



TOWN OF CALEDON
PLANNING
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Feb 03, 2025

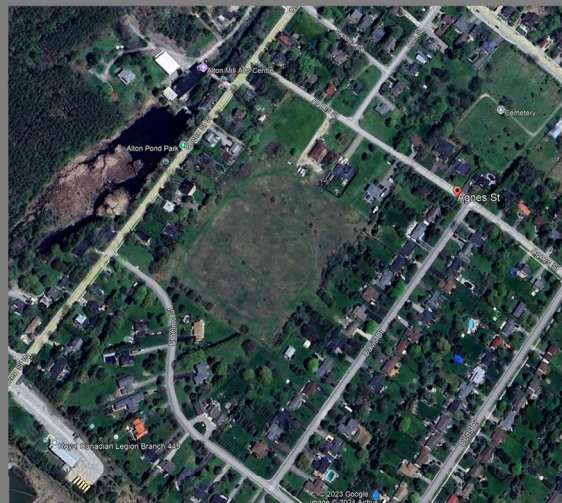
FUNCTIONING SERVICING REPORT

Agnes Street Townhouse Residential Development

Town of Caledon

March 14, 2023
(Revised December 7, 2023)
(Revised September 20, 2024)

Prepared for: The Alton Development Inc.



March 14, 2023
(Revised December 7, 2023)
(Revised September 20, 2024)

Mr. Jeremy Grant
The Alton Development Inc.
1402 Queen Street
Caledon, Ontario
L7K 0C3

Re: Agnes Street Residential Development – Town of Caledon
Functional Servicing Report: Ontario Building Code Sewage Systems
Our File: D3082

Dear Mr. Grant,

The proposed residential development is to consist of 65 townhouse units, which are to be developed into fourteen (14) condominium blocks, with each condominium block under separate land ownership. Each condominium block will include for 4 or 5 townhouse units.

Municipal sanitary sewers are not available to service the proposed development; however municipal water is to be provided. Wastewater servicing for each residential block (4 or 5 townhouse units) will be serviced with an on-site sewage system. Each condominium Townhouse Block (Blocks 1 to 14) will each be serviced by one Ontario Building Code (OBC) compliant Class IV Tertiary Sewage Treatment System and a Type 'A' Dispersal Bed, with each of the 14 sewage systems having a daily design sewage flow of less than 10,000 L/day. Refer to attached Drawing SP-1 for the Townhouse Condominium Block layout and leaching / dispersal bed locations. The permitting jurisdiction for these proposed Ontario Building Code (OBC) sewage systems will fall under the jurisdiction of the Town of Caledon Building Department (i.e. not the Ministry of the Environment, Conservation and Parks). In addition, and since the maximum number of residential units for each condominium block / land ownership is five, a Municipal Responsibility Assessment (MRA) is not required. We note that condominium townhouse blocks will be managed by the respective condominium association, to include for on-going service and maintenance, and funding for upgrades and component replacement within their designated reserve funds.

A septic test pit investigation in the area of the proposed leaching / dispersal beds was undertaken on August 11, 2022, with the 18 test pit locations shown on attached Drawing SP-1. The scope of the test pit investigation included identification of native soil type and percolation rate, as well as high groundwater elevation observations in the area of each sewage system Type ‘A’ Dispersal Bed. The test pit results concluded that the native soils were coarse sand, with a desirable soil percolation rate ranging between 6-10 min/cm. No bedrock or groundwater was not encountered in any test pit during the investigation. In addition, there was no soil staining that would be indicative of a seasonal high groundwater elevation. Preliminary design drawings have been prepared for the proposed on-site sewage treatment and leaching / dispersal bed systems for the proposed Agnes Street residential development, Town of Caledon. Based on the soil percolation rates of the native soil, site topography and layout, and absence of groundwater, soil staining that would be indicative of a seasonal high groundwater elevation, in the septic test pits; Waterloo Biofilter (WBF) tertiary treatment sewage systems, complete with Type ‘A’ Dispersal Beds, for each residential Condominium Block, has been proposed. There are 14 on-site sewage systems in total.

The configuration of three typical proposed sanitary servicing systems are shown on the attached preliminary site plan Drawings SP1-1, SP5-1 and SP9-1, with respective locations shown on Drawing SP-1, as described below:

Design Sanitary Flows

The sewage treatment plant and leaching / dispersal bed systems servicing each of the 14 residential Blocks, will have daily design sewage flow capacities ranging from 8,000 to of 9,900 L/day. Each Block proposes to include 4 or 5 three (3)-bedroom and four (4)-bedroom, 3 washroom townhouse units, with living area sizes up to 220 m² (2,360 sf), and a maximum 24 plumbing fixture units.

Individual townhouse daily design sewage flows for these 3-bedroom and 4-bedroom units are based on OBC Table 8.2.1.3.A. The size of the Type ‘A’ Dispersal Beds are based on OBC Section

8.7.7. Detailed calculations are illustrated on the preliminary sewage system layouts (Drawings SP1-1, SP5-1 and SP9-1), complete with our Ontario Building Code Compliance Analysis.

Proposed Sewage Treatment System

The proposed sewage treatment system for each of the five (5) unit residential townhouse condominium Blocks, with a daily design sewage flow of 9,900 L/day, will include a Class IV (tertiary) treatment system (Waterloo Biofilter). The Waterloo Biofilter sewage treatment system meets Ontario Building Code Level IV (tertiary) quality effluent ($CBOD_5 \leq 10$ mg/L and $TSS \leq 10$ mg/L), and is certified under the CAN/BNQ 3680-600 testing protocol per OBC Table 8.6.2.2. The Waterloo Biofilter sewage treatment system will each consist of a 22,500 L (5,000 gal) W.B. Anaerobic Digester with gravity flow to a 9,000 L Pump Station. Sewage effluent will be time dosed to a BT-22500 22,500 L (5,000 gal.) basket Biofilter tank. The Biofilter tank, c/w two (2) pumps; one pump to re-circulate to the W.B. Anaerobic Digester, the second pump to demand dose to the 18,000 L (4,000 gal.) WaterNox Tank (LS-18000), for nitrate treatment to 5.2 mg/L, as detailed in the Terraprobe hydro-geological report. Sewage from the WaterNox Tank will be demand dosed to the Type ‘A’ Dispersal Bed (timed dosed via the Pump Station).

The sewage tankage for the four (4) unit Waterloo Biofilter treatment systems will consist of an 18,000 L (4,000 gal.) W.B. Anaerobic Digester, a 6,800 L Pump Station, an 18,000L (4,000 gal.) basket Biofilter tank (BT-18000), and a 13,500 L (3,000 gal.) WaterNox Tank (LS-13500).

The Waterloo Biofilter WaterNOx-LS Denitrification Unit underwent BNQ 3680-600 testing in 2016 for nitrogen removal. The test results are attached to this report. During the CAN/BNQ 3680-600 protocol Period A (based on NSF-40), the total nitrogen removal of the system was 92% with an average effluent concentration of 4.8 mg/L (TKN was 4.6 mg/L and $NO_3-N + NO_2-N$ was 0.20 mg/L). The testing results indicated that the WaterNOx-LS system can successfully remove very high levels of total nitrogen passively, while buffering pH to neutral and keeping $CBOD_5$ and TSS levels below 10 mg/L.

Effluent Dispersal Systems

Treated effluent from the sewage treatment plant, servicing each townhouse Block, will be discharged to an in-ground Type 'A' Dispersal Bed, with a daily design sewage flow of either 8,000 or 9,900 L/day, depending on the number of townhouse units. Preliminary design calculations, in accordance with Part 8 of the OBC, for the effluent dispersal systems are outlined on the sewage system design details on attached site plan Drawings SP1-1, SP5-1, and SP9-1 (i.e. typical sewage system preliminary layouts for Townhouse Blocks 1, 5, and 9). Specified OBC clearance distances for the Type 'A' dispersal bed stone layers are shown on the attached drawings. The native sand soils were assessed with a desirable soil percolation rate of $T = 6 - 10$ min/cm. Refer to enclosed drawings DT-1, DT-2, and DT-3.

Reference is also made to the Agnes Street Infill Development 'Wastewater Systems Information' document. This document provides an overview of applicable regulations, a discussion on the hydrogeological report including MECP Procedure D-5-4 and Credit Valley Conservation Authority requirement for advanced nitrate treatment; additional discussion on wastewater flows and occupancy; discussion on the Waterloo Biofilter advanced treatment systems; operation and maintenance requirements and practices; and possible scenarios and safeguards / remedies.

Summary

In summary, the property is able to accommodate the proposed domestic on-site sewage treatment and on-site disposal from the proposed fourteen (14) block residential townhouse development, with the detailed 14 sewage treatment and leaching / dispersal bed systems. The sewage systems will be designed in accordance with the Ontario Building Code (OBC), to treat the effluent ($CBOD_5 \leq 10$ mg/L, $TSS \leq 10$ mg/L, & nitrate / nitrogen ≤ 5.2 mg/L) from the proposed residential development, for each of the 14 townhouse condominium block sewage systems, once the finalized townhouse drawings are prepared.

We trust that the above description of the on-site sewage systems meets your requirements. Please do not hesitate to contact us if you have any questions.

Yours truly,

GUNNELL ENGINEERING LTD.

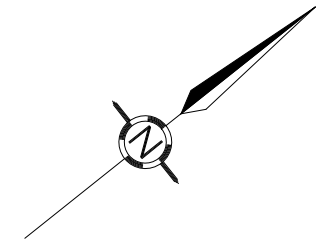


Eric Gunnell, P.Eng



Attachments:

- Gunnell Engineering Ltd Preliminary. Drawings SP-1, SP1-1, SP5-1, SP9-1, DT-1, DT-2 and DT-3
- Waterloo Biofilter WaterNOx-LS Third Party Testing Summary



Note: Municipal Town water provided for all adjacent streets, including Queen St, Agnes St, Emeline St, and Davis Dr.

Homeowner advises former well has been decommissioned (Lots 5, 7 & 8)

LEGEND

- Existing Known Wells
- Test Pit Locations
- ↗ Sub-Surface Groundwater flow direction, per Englobe Hydro-G Reporting
- ↗ Effluent Plume Flow Direction

Preliminary

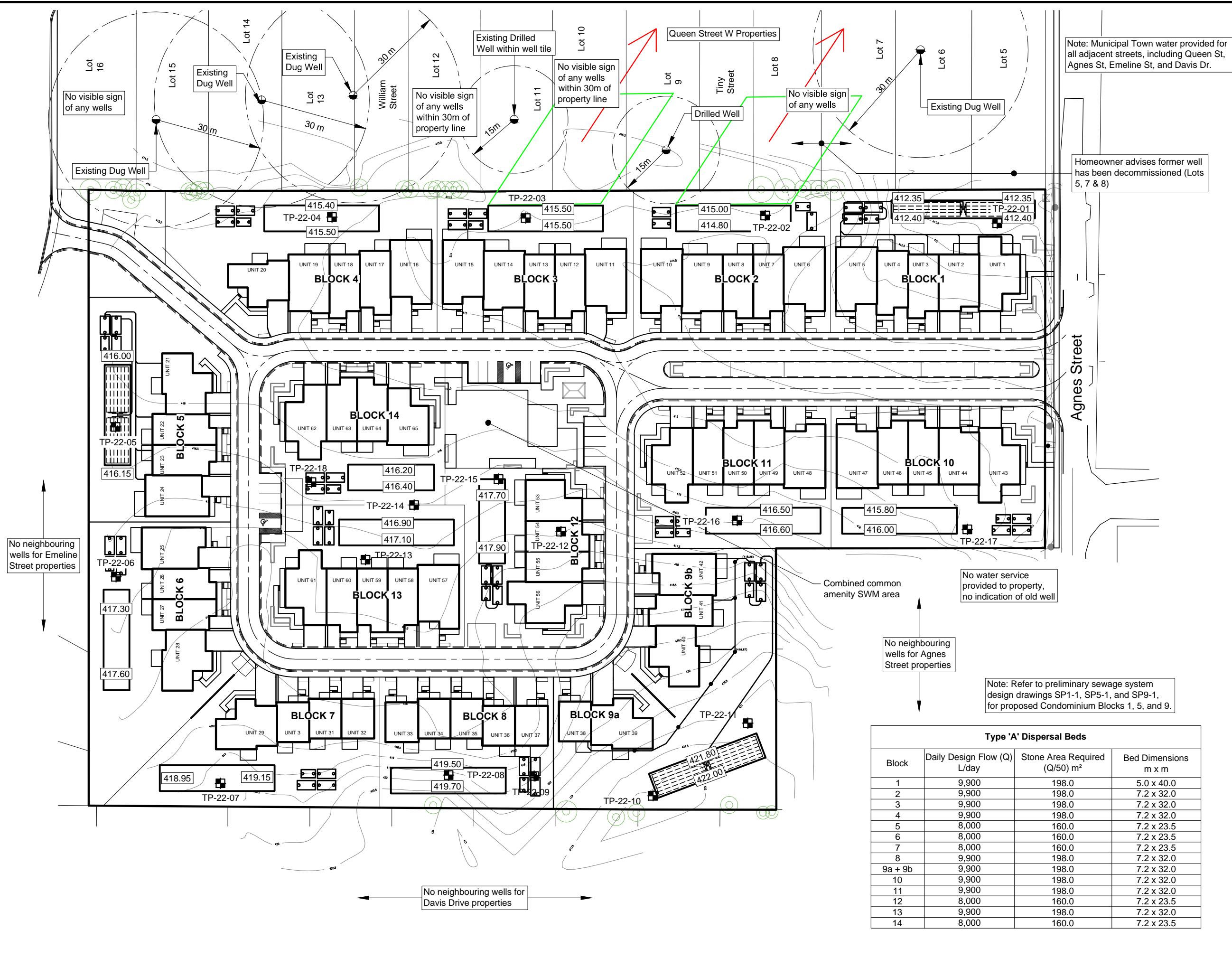
Rev. No.	Date	Description	CAD
Rev. 5	17-Jan-2025	Septic Field Loc. Adjusted Per Peer Reviewer	KB
Rev. 4	26-Aug-2024	Unit count reduced	CS
Rev. 3	28-Nov-2023	Town Comments	JK
Rev. 2	7-Mar-2023	Updated Site Plan	JK
Rev. 1	25-Jul-2022	Updated Well Locations	KD

**Agnes Street Townhouse Residential Development
 Town of Caledon**

**Overall Site Plan:
 Neighbouring Well Locations
 Test Pit Locations
 Sewage System Layouts**

Scale: 1:1,000	Designed By: EG
Date: 21-JUL-2022	Drawn By: JK
Project No.:	Checked By: EG
	Drawing No.:

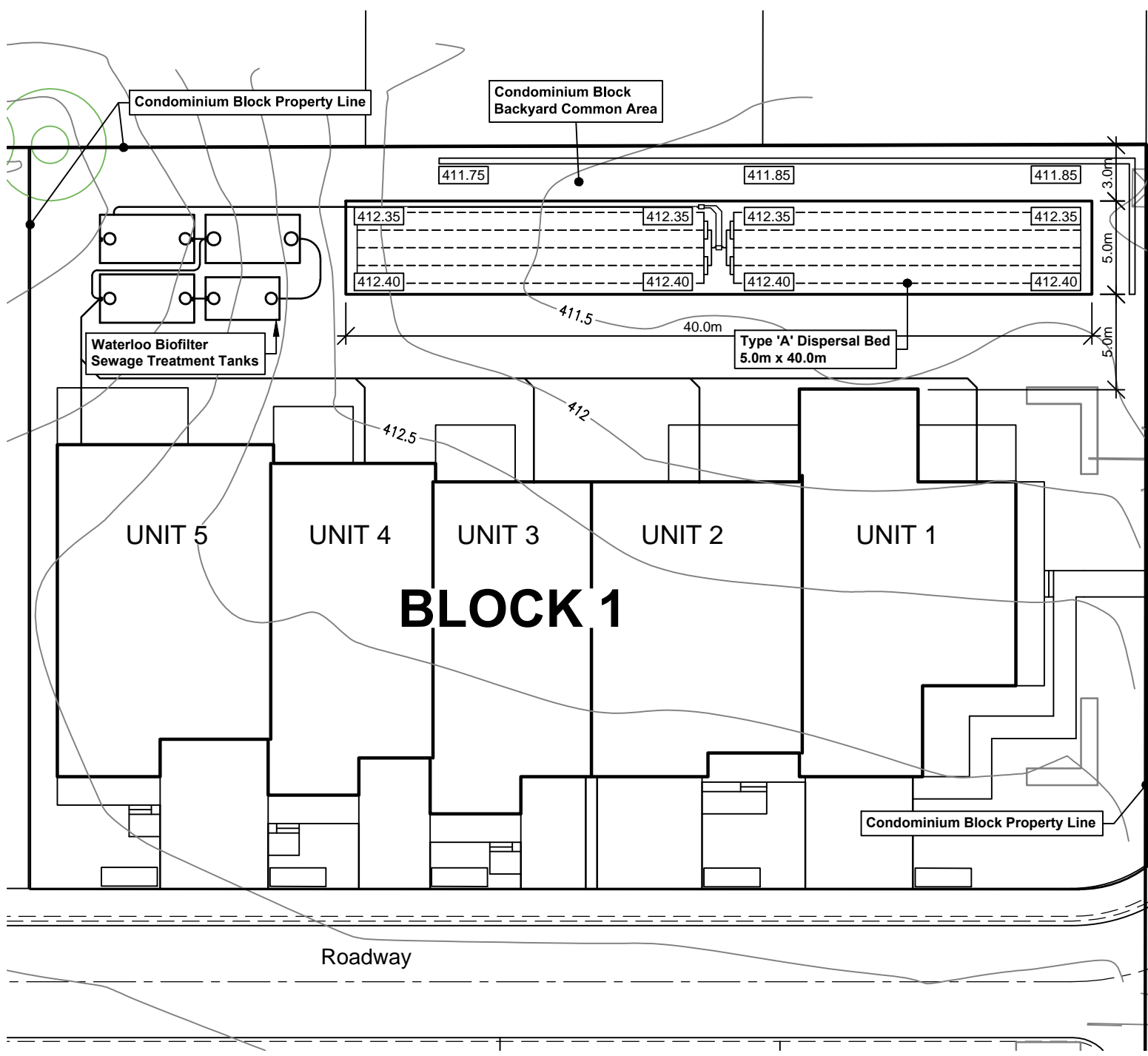
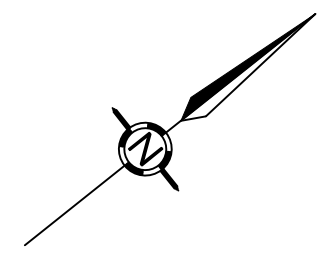
D3082 SP-1



Type 'A' Dispersal Beds

Block	Daily Design Flow (Q) L/day	Stone Area Required (Q/50) m ²	Bed Dimensions m x m
1	9,900	198.0	5.0 x 40.0
2	9,900	198.0	7.2 x 32.0
3	9,900	198.0	7.2 x 32.0
4	9,900	198.0	7.2 x 32.0
5	8,000	160.0	7.2 x 23.5
6	8,000	160.0	7.2 x 23.5
7	8,000	160.0	7.2 x 23.5
8	9,900	198.0	7.2 x 32.0
9a + 9b	9,900	198.0	7.2 x 32.0
10	9,900	198.0	7.2 x 32.0
11	9,900	198.0	7.2 x 32.0
12	8,000	160.0	7.2 x 23.5
13	9,900	198.0	7.2 x 32.0
14	8,000	160.0	7.2 x 23.5

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Class IV Tertiary Treatment System: Waterloo Biofilter - Preliminary Design: Block 1

Q = 9,900 L/day (Flows based on OBC Table 8.2.1.3.A)
 Three 3-bedroom, 3-bathroom (24 fixture units total) units each at 1,800 L/day +
 Two 4-bedroom, 3-bathroom (24 fixture units total) units each at 2,200 L/day
 = 1,800 L/day x 3 units [1,600 L + 200 L] (Additional flow of 200 L based on 20 m²
 Living Area > 200 m² or 200 L based on 4 Fixture Units > 20, in accordance with item 4 f of OBC Table
 8.2.1.3.A) + 2,200 L/day x 2 units + 100 L contingency = 9,900 L/day

Sewage Treatment: CBOD₅ ≤ 10 mg/L, TSS ≤ 10 mg/L, Nitrates ≤ 5 mg/L

W.B. Anaerobic Digester: 1.89 x daily flow = 1.89 x Q = 1.89 x 9,900 L = 18,711 L
 Provide Waterloo Biofilter Anaerobic Digester: 22,500 L (5,000 gal.) with gravity flow to Pump Station.

Pump Station: Provide 9,000 L (PT-9000) pump tank to time dose to BT-22500 Biofilter Tank.

Biofilter Tank: Provide 22,500 L (5,000 gal.) BT22500 Basket Biofilter tank, provided by Waterloo Biofilter. Biofilter
 Tank to have two pumps; one pump to re-circulate to W.B. Anaerobic Digester, second pump to demand
 dose to WaterNox Tank (advanced nitrate treatment).

WaterNox-LS Tank: Provide 18,000 L (4,000 gal.) LS-18000 Tank (to Waterloo Biofilter Specifications), to dose on
 a demand basis to Type 'A' Dispersal bed.

Soil Percolation: T = 6 min/cm. Test Pit Investigation Undertaken on August 11, 2022 by Gunnell Engineering
 identified Sand Soils.

Type 'A' Dispersal Bed (Based on Q = 9,900 L/day & T = 6 min/cm)

Stone Layer: Maximum loading = 50 L/m²/day (i.e.: Q ≥ 3,000 L/day); 9,900 / 50 = 198.0 m².
 Provide Stone Layer Area = 200.0 m². (5.0m x 40.0m)

Dispersal Bed Area: QT/850 [i.e. T < 15 min/cm]; 9,900 x 6 / 850 = 69.8m². Provide Dispersal Bed Area: 5.0m x
 40.0m = 200 m²

Mantle - N/A (i.e. T < 15 min/cm).

Stone Layer (c/w distribution piping) is to be a minimum of:
 - 15.0m from drilled wells
 - 30.0m from dug wells
 - 3.0m from property lines
 - 5.0m from townhouses
 Note: Type 'A' Dispersal Bed is not raised above finished grade, therefore no increase to setbacks to stone layer.

- Sewage System / Adjacent Grading Design Criteria:**
- 4:1 max. down slopes away from septic field.
 - No slopes directly down to septic fields (direct surface water around field with swales).
 - Swales are to be min. 0.15m deep with max. 4:1 side slopes adjacent to septic fields.
 - Septic fields are to be min. 3.0m from property lines and 5.0m from residences and installed at existing grades.
 - Septic tanks are to be min. 3.0m from property lines and 1.5m from residences.
 - No retaining walls constructed adjacent to septic fields.

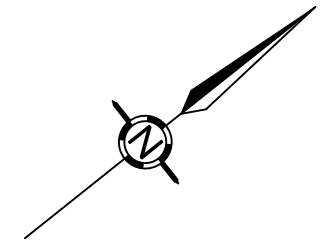
Preliminary

Rev. No.	Date	Description	CAD
Rev. 2	24-Aug-24	Layout revised	CS
Rev. 1	07-Jun-24	Additional Notes Provided	JK

**Agnes Street Townhouse Residential Development
 Town of Caledon**

**Typical Sewage System
 Layout: Block 1**

Scale: 1:300	Designed By: EG
Date: 7-Mar-2023	Drawn By: JK
Project No.:	Checked By: EG
D3082	SP1-1



Class IV Tertiary Treatment System: Waterloo Biofilter - Preliminary Design: Block 5

Q = 8,000 L/day (Flows based on OBC Table 8.2.1.3.A)
 Two 3-bedroom, 3-bathroom (24 fixture units total) units each at 1,800 L/day +
 Two 4-bedroom, 3-bathroom (24 fixture units total) units each at 2,200 L/day
 = 1,800 L/day x 2 units [1,600 L + 200 L] (Additional flow of 200 L based on 20 m²
 Living Area > 200 m² or 200 L based on 4 Fixture Units > 20, in accordance with item 4 f of OBC Table
 8.2.1.3.A) + 2,200 L/day [2,000 + 200] x 2 units = 8,000 L/day

Sewage Treatment: CBOD₅ ≤ 10 mg/L, TSS ≤ 10 mg/L, Nitrates ≤ 5 mg/L

W.B. Anaerobic Digester: 1.89 x daily flow = 1.89 x Q = 1.89 x 8,000 L = 15,120 L
 Provide Waterloo Biofilter Anaerobic Digester: 18,000 L (4,000 gal.) with gravity flow to Pump Station.

Pump Station: Provide 6,800 L (PT-6800) pump tank to time dose to BT-18000 Biofilter Tank.

Biofilter Tank: Provide 18,000 L (4,000 gal.) BT-18000 Basket Biofilter tank, provided by Waterloo Biofilter.
 Biofilter Tank to have two pumps; one pump to re-circulate to W.B. Anaerobic Digester, second pump to
 demand dose to WaterNox Tank (advanced nitrate treatment).

WaterNox-LS Tank: Provide 13,500 L (3,000 gal.) LS-13500 Tank (to Waterloo Biofilter Specifications), to
 dose on a demand basis to Type 'A' Dispersal bed.

Soil Percolation: T = 6 min/cm. Test Pit Investigation Undertaken on August 11, 2022
 by Gunnell Engineering identified Sand Soils.

Type 'A' Dispersal Bed (Based on Q = 8,000 L/day & T = 6 min/cm)

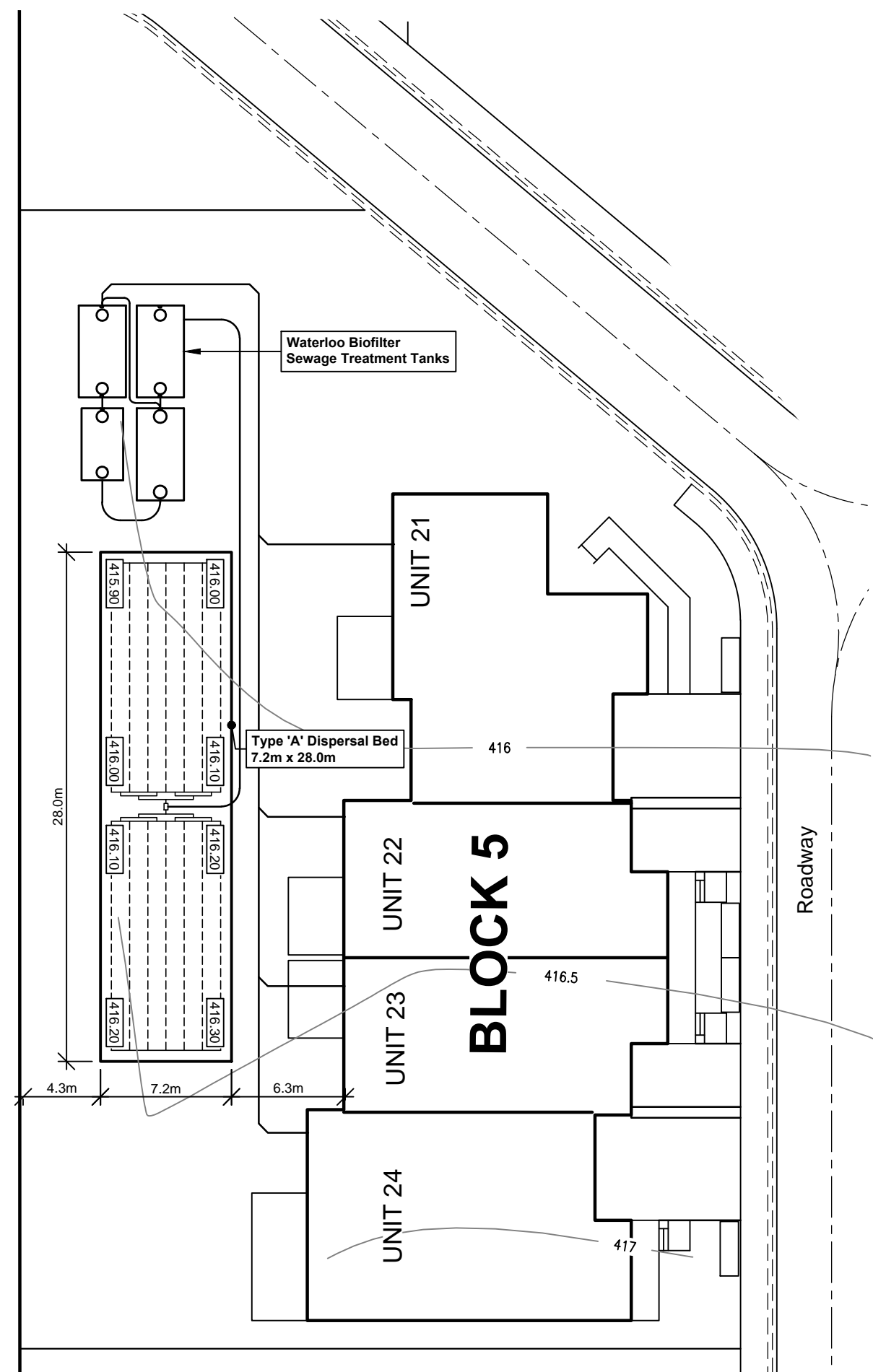
Stone Layer: Maximum loading = 50 L/m²/day (i.e.: Q ≥ 3,000 L/day); 8,000 / 50 = 160.0 m².
 Provide Stone Layer Area = 169.2 m². (7.2m x 23.5m)

Dispersal Bed Area: QT/850 (i.e. T < 15 min/cm); 8,000 x 6 / 850 = 56.5m². Provide Dispersal Bed Area:
 7.2m x 23.5m = 169.2 m²

Mantle - N/A (i.e. T < 15 min/cm).

Stone Layer (c/w distribution piping) is to be a minimum of:
 - 15.0m from drilled wells
 - 30.0m from dug wells
 - 3.0m from property lines
 - 5.0m from townhouses
 Note: Type 'A' Dispersal Bed is not raised above finished grade, therefore no increase to setbacks to stone layer.

- Sewage System / Adjacent Grading Design Criteria:**
- 4:1 max. down slopes away from septic field.
 - No slopes directly down to septic fields (direct surface water around field with swales).
 - Swales are to be min. 0.15m deep with max. 4:1 side slopes adjacent to septic fields.
 - Septic fields are to be min. 3.0m from property lines and 5.0m from residences and installed at existing grades.
 - Septic tanks are to be min. 3.0m from property lines and 1.5m from residences.
 - No retaining walls constructed adjacent to septic fields.



Preliminary

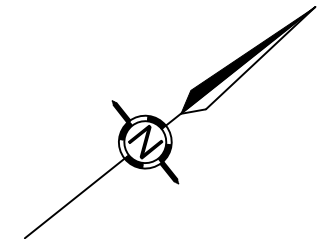
Rev. No.	Date	Description	CAD
Rev. 2	24-Aug-24	Layout revised	CS
Rev. 1	28-Nov-23	Town Comments	JK

**Agnes Street Townhouse Residential Development
 Town of Caledon**

**Typical Sewage System
 Layout: Block 5**

Scale: 1:300	Designed By: EG
Date: 7-Mar-2023	Drawn By: JK
Project No.:	Checked By: EG
D3082	SP5-1

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Sewage System / Adjacent Grading Design Criteria:

1. 4:1 max. down slopes away from septic field.
2. No slopes directly down to septic fields (direct surface water around field with swales).
3. Swales are to be min. 0.15m deep with max. 4:1 side slopes adjacent to septic fields.
4. Septic fields are to be min. 3.0m from property lines and 5.0m from residences and installed at existing grades.
5. Septic tanks are to be min. 3.0m from property lines and 1.5m from residences.
6. No retaining walls constructed adjacent to septic fields.

Stone Layer (c/w distribution piping) is to be a minimum of:
 - 15.0m from drilled wells
 - 30.0m from dug wells
 - 3.0m from property lines
 - 5.0m from townhouses
 Note: Type 'A' Dispersal Bed is not raised above finished grade, therefore no increase to setbacks to stone layer.

Class IV Tertiary Treatment System: Waterloo Biofilter - Preliminary Design: Block 9

Q = 9,900 L/day (Flows based on OBC Table 8.2.1.3.A)
 Three 3-bedroom, 3-bathroom (24 fixture units total) units each at 1,800 L/day +
 Two 4-bedroom, 3-bathroom (24 fixture units total) units each at 2,200 L/day
 = 1,800 L/day x 3 units [1,600 L + 200 L] (Additional flow of 200 L based on 20 m²
 Living Area > 200 m² or 200 L based on 4 Fixture Units > 20, in accordance with item 4 f
 of OBC Table 8.2.1.3.A) + 2,200 L/day x 2 units + 100 L contingency = 9,900 L/day

Sewage Treatment: CBOD5 ≤ 10 mg/L, TSS ≤ 10 mg/L, Nitrates ≤ 5 mg/L

W.B. Anaerobic Digester: 1.89 x daily flow = 1.89 x Q = 1.89 x 9,900 L = 18,711 L
 Provide Waterloo Biofilter Anaerobic Digester: 22,500 L (5,000 gal.) with gravity flow to Pump Station.

Pump Station: Provide 9,000 L (PT-9000) pump tank to time dose to BT-22500 Biofilter Tank.

Biofilter Tank: Provide 22,500 L (5,000 gal.) BT22500 Basket Biofilter tank, provided by Waterloo Biofilter. Biofilter Tank to have two pumps; one pump to re-circulate to W.B. Anaerobic Digester, second pump to demand dose to WaterNox Tank (advanced nitrate treatment tank).

WaterNox-LS Tank: Provide 18,000 L (4,000 gal.) LS-18000 Tank (to Waterloo Biofilter Specifications), to dose on a demand basis to Type 'A' Dispersal bed.

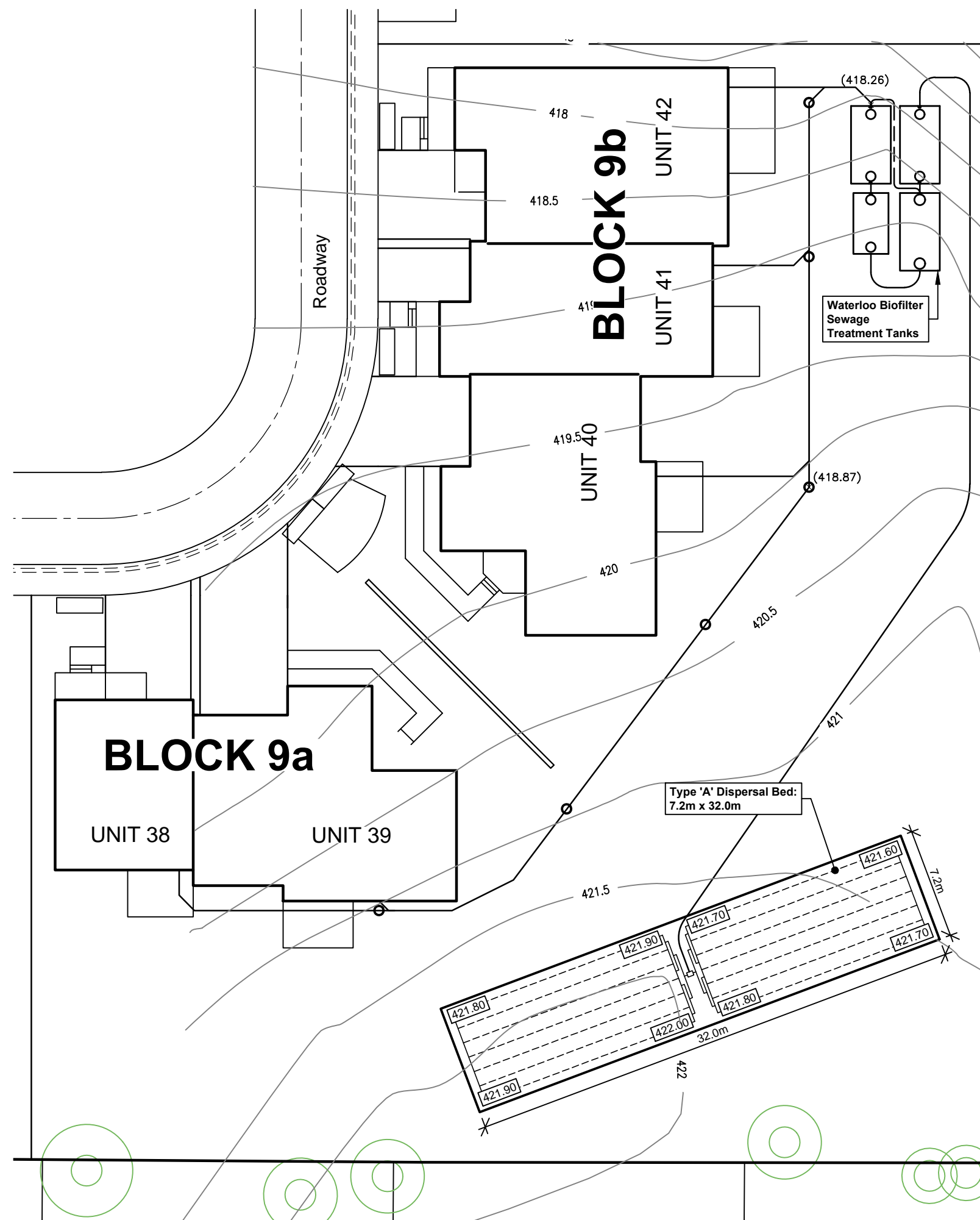
Soil Percolation: T = 8 min/cm. Test Pit Investigation Undertaken on August 11, 2022 by Gunnell Engineering identified Sand Soils.

Type 'A' Dispersal Bed (Based on Q = 9,900 L/day & T = 8 min/cm)

Stone Layer: Maximum loading = 50 L/m²/day (i.e.: Q ≥ 3,000 L/day); 9,900 / 50 = 198.0 m².
 Provide Stone Layer Area = 230.4 m². (7.2m x 32.0m)

Dispersal Bed Area: QT/850 (i.e. T < 15 min/cm): 9,900 x 8 / 850 = 93.2m².
 Provide Dispersal Bed Area: 7.2m x 32.0m = 230.4 m²

Mantle - N/A (i.e. T < 15 min/cm).



Preliminary

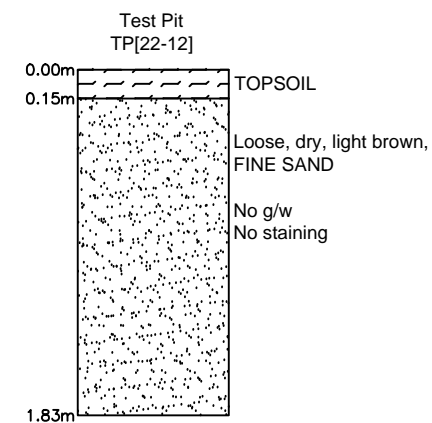
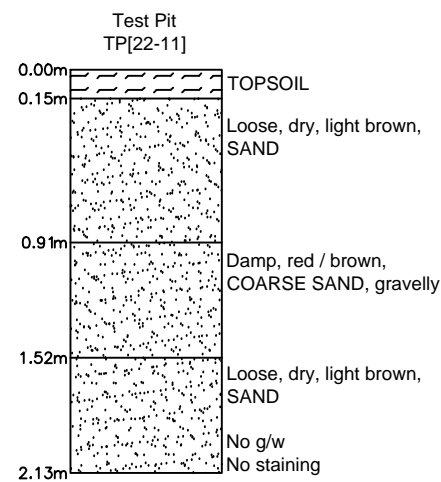
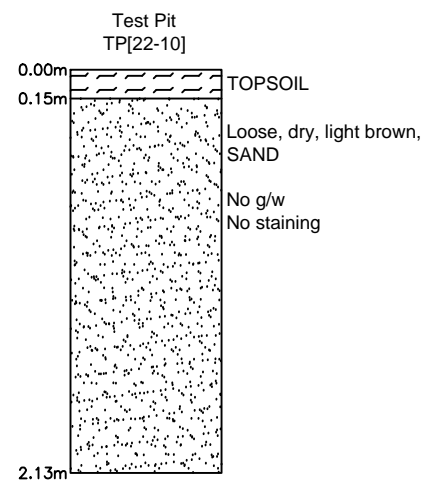
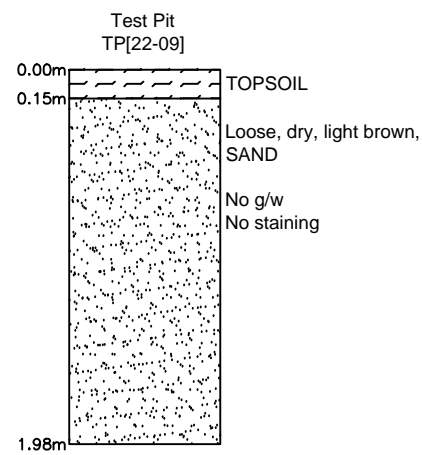
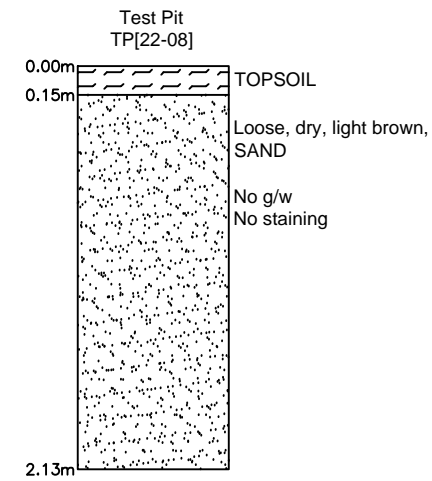
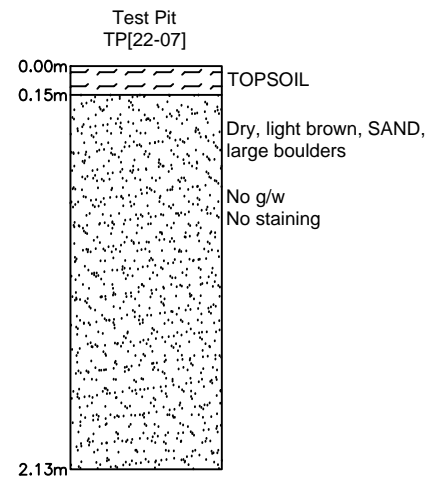
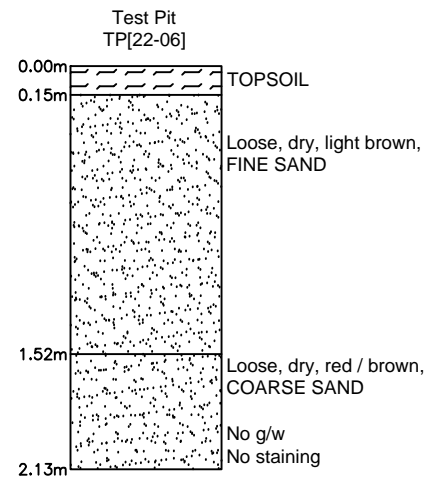
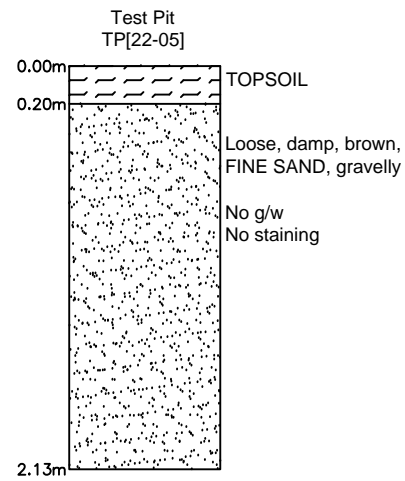
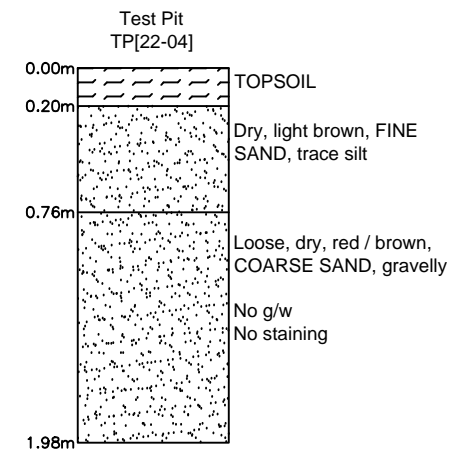
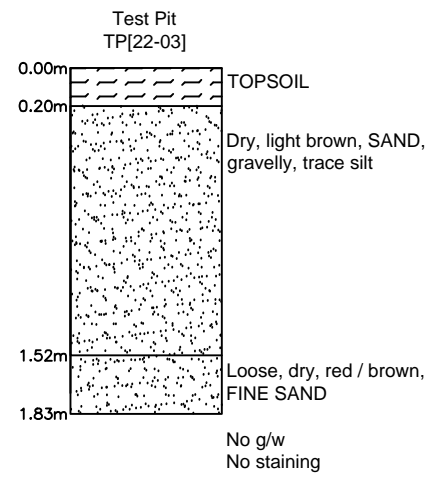
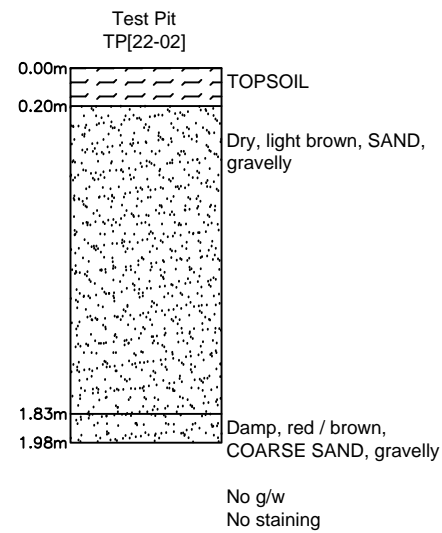
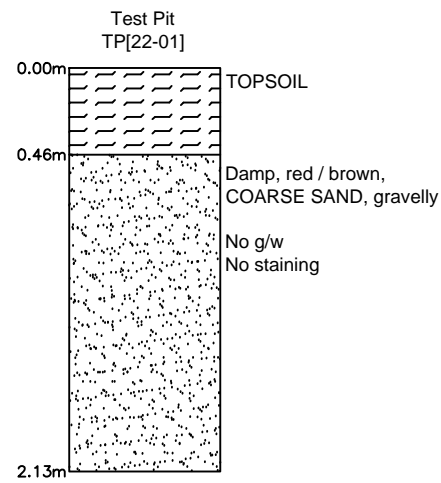
Rev. No.	Date	Description	CAD
Rev. 2	24-Aug-24	Layout revised	CS
Rev. 1	28-Nov-23	Town Comments	JK

**Agnes Street Townhouse Residential Development
 Town of Caledon**

Typical Sewage System Layout: Block 9

Scale: 1:300	Designed By: EG
Date: 7-Mar-2023	Drawn By: JK
Project No.:	Checked By: EG
	Drawing No.:

D3082 SP9-1



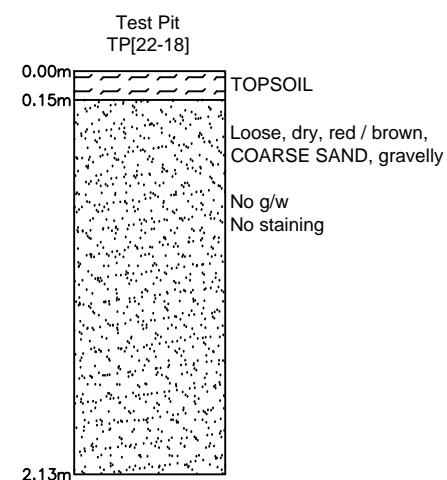
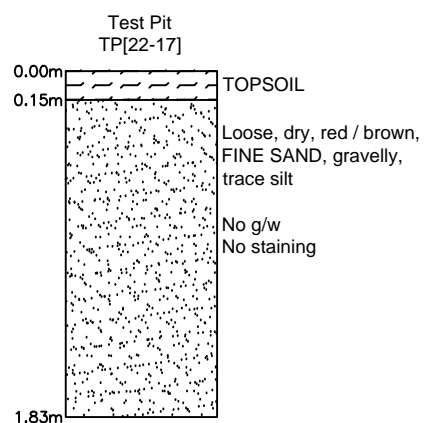
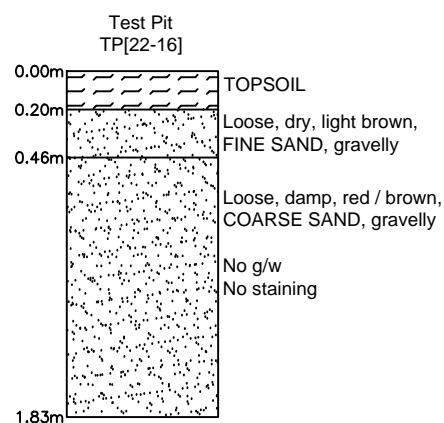
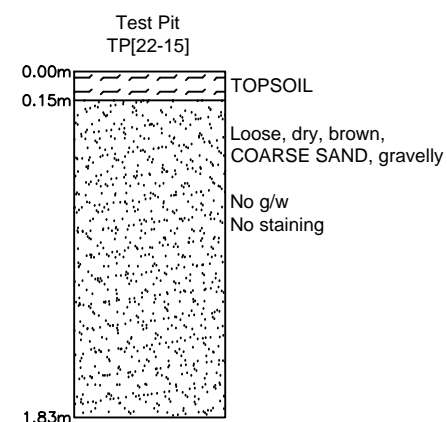
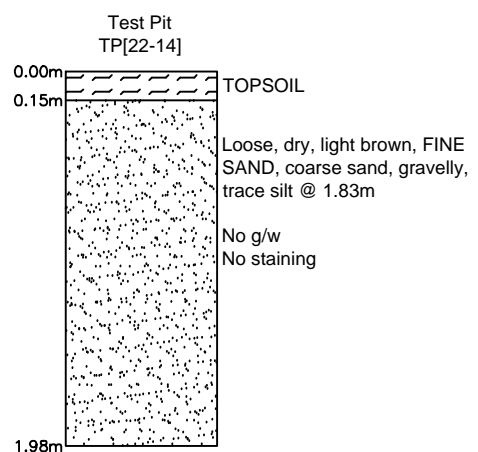
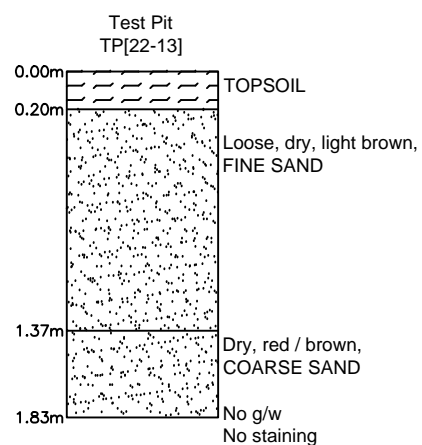
Alton Residential Infill
Agnes Street
Town of Caledon

Test Pit Soil Profiles

Scale: N.T.S.	Designed By: KD
Date: 19-AUG-2022	Drawn By: KD
Project No.:	Checked By: EG
	Drawing No.:

D3082

DT-1



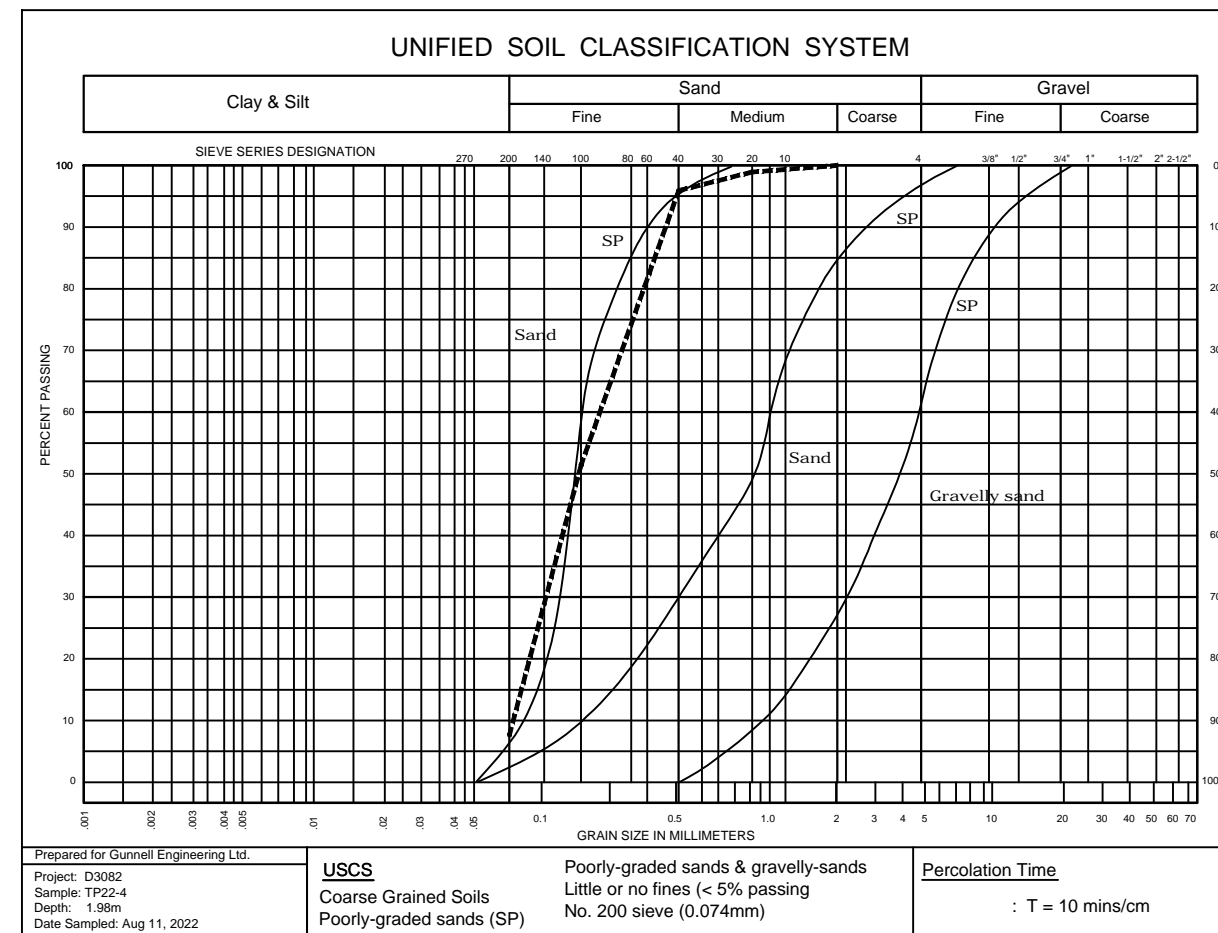
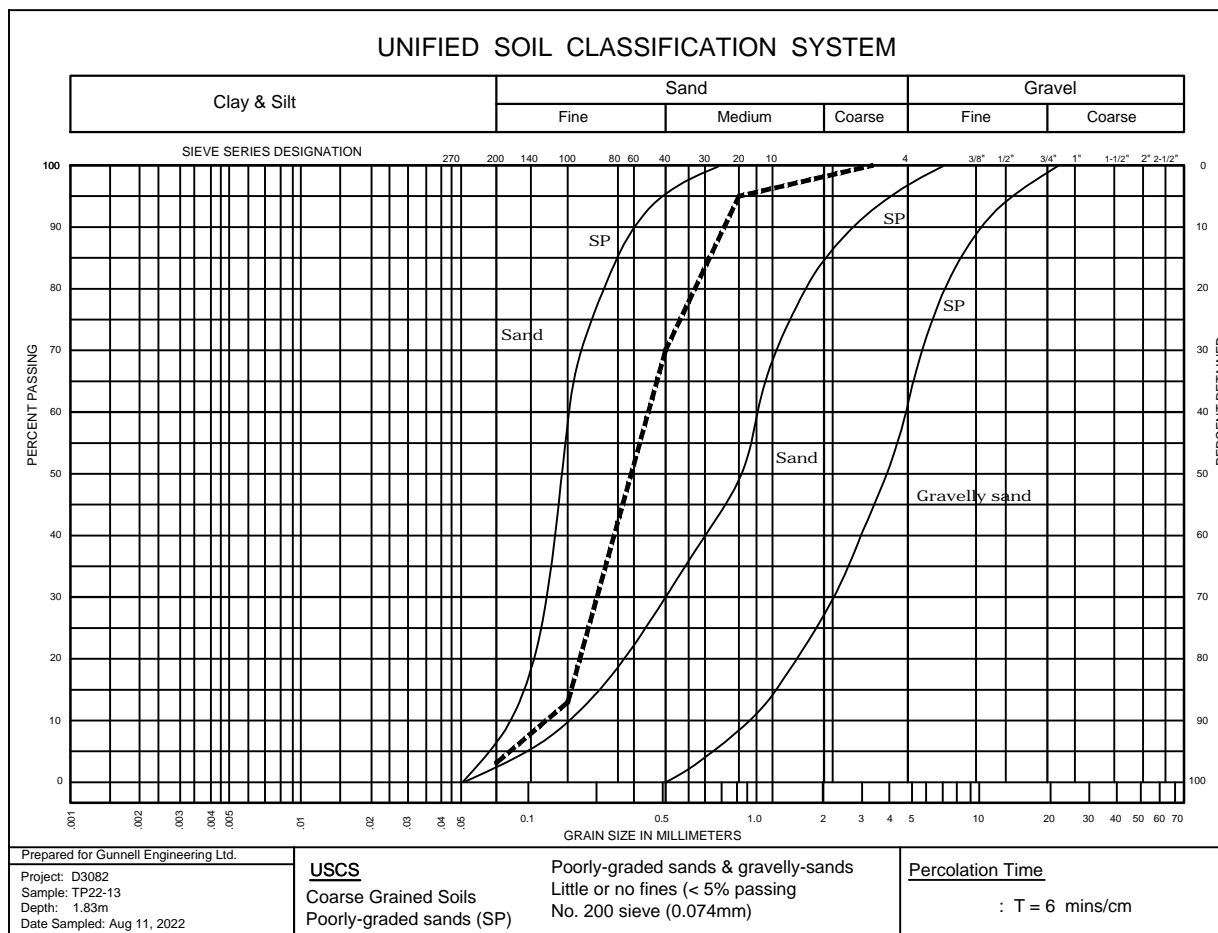
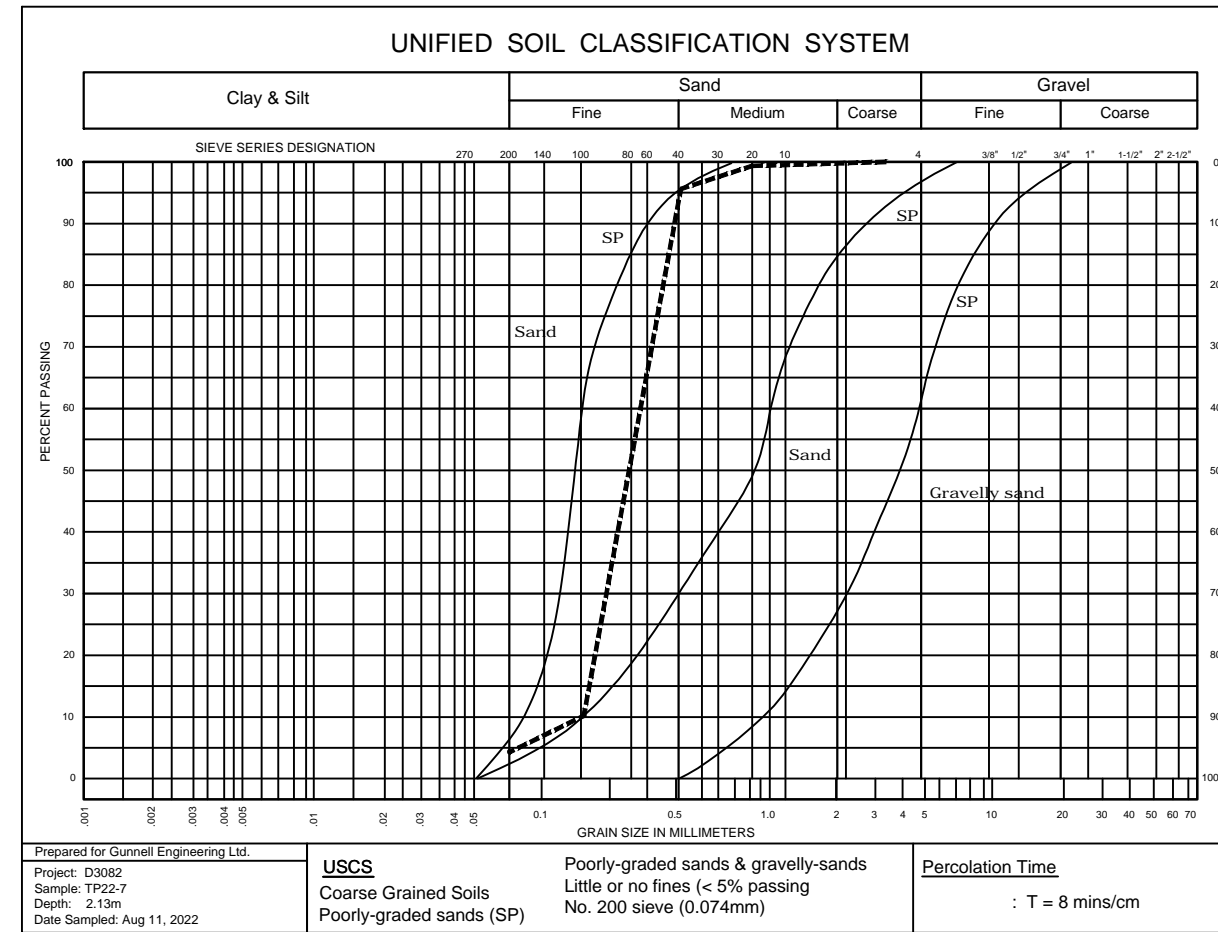
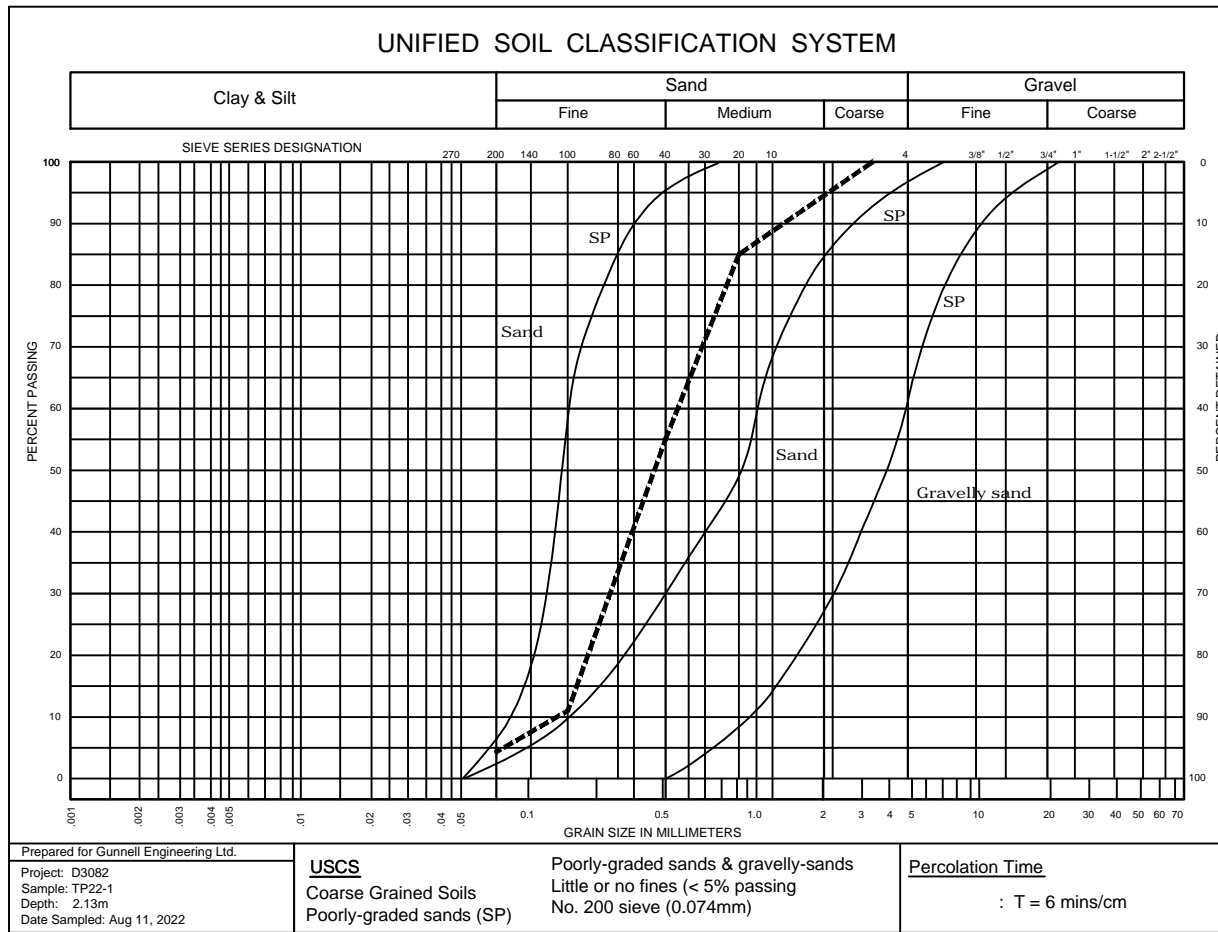
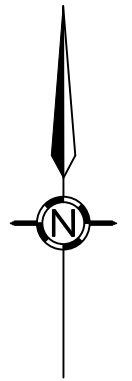
Alton Residential Infill
Agnes Street
Town of Caledon

Test Pit Soil Profiles

Scale: N.T.S.	Designed By: KD
Date: 19-AUG-2022	Drawn By: KD
Project No.:	Checked By: EG
	Drawing No.:

D3082

DT-2



**Alton Residential Infill
 Agnes Street
 Town of Caledon**

Soil Laboratory Analysis

Scale: N.T.S.	Designed By: --
Date: 7-MAR-2023	Drawn By: JK
Project No.:	Checked By: --
	Drawing No.:

D3082

DT-3

File: Z:\Gunnell Engineering\AutoCAD\3082 - PROJECTS\3082 - Alton Residential Infill\CAD\3082 - Updated Site Plan\3082BD007-DT3.dwg
 Plotted On: Fri, 13 Sep 2024 11:22:27am

WaterNOx-LS Third Party Testing Summary

In the fall of 2016, Waterloo Biofilter Systems Inc. installed their WaterNOx-LS™ denitrification unit at the Bureau de Normalisation du Quebec (BNQ) test site located in Quebec City. The system underwent BNQ 3680-600 test protocol which includes two parts - Period A and Period B. Period A is based on the methodology of NSF/ANSI Standards 40 and 245, containing the same flow patterns and stress tests. Period B provides for a further 6 months of seasonal reliability testing to ensure that the test includes cold weather results.

The WaterNOx-LS is a passive autotrophic denitrification process using sulphur-limestone minerals in a submerged, up-flow configuration. The WaterNOx-LS, which was sized for 1,600 L/day (350 gpd) followed a Waterloo Biofilter nitrifying treatment unit.

Period A Test Results

During Period A wastewater is dosed according to the hydraulic loading specified in NSF-40. Period A includes the wash-day, working-parent, power failure, and vacation period stress tests. All sample results taken during stress tests are included in the analysis. Influent wastewater temperature values ranged from 10.0 °C (50 °F) to 16.5 °C (62 °F) with an average value of 13.3 °C (56 °F). Influent pH averaged 7.9 and effluent pH averaged 7.2.

Table 1 – Period A Results for the WaterNOx-LS

Parameters	Influent	Effluent	Removal
(c)BOD ₅	260	6	97.6%
TSS	312	3	99.2%
Fecal Coliforms	2,403,000	4,900	99.8%
NO _{2,3}	0.08	0.20	
TKN	57.1	4.6	92.0%
TN	57.1	4.8	91.6%

n = 123; n = 357 for fecals

All parameters in mg/L except Fecal Coliforms in cfu/100mL

All values arithmetic averages except Fecal Coliforms in geometric average

Weekly influent total nitrogen concentrations ranged from 43.0 mg/L to 68.8 mg/L with a six-month average concentration of 57.1 mg/L.

Weekly effluent NO_{2,3} concentrations ranged from < 0.02 mg/L to 3.33 mg/L with a six-month average of 0.20 mg/L. Weekly effluent TKN concentrations ranged from 1.5 mg/L to 16.9 mg/L with a six-month average of 4.6 mg/L. Weekly effluent total nitrogen concentrations ranged from 1.7 mg/L to 17.1 mg/L with a six-month average of 4.8 mg/L. The total nitrogen reduction over the six-month period was 91.6%.

Period B Test Results

Weekday hydraulic loading is modified during Period B to a strenuous 'working parent' schedule where 40% of the flow is delivered over three hours in the morning, and 60% is delivered over three hours in the evening. All samples taken during Period B are included in the analysis. Influent wastewater temperature values ranged from 10.1 °C (50 °F) to 15.8 °C (60 °F) with an average value of 12.3 °C (54 °F). Influent pH averaged 8.0 and effluent pH averaged 7.1.

Table 2 – Period B Results for the WaterNOx-LS

Parameters	Influent	Effluent	Removal
(c)BOD ₅	248	4	98.2%
TSS	304	3	99.1%
Fecal Coliforms	2,142,000	2,800	99.9%
NO _{2,3}	0.17	3.38	
TKN	60.3	8.5	85.9%
TN	60.4	11.9	80.3%

n = 59 except Fecal Coliforms n = 118

All parameters in mg/L except Fecal Coliforms in cfu/100mL

All values arithmetic averages except Fecal Coliforms in geometric average

Weekly influent total nitrogen concentrations ranged from 21.2 mg/L to 85.6 mg/L with a six-month average concentration of 60.4 mg/L.

Weekly effluent NO_{2,3} concentrations ranged from < 0.04 mg/L to 15.2 mg/L with a six-month average of 3.38 mg/L. Weekly effluent TKN concentrations ranged from 1.2 mg/L to 21.2 mg/L with a weekly average of 8.5 mg/L. Weekly effluent total nitrogen concentrations ranged from 3.7 mg/L to 22.2 mg/L with a six-month average of 11.9 mg/L. The total nitrogen reduction over the six-month period was 80.3%.

Conclusion

In summary, the WaterNOx-LS system can successfully remove very high levels of total nitrogen passively, while buffering pH to neutral and keeping cBOD₅ and TSS levels below 10 mg/L.