Terra-Dynamics Consulting Inc.
432 Niagara Street, Unit 2 St. Catharines, ON L2M 4W3

February 23, 2024

DeHaan Homes Inc.
c/o Mr. Arie DeHaan, President
204 Canboro Road, P.O. Box 142
Ridgeville, Ontario
L0S 1M0

Re: Hydrogeological Study – Concession 1 Part Lot 20, Caistorville Expansion Area, Township of West Lincoln, ON

Dear Mr. DeHaan,

1.0 Introduction, Background Information and Purpose

DeHaan Homes Inc. retained Terra-Dynamics Consulting Inc. (Terra-Dynamics) to complete a Hydrogeological Study of sewage impacts to support the development of a residential subdivision located at Concession 1 Part Lot 20, Caistorville Expansion Area, in the Township of West Lincoln (the Site, Figure 1). The 7.4-hectare Site was recently added to the southern part of the rural settlement area of Caistorville, and it is our understanding that the Site is to be developed into privately serviced residential properties that are least 0.4 hectares (1.0 acre) in size (Appendix A). The DRAFT hydrogeological study provided herein assesses the risk to groundwater supplies from new private sewage systems created as part of this proposed residential development.

The hydrogeological study is a requirement of the Township of West Lincoln and Niagara Region, with applicable official plan policies listed below.

Township of West Lincoln Official Plan Policies for Hamlet Settlement Areas 7.2.3 (Township, 2018):

> *"(e) … a minimum lot area requirement of 1.0 hectares per lot unless a hydrogeological assessment determines that a smaller lot size is adequate as outlined in 18.13.5.a*
>
> *(f) The proponent of any subdivision shall be required to prepare a hydrogeological study in support of the proposed development…"*

Township of West Lincoln Official Plan Policies for Hamlet Settlement Areas 18.13.5 (Township, 2018):

> *"(a) The minimum lot size for lots created in a Hamlet designation shall be approximately 1.0 hectare as required to satisfy the Township Building Department and Part 8 of the Ontario Building Code for long term operation of a waste disposal system, unless a hydrological assessment determines that a smaller lot size will be adequate to accommodate private water and sewage treatment facilities."*

Niagara Official Plan Policy 4.1.9.2(b) [Niagara Region, 2022]:

> *"…the minimum size of the proposed and retained lots shall each be 1 hectare unless it is determined through a hydrogeological study, that considers potential cumulative impacts, that a smaller size lot*

will adequately accommodate private water and sewage treatment facilities for long-term operation but not be less than 0.4 hectares…"

The following documents the hydrogeological study of the Site.

2.0 Methodology

The following methodologies were used to investigate the Site:

A. Submission of a Hydrogeological Study Terms of Reference to the Township of West Lincoln and the Niagara Region.

B. Evaluation of Ministry of Environment, Conservation and Parks (MECP) water well and Ministry of Natural Resources and Forestry (MNRF) oil and gas well records located within 400 metres of the Site.

C. A visit to the Site to observe conditions, including collection of static groundwater levels and hydraulic conductivity testing of monitoring wells constructed during the geotechnical and Phase 2 Environmental Site Assessment studies.

D. Mailing of a water use survey to properties located within 100 m of the Site.

E. Assessment of geological information using regional mapping of elevation, soils, sediments/overburden and bedrock.

F. Preparation of a description of the hydrogeological setting using physical/geological information and water levels.

G. Assessment of the aquifer vulnerability completed using MECP guidance (i.e. Provincial Procedure D-5-4 (MECP, 1996) and MECP, 2008) (b) groundwater vulnerability procedures described by the Niagara Peninsula Source Protection Authority (NPSPA, 2013).

Terra-Dynamics began the assessment once confirmation of the appropriateness of the Terms of Reference was received from both the Township of West Lincoln (2023) and the Niagara Region (2023). As the new lots will be provided potable water via cisterns, this report does not include a water supply assessment (MECP, 1996), but it is recommended that a development agreement be implemented that will indicate water supply by cisterns only.

3.0 Wells

3.1 Ministry of Environment, Conservation and Parks (MECP) Water Well Records

MECP water well records (WWRs) located within 400 metres (m) of the Site were reviewed and twelve records were identified, dating between 1965 and 2021 (Figure 2 and Appendix B). Two of the records, WWRs 3800015 and 3804117, are bedrock wells that were constructed for water supply purposes (MECP, 2024). WWR 3804117 was plotted by the MECP as being outside of the 400 m Site boundary, however, the actual location of WWR 3804117 (Figure 2) was confirmed to be within the 400 m boundary based on the address information provided in the record and field observations during a Site

visit conducted by Terra-Dynamics on November 24, 2023. General water quality observations provided by the water well contractor described the water as fresh for WWR 3800015 (a description of water quality was not provided for WWR 3804117) (MECP, 2024). The records indicate that the wells were installed within the limestone bedrock with well depths ranging from 20.4 to 22.9 metres below ground surface (m BGS) (MECP, 2024).

The depth to bedrock (i.e. the overburden thickness) in these wells ranged from 16.8 to 19.8 m BGS, and the overburden material was described in both records as clay (MECP, 2024). Bedrock aquifer static water level depths were generally recorded as being above the top of bedrock in both wells, with a mean static water level of 9.9 m BGS (MECP, 2024) suggesting confined aquifer conditions. Both water wells were constructed with casing lengths greater than 6 m and are located greater than 15 m from the Site boundary (Figure 2). Under Part 8 of the Ontario Building Code, sewage disposal systems must be set-back 15 m or greater from wells with casing lengths to 6 m or greater (Sharaf, 2013).

The ten remaining WWRs are shallow overburden wells (i.e. 4.0 to 7.3 m BGS) constructed for monitoring purposes between 2007 and 2021 (MECP, 2024). The overburden borehole materials listed in these records was described as silty clay to clay (MECP, 2024). Copies of the twelve WWRs located within 400 m of the Site are provided in Appendix B.

3.2 Ministry of Natural Resources and Forestry (MNRF) Petroleum Records

MNRF petroleum well records located within 400 m of the Site were reviewed and two records were identified by MNRF Oil and Gas record numbers N002237 and T012143 (Figure 2, Appendix B). Record number N002237 is mapped approximately 160 m north of the Site boundary, however, the record indicates the location accuracy to be “within 200 m” based on a pre-1921 well record (OGSR Library, 2024) (Appendix B). Record number T012143 is mapped on-site and indicates that the well is a privately owned natural gas well that was constructed in 2011 (OGSR Library, 2024) (Appendix B). The location of natural gas well T012134 was confirmed during a Site visit completed by Terra-Dynamics on November 24, 2023.

4.0 Physical Setting

The Site is within the Upper Welland River Watershed (AquaResource Inc. and NPCA, 2009). The area immediately west of the Site is mapped as Provincially Significant Wetland (PSW) that is part of the Caistor Canborough Slough Forest Wetland Complex (NPCA, 2017). This PSW area drains into a small tributary that is mapped on-site, which flows east towards the Welland River (Figure 2) (NPCA, 2017). A pond is located in the northwest corner of the Site and was constructed between 2006 and 2010 based on a review of historic satellite imagery (Niagara Navigator, 2024). There are no tile drains mapped for the Site (OMAFRA, 2024).

The topography of the Site is fairly flat and slopes from west to east. The elevation ranges from approximately 190 metres above sea level (m ASL) at the western boundary of the Site to approximately 187 m ASL where the tributary crosses Caistorville Road at the eastern boundary of the Site (Figure 2) (NPCA, 2010). The Site is located on the Haldimand Clay Plain physiographic region (Chapman and Putnam, 1984).

4.1 Soils

The soils for the Site are mapped as Haldimand and Lincoln soils (OMAFRA, 2024) (Appendix D). Haldimand soils are classified as imperfectly drained and slowly permeable lacustrine heavy clay and silty clay, and Lincoln soils are classified as poorly drained and slowly permeable lacustrine heavy clay (OMAFRA, 1989) (Figure 3). Soil on the Site has been mapped as Hydrologic Soil Groups C and D, which are characterized as moderately fine to fine textured with slow infiltration rates (OMAFRA, 2024).

The soil mapping is consistent with on-site conditions which were confirmed to be primarily silty clay by Niagara Soil Solutions Inc. (2023). Seven boreholes (BH-1 to BH-7) and three monitoring wells (MW-1 (BH-10), MW-2 (BH-9), and MW-3 (BH-8)) were drilled on-site by Niagara Soil Solutions Inc. in October 2023 to depths ranging from 5.2 to 9.8 m BGS (Figure 2). The soil at each drilling location was described as "silty clay/clayey silt" (NSSI, 2023) (Appendix D).

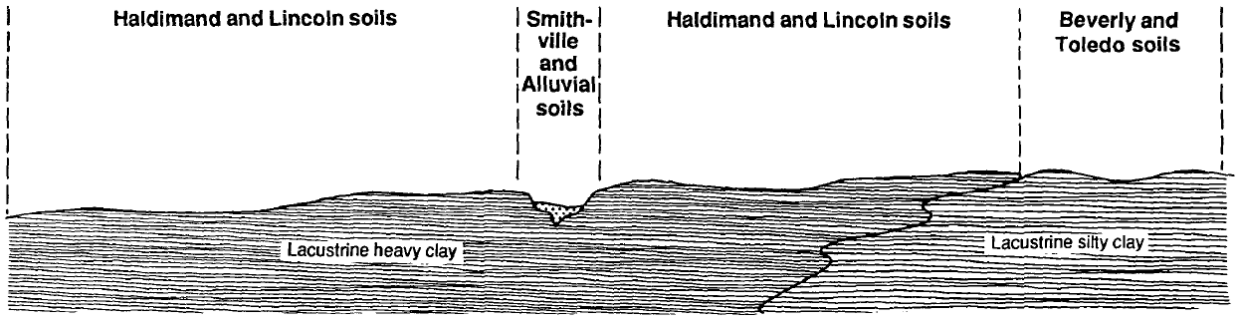


Figure 3 – Schematic cross-section showing the relationship of soils on the Haldimand Clay Plain (OMAFRA, 1989)

Table 1 - Hydrologic Soil Groups (USDA, 1986)

HSG Group	Soil description
A	sand, loamy sand or sandy loam
B	silt loam or loam
C	sandy clay loam
D	clay loam, silty clay loam, sandy clay, silty clay or clay

4.2 Overburden Geology

The surficial geology of the Site is mapped as clay and silt associated with fine-textured glaciolacustrine deep water deposits (OGS, 2003). The overburden thickness beneath the Site is estimated to be between 16.8 and 19.8 m based on nearby water well records (MECP, 2024) (Figure 2). This corresponds with NPCA regional mapping of overburden thickness between 15 and 20 m (WHI, 2005). Four nearby boreholes drilled by Ontario Geological Survey (OGS) indicate approximately 14 to 19 m of silty clay overburden underlying the area (Figure 1 and Appendix D). The OGS has delineated four overburden aquitards in these boreholes, which consist of the Upper Whittlesey Aquitard, Halton Aquitard, Lower Whittlesey Aquitard, and Wentworth Aquitard (Burt, 2020) (Appendix D). Two geologic cross-sections prepared for this hydrogeological study (A-A' and B-B') show that there is greater than 10 m of clay underlying the Site (Figures 4 and 5).

4.3 Bedrock Geology

The underlying bedrock is mapped as the Guelph Formation (Armstrong and Dodge, 2007). The bedrock topography dips to the southeast (NPSPA, 2013), and is at approximately 170 m ASL at the Site (Figure 4).

4.4 Hydrogeologic Setting

The Site is underlain by a low permeability overburden aquitard which protects the underlying bedrock aquifer as described below and shown in cross-section (Figures 4 and 5).

4.4.1 Overburden Aquitard

The Site is located in proximity to four OGS boreholes which identified between 14 and 19 m of silty clay and clayey sandy silt till aquitard overlying bedrock (Burt, 2020, Appendix D, Figure 1). This is consistent with classification of the glaciolacustrine unit as an overburden aquitard by Gartner Lee Limited (1987) because the '*horizons will not transmit appreciable quantities of water*". The hydraulic conductivity of this silty clay aquitard is expected to be $7x10^{-7}$ m/s, or less (GLL, 1987).

Soil samples were collected from on-site boreholes BH-2 and BH-7, and from monitoring well MW-3 (BH-8) at depths ranging from 2.3 to 5.2 m BGS and were submitted to an accredited laboratory for grain-size analyses (Figure 2 and Appendix D). The results of the grain-size analyses identify the soils as silty clay and heavy clay and are summarized in Table 3 (NTIL, 2023). The Excel-tool HydrogeoSieveXL (Devlin, 2015) was used to process the grain-size analyses to provide a hydraulic conductivity of $3x10^{-10}$ m/s (Appendix D). These results are similar to the results of hydraulic conductivity testing completed by Terra-Dynamics at monitoring wells MW-1 and MW-2, which indicated an overburden hydraulic conductivity of between $4x10^{-9}$ and $9x10^{-9}$ m/s (Figure 2 and Appendix D).

Table 2 – Summary of borehole grain-size analyses (NTIL, 2023)

Sampling Location	Sample Depth (m BGS)	Soil Texture Classification
BH-2	2.3 – 2.9	Heavy clay
BH-7	3.1 – 3.7	Silty clay
BH-8	4.6 – 5.2	

Gartner Lee Limited (1987) provides a good description of the expected water table conditions within the overburden aquitard:

> "*Detailed studies indicate that the water table fluctuates over the weathered/fractured upper two to three metres of the glaciolacustrine silts and clays comprising the overburden aquitard…flow in this shallow zone responds to daily climatic changes such that, during precipitation, the open fractures from weathering will quickly fill with water. The bulk of the discharge will then occur locally in swales that carry intermittent surface water …. The remainder will go to depth to recharge the ground water system.*"

Groundwater flow in the overburden aquitard it is expected to follow topography (i.e. west to east) while being limited in velocity by the low hydraulic conductivity (Haitjema and Mitchell-Bruker, 2005).

The vertical groundwater gradient is downwards from the overburden aquitard to the bedrock aquifer; however, the groundwater flow would be limited by the low hydraulic conductivity.

Continuous (1991-2005) surface water modelling for Upper Welland River completed by the Niagara Peninsula Conservation Authority (NPCA) estimate the infiltration rate for the Site as being low and on average 84 mm/year (AquaResource Inc. and NPCA, 2009), corresponding with a value for clay (MECP, 1995).

4.4.2 Bedrock Aquifer

The uppermost part of the bedrock is an aquifer where weathered, having "…*a higher hydraulic conductivity than the same formation at depth…attributed to weathering of the bedrock surface*…" (GLL, 1987). The potentiometric surface of the bedrock aquifer has been mapped as close to 179 m ASL in the area of the Site (NPSPA, 2013). The bedrock aquifer has a low intrinsic susceptibility to contamination due to the protection provided by the overlying low permeability materials, e.g. silty clay (WHI, 2005).

4.4.3 Confined Bedrock Aquifer Conceptual Model

The Section 4.0 information is summarized in the schematic below, as a conceptual model for the assessment of potential sewage system impacts to groundwater and private wells (Figure 6).

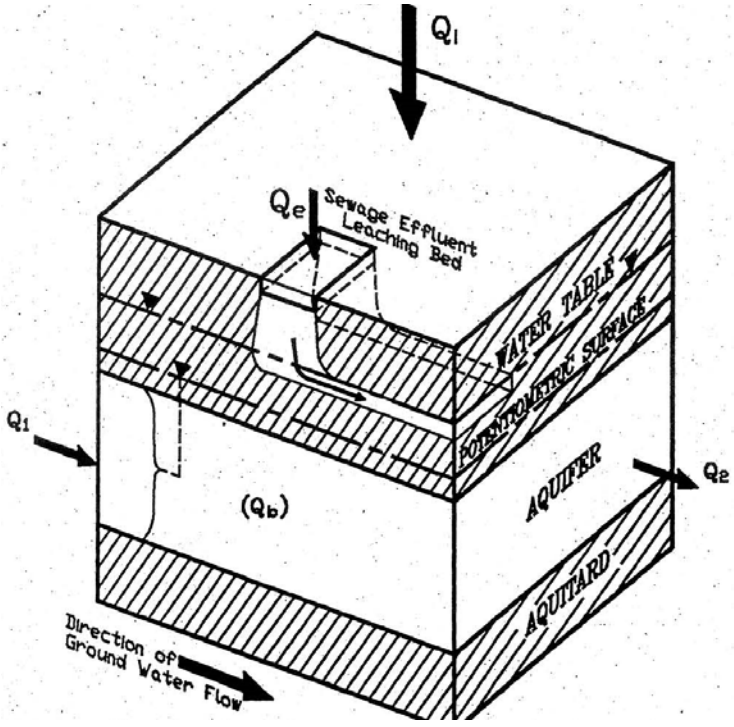


Figure 6 - Confined Aquifer Impact Assessment Subsurface Sewage System (MECP, 1995)

5.0 Water Use Survey Results

A water use and septic system survey was mailed-out on November 2, 2023 to the eight parcels located within 100 m of the Site (Appendix C). One completed survey was received from the property owner at

700 Broman Court indicating that the property's water supply is provided via cistern, and that on-site wastewater is treated using a septic system with a raised septic bed (Appendix C). Based on the site sketch provided by the property owner, the southeast corner of the raised bed is located approximately 43 m from the Site boundary (Appendix C). Under Part 8 of the Ontario Building Code, sewage disposal systems must be set-back 15 m or greater from wells with casing lengths to 6 m or greater (Sharaf, 2013). No other completed surveys were received.

6.0 Assessment of Potential Sewage Impacts

Provincial Procedure D-5-4 (MECP, 1996) provides an assessment process for assessing the groundwater impact potential of private sewage systems. The purpose of the assessment process "*is to ensure that the combined effluent discharges from all the individual on-site sewage systems in a development will have a minimal effect on the groundwater and the present or potential use of the adjacent property*" (MECP, 1996).

This assessment process involves two main steps: (i) consideration of system isolation and (ii) contaminant attenuation, as visualized below in Figure 6.

6.1 System Isolation

> *"Developments will normally be considered as low risk where it can be demonstrated that sewage effluent is hydrogeologically isolated from … supply aquifer(s)"* (MECP, 1996a).

The Design Guidelines for Sewage Works (MECP, 2008) provides criteria for evaluation of sewage system isolation from the underlying bedrock aquifer:

> "*Where it can be shown that the uppermost subsurface unit(s) at an infiltration facility have a vertical hydraulic conductivity of 10^{-5} cm/sec* (10^{-7} m/sec) *or less, is at least 10 metres (33 feet) thick and extends at least 100 m (330 ft) downgradient of the infiltration area, attenuation calculations may not be required."*

The overburden aquitard has a sufficiently low hydraulic conductivity (Section 4.4.1), and mapping of the aquitard thickness shows at least 10 metres of material at the Site (Figures 4 and 5) extending over 100 metres (Appendix D, OGS boreholes, Burt, 2020).

Consequently, private sewage servicing of the proposed development is (i) a low risk to the bedrock aquifer, and (ii) nearby water supply wells, because the Site is hydrogeologically isolated from the aquifer. This conclusion is based upon the following:

- The bedrock aquifer has been mapped as having low intrinsic susceptibility (WHI, 2005); and
- The thickness and extent of the underlying aquitard meets the 10 m MECP criterion (2008) for hydrogeologic isolation.

As there is considerable consistent documentation confirming these conditions at the Site, new collection of geologic information is not required.

Further responding to the guidance of Provincial Procedure D-5-4 under Step 2, it is worth noting that the effluent will infiltrate into the surficial clay and silt soils, become anaerobic, and consequently denitrify (Robertson et al, 1996).

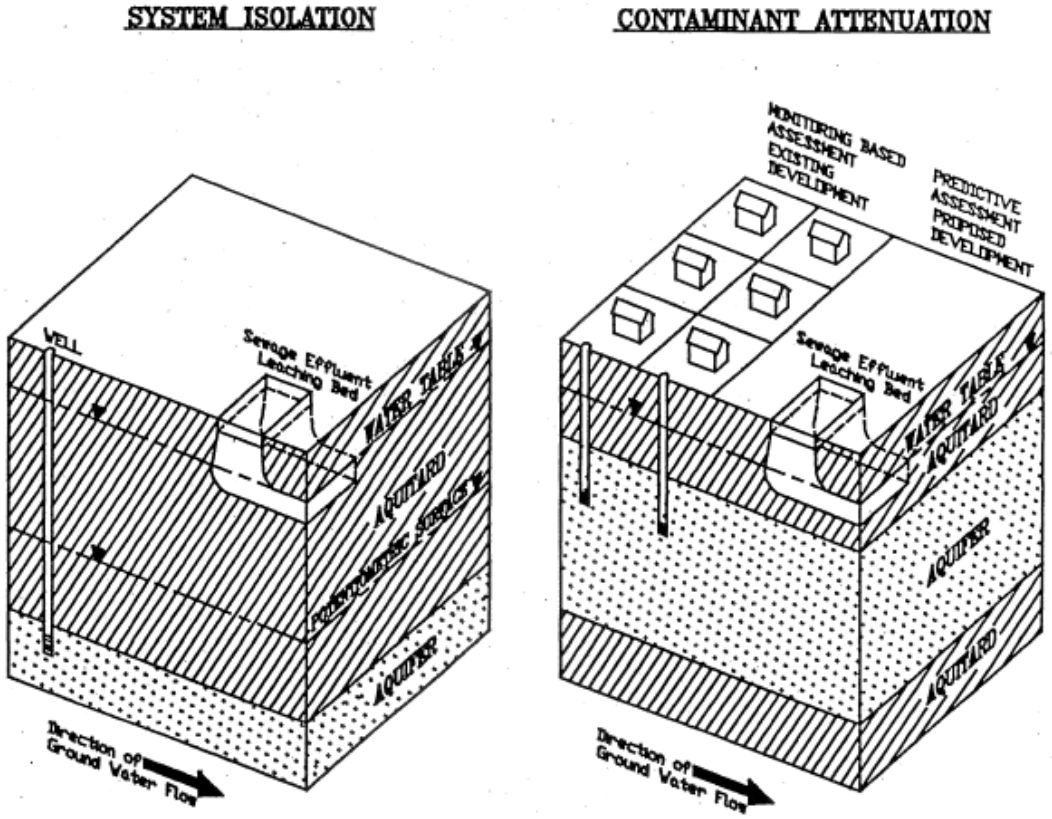


Figure 6 – Water Quality Assessment Process (MECP, 1995)

No sewage effluent will enter the water supply aquifer, hence "*the lot density of the proposed development may be dictated by… the need for sewage system replacement areas… and by the minimum distances… as defined by Ontario Regulations...*" (MECP, 1996). In this case that density is a minimum of 0.4 hectares or 1.0 acre (Township, 2018, Niagara Region, 2022).

Consequently, no Step 3 contamination attenuation calculations are required to be completed, because:

> "*…where it has been demonstrated that the sewage effluent will not enter supply aquifers, the lot density of the proposed development may be dictated by factors such as the need for sewage system replacement areas, and by the minimum distances between individual on-site beds and wells* (or cisterns)*, as defined by Ontario Regulations*…" (MECP, 1996)

6.2 Sewage System Effluent Disposal Location Considerations

Sewage system effluent disposal locations (e.g. raised leaching or filter bed) should be a minimum of 15 m from the future water supply cisterns.

7.0 Conclusions and Recommendations

7.1 Conclusions

The following conclusions are provided:

1. The Site is on the Haldimand Clay Plain, recognized as a regional aquitard that does '*not transmit appreciable quantities of water*".

2. The silty clay aquitard beneath the Site has sufficiently low permeability, is at least 10 m in thickness and extends greater than 100 m from the Site to be classified as a low permeability environment.

3. The bedrock aquifer is hydrogeologically isolated from the existing and proposed sewage disposals systems by the underling silty clay aquitard.

4. No potable water supplies have been identified off-site exerting Part 8 Ontario Building Code set-backs on proposed sewage disposal systems.

5. There is an existing gas well on-site identified by MRNF petroleum record T012143 (OGSR, 2024).

6. No sewage effluent will enter the water supply aquifer, hence "*the lot density of the proposed development may be dictated by… the need for sewage system replacement areas… and by the minimum distances… as defined by Ontario Regulations...*" (MECP, 1996). In this case that density is a minimum of 0.4 hectares or 1.0 acre (Township, 2018, Niagara Region, 2022).

7. There were no hydrogeological-based impediments to site development as long as the following recommendations are implemented.

7.2 Recommendations

The following recommendations are provided for your consideration:

1. Lots on private sewage systems and cisterns may be sustainability created on lot areas of 0.4 hectares (1 acre) as long as Ontario Building Code set-backs are met;

2. The design of the Site layout can be completed during the Building Permit stage and will need to ensure minimum 15 m set-backs from the wetlands areas and water supply cisterns and the sewage disposal systems;

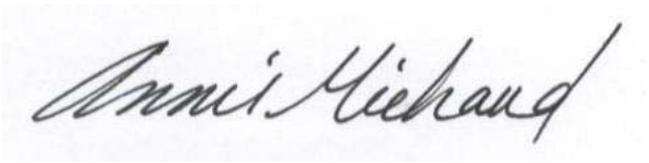
3. A development agreement should be completed with the Township indicating water supply will be a cistern(s); and

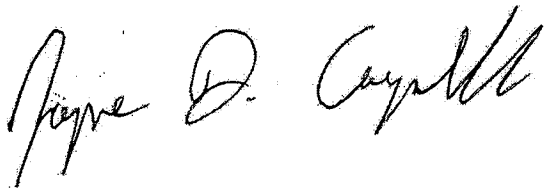
4. The monitoring wells should be decommissioned once Site Plan approval is received.

We trust this information is sufficient to your present needs. Please do not hesitate to contact the undersigned if you have any questions.

Yours truly,

TERRA-DYNAMICS CONSULTING INC.

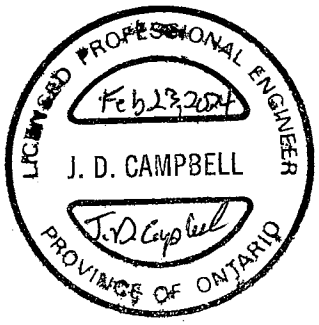




Annie Michaud, M. Eng., P. Eng.
Senior Water Resource Engineer

Jayme D. Campbell, P. Eng.
Senior Water Resource Engineer

cc. Craig Rohe, Upper Canada Consultants



Attachments
Figure 1 - Location of Site
Figure 2 – Site Details
Figure 4 – Hydrogeologic Cross-Section A-A'
Figure 5 – Hydrogeologic Cross-Section B-B'
Appendix A – Preliminary Site Plan
Appendix B – Water and Petroleum Well Records
Appendix C – Water Use and Septic System Survey
Appendix D – Supporting Information

8.0 References

AquaResource Inc. and Niagara Peninsula Conservation Authority, 2009. Water Availability Study for the Upper Welland River Watershed Plan Area, Niagara Peninsula Source Protection Area.

Armstrong, D.K. and Dodge, J.E.P., 2007. Paleozoic geology of southern Ontario. Ontario Geological Survey, Miscellaneous Release – Data 219.

Burt, A.K., 2020. Results of the 2014-2017 drilling programs on the Niagara Peninsula: Graphic logs, descriptions and analytical data; Ontario Geological Survey, Miscellaneous Release – Data 383.

Chapman, L.J., and Putnam, D.F., 1984. The Physiography of Southern Ontario. Ontario Geological Survey, Special Volume 2, 270 p.

Devlin, J.F., 2015. HydrogeoSieveXL: an Excel-based tool to estimate hydraulic conductivity from grain-size analysis.

Gartner Lee Limited (GLL), 1987. *Water Resources of the Niagara Frontier and the Welland River Drainage Basin*. Prepared for the Ontario Ministry of the Environment.

Haitjema, H.M. and Mitchell-Bruker, S., 2005. Are Water Tables a Subdued Replica of the Topography?, Vol. 43, No.6 – GROUND WATER, pg. 781-786.

Ministry of Agriculture, Food and Rural Affairs, 2024. AgMaps https://www.gisapplication.lrc.gov.on.ca/AIA/index.html?viewer=AIA.AIA&locale=en-US

Ministry of Agriculture and Food (and Rural Affairs), 1989. The Soils of the Regional Municipality of Niagara.

Ministry of the Environment, Conservation and Parks, 2024. *www.ontario.ca/environment-and-energy/map-well-records* .

Ministry of the Environment, (Conservation and Parks), 2008. Design Guidelines for Sewage Works.

Ministry of the Environment (Conservation and Parks), 1996. Procedure D-5-4, Technical Guideline for Individual On-site Sewage Systems: Water Quality Impact Assessment.

Ministry of the Environment and Energy (Conservation and Parks), 1995. MOEE Hydrogeological Technical Information Requirements for Land Development Applications.

Niagara Peninsula Conservation Authority (NPCA), 2017. Contemporary Watercourse Mapping.

Niagara Peninsula Conservation Authority, 2010. Ground surface contours.

Niagara Peninsula Conservation Authority and AquaResource Inc., 2010. Niagara Peninsula Tier 1 Water Budget and Water Quantity Stress Assessment, Final Report, Niagara Peninsula Source Protection Area.

Niagara Peninsula Source Protection Authority (NPSPA), 2013. Updated Assessment Report.

Niagara Region, 2023. Email from P. Lambert, Director of Infrastructure Planning & Development Engineering, dated October 3rd, 2023.

Niagara Region, 2022. Niagara Official Plan.

Niagara Soil Solutions Inc. (NSSI), 2023. Draft borehole logs prepared for DeHaan Homes Inc., Caistorville Road property in West Lincoln, dated October 30, 2023.

Niagara Testing and Inspection Limited (NTIL), 2023. Lab reports prepared for DeHaan Homes Inc., grain size distribution using sieve/hydrometer analysis, dated November 9, 2023.

Oil, Gas and Salt Resources Library, 2024. Well Search: http://www.ogsrlibrary.com/wellcards/ .

Ontario Geological Survey (OGS), 2003. Surficial geology of southern Ontario. Miscellaneous Release Data – 128. Project Summary and Technical Document, 53 pp.

Robertson, W.D., Russell, B.M., Cherry, J.A., 1996. Attenuation of nitrate in aquitard sediments of southern Ontario. Journal of Hydrology, vol.180, p. 267-281.

Sharaf, A., 2013. On-site Sewage Systems, Code Reference Series, contains Building Code Act, 1992 and relevant portions of O.Reg.332/12.

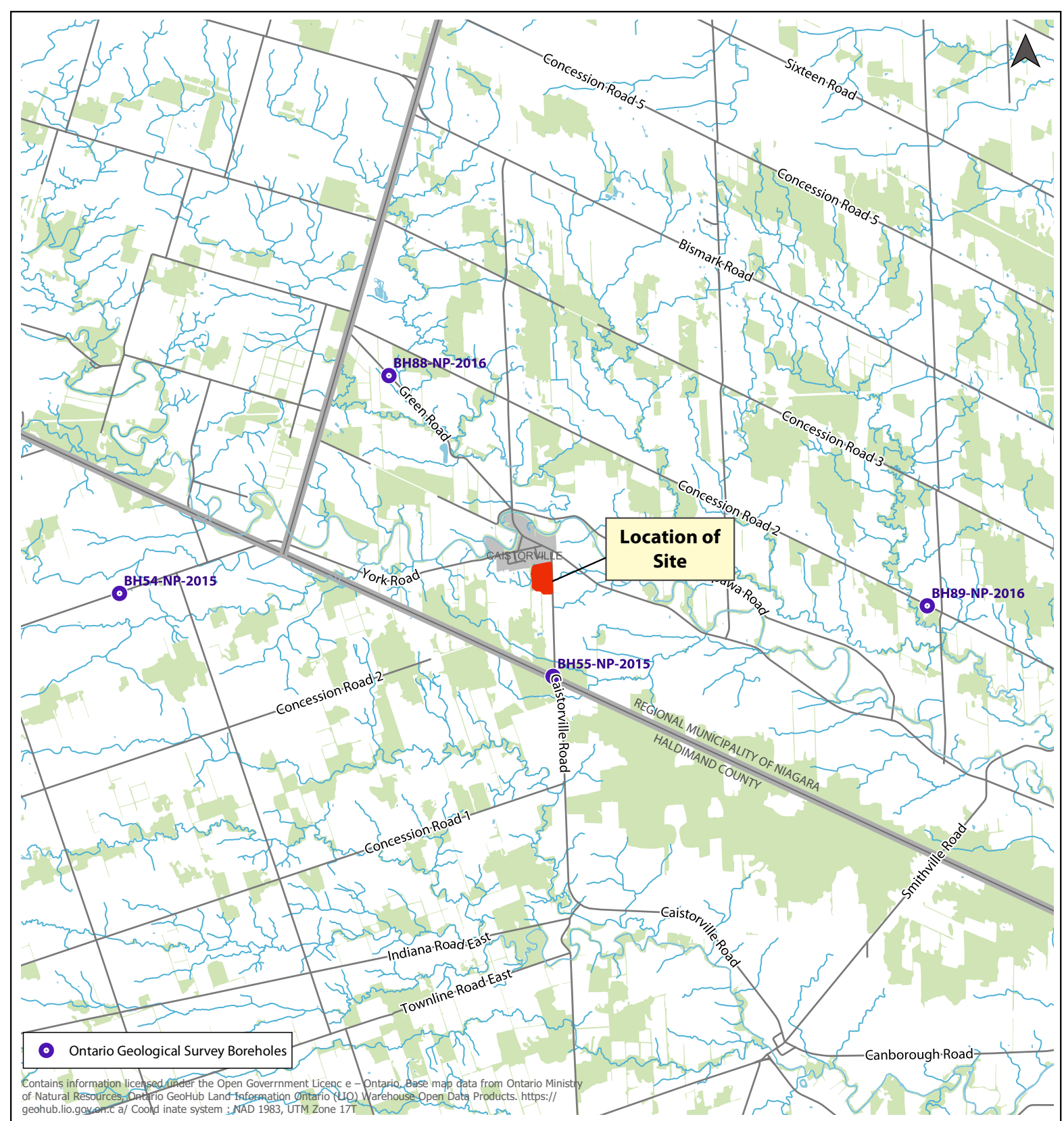
Township of West Lincoln, 2023. Memorandum from Lyle Killins, Septic System Inspection Manager to Brian Treble, Director of Planning and Building, and John Bartol, Chief Building Official. Dated October 19th, 2023.

Township of West Lincoln, 2018. Township of West Lincoln Official Plan.

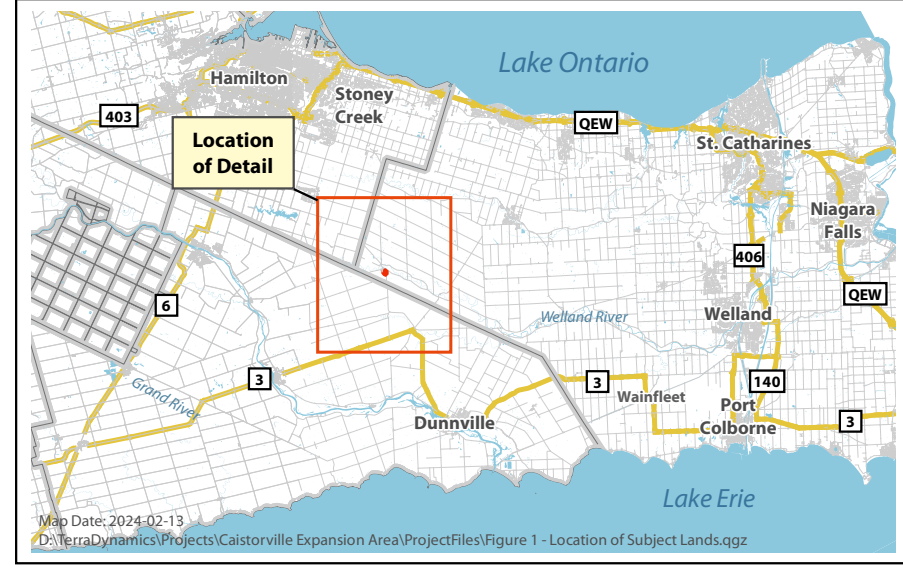
United States Department of Agriculture (USDA), 1986. Urban Hydrology for Small Watersheds.

Waterloo Hydrogeologic Inc. (WHI), 2005. Niagara Peninsula Conservation Authority Groundwater Study.

Figures



Contains information licensed under the Open Governrnment Licenc e – Ontario. Base map data from Ontario Ministry of Natural Resources, Ontario GeoHub Land Information Ontario (LIO) Warehouse Open Data Products. https://geohub.lio.gov.on.c a/ Coord inate system : NAD 1983, UTM Zone 17T



Map Date: 2024-02-13
D:\TerraDynamics\Projects\Caistorville Expansion Area\ProjectFiles\Figure 1 - Location of Subject Lands.qgz

Location of Subject Lands

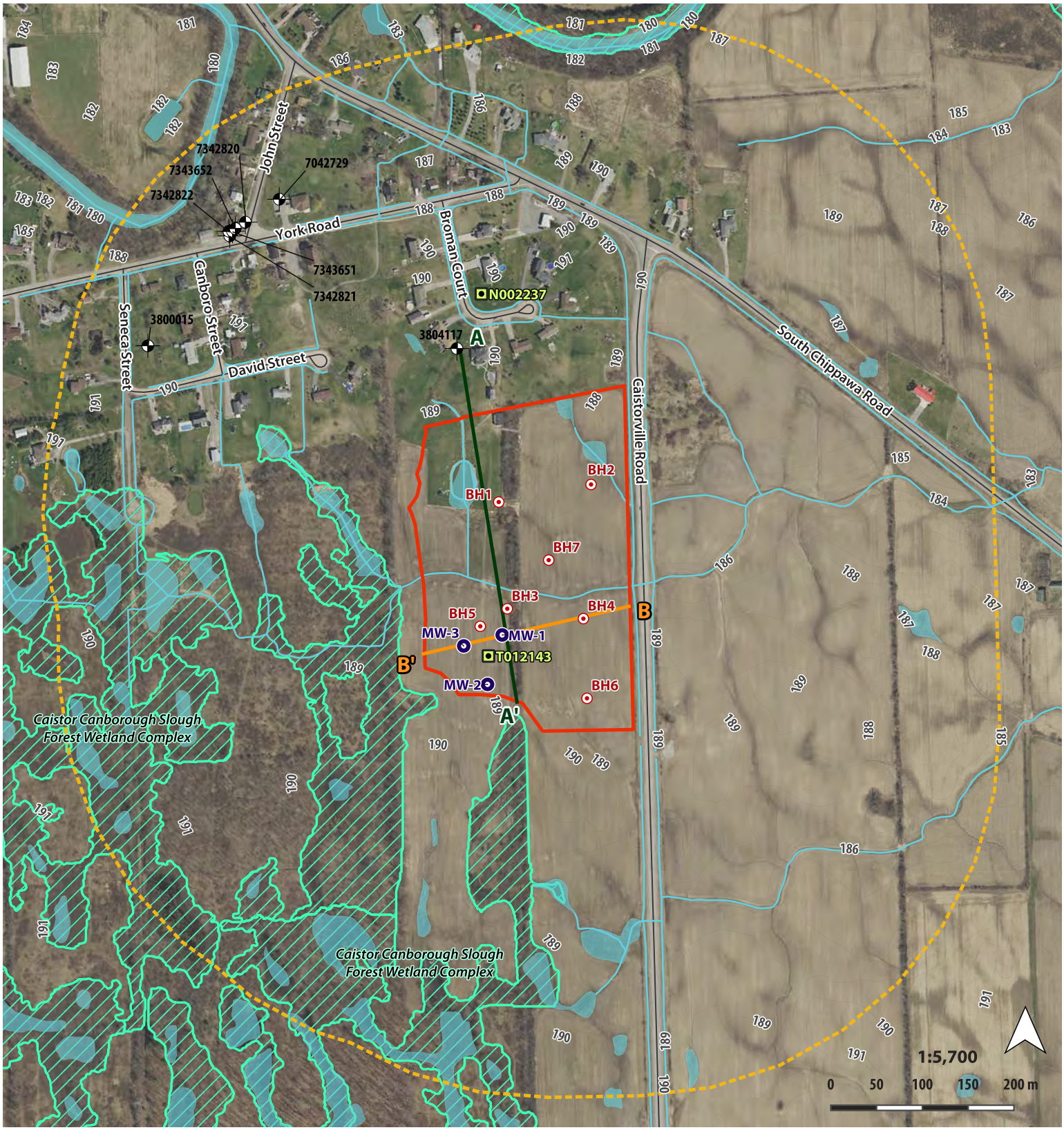
Hydrogeological Study
Caistorville Expansion Area
De Haan Homes Inc.

Terra-Dynamics Consulting Inc.

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Figure 1



- MECP Water Well Record
- NSSI Monitoring Wells
- NSSI Boreholes
- MNRF Gas Well
- Site Boundary
- 400m Buffer of Site
- Ground Surface Contour (1m)
- Watercourse
- Waterbody
- Wetland

Hydrogeologic Cross-Sections

- North-South Hydrogeologic Cross-Section
- East-West Hydrogeologic Cross-Section

Site Details

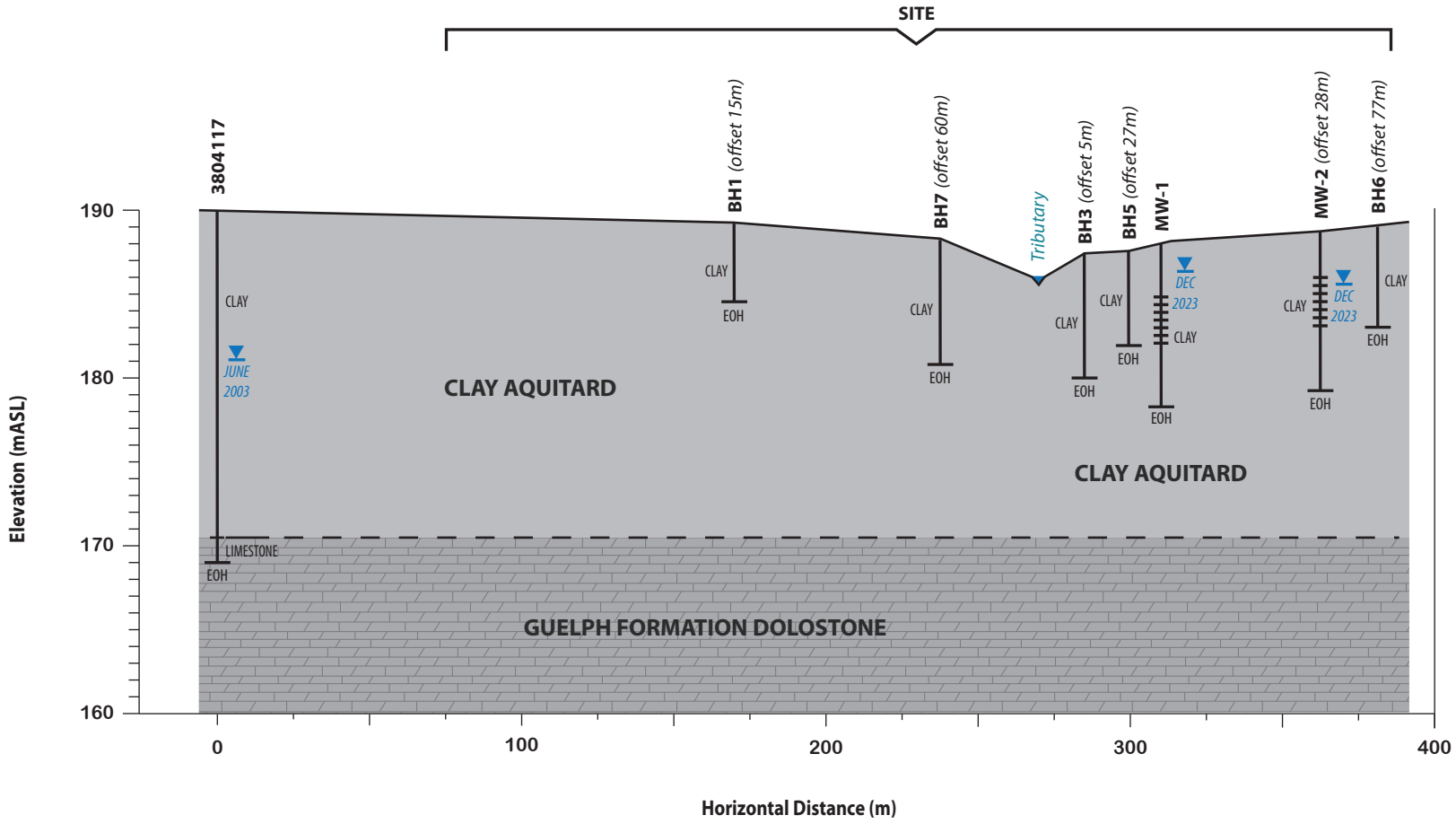
Hydrogeological Study
Caistorville Expansion Area
De Haan Homes Inc.

Terra-Dynamics Consulting Inc.

Figure 2

References: Contemporary Mapping of Watercourses, 2021. Brock University Maps, Data & GIS, Niagara Air Photo Digital Images: 2018
D:\TerraDynamics\Projects\Caistorville Expansion Area\ProjectFiles\Figure 2 - Site Details.qgz Map Date: 2024-02-13

NORTHWEST A A′ SOUTHEAST



▼ **Well Water Level on date as noted**

EOH **End of Hole**

See Figure 2 for line of cross-section

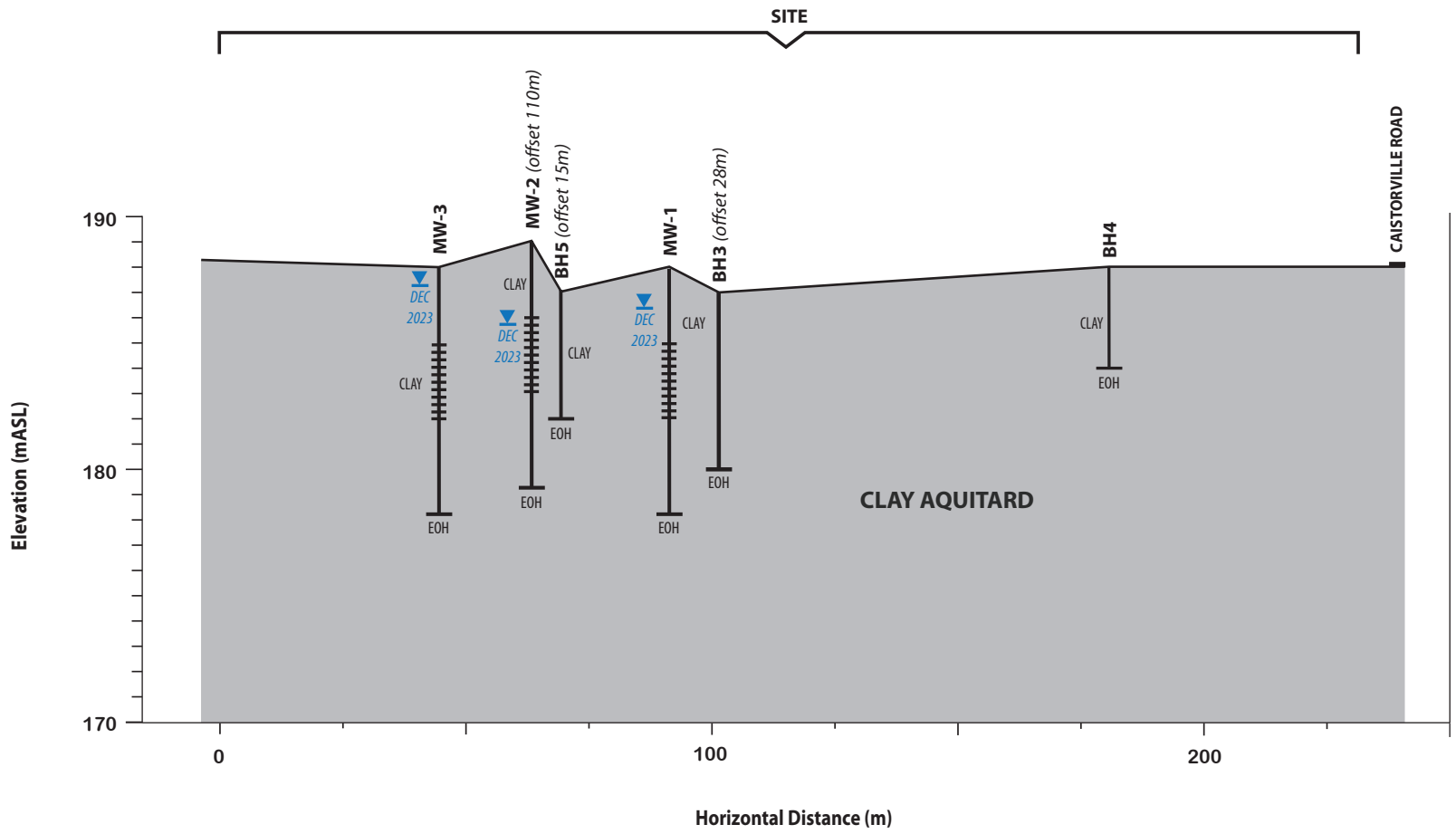
Hydrogeologic Cross-Section A-A′

Hydrogeological Study
Caistorville Expansion Area
De Haan Homes Inc.

TDC Terra-Dynamics Consulting Inc.

Figure 4

D:\TerraDynamics\Projects\Caistorville Expansion Area\ProjectFiles\Figure 4 - Cross Section A-A'.ai February 2, 2024



▼ **Well Water Level on date as noted**

EOH **End of Hole**

See Figure 2 for line of cross-section

Hydrogeologic Cross-Section B-B'

Hydrogeological Study
Caistorville Expansion Area
De Haan Homes Inc.

Terra-Dynamics Consulting Inc.

Figure 5

D:\TerraDynamics\Projects\Caistorville Expansion Area\ProjectFiles\Figure 4 - Cross Section B-B'.ai February 4, 2024

Appendix A

Preliminary Site Plan

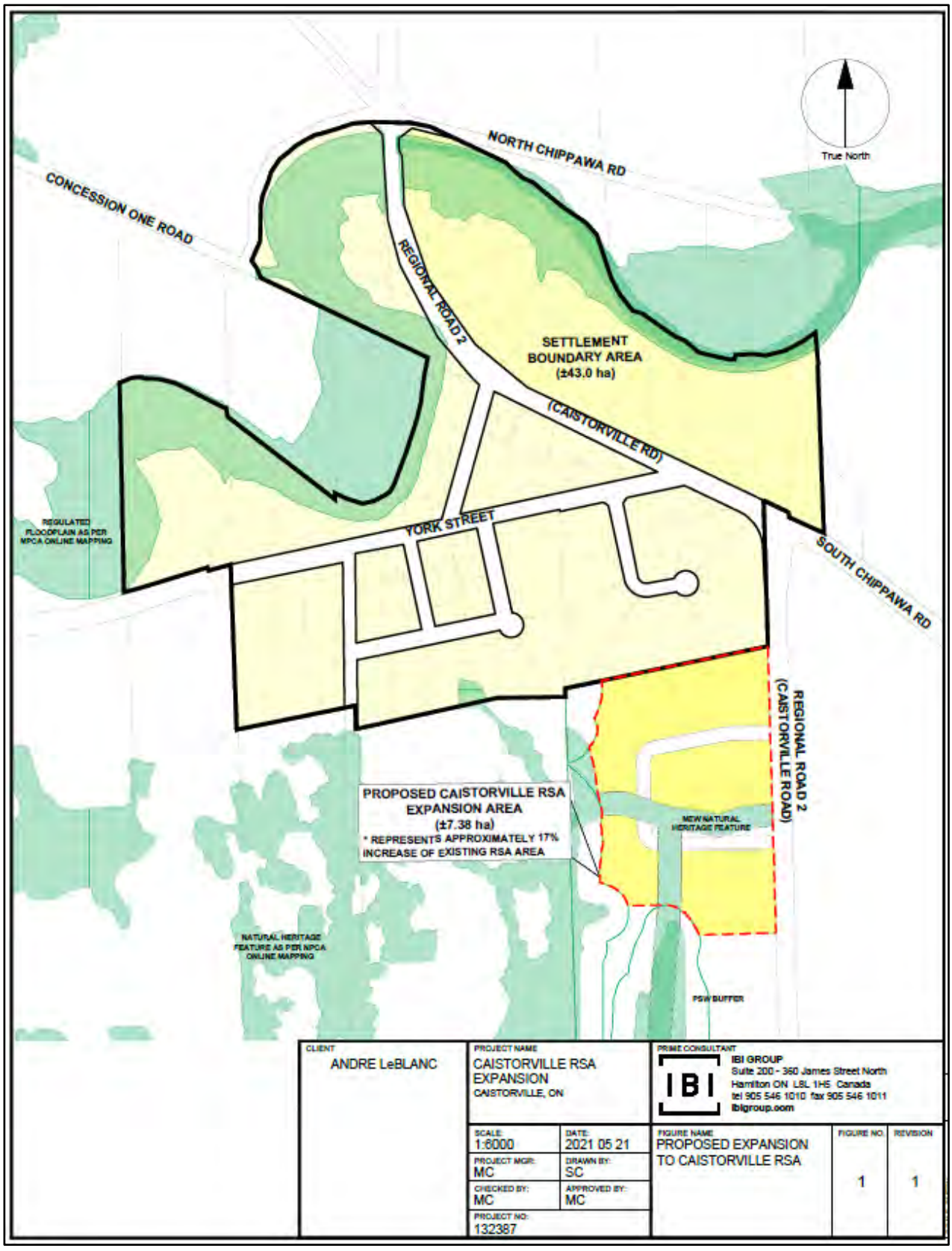


Figure 6 - Proposed Expansion Area in the Context of the Existing Settlement Area

Appendix B

Water and Petroleum Well Records

UTM Z E
R N
Elev. 54 R
Basin 24

The Ontario Water Resources Commission Act

WATER WELL RECORD

WATER RESOURCES DIVISION
38 N.
OCT 26 1965
ONTARIO WATER RESOURCES COMMISSION

0115

County or District Lincoln
Township, Village, Town or City WEST LINCOLN
Con. X I Lot 20
Date completed 27 (day) July (month) 65 (year)
[redacted] dress 150 East Main St.

Casing and Screen Record

Inside diameter of casing 6"
Total length of casing 30'
Type of screen
Length of screen
Depth to top of screen
Diameter of finished hole 6"

Pumping Test

Static level 35'
Test-pumping rate 3 G.P.M.
Pumping level 70'
Duration of test pumping 1 hour
Water clear or cloudy at end of test Clear
Recommended pumping rate 3 G.P.M.
with pump setting of 70 feet below ground surface

Well Log

Overburden and Bedrock Record	From ft.	To ft.	Water Record: Depth(s) at which water(s) found	Water Record: Kind of water (fresh, salty, sulphur)
Brown clay	0	15	70	fresh
Blue clay	15	55		
rock probably limestone R.C.D.	55	75		

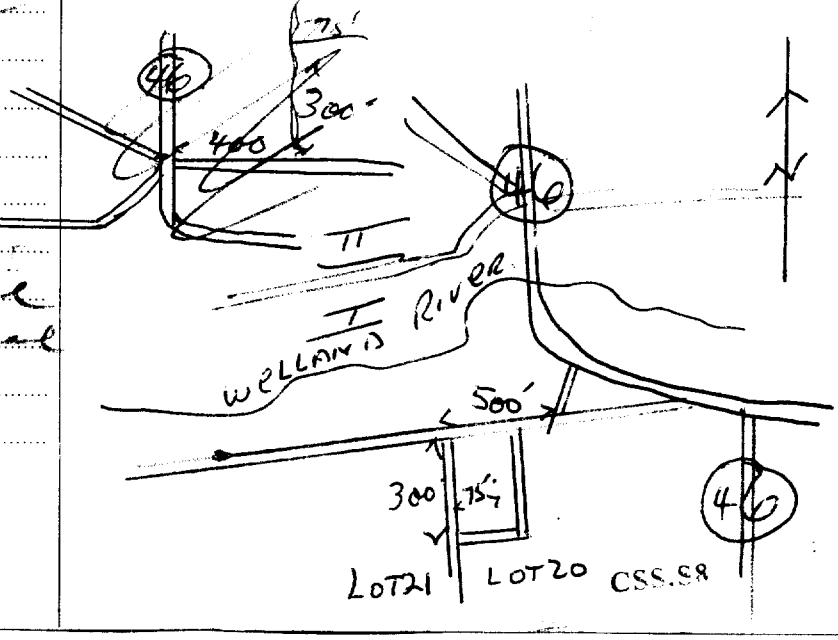
For what purpose(s) is the water to be used? Farm
Is well on upland, in valley, or on hillside? upland
Drilling or Boring Firm
Address
Licence Number 1727
Name of Driller or Borer Frank Shire
Address 17 [illegible] Crescent and
Date Oct 13/65
Frank Shire
(Signature of Licensed Drilling or Boring Contractor)

Form 7 15M-60-4138

OWRC COPY

Location of Well

In diagram below show distances of well from road and lot line. Indicate north by arrow.



Ontario **Ministry of Environment and Energy**

The Ontario Water Resources Act
WATER WELL RECORD

Print only in spaces provided.
Mark correct box with a checkmark, where applicable.

11 (1 2) **3804117**

Municipality (10 14) 38001 Con. (15 22 23 24) CON 01

LINCOLN

County or District	Township/Borough/City/Town/Village	Con block tract survey, etc.	Lot (25-27)
[redacted]	WEST LINCOLN	CON. 1	20

Address of Well Location: 698 BROWMAN COURT, CAISTORVILLE, ONT. NOA 1CO

Date completed (48-53): 27 day 06 month 03 year

21 (1 2) UTM (10) Zone (12) Easting (17) Northing (24) RC (25) Elevation (30) RC (31) Basin Code (47) ii iii iv

LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)

General colour	Most common material	Other materials	General description	Depth - feet From	Depth - feet To
BROWN	CLAY			0	20
GREY	CLAY			20	65
GREY	LIMESTONE		LOOSE	65	67

31 (32)

41 WATER RECORD

Water found at - feet (10-13)	Kind of water (14)	(19)	(24)	(29)	(34)
65-67	1 ☐ Fresh 2 ☐ Salty 3 ☐ Sulphur 4 ☐ Minerals 6 ☐ Gas				

(60)

51 CASING & OPEN HOLE RECORD

Inside diam inches (10-11)	Material (12)	Wall thickness inches	Depth - feet From	Depth - feet To (13-16)
6¼	1 ☑ Steel 2 ☐ Galvanized 3 ☐ Concrete 4 ☐ Open hole 5 ☐ Plastic	.188	+2	65
(17-18)	(19)		65	67 (20-23)
(24-25)	(26)			(27-30)

SCREEN

Sizes of opening (Slot No.) (31-33)	Diameter (34-38) inches	Length (39-40) feet
Material and type	Depth at top of screen (41-44) feet	(30)

61 PLUGGING & SEALING RECORD

☐ Annular space ☐ Abandonment

Depth set at - feet From (10-13)	To (14-17)	Material and type (Cement grout, bentonite, etc.)
18-21	22-25	
26-29	30-33	(80)

71 PUMPING TEST

Pumping test method (10): 1 ☑ Pump 2 ☐ Bailer

Pumping rate (11-14): 20 GPM

Duration of pumping (15-16 Hours, 17-18 Mins): 1 Hours

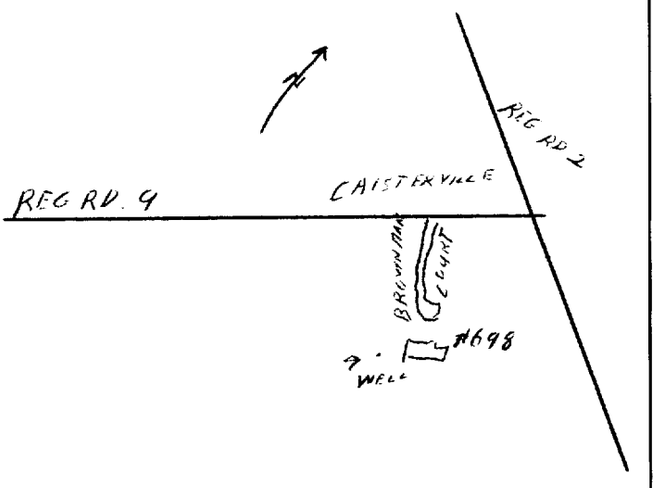
Static level (19-21)	Water level end of pumping (22-24)	Water levels during (25): 1 ☐ Pumping 2 ☑ Recovery			
		15 minutes (26-28)	30 minutes (29-31)	45 minutes (32-34)	60 minutes (35-37)
30 feet	32 feet	30 feet	feet	feet	30 feet

If flowing give rate (38-41)	Pump intake set at	Water at end of test (42)
GPM	feet	☐ Clear ☐ Cloudy
Recommended pump type: ☐ Shallow ☐ Deep	Recommended pump setting (43-45) feet	Recommended pump rate (46-49) GPM

(50-53)

LOCATION OF WELL

In diagram below show distances of well from road and lot line. Indicate north by arrow.



258642

FINAL STATUS OF WELL (54)

1 ☑ Water supply
2 ☐ Observation well
3 ☐ Test hole
4 ☐ Recharge well
5 ☐ Abandoned, insufficient supply
6 ☐ Abandoned, poor quality
7 ☐ Abandoned (Other)
8 ☐ Dewatering
9 ☐ Unfinished
10 ☐ Replacement well

WATER USE (55-56)

1 ☐ Domestic
2 ☐ Stock
3 ☑ Irrigation
4 ☐ Industrial
5 ☐ Commercial
6 ☐ Municipal
7 ☐ Public supply
8 ☐ Cooling & air conditioning
9 ☐ Not use
10 ☐ Other

METHOD OF CONSTRUCTION (57)

1 ☐ Cable tool
2 ☐ Rotary (conventional)
3 ☐ Rotary (reverse)
4 ☐ Rotary (air)
5 ☑ Air percussion
6 ☐ Boring
7 ☐ Diamond
8 ☐ Jetting
9 ☐ Driving
10 ☐ Digging
11 ☐ Other

Name of Well Contractor	Well Contractor's Licence No.
O'CONNOR WELL DRILLING LTD.	4005
Address: RR #1 MILLGROVE, ONT. LOR1V0	
Name of Well Technician: W. HOWE	Well Technician's Licence No.: TT18
Signature of Technician/Contractor	Submission date: day mo yr

MINISTRY USE ONLY

Data source (58)	Contractor (59-62)	Date received (63-68) (80)
	4005	SEP 11 2003
Date of inspection	Inspector	
Remarks		

2 - MINISTRY OF ENVIRONMENT AND ENERGY COPY

0506 (06/02) Front Form 9

T267

Ontario Ministry of the Environment

Well T A044374 mber below)

A044374

No.7042729

Well Record

Regulation 903 Ontario Water Resources Act

page 1 of 1

Instructions for Completing Form

- For use in the **Province of Ontario** only. This document is a permanent **legal** document. Please retain for future reference.
- All Sections **must** be completed in full to avoid delays in processing. Further instructions and explanations are available on the back of this form.
- Questions regarding completing this application can be directed to the Water Well Help Desk (Toll Free) at 1-888-396-9355.
- **All metre measurements shall be reported to 1/10th of a metre.**
- Please print clearly in blue or black ink only.

Ministry Use Only

MUN | CON | LOT

Well Owner's Information and Location of Well Information

First Name	Last Name	Mailing Address (Street Number/Name, RR,Lot,Concession)
c/o AMEC EARTH &	ENVIRONMENTAL	3300 MERRITTVILLE

County/District/Municipality	Township/City/Town/Village	Province	Postal Code	Telephone Number (include area code)
NIAGARA	THOROLD	Ontario	L2V4Y6	905 3120700

Address of Well Location (County/District/Municipality)	Township	Lot	Concession
NIAGARA	CAISTOR	20	1

RR#/Street Number/Name	City/Town/Village	Site/Compartment/Block/Tract etc.
716 JOHN STREET	CAISTORVILLE	—

GPS Reading	NAD	Zone	Easting	Northing	Unit Make/Model	Mode of Operation:
	83	17	604503	4767260		☐ Undifferentiated ☐ Averaged ☐ Differentiated, specify

Log of Overburden and Bedrock Materials (see instructions)

General Colour	Most common material	Other Materials	General Description	Depth From	Depth To
BROWN	SILT CLAY			0.0	7.3
	EOH			7.3	
			+FLUSHMOUNT CASING		

Hole Diameter

Depth From	Depth To	Diameter Centimetres
0.0	7.3	10.0

Water Record

Water found at ___ Metres / Kind of Water

- ___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other: _____
- ___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other: _____
- ___ m ☐ Fresh ☐ Sulphur ☐ Gas ☐ Salty ☐ Minerals ☐ Other: _____

After test of well yield, water was
☐ Clear and sediment free
☐ Other, specify _____

Chlorinated ☐ Yes ☐ No

Construction Record

Inside diam centimetres	Material	Wall thickness centimetres	Depth From	Depth To
Casing				
5.0	☐ Steel ☐ Fibreglass ☑ Plastic ☐ Concrete ☐ Galvanized		0.0	4.2
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
	☐ Steel ☐ Fibreglass ☐ Plastic ☐ Concrete ☐ Galvanized			
Screen				
Outside diam	☐ Steel ☐ Fibreglass ☑ Plastic ☐ Concrete ☐ Galvanized	Slot No. 0.010"	4.2	7.3
6.3				
No Casing or Screen				
	☐ Open hole			

Test of Well Yield

Pumping test method	Draw Down Time min	Draw Down Water Level Metres	Recovery Time min	Recovery Water Level Metres
Pump intake set at - (metres)	Static Level			
Pumping rate - (litres/min)	1		1	
Duration of pumping ___hrs +___ min	2		2	
Final water level end of pumping ___metres	3		3	
Recommended pump type. ☐ Shallow ☐ Deep	4		4	
Recommended pump depth. ___metres	5		5	
Recommended pump rate. (litres/min)	10		10	
	15		15	
If flowing give rate - (litres/min)	20		20	
	25		25	
If pumping discontinued, give reason.	30		30	
	40		40	
	50		50	
	60		60	

Plugging and Sealing Record

☑ Annular space ☐ Abandonment

Depth set at - Metres From	To	Material and type (bentonite slurry, neat cement slurry) etc.	Volume Placed (cubic metres)
0.0	0.2	CONCRETE	
0.2	3.8	BENTONITE	
3.8	7.3	SAND	
	7.3	EOH	

Method of Construction

☐ Cable Tool ☐ Rotary (air) ☐ Diamond ☐ Digging
☐ Rotary (conventional) ☐ Air percussion ☐ Jetting ☐ Other
☐ Rotary (reverse) ☐ Boring ☐ Driving POST, AUGER

Water Use

☐ Domestic ☐ Industrial ☐ Public Supply ☐ Other
☐ Stock ☐ Commercial ☑ Not used
☐ Irrigation ☐ Municipal ☐ Cooling & air conditioning

Final Status of Well

☐ Water Supply ☐ Recharge well ☐ Unfinished ☐ Abandoned, (Other)
☑ Observation well ☐ Abandoned, insufficient supply ☐ Dewatering
☐ Test Hole ☐ Abandoned, poor quality ☐ Replacement well

Well Contractor/Technician Information

Name of Well Contractor	Well Contractor's Licence No.
SONIC SOIL SAMPLING INC	7147

Business Address (street name, number, city etc.): 668 MILLWAY AVENUE, CONCORD

Name of Well Technician (last name, first name)	Well Technician's Licence No.
ARCHIBALD, ALAN	T2881

Signature of Technician/Contractor: X [signature] Date Submitted YYYY MM DD: 2007 04

Location of Well

In diagram below show distances of well from road, lot line, and building. Indicate north by arrow.

Audit No. Z 64345

Date Well Completed YYYY MM DD: 2007 04 04

Was the well owner's information package delivered? ☐ Yes ☑ No

Date Delivered YYYY MM DD: 2007 04

Ministry Use Only

Data Source	Contractor 7147
Date Received APR 17 2007	Date of Inspection YYYY MM DD
Remarks	Well Record Number

0506E (08/2006)

Ministry's Copy

Cette formule est disponible en français

Ontario (https://www.ontario.ca/page/government-ontario)

Map: Well records

This map allows you to search and view well record information from reported wells in Ontario.

Full dataset is available in the Open Data catalogue (https://data.ontario.ca/dataset/well-records) .

Go Back to Map

Well ID

Well ID Number: 7342820
Well Audit Number: *Z320280*
Well Tag Number: *A275324*
This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	702 JOHN ST
Township	WEST LINCOLN TWP (CAISTOR)
Lot	
Concession	

County/District/Municipality	NIAGARA (LINCOLN)
City/Town/Village	CAISTORVILLE
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 17 Easting: 604466.00 Northing: 4767235.00
Municipal Plan and Sublot Number	
Other	

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BRWN	SAND	GRVL	----	0 ft	2 ft
BRWN	CLAY	SLTY	----	2 ft	15 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed
0 ft	1 ft	#2 SILICA SAND STONE MIX	
1 ft	3 ft	3/8 BENTONITE CHIPS	
3 ft	15 ft	#2 SILICA SAND	

Method of Construction & Well Use

Method of Construction	Well Use
Rotary (Convent.)	
	Monitoring and Test Hole

Status of Well

Monitoring and Test Hole

Construction Record - Casing

Inside Diameter	Open Hole or material	Depth From	Depth To
2 Inch	PLASTIC	0 ft	5 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
2.2 inch	OTHER	5 ft	15 ft

Well Contractor and Well Technician Information

Well Contractor's Licence Number: 7320

Results of Well Yield Testing

After test of well yield, water was	
If pumping discontinued, give reason	
Pump intake set at	
Pumping Rate	
Duration of Pumping	
Final water level	
If flowing give rate	

Recommended pump depth	
Recommended pump rate	
Well Production	
Disinfected?	

Draw Down & Recovery

Draw Down Time(min)	Draw Down Water level	Recovery Time(min)	Recovery Water level
SWL			
1		1	
2		2	
3		3	
4		4	
5		5	
10		10	
15		15	

20		20	
25		25	
30		30	
40		40	
45		45	
50		50	
60		60	

Water Details

Water Found at Depth	Kind	
4 ft	Untested	

Hole Diameter

Depth From	Depth To	Diameter	

0 ft	15 ft	

Audit Number: Z320280

Date Well Completed: August 26, 2019

Date Well Record Received by MOE: September 16, 2019

Related

How to use a Ministry of the Environment map (https://www.ontario.ca/page/how-use-ministry-environment-map#wells)

Technical documentation: Metadata record (https://data.ontario.ca/dataset/well-records/resource/3031344e-e3f2-48d5-888c-c1deadfd2f77)

Updated: October 18, 2021
Published: March 20, 2014

Ontario (https://www.ontario.ca/page/government-ontario)

Map: Well records

This map allows you to search and view well record information from reported wells in Ontario.

Full dataset is available in the Open Data catalogue (https://data.ontario.ca/dataset/well-records) .

Go Back to Map

Well ID

Well ID Number: 7342821
Well Audit Number: *Z320279*
Well Tag Number: *A275332*
This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	702 JOHN ST
Township	WEST LINCOLN TWP (CAISTOR)
Lot	
Concession	

County/District/Municipality	NIAGARA (LINCOLN)
City/Town/Village	CAISTORVILLE
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 17 Easting: 604449.00 Northing: 4767220.00
Municipal Plan and Sublot Number	
Other	

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BRWN	SAND	GRVL	----	0 ft	2 ft
BRWN	CLAY	SLTY	----	2 ft	13 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed
0 ft	2 ft	3/8 BENTONITE CHIPS	
2 ft	13 ft	#2 SILICA SAND	

Method of Construction & Well Use

Method of Construction	Well Use
Rotary (Convent.)	
	Monitoring and Test Hole

Status of Well

Monitoring and Test Hole

Construction Record - Casing

Inside Diameter	Open Hole or material	Depth From	Depth To
2 Inch	PLASTIC	0 ft	3 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
2.2 inch	PLASTIC	3 ft	13 ft

Well Contractor and Well Technician Information

Well Contractor's Licence Number: 7320

Results of Well Yield Testing

After test of well yield, water was	
If pumping discontinued, give reason	
Pump intake set at	
Pumping Rate	
Duration of Pumping	
Final water level	
If flowing give rate	
Recommended pump depth	

Recommended pump rate	
Well Production	
Disinfected?	

Draw Down & Recovery

Draw Down Time(min)	Draw Down Water level	Recovery Time(min)	Recovery Water level
SWL			
1		1	
2		2	
3		3	
4		4	
5		5	
10		10	
15		15	
20		20	

25		25	
30		30	
40		40	
45		45	
50		50	
60		60	

Water Details

Water Found at Depth	Kind	
4 ft	Untested	

Hole Diameter

Depth From	Depth To	Diameter	
0 ft	13 ft	8 Inch	

Audit Number: Z320279

Date Well Completed: August 26, 2019

Date Well Record Received by MOE: September 16, 2019

Related

How to use a Ministry of the Environment map (https://www.ontario.ca/page/how-use-ministry-environment-map#wells)

Technical documentation: Metadata record (https://data.ontario.ca/dataset/well-records/resource/3031344e-e3f2-48d5-888c-c1deadfd2f77)

Updated: January 10, 2024
Published: March 20, 2014

Ontario (https://www.ontario.ca/page/government-ontario)

Map: Well records

This map allows you to search and view well record information from reported wells in Ontario.

Full dataset is available in the Open Data catalogue (https://data.ontario.ca/dataset/well-records) .

Go Back to Map

Well ID

Well ID Number: 7342822
Well Audit Number: *Z320281*
Well Tag Number: *A275333*
This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	702 JOHN ST
Township	WEST LINCOLN TWP (CAISTOR)
Lot	
Concession	

County/District/Municipality	NIAGARA (LINCOLN)
City/Town/Village	CAISTORVILLE
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 17 Easting: 604448.00 Northing: 4767225.00
Municipal Plan and Sublot Number	
Other	

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BRWN	SAND	GRVL	----	0 ft	2 ft
BRWN	CLAY	SLTY	----	2 ft	13 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed
0 ft	2 ft	3/8 BENTONITE CHIPS	
2 ft	13 ft	#2 SILICA SAND	

Method of Construction & Well Use

Method of Construction	Well Use
Rotary (Convent.)	
	Monitoring and Test Hole

Status of Well

Monitoring and Test Hole

Construction Record - Casing

Inside Diameter	Open Hole or material	Depth From	Depth To
2 Inch	PLASTIC	0 ft	2 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
2.2 inch	PLASTIC	3 ft	13 ft

Well Contractor and Well Technician Information

Well Contractor's Licence Number: 7320

Results of Well Yield Testing

After test of well yield, water was	
If pumping discontinued, give reason	
Pump intake set at	
Pumping Rate	
Duration of Pumping	
Final water level	
If flowing give rate	
Recommended pump depth	

Recommended pump rate	
Well Production	
Disinfected?	

Draw Down & Recovery

Draw Down Time(min)	Draw Down Water level	Recovery Time(min)	Recovery Water level
SWL			
1		1	
2		2	
3		3	
4		4	
5		5	
10		10	
15		15	
20		20	

25		25	
30		30	
40		40	
45		45	
50		50	
60		60	

Water Details

Water Found at Depth	Kind	
4 ft	Untested	

Hole Diameter

Depth From	Depth To	Diameter	
0 ft	13 ft	8 Inch	

Audit Number: Z320281

Date Well Completed: August 26, 2019

Date Well Record Received by MOE: September 16, 2019

Related

How to use a Ministry of the Environment map (https://www.ontario.ca/page/how-use-ministry-environment-map#wells)

Technical documentation: Metadata record (https://data.ontario.ca/dataset/well-records/resource/3031344e-e3f2-48d5-888c-c1deadfd2f77)

Updated: January 10, 2024
Published: March 20, 2014

Ontario (https://www.ontario.ca/page/government-ontario)

Map: Well records

This map allows you to search and view well record information from reported wells in Ontario.

Full dataset is available in the Open Data catalogue (https://data.ontario.ca/dataset/well-records) .

Go Back to Map

Well ID

Well ID Number: 7343651
Well Audit Number: *Z320388*
Well Tag Number:
This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	702 JOHN ST
Township	WEST LINCOLN TWP (CAISTOR)
Lot	
Concession	

County/District/Municipality	NIAGARA (LINCOLN)
City/Town/Village	WEST Lincoln
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 17 Easting: 604452.00 Northing: 4767225.00
Municipal Plan and Sublot Number	
Other	

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed	

0 ft	6 ft	BENTONITE	

Method of Construction & Well Use

Method of Construction	Well Use
Rotary (Convent.)	
	Monitoring

Status of Well

Abandoned-Other

Construction Record - Casing

Inside Diameter	Open Hole or material	Depth From	Depth To

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To

Well Contractor and Well Technician Information

Well Contractor's Licence Number: 7320

Results of Well Yield Testing

After test of well yield, water was	
If pumping discontinued, give reason	
Pump intake set at	
Pumping Rate	
Duration of Pumping	
Final water level	
If flowing give rate	
Recommended pump depth	
Recommended pump rate	
Well Production	

Disinfected?	

Draw Down & Recovery

Draw Down Time(min)	Draw Down Water level	Recovery Time(min)	Recovery Water level
SWL			
1		1	
2		2	
3		3	
4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	

40		40	
45		45	
50		50	
60		60	

Water Details

Water Found at Depth	Kind

Hole Diameter

Depth From	Depth To	Diameter
0 ft	6 ft	8 Inch

Audit Number: Z320388

Date Well Completed: August 15, 2019

Date Well Record Received by MOE: October 02, 2019

Related

How to use a Ministry of the Environment map (https://www.ontario.ca/page/how-use-ministry-environment-map#wells)

Technical documentation: Metadata record (https://data.ontario.ca/dataset/well-records/resource/3031344e-e3f2-48d5-888c-c1deadfd2f77)

Updated: January 10, 2024
Published: March 20, 2014

Ontario (https://www.ontario.ca/page/government-ontario)

Map: Well records

This map allows you to search and view well record information from reported wells in Ontario.

Full dataset is available in the Open Data catalogue (https://data.ontario.ca/dataset/well-records) .

Go Back to Map

Well ID

Well ID Number: 7343652
Well Audit Number: *Z320387*
Well Tag Number: *A275399*
This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	702 JOHN ST
Township	WEST LINCOLN TWP (CAISTOR)
Lot	
Concession	

County/District/Municipality	NIAGARA (LINCOLN)
City/Town/Village	West Lincoln
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 17 Easting: 604455.00 Northing: 4767228.00
Municipal Plan and Sublot Number	
Other	

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BRWN	SAND	GRVL		0 ft	2 ft
BRWN	CLAY			2 ft	12 ft
GREY	CLAY			12 ft	15 ft

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed
0 ft	1 ft	CEMENT	
1 ft	4 ft	BENTONITE	
4 ft	15 ft	SILICA SAND	

Method of Construction & Well Use

Method of Construction	Well Use
Rotary (Convent.)	
	Monitoring and Test Hole

Status of Well

Monitoring and Test Hole

Construction Record - Casing

Inside Diameter	Open Hole or material	Depth From	Depth To

2 Inch	PLASTIC	0 ft	5 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
2 inch	PLASTIC	5 ft	15 ft

Well Contractor and Well Technician Information

Well Contractor's Licence Number: 7320

Results of Well Yield Testing

After test of well yield, water was	
If pumping discontinued, give reason	
Pump intake set at	
Pumping Rate	
Duration of Pumping	
Final water level	

If flowing give rate	
Recommended pump depth	
Recommended pump rate	
Well Production	
Disinfected?	

Draw Down & Recovery

Draw Down Time(min)	Draw Down Water level	Recovery Time(min)	Recovery Water level
SWL			
1		1	
2		2	
3		3	
4		4	
5		5	
10		10	

15		15	
20		20	
25		25	
30		30	
40		40	
45		45	
50		50	
60		60	

Water Details

Water Found at Depth	Kind	

Hole Diameter

Depth From	Depth To	Diameter
0 ft	15 ft	6 Inch

Audit Number: Z320387

Date Well Completed: August 15, 2019

Date Well Record Received by MOE: October 02, 2019

Related

How to use a Ministry of the Environment map (https://www.ontario.ca/page/how-use-ministry-environment-map#wells)

Technical documentation: Metadata record (https://data.ontario.ca/dataset/well-records/resource/3031344e-e3f2-48d5-888c-c1deadfd2f77)

Updated: January 10, 2024
Published: March 20, 2014

Ontario (https://www.ontario.ca/page/government-ontario)

Map: Well records

This map allows you to search and view well record information from reported wells in Ontario.

Full dataset is available in the Open Data catalogue (https://data.ontario.ca/dataset/well-records) .

Go Back to Map

Well ID

Well ID Number: 7405173
Well Audit Number: *4AXUBIWL*
Well Tag Number: *A340708*
This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	702 John Street
Township	WEST LINCOLN TWP (CAISTOR)
Lot	020
Concession	CON 01

County/District/Municipality	NIAGARA (LINCOLN)
City/Town/Village	Caistorville
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 17 Easting: 604453.00 Northing: 4767230.00
Municipal Plan and Sublot Number	
Other	

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BLCK	LOAM			0 m	.31 m
BRWN	SILT	CLAY		.31 m	4.88 m
GREY	SILT	CLAY	DNSE	4.88	6.1

				m	m

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed
0 m	.3 m	Concrete	
.3 m	2.74 m	3/8 Bentonite Chips	
2.74 m	6.1 m	Sand #2	

Method of Construction & Well Use

Method of Construction	Well Use
Auger	
	Test Hole

Status of Well

Monitoring and Test Hole

Construction Record - Casing

Inside Diameter	Open Hole or material	Depth From	Depth To
5.1 cm	PLASTIC	-.76 m	3.05 m

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
6.1 cm	PLASTIC	3.05 m	6.1 m

Well Contractor and Well Technician Information

Well Contractor's Licence Number: 7320

Results of Well Yield Testing

After test of well yield, water was	
If pumping discontinued, give reason	
Pump intake set at	
Pumping Rate	

Duration of Pumping	
Final water level	
If flowing give rate	
Recommended pump depth	
Recommended pump rate	
Well Production	
Disinfected?	

Draw Down & Recovery

Draw Down Time(min)	Draw Down Water level	Recovery Time(min)	Recovery Water level
SWL			
1		1	
2		2	
3		3	
4		4	

5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
45		45	
50		50	
60		60	

Water Details

Water Found at Depth	Kind

Hole Diameter

Depth From	Depth To	Diameter
0 m	6.1 m	21 cm

Audit Number: 4AXUBIWL

Date Well Completed: December 02, 2021

Date Well Record Received by MOE: December 03, 2021

Related

How to use a Ministry of the Environment map (https://www.ontario.ca/page/how-use-ministry-environment-map#wells)

Technical documentation: Metadata record (https://data.ontario.ca/dataset/well-records/resource/3031344e-e3f2-48d5-888c-c1deadfd2f77)

Updated: January 10, 2024
Published: March 20, 2014

Ontario (https://www.ontario.ca/page/government-ontario)

Map: Well records

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Full dataset is available in the Open Data catalogue (https://data.ontario.ca/dataset/well-records) .

Go Back to Map

Well ID

Well ID Number: 7405174
Well Audit Number: *4B6MO6XV*
Well Tag Number: *A340706*
This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	702 John Street
Township	WEST LINCOLN TWP (CAISTOR)
Lot	020
Concession	CON 01

County/District/Municipality	NIAGARA (LINCOLN)
City/Town/Village	Caistorville
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 17 Easting: 604453.00 Northing: 4767230.00
Municipal Plan and Sublot Number	
Other	

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
GREY	CGVL		FILL	0 m	2.44 m
BRWN	SILT	CLAY		2.44 m	3.35 m
BRWN	SILT	SAND		3.35	4.26

				m	m
GREY	SILT	CLAY		4.26 m	6.1 m

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed	
0 m	.15 m	Concrete		
.15 m	2.74 m	3/8 Bentonite Chips		
2.74 m	6.1 m	Sand #2		

Method of Construction & Well Use

Method of Construction	Well Use	
Auger		
	Test Hole	

Status of Well

Monitoring and Test Hole

Construction Record - Casing

Inside Diameter	Open Hole or material	Depth From	Depth To
5.1 cm	PLASTIC	0 m	3.05 m

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
6.1 cm	PLASTIC	3.05 m	6.1 m

Well Contractor and Well Technician Information

Well Contractor's Licence Number: 7320

Results of Well Yield Testing

After test of well yield, water was	
If pumping discontinued, give reason	
Pump intake set at	

Pumping Rate	
Duration of Pumping	
Final water level	
If flowing give rate	
Recommended pump depth	
Recommended pump rate	
Well Production	
Disinfected?	

Draw Down & Recovery

Draw Down Time(min)	Draw Down Water level	Recovery Time(min)	Recovery Water level
SWL			
1		1	
2		2	
3		3	

4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
45		45	
50		50	
60		60	

Water Details

Water Found at Depth	Kind

Hole Diameter

Depth From	Depth To	Diameter
0 m	6.1 m	21 cm

Audit Number: 4B6MO6XV

Date Well Completed: December 02, 2021

Date Well Record Received by MOE: December 03, 2021

Related

How to use a Ministry of the Environment map (https://www.ontario.ca/page/how-use-ministry-environment-map#wells)

Technical documentation: Metadata record (https://data.ontario.ca/dataset/well-records/resource/3031344e-e3f2-48d5-888c-c1deadfd2f77)

Updated: January 10, 2024
Published: March 20, 2014

Ontario (https://www.ontario.ca/page/government-ontario)

Map: Well records

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Full dataset is available in the Open Data catalogue (https://data.ontario.ca/dataset/well-records) .

Go Back to Map

Well ID

Well ID Number: 7405178
Well Audit Number: *NSIRXPSY*
Well Tag Number: *A340707*
This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	702 John Street
Township	WEST LINCOLN TWP (CAISTOR)
Lot	020
Concession	CON 01

County/District/Municipality	NIAGARA (LINCOLN)
City/Town/Village	Caistorville
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 17 Easting: 604435.00 Northing: 4767220.00
Municipal Plan and Sublot Number	
Other	

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BLCK	LOAM			0 m	.31 m
BRWN	SILT	CLAY		.31 m	3.05 m
BRWN	SILT	SAND		3.05	4.27

				m	m
BRWN	SILT	CLAY		4.27 m	4.57 m

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed
0 m	.3 m	Concrete	
.3 m	1.22 m	3/8 Bentonite Chips	
1.22 m	4.57 m	Sand #2	

Method of Construction & Well Use

Method of Construction	Well Use
Auger	
	Test Hole

Status of Well

Monitoring and Test Hole

Construction Record - Casing

Inside Diameter	Open Hole or material	Depth From	Depth To
5.1 cm	PLASTIC	-.76 m	1.52 m

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
6.1 cm	PLASTIC	1.52 m	4.57 m

Well Contractor and Well Technician Information

Well Contractor's Licence Number: 7320

Results of Well Yield Testing

After test of well yield, water was	
If pumping discontinued, give reason	
Pump intake set at	

Pumping Rate	
Duration of Pumping	
Final water level	
If flowing give rate	
Recommended pump depth	
Recommended pump rate	
Well Production	
Disinfected?	

Draw Down & Recovery

Draw Down Time(min)	Draw Down Water level	Recovery Time(min)	Recovery Water level
SWL			
1		1	
2		2	
3		3	

4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
45		45	
50		50	
60		60	

Water Details

Water Found at Depth	Kind

Hole Diameter

Depth From	Depth To	Diameter
0 m	4.57 m	21 cm

Audit Number: NSIRXPSY

Date Well Completed: December 02, 2021

Date Well Record Received by MOE: December 03, 2021

Related

How to use a Ministry of the Environment map (https://www.ontario.ca/page/how-use-ministry-environment-map#wells)

Technical documentation: Metadata record (https://data.ontario.ca/dataset/well-records/resource/3031344e-e3f2-48d5-888c-c1deadfd2f77)

Updated: January 10, 2024
Published: March 20, 2014

Ontario (https://www.ontario.ca/page/government-ontario)

Map: Well records

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Full dataset is available in the Open Data catalogue (https://data.ontario.ca/dataset/well-records) .

Go Back to Map

Well ID

Well ID Number: 7405179
Well Audit Number: *UBHI8OOG*
Well Tag Number: *A340709*
This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location	702 John Street
Township	WEST LINCOLN TWP (CAISTOR)
Lot	020
Concession	CON 01

County/District/Municipality	NIAGARA (LINCOLN)
City/Town/Village	Caistorville
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 17 Easting: 604436.00 Northing: 4767226.00
Municipal Plan and Sublot Number	
Other	

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
BLCK	LOAM			0 m	.31 m
BRWN	SILT	CLAY		.31 m	3.35 m
BRWN	SILT	SAND		3.35	4.27

				m	m
BRWN	SILT	CLAY		4.27 m	4.57 m

Annular Space/Abandonment Sealing Record

Depth From	Depth To	Type of Sealant Used (Material and Type)	Volume Placed
0 m	.3 m	Concrete	
.3 m	1.22 m	3/8 Bentonite Chips	
1.22 m	4.57 m	Sand #2	

Method of Construction & Well Use

Method of Construction	Well Use
Auger	
	Test Hole

Status of Well

Monitoring and Test Hole

Construction Record - Casing

Inside Diameter	Open Hole or material	Depth From	Depth To
5.1 cm	PLASTIC	-.76 m	1.52 m

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To
6.1 cm	PLASTIC	1.52 m	4.57 m

Well Contractor and Well Technician Information

Well Contractor's Licence Number: 7320

Results of Well Yield Testing

After test of well yield, water was	
If pumping discontinued, give reason	
Pump intake set at	

Pumping Rate	
Duration of Pumping	
Final water level	
If flowing give rate	
Recommended pump depth	
Recommended pump rate	
Well Production	
Disinfected?	

Draw Down & Recovery

Draw Down Time(min)	Draw Down Water level	Recovery Time(min)	Recovery Water level
SWL			
1		1	
2		2	
3		3	

4		4	
5		5	
10		10	
15		15	
20		20	
25		25	
30		30	
40		40	
45		45	
50		50	
60		60	

Water Details

Water Found at Depth	Kind

Hole Diameter

Depth From	Depth To	Diameter
0 m	4.57 m	21 cm

Audit Number: UBHI8OOG

Date Well Completed: December 02, 2021

Date Well Record Received by MOE: December 03, 2021

Related

How to use a Ministry of the Environment map (https://www.ontario.ca/page/how-use-ministry-environment-map#wells)

Technical documentation: Metadata record (https://data.ontario.ca/dataset/well-records/resource/3031344e-e3f2-48d5-888c-c1deadfd2f77)

Updated: January 10, 2024
Published: March 20, 2014

CTY: Lincoln	**TWP:** Caistor	**TRACT:**	**LOT:** 20	**CON:** I
WELL NAME: Town of Caistorville - Consumers' No. 4765			**WELL ID:** N002237	**CLASS:**
OPERATOR: Unknown	**Target:**		**STATUS:** LOC - UNK	

DRILLING DATA

RIG TYPE:

GRND ELEV: 187.45

KB ELEV: 187.76

TVD: PBTD:

DATES

LICENCE ISSUED:

SPUD DATE:

TD DATE: 1900-01-01

COMPLETE DATE:

WORKOVER DATE:

PLUG DATE:

COORDINATES

N/S BOUND: 30.50 S

E/W BOUND: 182.90 W

NAD 83

SURF LAT: 43.05009333
SURF LONG: -79.71435139

BOT LAT: 43.05009333
BOT LONG: -79.71435139

SAMPLES

TRAY:

POOL

FORMATION	TOP	TVD	ELEV

LOCATION COMMENTS

DATE	ACCURACY	METHOD OBTAINED
	Within 200 metres	Well Records (pre 1921)

Some content could not be displayed because it requires a member login

CTY: Lincoln	**TWP:** Caistor	**TRACT:** 4	**LOT:** 20	**CON:** I
WELL NAME: PRIVATE CAISTOR 4-20-I			**WELL ID:** T012143	**CLASS:** DEV
OPERATOR: ref_90f791a2394444521565f2a8fb3e1adb	**Target:** CLI		**STATUS:** PGP - ACT	

DRILLING DATA

RIG TYPE: Cable

GRND ELEV: 189.01

KB ELEV: 189.50

TVD: 156.00 **PBTD:**

DATES

LICENCE ISSUED: 2011-11-17

SPUD DATE:

TD DATE: 2012-05-01

COMPLETE DATE:

WORKOVER DATE:

PLUG DATE:

COORDINATES

N/S BOUND: 454.12 S

E/W BOUND: 162.65 W

NAD 83

SURF LAT: 43.04631333
SURF LONG: -79.71414556

BOT LAT: 43.04631333
BOT LONG: -79.71414556

SAMPLES

TRAY: 11757

POOL

FORMATION	TOP	TVD	ELEV

LOCATION COMMENTS

DATE	ACCURACY	METHOD OBTAINED
2011-06-24	Within 2 metres	Survey Drawing (post 1997)

Some content could not be displayed because it requires a member login

Appendix C

Well Use & Septic System Survey

Terra-Dynamics Consulting Inc.

432 Niagara Street, Unit 2 St. Catharines, ON L2M 4W3

November 2, 2023

Dear Resident:

On behalf of DeHaan Homes Inc., Terra-Dynamics Consulting Inc. is completing a water well and septic system survey as part of a Hydrogeological Study of the Caistorville Expansion Area. This is a survey of properties in the vicinity of Caistorville Expansion Area, as shown on the attached map (Site). We are seeking to map nearby private wells in order to ensure protection of water quantity and quality as part of future residential development. This well and septic system survey is a recommended part of a hydrogeologic, or groundwater, study of the subject lands which informs water supplies and septic system designs and locations. This is a standard questionnaire for properties on private services.

The purpose of this survey is to collect information on private or residential water wells, cisterns and septic systems within approximately 100 metres of the Site (as shown by the outline on the attached map). **Participation is voluntary.** Participation involves completing the attached questionnaire on municipal, well and/or cistern use, groundwater quantity, quality and your septic system. Please complete it as best as you can. Please fill out the questionnaire and mail it back to Terra-Dynamics Consulting Inc. in the self-addressed and stamped envelope. The information you provide will be summarized in our report and personal information (e.g. name, address, etc.) will be kept confidential and will not be included in our report.

If you have any questions about the questionnaire, please contact Briar MacIntyre at 905-906-2311 or via email at bmacintyre@terra-dynamics.com.

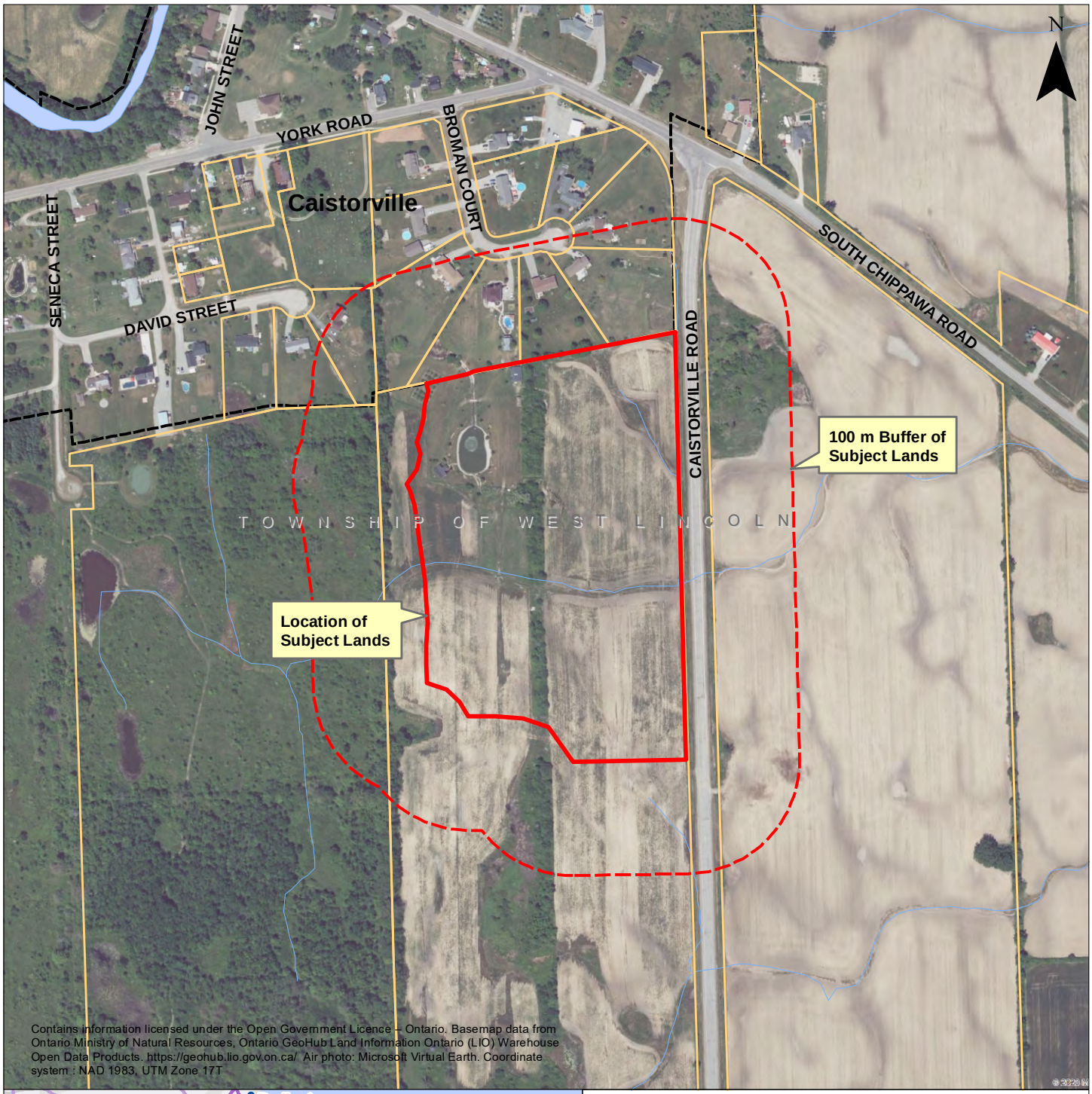
Thank you in advance for your assistance.

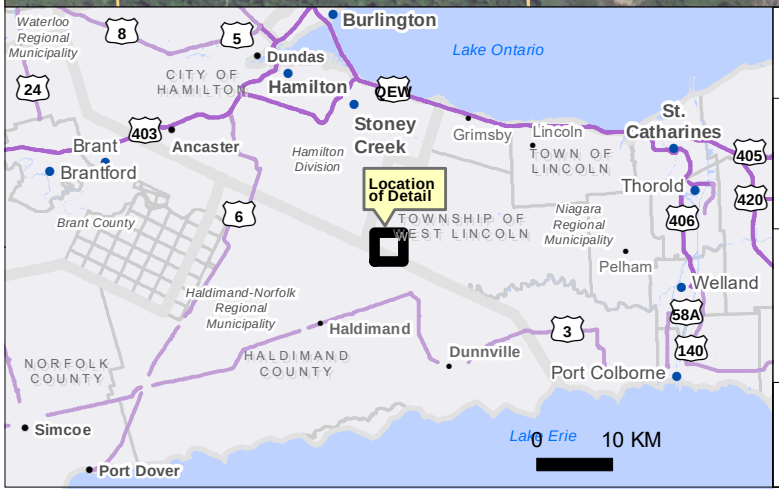
Yours truly,

TERRA-DYNAMICS CONSULTING INC.



Briar MacIntyre, P.Geo.
Environmental Geologist





Location of Subject Lands

Hydrogeological Study
Caistorville Expansion Area
DeHaan Homes Inc.

TDC Terra-Dynamics Consulting Inc.

0 100 Meters
1:5,000

Figure 1

Path: H:\TERRA_DYNAMICS\9695 - TD Caistorville Expansion Area\gis\mxd\Figure 1 Location of Subject Lands.mxd Revised: October 23, 2023

Terra-Dynamics Consulting Inc.
432 Niagara Street, Unit 2 St. Catharines, ON L2M 4W3

WATER WELL SURVEY FORM

Date:_____

Contact Person:_____

Property Address:_____

Telephone: _____

Email (if further information requested): _____

1.0 GENERAL QUESTIONS

Do you know your drinking water source? Please circle one or more of the following three options:

1.Well (20+ feet casing) 2.Shallow Well (less than 20 feet of casing)
3.Cistern 4. Municipal

Further comments:

_____

_____

Use page 3 or a separate sheet of paper for additional comments.

If your water supply is from a cistern, the rest of the questions do not apply. If you have both a cistern and a well, please complete the well questionnaire (Section 2.0 or 3.0). Please let us know where your place is located either on the supplied map or the area for a sketch on the second last page of this form. Please mail the completed form back to Terra-Dynamics in the provided envelope. Thank you for your assistance.

- If you have a drilled deep well (20+ feet of casing) please complete Sections 2 & 4
- If you have a shallow well (less than 20 feet of casing), please complete Sections 3&4

2.0 DRILLED WELL (greater than 20 feet of casing)

How deep is your well?_____

Is your well drilled into rock?_____What is the well casing diameter?_____

Do you know when your well was drilled?_____

Do you know the name of the well driller?_____

905-646-7931 Fax: 905-935-0397 www.terra-dynamics.com

Do you have a well log? (i.e. a description of the geology encountered when drilling your well and if yes, can you supply a copy or write down the information in the Comments Section).

_____

What is the use of your well water? (i.e. drinking water for house, garden irrigation, etc.)
_____

Has your well ever run dry? _____

Do you experience problems with taste, colour or odour? (if yes, please explain).

_____

Do you have any water purification systems for your well water? (i.e. water softeners, UV Light for bacteria, Sulphur/Iron Filter for odour or staining, etc.).

_____

Do you perform regular maintenance on your well? (i.e. pump service, silt removal, etc.)

_____

3.0 SHALLOW WELL (less than 20 feet of casing)

What is the well casing material and diameter? _____

What is the expected age of the well? _____

How deep is the well? _____

Does you utilize a jet pump or a submersible pump?_____

Is there problems with water quality (colour, odour, etc.)? Yes_____ No_____

If yes, please explain_____

Do you have any water purification systems for your dug well water? (i.e. water softeners, UV Light for bacteria, Sulphur/Iron Filter for odour or staining, etc.).

_____

Have you ever experienced freeze-up during the winter?_____

What is the use of your shallow dug well water? (i.e. drinking water for house, irrigation, etc.)
_____

Has your dug well ever run dry?

_____

Do you perform regular maintenance on your pump? (i.e. pump service, silt removal)

_____

Additional comments:_____

_____

4.0 LOCATION MAP

Can you please draw a sketch map of the location of your well(s), septic tank and sewage bed on your property (please show the location relative to buildings and roads).

_____

SKETCH MAP OF WELL(S) and SEWAGE SYSTEM LOCATIONS

Other Comments: (Use a separate sheet, if required)

Please mail the completed form back to Terra-Dynamics in the provided envelope.
Thank you for your help.

Briar MacIntyre, P. Geo., Environmental Geologist
432 Niagara Street, Unit 2, St. Catharines, ON L2M 4W3
905-906-2311





Location of Subject Lands

Hydrogeological Study
Caistorville Expansion Area
DeHaan Homes Inc.

TDC Terra-Dynamics Consulting Inc.

0 100 Meters
1:5,000

Figure 1

Path: H:\TERRA_DYNAMICS\9695 - TD Caistorville Expansion Area\gis\mxd\Figure 1 Location of Subject Lands.mxd Revised: October 23, 2023

Terra-Dynamics Consulting Inc.
432 Niagara Street, Unit 2 St. Catharines, ON L2M 4W3

WATER WELL SURVEY FORM

Date: NOVEMBER 8, 2023

Contact Person: [redacted]

Property Address: 700 B ROMAN COURT

Telephone: [redacted]

Email (if further information requested): [redacted]

1.0 GENERAL QUESTIONS

Do you know your drinking water source? Please circle one or more of the following three options:

1.Well (20+ feet casing) 2.Shallow Well (less than 20 feet of casing)
3.Cistern 4. Municipal

Further comments:
WE HAVE A RAISED SEPTIC BED WITHIN THIS VICINITY. I HAVE PENNED IN THE AREA ON YOUR MAP
Use page 3 or a separate sheet of paper for additional comments.

If your water supply is from a cistern, the rest of the questions do not apply. If you have both a cistern and a well, please complete the well questionnaire (Section 2.0 or 3.0). Please let us know where your place is located either on the supplied map or the area for a sketch on the second last page of this form. Please mail the completed form back to Terra-Dynamics in the provided envelope. Thank you for your assistance.

- If you have a drilled deep well (20+ feet of casing) please complete Sections 2 & 4
- If you have a shallow well (less than 20 feet of casing), please complete Sections 3&4

2.0 DRILLED WELL (greater than 20 feet of casing)

How deep is your well?_____

Is your well drilled into rock?_____What is the well casing diameter?_____

Do you know when your well was drilled?_____

Do you know the name of the well driller?_____

905-646-7931 Fax: 905-935-0397 www.terra-dynamics.com

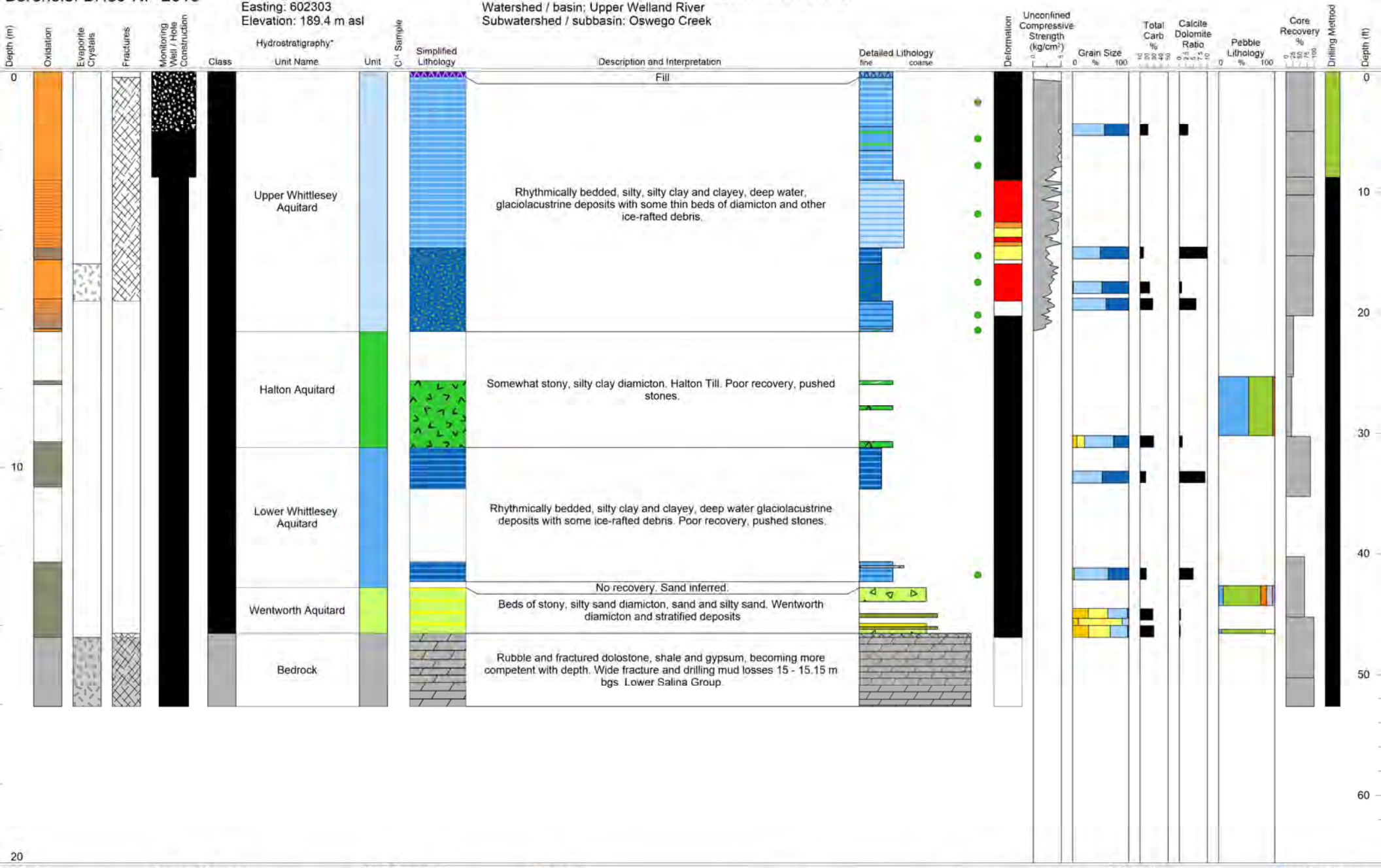
Appendix D

Supporting Information

Borehole: BH89-NP-2016

Northing: 4761050
Easting: 602303
Elevation: 189.4 m asl

Conservation Authority: Niagara Peninsula Conservation Authority
Watershed / basin: Upper Welland River
Subwatershed / subbasin: Oswego Creek



Oxidation
- Fill
- Oxidized
- Reduced
- Coarse layers oxidized
- Fracture planes oxidized
- Bedrock

Evaporite Crystals
- Macroscopic crystals in sediment
- Macroscopic crystals in bedrock
- Not observed

Fractures
- Fractures/desiccation cracks in sediment
- Fractures in bedrock
- Not observed

Well Construction
- Riser
- Screen
- Benseal - bentonite
- Concrete
- Quickgrout - bentonite grout
- Holeplug - bentonite chips
- Sand pack

Class
- Aquifer / potential Aquifer
- Aquitard
- Bedrock

Lithology
- No recovery
- Clay
- Clayey silt, silty clay
- Silt
- Fine sand to silt
- Fine to medium sand
- Medium to coarse sand
- Sand and gravel
- Gravel
- Sand and gravel with some silt/clay in matrix
- Clayey silt to clayey diamicton
- Sandy to silty diamicton
- Fill

- Fill
- Rhythmically bedded
- Interbedded
- Fragmented beds, intraclasts
- Ripples
- Cross-beds
- Grit
- Slightly to somewhat stony
- Stony to very stony
- Diamicton and other debris

- Rubble, fractured rock
- Ordovician bedrock
- Silurian bedrock
- Devonian bedrock

Symbols
- Rare ice-rafted debris
- Striated bedrock
- Polished bedrock
- Organic material
- Cold core
- Trace fossils
- Radiocarbon (C^{14}) date

Deformation
- Disturbed or low recovery intervals
- Not observed
- Slight
- Moderate
- High

Grain Size
- Coarse to medium sand
- Fine to very fine sand
- Silt
- Clay

Pebble Lithology
- Limestone
- Dolostone
- Sandstone
- Shale
- Chert, evaporite
- Precambrian

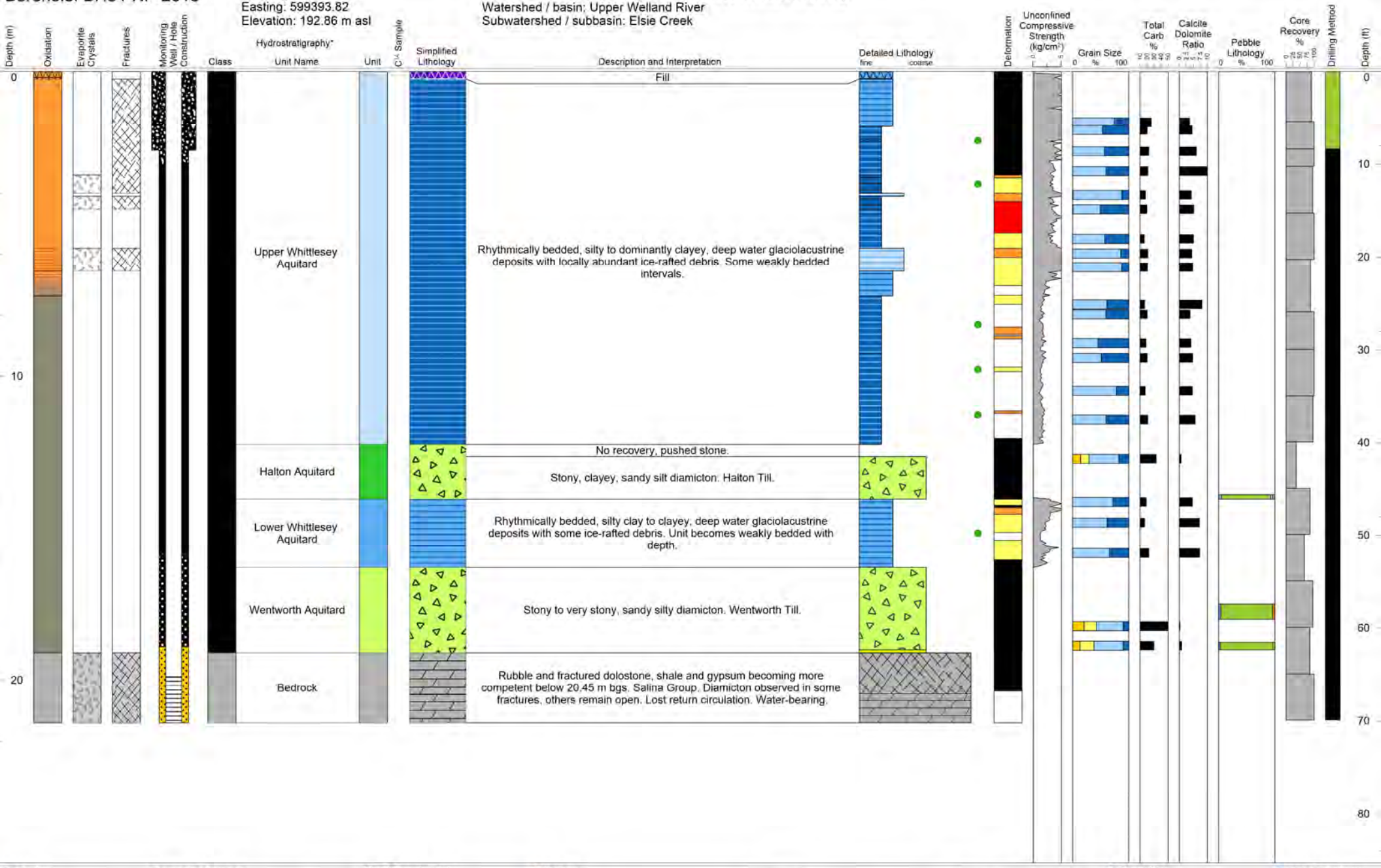
Drilling Method
- Hollow-stem auger
- PQ coring
- Split spoon
- Tricone
- Hydrovac

*Hydrostratigraphic units are intended to reflect regional-scale sediment packages that will be modeled in three dimensions. The units are time-transgressive and may group lithologic packages.

Borehole: BH54-NP-2015

Northing: 4766671.14
Easting: 599393.82
Elevation: 192.86 m asl

Conservation Authority: Niagara Peninsula Conservation Authority
Watershed / basin: Upper Welland River
Subwatershed / subbasin: Elsie Creek



Oxidation
- Fill
- Oxidized
- Reduced
- Coarse layers oxidized
- Fracture planes oxidized
- Bedrock

Evaporite Crystals
- Macroscopic crystals in sediment
- Macroscopic crystals in bedrock
- Not observed

Fractures
- Fractures/desiccation cracks in sediment
- Fractures in bedrock
- Not observed

Well Construction
- Riser
- Screen
- Benseal - bentonite
- Concrete
- Quickgrout - bentonite grout
- Holeplug - bentonite chips
- Sand pack

Class
- Aquifer / potential Aquifer
- Aquitard
- Bedrock

Lithology
- No recovery
- Clay
- Clayey silt, silty clay
- Silt
- Fine sand to silt
- Fine to medium sand
- Medium to coarse sand
- Sand and gravel
- Gravel
- Sand and gravel with some silt/clay in matrix
- Clayey silt to clayey diamicton
- Sandy to silty diamicton
- Fill

- Fill
- Rhythmically bedded
- Interbedded
- Fragmented beds, intraclasts
- Ripples
- Cross-beds
- Grit
- Slightly to somewhat stony
- Stony to very stony
- Diamicton and other debris

- Rubble, fractured rock
- Ordovician bedrock
- Silurian bedrock
- Devonian bedrock

Symbols
- Rare ice-rafted debris
- Striated bedrock
- Polished bedrock
- Organic material
- Cold core
- Trace fossils
- Radiocarbon (C^{14}) date

Deformation
- Disturbed or low recovery intervals
- Not observed
- Slight
- Moderate
- High

Grain Size
- Coarse to medium sand
- Fine to very fine sand
- Silt
- Clay

Pebble Lithology
- Limestone
- Dolostone
- Sandstone
- Shale
- Chert, evaporite
- Precambrian

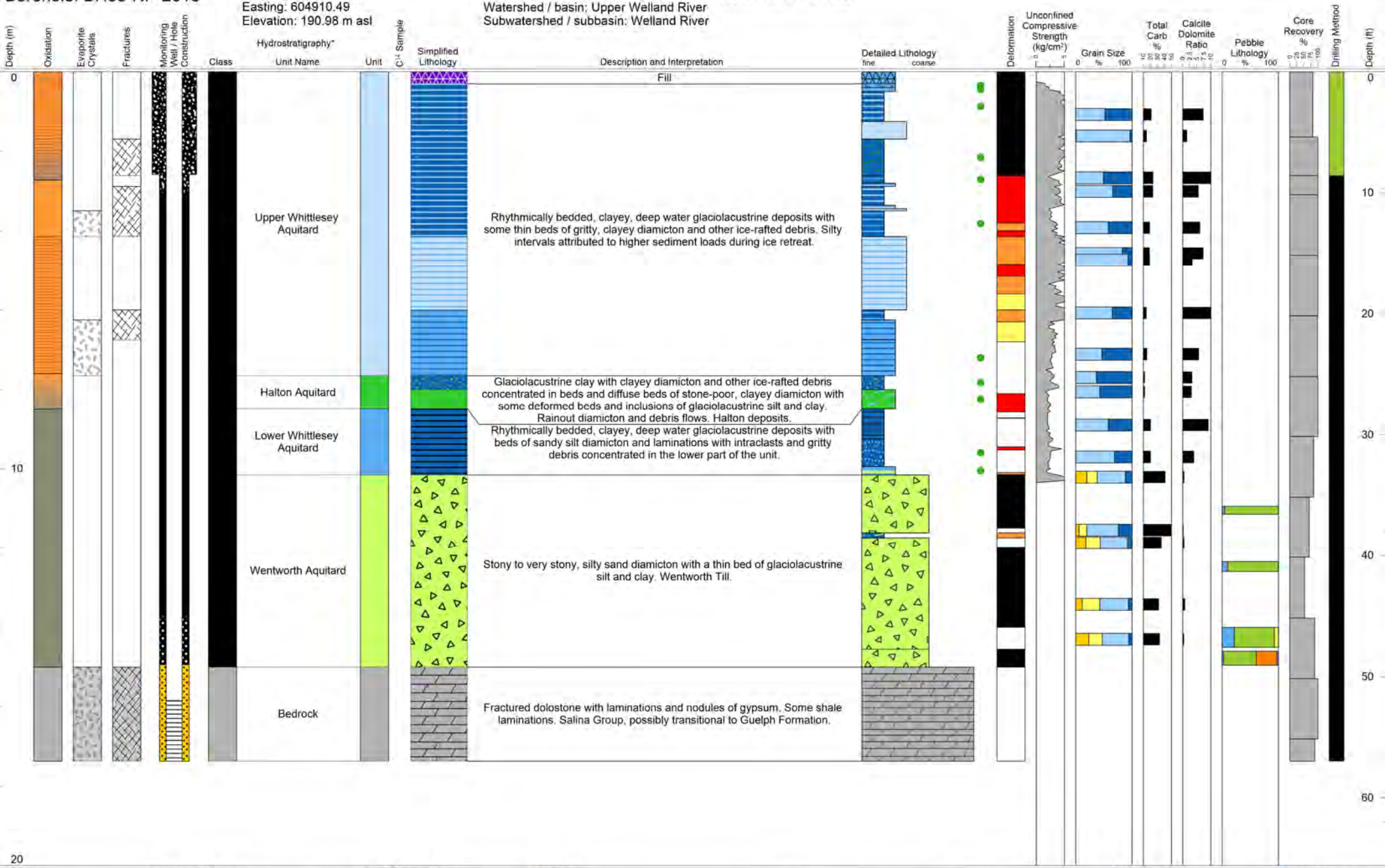
Drilling Method
- Hollow-stem auger
- PQ coring
- Split spoon
- Tricone
- Hydrovac

*Hydrostratigraphic units are intended to reflect regional-scale sediment packages that will be modeled in three dimensions. The units are time-transgressive and may group lithologic packages.

Borehole: BH55-NP-2015

Northing: 4765607.09
Easting: 604910.49
Elevation: 190.98 m asl

Conservation Authority: Niagara Peninsula Conservation Authority
Watershed / basin: Upper Welland River
Subwatershed / subbasin: Welland River



Oxidation
- Fill
- Oxidized
- Reduced
- Coarse layers oxidized
- Fracture planes oxidized
- Bedrock

Evaporite Crystals
- Macroscopic crystals in sediment
- Macroscopic crystals in bedrock
- Not observed

Fractures
- Fractures/desiccation cracks in sediment
- Fractures in bedrock
- Not observed

Well Construction
- Riser
- Screen
- Benseal - bentonite
- Concrete
- Quickgrout - bentonite grout
- Holeplug - bentonite chips
- Sand pack

Class
- Aquifer / potential Aquifer
- Aquitard
- Bedrock

Lithology
- No recovery
- Clay
- Clayey silt, silty clay
- Silt
- Fine sand to silt
- Fine to medium sand
- Medium to coarse sand
- Sand and gravel
- Gravel
- Sand and gravel with some silt/clay in matrix
- Clayey silt to clayey diamicton
- Sandy to silty diamicton
- Fill

- Fill
- Rhythmically bedded
- Interbedded
- Fragmented beds, intraclasts
- Ripples
- Cross-beds
- Grit
- Slightly to somewhat stony
- Stony to very stony
- Diamicton and other debris

- Rubble, fractured rock
- Ordovician bedrock
- Silurian bedrock
- Devonian bedrock

Symbols
- Rare ice-rafted debris
- Striated bedrock
- Polished bedrock
- Organic material
- Cold core
- Trace fossils
- Radiocarbon (C^{14}) date

Deformation
- Disturbed or low recovery intervals
- Not observed
- Slight
- Moderate
- High

Grain Size
- Coarse to medium sand
- Fine to very fine sand
- Silt
- Clay

Pebble Lithology
- Limestone
- Dolostone
- Sandstone
- Shale
- Chert, evaporite
- Precambrian

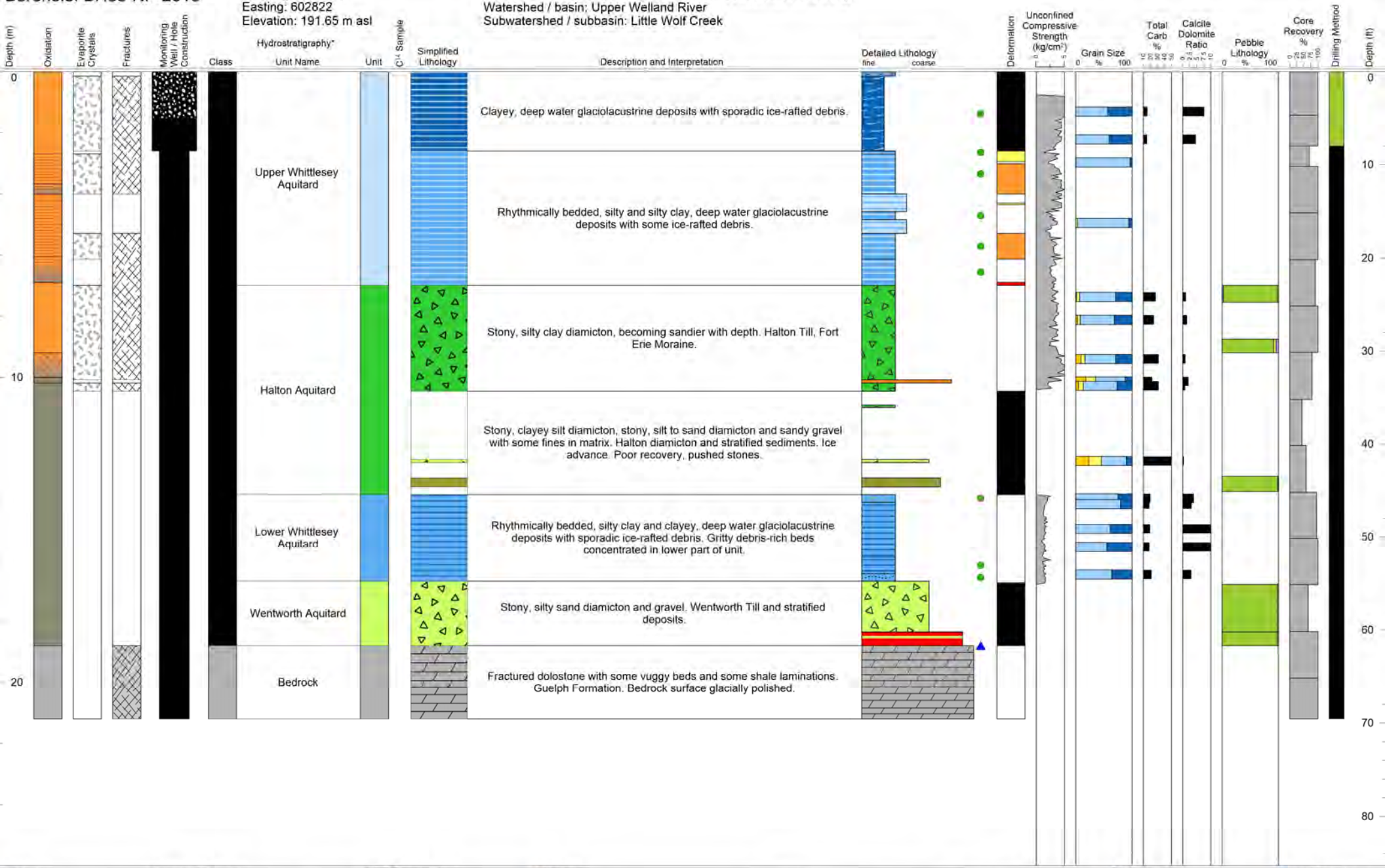
Drilling Method
- Hollow-stem auger
- PQ coring
- Split spoon
- Tricone
- Hydrovac

*Hydrostratigraphic units are intended to reflect regional-scale sediment packages that will be modeled in three dimensions. The units are time-transgressive and may group lithologic packages.

Borehole: BH88-NP-2016

Northing: 4769446
Easting: 602822
Elevation: 191.65 m asl

Conservation Authority: Niagara Peninsula Conservation Authority
Watershed / basin: Upper Welland River
Subwatershed / subbasin: Little Wolf Creek



Oxidation
- Fill
- Oxidized
- Reduced
- Coarse layers oxidized
- Fracture planes oxidized
- Bedrock

Evaporite Crystals
- Macroscopic crystals in sediment
- Macroscopic crystals in bedrock
- Not observed

Fractures
- Fractures/desiccation cracks in sediment
- Fractures in bedrock
- Not observed

Well Construction
- Riser
- Screen
- Benseal - bentonite
- Concrete
- Quickgrout - bentonite grout
- Holeplug - bentonite chips
- Sand pack

Class
- Aquifer / potential Aquifer
- Aquitard
- Bedrock

Lithology
- No recovery
- Clay
- Clayey silt, silty clay
- Silt
- Fine sand to silt
- Fine to medium sand
- Medium to coarse sand
- Sand and gravel
- Gravel
- Sand and gravel with some silt/clay in matrix
- Clayey silt to clayey diamicton
- Sandy to silty diamicton
- Fill

- Fill
- Rhythmically bedded
- Interbedded
- Fragmented beds, intraclasts
- Ripples
- Cross-beds
- Grit
- Slightly to somewhat stony
- Stony to very stony
- Diamicton and other debris

- Rubble, fractured rock
- Ordovician bedrock
- Silurian bedrock
- Devonian bedrock

Symbols
- Rare ice-rafted debris
- Striated bedrock
- Polished bedrock
- Organic material
- Cold core
- Trace fossils
- Radiocarbon (C^{14}) date

Deformation
- Disturbed or low recovery intervals
- Not observed
- Slight
- Moderate
- High

Grain Size
- Coarse to medium sand
- Fine to very fine sand
- Silt
- Clay

Pebble Lithology
- Limestone
- Dolostone
- Sandstone
- Shale
- Chert, evaporite
- Precambrian

Drilling Method
- Hollow-stem auger
- PQ coring
- Split spoon
- Tricone
- Hydrovac

*Hydrostratigraphic units are intended to reflect regional-scale sediment packages that will be modeled in three dimensions. The units are time-transgressive and may group lithologic packages.

Caistorville Road Expansion Area - Soil Classification Map



Legend

- Assessment Parcel
- Soil Name Label

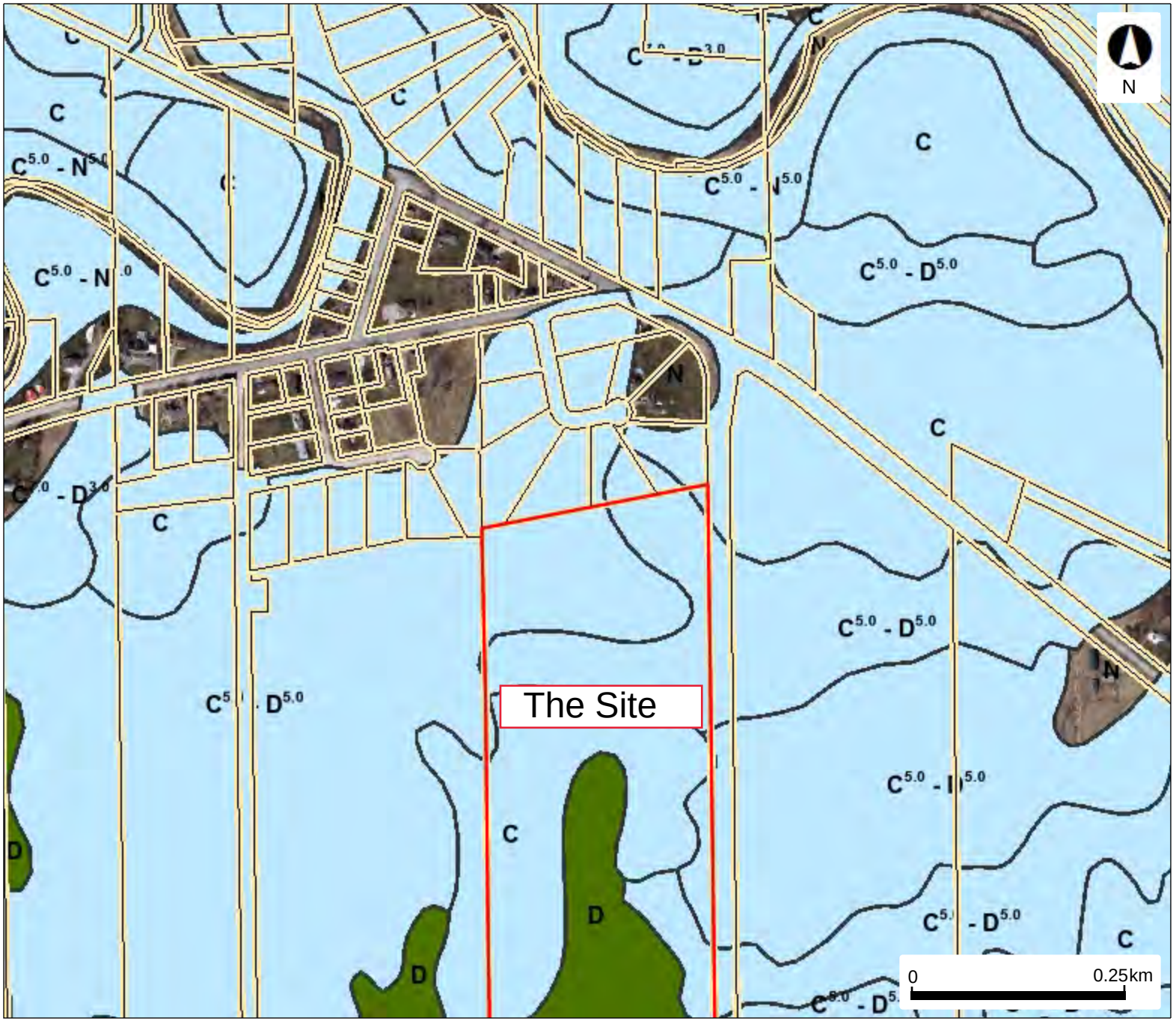
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Map Created: 2/7/2024
Map Center: 43.0487 N, -79.71396 W

Caistorville Road Expansion Area - Hydrologic Soil Group Map



Legend

- Assessment Parcel
- Hydrologic Soil Group
  - A - High
  - B - Moderate
  - C - Slow
  - D - Very Slow

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Map Created: 2/7/2024
Map Center: 43.0487 N, -79.71396 W

RECORD OF BOREHOLE: BH-1

PROJECT NO.: NT23182
PROJECT: Proposed Residential Development
LOCATION: Vacant Lot, Caistorville Road, West Lincoln, ON
CLIENT: DeHaan Homes Inc.

DRILLING COMPANY: Davis Drilling Ltd.
DRILLING METHOD: 150 mm O.D. Solid Stem Augers
DRILL RIG: Track Mount CME-55
BOREHOLE COORDINATE (UTM): 604741 E, 4766927 N

SHEET 1 of 1
DATE STARTED: October 30, 2023
DATE COMPLETED: October 30, 2023
DATUM: Temporary Benchmark

LITHOLOGY PLOT	ELEVATION (m / mbgs)	DESCRIPTION	SAMPLES: TYPE	SAMPLES: NUMBER	SAMPLES: SPT 'N' VALUE	SAMPLES: RECOVERY (%)
	0.0	Ground Surface				
	0.0	**125 mm Topsoil**				
		Silty Clay / Clayey Silt Reworked mottled brown trace sand occ. rootlets DTPL stiff to very stiff	SS	1	3,4,6,6	
			SS	2	4,5,5,10	
	-1.8		SS	3	3,8,10,10	
	1.8	occ. sand/silt seams/lenses				
	-2.2					
	2.2	**Silty Clay / Clayey Silt** brown trace sand APL very stiff	SS	4	5,9,11,13	
			SS	5	4,7,10,13	
	-4.9		SS	6	9,10,12,13	
	4.9	freq. silt seams/lenses				
	-5.2					
	5.2	End of Borehole				

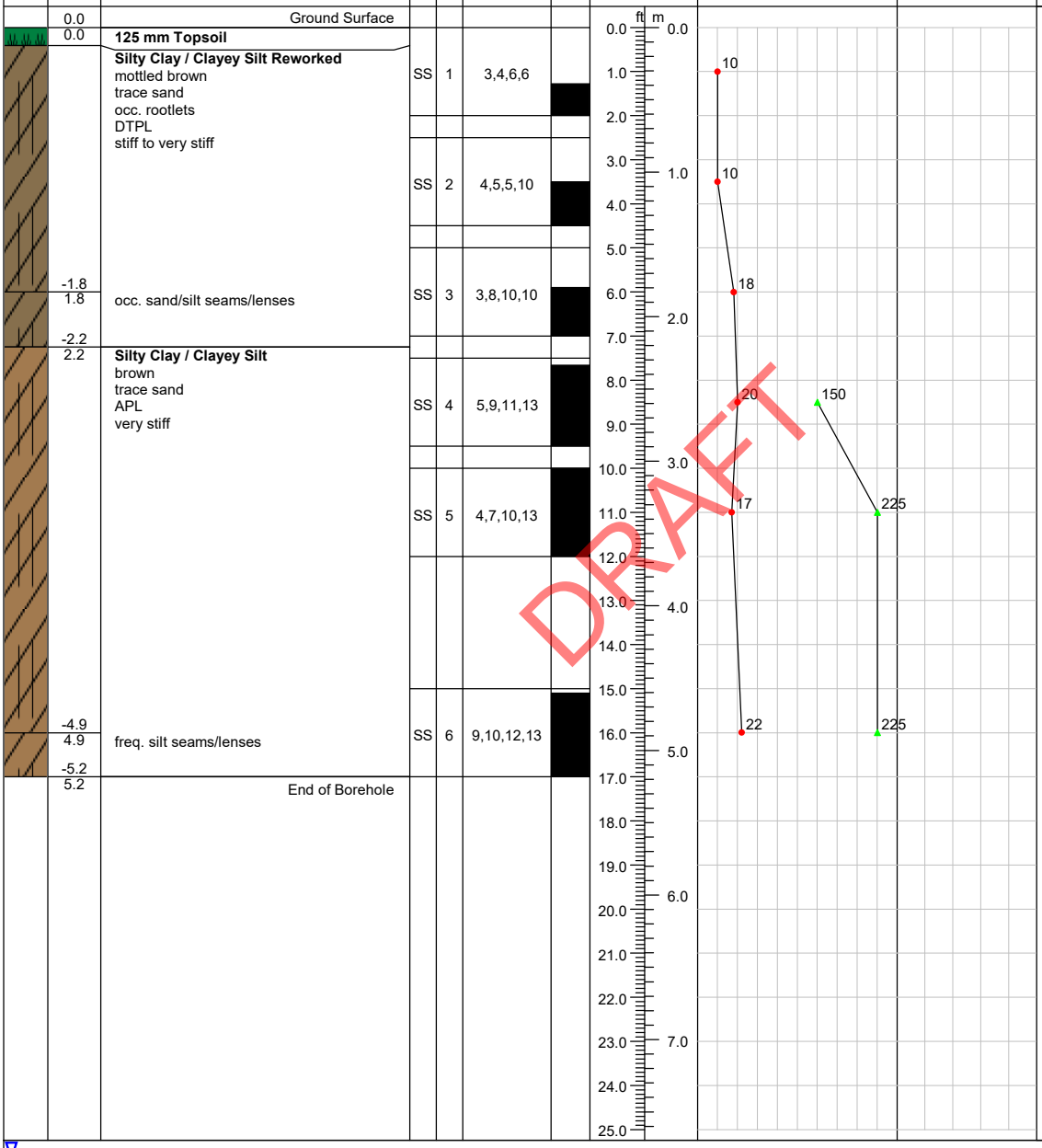
DEPTH SCALE ft / m

FIELD TESTING: SPT (N) 20 40 60 80; SHEAR STRENGTH (kPa) 50 100 150 200

LAB TESTING: MOISTURE CONTENT (%) 10 20 30 40

WELL INSTALLATION

COMMENTS and ADDITIONAL LAB TESTING



DRAFT

Groundwater Level Upon Completion:
Secondary Groundwater Level:

INITIAL WATER LEVEL: dry
SECONDARY WATER LEVEL: N/A
BOREHOLE CAVE UPON COMPLETION: Open

INITIAL WATER LEVEL DATE: October 30, 2023
SECONDARY WATER LEVEL DATE: N/A

LOGGED: DN
COMPILED: MP
CHECKED: DN

Niagara Testing and Inspection Ltd.
3300 Merrittville Highway, Unit 5
Thorold, Ontario, L2V 4Y6

Note: This borehole log has been prepared for Geotechnical purposes and does not necessarily contain information suitable for an Environmentall assessment of the subsurface conditions. Borehole details as presented, do not constitute a through understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer.

RECORD OF BOREHOLE: BH-2

PROJECT NO.: NT23182
PROJECT: Proposed Residential Development
LOCATION: Vacant Lot, Caistorville Road, West Lincoln, ON
CLIENT: DeHaan Homes Inc.

DRILLING COMPANY: Davis Drilling Ltd.
DRILLING METHOD: 150 mm O.D. Solid Stem Augers
DRILL RIG: Track Mount CME-55
BOREHOLE COORDINATE (UTM): 604851 E, 4766932 N

SHEET 1 of 1
DATE STARTED: October 30, 2023
DATE COMPLETED: October 30, 2023
DATUM: Temporary Benchmark

SOIL PROFILE			SAMPLES				DEPTH SCALE ft / m	FIELD TESTING	LAB TESTING	WELL INSTALLATION	COMMENTS and ADDITIONAL LAB TESTING
LITHOLOGY PLOT	ELEVATION (m / mbgs)	DESCRIPTION	TYPE	NUMBER	SPT 'N' VALUE	RECOVERY (%)		SPT (N) 20 40 60 80; SHEAR STRENGTH (kPa) 50 100 150 200	MOISTURE CONTENT (%) 10 20 30 40		
	0.0	Ground Surface									
	0.0	**Silty Clay / Clayey Silt Reworked** mottled brown trace sand and gravel contains organics DTPL stiff to very stiff	SS	1	2,3,5,7						
			SS	2	7,6,11,14						
	-1.8		SS	3	3,7,8,9						
	1.8	occ. silt/sand seams/lenses									
	-2.2										
	2.2	**Silty Clay / Clayey Silt** brown trace sand and gravel APL stiff to very stiff	SS	4	3,7,8,9						
			SS	5	3,6,8,10						
			SS	6	5,8,10,12						
	-5.2										
	5.2	End of Borehole									

ft m
0.0 0.0
1.0
2.0 1.0
3.0
4.0
5.0 2.0
6.0
7.0
8.0
9.0
10.0 3.0
11.0
12.0
13.0 4.0
14.0
15.0
16.0 5.0
17.0
18.0
19.0
20.0 6.0
21.0
22.0
23.0 7.0
24.0
25.0

SPT (N): 8, 17, 15, 15, 14, 18
SHEAR STRENGTH (kPa): 150, 225, 225

DRAFT

Groundwater Level Upon Completion:
Secondary Groundwater Level:

INITIAL WATER LEVEL: dry
SECONDARY WATER LEVEL: N/A
BOREHOLE CAVE UPON COMPLETION: Open

INITIAL WATER LEVEL DATE: October 30, 2023
SECONDARY WATER LEVEL DATE: N/A

LOGGED: DN
COMPILED: MP
CHECKED: DN

Niagara Testing and Inspection Ltd.
3300 Merrittville Highway, Unit 5
Thorold, Ontario, L2V 4Y6

Note: This borehole log has been prepared for Geotechnical purposes and does not necessarily contain information suitable for an Environmentall assessment of the subsurface conditions. Borehole details as presented, do not constitute a through understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer.

RECORD OF BOREHOLE: BH-3

PROJECT NO.: NT23182
PROJECT: Proposed Residential Development
LOCATION: Vacant Lot, Caistorville Road, West Lincoln, ON
CLIENT: DeHaan Homes Inc.

DRILLING COMPANY: Davis Drilling Ltd.
DRILLING METHOD: 150 mm O.D. Solid Stem Augers
DRILL RIG: Track Mount CME-55
BOREHOLE COORDINATE (UTM): 604812 E, 4766861 N

SHEET 1 of 1
DATE STARTED: October 30, 2023
DATE COMPLETED: October 30, 2023
DATUM: Temporary Benchmark

SOIL PROFILE			SAMPLES				DEPTH SCALE ft / m	FIELD TESTING	LAB TESTING	WELL INSTALLATION	COMMENTS and ADDITIONAL LAB TESTING
LITHOLOGY PLOT	ELEVATION (m / mbgs)	DESCRIPTION	TYPE	NUMBER	SPT 'N' VALUE	RECOVERY (%)		SPT (N) 20 40 60 80; SHEAR STRENGTH (kPa) 50 100 150 200	MOISTURE CONTENT (%) 10 20 30 40		
	0.0	Ground Surface									
	0.0	**Silty Clay / Clayey Silt Reworked** mottled brown trace sand DTPL to APL stiff to very stiff	SS	1	3,4,5,5						
			SS	2	5,8,10,13						
	-1.8		SS	3	4,8,11,12						
	1.8	occ. silt seams/lenses									
	-2.2										
	2.2	**Silty Clay / Clayey Silt** brown trace sand occ silt seams APL stiff to very stiff	SS	4	4,7,8,8						
			SS	5	3,5,7,8						
	-4.1										
	4.1	occ. sand lenses becomes WTPL	SS	6	3,5,5,5						
	-5.6										
	5.6	becomes grey	SS	7	3,4,6,5						
	-6.7										
	6.7	End of Borehole									

DRAFT

Groundwater Level Upon Completion:
Secondary Groundwater Level:

INITIAL WATER LEVEL: dry
SECONDARY WATER LEVEL: N/A
BOREHOLE CAVE UPON COMPLETION: Open

INITIAL WATER LEVEL DATE: October 30, 2023
SECONDARY WATER LEVEL DATE: N/A

LOGGED: DN
COMPILED: MP
CHECKED: DN

Niagara Testing and Inspection Ltd.
3300 Merrittville Highway, Unit 5
Thorold, Ontario, L2V 4Y6

Note: This borehole log has been prepared for Geotechnical purposes and does not necessarily contain information suitable for an Environmentall assessment of the subsurface conditions. Borehole details as presented, do not constitute a through understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer.

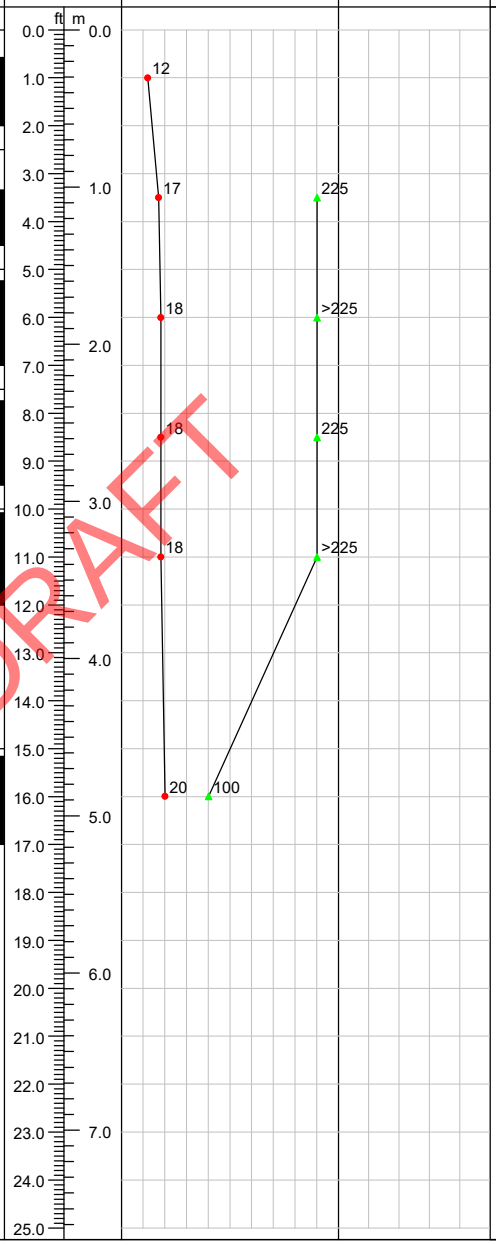
RECORD OF BOREHOLE: BH-4

PROJECT NO.: NT23182
PROJECT: Proposed Residential Development
LOCATION: Vacant Lot, Caistorville Road, West Lincoln, ON
CLIENT: DeHaan Homes Inc.

DRILLING COMPANY: Davis Drilling Ltd.
DRILLING METHOD: 150 mm O.D. Solid Stem Augers
DRILL RIG: Track Mount CME-55
BOREHOLE COORDINATE (UTM): 604751 E, 4766814 N

SHEET 1 of 1
DATE STARTED: October 30, 2023
DATE COMPLETED: October 30, 2023
DATUM: Temporary Benchmark

SOIL PROFILE			SAMPLES					FIELD TESTING	LAB TESTING		
LITHOLOGY PLOT	ELEVATION (m / mbgs)	DESCRIPTION	TYPE	NUMBER	SPT 'N' VALUE	RECOVERY (%)	DEPTH SCALE ft / m	SPT (N) 20 40 60 80 / SHEAR STRENGTH (kPa) 50 100 150 200	MOISTURE CONTENT (%) 10 20 30 40	WELL INSTALLATION	COMMENTS and ADDITIONAL LAB TESTING
	0.0	Ground Surface									
	0.0	**Silty Clay / Clayey Silt Reworked** mottled brown trace sand contains organics DTPL stiff	SS	1	3,5,7,9						
	-0.7 0.7	**Silty Clay / Clayey Silt** brown trace sand occ. sand seams APL very stiff	SS	2	4,8,9,12						
			SS	3	5,8,10,12						
			SS	4	5,8,10,13						
	-3.4 3.4	occ. to freq. silt seams	SS	5	5,7,11,12						
			SS	6	7,9,11,9						
	-5.2 5.2	End of Borehole									



DRAFT

Groundwater Level Upon Completion:
Secondary Groundwater Level:

INITIAL WATER LEVEL: dry
SECONDARY WATER LEVEL: N/A
BOREHOLE CAVE UPON COMPLETION: Open

INITIAL WATER LEVEL DATE: October 30, 2023
SECONDARY WATER LEVEL DATE: N/A

LOGGED: DN
COMPILED: MP
CHECKED: DN

Niagara Testing and Inspection Ltd.
3300 Merrittville Highway, Unit 5
Thorold, Ontario, L2V 4Y6

Note: This borehole log has been prepared for Geotechnical purposes and does not necessarily contain information suitable for an Environmentall assessment of the subsurface conditions. Borehole details as presented, do not constitute a through understanding of all potential conditions present and require interpretative assistance from a qualified Geotechnical Engineer.

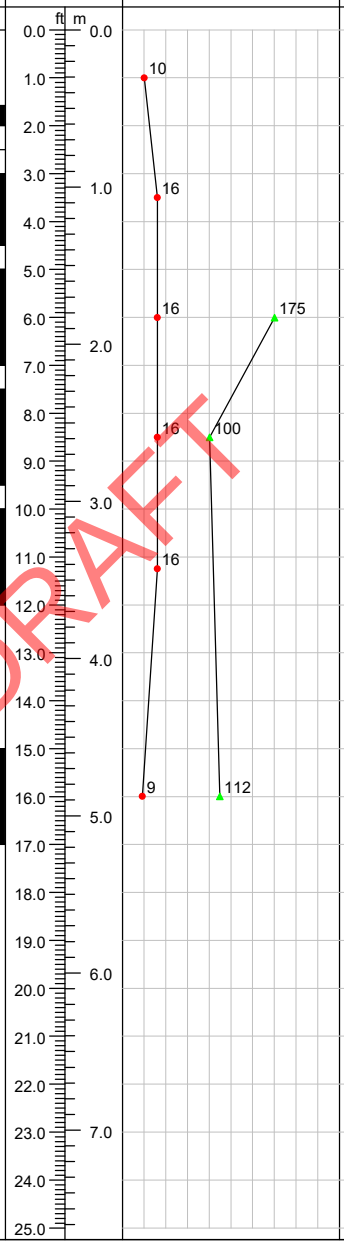
RECORD OF BOREHOLE: BH-5

PROJECT NO.: NT23182
PROJECT: Proposed Residential Development
LOCATION: Vacant Lot, Caistorville Road, West Lincoln, ON
CLIENT: DeHaan Homes Inc.

DRILLING COMPANY: Davis Drilling Ltd.
DRILLING METHOD: 150 mm O.D. Solid Stem Augers
DRILL RIG: Track Mount CME-55
BOREHOLE COORDINATE (UTM): 604867 E, 4766807 N

SHEET 1 of 1
DATE STARTED: October 30, 2023
DATE COMPLETED: October 30, 2023
DATUM: Temporary Benchmark

SOIL PROFILE			SAMPLES				DEPTH SCALE ft / m	FIELD TESTING	LAB TESTING	WELL INSTALLATION	COMMENTS and ADDITIONAL LAB TESTING
LITHOLOGY PLOT	ELEVATION (m / mbgs)	DESCRIPTION	TYPE	NUMBER	SPT 'N' VALUE	RECOVERY (%)		SPT (N) 20 40 60 80; SHEAR STRENGTH (kPa) 50 100 150 200	MOISTURE CONTENT (%) 10 20 30 40		
	0.0	Ground Surface									
	0.0	**Silty Clay / Clayey Silt Reworked** brown trace sand and gravel contains organics DTPL to APL stiff	SS	1	3,5,5,8						
	-1.4		SS	2	4,8,8,13						
	1.4	**Silty Clay / Clayey Silt** Silty Clay / Clayey Silt	SS	3	3,7,9,11						
	-2.6		SS	4	3,6,10,11						
	2.6	occ. to freq. silt seams/pockets	SS	5	5,8,8,10						
	-4.1										
	4.1	**Silty Clay / Clayey Silt** grey occ silt lenses WTPL stiff	SS	6	3,4,5,5						
	-5.2										
	5.2	End of Borehole									



DRAFT

Groundwater Level Upon Completion:
Secondary Groundwater Level:

INITIAL WATER LEVEL: dry
SECONDARY WATER LEVEL: N/A
BOREHOLE CAVE UPON COMPLETION: Open

INITIAL WATER LEVEL DATE: October 30, 2023
SECONDARY WATER LEVEL DATE: N/A

LOGGED: DN
COMPILED: MP
CHECKED: DN

Niagara Testing and Inspection Ltd.
3300 Merrittville Highway, Unit 5
Thorold, Ontario, L2V 4Y6

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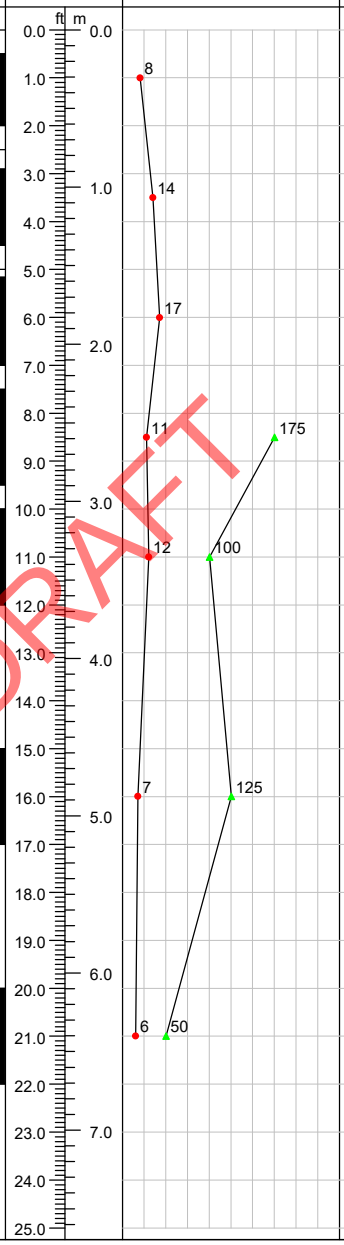
RECORD OF BOREHOLE: BH-6

PROJECT NO.: NT23182
PROJECT: Proposed Residential Development
LOCATION: Vacant Lot, Caistorville Road, West Lincoln, ON
CLIENT: DeHaan Homes Inc.

DRILLING COMPANY: Davis Drilling Ltd.
DRILLING METHOD: 150 mm O.D. Solid Stem Augers
DRILL RIG: Track Mount CME-55
BOREHOLE COORDINATE (UTM): 604720 E, 4766795 N

SHEET 1 of 1
DATE STARTED: October 30, 2023
DATE COMPLETED: October 30, 2023
DATUM: Temporary Benchmark

SOIL PROFILE			SAMPLES				DEPTH SCALE ft / m	FIELD TESTING	LAB TESTING		
LITHOLOGY PLOT	ELEVATION (m / mbgs)	DESCRIPTION	TYPE	NUMBER	SPT 'N' VALUE	RECOVERY (%)		SPT (N) 20 40 60 80 / SHEAR STRENGTH (kPa) 50 100 150 200	MOISTURE CONTENT (%) 10 20 30 40	WELL INSTALLATION	COMMENTS and ADDITIONAL LAB TESTING
	0.0	Ground Surface									
	0.0	**Silty Clay / Clayey Silt Reworked** mottled brown trace sand occ. silt seams DTPL to APL stiff to very stiff	SS	1	2,3,5,7						
			SS	2	5,6,8,11						
			SS	3	4,8,9,11						
	-2.2										
	2.2	**Silty Clay / Clayey Silt** brown trace sand APL stiff to very stiff	SS	4	3,5,6,8						
	-3.4										
	3.4	becomes WTPL freq. silt seams/lenses	SS	5	3,5,7,8						
			SS	6	2,3,4,5						
	-5.6										
	5.6	**Silty Clay / Clayey Silt** grey trace sand occ silt lenses WTPL	SS	7	2,3,3,4						
	-6.7										
	6.7	End of Borehole									



DRAFT

Groundwater Level Upon Completion:
Secondary Groundwater Level:

INITIAL WATER LEVEL: 5.5 m
SECONDARY WATER LEVEL: N/A
BOREHOLE CAVE UPON COMPLETION: 6.4 m

INITIAL WATER LEVEL DATE: October 30, 2023
SECONDARY WATER LEVEL DATE: N/A

LOGGED: DN
COMPILED: MP
CHECKED: DN

Niagara Testing and Inspection Ltd.
3300 Merrittville Highway, Unit 5
Thorold, Ontario, L2V 4Y6

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RECORD OF BOREHOLE: BH-7

PROJECT NO.: NT23182
PROJECT: Proposed Residential Development
LOCATION: Vacant Lot, Caistorville Road, West Lincoln, ON
CLIENT: DeHaan Homes Inc.

DRILLING COMPANY: Davis Drilling Ltd.
DRILLING METHOD: 150 mm O.D. Solid Stem Augers
DRILL RIG: Track Mount CME-55
BOREHOLE COORDINATE (UTM): 604868 E, 4766760 N

SHEET 1 of 1
DATE STARTED: October 30, 2023
DATE COMPLETED: October 30, 2023
DATUM: Temporary Benchmark

SOIL PROFILE			SAMPLES				DEPTH SCALE ft / m	FIELD TESTING	LAB TESTING	WELL INSTALLATION	COMMENTS and ADDITIONAL LAB TESTING
LITHOLOGY PLOT	ELEVATION (m / mbgs)	DESCRIPTION	TYPE	NUMBER	SPT 'N' VALUE	RECOVERY (%)		SPT (N) 20 40 60 80; SHEAR STRENGTH (kPa) 50 100 150 200	MOISTURE CONTENT (%) 10 20 30 40		
	0.0	Ground Surface									
	0.0	**Silty Clay / Clayey Silt Reworked** mottled brown trace sand DTPL stiff to very stiff	SS	1	3,4,6,8						
			SS	2	3,9,13,14						
			SS	3	5,8,11,12						
	-2.2										
	2.2	**Silty Clay / Clayey Silt** brown trace sand and gravel APL stiff to very stiff	SS	4	4,7,8,9						
			SS	5	3,6,6,9						
	-4.1										
	4.1	**Silty Clay / Clayey Silt** greyish brown to grey trace sand WTPL firm to stiff	SS	6	3,5,6,7						
			SS	7	3,3,4,5						
	-6.7										
	6.7	End of Borehole									

ft m
0.0 0.0
1.0
2.0
3.0 1.0
4.0
5.0
6.0 2.0
7.0
8.0
9.0
10.0 3.0
11.0
12.0
13.0 4.0
14.0
15.0
16.0 5.0
17.0
18.0
19.0
20.0 6.0
21.0
22.0
23.0 7.0
24.0
25.0

DRAFT

Groundwater Level Upon Completion:
Secondary Groundwater Level:

INITIAL WATER LEVEL: Open
SECONDARY WATER LEVEL: N/A
BOREHOLE CAVE UPON COMPLETION: Dry

INITIAL WATER LEVEL DATE: October 30, 2023
SECONDARY WATER LEVEL DATE: N/A

LOGGED: DN
COMPILED: MP
CHECKED: DN

Niagara Testing and Inspection Ltd.
3300 Merrittville Highway, Unit 5
Thorold, Ontario, L2V 4Y6

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RECORD OF BOREHOLE: BH-8/MW-3

PROJECT NO.: NT23182
PROJECT: Proposed Residential Development
LOCATION: Vacant Lot, Caistorville Road, West Lincoln, ON
CLIENT: DeHaan Homes Inc.

DRILLING COMPANY: Davis Drilling Ltd.
DRILLING METHOD: 150 mm O.D. Solid Stem Augers
DRILL RIG: Track Mount CME-55
BOREHOLE COORDINATE (UTM): 604705 E, 4766775 N

SHEET 1 of 2
DATE STARTED: October 31, 2023
DATE COMPLETED: October 31, 2023
DATUM: Temporary Benchmark

SOIL PROFILE			SAMPLES				DEPTH SCALE ft / m	FIELD TESTING	LAB TESTING	WELL INSTALLATION	COMMENTS and ADDITIONAL LAB TESTING
LITHOLOGY PLOT	ELEVATION (m / mbgs)	DESCRIPTION	TYPE	NUMBER	SPT 'N' VALUE	RECOVERY (%)		SPT (N) 20 40 60 80; SHEAR STRENGTH (kPa) 50 100 150 200	MOISTURE CONTENT (%) 10 20 30 40		
	0.0	Ground Surface									
	0.0	**Silty Clay / Clayey Silt Reworked** mottled brown trace sand and gravel contains organics DTPL stiff	SS	1	2,3,5,6						
			SS	2	4,8,7,10						
	-1.4 1.4	**Silty Clay / Clayey Silt** brown trace sand and gravel occ. sand seams/lenses APL stiff to very stiff	SS	3	5,9,11,11						
			SS	4	3,5,6,8						
			SS	5	3,5,7,9						
	-4.1 4.1	**Silty Clay / Clayey Silt** greyish brown to grey trace sand WTPL firm to stiff	SS	6	3,4,5,6						
			SS	7	4,6,7,8						

DRAFT

Groundwater Level Upon Completion:
Secondary Groundwater Level:

INITIAL WATER LEVEL: Open
SECONDARY WATER LEVEL: N/A
BOREHOLE CAVE UPON COMPLETION: Dry

INITIAL WATER LEVEL DATE: October 31, 2023
SECONDARY WATER LEVEL DATE: N/A

LOGGED: DN
COMPILED: MP
CHECKED: DN

Niagara Testing and Inspection Ltd.
3300 Merrittville Highway, Unit 5
Thorold, Ontario, L2V 4Y6

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RECORD OF BOREHOLE: BH-8/MW-3

PROJECT NO.: NT23182
PROJECT: Proposed Residential Development
LOCATION: Vacant Lot, Caistorville Road, West Lincoln, ON
CLIENT: DeHaan Homes Inc.

DRILLING COMPANY: Davis Drilling Ltd.
DRILLING METHOD: 150 mm O.D. Solid Stem Augers
DRILL RIG: Track Mount CME-55
BOREHOLE COORDINATE (UTM): 604705 E, 4766775 N

SHEET 2 of 2
DATE STARTED: October 31, 2023
DATE COMPLETED: October 31, 2023
DATUM: Temporary Benchmark

SOIL PROFILE			SAMPLES				DEPTH SCALE ft / m	FIELD TESTING	LAB TESTING	WELL INSTALLATION	COMMENTS and ADDITIONAL LAB TESTING
LITHOLOGY PLOT	ELEVATION (m / mbgs)	DESCRIPTION	TYPE	NUMBER	SPT 'N' VALUE	RECOVERY (%)		SPT (N) 20 40 60 80; SHEAR STRENGTH (kPa) 50 100 150 200	MOISTURE CONTENT (%) 10 20 30 40		
			SS	8	3,3,5,6		24.0 25.0 26.0 27.0 28.0 29.0 30.0	8 75			
			SS	9	2,3,4,5		30.0 31.0 32.0	7 50			
	-9.8 / 9.8	End of Borehole					32.0 33.0 34.0 35.0 36.0 37.0 38.0 39.0 40.0 41.0 42.0 43.0 44.0 45.0 46.0 47.0 48.0				

8.0 9.0 10.0 11.0 12.0 13.0 14.0

DRAFT

Groundwater Level Upon Completion:
Secondary Groundwater Level:

INITIAL WATER LEVEL: Open
SECONDARY WATER LEVEL: N/A
BOREHOLE CAVE UPON COMPLETION: Dry

INITIAL WATER LEVEL DATE: October 31, 2023
SECONDARY WATER LEVEL DATE: N/A

LOGGED: DN
COMPILED: MP
CHECKED: DN

Niagara Testing and Inspection Ltd.
3300 Merrittville Highway, Unit 5
Thorold, Ontario, L2V 4Y6

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RECORD OF BOREHOLE: BH-9/MW-2

PROJECT NO.: NT23182
PROJECT: Proposed Residential Development
LOCATION: Vacant Lot, Caistorville Road, West Lincoln, ON
CLIENT: DeHaan Homes Inc.

DRILLING COMPANY: Davis Drilling Ltd.
DRILLING METHOD: 150 mm O.D. Solid Stem Augers
DRILL RIG: Track Mount CME-55
BOREHOLE COORDINATE (UTM): 604732 E, 4766735 N

SHEET 1 of 2
DATE STARTED: October 31, 2023
DATE COMPLETED: October 31, 2023
DATUM: Temporary Benchmark

SOIL PROFILE			SAMPLES				DEPTH SCALE ft / m	FIELD TESTING	LAB TESTING	WELL INSTALLATION	COMMENTS and ADDITIONAL LAB TESTING
LITHOLOGY PLOT	ELEVATION (m / mbgs)	DESCRIPTION	TYPE	NUMBER	SPT 'N' VALUE	RECOVERY (%)		SPT (N) 20 40 60 80; SHEAR STRENGTH (kPa) 50 100 150 200	MOISTURE CONTENT (%) 10 20 30 40		
	0.0	Ground Surface									
	0.0	**Silty Clay / Clayey Silt Reworked** brown trace sand DTPL stiff	SS	1	3,5,7,10						
	-0.7										
	0.7	**Silty Clay / Clayey Silt** brown trace sand and gravel APL stiff to very stiff	SS	2	6,7,9,12						
			SS	3	4,8,9,12						
			SS	4	4,5,7,10						
			SS	5	4,6,7,9						
	-4.9										
	4.9	occ. silt seams/lenses	SS	6	4,8,8,9						
	-5.6										
	5.6	**Silty Clay / Clayey Silt** grey trace sand WTPL Firm	SS	7	2,2,4,4						

DEPTH SCALE: ft 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0, 15.0, 16.0, 17.0, 18.0, 19.0, 20.0, 21.0, 22.0, 23.0 / m 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0

FIELD TESTING: 12, 16, 17, 12, 13, 16, 25, 6; >225, 225, 200, 200, 200, 200

WELL INSTALLATION: Concrete, Steel Casing, Bentonite, Silca Sand, 2" Slot 10 Screen

DRAFT

Groundwater Level Upon Completion:
Secondary Groundwater Level:

INITIAL WATER LEVEL: Open
SECONDARY WATER LEVEL: N/A
BOREHOLE CAVE UPON COMPLETION: Dry

INITIAL WATER LEVEL DATE: October 31, 2023
SECONDARY WATER LEVEL DATE: N/A

LOGGED: DN
COMPILED: MP
CHECKED: DN

Niagara Testing and Inspection Ltd.
3300 Merrittville Highway, Unit 5
Thorold, Ontario, L2V 4Y6

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RECORD OF BOREHOLE: BH-9/MW-2

PROJECT NO.: NT23182
PROJECT: Proposed Residential Development
LOCATION: Vacant Lot, Caistorville Road, West Lincoln, ON
CLIENT: DeHaan Homes Inc.

DRILLING COMPANY: Davis Drilling Ltd.
DRILLING METHOD: 150 mm O.D. Solid Stem Augers
DRILL RIG: Track Mount CME-55
BOREHOLE COORDINATE (UTM): 604732 E, 4766735 N

SHEET 2 of 2
DATE STARTED: October 31, 2023
DATE COMPLETED: October 31, 2023
DATUM: Temporary Benchmark

SOIL PROFILE			SAMPLES				DEPTH SCALE ft / m	FIELD TESTING	LAB TESTING	WELL INSTALLATION	COMMENTS and ADDITIONAL LAB TESTING
LITHOLOGY PLOT	ELEVATION (m / mbgs)	DESCRIPTION	TYPE	NUMBER	SPT 'N' VALUE	RECOVERY (%)		SPT (N) 20 40 60 80; SHEAR STRENGTH (kPa) 50 100 150 200	MOISTURE CONTENT (%) 10 20 30 40		
							24.0				
							25.0				
			SS	8	2,3,4,5		26.0	25, 7			
							27.0				
							28.0				
							29.0				
							30.0				
			SS	9	2,3,4,4		31.0	12, 7			
	-9.8						32.0				
	9.8	End of Borehole					33.0				
							34.0				
							35.0				
							36.0				
							37.0				
							38.0				
							39.0				
							40.0				
							41.0				
							42.0				
							43.0				
							44.0				
							45.0				
							46.0				
							47.0				
							48.0				

8.0
9.0
10.0
11.0
12.0
13.0
14.0

DRAFT

Groundwater Level Upon Completion:
Secondary Groundwater Level:

INITIAL WATER LEVEL: Open
SECONDARY WATER LEVEL: N/A
BOREHOLE CAVE UPON COMPLETION: Dry

INITIAL WATER LEVEL DATE: October 31, 2023
SECONDARY WATER LEVEL DATE: N/A

LOGGED: DN
COMPILED: MP
CHECKED: DN

Niagara Testing and Inspection Ltd.
3300 Merrittville Highway, Unit 5
Thorold, Ontario, L2V 4Y6

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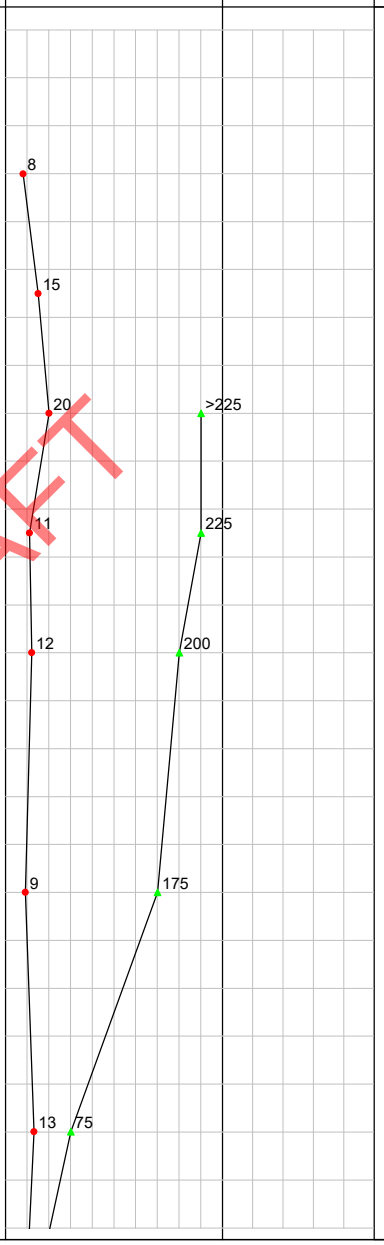
RECORD OF BOREHOLE: BH-10/MW-1

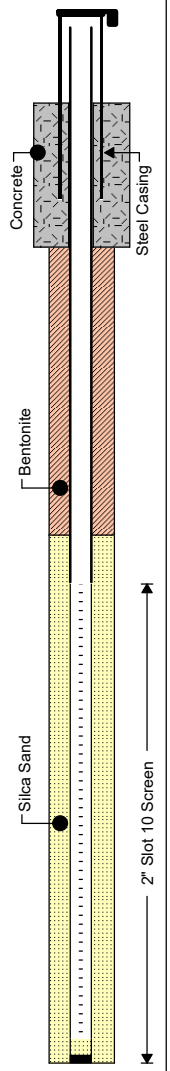
PROJECT NO.: NT23182
PROJECT: Proposed Residential Development
LOCATION: Vacant Lot, Caistorville Road, West Lincoln, ON
CLIENT: DeHaan Homes Inc.

DRILLING COMPANY: Davis Drilling Ltd.
DRILLING METHOD: 150 mm O.D. Solid Stem Augers
DRILL RIG: Track Mount CME-55
BOREHOLE COORDINATE (UTM): 604743 E, 4766787 N

SHEET 1 of 2
DATE STARTED: October 31, 2023
DATE COMPLETED: October 31, 2023
DATUM: Temporary Benchmark

SOIL PROFILE			SAMPLES					FIELD TESTING	LAB TESTING		
LITHOLOGY PLOT	ELEVATION (m / mbgs)	DESCRIPTION	TYPE	NUMBER	SPT 'N' VALUE	RECOVERY (%)	DEPTH SCALE ft / m	SPT (N) 20 40 60 80 / SHEAR STRENGTH (kPa) 50 100 150 200	MOISTURE CONTENT (%) 10 20 30 40	WELL INSTALLATION	COMMENTS and ADDITIONAL LAB TESTING
	0.0	Ground Surface									
	0.0	**Silty Clay / Clayey Silt Reworked** mottled brown trace sand occ. silt seams contains rootlets DTPL to APL stiff	SS	1	3,5,7,10						
	-1.4		SS	2	3,7,11,12						
	1.4	**Silty Clay / Clayey Silt** brown trace sand occ. silt seams APL stiff to very stiff	SS	3	5,7,10,11						
			SS	4	3,4,9,6						
	-3.4		SS	5	4,8,8,9						
	3.4	freq. silt seams/pockets									
	-4.1										
	4.1	**Silty Clay / Clayey Silt** greyish brown to grey trace sand WTPL firm to stiff	SS	6	3,4,5,7						
			SS	7	3,4,5,6						





DRAFT

Groundwater Level Upon Completion:
Secondary Groundwater Level:

INITIAL WATER LEVEL: Open
SECONDARY WATER LEVEL: N/A
BOREHOLE CAVE UPON COMPLETION: Dry

INITIAL WATER LEVEL DATE: October 31, 2023
SECONDARY WATER LEVEL DATE: N/A

LOGGED: DN
COMPILED: MP
CHECKED: DN

Niagara Testing and Inspection Ltd.
3300 Merrittville Highway, Unit 5
Thorold, Ontario, L2V 4Y6

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RECORD OF BOREHOLE: BH-10/MW-1

PROJECT NO.: NT23182
PROJECT: Proposed Residential Development
LOCATION: Vacant Lot, Caistorville Road, West Lincoln, ON
CLIENT: DeHaan Homes Inc.

DRILLING COMPANY: Davis Drilling Ltd.
DRILLING METHOD: 150 mm O.D. Solid Stem Augers
DRILL RIG: Track Mount CME-55
BOREHOLE COORDINATE (UTM): 604743 E, 4766787 N

SHEET 2 of 2
DATE STARTED: October 31, 2023
DATE COMPLETED: October 31, 2023
DATUM: Temporary Benchmark

SOIL PROFILE			SAMPLES				DEPTH SCALE ft / m	FIELD TESTING	LAB TESTING	WELL INSTALLATION	COMMENTS and ADDITIONAL LAB TESTING
LITHOLOGY PLOT	ELEVATION (m / mbgs)	DESCRIPTION	TYPE	NUMBER	SPT 'N' VALUE	RECOVERY (%)		SPT (N) 20 40 60 80; SHEAR STRENGTH (kPa) 50 100 150 200	MOISTURE CONTENT (%) 10 20 30 40		
			SS	8	2,3,3,4		8.0	8, 12			
			SS	9	2,3,4,5		9.0	7, 12			
	-9.8										
	9.8	End of Borehole					10.0				
							11.0				
							12.0				
							13.0				
							14.0				

DRAFT

Groundwater Level Upon Completion:
Secondary Groundwater Level:

INITIAL WATER LEVEL: Open
SECONDARY WATER LEVEL: N/A
BOREHOLE CAVE UPON COMPLETION: Dry

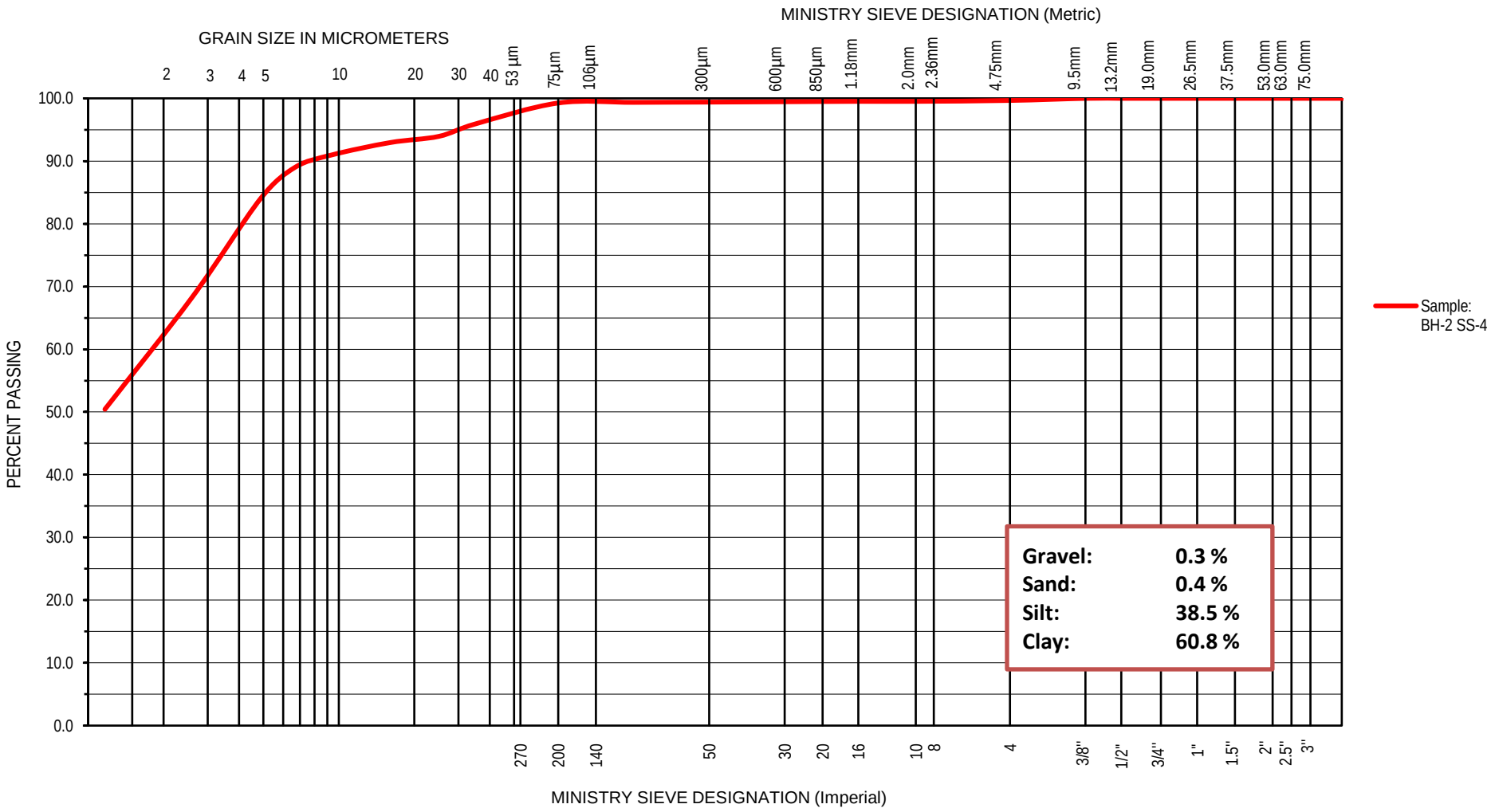
INITIAL WATER LEVEL DATE: October 31, 2023
SECONDARY WATER LEVEL DATE: N/A

LOGGED: DN
COMPILED: MP
CHECKED: DN

Niagara Testing and Inspection Ltd.
3300 Merrittville Highway, Unit 5
Thorold, Ontario, L2V 4Y6

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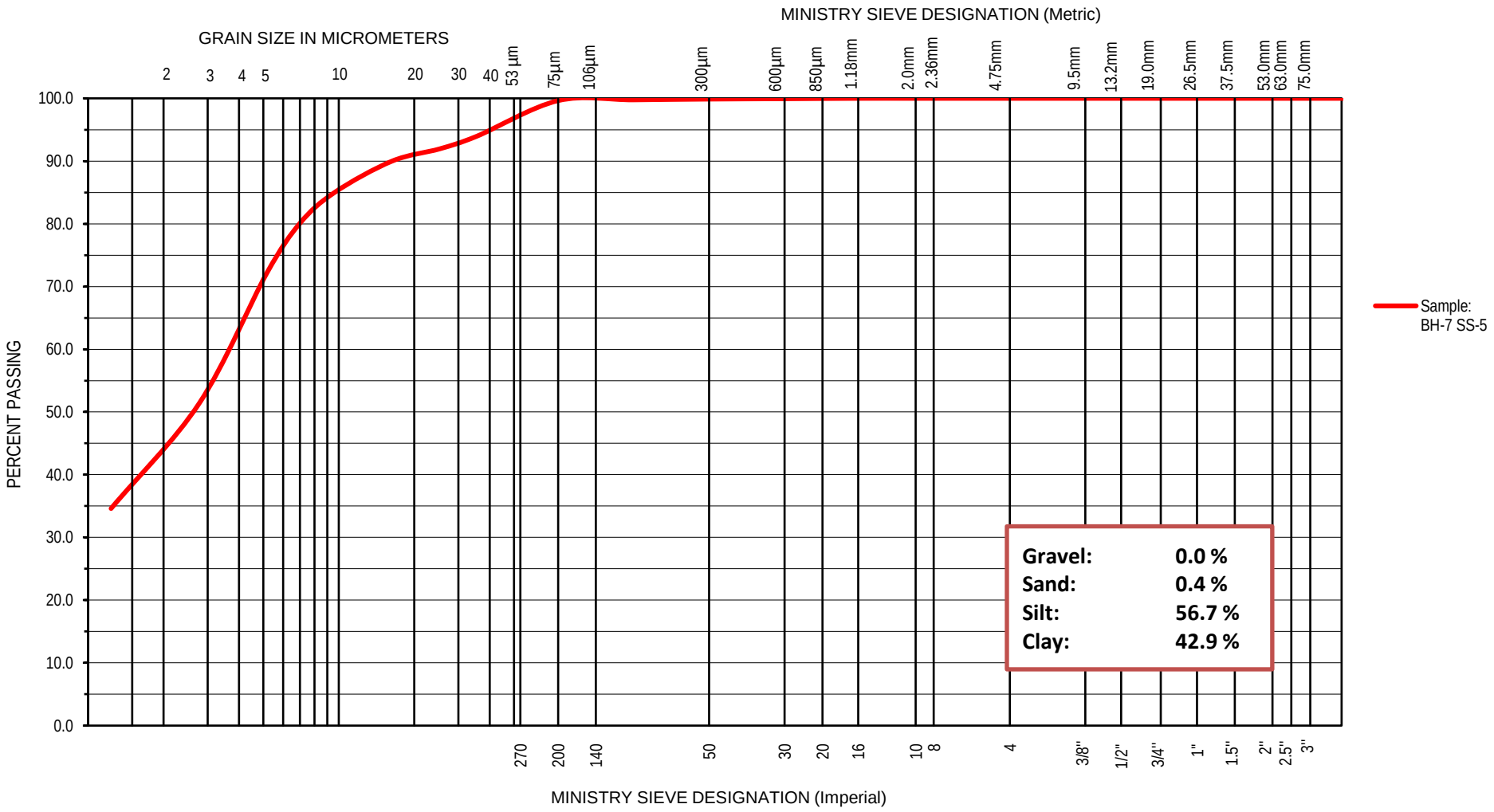
UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



CLIENT **DeHaan Homes Inc.**	PREPARED BY KC	PROJECT Sieve / Hydrometer Analysis Vacant Lot - Caistorville Road	DATE November 9, 2023
Niagara Testing & Inspection Ltd. 3300 Merrittville Highway, Unit #5 Thorold, Ontario	CHECKED BY MP	TITLE Grain Size Distribution	PROJECT NO NT23182 FIGURE NO 1

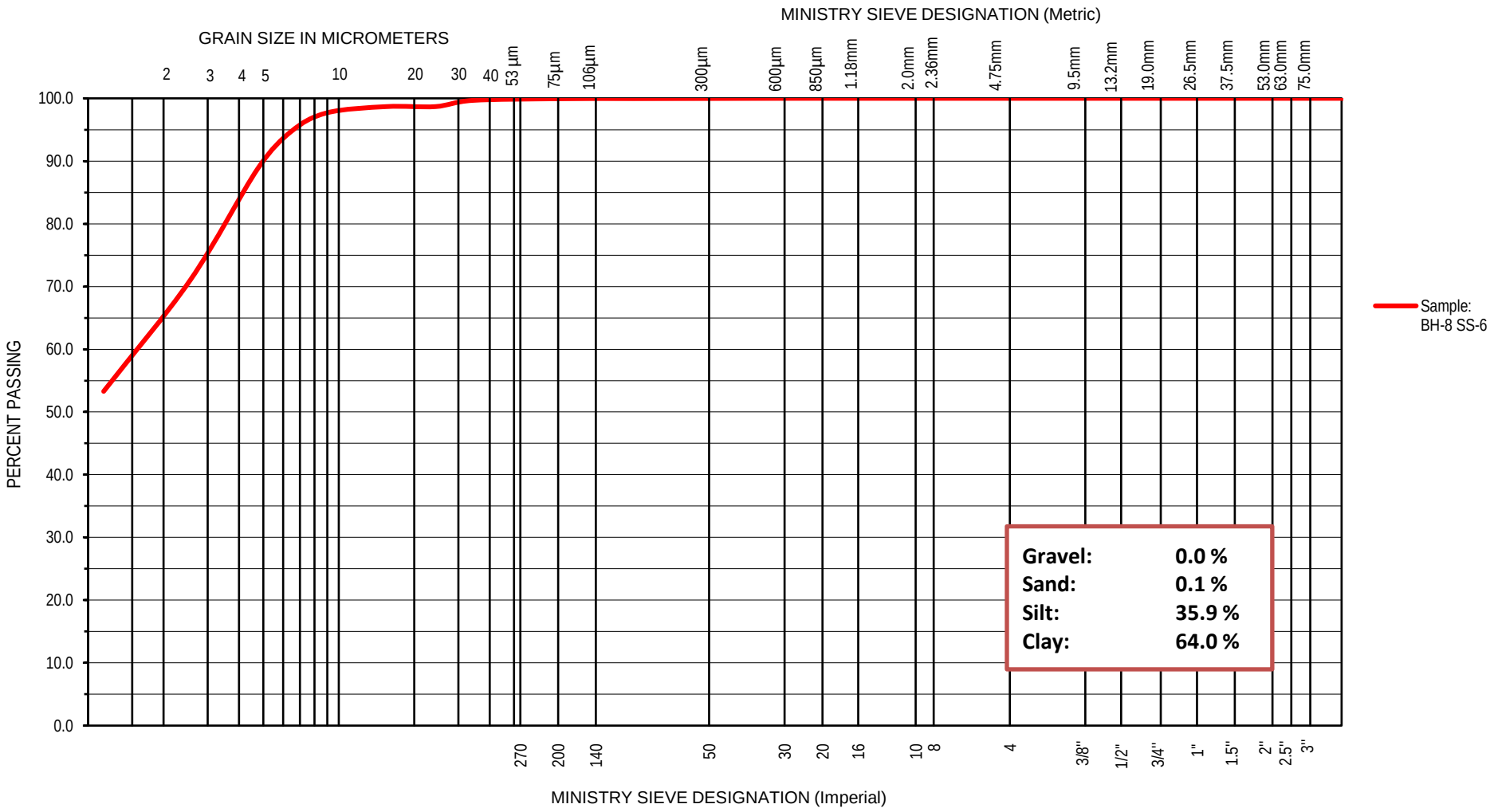
UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



CLIENT: **DeHaan Homes Inc.**	PREPARED BY: KC	PROJECT: Sieve / Hydrometer Analysis Vacant Lot - Caistorville Road	DATE: November 9, 2023
			PROJECT NO: NT23182
Niagara Testing & Inspection Ltd. 3300 Merrittville Highway, Unit #5 Thorold, Ontario	CHECKED BY: MP	TITLE: Grain Size Distribution	FIGURE NO: 2

UNIFIED SOIL CLASSIFICATION SYSTEM					
CLAY & SILT	SAND			GRAVEL	
	Fine	Medium	Coarse	Fine	Coarse



CLIENT **DeHaan Homes Inc.**	PREPARED BY KC	PROJECT Sieve / Hydrometer Analysis Vacant Lot - Caistorville Road	DATE November 9, 2023
Niagara Testing & Inspection Ltd. 3300 Merrittville Highway, Unit #5 Thorold, Ontario	CHECKED BY MP	TITLE Grain Size Distribution	PROJECT NO NT23182 FIGURE NO 3

K from Grain Size Analysis Report

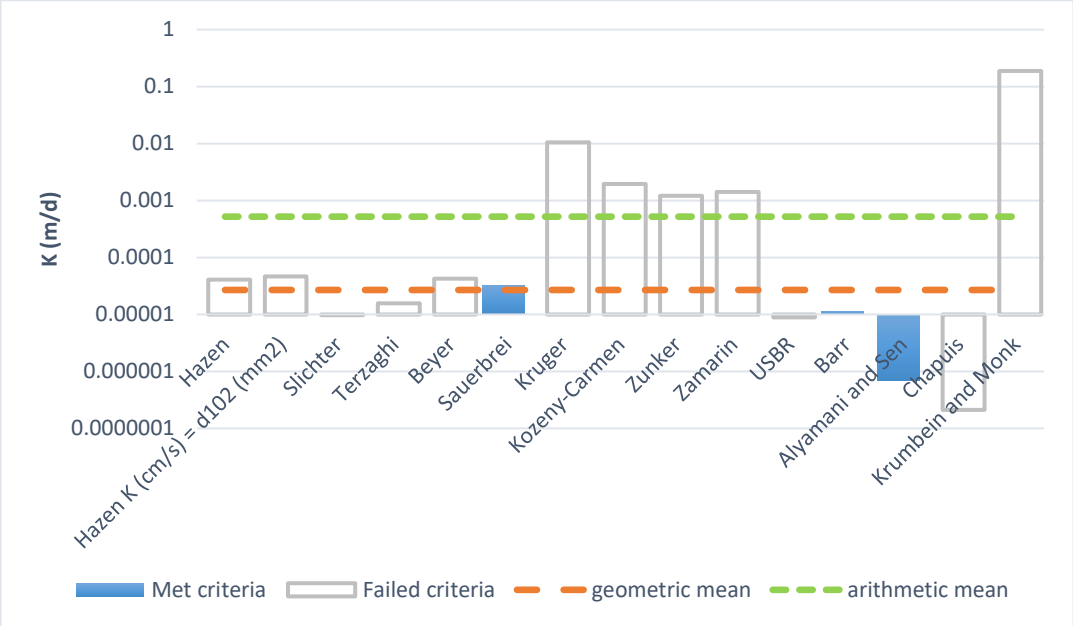
Date: 09-Nov-23

Sample Name: BH-2 SS-4

Mass Sample (g): 100

T (oC) 20

Poorly sorted clay with fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	5.E-08	5.E-10	0.00	
Hazen K (cm/s) = d_{10} (mm)	5.E-08	5.E-10	0.00	
Slichter	1.E-08	1.E-10	0.00	
Terzaghi	2.E-08	2.E-10	0.00	
Beyer	5.E-08	5.E-10	0.00	
Sauerbrei	4.E-08	4.E-10	0.00	
Kruger	1.E-05	1.E-07	0.01	
Kozeny-Carmen	2.E-06	2.E-08	0.00	
Zunker	1.E-06	1.E-08	0.00	
Zamarin	2.E-06	2.E-08	0.00	
USBR	1.E-08	1.E-10	0.00	
Barr	1.E-08	1.E-10	0.00	
Alyamani and Sen	8.E-10	8.E-12	0.00	
Chapuis	2.E-10	2.E-12	0.00	
Krumbein and Monk	2.E-04	2.E-06	0.19	
Shepherd	2.E-06	2.E-08	0.00	
geometric mean	3.E-08	3.E-10	0.0	
arithmetic mean	6.E-07	6.E-09	0.00	

K from Grain Size Analysis Report

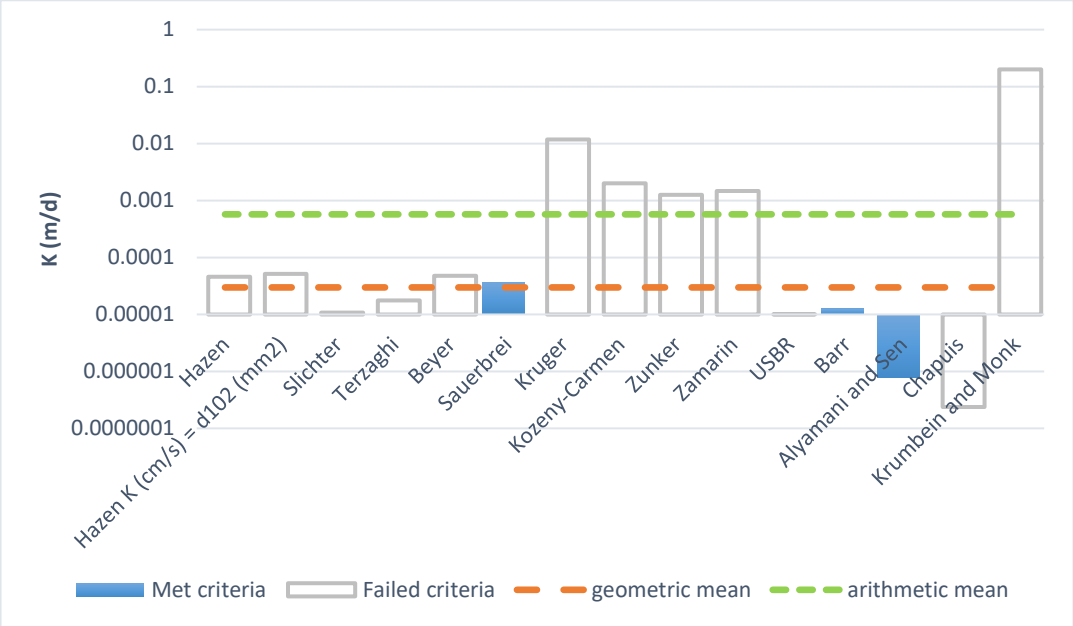
Date: 09-Nov-23

Sample Name: BH-7 SS-5

Mass Sample (g): 100

T (oC) 20

Poorly sorted clay with fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	5.E-08	5.E-10	0.00	
Hazen K (cm/s) = d_{10} (mm)	6.E-08	6.E-10	0.00	
Slichter	1.E-08	1.E-10	0.00	
Terzaghi	2.E-08	2.E-10	0.00	
Beyer	5.E-08	5.E-10	0.00	
Sauerbrei	4.E-08	4.E-10	0.00	
Kruger	1.E-05	1.E-07	0.01	
Kozeny-Carmen	2.E-06	2.E-08	0.00	
Zunker	1.E-06	1.E-08	0.00	
Zamarin	2.E-06	2.E-08	0.00	
USBR	1.E-08	1.E-10	0.00	
Barr	1.E-08	1.E-10	0.00	
Alyamani and Sen	9.E-10	9.E-12	0.00	
Chapuis	3.E-10	3.E-12	0.00	
Krumbein and Monk	2.E-04	2.E-06	0.20	
Shepherd	3.E-06	3.E-08	0.00	
geometric mean	3.E-08	3.E-10	0.0	
arithmetic mean	7.E-07	7.E-09	0.00	

K from Grain Size Analysis Report

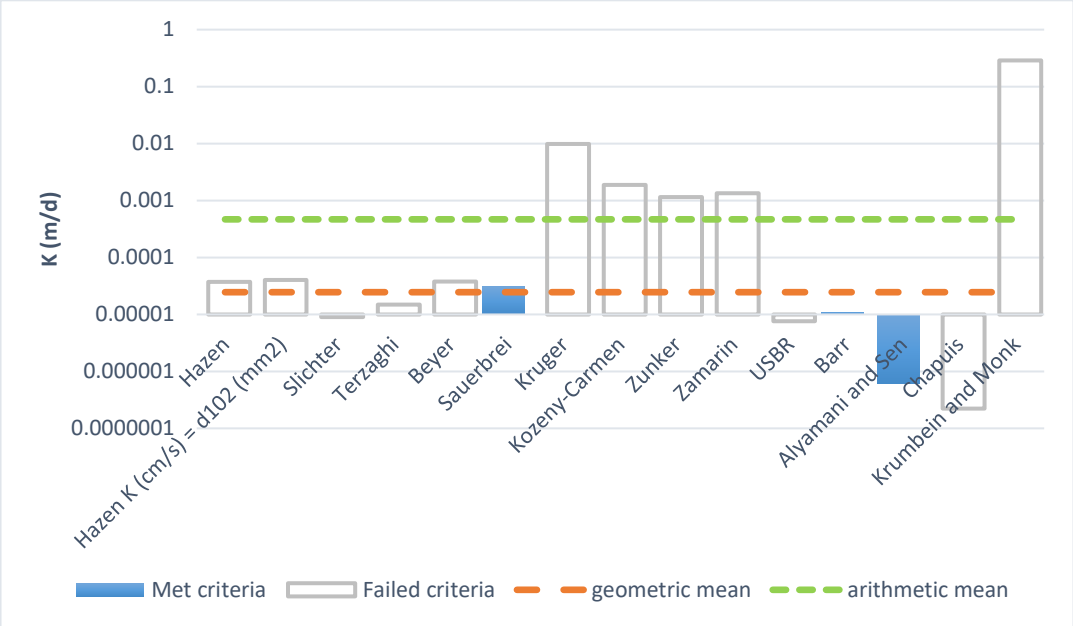
Date: 09-Nov-23

Sample Name: BH-8 SS-6

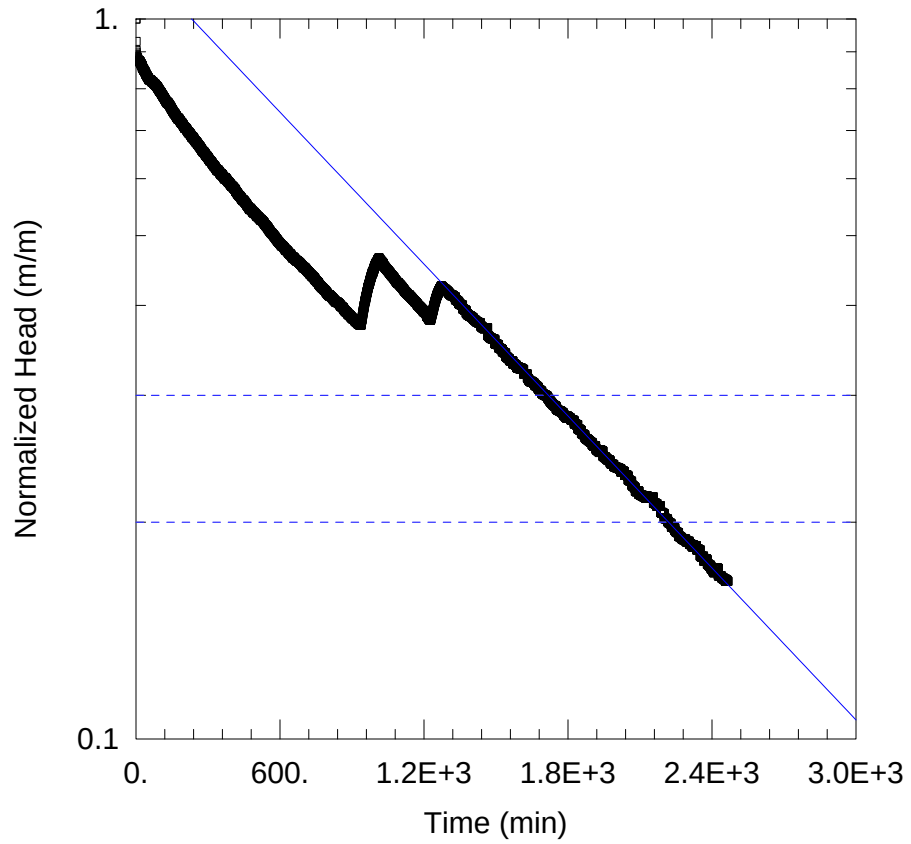
Mass Sample (g): 100

T (oC) 20

Poorly sorted clay with fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	4.E-08	4.E-10	0.00	
Hazen K (cm/s) = d_{10} (mm)	5.E-08	5.E-10	0.00	
Slichter	1.E-08	1.E-10	0.00	
Terzaghi	2.E-08	2.E-10	0.00	
Beyer	4.E-08	4.E-10	0.00	
Sauerbrei	4.E-08	4.E-10	0.00	
Kruger	1.E-05	1.E-07	0.01	
Kozeny-Carmen	2.E-06	2.E-08	0.00	
Zunker	1.E-06	1.E-08	0.00	
Zamarin	2.E-06	2.E-08	0.00	
USBR	9.E-09	9.E-11	0.00	
Barr	1.E-08	1.E-10	0.00	
Alyamani and Sen	7.E-10	7.E-12	0.00	
Chapuis	3.E-10	3.E-12	0.00	
Krumbein and Monk	3.E-04	3.E-06	0.29	
Shepherd	2.E-06	2.E-08	0.00	
geometric mean	3.E-08	3.E-10	0.0	
arithmetic mean	5.E-07	5.E-09	0.00	



BAIL-DOWN TEST

Data Set: C:\...\MW1.aqt
Date: 01/09/24 Time: 10:36:46

PROJECT INFORMATION

Company: Terra-Dynamics Consulting Inc.
Client: DeHaan Homes Inc.
Location: Caistorvile Rd, West Lincoln
Test Well: MW-1
Test Date: November 24, 2023

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

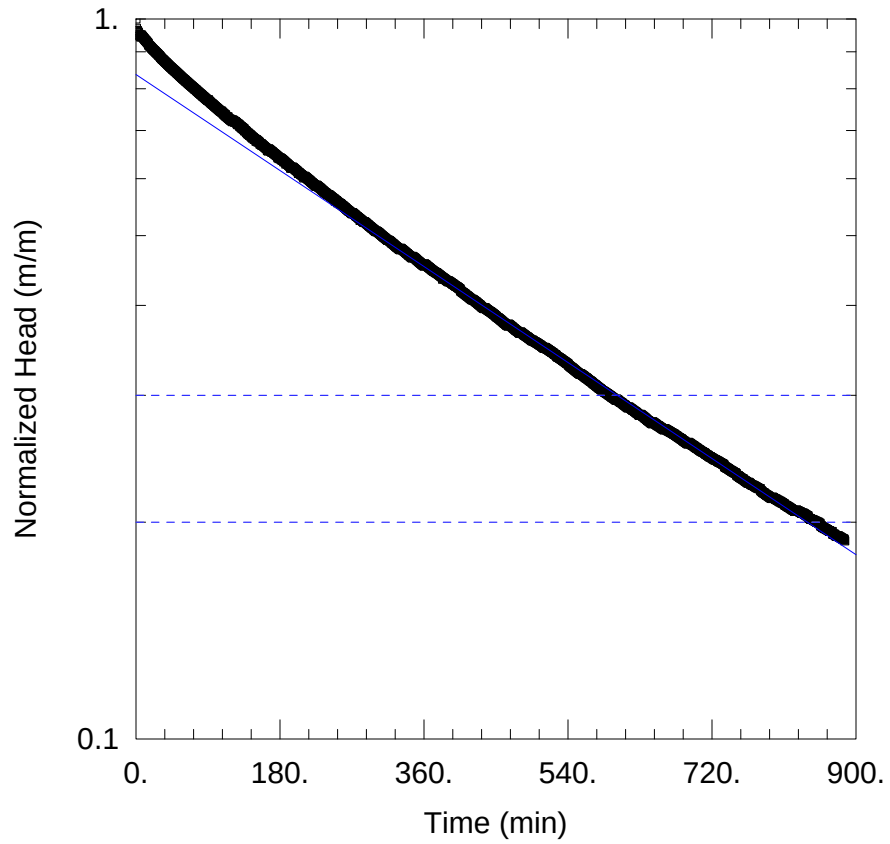
K = 4.281E-9 m/sec
y0 = 2.076 m

AQUIFER DATA

Saturated Thickness: 4.487 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-1)

Initial Displacement: 1.721 m
Total Well Penetration Depth: 4.437 m
Casing Radius: 0.0254 m
Static Water Column Height: 4.487 m
Screen Length: 3.05 m
Well Radius: 0.075 m



BAIL-DOWN TEST

Data Set: C:\...\MW2.aqt
Date: 01/09/24 Time: 10:31:54

PROJECT INFORMATION

Company: Terra-Dynamics Consulting Inc.
Client: DeHaan Homes Inc.
Location: Caistorvile Rd, West Lincoln
Test Well: MW-2
Test Date: November 24, 2023

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 9.388E-9 m/sec
y0 = 1.44 m

AQUIFER DATA

Saturated Thickness: 2.74 m
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-2)

Initial Displacement: 1.72 m
Total Well Penetration Depth: 3.05 m
Casing Radius: 0.0254 m
Static Water Column Height: 2.74 m
Screen Length: 3.05 m
Well Radius: 0.075 m