	µg/g	0.48	0.02	**7.4**	0.05	<0.02
Benzo(a)pyrene	µg/g	0.49	0.02	**16**	0.12	<0.02
Indeno(1,2,3-cd)pyrene	µg/g	0.38	0.02	**6.3**	**0.39**	<0.02
Dibenz(a,h)anthracene	µg/g	0.16	0.02	**2.2**	0.08	<0.02
Benzo(g,h,i)perylene	µg/g	0.68	0.02	**5.4**	0.61	0.02
2-and 1-methyl Naphthalene	µg/g		0.05	3.9	5.0	0.05
Surrogate	**Unit**	**Acceptable Limits**				
Chrysene-d12	%	60-130		77	**15**	83

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T1(All)

2340861 Results are based on the dry weight of the soil.

2340879 Results are based on the dry weight of the soil.
Recovery of Chrysene-d12 was below our allowable QC range. The sample was reextracted and re-analyzed. The recovery of Chrysene-d12 was still below our allowable QC range this suggests that the problem is caused by the soil sample itself, other samples in this workorder had good recovery for the surrogate.

2340888 Results are based on the dry weight of the soil.

Certified By: Jocky Takeuchi

O. Reg. 153 - Petroleum Hydrocarbons F1 - F4 (C6 - C50) in Soil (-BTEX)

DATE SAMPLED: Apr 04, 2011 **DATE RECEIVED: Apr 07, 2011** **DATE REPORTED: Apr 14, 2011** **SAMPLE TYPE: Soil**

Parameter	Unit	G / S	RDL	BH-101-8 2340875	BH-102-7 2340882	BH-103-5 2340904
C6 - C10 (F1)	µg/g		5	<5	<5	<5
C6 - C10 (F1 minus BTEX)	µg/g		5	<5	<5	<5
C>10 - C16 (F2)	µg/g		10	<10	<10	<10
C>16 - C34 (F3)	µg/g		50	<50	<50	<50
C>34 - C50 (F4)	µg/g		50	<50	<50	<50
Gravimetric Heavy Hydrocarbons	µg/g		50	NA	NA	NA
Moisture Content	%		0.1	31.3	25.9	16.7

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T1(All)

2340875-2340904 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
Total C6 - C50 results are corrected for BTEX contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified without the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.

Certified By: Jocky Takeuchi

Certificate of Analysis

AGAT WORK ORDER: 11T484279

PROJECT NO: 09-1140-WO25-2000

CLIENT NAME: GOLDER ASSOCIATES LTD. **ATTENTION TO: Radwan Tamr**

O. Reg. 153 - Petroleum Hydrocarbons F1 - F4 (C6 - C50) in Soil (PAHs Incl.)

DATE SAMPLED: Apr 04, 2011 **DATE RECEIVED: Apr 07, 2011** **DATE REPORTED: Apr 14, 2011** **SAMPLE TYPE: Soil**

Parameter	Unit	G / S	RDL	BH-101-4A 2340861	BH-102-3 2340879	BH-103-2B 2340888
C6 - C10 (F1)	µg/g		5	7	<5	<5
C6 - C10 (F1 minus BTEX)	µg/g		5	7	<5	<5
C>10 - C16 (F2)	µg/g		10	56	310	<10
C>10 - C16 (F2 minus Naphthalene)	µg/g		10	55	310	<10
C>16 - C34 (F3)	µg/g		50	660	4100	<50
C>16 - C34 (F3 minus PAHs)	µg/g		50	460	4100	<50
C>34 - C50 (F4)	µg/g		50	120	390	<50
Gravimetric Heavy Hydrocarbons	µg/g		50	NA	NA	NA
Moisture Content	%		0.1	33.3	16.4	23.5

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T1(All)

2340861-2340888 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
Total C6 - C50 results are corrected for BTEX and PAH contributions.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.

Certified By: Jacky Takeuchi

CLIENT NAME: GOLDER ASSOCIATES LTD. **ATTENTION TO: Radwan Tamr**

ON Regulation 558 BTEX

DATE SAMPLED: Apr 05, 2011 **DATE RECEIVED: Apr 07, 2011** **DATE REPORTED: Apr 14, 2011** **SAMPLE TYPE: Soil**

Parameter	Unit	G / S	RDL	SS-Comp. Native 2340906	SS-Comp. Fill 2340917
Benzene	mg/L	0.5	0.020	<0.020	<0.020
Toluene	mg/L		0.020	<0.020	<0.020
Ethylbenzene	mg/L		0.010	<0.010	<0.010
m & p-Xylene	mg/L		0.020	<0.020	<0.020
o-Xylene	mg/L		0.010	<0.010	<0.010

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Regulation 558

2340906 Surrogate Recovery for Toluene-d8: 100 %
Surrogate recovery for 4-Bromofluorobenzene: 94 %
Sample was prepared using Regulation 558 protocol and a zero headspace extractor.
Results relate only to the items tested.

2340917 Surrogate Recovery for Toluene-d8: 102 %
Surrogate recovery for 4-Bromofluorobenzene: 93 %
Sample was prepared using Regulation 558 protocol and a zero headspace extractor.
Results relate only to the items tested.

Certified By: Jacky Takeuchi

ON Regulation 558 Benzo(a) pyrene

DATE SAMPLED: Apr 05, 2011 **DATE RECEIVED: Apr 07, 2011** **DATE REPORTED: Apr 14, 2011** **SAMPLE TYPE: Soil**

Parameter	Unit	G / S	RDL	SS-Comp. Native 2340906	SS-Comp. Fill 2340917
Benzo(a)pyrene	mg/L	0.001	0.001	<0.001	<0.001

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Regulation 558

2340906-2340917 The sample was leached according to Regulation 558 protocol. Analysis was performed on the leachate.

Certified By: Jocky Takeuchi

Certificate of Analysis

AGAT WORK ORDER: 11T484279

PROJECT NO: 09-1140-WO25-2000

AGAT Laboratories
5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
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TEL (905)712-5100
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http://www.agatlabs.com

CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Radwan Tamr

ON Regulation 558 PCBs

DATE SAMPLED: Apr 05, 2011 **DATE RECEIVED: Apr 07, 2011** **DATE REPORTED: Apr 14, 2011** **SAMPLE TYPE: Soil**

Parameter	Unit	G / S	RDL	SS-Comp. Native 2340906	SS-Comp. Fill 2340917
Polychlorinated Biphenyls	mg/L	0.3	0.005	<0.005	<0.005
Surrogate	**Unit**	**Acceptable Limits**			
Decachlorobiphenyl	%	60-130		83	101

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Regulation 558

2340906-2340917 The soil sample was leached using the Regulation 558 procedure. Analysis was performed on the leachate.

Certified By: Jacky Takeuchi

Certificate of Analysis

AGAT WORK ORDER: 11T484279

PROJECT NO: 09-1140-WO25-2000

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CLIENT NAME: GOLDER ASSOCIATES LTD. **ATTENTION TO: Radwan Tamr**

PCBs (soil)

DATE SAMPLED: Apr 04, 2011 **DATE RECEIVED: Apr 07, 2011** **DATE REPORTED: Apr 14, 2011** **SAMPLE TYPE: Soil**

Parameter	Unit	G / S	RDL	BH-101-4A 2340861	BH-102-3 2340879
PCBs	µg/g	0.3	0.5	<0.5	<0.5
Surrogate	**Unit**	**Acceptable Limits**			
Decachlorobiphenyl	%	60-130		120	120

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to T1(All)

2340861-2340879 Results are based on the dry weight of soil extracted.
Sample was diluted and Reporting Detection Limit raised due to chromatographic interference.

Certified By: Jocky Takeuchi

Guideline Violation

AGAT WORK ORDER: 11T484279

PROJECT NO: 09-1140-WO25-2000

5835 COOPERS AVENUE
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CLIENT NAME: GOLDER ASSOCIATES LTD.

ATTENTION TO: Radwan Tamr

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	GUIDEVALUE	RESULT
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Acenaphthene	0.07	3.8
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Acenaphthylene	0.08	0.24
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Anthracene	0.16	15
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Benzo(a)anthracene	0.74	23
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Benzo(a)pyrene	0.49	16
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Benzo(b)fluoranthene	0.47	17
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Benzo(g,h,i)perylene	0.68	5.4
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Benzo(k)fluoranthene	0.48	7.4
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Chrysene	0.69	18
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Dibenz(a,h)anthracene	0.16	2.2
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Fluoranthene	1.1	44
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Fluorene	0.12	6.3
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Indeno(1,2,3-cd)pyrene	0.38	6.3
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Naphthalene	0.09	0.97
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Phenanthrene	0.69	44
2340861	BH-101-4A	T1(All)	O. Reg. 153 - PAHs in Soil	Pyrene	1.0	37
2340861	BH-101-4A	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Antimony	1.0	1.4
2340861	BH-101-4A	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Barium	210	300
2340861	BH-101-4A	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Cadmium	1.0	1.1
2340861	BH-101-4A	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Electrical Conductivity (2:1)	0.57	0.944
2340861	BH-101-4A	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Lead	120	144
2340861	BH-101-4A	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Mercury	0.23	0.49
2340861	BH-101-4A	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Sodium Adsorption Ratio (2:1)	2.4	10.9
2340861	BH-101-4A	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Zinc	160	239
2340875	BH-101-8	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Chloride (2:1)	330	674
2340875	BH-101-8	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Electrical Conductivity (2:1)	0.57	1.51
2340875	BH-101-8	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Sodium Adsorption Ratio (2:1)	2.4	4.70
2340879	BH-102-3	T1(All)	O. Reg. 153 - PAHs in Soil	Acenaphthene	0.07	0.28
2340879	BH-102-3	T1(All)	O. Reg. 153 - PAHs in Soil	Acenaphthylene	0.08	0.17
2340879	BH-102-3	T1(All)	O. Reg. 153 - PAHs in Soil	Anthracene	0.16	0.20
2340879	BH-102-3	T1(All)	O. Reg. 153 - PAHs in Soil	Fluorene	0.12	1.7
2340879	BH-102-3	T1(All)	O. Reg. 153 - PAHs in Soil	Indeno(1,2,3-cd)pyrene	0.38	0.39
2340879	BH-102-3	T1(All)	O. Reg. 153 - PAHs in Soil	Naphthalene	0.09	0.67
2340879	BH-102-3	T1(All)	O. Reg. 153 - PAHs in Soil	Phenanthrene	0.69	0.81
2340879	BH-102-3	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Antimony	1.0	1.1
2340879	BH-102-3	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Mercury	0.23	0.27
2340879	BH-102-3	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Molybdenum	2.5	2.7
2340882	BH-102-7	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Chloride (2:1)	330	376
2340882	BH-102-7	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Electrical Conductivity (2:1)	0.57	0.826
2340882	BH-102-7	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Sodium Adsorption Ratio (2:1)	2.4	2.59
2340888	BH-103-2B	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Chloride (2:1)	330	403
2340888	BH-103-2B	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Electrical Conductivity (2:1)	0.57	1.05
2340888	BH-103-2B	T1(All)	O. Reg. 153 Metals & Inorganics in Soil - Table 1	Sodium Adsorption Ratio (2:1)	2.4	3.67

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD. **AGAT WORK ORDER: 11T484279**

PROJECT NO: 09-1140-WO25-2000 **ATTENTION TO: Radwan Tamr**

Soil Analysis

RPT Date: Apr 14, 2011			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153 Metals & Inorganics in Soil - Table 1															
Antimony	1		< 0.8	< 0.8	0.0%	< 0.8	100%	90%	110%	110%	90%	110%	89%	70%	130%
Arsenic	1		4	4	0.0%	< 1	101%	90%	110%	106%	90%	110%	91%	70%	130%
Barium	1		73	73	0.0%	< 2	96%	90%	110%	100%	90%	110%	83%	70%	130%
Beryllium	1		0.6	0.6	0.0%	< 0.5	100%	90%	110%	102%	90%	110%	92%	70%	130%
Boron	1		8	8	0.0%	< 5	95%	90%	110%	99%	90%	110%	81%	70%	130%
Boron (Hot Water Extractable)	1	2340904	0.11	< 10		< 0.10	98%	80%	120%	114%	80%	120%	100%	70%	130%
Cadmium	1		< 0.5	< 0.5	0.0%	< 0.5	97%	90%	110%	105%	90%	110%	83%	70%	130%
Chromium	1		21	21	0.0%	< 2	99%	90%	110%	107%	90%	110%	96%	70%	130%
Cobalt	1		9.62	9.68	0.6%	< 0.5	94%	90%	110%	105%	90%	110%	84%	70%	130%
Copper	1		23	23	0.0%	< 1	101%	90%	110%	107%	90%	110%	91%	70%	130%
Lead	1		9	9	0.0%	< 1	97%	90%	110%	100%	90%	110%	86%	70%	130%
Molybdenum	1		< 0.5	< 0.5	0.0%	< 0.5	94%	90%	110%	108%	90%	110%	89%	70%	130%
Nickel	1		21	20	4.9%	< 1	98%	90%	110%	106%	90%	110%	85%	70%	130%
Selenium	1		< 0.4	< 0.4	0.0%	< 0.4	94%	90%	110%	100%	90%	110%	85%	70%	130%
Silver	1		< 0.2	< 0.2	0.0%	< 0.2	96%	90%	110%	116%	80%	120%	90%	70%	130%
Thallium	1		< 0.4	< 0.4	0.0%	< 0.4	98%	90%	110%	102%	90%	110%	87%	70%	130%
Uranium	1		0.5	0.5	0.0%	< 0.5	94%	90%	110%	105%	90%	110%	90%	70%	130%
Vanadium	1		29	28	3.5%	< 1	96%	90%	110%	104%	90%	110%	90%	70%	130%
Zinc	1		50	51	2.0%	< 5	102%	90%	110%	112%	80%	120%	91%	70%	130%
Chromium, Hexavalent	1		< 0.2	< 0.2	0.0%	< 0.2	103%	80%	120%	100%	90%	110%	107%	70%	130%
Cyanide, Free	1		< 0.05	< 0.05	0.0%	< 0.05	92%	80%	120%	96%	90%	110%	82%	70%	130%
Mercury	1	2340875	0.02	0.02	0.0%	< 0.01	100%	80%	120%	94%	90%	110%	97%	70%	130%
Electrical Conductivity (2:1)	1	2340861	0.944	0.942	0.2%	< 0.002	99%	80%	120%						
Sodium Adsorption Ratio (2:1)	1	2340861	10.8	11.2	2.9%	N/A									
pH, 2:1 CaCl2 Extraction	1	2340861	7.17	7.11	0.8%	<	100%	90%	110%						
Chloride (2:1)	1	2340861	205	207	1.0%	< 2	99%	90%	110%	106%	90%	110%	93%	70%	140%
O. Reg. 558 Metals															
Arsenic Leachate	1		0.041	0.041	0.0%	< 0.010	106%	90%	110%	102%	90%	110%	102%	70%	130%
Barium Leachate	1		3.62	3.67	1.4%	< 0.100	106%	90%	110%	100%	90%	110%	96%	70%	130%
Boron Leachate	1		3.70	3.63	1.9%	< 0.050	104%	90%	110%	91%	90%	110%	81%	70%	130%
Cadmium Leachate	1		0.230	0.233	1.3%	< 0.010	104%	90%	110%	103%	90%	110%	103%	70%	130%
Chromium Leachate	1		0.192	0.187	2.6%	< 0.010	107%	90%	110%	103%	90%	110%	102%	70%	130%
Lead Leachate	1		68.6	67.2	2.1%	< 0.010	98%	90%	110%	83%	80%	120%	85%	70%	130%
Mercury Leachate	1		< 0.005	< 0.005	0.0%	< 0.005	98%	90%	110%	91%	90%	110%	90%	70%	130%
Selenium Leachate	1		0.019	0.016	17.1%	< 0.010	98%	90%	110%	92%	90%	110%	94%	70%	130%
Silver Leachate	1		0.019	0.019	0.0%	< 0.010	113%	80%	120%	105%	90%	110%	105%	70%	130%
Uranium Leachate	1		< 0.050	< 0.050	0.0%	< 0.050	102%	90%	110%	90%	90%	110%	94%	70%	130%

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD. **AGAT WORK ORDER: 11T484279**

PROJECT NO: 09-1140-WO25-2000 **ATTENTION TO: Radwan Tamr**

Soil Analysis (Continued)

RPT Date: Apr 14, 2011			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper

Certified By:

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD. **AGAT WORK ORDER: 11T484279**

PROJECT NO: 09-1140-WO25-2000 **ATTENTION TO: Radwan Tamr**

Trace Organics Analysis

RPT Date: Apr 14, 2011			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
ON Regulation 558 BTEX															
Benzene	1		< 0.020	< 0.020	0.0%	< 0.020	83%	60%	140%	84%	60%	140%	93%	60%	140%
Toluene	1		< 0.020	< 0.020	0.0%	< 0.020	95%	60%	140%	74%	60%	140%	87%	60%	140%
Ethylbenzene	1		< 0.010	< 0.010	0.0%	< 0.010	104%	60%	140%	79%	60%	140%	89%	60%	140%
m & p-Xylene	1		< 0.020	< 0.020	0.0%	< 0.020	90%	60%	140%	72%	60%	140%	79%	60%	140%
o-Xylene	1		< 0.010	< 0.010	0.0%	< 0.010	94%	60%	140%	74%	60%	140%	77%	60%	140%
ON Regulation 558 PCBs															
Polychlorinated Biphenyls	1					< 0.005	107%	60%	130%	100%	60%	130%		60%	130%
ON Regulation 558 Benzo(a) pyrene															
Benzo(a)pyrene	1					< 0.001	101%	70%	130%	75%	70%	130%		70%	130%
O. Reg. 153 - Petroleum Hydrocarbons F1 - F4 (C6 - C50) in Soil (PAHs Incl.)															
C6 - C10 (F1)	1		< 5	< 5	0.0%	< 5	103%	60%	130%	96%	60%	130%	89%	60%	130%
C>10 - C16 (F2)	1		< 10	< 10	0.0%	< 10	108%	70%	130%	108%	70%	130%	94%	70%	130%
C>16 - C34 (F3)	1		< 50	< 50	0.0%	< 50	106%	70%	130%	109%	70%	130%	112%	70%	130%
C>34 - C50 (F4)	1		< 50	< 50	0.0%	< 50	100%	70%	130%	102%	70%	130%	107%	70%	130%
O. Reg. 153 - PAHs in Soil															
Naphthalene	1		< 0.03	< 0.03	0.0%	< 0.03	92%	60%	130%	68%	60%	130%	63%	60%	130%
Acenaphthylene	1		< 0.02	< 0.02	0.0%	< 0.02	96%	60%	130%	72%	60%	130%	67%	60%	130%
Acenaphthene	1		< 0.03	< 0.03	0.0%	< 0.03	97%	60%	130%	72%	60%	130%	69%	60%	130%
Fluorene	1		< 0.02	< 0.02	0.0%	< 0.02	99%	60%	130%	75%	60%	130%	76%	60%	130%
Phenanthrene	1		< 0.02	< 0.02	0.0%	< 0.02	100%	60%	130%	75%	60%	130%	86%	60%	130%
Anthracene	1		< 0.02	< 0.02	0.0%	< 0.02	104%	60%	130%	82%	60%	130%	75%	60%	130%
Fluoranthene	1		< 0.02	< 0.02	0.0%	< 0.02	108%	60%	130%	84%	60%	130%	108%	60%	130%
Pyrene	1		< 0.02	< 0.02	0.0%	< 0.02	110%	60%	130%	86%	60%	130%	104%	60%	130%
Benzo(a)anthracene	1		< 0.02	< 0.02	0.0%	< 0.02	109%	60%	130%	91%	60%	130%	110%	60%	130%
Chrysene	1		< 0.02	< 0.02	0.0%	< 0.02	105%	60%	130%	101%	60%	130%	110%	60%	130%
Benzo(b)fluoranthene	1		< 0.02	< 0.02	0.0%	< 0.02	92%	60%	130%	75%	60%	130%	77%	60%	130%
Benzo(k)fluoranthene	1		< 0.02	< 0.02	0.0%	< 0.02	97%	60%	130%	83%	60%	130%	82%	60%	130%
Benzo(a)pyrene	1		< 0.02	< 0.02	0.0%	< 0.02	117%	60%	130%	80%	60%	130%	79%	60%	130%
Indeno(1,2,3-cd)pyrene	1		< 0.02	< 0.02	0.0%	< 0.02	102%	60%	130%	80%	60%	130%	72%	60%	130%
Dibenz(a,h)anthracene	1		< 0.02	< 0.02	0.0%	< 0.02	97%	60%	130%	77%	60%	130%	70%	60%	130%
Benzo(g,h,i)perylene	1		< 0.02	< 0.02	0.0%	< 0.02	95%	60%	130%	78%	60%	130%	75%	60%	130%
2-and 1-methyl Naphthalene	1		< 0.05	< 0.05	0.0%	< 0.05	101%	60%	130%	75%	60%	130%	71%	60%	130%
(P & T) BTEX - Soil (GC/MS)															
Benzene	1		< 0.002	< 0.002	0.0%	< 0.002	73%	60%	130%	82%	60%	130%	76%	60%	130%
Toluene	1		< 0.002	< 0.002	0.0%	< 0.002	116%	60%	130%	75%	60%	130%	87%	60%	130%
Ethylbenzene	1		< 0.002	< 0.002	0.0%	< 0.002	110%	60%	130%	90%	60%	130%	99%	60%	130%
m & p-Xylene	1		< 0.002	< 0.002	0.0%	< 0.002	105%	60%	130%	89%	60%	130%	98%	60%	130%

Quality Assurance

CLIENT NAME: GOLDER ASSOCIATES LTD.

AGAT WORK ORDER: 11T484279

PROJECT NO: 09-1140-WO25-2000

ATTENTION TO: Radwan Tamr

Trace Organics Analysis (Continued)

RPT Date: Apr 14, 2011			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
o-Xylene	1		< 0.002	< 0.002	0.0%	< 0.002	102%	60%	130%	73%	60%	130%	79%	60%	130%
Xylene Mixture (Total)	1		< 0.002	< 0.002	0.0%	< 0.002	102%	60%	130%	73%	60%	130%	79%	60%	130%
PCBs (soil)															
PCBs	1		<0.1	<0.1	0.0%	< 0.1	102%	60%	140%	92%	60%	140%	95%	60%	140%

Certified By: Jody Takeuchi

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
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Method Summary

CLIENT NAME: GOLDER ASSOCIATES LTD. **AGAT WORK ORDER: 11T484279**

PROJECT NO: 09-1140-WO25-2000 **ATTENTION TO: Radwan Tamr**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Arsenic	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Barium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Beryllium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Boron (Hot Water Extractable)	MET-93-6104	EPA SW 846 6010C; MSA, Part 3, Ch.21	ICP/OES
Cadmium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Cobalt	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Copper	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Lead	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Molybdenum	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Nickel	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Selenium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Silver	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Thallium	MET-93-1003	EPA SW 846 3050B & 6020A	ICP-MS
Uranium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Vanadium	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Zinc	MET-93-6103	EPA SW-846 3050B & 6020A	ICP-MS
Chromium, Hexavalent	INOR-93-6029	SM 3500 B; MSA Part 3, Ch. 25	SPECTROPHOTOMETER
Cyanide, Free	INOR-93-6052	MOE CN-3015 & E 3009 A;SM 4500 CN	TECHNICON AUTO ANALYZER
Mercury	MET-93-6101	EPA SW 846 7471A 245.5	CVAAS
Electrical Conductivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B	EC METER
Sodium Adsorption Ratio (2:1)	INOR-93-6007	McKeague 4.12 & 3.26 & EPA SW-846 6010C	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Nitrate + Nitrite	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Arsenic Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Barium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Boron Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Cadmium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Chromium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Lead Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Mercury Leachate	MET-93-6100	EPA SW-846 1311 & 7470, 245.1	CVAAS
Selenium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Silver Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS
Uranium Leachate	MET-93-6103	EPA SW-846 1311 & 3010A & 6020A	ICP-MS

Method Summary

CLIENT NAME: GOLDER ASSOCIATES LTD. **AGAT WORK ORDER: 11T484279**

PROJECT NO: 09-1140-WO25-2000 **ATTENTION TO: Radwan Tamr**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Benzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Toluene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Ethylbenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
m & p-Xylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
o-Xylene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Xylene Mixture (Total)	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Toluene-d8	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
4-Bromofluorobenzene	VOL-91-5002	EPA SW-846 5035 & 8260	(P&T)GC/MS
Naphthalene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Acenaphthylene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Acenaphthene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Fluorene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Phenanthrene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Anthracene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Fluoranthene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Pyrene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Benzo(a)anthracene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Chrysene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Benzo(b)fluoranthene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Benzo(k)fluoranthene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Benzo(a)pyrene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Indeno(1,2,3-cd)pyrene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Dibenz(a,h)anthracene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Benzo(g,h,i)perylene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
2-and 1-methyl Naphthalene	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
Chrysene-d12	ORG-91-5106	EPA SW846 3541 & 8270	GC/MS
C6 - C10 (F1)	VOL-91-5009	CCME Tier 1 Method, SW846 5035	P &T GC / FID
C6 - C10 (F1 minus BTEX)	VOL-91-5009	CCME Tier 1 Method, SW846 5035	P & T GC / FID
C>10 - C16 (F2)	VOL-91-5009	CCME Tier 1 Method	GC / FID
C>16 - C34 (F3)	VOL-91-5009	CCME Tier 1 Method	GC / FID
C>34 - C50 (F4)	VOL-91-5009	CCME Tier 1 Method	GC / FID
Gravimetric Heavy Hydrocarbons	VOL-91-5009	CCME Tier 1 Method	GRAVIMETRIC ANALYSIS
Moisture Content	VOL-91-5009	CCME Tier 1 Method, SW846 5035,8015	GC / FID
C6 - C10 (F1)	VOL-91-5009	CCME Tier 1 Method	GC / FID
C6 - C10 (F1 minus BTEX)	VOL-91-5009	CCME Tier 1 Method	GC / FID
C>10 - C16 (F2)	VOL-91-5009	CCME Tier 1 Method	GC / FID
C>10 - C16 (F2 minus Naphthalene)	VOL-91-5009	CCME Tier 1 Method	GC / FID
C>16 - C34 (F3)	VOL-91-5009	CCME Tier 1 Method	GC / FID
C>16 - C34 (F3 minus PAHs)	VOL-91-5009	CCME Tier 1 Method	GC / FID
C>34 - C50 (F4)	VOL-91-5009	CCME Tier 1 Method	GC / FID
Gravimetric Heavy Hydrocarbons	VOL-91-5009	CCME Tier 1 Method	GRAVIMETRIC ANALYSIS
Moisture Content	VOL-91-5009	CCME Tier 1 Method	GRAVIMETRIC
Benzene	VOL - 5001	EPA 1311, EPA 8260	(P&T)GC/MS
Toluene	VOL 5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Ethylbenzene	VOL 5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
m & p-Xylene	VOL 5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
o-Xylene	VOL 5001	EPA SW-846 5230B & 8260	(P&T)GC/MS
Benzo(a)pyrene	ORG-91-5114	EPA SW846 3540 & 8270	GC/MS

Method Summary

CLIENT NAME: GOLDER ASSOCIATES LTD. **AGAT WORK ORDER: 11T484279**

PROJECT NO: 09-1140-WO25-2000 **ATTENTION TO: Radwan Tamr**

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Polychlorinated Biphenyls	ORG-91-5112	Regulation 558, EPA SW846 3510C/8082	GC/ECD
Decachlorobiphenyl	ORG-91-5112	EPA SW846 3510C/8082	GC/ECD
PCBs	ORG-91-5113	EPA SW-846 3541 & 8082	GC/ECD
Decachlorobiphenyl	ORG-91-5113	EPA SW-846 3541 & 8082	GC/ECD

APPENDIX B

CPT Results

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 5

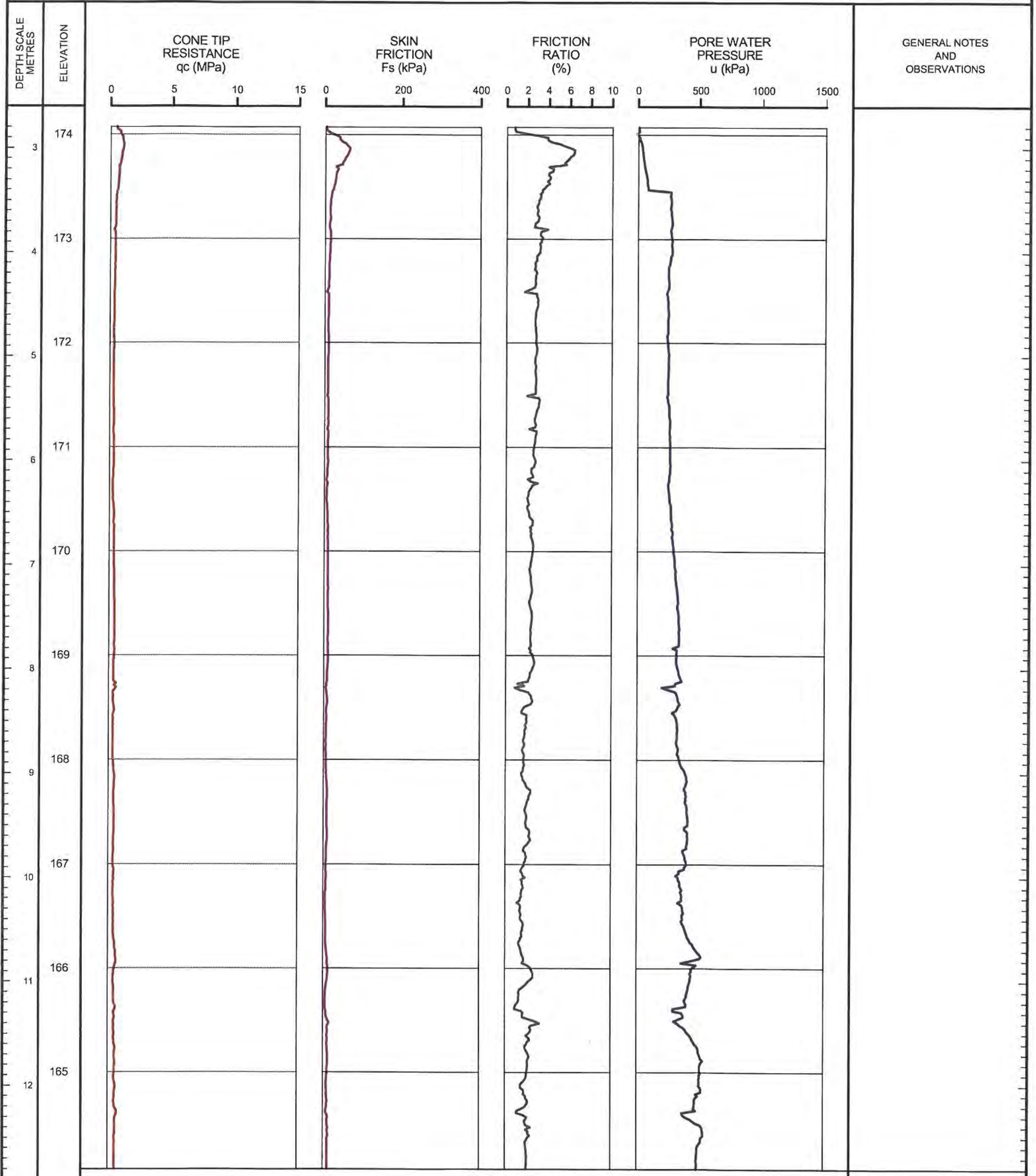
SHEET 1 OF 2

LOCATION: SEE LOCATION PLAN

TEST DATE: November 26, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 176.87m PREDRILL DEPTH: 2.80m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



— CONTINUED NEXT PAGE —

DEPTH SCALE

1 : 50

Golder Associates

OPERATOR: CC

CHECKED: NP

LDN_CPT_01 09-1140-W025_CPT.GPJ GLDR_LON.GDT 5/6/10 DATA INPUT: DMB

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 5

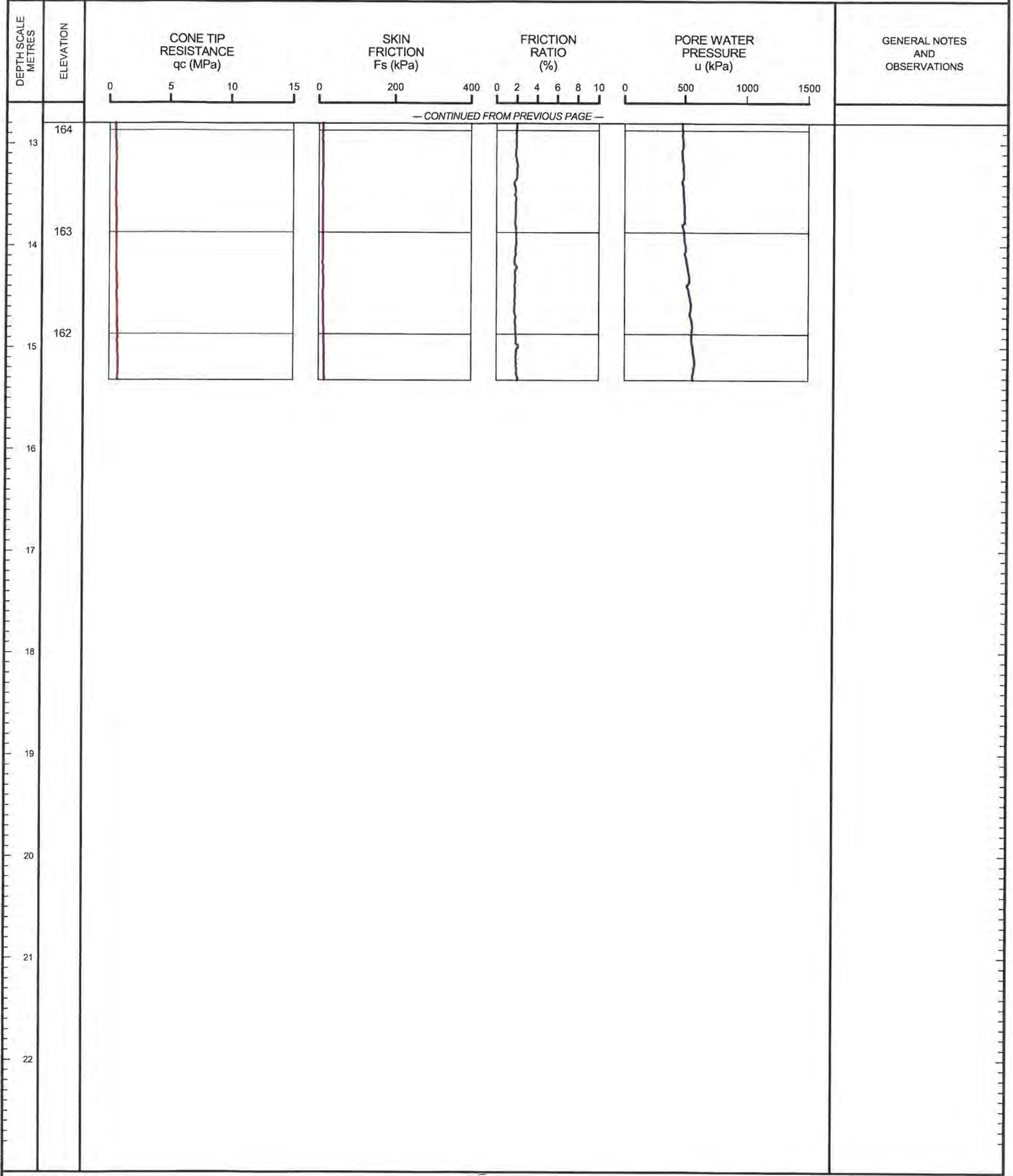
SHEET 2 OF 2

LOCATION: SEE LOCATION PLAN

TEST DATE: November 26, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 176.87m PREDRILL DEPTH: 2.80m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



DEPTH SCALE

1 : 50

OPERATOR: CC

CHECKED: NP

LDN_CPT_01 09-1140-W025_CPT.GPJ GLDR_LON.GDT 5/6/10 DATA INPUT: DMB

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 6

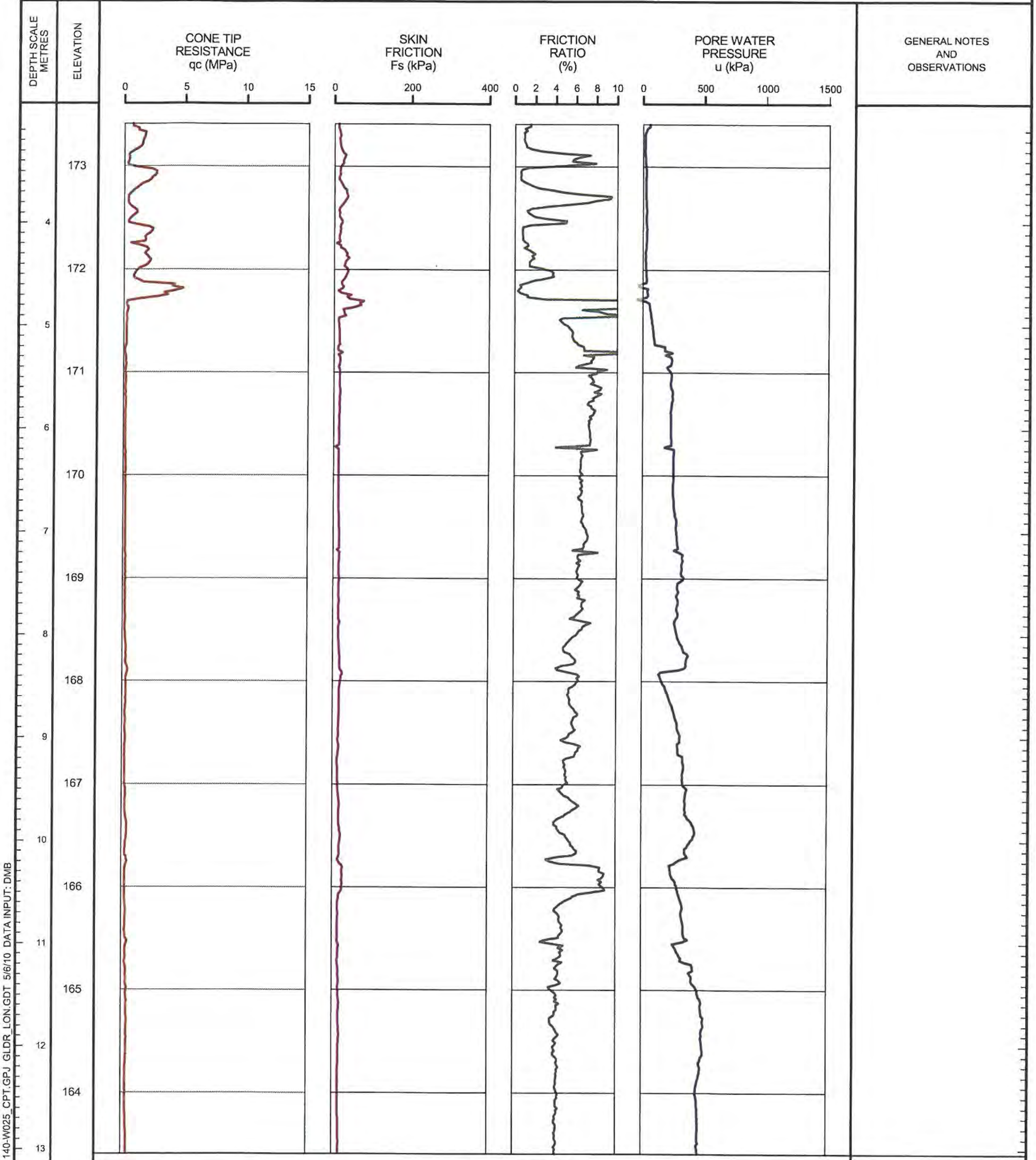
SHEET 1 OF 3

LOCATION: SEE LOCATION PLAN

TEST DATE: November 27, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 176.45m PREDRILL DEPTH: 3.04m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



— CONTINUED NEXT PAGE —

DEPTH SCALE
1 : 50

Golder Associates

OPERATOR: CC

CHECKED: NR

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 6

SHEET 2 OF 3

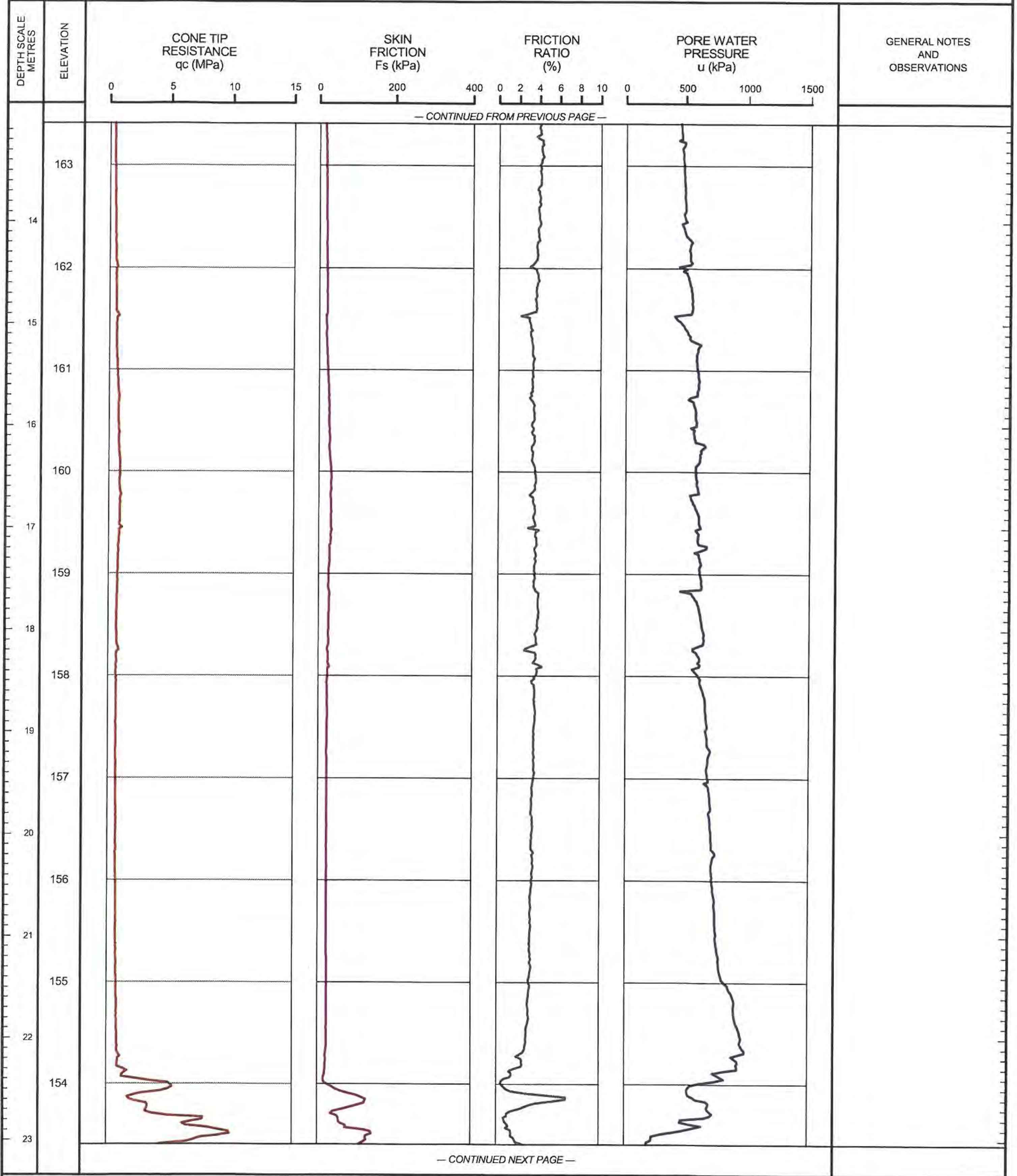
LOCATION: SEE LOCATION PLAN

TEST DATE: November 27, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 176.45m PREDRILL DEPTH: 3.04m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012

— CONTINUED FROM PREVIOUS PAGE —



— CONTINUED NEXT PAGE —

DEPTH SCALE
1 : 50

Golder Associates

OPERATOR: CC
CHECKED: MR

PROJECT: 09-1140-W025

RECORD OF CONE PENETRATION TEST CPT 6

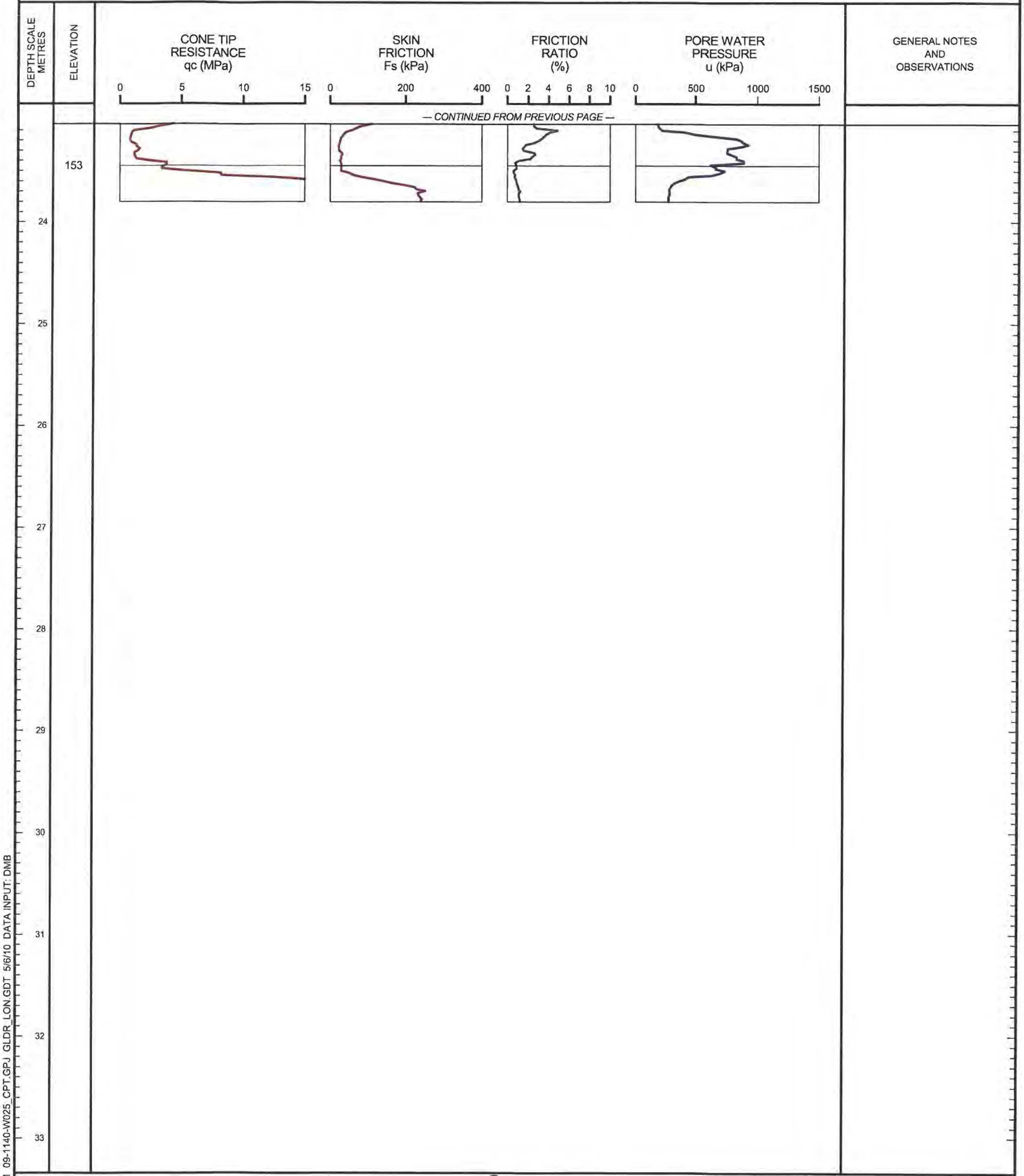
SHEET 3 OF 3

LOCATION: SEE LOCATION PLAN

TEST DATE: November 27, 2009

DATUM: GEODETIC

GROUND SURFACE ELEVATION: 176.45m PREDRILL DEPTH: 3.04m CORRECTION FACTOR A: 0.584 CORRECTION FACTOR B: 0.012



DEPTH SCALE

1 : 50

OPERATOR: CC

CHECKED: NR

LDN_CPT_01 09-1140-W025_CPT.GPJ GLDR_LON.GDT 5/6/10 DATA INPUT: DMB

At Golder Associates we strive to be the most respected global group of companies specializing in ground engineering and environmental services. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organizational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees now operating from offices located throughout Africa, Asia, Australasia, Europe, North America and South America.

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Golder Associates

APPENDIX D

Archaeology

Ministry of Heritage, Sport, Tourism, and Culture Industries

Archaeology Program Unit
Programs and Services Branch
Heritage, Tourism and Culture Division
5th Floor, 400 University Ave.
Toronto ON M7A 2R9
Tel.: (249) 885-1567
Email: Paige.Campbell@ontario.ca

Ministère des Industries du patrimoine, du sport, du tourisme et de la culture

Unité des programme d'archéologie
Direction des programmes et des services
Division du patrimoine, du tourisme et de la culture
5e étage, 400 ave. University
Toronto ON M7A 2R9
Tél. : (249) 885-1567
Email: Paige.Campbell@ontario.ca

Dec 13, 2021

Heather Kerr (P1148)
Stantec Consulting
3 - 86 Indian Toronto ON M6R 2V4

RE: Review and Entry into the Ontario Public Register of Archaeological Reports: Archaeological Assessment Report Entitled, "Stage 1 Archaeological Assessment: City of Windsor, Prince Road Storm Sewer Outlet, Municipal Class Environmental Assessment, Part of Lot 59, Concession 1, Geographic Township of Sandwich, former Essex County, now City of Windsor, Ontario. ", Dated Oct 25, 2021, Filed with MHSTCI Toronto Office on Nov 5, 2021, MHSTCI Project Information Form Number P1148-0010-2021, MHSTCI File Number 0014628

Dear Ms. Kerr:

This office has reviewed the above-mentioned report, which has been submitted to this ministry as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c 0.18.[1] This review has been carried out in order to determine whether the licensed professional consultant archaeologist has met the terms and conditions of their licence, that the licensee assessed the property and documented archaeological resources using a process that accords with the 2011 *Standards and Guidelines for Consultant Archaeologists* set by the ministry, and that the archaeological fieldwork and report recommendations are consistent with the conservation, protection and preservation of the cultural heritage of Ontario.

The report documents the assessment of the study area as depicted in Figure 12 of the above titled report and recommends the following:

The Stage 1 archaeological assessment, involving background research and property inspection, resulted in the determination that the entire study area retains low to no archaeological potential as it consists of extensive land disturbance from gravel roads, grading, extant structures, utilities, and railway tracks. In accordance with Section 1.3.2 and Section 7.7.4 of the MHSTCI's 2011 Standards and Guidelines for Consultant Archaeologists (Government of Ontario 2011), Stage 2 archaeological assessment is not required for the study area (Figure 12).

Based on the information contained in the report, the ministry is satisfied that the fieldwork and reporting for the archaeological assessment are consistent with the ministry's 2011 *Standards and Guidelines for Consultant Archaeologists* and the terms and conditions for archaeological licences. This report has been entered into the Ontario Public Register of Archaeological Reports. Please note that the ministry makes no representation or warranty as to the completeness, accuracy or quality of reports in the register.

Should you require any further information regarding this matter, please feel free to contact me.

Sincerely,

Paige Campbell
Archaeology Review Officer

cc. Archaeology Licensing Officer
Ian Wilson ,City of Windsor
Ian Wilson ,City of Windsor

---

[1] *In no way will the ministry be liable for any harm, damages, costs, expenses, losses, claims or actions that may result: (a) if the Report(s) or its recommendations are discovered to be inaccurate, incomplete, misleading or fraudulent; or (b) from the issuance of this letter. Further measures may need to be taken in the event that additional artifacts or archaeological sites are identified or the Report(s) is otherwise found to be inaccurate, incomplete, misleading or fraudulent.*

Stage 1 Archaeological Assessment: City of Windsor Prince Road Storm Sewer Outlet, Municipal Class Environmental Assessment

Part of Lot 59, Concession 1,
Geographic Township of Sandwich,
former Essex County, now City of
Windsor, Ontario

October 25, 2021

Prepared for:

City of Windsor
350 City Hall Square West
Windsor, Ontario N9A 6S1

Prepared by:

Stantec Consulting Ltd.
100-401 Wellington Street West
Toronto, Ontario M5V 1E7

Licensee: Heather Kerr, MA
Licence Number: P1148
Project Information Form Number:
P1148-0010-2021
Project Number: 165620224

ORIGINAL REPORT

Table of Contents

LIST OF TABLES

LIST OF FIGURES

Executive Summary

Stantec Consulting Ltd. (Stantec) was retained by the City of Windsor to complete a Stage 1 archaeological assessment for the lands associated with the proposed Prince Road Storm Sewer Outlet Project (the Project). The study area for the Project comprises approximately 0.37 hectares and is located on part of Lot 59, Concession 1, Geographic Township of Sandwich, former Essex County, now the City of Windsor, Ontario. The Stage 1 archaeological assessment was conducted in accordance with the provisions of the *Ontario Heritage Act* (Government of Ontario 1990b) and triggered as a part of a Schedule “C” Municipal Class Environmental Assessment (Government of Ontario 1990c).

The Stage 1 archaeological assessment was completed under Project Information Form number P1148-0010-2021 issued to Heather Kerr, MA, by the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI). A property inspection of the study area was conducted on July 9, 2021.

The Stage 1 archaeological assessment resulted in the determination that the entire study area retains low to no archaeological potential due to extensive land disturbance. In accordance with Section 1.3.2 and Section 7.7.4 of the MHSTCI’s 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011), **Stage 2 archaeological assessment is not required for the study area.**

The MHSTCI is asked to review the results presented and accept this report into the *Ontario Public Register of Archaeological Reports*.

The Executive Summary highlights key points form the report only; for complete information and findings, the reader should examine the complete report.

Project Personnel

Project Manager:	Paula Hohner, MScPl, MCIP, RPP
Licensed Archaeologist:	Heather Kerr, MA (P1148)
Licensed Field Director:	Nathan Ng (R1223)
Report Writer:	Heather Kerr, MA (P1148)
GIS Analyst:	Christina Coghlan
Quality Review:	Parker Dickson, MA (P256)
Independent Review:	Colin Varley, MA, RPA (P002)

Acknowledgements

Proponent Contact:	Ian Wilson, City of Windsor
Ministry of Heritage, Sport, Tourism and Culture Industries:	Robert von Bitter, Archaeological Data Coordinator

1.0 PROJECT CONTEXT

1.1 DEVELOPMENT CONTEXT

Stantec Consulting Ltd. (Stantec) was retained by the City of Windsor to complete a Stage 1 archaeological assessment for the lands associated with the proposed Prince Road Storm Sewer Outlet (the Project). The study area for the Stage 1 archaeological assessment of the Project comprises approximately 0.37 hectares and is located on part of Lot 59, Concession 1, Geographic Township of Sandwich, former Essex County, now the City of Windsor, Ontario (Figures 1 and 2). The Stage 1 archaeological assessment was conducted in accordance with the provisions of the *Ontario Heritage Act* (Government of Ontario 1990b) and a Schedule "C" Municipal Class Environmental Assessment regulated by the *Environmental Assessment Act* (Government of Ontario 1990c).

1.1.1 Objectives

In compliance with the provincial standards and guidelines set out in the Ministry of Heritage, Sport, Tourism and Culture Industries' (MHSTCI) 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011), the objectives of the Stage 1 are as follows:

- To provide information about the study area's geography, history, previous archaeological fieldwork and current land conditions.
- To evaluate the study area's archaeological potential which will support recommendations for Stage 2 survey for all or parts of the property.
- To recommend appropriate strategies for Stage 2 survey.

To meet these objectives, Stantec archaeologists employed the following research strategies:

- A review of relevant archaeological, historical, and environmental literature pertaining to the study area.
- A review of the land use history, including pertinent historical maps.
- An examination of the *Ontario Archaeological Sites Database* to determine the presence of registered archaeological sites in and around the study area.
- A property inspection of the study area.
- A review of the City of Windsor *Archaeological Management Plan* (Cultural Resource Management Group Limited [CRM Group] *et al.* 2005)

Permission to enter the study area to document archaeological resources was provided by the City of Windsor.

1.2 HISTORICAL CONTEXT

1.2.1 Post-contact Indigenous Resources

“Contact” is typically used as chronological benchmark when discussing Indigenous archaeology in Canada and describes the contact between Indigenous and European cultures. The precise moment of contact is a constant matter of discussion. Contact in what is now the province of Ontario is broadly assigned to the 16th century (Loewen and Chapdelaine 2016).

At the turn of the 16th century, the study area is documented to have been occupied by the Western Basin Tradition archaeological culture (see Section 1.3.2). Following the turn of the 17th century, the region of the study area is understood to have been within the territory of the Fire Nation, an Algonkian group occupying the western end of Lake Erie. It is argued, however, that the Attiwandaron (Neutral) expanded extensively westward, displacing the Fire Nation (Lennox and Fitzgerald 1990:418-419). It is debated whether the Fire Nation was descendent from the archaeologically described Western Basin Tradition, or if they migrated into the western part of Lake Erie, displacing a previous Indigenous culture (Murphy and Ferris 1990:193-194). Historians understand that the displaced Fire Nation move across the St. Clair and Detroit Rivers into modern-day lower Michigan and their populations are synonymous with the later Kickapoo, Miami, Potawatomi, Fox, and Sauk (Heidenreich 1990: Figure 15.1). Bkejwanong (Walpole Island) First Nation oral tradition states that nations of the Three Fires (a political confederacy constituted of the Potawatomi, Ojibwa, and Ottawa) have occupied the delta of the St. Clair River and the surrounding region continually for thousands of years. In 1649, the Seneca, with the Mohawk, led a campaign into southern Ontario and dispersed the resident populations, and the Seneca used the lower Great Lakes basin as a prolific hinterland for beaver hunting (Heidenreich 1978; Trigger 1978:345). By 1690, Ojibwa-speaking people had begun to displace the Seneca from southern Ontario.

The Indigenous economy, since the turn of the 18th century, focused on fishing and the fur trade, supplemented by agriculture and hunting (Konrad 1981; Rogers 1978). The study area falls within the traditional territory of the Walpole Island First Nation (WIFN), the Aamjiwnaang (Sarnia) First Nation (Aamjiwnaang First Nation), the Wiiwkwedong and Aazhoodena (Kettle Point and Stony Point) First Nation (Lytwyn 2009), and the Deshkaan Ziibing Anishnaabeg (Chippewas of the Thames First Nation). Some populations of Wyandot (an Indigenous population of historically amalgamated Petun and Huron-Wendat individuals) also had moved to the region of Lake St. Clair at the turn of the 18th century and resided with the Three Fires nations (Tooker 1978:398).

In Essex County, and specifically in the Windsor region, a splinter group of Ottawa settled in the area (CRM Group *et al.* 2005: 2-14 to 2-15). Also, the surviving remnants of the Huron and Petun were settling in the Windsor region as the Wyandot, exhibiting continuities with their 16th and 17th century predecessors from the Midland and Blue Mountain regions (Garrad 2014; Steckley 2014). Given the amalgamated nature of the Wyandot people, sometimes one of the contributing Indigenous peoples was recognized over another, the Wyandot were known as Huron in the Windsor region (Garrad 2014:16-54). Therefore, the Wyandot settlement in the Windsor region is commonly referred to as the “Huron Village” and related place names survive in Windsor today, such as Huron Church Road (but also note Wyandotte Street).

A 1749 French map of the Detroit River region (Chaussegros de Léry 1752) depicts both Ottawa and the Huron villages on the waterfront of the Windsor region. The study area for the Project is depicted on the 1749 map, north of a river, identified as number “32” on the map and “Riviere aux dinde” (Turkey River, now Turkey Creek) in the legend (Figure 3). The study area is located in an area where plots of land were laid out, identified as number “40” on the map and “Nouvelle habitation francaise de 1749” (New French dwelling from 1749) in the legend. The islands to the south of the study area, identified as “15” and “16” on the map, are noted as “isle aux dinde” and “petite isle aux dinde” respectively (Turkey Island and Little Turkey island, now Fighting Island) in the legend.

Despite the dispersal and movement of Indigenous groups throughout southern Ontario during the 17th and 18th centuries, archaeologically they can be characterized by continuity with their pre-contact Indigenous counterparts. These peoples still maintained a Terminal Woodland archaeological culture, albeit with some features of European colonial powers, there was equally a definite persistence of Indigenous socio-cultural practices since these groups were not so profoundly affected by European contact that they left their former lifeways behind (Ferris 2009).

In the middle of the 18th century, the Chippewa were located on the south shores of Lake Huron, the east shores of Georgian Bay, and on the west end of Lake Ontario. Indigenous peoples and their communities continue to play a large role in the occupation of the study area and its environs. Under British administration in the 19th century, the various Indigenous groups were divided into separate bands. The Anishinaabe included the western Algonquian peoples, among them the Chippewa and the Ottawa. Until the 18th century, the central Algonquian-speaking peoples, including the Potawatomi, were located in the Michigan Peninsula (Blackbird 1887).

Following the American Revolutionary War, the British Government (the Crown) focused on the settlement of European immigrants into what became the province of Upper Canada in 1791. To enable widespread settlement, the Crown negotiated a series of treaties with Indigenous peoples. One of the earliest treaties involving lands located in close proximity to the study area was make on May 19, 1790. Originally identified as the Detroit Treaty, the chiefs of the Ottawa, Chippewa, Potawatomi, and Huron (or Wyandot) nations and representatives of the Crown established a vast tract of land “…from the Detroit River easterly to Catfish Creek and south of the river La Tranche [now Thames River] and Chenail Ecarte [now St. Clair River], and contains Essex County except Anderdon Township and part of West Sandwich; Kent County except Zone Township, and Gores of Camden and Chatham; Elgin County except Bayham Township and parts of South Dorchester and Malahide…[i]n Middlesex County, Del[a]aware and Westminster Township and part of North Dorchester” (Morris 1943:17). Today, the treaty is identified as Treaty Number 2, illustrated by the letter “C” on Figure 4. A commemorative plaque erected by the Historic Sites and Monuments Board of Canada further identifies this treaty as *McKee’s Purchase.* The plaque, located in Blenheim Memorial Park in Blenheim, Ontario reads:

> *In May 1790 Alexander McKee, Deputy Agent of the British Indian Department, and the principle chiefs of the Ottawa, Potawatomi, Chippewa, and Wyandot negotiated a treaty whereby the British Crown acquired title to what is now southwestern Ontario. This treaty completed the process begun with Niagara treaties of 1781 and 1784, with the result that most of the Ontario peninsula was soon opened to British and Loyalist settlement.*
>
> (Parks Canada 2020)

In addition to the above, Figure 5 reproduces a map from the *History of the Windsor Border Region* (Lajeunesse 1960) which depicts several Indigenous sites and trails documented in Essex County during the late 18th century. The study area is illustrated along “Trail F”, identified as the River Shore path, now Highway 18. North of the study area, the map illustrates “Trail G”, which represents an early path along the south shore of Lake St. Clair, connecting the Thames River to Sandwich (now, the City of Windsor). This road was also travelled by Governor Simcoe in 1793 (Lajeunesse 1960:xxxix). Also shown on the map, north of the study area, a Huron village is depicted as “14” and two large mounds, located across the Detroit River in Michigan, identified as “18” and “19” on Lajeunesse’s map (Lajeunesse 1960:xxxix).

The nature of Indigenous settlement size, population distribution, and material culture shifted as European settlers encroached upon Indigenous territory. However, despite this shift, “written accounts of material life and livelihood, the correlation of historically recorded villages to their archaeological manifestations, and the similarities of those sites to more ancient sites have revealed an antiquity to documented cultural expressions that confirms a deep historical continuity to…systems of ideology and thought” (Ferris 2009:114). As a result, Indigenous peoples have left behind archaeological resources throughout the region which show continuity with past peoples, even if they have not been explicitly recorded in Euro-Canadian documentation.

1.2.2 Euro-Canadian Resources

In 1791, the Provinces of Upper Canada and Lower Canada were created from the former Province of Quebec by an act of British Parliament. At this time, Colonel John Graves Simcoe was appointed as the Lieutenant Governor of Upper Canada and was tasked with governing the new province, directly its settlement, and establishing a constitutional government modelled after that of Britain. In 1792, Simcoe divided Upper Canada into 19 counties consisting of previously settled lands, new lands opened for settlement, and lands not yet acquired by the Crown. These new counties stretched from Essex in the west to Glengarry in the east. The study area for the Project is within the Geographic Township of Sandwich (now the City of Windsor) in Essex County, Ontario.

The first French settlers arrived in the Detroit-Windsor area in 1701 when the Sieur De Lamothe Cadillac and roughly 100 military and civilian personnel established Fort Pontchartrain on the Detroit side of the Detroit River (Fuller 1972:6-8). The French settlement remained on the Detroit side until 1748 when the Jesuit mission to the Huron was established on the south shore near the foot of the present-day Huron Church Road and the Ambassador Bridge. Fort Pontchartrain surrendered to the British in 1760 and remained under British control until 1796, although it was officially a part of the United States from 1783 onwards.

During this period, the settlement continued to grow, but remained predominantly French. The area across the river from Fort Pontchartrain (later to become Detroit), now in present-day Windsor, was called “Petite côte” (small coast) and served the agricultural needs of the fort (Archives of Ontario 2014). The street pattern of the City of Windsor still reflects the French method of agricultural land division; for example, the long narrow parcels fronting the river where the “Petite côte” was located (Morrison 1954:3-4).

In 1796, the original townsite of Sandwich was established to accommodate new immigrants of both French and British origin from the United States who wished to remain under British rule following American occupation of Detroit. This constituted the first urban settlement in what is now the City of Windsor and the first significant migration of English-speaking people into the Windsor area (Neal 1909:86-87).

Essex County was originally part of the District of Hesse and, in 1792, was renamed the Western District. On January 1, 1800, in the *Act for the Better Division of the Province*, the townships of Rochester, Mersea, Gosfield, Maidstone, Sandwich, and Malden were created as part of the County of Essex. The townships of Essex County were surveyed by Patrick McNiff, Abraham Iredell, and Thomas Smith (Clarke 2010).

As the area began to attract more Euro-Canadian interest, Patrick McNiff was assigned to survey and organize the area into a township, also to be named Sandwich. His survey of the township was completed in 1793. The form of the concessions, noted as “Petite côte”, were dictated by the land divisions already used by the French farmers in the “Petite côte” area, in what was to become Concession 1 Petite Côte. In fact, on his original township map where he measured the Concession 1 lots, Patrick McNiff notes that “on my measuring the farms in front from No.1 to No. 154 found their division Lines to run in the very irregular manner they appear on the Plan” (McNiff 1956). The most accurate map produced of the township at this time was completed by Abraham Iredell in 1797, who resurveyed the area and renumbered the lots from Lot 82 onwards in Concession 1 to 3 Petite Côte (Morris 1943), reproduced here as Figure 6 (Iredell 1797). The map shows the study area adjacent to Naggs Creek and part of a larger parcel of land, listed as “Huron Reserve” on the Iredell map. No structures are illustrated on the 1797 map in association with the study area

The 1815 Royal Navy survey of the Detroit River by Captain W.F.W. Owen (Figure 7), published in 1828 (Owen 1828), illustrates various structures/buildings, windmills, and roads/trails (likely the same Indigenous “Trail F” or River Shore Path identified on Lajeunesse’s [1960] *History of the Windsor Border Region* map [see Figure 5]). Owen’s (1828) map also shows numerous structures, such as windmills and churches, to the north and south of the study area (Figure 7). No structures fall within the study area, and the environment around the study area is indicated as low and marshy.

A map of the Western District from 1847 (Billyard and Parr 1847) depicts the surveyed layout of the township, Town of Sandwich, and road system. No structures or landowners are illustrated within the study area (Figure 8).

In the 1830s, the town of Sandwich became an important terminal on the Underground Railroad following the American *Emancipation Act* in 1833. Escaped African American slaves, numbering between 30,000 and 100,000, made their journey from the southern United States into Upper Canada by way of Sandwich, with many settling in the town (City of Windsor 2021). By 1830, the population of Sandwich Township had increased to 2,201 (Chewett 1831:52).

By the mid-1850s, the community of Windsor became more established and grew large enough to compete with the adjacent community of Sandwich for important industrial development. For example, the Great Western Railway chose Windsor over Sandwich as its termination point in 1854. The arrival of the railway also allowed for the foundation of Walkerville, the third oldest settlement that is now part of the City of Windsor. In 1857, Hiram Walker established his distillery in the downtown area of Windsor where the Great Western Railway first met the waterfront (Morrison 1954:26).

In 1858, Windsor and Sandwich were incorporated as towns (Morrison 1954:42). In 1861, the Township of Sandwich was subdivided into the Townships of Sandwich West, Sandwich East, and Sandwich South (Neal 1909:12). The 1877 Map of Essex County, Ontario (Walling 1877) depicts a developed township with robust transportation routes (Figure 9). The study area is depicted just outside the township, in what appears to be an area of marshlands. The 1877 map demonstrates the growing development of the townships with more robust transportation routes and named streets laid out on an orthogonal grid pattern.

The 1881 Essex Supplement in the *Illustrated Atlas of the Dominion of Canada* (Belden & Co. 1881) does not list a landowner for the lot associated with the study area. However, a fish hatchery on the lot south of the study area is depicted (Figure 10). The 1881 map does not show the Mineral Springs Spa and Hotel; however, historical records indicate that the establishment was still operating at this time. The Essex County historical atlas of 1881 documents a total population of 36,258 for Essex County (Belden & Co. 1881:8). Of the total population, 25,303 settlers lived in rural settings, while 10,955 lived in urban settings (Belden & Co. 1881:8).

In discussing 19th century historical atlas mapping it must be remembered that many historical county atlases were produced primarily to identify factories, offices, residences, and landholdings of subscribers and were funded by subscription fees. Landowners who did not subscribe were not always listed on the maps (Caston 1997: 100). As such, structures were not necessarily depicted or placed accurately (Gentilcore and Head 1984). Further, review of 18th and 19th century historical mapping has inherent accuracy difficulties due to potential error in georeferencing. Georeferencing is conducted by assigning spatial coordinates to fixed locations and using these points to spatially reference the remainder of the map. Due to changes in “fixed” locations over time (e.g., road intersections, road alignments, watercourses, shorelines, etc.), errors/difficulties of scale and the relative idealism of the historical cartography, historical maps may not translate accurately into real space points. This may provide obvious inconsistencies during historical map review.

1.2.2.1 The Mineral Springs Spa and Resort

In 1864, sulphur springs were discovered near the study area while drilling for oil. This led to the establishment of the Mineral Springs Spa and Resort at the southwest corner of Sandwich Street and Chappell Ave, approximately 150 metres east of the study area (Fisher Archaeological Consulting [FAC]2019). The discovery of the mineral springs led to a boom in visitors and spa goers to the area and eventually a brick hotel was built by J.B. Gauthier to accommodate the surge of American and Canadian tourists (Neal 1909).

Eventually, a canal was dug from the Detroit River to Russell Street as a means to better accommodate American tourists from Detroit. A round trip from Detroit to Sandwich would have cost 25 cents (Neal 1909). The resort and hotel experienced a few years of prosperity; however, a dispute between the co-owners J.B. Gauthier and John P. Clark lead to the suspicious placement of eight large boulders at the entrance to the canal (Neal 1909). A lawsuit was enacted against Clark by Gauthier, which resulted in verdict requiring Clark to pay one York shilling and remove the boulders from the canal.

The Mineral Springs Spa and Resort continued to be a popular visitor attraction until the late 1880s when the number of visitors began to diminish (Neal 1909). The hotel itself underwent numerous proprietor and name changes after the late 1880s. These include ownership by B.H. Rothwell and Gilbert Graham, who changed the name from Manhattan Park to Lagoon Park in 1909 (Neal 1909). It is unclear when operations ceased at Lagoon Park. The canal was originally dug in the late 1800’s and connected McKee Creek to the Detroit River (FAC 2020). However, since it’s original construction, the canal and surrounding environs have been subject to extensive disturbance from modern dredging and infrastructure impacts (railroad, hydro towers, etc.). Portions of the former canal fall within the southwestern edge of the study area.

While not within 50 metres of the study area, there is one historical plaque related to the Mineral Springs Spa and Resort, which can be found on the side of the historical Sandwich Arch (Plate 1). The Sandwich Arch is located approximately 1.3 kilometres north of the study area (Millerman 2021).

1.2.2.2 Essex Terminal Railway and Windsor Salt Company

In 1902, the Essex Terminal Railway was constructed between Windsor and Amherstburg and ran through Lot 58, Concession 1 Petite Côte, facilitating the development of industry in the area (ETR 2013). The construction of the Essex Terminal Railway would have contributed to the extensive disturbance documented throughout the study area.

In 1904, the Saginaw Lumber and Salt Company began operations directly south of the study area. The company later became the Canadian Salt Company and is presently the Windsor Salt Company (Morrison 1954:197). The Windsor Salt company continues to operate today.

1.2.3 Aerial Photography

Historical aerial photography of the study area was obtained from Wayne State University Library's DTE Aerial Photo Collection (Wayne State University 2020). The aerial photography from 1952, 1956, 1961, and 1981 illustrates the development and extensive disturbance throughout the study area (Figure 11). Beginning in 1956, impacts to the study area are noted. By 1981, aerial imagery shows extensive changes to the study area, including additional extant structures, extensive grading, access roads, and the infilling of the canal.

1.3 ARCHAEOLOGICAL CONTEXT

1.3.1 The Natural Environment

The study area is situated in the St. Clair Clay Plains physiographic region, as identified by Chapman and Putnam (1984). The region is described as:

> *Adjoining Lake St. Clair in Essex and Kent County Counties and the St. Clair River in Lambton County are extensive clay plains covering 2,270 square miles. The region is one of little relief, lying between 575 and 700 feet a.s.l., except the for moraine at Ridgetown and Blenheim which rises 50 to 500 feet higher…Glacial Lake Wittlesey, which deeply covered all of these lands, and Lake Warren which subsequently covered nearly the whole area, failed to leave deep stratified beds of sediment on the underlying clay till except around Catham, between Blenheim and the Rondeau marshes, and in a few other smaller areas. Most of Lambton and Essex Counties, therefore are essentially till plains smoothed by shallow deposits of lacustrine clay which settled in the depression while the knolls were being lowered by wave action.*
>
> (Chapman and Putnam 1984:147)

The predominant soil type within the study area is Burford Loam, with a small pocket of Granby Sand in the northwest portion of the study area (Richards *et al*. 1949). Burford Loam is characterized by a brown gravelly loam overtop of a reddish-brown clay loam, formed by dolomitic limestone and shaley siliceous material (Richards *et al*. 1949). Burford Loam is a well-drained soil type with level to undulating topography. This soil type is well suited for growing vegetables and orchard fruits, such as peaches, cherries, apples, and pears. Cash crops such as corn, wheat, beans, and some tobacco strains are also suited to this soil type (Richards *et al.* 1949).

The Granby Sand soil type consists of a dark grey sandy loam overlying a grey or mottled clay inclusions (Richards *et al*. 1949). Granby Sand is poorly drained and is generally found south of the city of Windsor. This soil type is not ideal for the cultivation of crops and is predominantly either pasture or woodlot. Today, the region around the study area is predominantly utilized for industrial and commercial uses.

The closest, natural source, of extant potable water is the Detroit River, which lies approximately 400 metres west of the study area. The east end of a channelized canal, formerly used to access the Mineral Springs Spa and Resort, runs along the southwestern edge of the study area. The 1981 aerial photograph of the study area shows the part of the canal that was once within the study area has undergone recent extensive modern infilling (see Figure 11).

1.3.2 Pre-contact Indigenous Resources

This portion of southwestern Ontario has been occupied by Indigenous peoples since the retreat of the Wisconsin glacier, approximately 11,000 years ago. Much of what is understood about the lifeways of Indigenous peoples is derived from archaeological evidence and ethnographic analogy. In Ontario, Indigenous culture prior to the period of contact with European people has been distinguished into cultural period based on observed changes in material culture. These cultural periods are l[largely based in observed changes in material culture. These cultural periods are largely based in observed changes in formal lithic tools, and separated into the Early Paleo-Indian, Later Paleo-Indian, Early Archaic, Middle Archaic, and Late Archaic periods. Following the advent of ceramic technology in the Indigenous archaeological record, cultural periods are separated into the Early Woodland, Middle Woodland, and Late Woodland periods, based primarily on observed changes in formal ceramic decoration. It should be noted that these cultural periods do not necessarily represent specific cultural identified but are a useful paradigm for understanding changes in Indigenous culture through time. The current understanding of Indigenous archaeological culture is summarized in Table 1, based on Ellis and Ferris (1990). The provided time periods are based on the “Common Era” calendar notation system, i.e. Before Common Era (BCE) and Common Era (CE).

Table 1: Cultural Chronology for Essex County

Period	Characteristics	Time Period	Comments
Early Paleo-Indian	Fluted Projectiles	9000 – 8400 BCE	Spruce parkland/caribou hunters
Late Paleo-Indian	Hi-Lo Projectiles	8400 – 8000 BCE	Smaller but more numerous sites
Early Archaic	Kirk and Bifurcate Base Points	8000 – 6000 BCE	Slow population growth
Middle Archaic	Brewerton-like Points	6000 – 2500 BCE	Environment similar to present
Late Archaic	Narrow Point	2500 – 1800 BCE	Increasing site size
	Broad Point	1800 – 1500 BCE	Large chipped lithic tools
	Small Point	1500 – 1100 BCE	Introduction of bow hunting
Terminal Archaic	Hind Points	1100 – 950 BCE	Emergence of true cemeteries
Early Woodland	Meadowood Points	950 – 400 BCE	Introduction of pottery
Middle Woodland	Couture Corded Pottery	400 BCE – 500 CE	Increased sedentism
	Riviere au Vase Phase	500 – 800 CE	Seasonal hunting and gathering
Late Woodland	Younge Phase	800 – 1200 CE	Incipient agriculture
	Springwells Phase	1200 – 1400 CE	Agricultural villages
	Wolf Phase	1400 – 1550 CE	Earth worked villages, warfare
Contact Indigenous	Various Algonkian andIroquoian Groups	1600 – 1875 CE	Early written records and treaties
Historic	French/Euro-Canadian	1749 CE – present	European settlement

Between 9000 and 8000 BCE, Indigenous populations were sustained by hunting, fishing, and foraging and lived a relatively mobile existence across and extensive geographic territory. Despite these wide territories, social ties were maintained between groups. One method in particular was through gift exchange, evident through exotic lithic material documented on many sites (Ellis 2013:35-40).

By approximately 8000 BCE, evidence exists and becomes more common for the production of ground-stone tools such as aces, chisels and adzes. These tools themselves are believed to be indicative specifically of woodworking. This evidence can be extended to indicate an increase in craft production and arguably craft specialization. This latter statement is also supported by evidence, dating to approximately 7000 BCE, of ornately carved stone objects which would be laborious to produce and have explicitly aesthetic qualities (Ellis 2013:41). This is indirectly indicative of changes in social organization which permitted individuals to devote time and effort to craft specialization. Since 8000 BCE, the Great Lakes basin experienced a low-water phase, with shorelines significantly below modern lake levels (Stewart 2013: Figure 1.1.C). It is presumed that the majority of human settlements would have been focused along these formed shorelines. At approximately 6500 BCE, the climate had warmed considerably since the recession of the glaciers and the environment had grown more similar to the present day. By approximately 4500 BCE, evidence exists from southern Ontario for the utilization of native copper, i.e., naturally occurring pure copper metal (Ellis 2013:42). The known origin of this material along the north shore of Lake Superior indicated the existence of extensive exchange networks across the Great Lakes basin.

At approximately 3500 BCE, the isostatic rebound of the North American plate following the melt of the Laurentide glacier has reached a point which significantly affected the watershed of the Great Lakes basin. Prior to this, the Upper Great Lakes had drained down the Ottawa Valley via the French-Mattawa River valleys. Following this shift the watershed, the drainage course of the Great Lakes basis has changed to its present course. This also prompted a significant increase in water-level to approximately modern levels (with a brief high-water period); this change in water levels is believed to have occurred catastrophically (Stewart 2013:28-30). This change in geography coincides with the earliest evidence for cemeteries (Ellis 2013:46). By 2500 BCE, the earliest evidence exists for the for the construction of fishing weirs (Ellis *et al*. 1990: Figure 4.1). Construction of these weirs would have required a large amount of communal labor and are indicative of the continued development of social organization and communal identity. The large-scale procurement of food at a single location also has significant implications for permanence of settlement within the landscape. This period is also marked by further population increase and, by 1500 BCE, evidence exists for substantial permanent structures (Ellis 2013:45-46).

By approximately 950 BCE, the earliest evidence exists for populations using ceramics. Populations are understood to have continued to seasonally exploit natural resources. This advent of ceramic technology correlated, however, with the intensive exploitation of seed foods such as goosefoot and knotweed as well as mast such as nuts (Williamson 2013:48). The use of ceramics implies changes in the social organization of food storage as well as in the cooking of food and changes in diet. Fish also continued to be an important facet of the economy at this time. Evidence continues to exist for the expansion of social organization (including hierarchy), group identity, ceremonialism (particularly burials), interregional exchange throughout the Great Lakes basin and beyond, and craft production (Williamson 2013:48-54).

By approximately 550 CE, evidence emerges for the introduction of maize in southern Ontario. This crop would have initially only supplemented the Indigenous diet and economy (Birch and Williamson 2013:13-14). Maize-based agriculture gradually became more important to society and by approximately 900 CE permanent communities emerge which are primarily focused on agriculture and the storage of crops, with satellite locations, oriented toward the procurement of other resources such as hunting, fishing, and foraging. By approximately 1250 CE, evidence exists for the common cultivation of Indigenous cultigens, including maize, beans, squash, sunflower, and tobacco. The cultural affiliation of populations within the region of the study area at this time period is debated; they may have spoken a form of Iroquoian language or Algonquian (Murphy and Ferris 1990). The extant archaeological record demonstrated many cultural traits similar to historical Indigenous nations (Williamson 2013:55).

By the Late Woodland period there was a distinctive cultural occupation in southwestern Ontario, including Essex, Kent, and Lambton counties. The primary Late Woodland occupants of the Windsor area were populations described by archaeologists as belonging to the Western Basin Tradition. Murphy and Ferris 1990:189) indicate that these people had tires with populations in southeastern Michigan and northwestern Ohio and represent an *in situ* cultural development from the earlier Middle Woodland groups. The Western Basin Tradition seems to have been centered in the territory comprising the eastern drainage basin of Lake Erie, Lake St. Clair, and the southern end of Lake Huron. The Western Basin Tradition is divided into four phases based on differences in settlement and subsistence strategies and pottery attributes. By the time of increased European interaction in the last half of the 16th century and early 17th century, there were no Western Basin Tradition sites in the Essex County area, as these populations had moved west into Michigan (Ferris 2009:32-33).

1.3.3 City of Windsor's Archaeological Master Plan

The City of Windsor's *Archaeological Master Plan Study Report* (CRM Group *et al.* 2005) discusses the City of Windsor's and the northern portion of the Town of LaSalle's archaeological context in general. As of 2005, only 23 archaeological sites had been registered within the city limits or within the immediate vicinity (CRM Group *et al.* 2005). However, the authors of the archaeological management plan recognized that a number of poorly documented sites exist and there are many sites still to be documented, especially since the majority of the archaeological studies discussed in the archaeological management plan maps are concentrated along the Detroit River or in southwest Windsor (CRM Group *et al*. 2005:3-1to 3-23). Additionally, a number of newly identified archaeological sites have been registered within the city limits since the time of the study report. The study area for the Project is identified in areas as retaining archaeological potential on the archaeological management plan's archaeological potential mapping (CRM Group *et al*. 2005: Figure 15).

1.3.4 Registered Archaeological Sites and Surveys

In Canada, archaeological sites are registered within the Borden system, a national grid system designed by Charles Borden in 1952 (Borden 1952). The grid covers the entire surface area of Canada and is divided into major units containing an area that is two degrees in latitude by four degrees in longitude. Major units are designated by upper case letters. Each major unit is subdivided into 288 basic unit areas, each containing an area of 10 minutes in latitude by 10 minutes in longitude. The width of basic units reduces as one moves north due to the curvature of the earth. In southern Ontario, each basic unit measures approximately 13.5 kilometres east-west by 18.5 kilometres north-south. In northern Ontario, adjacent to Hudson Bay, each basic unit measures approximately 10.2 kilometres east-west by 18.5 kilometres north-south. Basic units are designated by lower case letters. Individual sites are assigned a unique, sequential number as they are registered. These sequential numbers are issued by the MHSTCI who maintain the *Ontario Archaeological Sites Database*. The study area under review is located within Borden Block AbHs.

Information concerning specific site locations is protected by provincial policy and is not fully subject to the *Freedom of Information and Protection of Privacy Act* (Government of Ontario 1990a). The release of such information in the past has led to looting or various forms of illegally conducted site destruction. Confidentiality extends to media capable of conveying location, including maps, drawings, or textual descriptions of a site location. The MHSTCI will provide information concerning site location to the party or an agent of the party holding title to a property, or to a licensed archaeologist with relevant cultural resource management interests.

An examination of the *Ontario Archaeological Sites Database* has shown that there are 12 archaeological sites registered within a one-kilometre radius of the study area (Government of Ontario 2021a). None of the registered archaeological sites are within 50 metres of the study area. Table 2 provides a summary of the registered archaeological sites within a one-kilometre radius of the study area.

Table 2: Registered Archaeological Sites within One Kilometre of the Study Area

Borden #	Site Name	Site Type	Cultural Affiliation
AbHs-12	Mackenzie Hall	19th century Jail	Euro-Canadian
AbHs-21	Nordic Power	Dump	Euro-Canadian
AbHs-63	Essex County Jail	Jail, burials	Euro-Canadian
AbHs-69	-	Scatter	Euro-Canadian
AbHs-75	Location 4	Homestead	Euro-Canadian
AbHs-77	Location 5	Homestead	Euro-Canadian
AbHs-78	Location 6	Homestead	Euro-Canadian
AbHs-79	Location 7	Homestead	Euro-Canadian
AbHs-80	Location 8	Homestead	Euro-Canadian
AbHs-81	Location 9	Homestead	Euro-Canadian

Borden #	Site Name	Site Type	Cultural Affiliation
AbHs-82	Location 10	Homestead	Euro-Canadian
AbHs-83	Location 11	Homestead	Euro-Canadian

A query of the *Ontario Public Register of Archaeological Reports* (Government of Ontario 2021b) has identified four archaeological assessments which may document work within 50 metres of the study area (Table 3).

Table 3: Archaeological Assessments within 50 metres of the Study Area

Company / Author	Report	Project Information Form (PIF) Number	Year
AECOM	*Stage 1-2 Archaeological Assessment, Detroit River Crossing Pipeline Replacement Project Part of Lot 59, 1 Petite Côte, Geographic Township of Sandwich West, now the City of Windsor, Essex County, Ontario*	P131-0078-2018	2018
Stantec	*Stage 1 Archaeological Assessment: Windsor Riverfront Combined Sewer Overflow Control Facilities, Part of Lot 59, Concession 1 Petite Côte, and Lot 63, Concession 1 Petite Côte, Geographic Township of Sandwich, former Essex County, now City of Windsor, Ontario*	P256-0563-2019	2019
Fisher Archaeological Consulting	*City of Windsor Sewer Master Plan, Type 2, City of Windsor, in the Geographic Township of Sandwich, Essex County, Ontario, Archaeological Stage 1: Background Study*	P359-0117-2019	2019
Earthworks Archaeological Services Inc.	*Stage 1&2 Archaeological Assessment: 3885 Sandwich Street, Part of Lot 27 & 28 East of Sandwich Street and Part of Lot 28 West of Peter Street, Registered Plan 40, Geographic Township of Sandwich, City of Windsor, Essex County*	P321-0110-2020	2020

In 2018, AECOM conducted a Stage 1-2 archaeological assessment for the Detroit River Crossing Pipeline Replacement Project, located on part of Lot 59, 1 Petite Côte, Geographic Township of Sandwich West, now the City of Windsor, Essex County, Ontario. The Stage 1-2 assessment was conducted under PIF number P131-0078-2018, issued to Adria Grant by the MHSTCI, and does not overlap with the current study area. No archaeological resources were identified as part of the Stage 1-2 archaeological assessment and no further archaeological work was recommended (AECOM 2018).

In 2019, Stantec conducted a Stage 1 archaeological assessment for the Windsor Riverfront Combined Sewer Overflow Control Facilities Project, located on part of Lot 59, Concession 1 Petite Côte, and Lot 63, Concession 1 Petite Côte, Geographic Township of Sandwich, former Essex County, now City of Windsor, Ontario. The Stage 1 assessment was conducted under PIF number P256-0563-2019, issued to Parker Dickson by the MHSTCI. The Stage 1 assessment determined that portions of the property retained potential for the identification of archaeological resources and recommended additional archaeological assessment of these areas. The assessment also determined that portions of the study area had been subject to extensive land disturbance. The Windsor Riverfront Combined Sewer project does not overlap with the current study area.

Fisher Archaeological Consulting (FAC) was retained to conduct a Stage 1 archaeological assessment for the Windsor Sewer Management Plan (WSMP) Type 2 project (FAC 2019). The assessment included 24 proposed sewer solutions, eight of which are in Central Windsor, 11 in East Windsor, four in South Windsor, and one at the Riverside Landform Barrier. The assessment was conducted under PIF number P359-0117-2019, issued to Ruth Macdougall by the MHSTCI. Of the 24 proposed solutions within the WSMP, one, the new Prince Road Sewer Outfall, is located within 50 metres of the current study area. The lands that fall within the current study area were identified as being subject to extensive previous disturbance and no further assessment was recommended. Portions of the FAC study that fall outside of the current study area were recommended for Stage 2 archaeological monitoring.

Earthworks Archaeological Services Inc. was retained in 2020 to complete a Stage 1-2 archaeological assessment for lands located at 3885 Sandwich Street, Windsor, Ontario. The assessment was conducted under PIF number P321-0110-2020, issued to Shane McCartney by the MHSTCI, and does not overlap with the current study area. No archaeological resources were identified as part of the Stage 1-2 archaeological assessment and no further work was recommended (Earthwork Archaeological Services Inc. 2020).

1.3.5 Existing Conditions

The study area for the Project comprises approximately 0.37 hectares of land, located on part of Lot 59, Concession 1, Geographic Township of Sandwich, former Essex County, now City of Windsor, Ontario. The study area consists of graded lands, gravel roads, utilities (hydro poles), extant structures, and a railway. Portions of a channelized canal of McKee Creek, which has been subject to 20th century infilling (see Figure 11), is also within the study area.

2.0 FIELD METHODS

The Stage 1 archaeological assessment complied information concerning registered and/or potential archaeological resources within the study area. A property inspection was conducted on July 9, 2021 by Nathan Ng (R1223), under PIF number P1148-0010-2021 issued to Heather Kerr, MA, by the MHSTCI.

The property inspection involved examining the entirety of the study area to identify the presence or absence of features of archaeological potential in accordance with Section 1.2 of the MHSTCI's 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011). During the property inspection on July 9, 2021, the weather was warm and sunny, and visibility of land features was excellent. Field, lighting, and weather conditions were not detrimental to the identification of features of archaeological potential.

The property inspection confirmed that the study area has been subject to deep and extensive disturbance from gravel roads, graded lands, extant structures, utilities, and railway tracks (Photos 1 to 18). The photography from the property inspection is presented in Section 7.1 and confirm that the requirements for a Stage 1 property inspection were met, as per Section 1.2 and Section 7.7.2 Standard 1 of the MHTSCI's 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011). Figure 12 illustrates photo locations and the archaeological potential of the study area.

3.0 ANALYSIS AND CONCLUSIONS

Archaeological potential is established by determining the likelihood that archaeological resources may be present within a study area. Stantec applied archaeological potential criteria commonly used by the MHSTCI (Government of Ontario 2011) to determine areas of archaeological potential within the study area. These variables include proximity to previously identified archaeological sites, distance to various types of water sources, soil texture and drainage, glacial geomorphology, elevated topography, and the general topographic variability of the area. However, it is worth noting that extensive land disturbance can eradicate archaeological potential (Government of Ontario 2011).

Potable water is the single most important resource for any extended human occupation or settlement and since water sources in Ontario have remained relatively stable over time, current proximity to drinkable water is regarded as a useful index for the evaluation of archaeological potential. In fact, distance to water is one of the most commonly used variables for predictive modeling of archaeological site locations. Distance to modern or ancient water sources is generally accepted as the most important determinant of past human settlement patterns and considered alone, may result in a determination of archaeological potential. However, any combination of two or more other criteria, such as well-drained soils or topographic variability, may also indicate archaeological potential (Government of Ontario 2011).

As discussed above, distance to water is an essential factor in archaeological potential modeling. When evaluating distance to water it is important to distinguish between water and shoreline, as well as natural and artificial water sources, as these features affect site location and type to varying degrees. The MHSTCI categorizes water sources in the following manner:

- Primary water sources: lakes, rivers, streams, creeks.
- Secondary water sources: intermittent streams and creeks, springs, marshes, and swamps.
- Past water sources: glacial lake shorelines, relic river or stream channels, cobble beaches, shorelines and drained lakes or marshes,
- Accessible or inaccessible shorelines: high bluffs, swamp or marshy lake edges, sandbars stretching into marsh.

As stated in Section 1.3.1, the closest extant primary water source is the Detroit River, which lies west of the study area. A channelized canal, constructed in the late 1800s, is adjacent to the study area, and now connects McKee Creek to the Detroit River. The canal's initial use was to facilitate access to the Mineral Springs Spa and Hotel by tourists. Since its original construction, the canal and its surrounding environs have undergone extensive disturbance from dredging, infilling, and infrastructure impacts.

Examination of the study area's natural environment identified soil conditions which would have been suitable for Indigenous and Euro-Canadian agriculture prior to extensive modern development. There are no registered Indigenous archaeological sites within one kilometre of the study area. However, historical maps indicate an Indigenous presence throughout the region. An Indigenous trail (now Front Road) is recorded as running adjacent to the study area and numerous Indigenous villages are illustrated along the Detroit River waterfront.

Archaeological potential can be extended to areas of early Euro-Canadian settlement, including places of military or pioneer settlements; early transportation routes; and properties listed on the municipal register or designated under the *Ontario Heritage Act* (Government of Ontario 1990b) or property that local histories or informants have identified with possible historical events, activities or occupations. Historical mapping demonstrates that the study area follows early interior roads and concessions with structures illustrated as fronting these roads. Much of the established road networks are still visible today. There are 12 registered Euro-Canadian archaeological sites within one kilometre of the study area; none of which fall within the study area, nor within 50 metres of the study area.

Generally, the City of Windsor's *Archaeological Master Plan Study Report* (CRM Group *et al.* 2005) indicates the study area as retaining archaeological potential.

Considering these factors, the study area would have potential for the identification of Indigenous and Euro-Canadian archaeological resources. However, as noted above, extensive and deep land alteration can eradicate archaeological potential. Historical background research (including aerial photographs) and the Stage 1 property inspection have determined that the entire study area has been subject to extensive alteration from modern disturbances, such as roads, grading, extant structures, utilities, railway tracks, and the infilling of the canal. Thus, the Stage 1 archaeological assessment, aided by a property inspection, has determined that the entirety of the study area retains low to no archaeological potential as it has been subject to extensive disturbance and alteration throughout the 20th and 21st centuries. The results of the Stage 1 assessment are illustrated on Figure 12.

4.0 RECOMMENDATIONS

The Stage 1 archaeological assessment, involving background research and property inspection, resulted in the determination that the entire study area retains low to no archaeological potential as it consists of extensive land disturbance from gravel roads, grading, extant structures, utilities, and railway tracks. In accordance with Section 1.3.2 and Section 7.7.4 of the MHSTCI's 2011 *Standards and Guidelines for Consultant Archaeologists* (Government of Ontario 2011), **Stage 2 archaeological assessment is not required for the study area (Figure 12).**

The MHSTCI is asked to review the results presented and to accept this report into the *Ontario Public Register of Archaeological Reports*.

5.0 ADVICE ON COMPLIANCE WITH LEGISLATION

In accordance with Section 7.5.9 of the MHSTCI's 2011 Standards and Guidelines for Consultant Archaeologists *(Government of Ontario 2011), the following standard statements are a required component of archaeological reporting and are provided verbatim from the MHSTCI's 2011* Standards and Guidelines for Consultant Archaeologists *(Government of Ontario 2011).*

This report is submitted to the Minister of Heritage, Sport, Tourism and Culture Industries as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O. 1990, c. O.18 (Government of Ontario 1990a). The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Heritage, Sport, Tourism and Culture Industries, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* (Government of Ontario 1990a) for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeological Reports referred to in Section 65.1 of the *Ontario Heritage Act* (Government of Ontario 1990a).

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act* (Government of Ontario 1990a). The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48(1) of the *Ontario Heritage Act* (Government of Ontario 1990a).

The *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 (Government of Ontario 2002) requires that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Government and Consumer Services.

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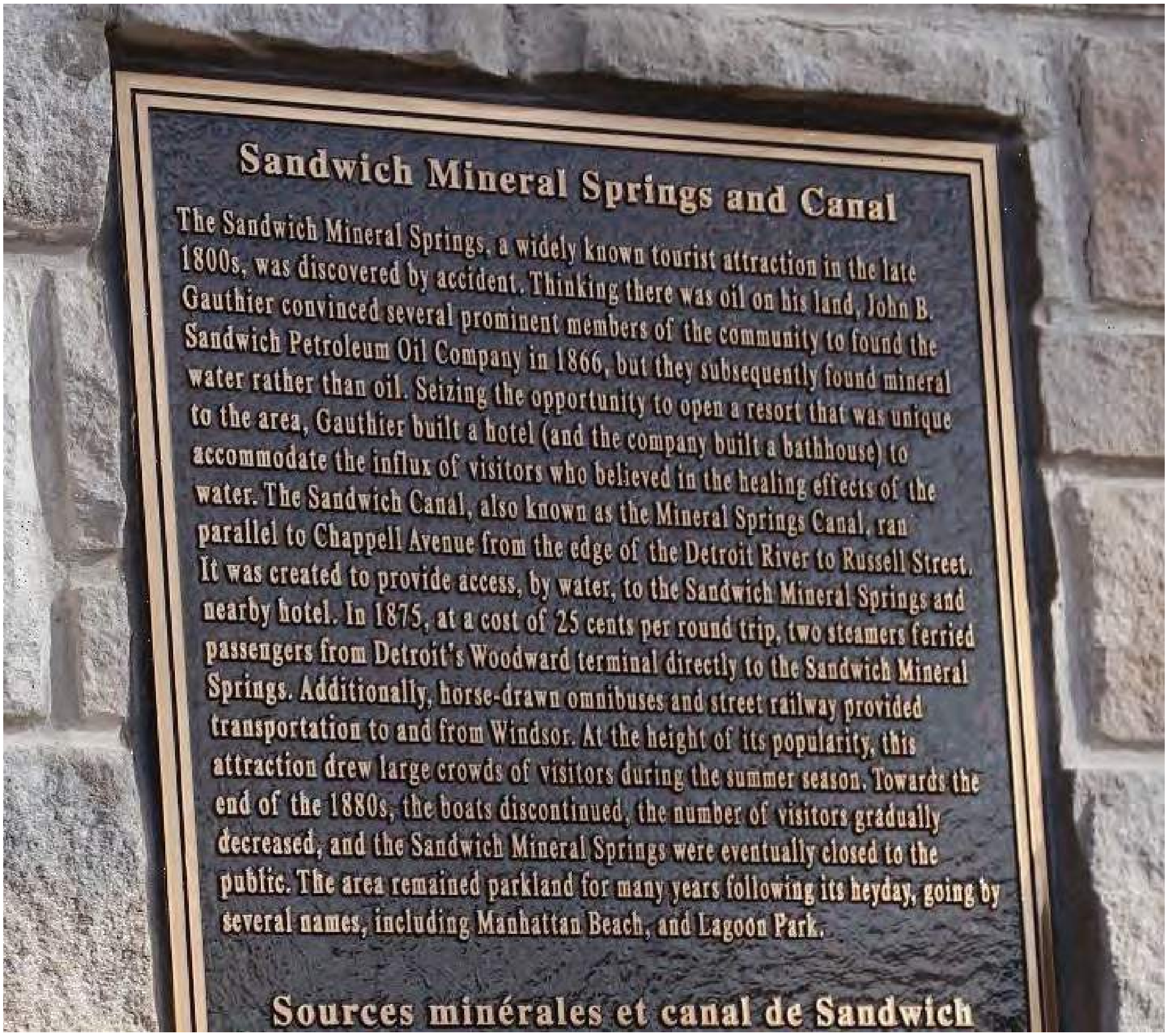
7.0 IMAGES

7.1 PLATES

Plate 1: Ontario Historical Plaque – *Sandwich Mineral Springs and Canal* (Millerman 2021).



Sandwich Mineral Springs and Canal

The Sandwich Mineral Springs, a widely known tourist attraction in the late 1800s, was discovered by accident. Thinking there was oil on his land, John B. Gauthier convinced several prominent members of the community to found the Sandwich Petroleum Oil Company in 1866, but they subsequently found mineral water rather than oil. Seizing the opportunity to open a resort that was unique to the area, Gauthier built a hotel (and the company built a bathhouse) to accommodate the influx of visitors who believed in the healing effects of the water. The Sandwich Canal, also known as the Mineral Springs Canal, ran parallel to Chappell Avenue from the edge of the Detroit River to Russell Street. It was created to provide access, by water, to the Sandwich Mineral Springs and nearby hotel. In 1875, at a cost of 25 cents per round trip, two steamers ferried passengers from Detroit's Woodward terminal directly to the Sandwich Mineral Springs. Additionally, horse-drawn omnibuses and street railway provided transportation to and from Windsor. At the height of its popularity, this attraction drew large crowds of visitors during the summer season. Towards the end of the 1880s, the boats discontinued, the number of visitors gradually decreased, and the Sandwich Mineral Springs were eventually closed to the public. The area remained parkland for many years following its heyday, going by several names, including Manhattan Beach, and Lagoon Park.

Sources minérales et canal de Sandwich

7.2 IMAGES

Photo 1: View of study area, showing disturbance from extant structure, utilities and gravel road, facing northwest.

Photo 2: View of study area showing disturbance from gravel road and railway, facing southeast.

Photo 3: View of study area, showing railway, utilities and gravel roadway, facing south.

Photo 4: View of study area, showing utilities and gravel roadway, facing west.

Photo 5: View of study area, showing edge of railway and gravel road, facing west.

Photo 6: View of study area, showing utilities and gravel road, facing south.

Photo 7: View of study area, showing gravel roadway and graded land, facing southeast.

Photo 8: View of study area, showing graded land area and utilities, facing northwest.

Photo 9: View of study area, showing disturbed canal and utilities, facing northwest.

Photo 10: View of study area, showing disturbed canal and utilities, facing northwest.

Photo 11: View of study area, showing graded lands, utilities, gravel roadway and extant structure, facing northeast.

Photo 12: View of study area, showing gravel roadway and utilities, facing southeast.

Photo 13: View of study area, showing disturbed canal and utilities, facing northwest.

Photo 14: View of study area, showing utilities, gravel roadway, and extant structure, facing north.

Photo 15: View of study area, showing gravel roadway and graded lands, facing west.

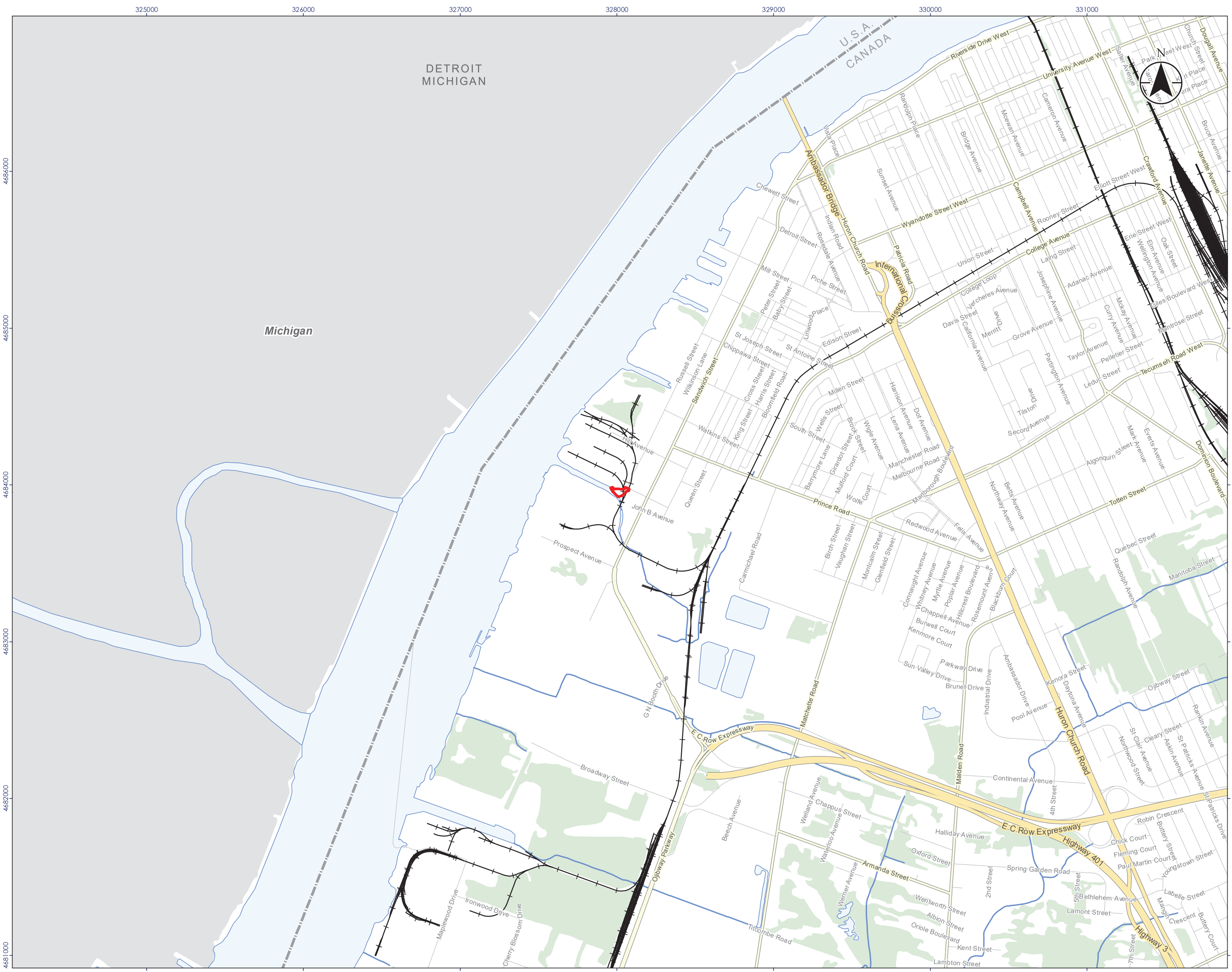
Photo 16: View of study area, showing railway, utilities, and extant structure, facing north.

Photo 17: View of study area, showing graded lands, gravel roadway, and utilities, facing southwest.

Photo 18: View of study area, showing railway, graded lands, gravel roadway and utilities, facing northwest.

8.0 MAPS

Maps of the study area for the Project follow on succeeding pages.



Legend

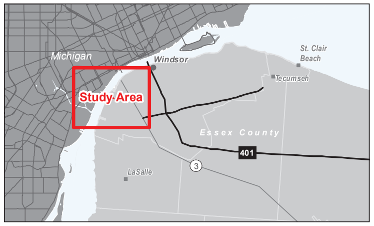
- 🟥 Study Area
- Railway - Operational
- Expressway / Highway
- Major Road
- Minor Road
- Watercourse
- Municipal Boundary
- Waterbody
- Wooded Area

0 500 1,000 metres

1:25,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Contains information licensed under the Open Government License - Ontario.



Project Location
Windsor, ON

165620224 REVA
Prepared by CMC on 2021-08-27

Client/Project
STAGE 1 ARCHAEOLOGICAL ASSESSMENT
CITY OF WINDSOR, PRINCE ROAD STORM SEWER OUTLET
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
1

Title
Location of Study Area

\\cd1004-f01\work_group\01609\active\165620224\03_data\gis_cad\gis\mxds\archaeology\report_figures\St1\165620224_ArchSt1_Fig01_Overview.mxd Revised: 2021-08-27 By: CCoghlan

Stantec

Legend

🟥 Study Area (Approximate)

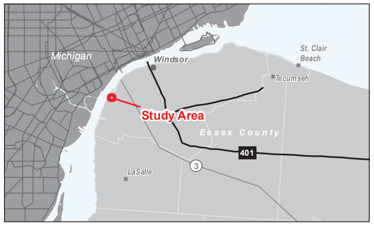
—+— Railway

0 25 50 Meters

1:750 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Orthoimagery © First Base Solutions, 2021. Imagery flown in 2019.



Project Location
Windsor, ON

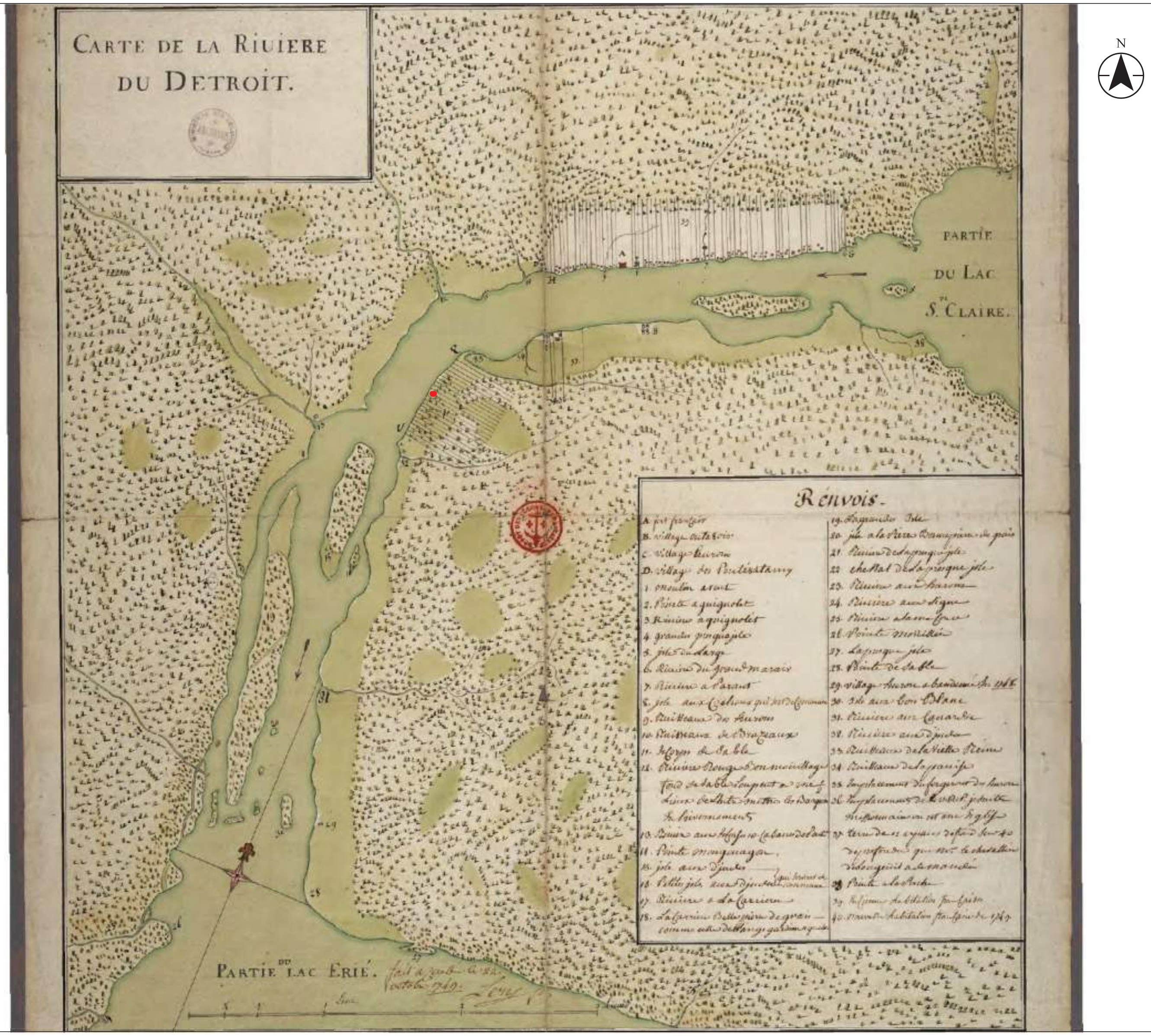
165620224 REV4
Prepared by CMC on 2021-08-27
Technical Review by PRM on 2021-08-23

Client/Project
STAGE 1 ARCHAEOLOGICAL ASSESSMENT
CITY OF WINDSOR, PRINCE ROAD STORM SEWER OUTLET
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
2

Title
Study Area in Detail

\\cd1004-f01\work_group\01609\active\165620224\03_data\gis_cad\gis\mxds\archaeology\report_figures\St1\165620224_ArchSt1_Fig02_StudyAreaDetail.mxd Revised: 2021-08-27 By: CCoghlan



Stantec

Legend

🟥 Approximate Location of Study Area

Notes

1. Historical mapping not to scale.
2. Source: Chaussegros de Lery, Gaspar-Joseph. 1752. *Carte de La Riviere du Detroit depuis de le Lac Erie jusques au Lac S. Claire*. Department of Marine, Paris.

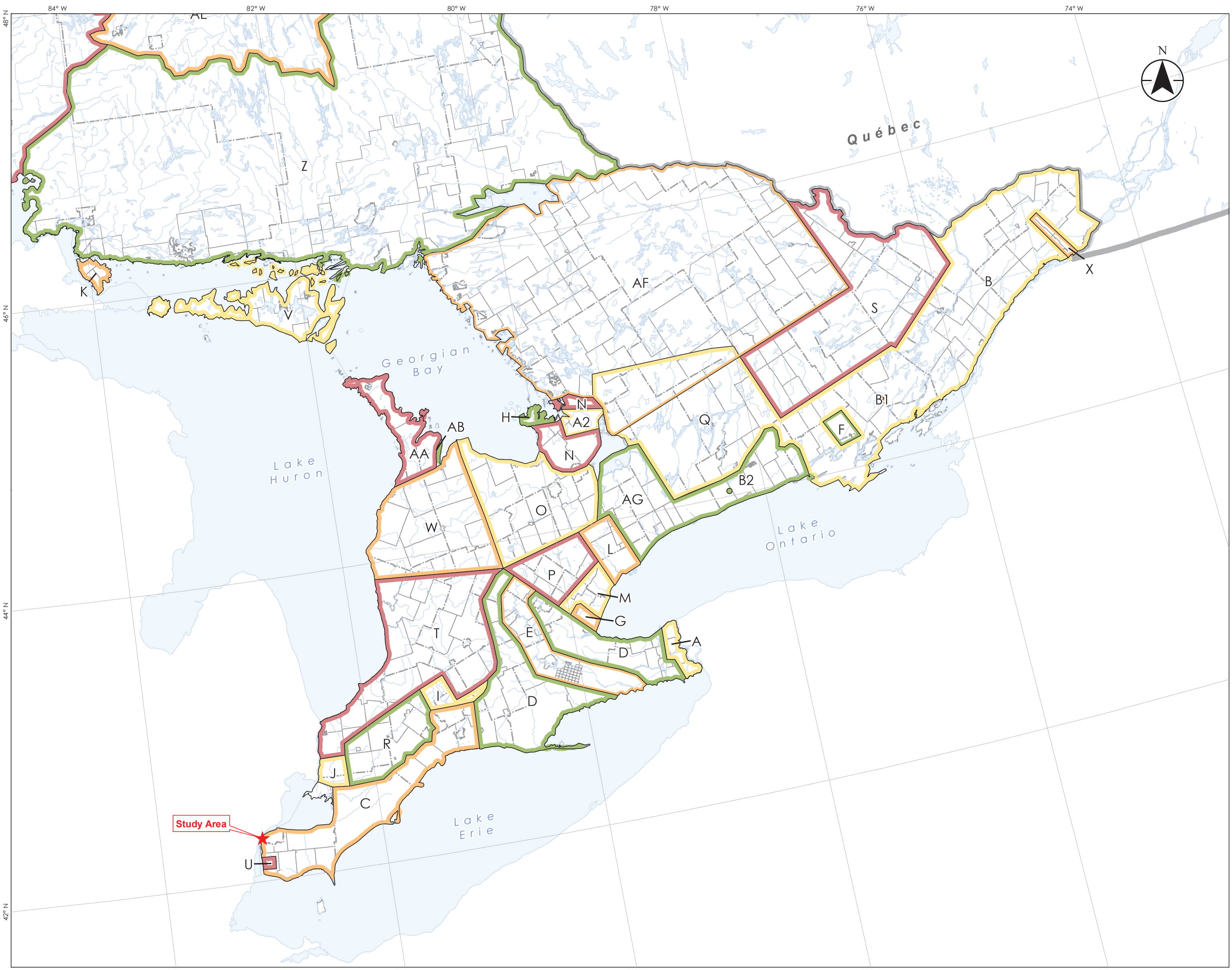
Project Location
Windsor, ON

165620224 REVA
Prepared by CMC on 2021-08-27

Client/Project
STAGE 1 ARCHAEOLOGICAL ASSESSMENT
CITY OF WINDSOR, PRINCE ROAD STORM SEWER OUTLET
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
3

Title
Portion of the 1749 Map of the Detroit River



Stantec

Legend

★ Approximate Location of Study Area

─ Watercourse

▭ Waterbody

⬚ Municipal Boundary - Upper Tier

□ Municipal Boundary - Lower or Single Tier

A	Treaty No. 381, May 9th, 1781 (Mississauga and Chippewa)
B	Crawford's Purchase, October 9th, 1783 (Algonquin and Iroquois)
B1	Crawford's Purchase, October 9th, 1783 (Mississauga)
B2	Crawford's Purchases, 1784, 1787 And 1788 (Mississauga)
A2	John Collins' Purchase, 1785 (Chippewa)
C	Treaty No. 2, May 19th, 1790 (Odawa, Chippewa, Pottawatomi, and Huron)
D	Treaty No. 3, December 2nd, 1792 (Mississauga)
E	Haldimand Tract:from the Crown to the Mohawk, 1793
F	Tyendinaga:from the Crown to the Mohawk, 1793
G	Treaty No. 3 3/4:from the Crown to Joseph Brant, October 24th, 1795
H	Treaty No. 5, May 22nd, 1798 (Chippewa)
I	Treaty No. 6, September 7th, 1796 (Chippewa)
J	Treaty No. 7, September 7th, 1796 (Chippewa)
L	Treaty No. 13, August 1st, 1805 (Mississauga)
M	Treaty No. 13A, August 2nd, 1805 (Mississauga)
N	Treaty No.16, November 18th, 1815 (Chippewa)
O	Treaty No. 18, October 17th, 1818 (Chippewa)
P	Treaty No. 19, October 28th 1818 (Chippewa)
Q	Treaty No. 20, November 5th, 1818 (Chippewa)
R	Treaty No. 21, March 9th, 1819 (Chippewa)
S	Treaty No. 27, May 31st, 1819 (Mississauga)
T	Treaty No. 27½, April 25th, 1825 (Ojibwa and Chippewa)
U	Treaty No. 35, August 13th, 1833 (Wyandot or Huron)
V	Treaty No. 45, August 9th, 1836 (Chippewa and Odawa, "For All Indians To Reside Thereon")
W	Treaty No. 45½, August 9th, 1836 (Saugeen)
X	Treaty No. 57, June 1st, 1847 (Iroquois of St. Regis)
Z	Treaty No. 61, September 9th, 1850 (Robinson Treaty:Ojibwa)
AA	Treaty No. 72, October 30th, 1854 (Chippewa)
AB	Treaty No. 82, February 9th, 1857 (Chippewa)
AF	Williams Treaty, October 31st and November 15th, 1923 (Chippewa and Mississauga)
AG	Williams Treaty, October 31st, 1923 (Chippewa)

0 50 100
Km
1:3,000,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 Statistics Canada Lambert
2. Contains information used under the Open Government License - Ontario.

Project Location
Windsor, ON

165620224 REVA
Prepared by CMC on 2021-08-27

Client/Project
STAGE 1 ARCHAEOLOGICAL ASSESSMENT
CITY OF WINDSOR, PRINCE ROAD STORM SEWER OUTLET
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
4

Title
Treaties and Purchases (Adapted from Morris 1943)

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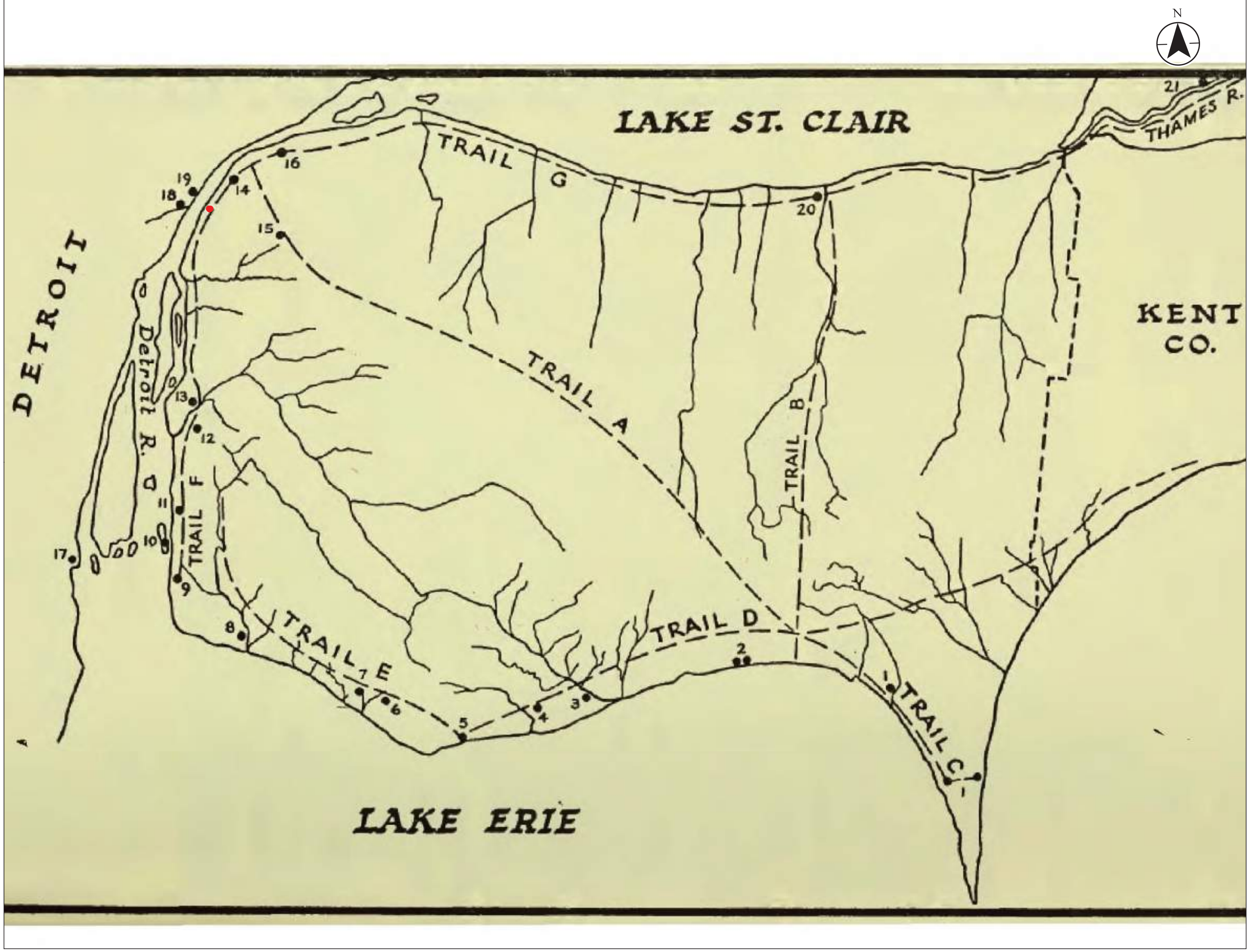

Stantec

Legend

🟥 Approximate Location of Study Area

Indigenous Places Found in Essex County and Vicinity
1. Village, cornfields, and portage, Point Pelee (plan by Iredell 1799)
2. Two Indigenous entrenchments, Gosfield Township (plan by McNiff 1794)
3. Village on Cedar Creek, entrenched, Gosfield Township
4. Village, Colchester, South Township
5. Indigenous encampment, Colchester Township (McNiff 1794)
6. Village and mound, Daniel Wright farm, Colchester Township
7. Several mounds, Colchester Township
8. Village, Big Creek (plan by Iredell 1796)
9. Former village of the Hurons abandoned in 1748
(map by Chaussegros de Léry, fils, 1749)
10. Camping site used by all tribes, Bois Blanc Island
11. Village above Fort Malden (McNiff's map of 1790)
12. Huron village, Anderdon Township (McNiff 1790)
13. Cornfields, Anderdon Township (McNiff 1790)
14. Huron village, Huron Church Line
15. Burial mound, Huron Church Line and Third Concession, Sandwich West Township
(excavated by W.J. Wintemberg for National Museum of Canada 1936)
16. Ottawa village and cemetery, Louis Avenue, Windsor (Chaussegros de Léry 1754)
17. Huron village, Brownstowe, Wayne County, Michigan
18. The great mound at the mouth of the Rouge River, Wayne County, Michigan
19. Circular mound and several smaller mounds at old Fort Wayne
20. Indigenous village, Ruscom River, Rochester Township (plan by Col. Burwell 1823)
21. Chippewa town reported by Major E.B. Littlehales in 1793

Indigenous Trails and Paths
A. Talbot Road, through the county from beyond Wheatley to Sandwich
(shown on McNiff's map of 1791)
B. From Lake Erie to Lake St. Clair, following the Ruscum River (Burwell's map 1823)
C. From Point Pelee to Talbot Road
D. Lake Erie trail connecting shoreline settlements
E. From Lake Erie shoreline to Amherstburg area
F. River shore path, now Highway 18
G. River and lake shoreline to the Thames River and eastward,
followed by Governor Simcoe in 1793

Notes
1. Historical mapping not to scale.
2. Source: Lajeunesse, Ernest J. 1960. *The Windsor Border Region: Canada's Southernmost Frontier*. The Champlain Society. Toronto: University of Toronto Press.

Project Location
Windsor, ON

165620224 REVA
Prepared by CMC on 2021-08-27

Client/Project
STAGE 1 ARCHAEOLOGICAL ASSESSMENT
CITY OF WINDSOR, PRINCE ROAD STORM SEWER OUTLET
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
5

Title
Documented Indigenous Activity in Essex County

\\cd1004-f01\work_group\01609\active\165620224\03_data\gis_cad\gis\mxds\archaeology\report_figures\St1\165620224_ArchSt1_Fig05_IndigenousActivity.mxd Revised: 2021-08-27 By: CCoghlan

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Legend

🟥 Approximate Location of Study Area

Notes
1. Historical mapping not to scale.
2. Source: Iredell, Abraham. 1797. Sandwich. Unpublished map, on file with the Ministry of Natural Resources Crown Land Survey Records Office, Peterborough, Ontario.

Project Location Windsor, ON	161414044 REVA Prepared by CMC on 2021-08-27

Client/Project
STAGE 1 ARCHAEOLOGICAL ASSESSMENT
CITY OF WINDSOR, PRINCE ROAD STORM SEWER OUTLET
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
6

Title
Portion of the 1797 Plan of a Portion of Sandwich Township

\\cd1004-f01\work_group\01609\active\165620224\03_data\gis_cad\gis\mxds\archaeology\report_figures\St1\165620224_ArchSt1_Fig06_Hist1797.mxd Revised: 2021-08-27 By: CCoghlan

Legend

🟥 Approximate Location of Study Area

Notes

1. Historical mapping not to scale.
2. Source: Owen, W.F.W., Capatin R.N. 1828 *A Survey of the River Detroit: From Lake Erie to Lake St. Clair.* J and C Walker. Library and Archives Canada.

Project Location
Windsor, ON

165620224 REVA
Prepared by CMC on 2021-08-27

Client/Project
STAGE 1 ARCHAEOLOGICAL ASSESSMENT
CITY OF WINDSOR, PRINCE ROAD STORM SEWER OUTLET
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
7

Title

Portion of the 1828 Historical Map of a Survey of the Detroit River

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Legend

🟥 Approximate Location of Study Area

Notes

1. Historical mapping not to scale.
2. Source: Billyard, William and Richard Parr. 1847. *Map of the Western District in the Province of Canada*. Toronto: Scobie and Balfour.

Project Location
Windsor, ON

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Prepared by CMC on 2021-08-27

Client/Project
STAGE 1 ARCHAEOLOGICAL ASSESSMENT
CITY OF WINDSOR, PRINCE ROAD STORM SEWER OUTLET
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
8

Title
Portion of the 1847 Historical Map of Western District

Stantec

Legend

🟥 Approximate Location of Study Area

Notes
1. Historical mapping not to scale.
2. Source: Walling, H.F. 1877. *Map of Essex County, Ontario.* R.M. Tackabury.

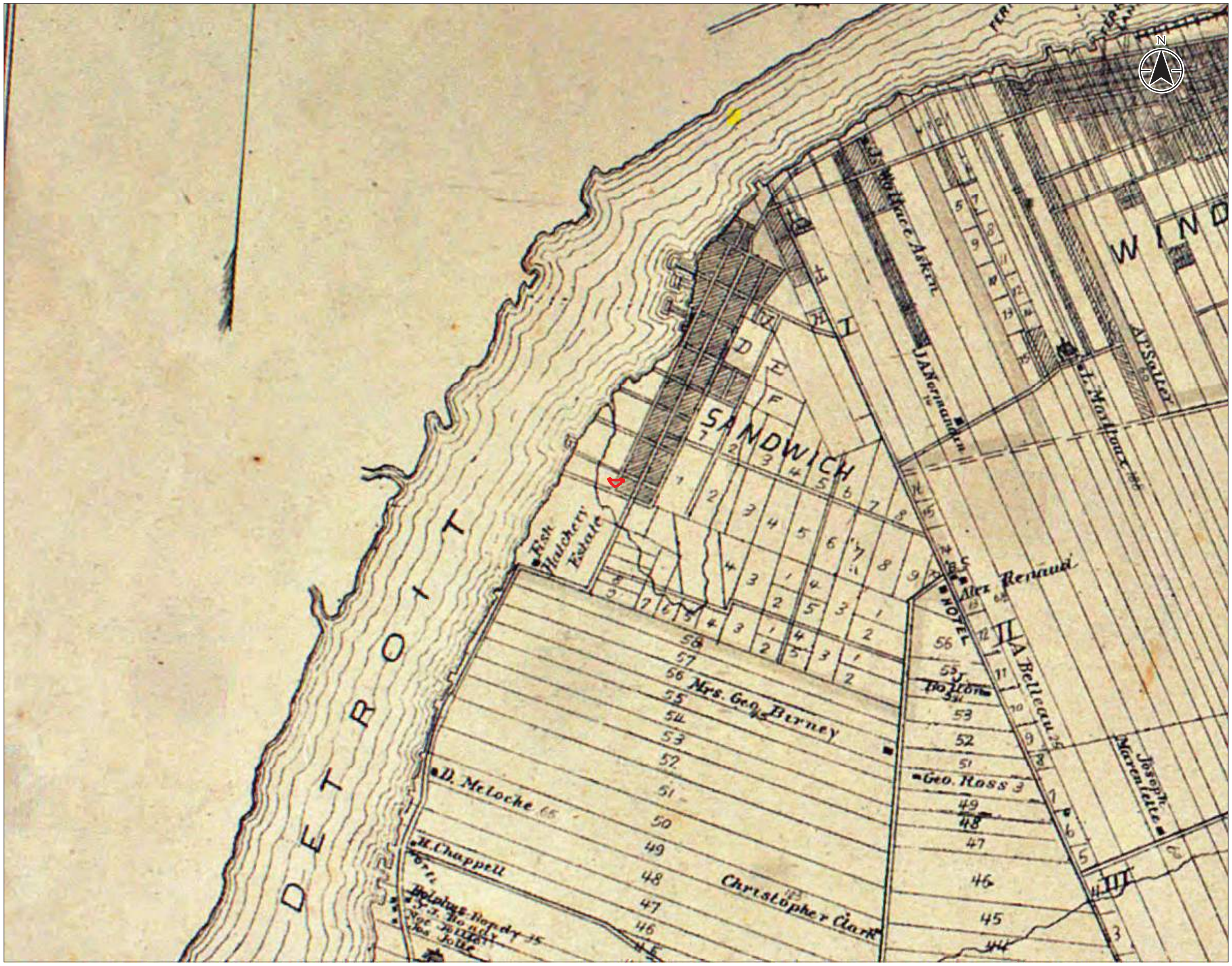
Project Location
Windsor, ON

165620224 REVA
Prepared by CMC on 2021-08-27

Client/Project
STAGE 1 ARCHAEOLOGICAL ASSESSMENT
CITY OF WINDSOR, PRINCE ROAD STORM SEWER OUTLET
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
9

Title
Portion of the 1877 Historical Map of Essex County



Stantec

Legend

▭ Approximate Location of Study Area

Notes

1. Historical mapping not to scale.
2. Source: Belden, H. and Co. 1881. *Essex Supplement in Illustrated Historical Atlas of the Dominion of Canada*. Toronto: Belden and Co.

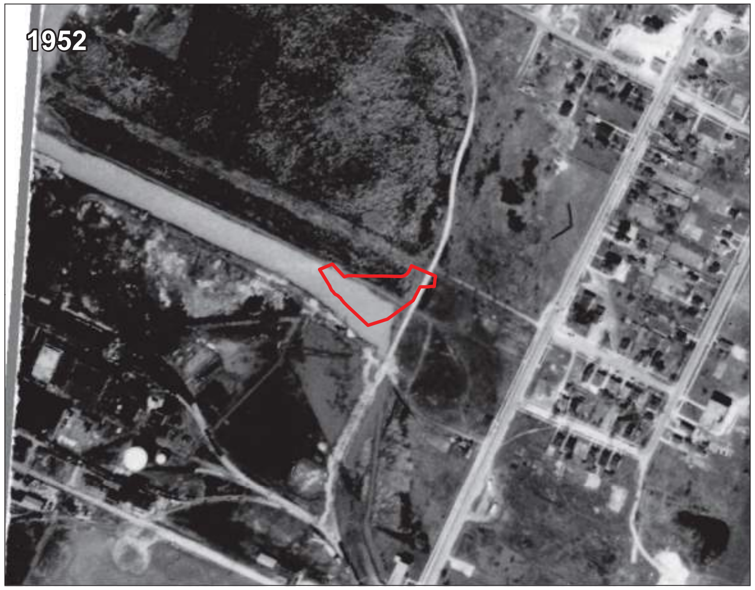
Project Location Windsor, ON	165620224 REVA Prepared by CMC on 2021-08-27

Client/Project

STAGE 1 ARCHAEOLOGICAL ASSESSMENT
CITY OF WINDSOR, PRINCE ROAD STORM SEWER OUTLET
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
10

Title
Portion of the 1881 Historical Map of Sandwich Township


1952


1956


1961


1981

Stantec

Legend

🟥 Approximate Location of Study Area

Notes
1. Non-orthorectified imagery not to scale.
2. Source: DTE Aerial Photo Collection at Wayne State University.

Project Location Windsor, ON	165620224 REV4 Prepared by CMC on 2021-08-27 Technical Review by PRM on 2021-08-23

Client/Project
STAGE 1 ARCHAEOLOGICAL ASSESSMENT
CITY OF WINDSOR, PRINCE ROAD STORM SEWER OUTLET
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
11

Title
Aerial Photography of the Study Area

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Stantec

Legend

🟥 Study Area

—+— Railway

▲ Photo Location and Direction

Assessment Method

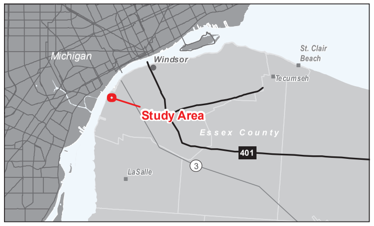
▨ Previously Disturbed, Low to No Archaeological Potential - No Further Archaeological Work Required

0 25 50 Meters

1:750 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2021.
3. Orthoimagery © First Base Solutions, 2021. Imagery flown in 2019.



Project Location
Windsor, ON

165620224 REV4
Prepared by CMC on 2021-08-27
Technical Review by PRM on 2021-08-23

Client/Project
STAGE 1 ARCHAEOLOGICAL ASSESSMENT
CITY OF WINDSOR, PRINCE ROAD STORM SEWER OUTLET
MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

Figure No.
12

Title
Stage 1 Results

9.0 CLOSURE

This report documents work that was performed in accordance with generally accepted professional standards at the time and location in which the services were provided. No other representations, warranties or guarantees are made concerning the accuracy or completeness of the data or conclusions contained within this report, including no assurance that this work has uncovered all potential archaeological resources associated with the identified property.

All information received from the client or third parties in the preparation of this report has been assumed by Stantec to be correct. Stantec assumes no responsibility for any deficiency or inaccuracy in information received from others.

Conclusions made within this report consist of Stantec's professional opinion as of the time of the writing of this report and are based solely on the scope of work described in the report, the limited data available and the results of the work. The conclusions are based on the conditions encountered by Stantec at the time the work was performed. Due to the nature of archaeological assessment, which consists of systematic sampling, Stantec does not warrant against undiscovered environmental liabilities nor that the sampling results are indicative of the condition of the entire property.

This report has been prepared for the exclusive use of the client identified herein and any use by any third party is prohibited. Stantec assumes no responsibility for losses, damages, liabilities or claims, howsoever arising, from third party use of this report. We trust this report meets your current requirements. Please do not hesitate to contact us should you require further information or have additional questions about any facet of this report.

Quality Review ____________________
Dickson, Parker
2021.10.25
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(signature)

Parker Dickson – Associate, Senior Archaeologist

Independent Review ____________________
Digitally signed by Varley, Colin
Date: 2021.10.25
15:24:10 -04'00'
(signature)

Colin Varley – Senior Associate, Senior Archaeologist