

September 22, 2021

Mr. Peter Smith
Grow Green Communities
2559 Firelane 3
Port Colborne, ON L3K 5V3

Re: Hydrogeological Assessment – Lots 31, 32 and 33, Firelane 3, Port Colborne, ON

Dear Mr. Smith,

1.0 Introduction, Background Information and Purpose

Terra-Dynamics Consulting Inc. (Terra-Dynamics) respectfully submits this hydrogeological assessment of sewage impacts to support residential development of two lots from combining three existing lots 31, 32 and 33 (Appendix A). Our study assessed the risk to groundwater supplies from the new private sewage systems. The two lots will be located on 0.19 hectares on Firelane 3, Port Colborne (Figure 1, the Site).

The purpose of the assessment is to satisfy the Niagara Region By-law for small, on-site sewage systems:

“where the application relates to a lot less than one (1) hectare in area, and where that lot forms part of more than five continuously connecting lots...the results of a hydrogeological analysis conducted in accordance with the Ministry of the Environment Procedure D-5-4 ‘Technical Guideline for On-Site Sewage Systems – Water Quality Risk Impact Assessment’”

The following documents the hydrogeological assessment of the Site. It is also noted that the Niagara Peninsula Conservation Authority (NPCA) policy 8.2.3.5 (2019) does not allow a septic system within 30 metres of a wetland. Portions of policy 8.2.3.5 are presented below:

“Proposed New Development within 30 metres of a Wetland

a) For new residential development, no new septic systems are permitted within 30m of any wetland.”

2.0 Methodology

The following methodologies were used to investigate the Site:

- A. Submission of a Hydrogeological Study Terms of Reference to Niagara Region and the Township.
- B. Evaluation of Ministry of the Environment, Conservation and Parks (MECP) water well and Ministry of Natural Resources and Forestry (MNRF) well records located within 250 metres of the Site.
- C. Site visits that included (i) identifying nearby existing water supply wells, (ii) observation of soil conditions within existing test pits, (iii) collection of soil samples for grain size and iron and aluminum analyses and (iv) estimation of the depth to bedrock.
- D. A water well and septic system survey of properties within a 100 m radius of the Site (Figure 2).

- E. Assessment of geological information using regional mapping of elevation, sediments/overburden, bedrock, geotechnical records and nearby hydrogeological studies.
- F. Preparation of a description of the hydrogeological setting using physical/geological information and water levels.
- G. Assessment of the aquifer vulnerability completed using (a) provincial procedure D-5-4 (MECP, 1996) and (b) groundwater vulnerability procedures described by the Niagara Peninsula Source Protection Authority (NPSPA) (NPCA, 2013).
- H. A predictive assessment of sewage impacts was completed including a nitrate-nitrogen dilution calculation for the proposed septic systems as per provincial procedure D-5-4 (MECP, 1996).

Terra-Dynamics Consulting Inc. began the assessment once confirmation of the appropriateness of the Terms of Reference was received from Niagara Region (2021).

As the new lots will be provided potable water via cisterns, this report does not include a water supply assessment, but it is recommended that a development agreement be implemented that will indicate water supply by cisterns only.

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

MECP water well records within 250 m of the Site were reviewed and thirteen records identified (Figure 2, Appendix B). The water wells were constructed to take water from the bedrock aquifer for potable water supplies with most (11 of 13) constructed between 1946 and 1970 (Table 1).

The water wells were generally completed between 7-8 metres deep, with the overburden having a median thickness of 3 metres, with the depth to bedrock recorded as from 1.8 to 5.5 metres below ground surface (m BGS). The overburden was generally recorded as sandy however clayey soils were also noted to the southwest and north of the Site close to the 150 m search radius (Table 1, Figure 2).

Water levels were generally at the depth of bedrock or just above. Water well contractor water quality observations were evenly split between sulphurous and fresh at 12 of the 13 wells while observations of water quality were not available at one well.

All but the most recent water well (7232409) constructed in 2014, recorded water well casings that are less than 6 metres (20 feet) (Table 1), requiring 30 metre set-backs from sources of contamination as per the Ontario Building Code (Sharaf, 2013). No Provincial records plot at the Site (Figure 2), and no water wells have been identified at the Site, and historical aerial photos do not suggest previous dwellings at the Site (Brock University, 2021).

Table 1 – MECP Water Well Information System Summary

WWIS	Year Constructed	Overburden	Bedrock Depth (mBGS)	Water Level (mBGS)	Finished Well Depth (mBGS)	Water Quality
6602788	1946	na	2.4*	2.4	9.8	na

WWIS	Year Constructed	Overburden	Bedrock Depth (mBGS)	Water Level (mBGS)	Finished Well Depth (mBGS)	Water Quality
6600852	1955	Sand	3.0*	3.0	4.6	Fresh
6600853	1955	Sand	3.4*	3.0	5.5	Fresh
6600854	1955	Sand	2.1*	3.7	6.1	Fresh
6600855	1956	Sand	3.0*	3.7	6.1	Fresh
6600857	1956	Clay	1.8*	0.9	6.7	Sulphur
6600858	1958	Sand	4.6*	2.7	9.8	Sulphur
6600859	1963	Sand & Gravel	3.4*	2.4	6.1	Fresh
6600860	1963	Sand	5.5*	3.7	8.2	Fresh
6600868	1967	Clay	1.8*	2.4	7.0	Sulphur
6602529	1970	Sand & Gravel	2.4*	3.0	11.6	Sulphur
6603593	1983	Sandy Clay	2.4*	1.2	9.1	Sulphur
7232409	2014	Sand over Gravelly Clay	5.5	4.0	11.6	Sulphur

Notes: * - less than 6.1 m well casing, na – not available/applicable

4.0 Water Supply and Septic System Survey Results

A water supply and septic system survey (Appendix C) was mailed in June 2021 to the fifteen (15) parcels within 100 m of the Site (Figure 2). One survey response was received for 2552 Firelane 3 at which a drilled well and septic system were identified with the drilled well age estimated as around 25 years by the homeowner (Appendix C). Terra-Dynamics staff visited this resident and used a hand-held GPS to map the location of the well. While on-site, Terra-Dynamics were also able to talk with the resident at 2545 Firelane 3 and map their drilled well location (Figure 3). The resident at 2545 indicated their well was drilled “*approximately 2 years ago, to 16 feet, with bedrock encountered at 8 feet and water at 12 feet*”. However, the well did not have a MECP well tag in order to correlate that to the MECP water well information system and document if the well casing was extended into bedrock to 6 metres (20 feet).

5.0 Physical Setting

The Site is within the Oil Mill Creek subwatershed which eventually outlets to Lake Erie approximately 565 metres northeast of the Site (AquaResource Inc. and NPCA, 2009) via the Oil Mill Creek Drain, classified as Department of Fisheries and Oceans Type F intermittent flow (OMAFRA, 2021). The subwatershed drainage divide is approximately 30 metres southeast of the Site (Figure 2) (AquaResource Inc. and NPCA, 2009).

The ground surface slopes to the northwest and the southeast from a topographic high of 178 metres above sea level (m ASL) at the Site (Figure 2). However, most of the Site slopes to the northwest away from Firelane 3 (Figures 3 and 4).

No surface water features are mapped at the Site (NPCA, 2017). However, Lake Erie is approximately 100 metres to the east, with the Site is located between Whiteman’s Point to the southwest and Cedar Bay to the northeast. The Oil Mill Creek Wetland Complex, not provincially significant (MNRF, 2009) is located 23 metres to the west exerting a set-back on sewage disposal system locations at the Site

(Figure 2). The MNRF (2009) have reported the polygons of the Oil Mill Creek Wetland Complex adjacent the Site as swamp with silty clay soils, with the dominant species as silver maple.

5.1 Overburden Geology

The Site is located on modern coastal dune sand (Ontario Geological Survey, 2003), and the dune trends southwest to northeast, parallel to the Lake Erie shoreline (Figure 2). These dunes were formed by eolian (windblown) processes and consist of uniform fine to medium sand, but predominantly fine-grained sand derived from the Lake Erie Beach (Feenstra, 1981). The thickness of the dune sand has been regionally estimated as 3-4 metres (NPSPA, 2013) and is almost totally leached of calcium carbonate to a depth of 3 metres (Feenstra, 1981). The surficial geology northwest of the Site is mapped as silty clay glaciolacustrine deep water deposits, while southeast of the Site as modern beach sand and gravel (Figure 2).

Three test-pits were completed by Dynamic Fusion in late 2019 (Dynamic Fusion, 2021) (Figure 2) to the approximate depths of between 1.4 and 1.5 metres below ground surface for sewage disposal system design. A sample was submitted from Test Pit #2 for grain size analyses (Appendix D). Analysis of the grain size provides a sediment classification of poorly sorted sandy gravel low in fines with a calculated hydraulic conductivity of 1×10^{-3} m/s (Appendix D).

Terra-Dynamics reviewed conditions at these test pits in July 2021 and Test Pits #1 and #3 were still open approximately to 0.9 and 1.1 m BGS. The fine sand from these locations was sampled and submitted for grain size analysis (Appendix D). Analysis of the grain size provides a sediment classification of uniform sand low in fines with a hydraulic conductivity of 3×10^{-4} m/s (Appendix D). The fine-medium sand in the test pits was non-calcareous, i.e. it did not react with hydrochloric acid, and was submitted for laboratory analyses of iron and aluminum (Appendix D). The depth to bedrock was probed in Test Pits 1 and 3 and exceeded 1.9 m BGS.

Although, regional water balance modelling completed for the NPCA estimated the average annual infiltration rates for the Site as 116 mm/year (AquaResource Inc. and NPCA, 2009). This low value is an underestimation as such a value is appropriate for clayey silt (MECP, 1995), but not the sandy gravel to fine/medium sand identified at the Site (Figure 4). Fine to medium sand is reported as having a groundwater recharge rate of 200-250 mm/year (MECP, 1995).

Based upon (i) nearby water well records (Section 3), (ii) topographic contours, (iii) surficial geological mapping, and the (iv) test pit investigations, a Hydrogeologic Schematic for the Site has been prepared (Figure 4). The Site is located on a topographic high, with the high infiltration soils functioning as a recharge area.

5.2 Bedrock Geology

The bedrock underlying the Site is very cherty limestone of the Clarence Member of the Onondaga Formation (Armstrong, 2017). The top of bedrock has been regionally mapped beneath the Site at 175 m ASL (NPSPA, 2013) and is expected to be at depths between 2.5 and 4 metres (Figure 4). This bedrock unit is the aquifer for the local drilled wells.

5.3 Aquifer Vulnerability

The Site has been mapped as on a Highly Vulnerable Aquifer (HVA) by the Niagara Peninsula Source Protection Authority (NPSPA, 2013). This HVA designation was because of the limited thickness and high permeability of the overlying sand and gravel over the bedrock aquifer (WHI, 2005). The information for the Site is summarized in the schematic below, as a conceptual model for the assessment of potential sewage system impacts to groundwater and private wells (Figure 5). Consequently, as a result of the bedrock aquifer being highly vulnerable to at-surface activities (MECP, 1996), a prediction of contaminant attenuation was completed to see if proposed lot sizes are appropriate, as per Step 3 (Figure 6).

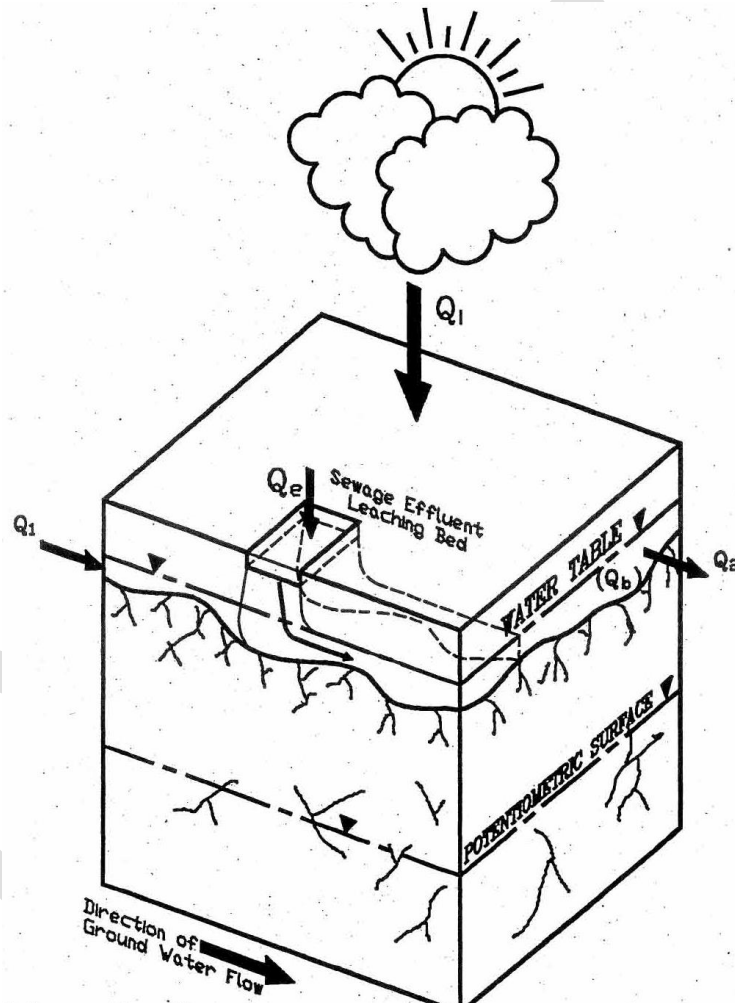


Figure 5 – Dune Sand over Bedrock Aquifer, Subsurface Sewage System (MECP, 1995)

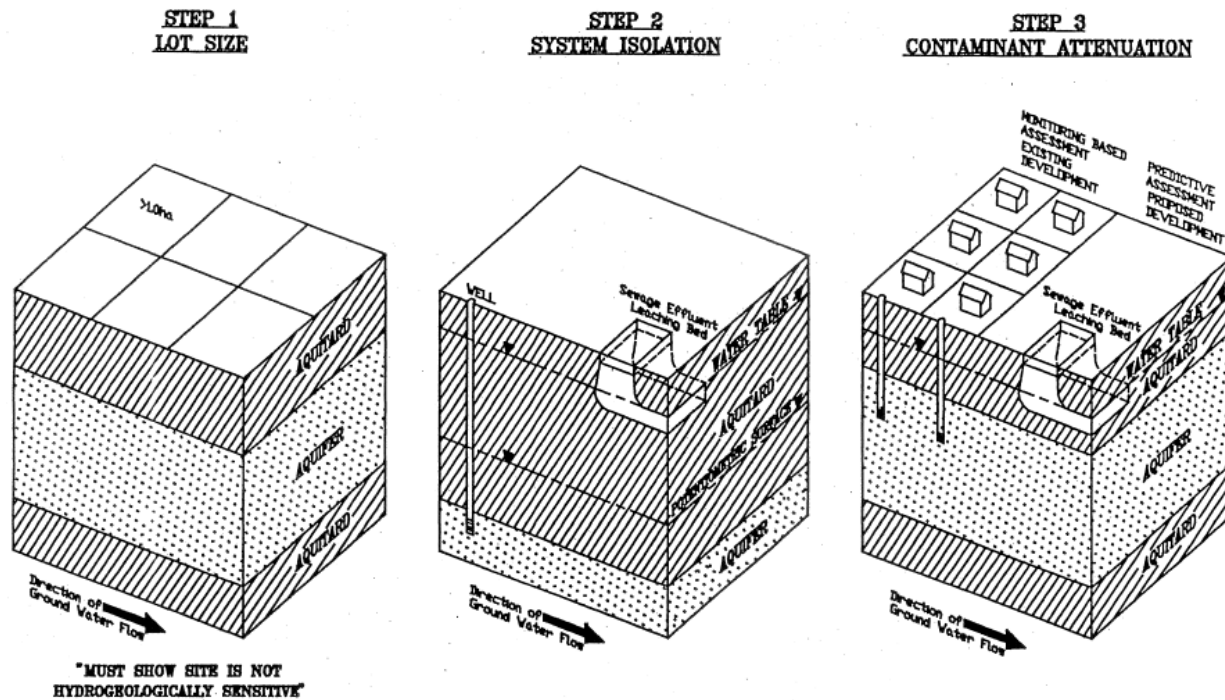


Figure 6 – Three Step Water Quality Assessment Process (MECP, 1995)

6.0 Prediction of Contaminant Attenuation

6.1 Nitrate-Nitrogen Assessment

Using Provincial Procedure D-5-4 (MECP, 1996), an assessment was completed to calculate the per lot property boundary nitrate-nitrogen ($\text{NO}_3\text{-N}$) groundwater concentrations based upon two lots being created from existing lots 31, 32 and 33. The calculations are presented on Table E-1 (Appendix E) and summarized herein:

1. For the purposes of predicting the potential for groundwater impacts concentrations of:
 - a. 40 mg/L nitrate-nitrogen was used for sewage effluent as appropriate for a Class IV system, i.e. without Level IV (or tertiary treatment) nitrogen reduction; and
 - b. 10 mg/L nitrate-nitrogen was used for sewage effluent as appropriate for Level IV (or tertiary treatment) 75% nitrogen reduction
2. An average, not peak, sewage loading rate was used, which was 1,000 Litres/day as appropriate for a three-bedroom home (MECP, 1996).
3. Each entire lot was considered for dilution of the sewage effluent to calculate if 40 mg/L of nitrate-nitrogen ($\text{NO}_3\text{-N}$) is diluted below the drinking water standard of 10 mg/L (i.e. Safe Drinking Water Act, 2002).
4. Infiltration rates for sewage effluent dilution was based upon grain-size analyses from test pitting (Section 5.1).
5. Dilution area reduced by 0.07 hectares to account for two future building footprints (Dynamic Fusion, 2019)

Nitrate-nitrogen concentrations for a standard Class 4 septic system will exceed the 10 mg/L criterion (Table E-1). However, with nitrogen effluent reduction treatment of 75% which corresponds with a sewage effluent nitrogen concentration of 10 mg/L or less, there is sufficient infiltration dilution. The 75% nitrogen effluent reduction criterion corresponds with the CAN-BNQ 3680-600 standard of N-II (75%) total nitrogen reduction (Ministry of Municipal Affairs and Housing, 2011).

6.2 Phosphorus Considerations

The physical setting should be sufficient to attenuate sewage effluent phosphorus before any surface water discharge. This conclusion is based upon meeting the City of Hamilton's criteria (2020) for phosphorus attenuation:

- (i) Non-calcareous soils (Section 5.1);
- (ii) Iron and aluminum >1.5% (Appendix D); and
- (iii) Estimated 2.5 m of separation from the sewage disposal distribution piping to bedrock aquifer, when positioned 10 m from northwest Site boundary (Dynamic Fusion, 2019)

As stated by Roberston et al (1998) in their review of phosphate mobility and persistence in 10 Septic System Plumes “....smaller scale phosphate plumes (<3 m in length) are present at ...sites on noncalcareous sands”.

6.3 Effluent Treatment

Niagara Region is the local approval authority within the City of Port Colborne for Part 8 Ontario Building Code septic system permits and allows the use of Level IV/Tertiary treatment to improve septic effluent quality.

In Ontario, certification of systems for nitrogen removal had begun through the application of the CAN-BNQ 3680-600 standard (Ministry of Municipal Affairs and Housing, 2011). Some CAN-BNQ certified systems are listed on the Ontario On-site Wastewater Association (<https://www.oowa.org/consumer-information/options-onsite-residential-wastewater-treatment-technologies/>). However, there are also other systems which have test data showing system performance of reducing effluent nitrogen to greater than 75% nitrate-nitrogen such as Bionest with a DE-OX unit has a reported total nitrogen effluent quality of 6 mg/L (Gauthier, 2019), or a Waterloo Biofilter Unit with WaterNOx™ (an advanced nitrogen removal filter) is expected to be less than 5 mg/L total nitrogen (<https://waterloo-biofilter.com/products/nutrient-removal/nitrogen-removal-products/waternox/>). Systems having test data showing performance of reducing effluent nitrogen may be acceptable for use in Niagara Region (2020).

6.4 Other Considerations

Development agreements should be completed that cisterns will be used for water supplies on the lots.

Future sewage system effluent disposal locations (e.g. raised leaching or filter bed) are constrained by the Part 8 Ontario Building Code set-back of 15 metres from a cistern (referred to as a reservoir in the code).

Future sewage system effluent disposal locations (e.g. filter bed) are also constrained by the Part 8 Ontario Building Code set-back of 30 metres from wells without casing to 6 metres (20 feet). Consequently, the existing water supply wells at 2552 and 2545 Fireline 3, exert 30 m set-backs onto development at the Site, requiring slightly different lot areas for the two new lots of 840 m² and 1060 m² (Figure 3).

7.0 Summary of Recommendations

The two proposed lots can be safely serviced by private sewage systems with the implementation of the following recommendations:

1. All lots be equipped with sewage systems that provide at least 75% nitrogen reduction of septic sewage effluent Level IV/tertiary treatment;
2. Future sewage disposal systems observe the required Ontario Building Code set-backs from water supplies as shown on Figure 3;
3. Future sewage disposal systems observe the required NPCA set-backs from wetlands; and
4. Development agreement should be completed indicating water supply will be by cistern(s).

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.

DRAFT FOR DISCUSSION

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

Attachments

Figure 1 - Location of Site
Figure 2 – Regional Details
Figure 3 – Site Details
Figure 4 – Hydrogeologic Cross-Section
Appendix A – Lot Surveys
Appendix B – MECP Water Well Logs
Appendix C - Water Use and Septic System Surveys
Appendix D – Laboratory Analyses
Appendix E – Nitrogen Dilution Calculations

8.0 References

AquaRsource Inc. and Niagara Peninsula Conservation Authority, 2009. Water Availability Study for the Lake Erie North Shore Watershed Plan Area, Niagara Peninsula Source Protection Area.

Armstrong, D.K., 2017. Paleozoic geology of the Welland-Fort Erie area, southern Ontario. Ontario Geological Survey, Preliminary Map P.3811, scale 1:50 000.

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Dynamic Fusion, 2019. Septic Design for Peter Smith, Lots 31, 32 and 33.

Feenstra, B.H., 1981. Quaternary Geology and Industrial Minerals of the Niagara-Welland Area, Southern Ontario, Ontario Geological Survey OFR 5361, 260 p.

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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, 2019. NPCA Policy document: Policies for the administration of Ontario Regulation 155/06 and the Planning Act.

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

Niagara Peninsula Conservation Authority, 2010. Ground surface contours.

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

Niagara Region, 2021. Email from P. Lambert, Director of Infrastructure Planning & Development Engineering.

Niagara Region, 2020. Email from P. Lambert, Director of Infrastructure Planning & Development Engineering.

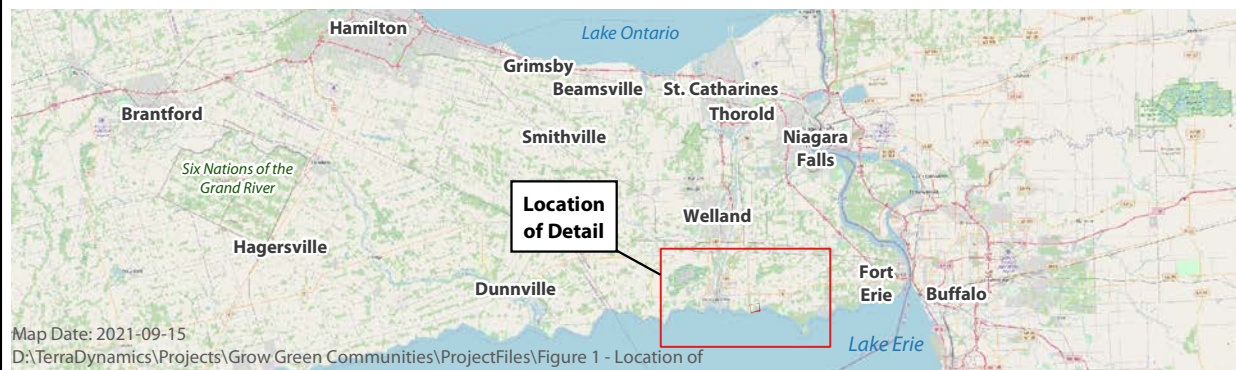
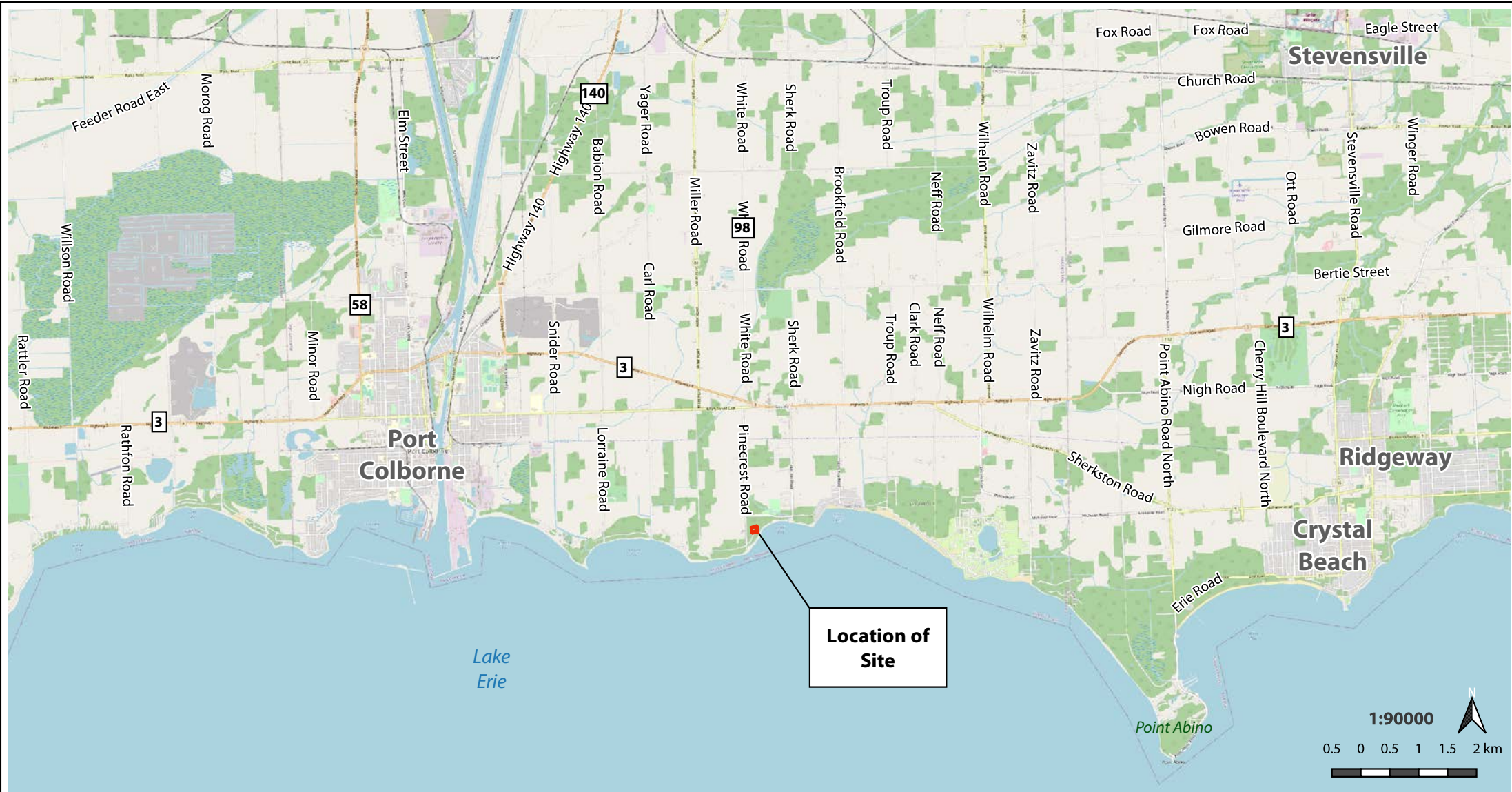
Niagara Region, 2014. Existing 2014 Consolidated Regional Official Plan.

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

Robertson, W.D., Schiff, S.L. and Ptacek, C.J., 1998. Review of Phosphate Mobility and Persistence in 10 Septic System Plumes. GROUND WATER, Vol.36, No. 6, November – December 1998.

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

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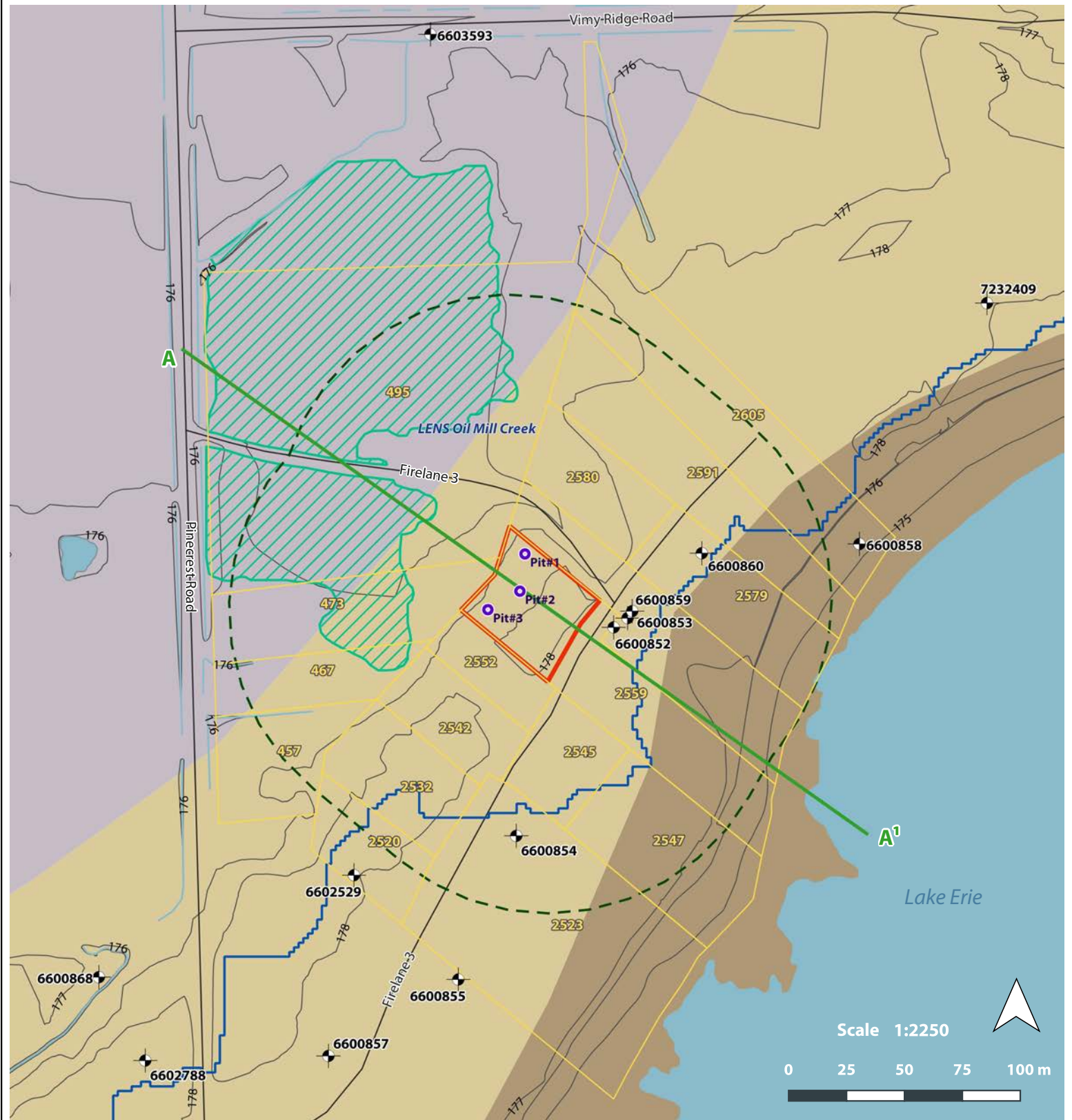
Location of Site

**Hydrogeological Assessment, Lots 31, 32 and 33,
Firelane 3, Port Colborne, ON**



Terra-Dynamics Consulting Inc.

Figure 1



- MECP Water Well Record within 250m of Site
- Test Pits
- Line of Hydrogeologic Cross-Section A-A'
- Site
- 100m Buffer of Site
- Parcels Within 100m of Site
- Ground Surface Contour (1m)
- Oil Mill Creek Wetland Complex
- Subwatershed Boundary
- Watercourse
- Waterbody
- Surficial Geology**
 - Glaciolacustrine deep water deposits
 - Modern beach
 - Modern coastal dune sand

Regional Details

Hydrogeological Assessment, Lots 31, 32 and 33, Firelane 3, Port Colborne, ON



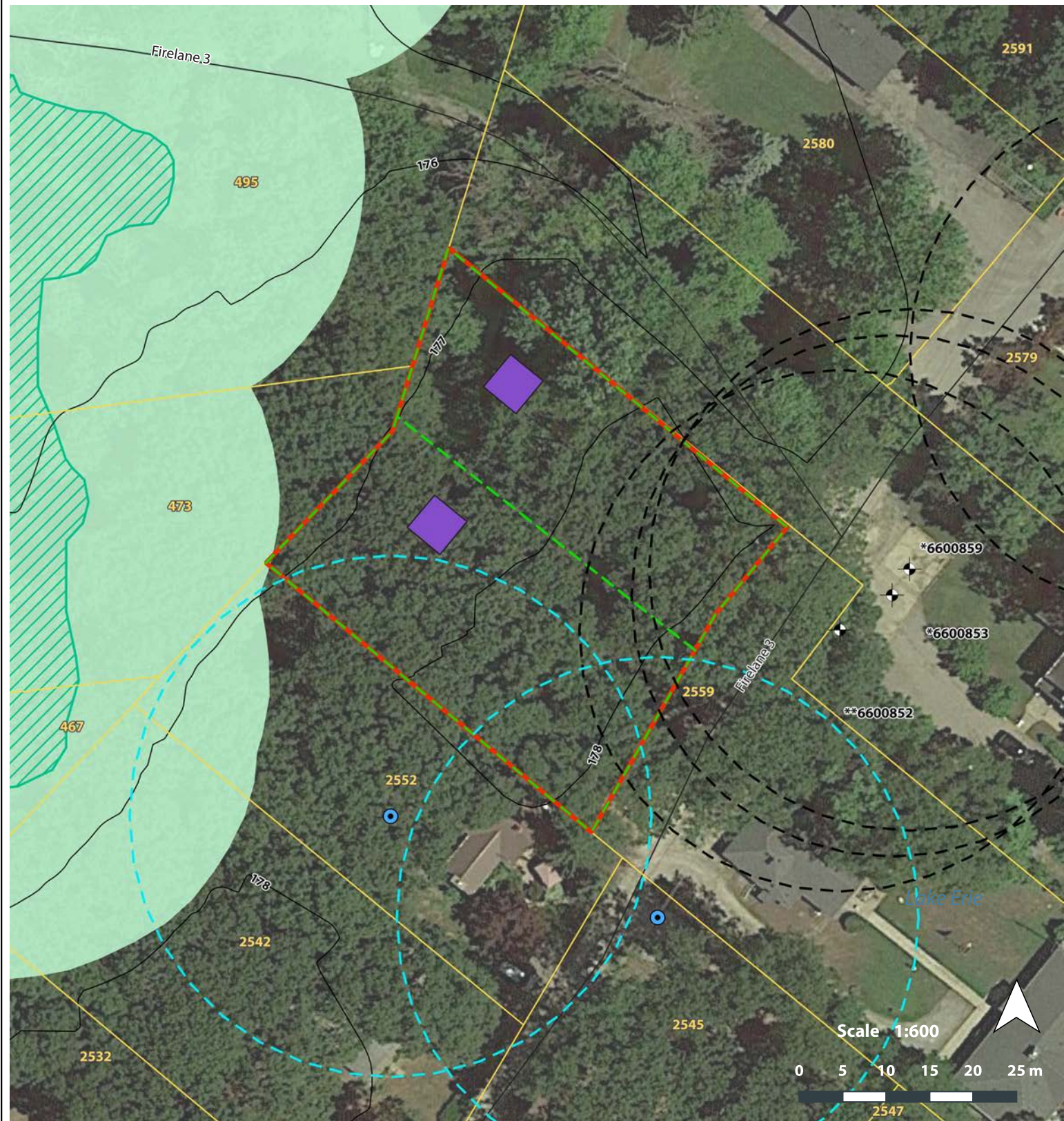
Terra-Dynamics Consulting Inc.

**Prepared for:
Grow Green Communities**

Figure 2

References: Ministry of Environment, Conservation and Parks: Drilled Water Wells, 2021. Northern Development, Mines, Natural Resources and Forestry: OWES Wetland, 2021. Ontario Geological Survey: Surficial Geology. Niagara Peninsula Conservation Authority: Watercourse, 1:2000. Waterbody 1:2000, Subwatershed 1:2000, Contours (1m) 2010.

Map Date: 2021-09-15 D:\TerraDynamics\Projects\Grow Green Communities\ProjectFiles\Figure 2 - Regional Details.qgz



- MECP Water Well Record
* - locational accuracy 100-300 m
** - locational accuracy unknown
- 30m Buffer of MECP Water Well
- Private Well
- 30m Buffer of Private Well
- Site
- Proposed Lot Fabric
- Parcels Within 100m of Site
- Sewage Disposal Distribution Piping
- Oil Mill Creek Wetland Complex
- 30m Buffer of Oil Mill Creek Wetland Complex
- Ground Surface Contour (1m)

Site Details

Hydrogeological Assessment, Lots 31, 32 and 33, Firelane 3, Port Colborne, ON



Terra-Dynamics Consulting Inc.

**Prepared for:
Grow Green Communities**

Figure 3

References: Ministry of Environment, Conservation and Parks: Drilled Water Wells, 2021. Northern Development, Mines, Natural Resources and Forestry: OWES Wetland, 2021. Niagara Peninsula Conservation Authority: Watercourse, 1:2000. Waterbody 1:2000, Subwatershed 1:2000, Contours (1m) 2010.

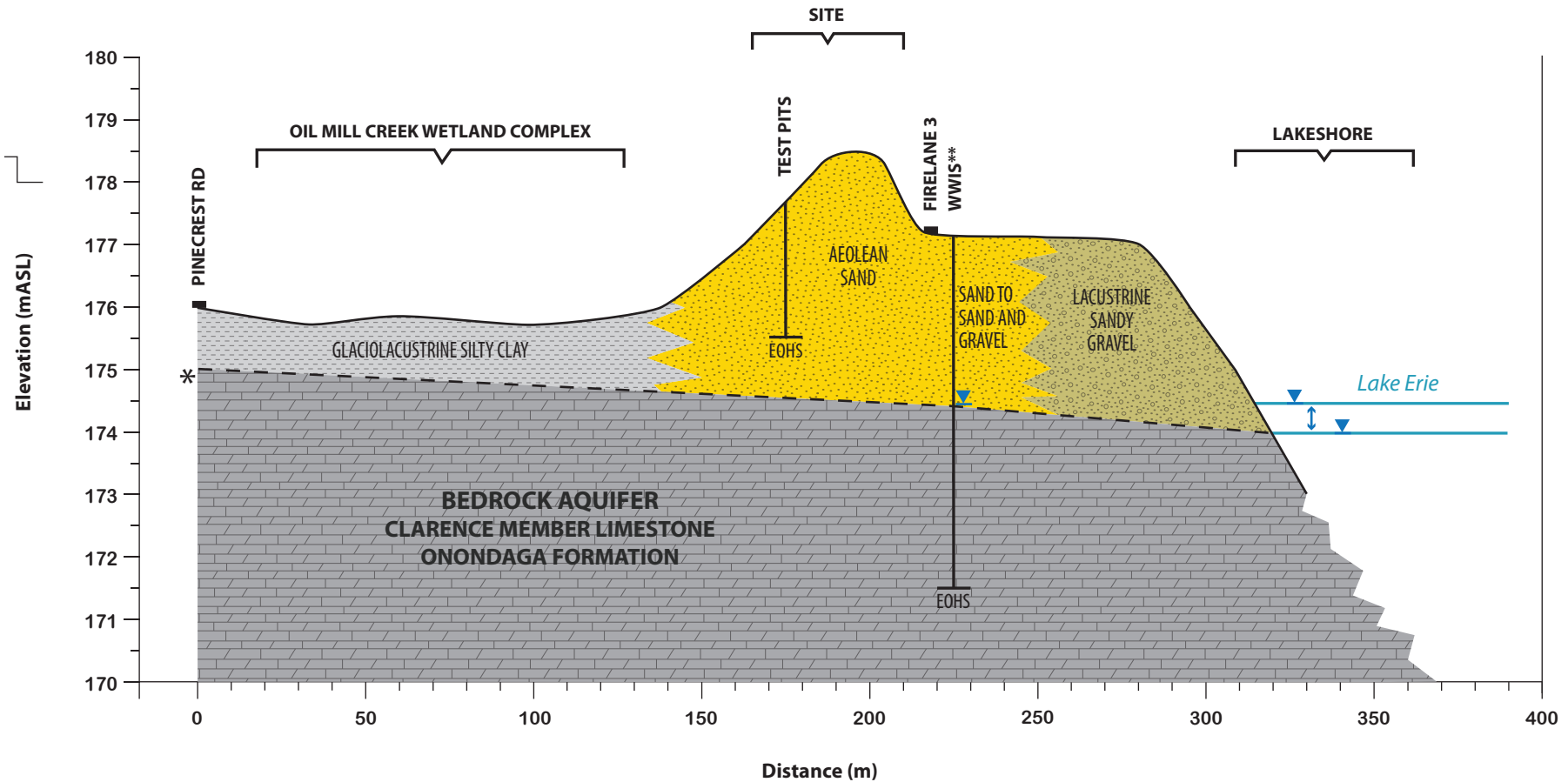
Map Date: 2021-09-16 D:\TerraDynamics\Projects\Grow Green Communities\ProjectFiles\Figure 3 - Site Details.qgz

NORTHWEST

A

A'

SOUTHEAST



AVERAGE WATER LEVELS



TOP OF BEDROCK

EOHS

END OF HOLES



TOP OF BEDROCK AS PER NPSA (2013)

ADJACENT MECP WWIS 660852/6600853/6600859
AVERAGE INFORMATION

See Figure 2 for line of hydrogeologic cross-section

Hydrogeologic Cross-Section A-A'

Hydrogeological Assessment, Lots 31, 32
and 33, Firelane 3, Port Colborne, ON

Terra-Dynamics Consulting Inc.

Prepared For:
Grow Green Communities

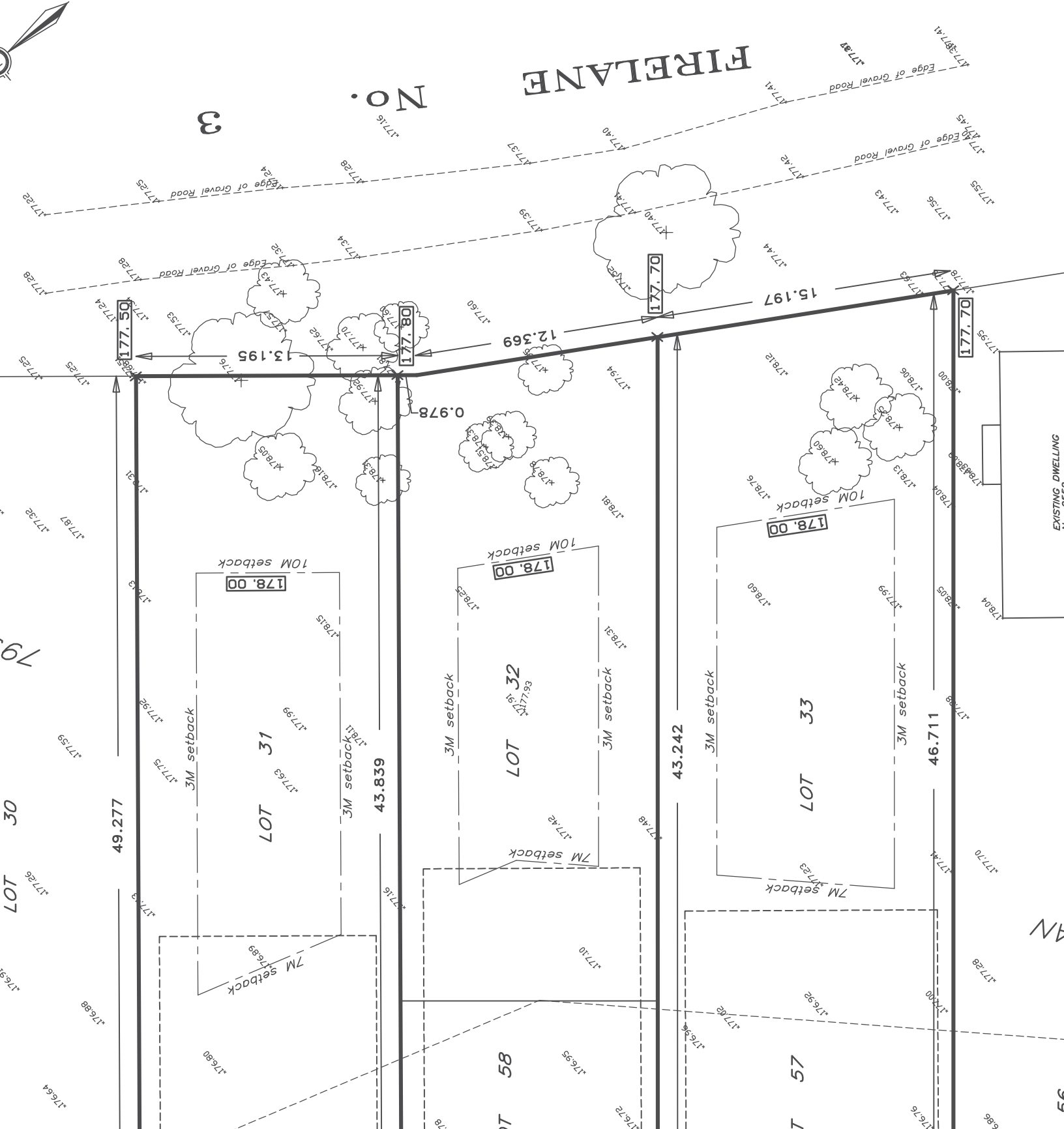
Figure 4

Appendix A

Lot Surveys

BUILDER:	
OWNER:	
LEGEND	
EXISTING	
PROPOSED	
FINISHED	
DRAINAGE	
SUBDIVISION	
BENCH MARK	

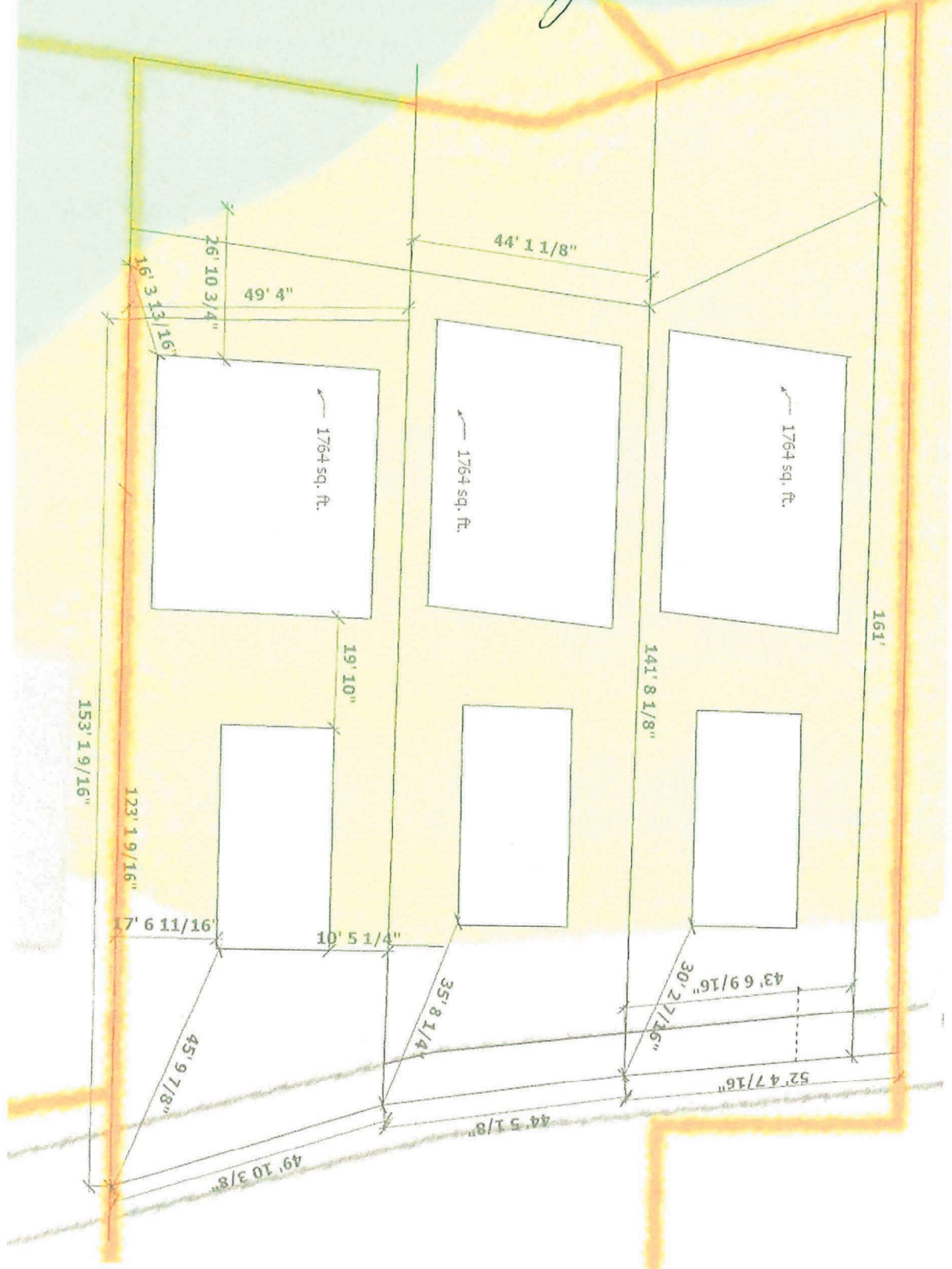
<p>P</p> <p>I HEREBY CONFORM TO THIS</p> <p>PHILIP</p> <p>ACCEPTED</p>	<p>AS CO</p> <p>I HEREBY SHOWN, A CONFORMS TO THIS A</p>
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NO OBJECTION

PLBPC202000090
FILE

DATE Jan. 29 2020



Sent with ProtonMail Secure Email.

----- Original Message -----

On Tuesday, December 3, 2019 11:46 AM, <davidschulz@portcolborne.ca> wrote:

> Hi Peter,

>

> Yes, these are all existing lots on registered plan 40, as attached. You own Lots 21, 22, 31, 32, 33, 57, 58 and 59 and they can be legal separated

> without the need of any planning approvals.

>

> As for the zoning, I spoke with Dan who said that as long as you can build within the requirements of the LR zone, you will not need to change the

> zoning of the properties.

>

> Hope this is helpful.

>

> Regards,

>

> David Schulz, BURPI

> Planner

> Planning and Development Department

>

> City of Port Colborne

> 66 Charlotte Street

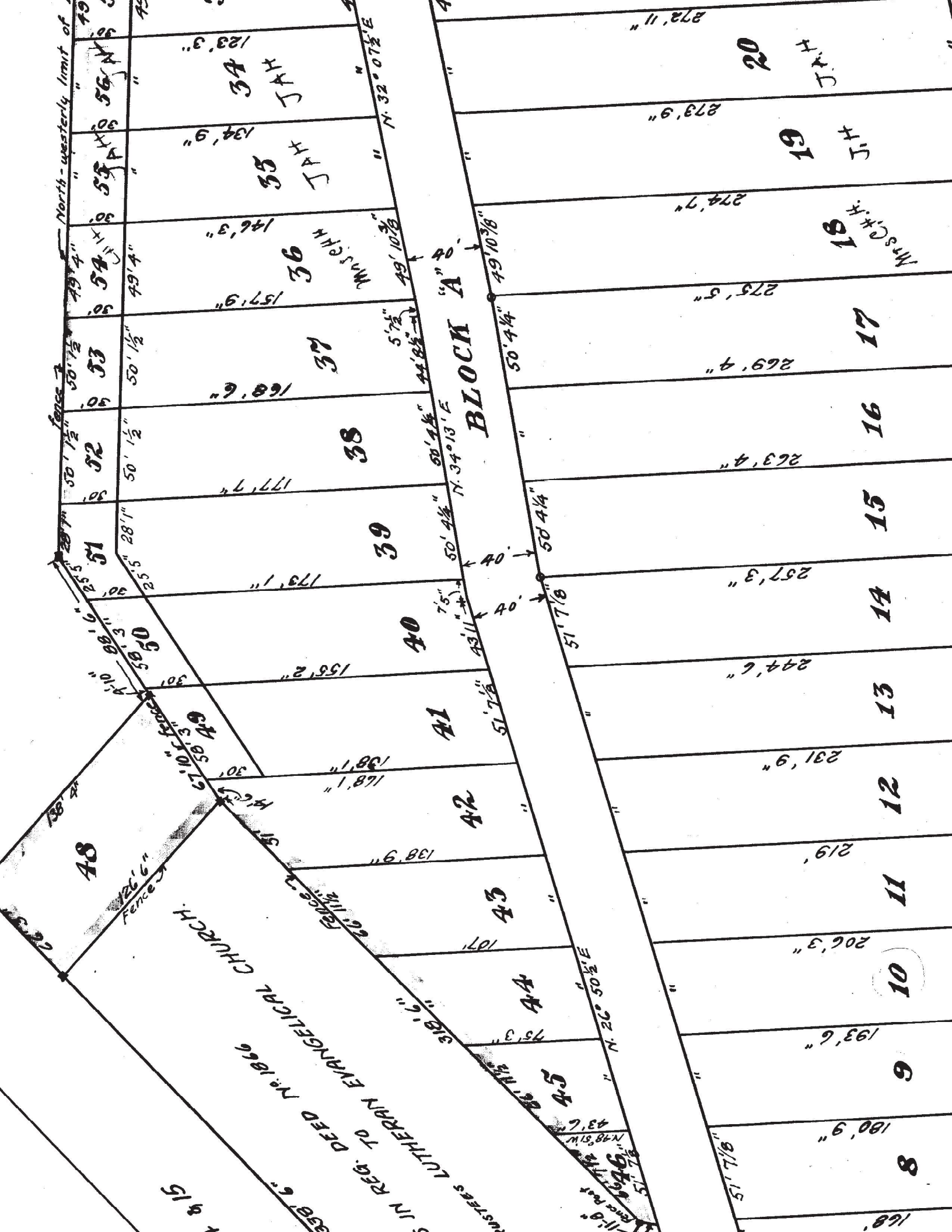
> Port Colborne ON L3K 3C8

> (905) 835-2901 x. 202

> Serving you to create an even better community

>

> (See attached file: H-40.tif)



Appendix B

MECP Water Well Logs

Com. 1
Lot 14



The Water-well Drillers Act, 1954
Department of Mines

66 № 852

RECEIVED

JUN 14 1955

**GEOLOGICAL BRANCH
DEPARTMENT OF MINES**

Water-Well Record

County or Territorial District... Welland Township, Village, Town or City... Humberstone Twp

Village, Town or City).....

Address P.R.I. Fort Colborne

Date completed 11/1/77
(day) (month) (year)

Pipe and Casing Record

Pumping Test

Casing diameter(s)	5"	Static level	10 ft
Length(s)	10 ft	Pumping rate	4 gal per min
Type of screen	Pumping level	10 ft
Length of screen	Duration of test	half hour

Well Log

Water Record

[illegible]

For what purpose(s) is the water to be used?

Is water clear or cloudy?.....clear.....

Is well on upland, in valley, or on hillside?.....

Drilling firm Raymond Schuler

Address 222-3

Name of Driller *Sam*

Address

Licence Number.....362.....

I certify that the foregoing
statements of fact are true.

Date: June 13/55

Signature of Licensee

Location of Well

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

Plan 42
Lots 65 + 66
Well falls close to line between
lots 65 + 66

1000 ft. E. of Pine Creek Rd.
200 ft. S. of Private Rd.
CSS.58



S.

Basin 123



66 № 857

Department of Mines

Water-Well Record

Address 441 East Calumet

(year)

Pumping Test

Duration of test 1 hour

Water Record

Kind of water
(fresh, salty,
or sulphur)

Play
H. Long

0

$$\begin{array}{r} 6 \\ 22 \end{array}$$

22/4

1988

sulphur

Signature of Licensee

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

260 *ph*

Park Road

UTM Z EC 5 R NElev. 4 R 0 5 8 5Basin 2 3

County or District

Con. 1

Lot

The Ontario Water Resources Commission Act

WATER WELL RECORD

Township, Village, Town or City

Date completed

2 3

(day)

PORT COLBORNE
Humberstone by
July 6.3
month year

Address

R.R. 1 Port Colborne

Casing and Screen Record

Inside diameter of casing 6 "Total length of casing 11 ft.

Type of screen

Length of screen

Depth to top of screen

Diameter of finished hole 5 1/2

Pumping Test

Static level 8 ft.Test-pumping rate 6 G.P.M.Pumping level 15 ft.Duration of test pumping 1 1/2 hrsWater clear or cloudy at end of test clearRecommended pumping rate 2 G.P.M.with pump setting of 18 feet below ground surface

Well Log

Water Record

Overburden and Bedrock Record

From
ft.To
ft.Depth(s) at
which water(s)
foundKind of water
(fresh, salty,
sulphur)Sand + gravel
flint01120fresh

For what purpose(s) is the water to be used?

cottage

Is well on upland, in valley, or on hillside?

upland

Drilling or Boring Firm

Raymond L. Schooley

Address

R.R. 3
Port Colborne

Licence Number

845

Name of Driller or Borer

Same

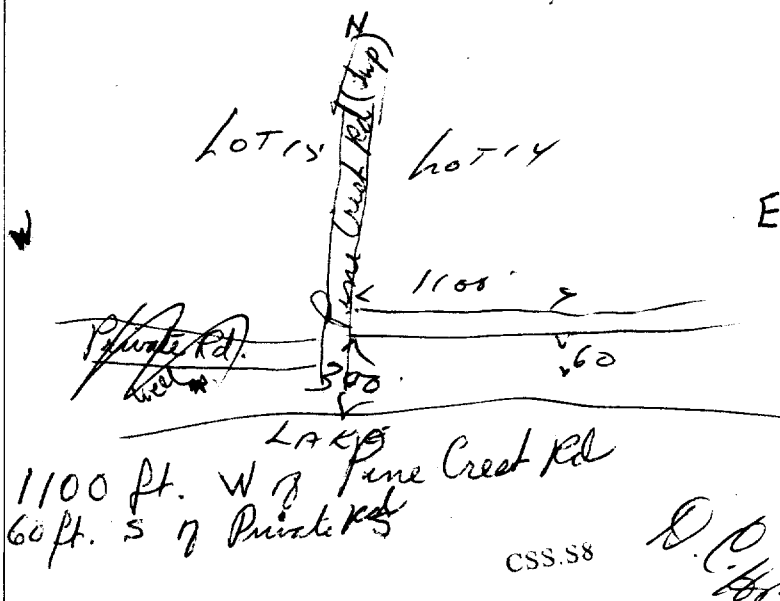
Address

Date July 29/63Raymond L. Schooley
(Signature of Licensed Drilling or Boring Contractor)

Form 7 10M-62-1152

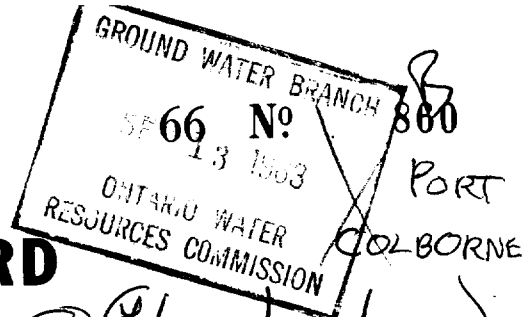
OWRC COPY

Location of Well

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

CSS.58

D.P.
Hos



Con 1 Lot Par

WATER WELL RECORD

RP1 Fort Colborne

Pumping Test

Static level 12 ft.
Test-pumping rate 10 G.P.M.
Pumping level 15 ft.
Duration of test pumping 1½ hrs.
Water clear or cloudy at end of test clear
Recommended pumping rate 2 G.P.M.
with pump setting of 24 feet below ground surface

Water Record

Kind of water
(fresh, salty,
sulphur)

sand
flint

0	18
18	27

27	fresh
----	-------

O W R C COPY

Location of Well

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

W LOT 15' 100' 1200' Pine Crest Rd (Dup) D
Pine Crest Rd.
300' Lake Erie
1/100 ft E 1/2 Pine Crest Rd
65 ft S 7/8 Pine Crest Rd
CSS.S8

CSS.S8

UTM Z E455 R NElev. 9 R 0579 The Ontario Water Resources Commission ActBasin 23 Welland
County or DistrictCon. 1 Lot part 7 15 HB Township, Village, Town or City Thurberston
Date completed 4 Aug 67
(day month year)Address RR1 Port Colborne

66 No 868

PORT COLBORNE

WATER WELL RECORD

Casing and Screen Record

Inside diameter of casing 6 in
Total length of casing 7 ft
Type of screen
Length of screen
Depth to top of screen
Diameter of finished hole 5 1/2

Pumping Test

Static level 8 ft
Test-pumping rate 10 G.P.M.
Pumping level 8 ft
Duration of test pumping 1 1/2 hrs
Water clear or cloudy at end of test cloudy
Recommended pumping rate 2 G.P.M.
with pump setting of 20 feet below ground surface

Well Log

Water Record

Overburden and Bedrock Record

From
ft.To
ft.Depth(s) at
which water(s)
foundKind of water
(fresh, salty,
sulphur)clay
flint0
66
2323 ftsulphur ✓

For what purpose(s) is the water to be used?

Is well on upland, in valley, or on hillside?

Drilling or Boring Firm

Raymond L. SchooleyAddress RR3
Port ColborneLicence Number 2454Name of Driller or Borer same

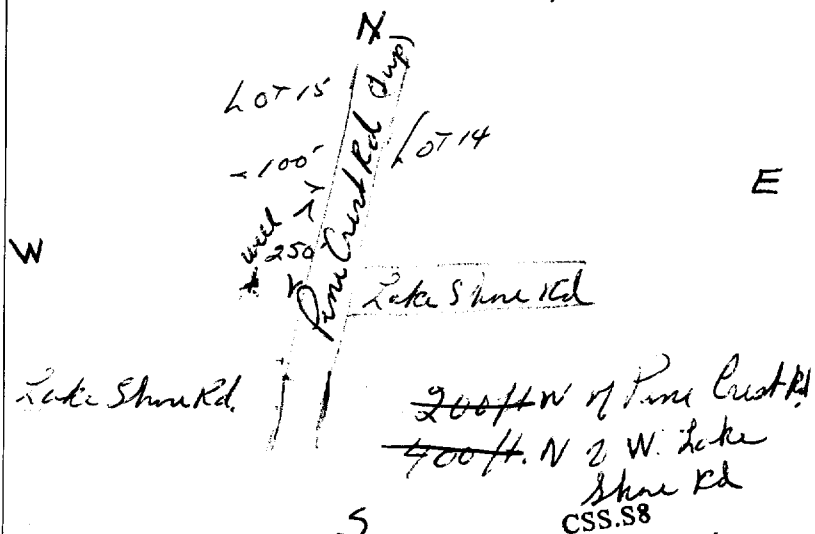
Address

Date Sept 2/67Raymond L. Schooley
(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 is now in Step Three of the [Roadmap to Reopen \(/page/reopening-ontario\)](/page/reopening-ontario). Follow the [restrictions and public health measures \(https://covid-19.ontario.ca/public-health-measures\)](https://covid-19.ontario.ca/public-health-measures).



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 \(https://data.ontario.ca/dataset/well-records\)](https://data.ontario.ca/dataset/well-records).

[Go Back to Map \(\)](#)

Well ID

Well ID Number: 6602529

Well Audit Number:

Well Tag Number:

This table contains information from the original well record and any subsequent updates.

Well Location

Address of Well Location

Township	PORT COLBORNE CITY (HUMBERSTONE)
Lot	014
Concession	CON 01
County/District/Municipality	NIAGARA (WELLAND)
City/Town/Village	
Province	ON
Postal Code	n/a
UTM Coordinates	NAD83 — Zone 17 Easting: 648355.00 Northing: 4748183.00
Municipal Plan and Sublot Number	
Other	

Overburden and Bedrock Materials Interval

General Colour	Most Common Material	Other Materials	General Description	Depth From	Depth To
	MSND	GRVL		0 ft	8 ft
	LMSN			8 ft	38 ft

Annular Space/Abandonment Sealing Record

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

Method of Construction & Well Use

Method of Construction	Well Use
Cable Tool	
	Domestic

Status of Well

Water Supply

Construction Record - Casing

Inside Diameter	Open Hole or material	Depth From	Depth To
6 inch	STEEL		10 ft
	OPEN HOLE		38 ft

Construction Record - Screen

Outside Diameter	Material	Depth From	Depth To

Well Contractor and Well Technician Information

Well Contractor's Licence Number: 5405

Results of Well Yield Testing

After test of well yield, water was	CLOUDY
-------------------------------------	--------

If pumping discontinued, give reason	
Pump intake set at	
Pumping Rate	20 GPM
Duration of Pumping	1 h:30 m
Final water level	10 ft
If flowing give rate	
Recommended pump depth	25 ft
Recommended pump rate	5 GPM
Well Production	BAILER
Disinfected?	

Draw Down & Recovery

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

25		25
30	10 ft	30
40		40
45	10 ft	45
50		50
60	10 ft	60

Water Details

Water Found at Depth	Kind
36 ft	Sulphur

Hole Diameter

Depth From	Depth To	Diameter

Audit Number:

Date Well Completed: June 27, 1970

Date Well Record Received by MOE: July 17, 1970

Related

How to use a Ministry of the Environment map (/page/how-use-ministry-environment-map#wells)

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

[about Ontario \(https://www.ontario.ca/page/about-ontario\)](https://www.ontario.ca/page/about-ontario).

[accessibility_ \(https://www.ontario.ca/page/accessibility\)](https://www.ontario.ca/page/accessibility).

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ROUGH, CITY, TOWN, VILLAGE, ~~SECTION~~, CON., BLOCK, TRACT, SURVEY, ETC

101 3-11

DATE COMPLETED

48-53

DAY 13 MO 6 YR 46

21

U I L

EASTING
6 48 250

NORTHING
47.47880

RC.	ELEVATION
15	195.70

凡そ

BASIN CODE
23

1

1

1

348

1

1 0

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

[illegible]

31

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER			
10-13	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	4 <input type="checkbox"/> MINERAL	14
	2 <input type="checkbox"/> SALTY	4 <input type="checkbox"/> MINERAL		
15-18	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	4 <input type="checkbox"/> MINERAL	19
	2 <input type="checkbox"/> SALTY	4 <input type="checkbox"/> MINERAL		
20-23	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	4 <input type="checkbox"/> MINERAL	24
	2 <input type="checkbox"/> SALTY	4 <input type="checkbox"/> MINERAL		
25-28	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	4 <input type="checkbox"/> MINERAL	29
	2 <input type="checkbox"/> SALTY	4 <input type="checkbox"/> MINERAL		
30-33	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	4 <input type="checkbox"/> MINERAL	34
	2 <input type="checkbox"/> SALTY	4 <input type="checkbox"/> MINERAL		

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET	
			FROM	TO
10-11 6	<input checked="" type="checkbox"/> STEEL <input type="checkbox"/> GALVANIZED <input type="checkbox"/> CONCRETE <input type="checkbox"/> OPEN HOLE	12	0	8
17-18 6	<input type="checkbox"/> STEEL <input type="checkbox"/> GALVANIZED <input type="checkbox"/> CONCRETE <input checked="" type="checkbox"/> OPEN HOLE	19	8	32 $\frac{1}{2}$
24-25	<input type="checkbox"/> STEEL <input type="checkbox"/> GALVANIZED <input type="checkbox"/> CONCRETE <input type="checkbox"/> OPEN HOLE	26		27-30

SCREEN	STIFFNESS OF OPENING (SLOF NO.1)	31-33	DIAMETER	34-36	LENGTH	37-39
	INCHES			FEET		
	MATERIAL AND TYPE			DEPTH TO TOP OF SCREEN	41-44	FEET

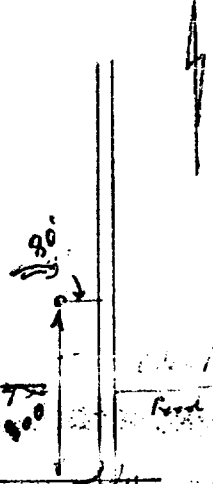
61 PLUGGING & SEALING RECORD

DEPTH SET AT - FEET		MATERIAL AND TYPE	CEMENT GROUT LEAD PACKER, ETC.
FROM	TO		
10-13	14-17		
18-21	22-25		
26-29	30-33	60	

PUMPING TEST	PUMPING TEST METHOD		10	PUMPING RATE		21-18	DURATION OF PUMPING	
	1 <input type="checkbox"/> PUMP 2 <input type="checkbox"/> SAILER			GPM			15-18 HOURS	17-18 MINS
	STATIC LEVEL	WATER LEVEL END OF PUMPING	25	WATER LEVELS DURING			1 <input type="checkbox"/> PUMPING 2 <input type="checkbox"/> RECOVERY	
	19-21	22-24	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES		
	8:45		26-28	29-31	32-34	35-37		
	FEET	FEET	FEET	FEET	FEET	FEET		
	IF FLOWING, GIVE RATE		38-41	PUMP INTAKE SET AT		WATER AT END OF TEST		42
	GPM				FEET		1 <input type="checkbox"/> CLEAR 2 <input type="checkbox"/> CLOUDY	
	RECOMMENDED PUMP TYPE		RECOMMENDED PUMP SETTING		43-45	RECOMMENDED PUMPING RATE		46-49 GPM
	<input type="checkbox"/> SHALLOW <input type="checkbox"/> DEEP				FEET			
50-53								

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS

FINAL STATUS OF WELL	54	1 <input type="checkbox"/> WATER SUPPLY 2 <input checked="" type="checkbox"/> OBSERVATION WELL 3 <input type="checkbox"/> TEST HOLE 4 <input type="checkbox"/> RECHARGE WELL	5 <input type="checkbox"/> ABANDONED, INSUFFICIENT SUPPLY 6 <input type="checkbox"/> ABANDONED, POOR QUALITY 7 <input type="checkbox"/> UNFINISHED
	55-56	1 <input type="checkbox"/> DOMESTIC 2 <input type="checkbox"/> STOCK 3 <input type="checkbox"/> IRRIGATION 4 <input type="checkbox"/> INDUSTRIAL <input type="checkbox"/> OTHER	5 <input type="checkbox"/> COMMERCIAL 6 <input type="checkbox"/> MUNICIPAL 7 <input type="checkbox"/> PUBLIC SUPPLY 8 <input type="checkbox"/> COOLING OR AIR CONDITIONING <input checked="" type="checkbox"/> NOT USED
METHOD OF DRILLING	57	1 <input checked="" type="checkbox"/> CABLE TOOL 2 <input type="checkbox"/> ROTARY (CONVENTIONAL) 3 <input type="checkbox"/> ROTARY (REVERSE) 4 <input type="checkbox"/> ROTARY (AIR) 5 <input type="checkbox"/> AIR PERCUSSION	6 <input type="checkbox"/> BORING 7 <input type="checkbox"/> DIAMOND 8 <input type="checkbox"/> JETTING 9 <input type="checkbox"/> GRIVING

CONTRACTOR	NAME OF WELL CONTRACTOR		LICENCE NUMBER
	ADDRESS		
	NAME OF DRILLER OR BORER		LICENCE NUMBER
	SIGNATURE OF CONTRACTOR		SUBMISSION DATE DAY _____ MO _____ YR _____

OFFICE USE ONLY

DATA SOURCE	58 CONTRACTOR	59-62 DATE RECEIVED	63-64
DATE OF INSPECTION		INSPECTOR	
REMARKS: This record created for the purpose of giving this road a C-2 P-2 rating. H. B. Smith			



The Ontario Water Resources Act

660359.3

MUNICIP

CON

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COUNTY OR DISTRICT

TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE

CON ~~BLOCK TRACT SURVEY ETC~~

LOT 25-27

55 Vimy Rd RR#1 Port Colborne

DATE COMPLETED 48-53
DAY 17 MO Sept YR 83

HING RC ELEVATION RC BASIN CODE II III IV

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

[illegible]

31

32

41 WATER RECORD

WATER FOUND AT - FEET		KIND OF WATER			
28	10-13	1 <input type="checkbox"/> FRESH	3 <input checked="" type="checkbox"/> SULPHUR	1A	
		2 <input type="checkbox"/> SALTY	4 <input type="checkbox"/> MINERAL		
	15-18	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	1B	
		2 <input type="checkbox"/> SALTY	4 <input type="checkbox"/> MINERAL		
	20-23	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	2A	
		2 <input type="checkbox"/> SALTY	4 <input type="checkbox"/> MINERAL		
	25-28	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	2B	
		2 <input type="checkbox"/> SALTY	4 <input type="checkbox"/> MINERAL		
	30-33	1 <input type="checkbox"/> FRESH	3 <input type="checkbox"/> SULPHUR	3A	
		2 <input type="checkbox"/> SALTY	4 <input type="checkbox"/> MINERAL		

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES		MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET	
				FROM	TO
10-11	1 <input checked="" type="checkbox"/> STEEL	12	.188	0	10
6 3/4	2 <input type="checkbox"/> GALVANIZED				
	3 <input type="checkbox"/> CONCRETE				
	4 <input type="checkbox"/> OPEN HOLE				
	17-18	1 <input type="checkbox"/> STEEL	19	10	30
6 3/4	2 <input type="checkbox"/> GALVANIZED				
	3 <input type="checkbox"/> CONCRETE				
	4 <input checked="" type="checkbox"/> OPEN HOLE				
	24-25	1 <input type="checkbox"/> STEEL	26		27-30
	2 <input type="checkbox"/> GALVANIZED				
	3 <input type="checkbox"/> CONCRETE				
	4 <input type="checkbox"/> OPEN HOLE				

SCREEN

SIZE - S1 OF OPENING (SLOT NO.)	31-33	DIAMETER	34-38	LENGTH	39-40
		INCHES		FEET	
MATERIAL AND TYPE		DEPTH TO TOP OF SCREEN		41-44	30
				FEET	

61 PLUGGING & SEALING RECORD

DEPTH SET AT FEET		MATERIAL AND TYPE		CEMENT GROUT LEAD PACKER ETC.)	
FROM	TO				
10-13	14-17				
18-21	22-25				
26-29	30-33	80			

71 PUMPING TEST

71	PUMPING TEST METHOD		10	PUMPING RATE		11-14	DURATION OF PUMPING	
	1 <input type="checkbox"/> PUMP 2 <input checked="" type="checkbox"/> BAILER			6		GPM	1 15-16 HOURS 30	17-18 MIN
	STATIC LEVEL	WATER LEVEL END OF PUMPING	25	WATER LEVELS DURING			1 <input type="checkbox"/> PUMPING 2 <input checked="" type="checkbox"/> RECOVERY	
	19-21	22-24	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES		
	4 FEET	18 FEET	11 26-28 FEET	8 29-31 FEET	6 32-34 FEET	4 35-37 FEET		
IF FLOWING GIVE RATE		38-41	PUMP INTAKE SET AT		FEET	WATER AT END OF TEST		
RECOMMENDED PUMP TYPE		GPM	RECOMMENDED PUMP SETTING		43-45	RECOMMENDED PUMP RATE		
<input checked="" type="checkbox"/> SHALLOW <input type="checkbox"/> DEEP			28		FEET	1 <input type="checkbox"/> CLEAR 2 <input checked="" type="checkbox"/> CLOUDY		
						5 GPM		
50-53								

LOCATION OF WELL


IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.

$N \uparrow$

Pinecrest Rd
 Vimy
 1/10th K
 Lake Erie

DRILLERS REMARKS

**FINAL
STATUS
OF WELL**

- | | |
|--|---|
| 1  WATER SUPPLY | 5 <input type="checkbox"/> ABANDONED, INSUFFICIENT SUPPLY |
| 2 <input type="checkbox"/> OBSERVATION WELL | 6 <input type="checkbox"/> ABANDONED POOR QUALITY |
| 3 <input type="checkbox"/> TEST HOLE | 7 <input type="checkbox"/> UNFINISHED |
| 4 <input type="checkbox"/> RECHARGE WELL | |

WATER USE

- | | |
|--|--|
| 1 <input checked="" type="checkbox"/> DOMESTIC | 5 <input type="checkbox"/> COMMERCIAL |
| 2 <input type="checkbox"/> STOCK | 6 <input type="checkbox"/> MUNICIPAL |
| 3 <input type="checkbox"/> IRRIGATION | 7 <input type="checkbox"/> PUBLIC SUPPLY |
| 4 <input type="checkbox"/> INDUSTRIAL | 8 <input type="checkbox"/> COOLING OR AIR CONDITIONING |
| <input type="checkbox"/> OTHER | 9 <input type="checkbox"/> NOT USED |

METHOD OF DRILLING

- | | | | |
|---|--|---|----------------------------------|
| 1 | <input checked="" type="checkbox"/> CABLE TOOL | 6 | <input type="checkbox"/> BORING |
| 2 | <input type="checkbox"/> ROTARY (CONVENTIONAL) | 7 | <input type="checkbox"/> DIAMOND |
| 3 | <input type="checkbox"/> ROTARY (REVERSE) | 8 | <input type="checkbox"/> JETTING |
| 4 | <input type="checkbox"/> ROTARY (AIR) | 9 | <input type="checkbox"/> DRIVING |
| 5 | <input type="checkbox"/> AIR PERCUSSION | | |

CONTRACTOR

CONTRACTOR	NAME OF WELL CONTRACTOR		LICENCE NUMBER	
	Donald Merritt		3640	
	ADDRESS			
	RR #1 Smithville			
CONTRACTOR	NAME OF DRILLER OR BORER		LICENCE NUMBER	
	Donald Merritt		3640	
	SIGNATURE OF CONTRACTOR		SUBMISSION DATE	
	Donald Merritt		DAY 19 MO Sept YR 83	

OFFICE USE ONLY

DATA SOURCE	58	CONTRACTOR	59-62	DATE RECEIVED	63-68	80
				20 01 84		
DATE OF INSPECTION			INSPECTOR			
REMARKS						
CSS.ES						

CSS.ES

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506--4--77 FORM 7



Measurements recorded in: ☐ Metric ☒ Imperial

Well _____ (Place Sticker and/or Print Below)

A 091780

Well Record

Regulation 903 Ontario Water Resources Act

Page 1 of 1

Address of Well Location (Street Number/Name) 2691 VIMY RD				Township PORT COLBORNE		Lot 14		Concession 1	
County/District/Municipality NIAGARA				City/Town/Village PORT COLBORNE		Province Ontario		Postal Code L3K5V3	
UTM Coordinates		Zone	Easting	Northing		Municipal Plan and Sublot Number		Other	
NAD		8	3	1	7	6	4	8	6
				2	8	4	7	4	8
				4	3	0			

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft)	
				From	To
BROWN	SAND		LOOSE	0	13
BROWN	CLAY	FINE GRAVEL	PACKED	13	18
GREY	LIMESTONE		LAYERED	18	38

Annular Space			
Depth Set at (m/ft)		Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
From	To		
22	6"	BENTONITE	41 gal.
6"	0	TOPSOIL	

Method of Construction		Well Use		
<input checked="" type="checkbox"/> Cable Tool	<input type="checkbox"/> Diamond	<input type="checkbox"/> Public	<input type="checkbox"/> Commercial	<input type="checkbox"/> Not used
<input type="checkbox"/> Rotary (Conventional)	<input type="checkbox"/> Jetting	<input checked="" type="checkbox"/> Domestic	<input type="checkbox"/> Municipal	<input type="checkbox"/> Dewatering
<input type="checkbox"/> Rotary (Reverse)	<input type="checkbox"/> Driving	<input type="checkbox"/> Livestock	<input type="checkbox"/> Test Hole	<input type="checkbox"/> Monitoring
<input type="checkbox"/> Boring	<input type="checkbox"/> Digging	<input type="checkbox"/> Irrigation	<input type="checkbox"/> Cooling & Air Conditioning	
<input type="checkbox"/> Air percussion		<input type="checkbox"/> Industrial		
<input type="checkbox"/> Other, <i>specify</i> _____		<input type="checkbox"/> Other, <i>specify</i> _____		

Construction Record - Casing					Status of Well
Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft)		<input checked="" type="checkbox"/> Water Supply <input type="checkbox"/> Replacement Well <input type="checkbox"/> Test Hole <input type="checkbox"/> Recharge Well <input type="checkbox"/> Dewatering Well <input type="checkbox"/> Observation and/or Monitoring Hole <input type="checkbox"/> Alteration (Construction) <input type="checkbox"/> Abandoned, Insufficient Supply
			From	To	
5 1/8"	STEEL	1.88	0	22	
5"	OPEN HOLE		22	38	

Construction Record - Screen					<input type="checkbox"/> Abandoned, Poor Water Quality <input type="checkbox"/> Abandoned, other, <i>specify</i> _____ <input type="checkbox"/> Other, <i>specify</i> _____
Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft)		
			From	To	

Water Details		Hole Diameter		
Water found at Depth <u>37</u> (m/ft) <input type="checkbox"/> Gas	Kind of Water: <input type="checkbox"/> Fresh <input type="checkbox"/> Untested <input type="checkbox"/> Other, specify <u>SULPHUR</u>	Depth (m/ft) From	To	Diameter (cm/in)
Water found at Depth (m/ft) <input type="checkbox"/> Gas	Kind of Water: <input type="checkbox"/> Fresh <input type="checkbox"/> Untested <input type="checkbox"/> Other, specify _____	<u>0</u>	<u>20</u>	<u>8"</u>
Water found at Depth (m/ft) <input type="checkbox"/> Gas	Kind of Water: <input type="checkbox"/> Fresh <input type="checkbox"/> Untested <input type="checkbox"/> Other, specify _____			

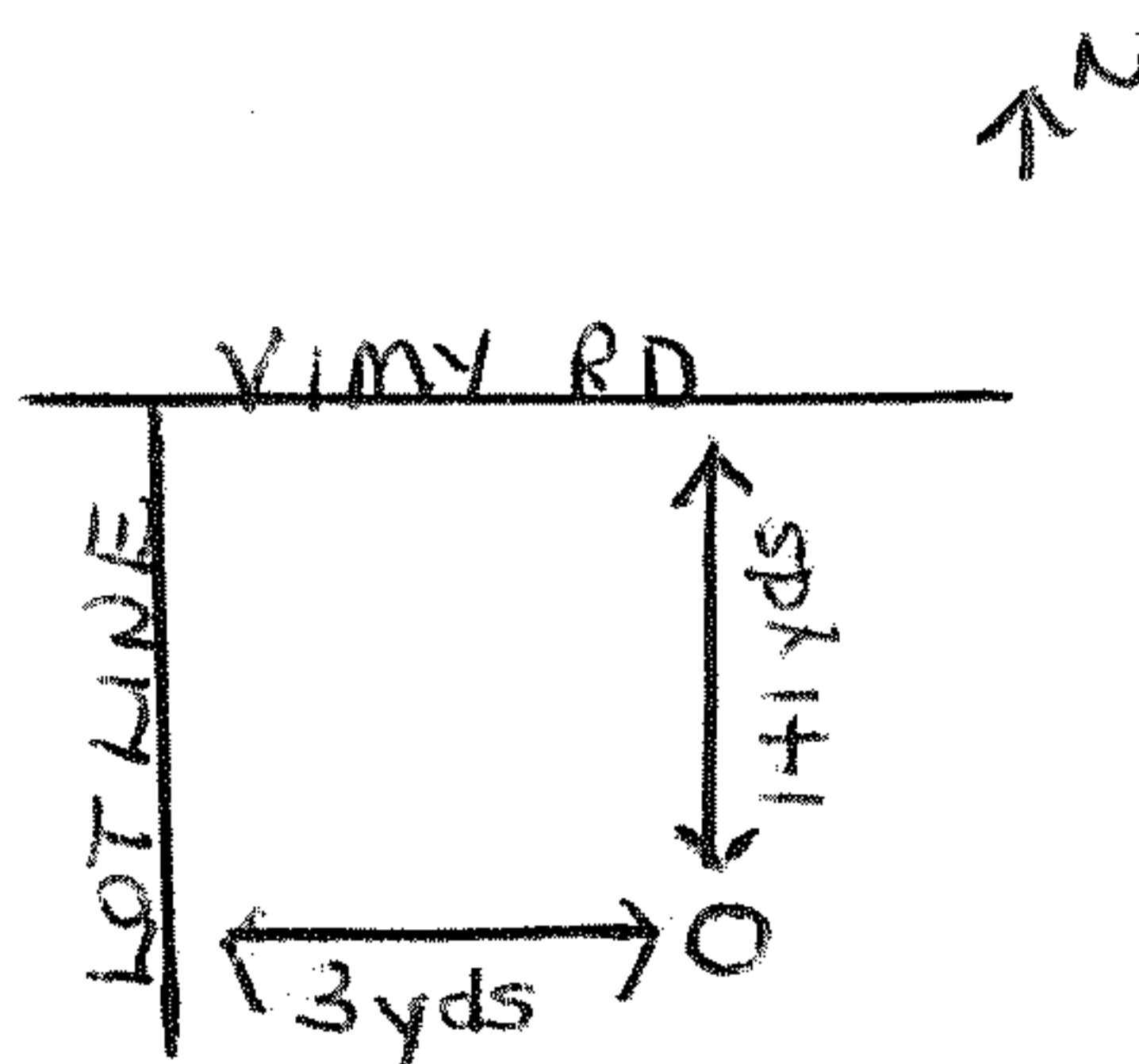
Well Contractor and Well Technician Information									
Business Name of Well Contractor						Well Contractor's Licence No.			
SCHOOLEY WATERWELL DRILLING						4 7 9 5			
Business Address (Street Number/Name)						Municipality			
2387 HOUSE RD STEVENSVILLE						NIAGARA			
Province		Postal Code		Business E-mail Address					
ON		L8S1S0		aschooley@bell.net					
Bus. Telephone No. (inc. area code)				Name of Well Technician (Last Name, First Name)					
9053820720				SCHOOLEY KEN					
Well Technician's Licence No.		Signature of Technician and/or Contractor				Date Submitted			
0 3 5 1		Ken Schooley				20141118			

Results of Well Yield Testing

After test of well yield, water was:	Draw Down		Recovery	
<input checked="" type="checkbox"/> Clear and sand free	Time (min)	Water Level (m/ft)	Time (min)	Water Level (m/ft)
<input type="checkbox"/> Other, specify _____	Static Level			
If pumping discontinued, give reason:				
Pump intake set at (m/ft)	1		1	
Pumping rate (l/min / GPM)	2		2	
Duration of pumping	3		3	
<u>2</u> hrs + <u>0</u> min	4		4	
Final water level end of pumping (m/ft)	5		5	
If flowing give rate (l/min / GPM)	10		10	
Recommended pump depth (m/ft)	15		15	
	20		20	
	25		25	
Recommended pump rate (l/min / GPM)	30		30	
	40		40	
Well production (l/min / GPM)	50		50	
	60		60	
Disinfected?				
<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				

Map of Well Location

Please provide a map below following instructions on the back.



Comments:

Well owner's information package delivered <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Date Package Delivered 20141118	Ministry Use Only Audit No. z158722 NOV 25 2014 Received
	Date Work Completed 20141107	

Appendix C

Water Use and Septic System Surveys



Terra-Dynamics Consulting Inc.

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

June, 2021

Dear Resident:

On behalf of our client, Terra-Dynamics Consulting Inc. is completing a water well and septic system survey. This is a survey of properties in the vicinity of Lots 31, 32 and 33 on Firelane 3, as shown on the attached map (Site). Our client is making application to build two residences on the properties. This well and septic system survey is a recommended part of a hydrogeologic, or groundwater, study of the subject lands. 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 his property (as shown by the outline on the attached map). **Participation is voluntary.** Participation involves completing the attached questionnaire on 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 to Niagara Region 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 Jayme Campbell at 289-407-0915 or via email at jcampbell@terra-dynamics.com.

Thank you in advance for your assistance.

Yours truly,

TERRA-DYNAMICS CONSULTING INC.

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

Water well survey



This map should not be relied on as a precise indicator of routes or locations, nor as a guide to navigation. The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) shall not be liable in any way for the use or any information on this map. of, or reliance upon, this map.



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? _____

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).

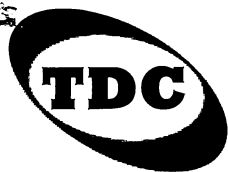
SKETCH MAP OF WELL(S) and SEWAGE SYSTEM LOCATIONS



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.

Jayme Campbell, P. Eng., Senior Water Resource Engineer
432 Niagara Street, Unit 2, St. Catharines, ON L2M 4W3
289-407-0915



Terra-Dynamics Consulting Inc.

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

WATER WELL SURVEY FORM

Date: July 15, 2021

Contact Person: [REDACTED]

Property Address: 2552 FIRELANE 3

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:

THE LIMITED INFO BELOW WAS SUPPLIED
BY NEIGHBOURS WHEN WE MOVED IN 2009

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?

I WAS TOLD IT WAS DRILLED DEEPER
THAN NORMAL AS IT PRODUCES SULPHUR SMOEL

Is your well drilled into rock? NO

What is the well casing diameter? 5 1/2"

Do you know when your well was drilled?

NO (PERHAPS WITHIN 25 YEARS)

Do you know the name of the well driller?

NO (NAME ON CAP - SEAL WELL PRODUCTS)

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).

NO

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

GARDEN IRRIGATION PRIOR TO TREATMENT - DRINKING WATER
+ HEATING AFTER TREATMENT

Has your well ever run dry?

NO

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

RAW WATER FROM WELL SMELLS OF SULPHUR (PRIOR TO TREATMENT)

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.).

CULLIGAN - WATER SOFTENER / CARBON TREATMENT / PEROXIDE / SALT SYSTEM

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

NO

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.)

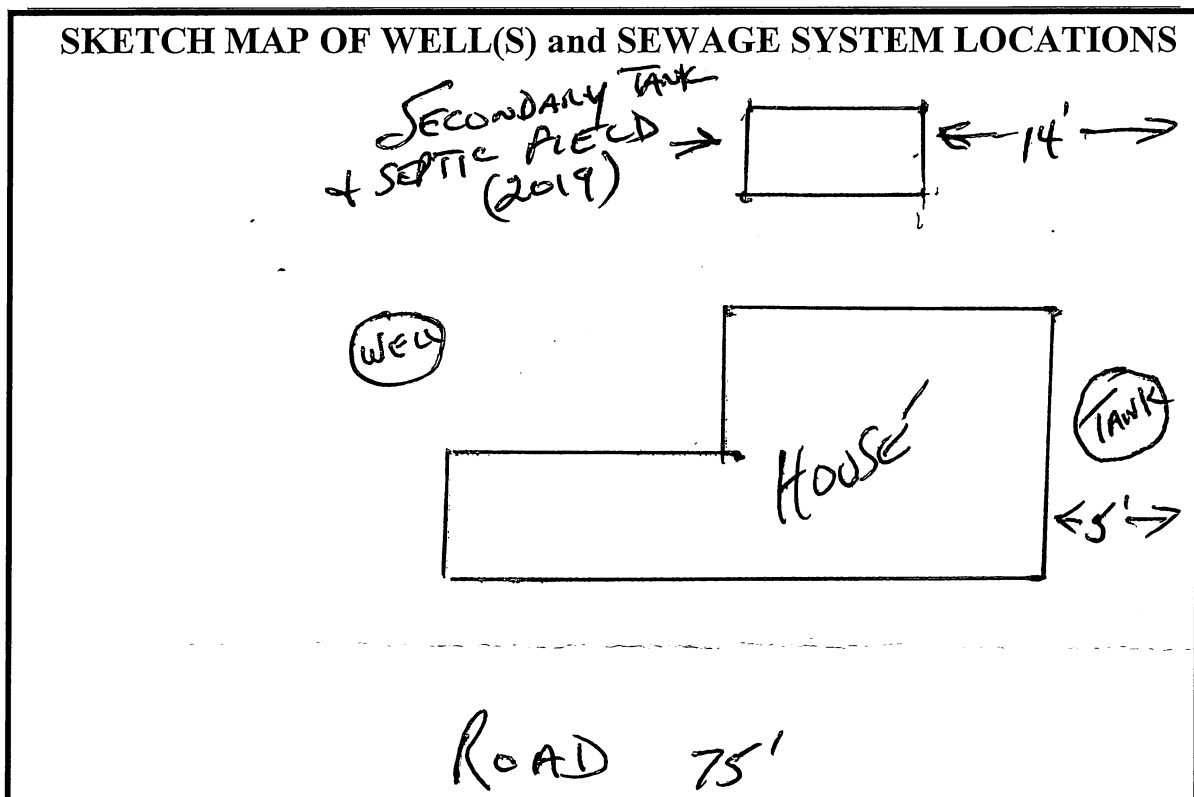
Has your dug well ever run dry?

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).



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.

Jayme Campbell, P. Eng., Senior Water Resource Engineer
432 Niagara Street, Unit 2, St. Catharines, ON L2M 4W3
289-407-0915

Water well survey



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Appendix D

Laboratory Analyses

**E3 Laboratories Inc.**

SS#4, 360 York Rd., Unit 10, Niagara-on-the-Lake, Ontario L0S 1J0

Email: info@e3labs.ca

Tel: (905) 641-9000, Fax: (905) 641-9001

CERTIFICATE OF ANALYSIS

Dynamic Fusion
Mark Heeg
134 Moote Rd
Dunnville
N1A 2W1
Tel: 289-442-5242

Fax:

Email: mark@dynamicfusion.ca

Work Order No.:2601742
Received : 2019-11-26
PO Number:
Reported: 2019-12-05
Project Name: Lot 32
Chain of Custody No.:

Client Sample ID	Sample		Parameter	Result	Unit	RDL	Date	Method
	Date	Lab ID					Analyzed	
Lot 32 Firelane #3	2019-11-11	616112	T Time	See	Attached	N/A	2019-12-05	Subcontracted

Reported by:

*Niloufar Ghazi*

Nilou Ghazi, Ph.D.,P.Eng.

Laboratory Manager

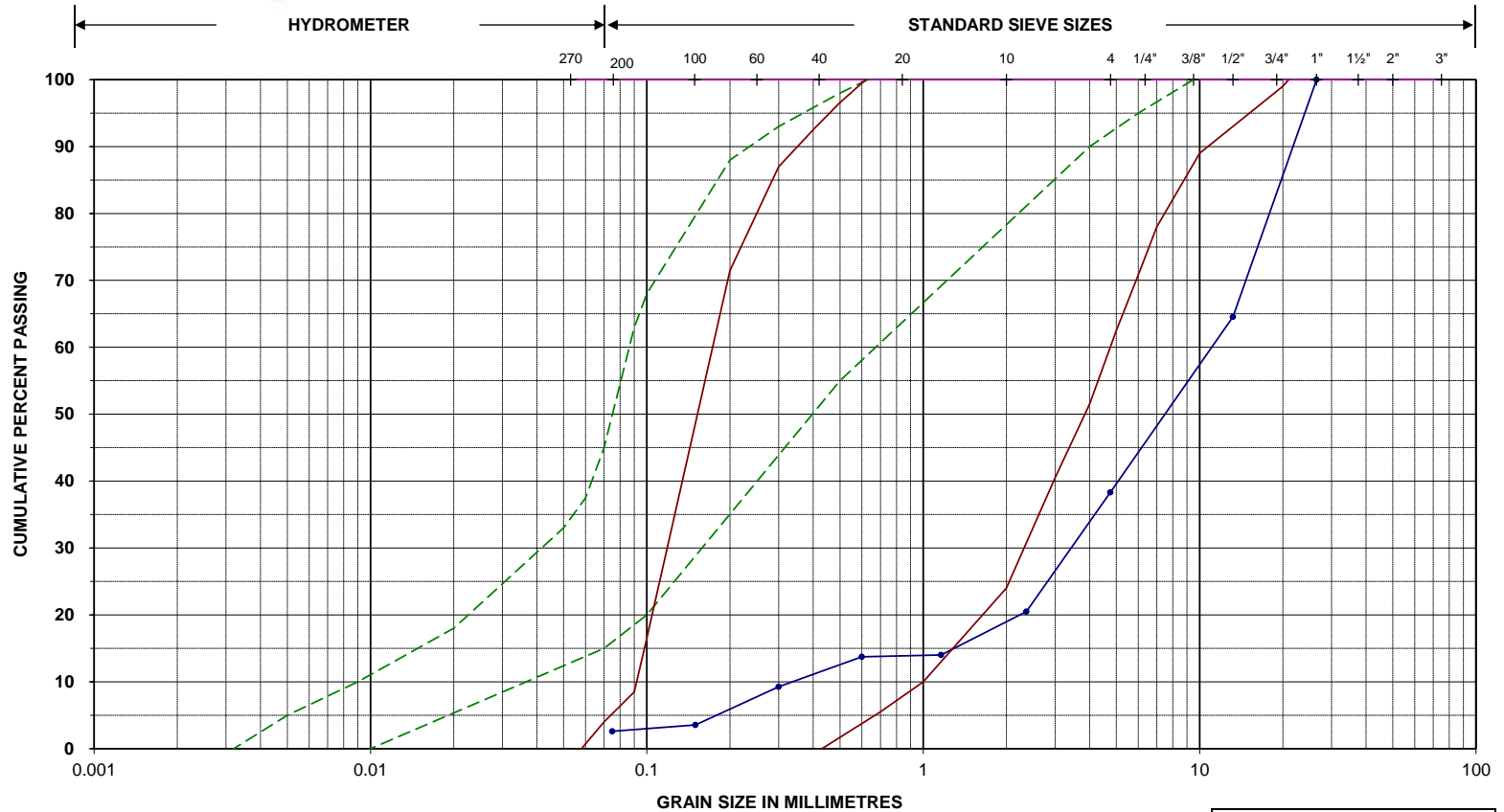
Page 1 of 1

All work has been performed using accepted testing methodologies, except where otherwise agreed to by the client in writing. Our total liability in connection with this work shall be limited to the amount paid by the client.

Results relate only to items tested as received.



PARTICLE SIZE DISTRIBUTION



Unified Classification System

SILT AND CLAY	SAND	GRAVEL
---------------	------	--------

----- sm envelope T = 8 - 20 min/cm

----- sp envelope T = 2 - 8 min/cm

Estimated T = 4 min/cm

GRAVEL	62 %
SAND	36 %
SILT	3 %
CLAY	----

Project Name: E3 Laboratories
Location ID.: Lot 32 Firelane #3

Project No.: 111-53143-00 (2601742)
Sample No./Depth: 616112

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine
37.5 mm	100.0	1.16 mm	14.0
26.5 mm	100.0	0.60 mm	13.7
13.2 mm	64.6	0.30 mm	9.2
4.75 mm	38.3	0.15 mm	3.5
2.36 mm	20.5	0.075 mm	2.6



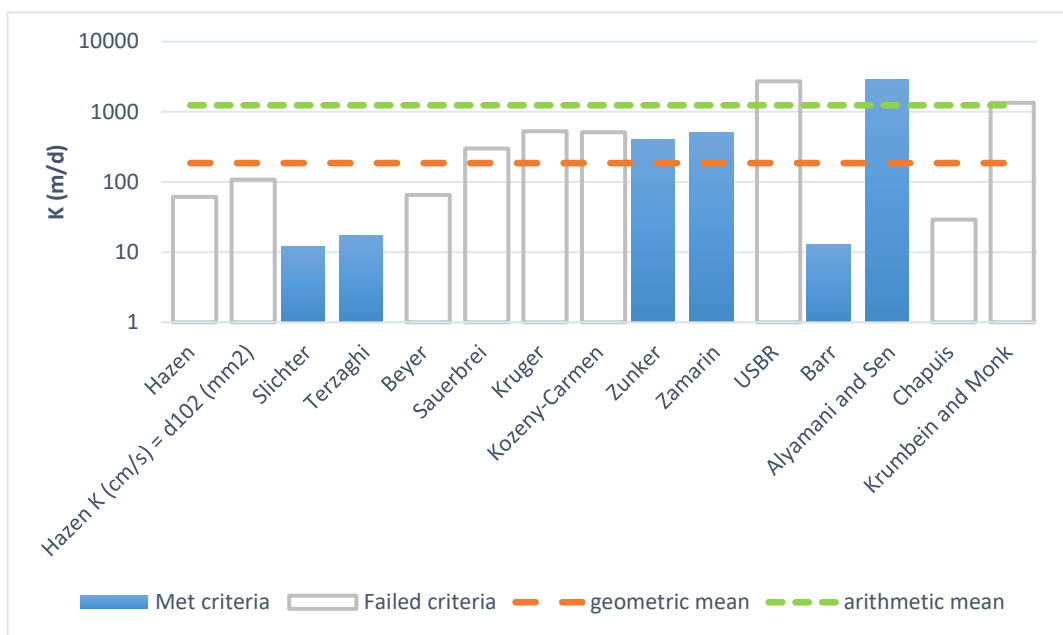
K from Grain Size Analysis Report

Date: 19-Aug-21

Sample Name: Lot 32 Firelane #3 (Test Pit #2)

Mass Sample (g): 100 T (oC) 20

Poorly sorted sandy gravel low in fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	.711E-01	.711E-03	61.41	
Hazen K (cm/s) = d ₁₀ (mm)	.125E+00	.125E-02	107.87	
Slichter	.140E-01	.140E-03	12.08	
Terzaghi	.200E-01	.200E-03	17.26	
Beyer	.760E-01	.760E-03	65.64	
Sauerbrei	.347E+00	.347E-02	299.64	
Kruger	.611E+00	.611E-02	528.10	
Kozeny-Carmen	.592E+00	.592E-02	511.81	
Zunker	.470E+00	.470E-02	406.49	
Zamarin	.581E+00	.581E-02	501.90	
USBR	.313E+01	.313E-01	2708.11	
Barr	.150E-01	.150E-03	12.97	
Alyamani and Sen	.330E+01	.330E-01	2854.14	
Chapuis	.337E-01	.337E-03	29.10	
Krumbein and Monk	.157E+01	.157E-01	1352.21	
Shepherd	.566E+01	.566E-01	4886.95	
geometric mean	.215E+00	.215E-02	185.98	
arithmetic mean	.144E+01	.144E-01	1241.69	

1.E-03

**E3 Laboratories Inc.**

SS#4, 360 York Rd., Unit 10, Niagara-on-the-Lake, Ontario L0S 1J0

Email: info@e3labs.ca

Tel: (905) 641-9000, Fax: (905) 641-9001

CERTIFICATE OF ANALYSIS

Terra-Dynamics Consulting

Jayme Campbell

432 Niagara St

St.Catharines

L2M 4W3

Tel: Fax:

Email: jcampbell@terra-dynamics.com

Work Order No.:2624917

Received : 2021-07-20

PO Number: Peter Smith

Reported: 2021-07-23

Project Name:

Chain of Custody No.: 2624917

Client Sample ID	Sample		Parameter	Result	Unit	RDL	Date	Method
	Date	Lab ID					Analyzed	
Peter Smith - Pit	2021-07-19	687095	T Time	See	Attached		2021-07-23	Subcontracted

Reported by:

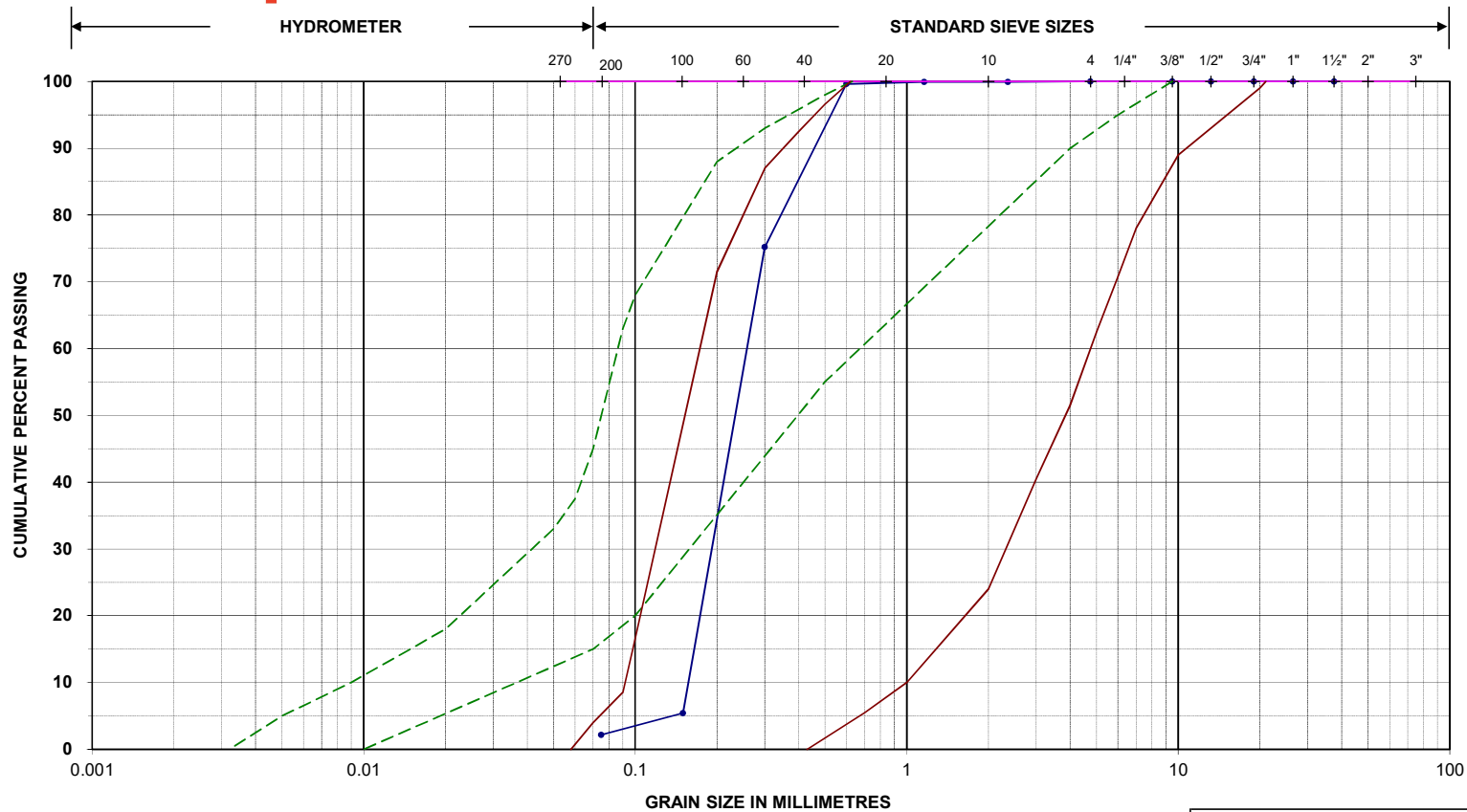
Nilou Ghazi, Ph.D.,P.Eng.
Laboratory Manager

Page 1 of 1

All work has been performed using accepted testing methodologies, except where otherwise agreed to by the client in writing. Our total liability in connection with this work shall be limited to the amount paid by the client.
Results relate only to items tested as received.



PARTICLE SIZE DISTRIBUTION



Unified Classification System

SILT AND CLAY	SAND	GRAVEL
---------------	------	--------

----- sm envelope T = 8 - 20 min/cm

_____ sp envelope T = 2 - 8 min/cm

Estimated T = 7 min/cm

GRAVEL	0	%
SAND	98	%
SILT	2	%
CLAY	---	%

Project Name: E3 Laboratories
Location ID.: Peter Smith - Pit A.D.

Project No.: 111-53143-00 (2624917)
Sample No./Depth: 687095

Sieve Size	% Passing Coarse	Sieve Size	% Passing Fine
37.5 mm	100.0	2.36 mm	99.9
26.5 mm	100.0	1.16 mm	99.9
19.0 mm	100.0	0.60 mm	99.6
13.2 mm	100.0	0.30 mm	75.2
9.5 mm	100.0	0.15 mm	5.4
4.75 mm	100.0	0.075 mm	2.2



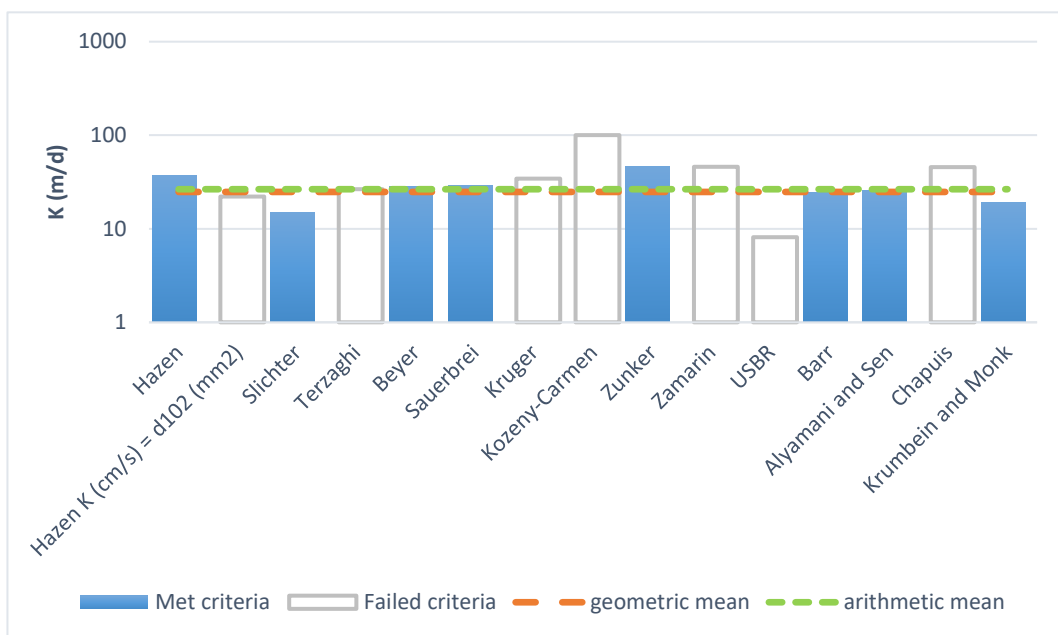
K from Grain Size Analysis Report

Date: 23-Jul-21

Sample Name: Test Pit, July 19, 2021

Mass Sample (g): 100 T (oC) 20

Uniform sand low in fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	4.3E-02	4.3E-04	37.08	
Hazen K (cm/s) = d ₁₀ (mm)				
Slichter	1.7E-02	1.7E-04	14.96	
Terzaghi				
Beyer	3.3E-02	3.3E-04	28.24	
Sauerbrei	3.3E-02	3.3E-04	28.68	
Kruger				
Kozeny-Carmen				
Zunker	5.3E-02	5.3E-04	46.00	
Zamarin				
USBR				
Barr	2.8E-02	2.8E-04	24.39	
Alyamani and Sen	3.0E-02	3.0E-04	25.68	
Chapuis				
Krumbein and Monk	2.2E-02	2.2E-04	19.08	
Shepherd	1.6E-02	1.6E-04	14.10	
geometric mean	2.9E-02	2.9E-04	24.75	
arithmetic mean	3.1E-02	3.1E-04	26.47	

**SGS Canada Inc.**

P.O. Box 4300 - 185 Concession St.
 Lakefield - Ontario - K0L 2H0
 Phone: 705-652-2000 FAX: 705-652-6365

Project : Peter Smith

11-August-2021

Terra-Dynamics Consulting Inc.**Attn :** David Slaine

404 Queenston Street
 St. Catharines, ON
 L2P 2Y2, Canada

Phone: 905-646-7931

Fax:

Date Rec. : 21 July 2021
LR Report: CA13673-JUL21
Reference: Peter Smith

Copy: #1

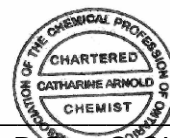
CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Completed Date	4: Analysis Completed Time	5: Peter Smith Pit
Sample Date & Time					19-Jul-21
Temp Upon Receipt [°C]	---	---	---	---	19.0
Fe [µg/g]	30-Jul-21	14:41	04-Aug-21	09:59	9700
Al [µg/g]	30-Jul-21	14:41	04-Aug-21	09:59	5200

Catharine Arnold

Catharine Arnold, B.Sc., C.Chem
Project Specialist,
Environment, Health & Safety



Appendix E

Nitrogen Dilution Calculations

Table E-1 - Procedure Nitrate-nitrogen concentration calculation

<u>Site</u>	<u>Dilution Area (ha)</u>	<u>#Lots</u>	<u>Average Lot Size (ha)</u>	<u>Total Site Sewage Flow (L/Day)</u>	<u>Max Allowable Nitrate-N Criterion (mg/L)</u>	<u>Downgradient Nitrate-N Concentration (mg/L)</u>
	0.12	2	0.10	2,000	10	30.1

Notes:

Sewage flow 1000 L/day per lot
Infiltration rate 0.200 m/year Based on grain-size analyses, 200-250 mm/year
Nitrate effluent load 40 mg/L No Nitrogen Removal

<u>Site</u>	<u>Dilution Area (ha)</u>	<u>#Lots</u>	<u>Average Lot Size (ha)</u>	<u>Total Site Sewage Flow (L/Day)</u>	<u>Max Allowable Nitrate-N Criterion (mg/L)</u>	<u>Downgradient Nitrate-N Concentration (mg/L)</u>
	0.12	2	0.10	2,000	10	7.5

Notes:

Sewage flow 1000 L/day per lot
Infiltration rate 0.200 m/year Based on grain-size analyses, 200-250 mm/year
Nitrate effluent load 10 mg/L Need at least N-II (75% removal)

Table 3: Typical Ground Water Recharge Rates		
Soil Texture	Ground Water Recharge Rate	
	(mm/yr)	(L/Day/Hectare)
■ coarse sand and gravel	250+	7000+
■ fine to medium sand	200 - 250	5600 - 7000
■ silty sand to sandy silt	150 - 200	4200 - 5600
■ silt	125 - 150	3500 - 4200
■ clayey silt	100 - 125	2800 - 3500
■ clay	less than 100	less than 2800