



June 6, 2022
File: GE-00725

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**Reference: Conceptual Servicing Plan and Nitrate Impact Assessment
Proposed Lot Severance
23790 Denfield Road, Denfield**

As requested, this letter provides a review of the site and soil conditions for the property located at 23790 Denfield Road, to determine the general feasibility of a future lot severance.

The current residence located at this site is serviced with a private septic system. The proposed lot severance would result in splitting the property into two similarly-sized parcels. As such, the existing house and septic would remain on one parcel, and the severed parcel would be sufficient in size to accommodate a new residence, septic system, and contingency area for the septic system.

Soil Conditions and Soil T-time

LDS visited the site to assess the soil conditions at the property and to collect soil samples to confirm the design soil percolation rate. During the site visit, two (2) test pits were hand-dug to collect soil samples at a depth of 0.45 m below existing ground surface. The soil conditions observed in all three holes were described as silt with some sand. No groundwater seepage was observed in the open test holes. A summary of the test pit observations is appended for reference.

A sample from each test pit was submitted for laboratory testing, to determine the soil percolation T-time. A copy of the gradation analysis is also appended for reference. Based on the results of the gradation analysis, the soil conditions are consistent with a silty loam, with an estimated soil T-time in the range of 20 to 50 min/cm. A design T-time of 35 min/cm is considered appropriate for the purposes of this design. A copy of the gradation results is appended for reference. A factor of safety of 1.2 was applied to the calculated T-time value on the sample collected by LDS to account for local soil variations, in determining the design T-time value used for this septic design report.

Septic Design Flow

For the purposes of estimating a typical footprint for the septic distribution system, a daily design flow of 3000 L/day was utilized in the analysis. This is the value associated with a four-bedroom house, with a fixture count of 30, in accordance with Part 8 (Section 8.2.1.3 of the Ontario Building Code (OBC

Minimum design requirements for a filter bed system, including the design dimensions for a typical distribution system which can accommodate the design flows and soil characterization, are summarized in the following table.

Parameter	Minimum Requirement
Contact Area – based of the sand filter bed $A=QT/850$	$Q = 3000 \text{ L/day}$ $T = 35 \text{ min/cm}$ $A = 123.5 \text{ m}^2$
Surface Area for the contact medium (Stone) If $Q < 3000 \text{ l/day}$, loading area = $75 \text{ L/m}^2/\text{day}$ If $Q > 3000\text{L/day}$. Loading area = $50 \text{ L/m}^2/\text{day}$	$Q = 3000 \text{ L/day}$ Stone Area = 60 m
Loading Area - the area required to move the treated effluent out of the filter media into the underlying native soils $A = Q / \text{Loading Rate}$	$Q = 3000$ Loading Rate = $8 \text{ L/m}^2/\text{day}$ Area = 375 m^2

Based on the above summary table, a maximum loading area of 375 m^2 is required. This can be accommodated with a filter bed having the following dimensions: $16.0 \text{ m} \times 23.4 \text{ m}$. This is demonstrated on the attached site plan.

The Septic Tank must be located at least 1.5 m from the new residence or any other structures. A 15 m clearance is required from the water supply well. Other minimum clearances are outlined in OBC Table 8.2.1.6. (A) for the septic tank.

The septic distribution system must have a minimum clearance of 5 m from the new residence or any other structures. A 15 m clearance also applies to the water supply well. A 3 m clearance is required from the property line. Other minimum clearances are outlined in OBC Table 8.2.1.6. (B) for the septic distribution bed.

The water supply well must be located to meet the minimum clearance distances from the septic treatment tanks, pump chamber and distribution system, as noted above.

Nitrate Impact Assessment

LDS has carried out a nitrate impact assessment for the proposed lot severance, considering a conventional filter bed, and a level IV treatment system within the proposed lot. Calculations were carried out in accordance with the predictive assessment model (calculation) outlined in the MECP D-5-4 Guideline document. The model has been established to demonstrate the theoretical nitrate concentration which would occur at the downstream property boundary (considered to be the worse case boundary condition), and sets a target value of 10 mg/L , based on the applicable Ontario Drinking Water Objective (ODWO). The following is a mass balance calculation for the theoretical nitrate concentration which would occur at the downstream property boundary based on a conventional Class IV septic system.

$$C_o = [Q_E (N_E) + D_w (N_B)]/[D_w + Q_E]$$

Where:

- C_o = Nitrate Concentration at the property boundary (mg/L);
- N_E = Nitrate Concentration of the sewage effluent (from the tank) (mg/L);
- Q_E = Yearly volume of effluent produced (L/year);
- D_w = Dilution Water available (L/yr);
- N_B = Background Nitrate Concentration, (mg/L).

The average daily design sewage load for a typical residence is 1000 L/day , based on the procedures outlined in D-5-4. This average flow rate is considered a realistic and conservative average daily flow rate and should not be confused with the peak design flow used to design the sewage system, (which is often 2 to 3 times this amount).

The site area used in the calculation is based on the area of the anticipated lot severance.

Precipitation and infiltration through the soil to groundwater normally provide dilution and provide the basis for the following nitrite loading calculations. The values used in the calculation are based on Environment Canada '30-year average' weather data, established at the London Airport and through currently accepted MECP Stormwater management guidance materials.

Nitrate (N) concentrations in conventional septic effluent (without treatment) have anecdotally been identified at 40 mg/L. Using the actual values in the technical case studies and science-based analyses, the average nitrate value in pre-treated septic effluent is identified as 37 mg/L. This value has been utilized in the analysis.

A background nitrate level of 1.2 mg/L is incorporated into the calculation (based on average values in precipitation reported by the US EPA National Air Quality and Emissions Trend Report, 1997, and referenced by Environment Canada in the Canada – United States Air Quality Agreement, 2012).

For analysis considering the Enviro-Septic system, in the same testing program that was carried out to confirm compliance with the Level IV effluent quality, testing on the pre and post-treatment nitrate concentrations indicates a typical nitrate reduction in the range of 30%. LDS has confirmed this value with Makeway Environmental Technologies Inc., the engineering and design company responsible for the design of the Enviro-Septic system.

Sample calculations are appended for reference, and demonstrate the following:

- Proposed Lot Severance with frontage of approximately 43.25 m and depth of 84.6 m, equipped with a conventional septic system (nitrate level in effluent = 37 mg/L) results in a boundary nitrate level of 9.93 mg/L.
- Proposed Lot Severance with frontage of approximately 43.25 m and depth of 84.6 m, equipped with a septic system which produces Level 4 quality effluent and reduced nitrate loading (nitrate level in effluent = 25.9 mg/L) results in a boundary nitrate level of 7.22 mg/L.

Based on the above calculation, the severed lot can accommodate a conventional filter bed septic system. However, it is recommended that consideration be given to servicing the new lot with a Level 4 treatment system, similar to those which have been designed and used for the lots located on the south side of Denfield Road. The Enviro-Septic System is a combined treatment and dispersal system, and also provides a reduction to the nitrate concentration in the septic effluent.

These types of treatment systems were formerly known as tertiary treatment systems, however, under the recent updates to the building code which require the use of effluent filters in new septic systems, and BNQ standards for effluent quality, these types of systems are becoming more common place. In addition to providing the environmental benefit of reducing nitrate levels in the septic effluent, this type of system offers the added benefit of being able to optimize the area required to accommodate the septic distribution bed, having a smaller impact on disturbed subgrade soils within the lot. This system does not require any washed stone, or require any mechanical or electrical components, and therefore has a smaller carbon footprint compared to traditional septic distribution systems.

Summary Comments

Based on this preliminary review and analysis, the retained parcel can accommodate a replacement septic system within the retained lands, as well as a contingency area, both of which can be located outside of the water pipeline easement.

In addition, proposed lot severance can also accommodate a typical 4-bedroom house, a septic system which provides Level IV quality effluent, as well as the contingency area for the septic distribution area. The retained parcel can also accommodate a similar septic system and contingency area.

This is demonstrated on the attached Site Plan. This plan provides assumed typical building characteristics and is provided for land division approvals only. The plan is not meant to limit the proposed building size or characteristics to the assumed values. It is also not meant to necessarily limit the type of treatment system to the specified alternatives. A site specific site/waste/grading plan is required for final home design and location.

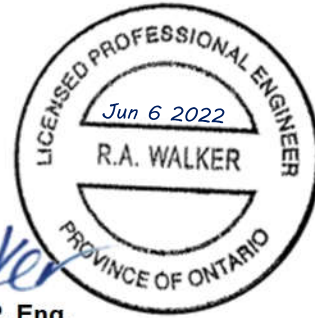
We trust this meets your current requirements. If you require any clarification or technical support, please don't hesitate to contact our office.

Respectfully,

LDS CONSULTANTS INC.

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Attachments:

Grain Size Analyses
Nitrate Loading Sample Calculations
Site Plan



Particle Size Distribution Results of Sieve Analysis

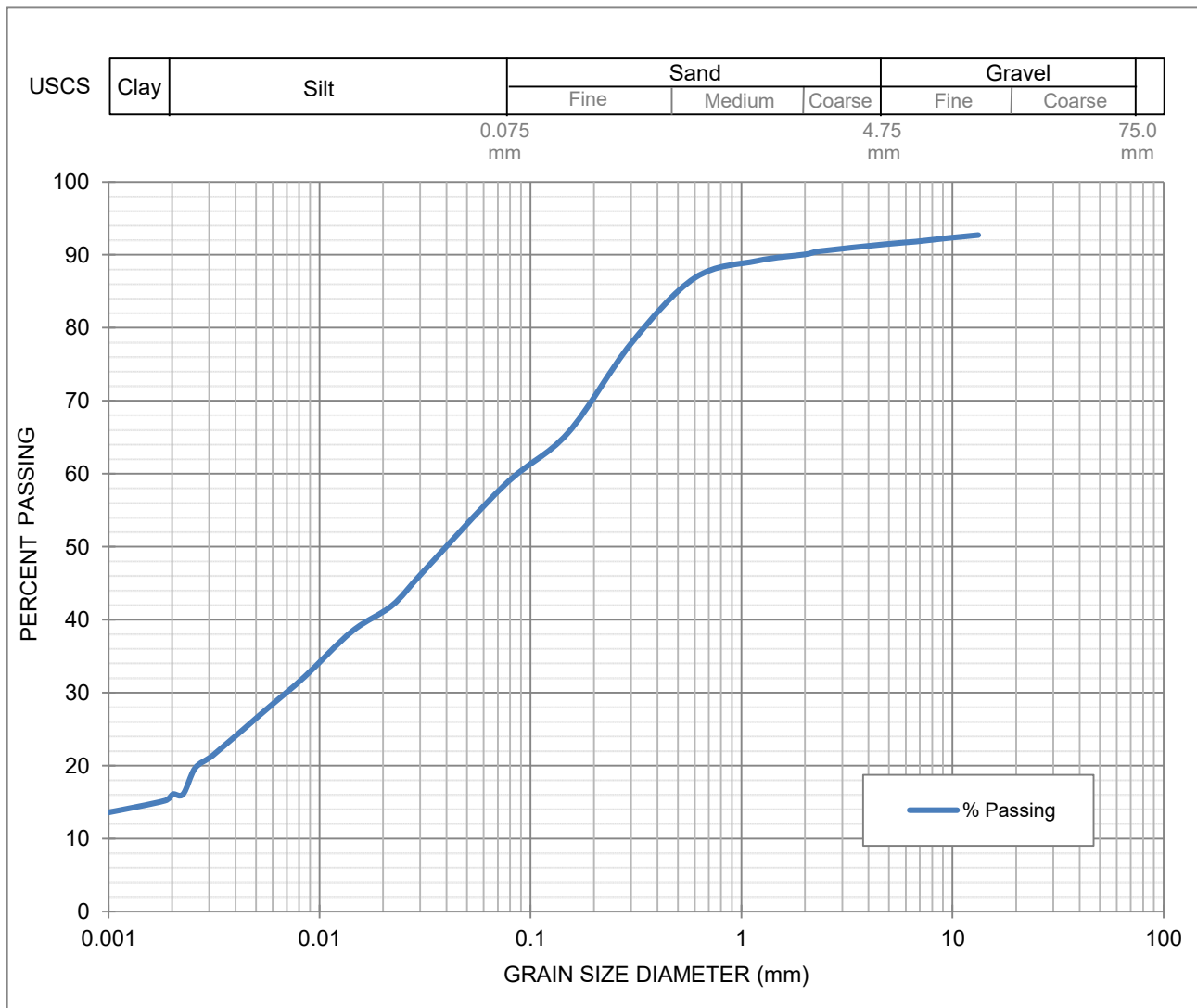
Project Name: Septic System Design

Date: 17-May-22

Project Location: 23790 Denfield Road, Denfield

Project No.: GE-00725

Sample ID	Unified Soil Classification				Moisture Content (%)
	% Clay	% Silt	% Sand	% Gravel	
Natural Subgrade Soils - Test Pit 1	16.1	42.4	33.0	8.5	20.9





Particle Size Distribution Results of Sieve Analysis

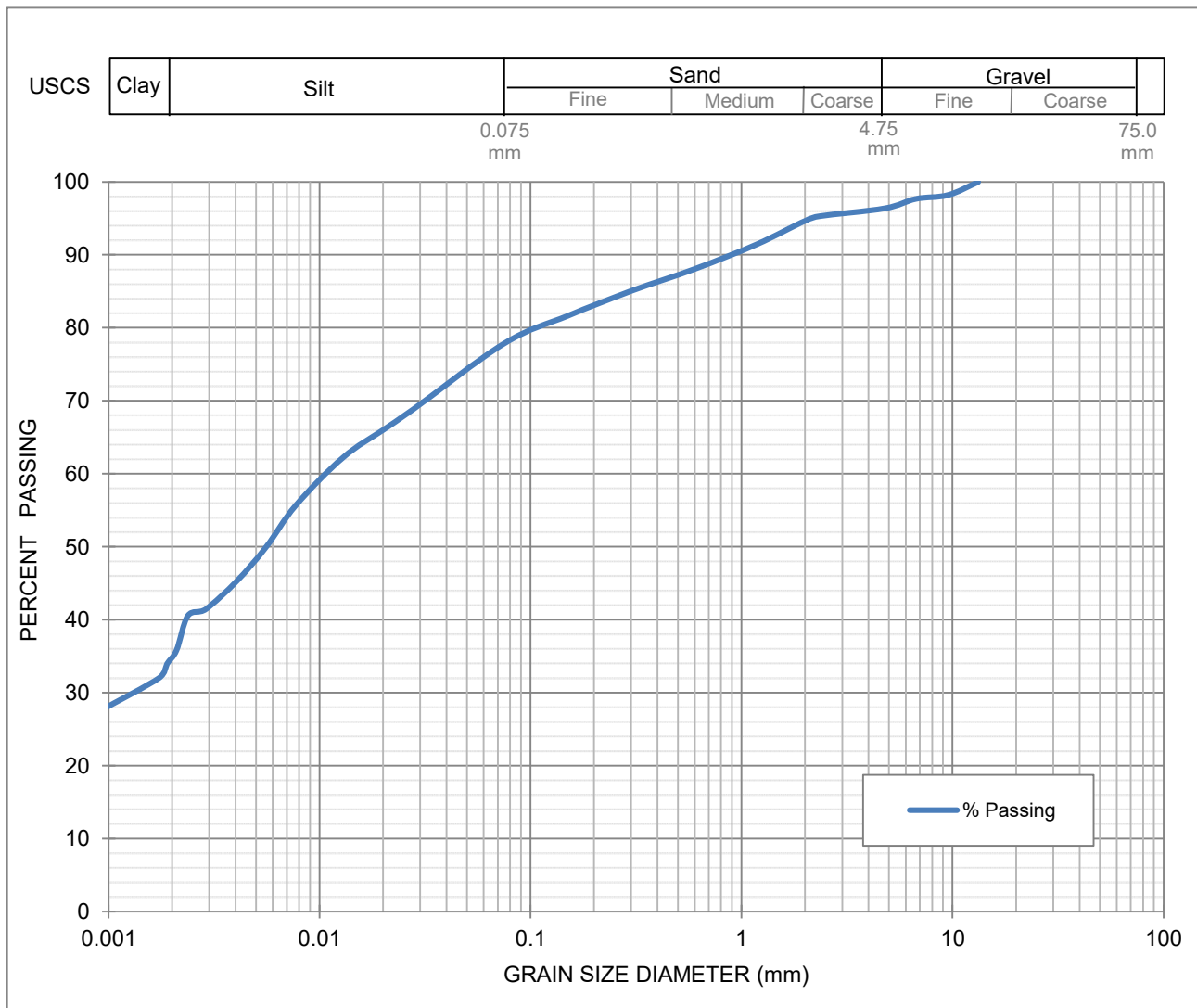
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Sample ID	Unified Soil Classification				Moisture Content (%)
	% Clay	% Silt	% Sand	% Gravel	
Natural Subgrade Soils - Test Pit 2	35.0	42.9	18.5	3.6	15.8



D-5-4 Septic Calculations - 23790 Denfield Road (proposed lot severance - retained and new parcel each w/ 43.25 m frontage)

Residential Lots - Effluent Flow

1 lot
1000 L/day
365 days/yr

365,000 L/year

Surplus Water (Run-off and Infiltration)

Precipitation 1011.5 mm/yr
Based in 1981-2010 Climate Normals @ London Weather Station
Evapotranspiration 569.3 mm/yr
MECP SWM Manual, 2003
Surplus Water 0.4422 m/yr

Dilution Water (Infiltration Component of Precipitation)

Determine Infiltration Factor, based on MECP SWM Design

Topography

Flat 0.3
Rolling 0.2
Hilly 0.1

Soil

Tight Impervious Clay 0.1
Medium (Clay & Loam) 0.2
Open Sandy Loam 0.4

Vegetative Cover

Cultivated Land 0.1
Woodland 0.2
Grassland 0.2

Infiltration Factor, I 70%

Site Area (43.25 m x 84.6m) 3,659.0 m²

Dilution Water 1,132.59 m³/yr
1,132,591 L/year

Nitrate Concentration

$$N_c = [QE (NE) + DW (NB)]/[DW + QE]$$

N_c = Nitrate Concentration at the property boundary (mg/L);
NE = Nitrate Concentration of the sewage effluent (from the tank) (mg/L);
QE = Yearly volume of effluent produced (L/year);
DW = Dilution Water available (L/yr);
NB = Background Nitrate Concentration, (mg/L).

Maximum Allowable Nitrate Concentration at Boundary

10 mg/L *Based on ODWQ Guidelines*

Calculations

Scenario 1 - Conventional Septic System - Nitrate @ 37 mg/L

NE 37 mg/L *standard nitrate level*
QE 365,000 L/year *Effluent Flow Calculated for proposed lots*
DW 1,132,591 L/year *Using Standard Dilution water calculated for site*
NB 1.2 mg/L *Background Nitrate Level - Env. Canada*

Co 9.93 mg/L *meets ODWQ Guidelines*

Scenario 2 - Level IV Treatment, Enviro-Septic System - 30% nitrate reduction

NE 25.9 mg/L *30% nitrate reduction*
QE 365,000 L/year *Effluent Flow Calculated for proposed lots*
DW 1,132,591 L/year *Using Standard Dilution water calculated for site*
NB 1.2 mg/L *Background Nitrate Level - Env. Canada*

Co 7.22 mg/L *meets ODWQ Guidelines*

Notes:

Calculations based on predictive assessment modelling for residential developments, as outlined in MECP D-5-4 Guidelines. Background nitrate concentration based on Environment Canada study.

TYPICAL NEW HOME CHARACETRISTICS AND PRIVATE CLASS 4 SEPTIC SYSTEM ENVELOPE

This assessment has been completed to demonstrate that each lot is a sufficient size to allow for the construction of a conventional (filter bed) septic system. This plan is not for building permit approval. A site specific site/waste/grading plan is required for final home design and location.

This plan provides assumed typical building characteristics and is provided for land division approvals only. The plan is not meant to limit the proposed building size or characteristics to the assumed values. It is also not meant to necessarily limit the type of treatment system to specified alternatives.

Conventional systems are indicated for lot sizing only. A level 4 treatment system with Type A treatment bed is recommended for the severed lot.

TYPICAL NEW HOME CHARACTERISTICS
Design is based on 4 bedroom home with total living area = 300 m², total fixture count ~ 30, design daily sewage flow = 3000 L/day.

SOIL T-TIME DETERMINATION – Design T-time of 35 min/cm, based on sample gradation conducted by LDS Consultants Inc.

SEPTIC SYSTEM SIZING - Filter Bed Design
Septic Design Load = 3000 L/day
Min. Loading Area, loading rate of 8 L/m² /day = 375 m²
For design purposes, bed size is 16.0 m x 23.4 m in size

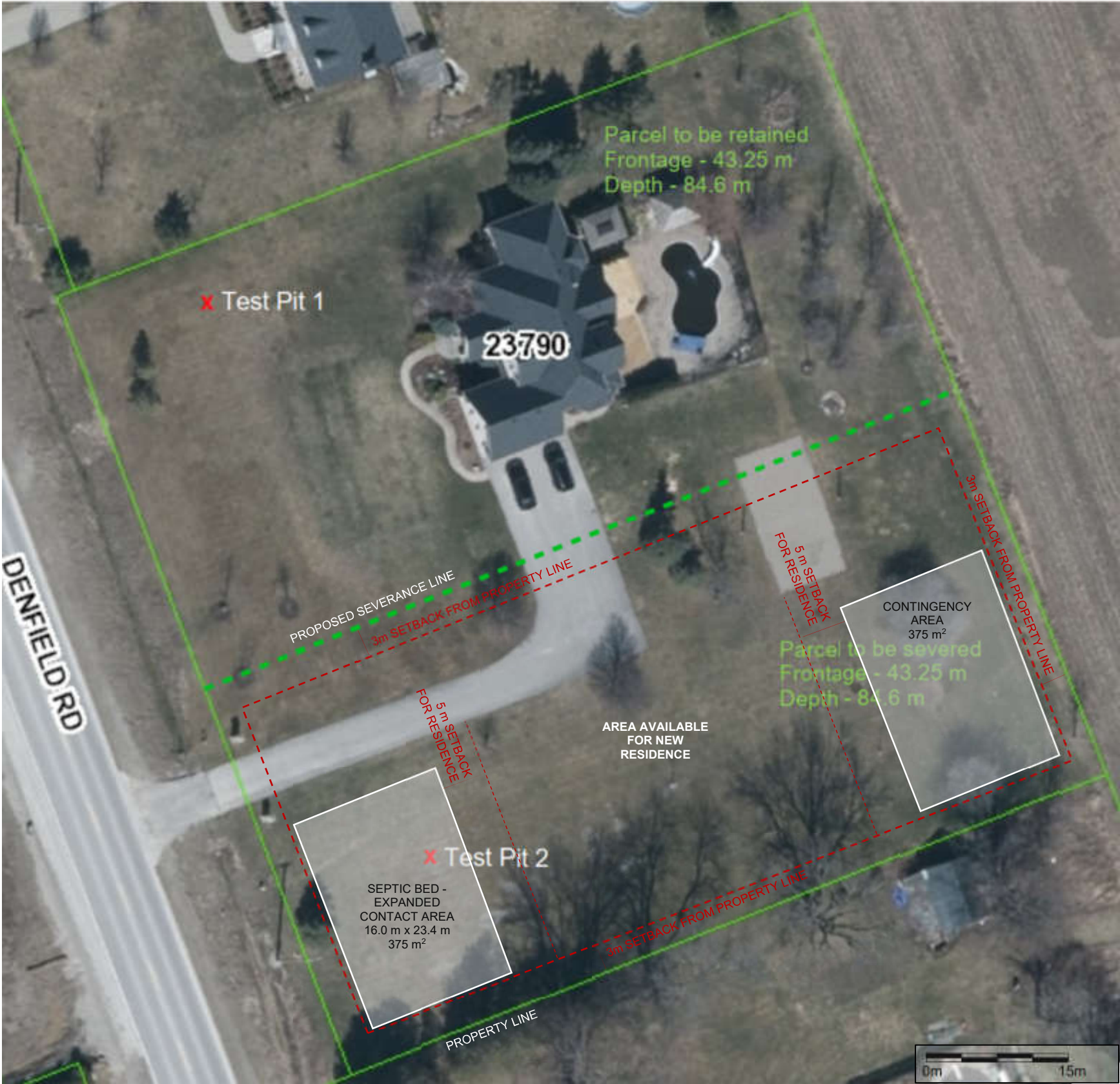
Septic Tank = 2Q = 6000 L
Recommend standard 1500 gallon concrete tank.

- Septic System Setbacks, as per Ontario Building Code
- Septic system to property line, 3 m
 - Septic system to residence, 5 m
 - Septic system to cased well, 15 m
 - Septic tank to residence, 1.5 m

NITRATE IMPACT ASSESSMENT
(as per MECP D-5-4 Guideline)
Maximum allowable nitrate conc. at boundary = 10 mg/L
Assume background nitrate concentration of 1.2 mg/L, as per Environmental Canada Study.
Annual Precipitation – 1011.5 mm/year;
Evapotranspiration – 569.3 mm/year;
Infiltration factor 0.7;
Severed parcel size = 3299 m²

Nitrate conc. for conventional septic – 9.93 mg/L
Nitrate conc. for Level 4 septic – 7.22 mg/L

Level 4 treatment system with a Type A treatment bed is recommended for the severed lot.



SOURCE:
Middlesex County Mapping, Online aerial Imagery



PROJECT NAME
Proposed Lot Severance

PROJECT LOCATION
23790 Denfield Road,
Denfield, Ontario

DRAWING NAME
Conceptual Servicing Plan

SCALE
As Shown

PROJECT NO.
GE-00725

DATE
June 2022

DRAWING NO.
1