APPENDIX 'A'

Additional Completed Site Investigations

Falcon Creek Erosion Control Study
(CNR to Willowbrook Road)

City of Burlington

Appendix 'A' Contents:

Aquafor Beech Limited

Prepared for:

City of Burlington

Mr. Arif Shahzad, M.Eng., P.Eng.
Senior Project Manager
Stormwater Engineering
Capital Works Department
City of Burlington
426 Brant Street,
Burlington, Ontario L7R 3Z6

City of Burlington
2020 Creeks Inventory and Erosion Assessment

Submitted by:

Aquafor Beech Ltd.

May 26th, 2021

Contact:
Rob Amos, P.Eng
Aquafor Beech Ltd.
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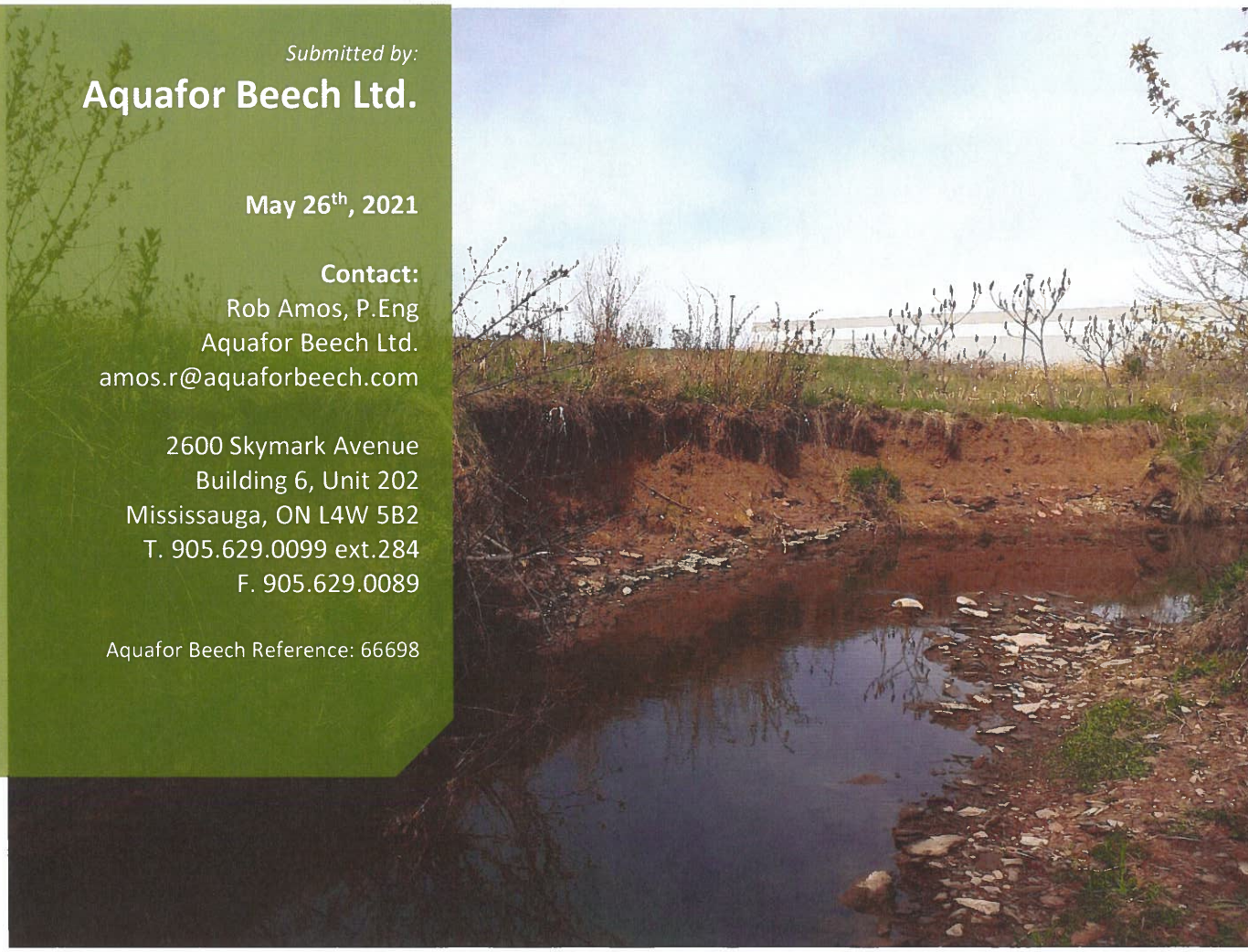
Aquafor Beech Reference: 66698



Site ID: 76 — FALCON CREEK — Priority Rank: 20

Overview

Priority Rank: 20 (of 94)
Erosion Hazard Score: 80 /100
Risk Type: Critical Infrastructure (Willowbrook Rd)
Asset Owner: City of Burlington
Site Length: 15 m

Description of Problem

- Willowbrook Rd is at risk on an outside meander bend of Falcon Creek (F05), downstream of Enfield Rd.
- The creek passes through a circular concrete culvert at Enfield Rd after which the channel meanders towards Willowbrook Rd.
- The top of bank is approximately 2 m from the guardrail and 3 m from the pavement.
- The bank slope is 2.5 m and comprised of unconsolidated soils and is highly erodible.
- Several large trees are located along the slope between the road and the watercourse.

Recommended Solution

- Utilize City land holding to realign channel approximately 6 m to the southwest away from Willowbrook Rd to accommodate 2.5:1 (H:V) regrading of east slope.
- Construct vegetated buttress slope protection on both banks (approximately 15 m in length) with boulders at the toe for long-term stability.
- Revegetate upper slopes above buttress.

Constraints & Comments:

- Warm water stream classification (specific construction timing window to be determined at the detailed design stage).
- Retain large trees at top of slope where possible to maintain established tree canopy on residential street.

Construction Cost Estimate: $300,000
Recommended Timeframe: 0 - 5 Years (2020 - 2025)

Representative Photographs

Looking east towards Willowbrook Rd at exposed tree roots

Looking upstream at active erosion along toe of slope

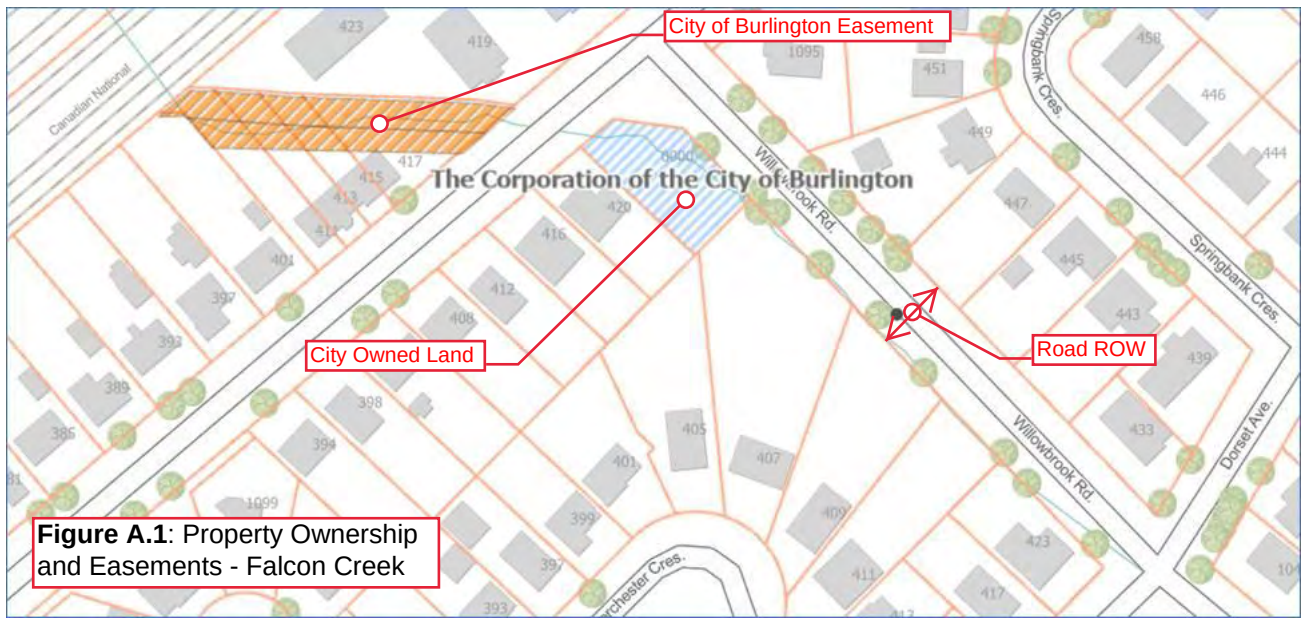
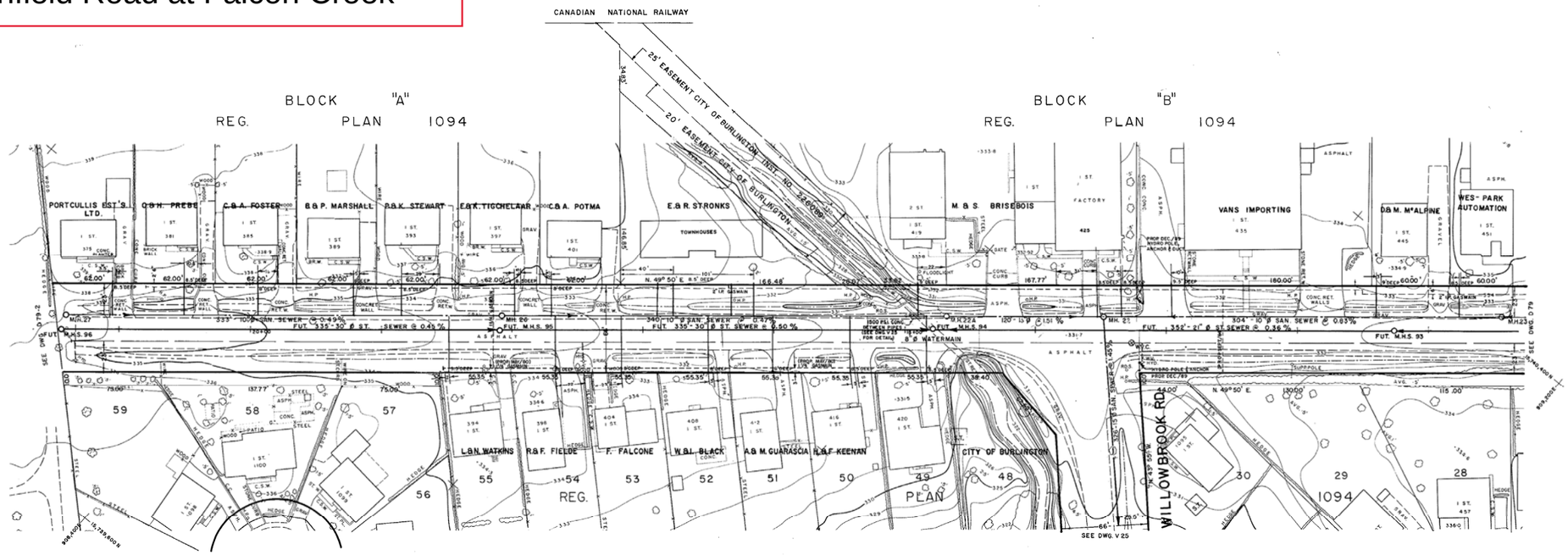


Figure A.1: Property Ownership and Easements - Falcon Creek

Figure A.2: Plan & Profile Drawing
- Enfield Road at Falcon Creek



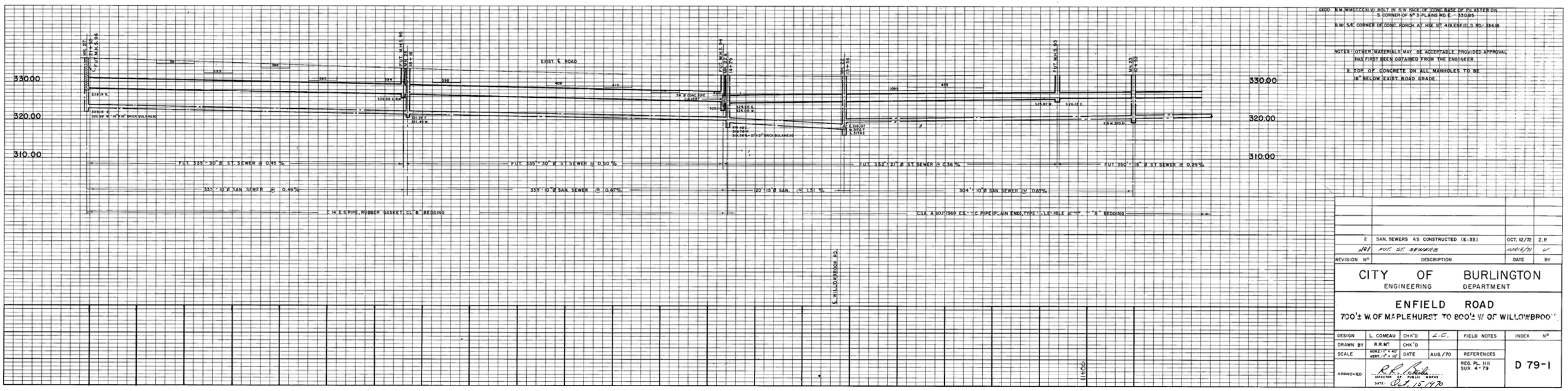


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Figure A.3: Plan & Profile Drawing - Willowbrook Road at Falcon Creek

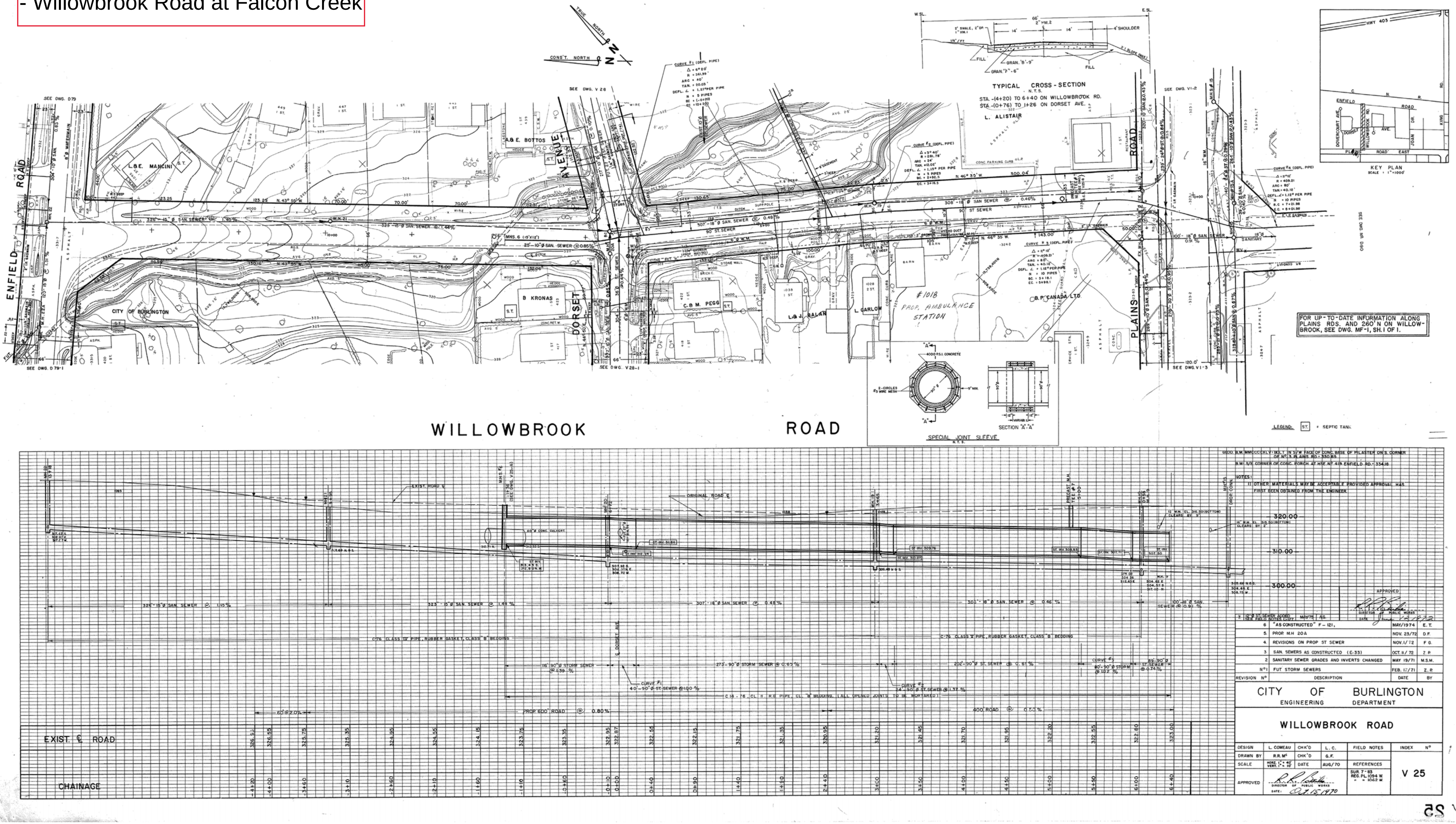

TABLE A.1: Falcon Creek - Comparison of Elevations Between Survey vs LiDAR

	Location	*Survey Elevation*	*LiDAR Elevation*	*Difference, m*
1	Intersection of Willowbrook and Enfield Rd	100.67	100.66	0.01
2	Willowbrook Road Centre (close to Enfield Rd)	99.03	99.05	-0.02
3	Willowbrook Road Centre (far east from Enfield Rd)	98.576	98.644	-0.068
4	Willowbrook Rd - Edge of Pavement (close to Enfield Rd)	100.433	100.427	0.006
5	Willowbrook Rd - Edge of Pavement (close to Enfield Rd)	100.198	100.191	0.007
6	Willowbrook Rd - Edge of Pavement (Mid distance)	98.872	98.909	-0.037
7	Willowbrook Rd - Edge of Pavement (far east from Enfield Rd)	98.075	98.173	-0.098
8	Enfield Road Centre	100.684	100.707	-0.023
9	Enfield Road Centre	100.68	100.668	0.012
10	Enfield Road - Edge of Pavement	100.616	100.655	-0.039
11	Enfield Road - Edge of Pavement	100.535	100.515	0.02
			AVERAGE	-0.021

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE
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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 542-2769

January 19, 2023

Valdor Engineering Inc.
571 Chrislea Road, Unit 4
Vaughan, Ontario
L4L 8A2

Attention: Mr. Bill Coffey

Re: A Geotechnical Assessment for
Erosion Control Study and Rehabilitation
Enfield Road and Willowbrook Road
City of Burlington

Dear Sir:

Accordance with the written authorization dated May 31, 2022, Soil Engineers Ltd. (SEL) was retained to perform a geotechnical assessment in the subject site. The objective of the geotechnical assessment is to evaluate the subsoil and groundwater conditions in vicinity of Falcon Creek to support an erosion control study and the rehabilitation project along the Creek within the investigated area.

BACKGROUND

The investigated area is located along the Falcon Creek, between the CN Railway and Dorset Avenue, in the City of Burlington. Based on the topographic survey, the bottom of creek is approximately 1 to 3 m lower than the street level. At the time of investigation, the vicinity of the creek is well vegetated with weeds, trees and shrubs. In addition, the creek was dry and weed-covered.

It is understood that the final design for the rehabilitation of the creek was not finalized. This letter report herein provides a factual summary of the subsurface findings.

FIELD WORK

The field work, consisting of eight (8) boreholes extending to depths ranging from 3.7 to 6.7 m below grade, was completed between December 5 and 7, 2022. The locations of the boreholes are illustrated on Drawing Nos.1 and 2, enclosed.

Majority of the boreholes were advanced at intervals to the sampling depths by a track-mounted machine using solid stem augers and equipped with split spoon sampler for soil sampling. Where boreholes are not accessible with the track-mounted machine, these boreholes were advanced with split spoon sampler using Hand-Hammer. Split-spoon samples were recovered for soil classification and laboratory testing. Standard Penetration Tests, using the procedures described on the enclosed "List of Abbreviations and Terms", were performed at the sampling depths. The results are recorded as the Standard Penetration Resistance (or 'N' values) of the subsoil. The relative density of the non-cohesive strata and the consistency of the cohesive strata are inferred from the 'N' values. The field work was supervised and the findings were recorded by a Geotechnical Technician.

The ground elevation of each borehole is interpolated from the elevation contours presented in the provided topographic survey.

SUBSURFACE FINDINGS

Details of the borehole findings are presented in the Borehole Logs, Figures 1 to 8, enclosed. The revealed stratigraphy is also plotted on the Subsurface Profile, Drawing No. 3. The engineering properties of the disclosed soils are discussed herein.

The investigation revealed that beneath a layer of earth fill extending to the depths from 1.9 to 3.5 m, the site is underlain by a silty clay till with localized sand deposit in some borehole locations.

Earth Fill

The earth fill generally consists of gravelly sand to silty sand, mixed with occasional clay layers/pockets and topsoil inclusions. In Borehole 8, construction debris such as brick fragments and wood debris were also observed in the fill samples. Based on the soil stratigraphy and the topographic survey, the bottom of the earth fill generally coincides with the creek elevation.

Silty Clay Till

Beneath the earth fill, the silty clay till was contacted in all boreholes. All boreholes terminated within the till deposit and the lower limit of the till was not determined. The obtained 'N' values ranged from 12 to 21, with a median of 20 blows per 30 cm of penetration, showing a generally very stiff consistency. The natural water content of the till

samples ranged from 13% to 22%, with a median of 17%, indicating a generally moist condition.

Atterberg Limit was performed on a selected sample and the result was presented in the corresponding borehole log. The resulting Plastic Limit and the Liquid Limit were 21% and 40%, respectively, indicating that the silty clay till is in medium plasticity, where the natural moisture content are generally at or below the Plastic Limit. Grain size analysis was also performed on a representative sample and the result was plotted on Figure 9, enclosed.

Sand

A layer of sand was contacted below the earth fill in Boreholes 1, 3, 4, 5, 7 and 8, extending to a depth of 3.1 to 4.2 m below grade. It is fine grained with a trace of silt. The obtained 'N' value range from 11 to 45, with a median of 16 blows per 30 cm of penetration showing a compact to dense, generally compact in relative density. The natural water content range from 18% to 21%, wth a median of 19%, indicating a wet condition. Grain size analysis was also performed on a representative sample and the result was plotted on Figure 10, enclosed.

Groundwater Condition

Upon completion of the field work, groundwater was recorded at depths from 3.5 to 6.6 m below grade. Due to the proximity of Falcon Creek, groundwater can be expected at the level of creek bottom during the wet season. During the dry season, the groundwater can be lowered than the creek bottom, as observed during our field investigation. The groundwater is subject to seasonal fluctuation of the water level in the creek.

As mentioned, this letter only covers the factual subsoil and groundwater conditions. Recommendation of the design and construction of the rehabilitation can be provided once the design is finalized.

We trust this letter satisfied your present requirements; however, should any queries arise please feel free to contact this office.

Yours truly,
SOIL ENGINEERS LTD.

Daric Yang B.A.Sc.

Kin Fung Li, P.Eng.
DY/KFL

ENCLOSURES

Borehole Log ..... Figure No. 1 to 8
Grain Size Distribution Graphs ..... Figure Nos. 9 and 10
Borehole Location Plans ..... Drawing No. 1 and 2
Subsurface Profile ..... Drawing No. 3

LIST OF ABBREVIATIONS AND DESCRIPTION OF TERMS

The abbreviations and terms commonly employed on the borehole logs and figures, and in the text of the report, are as follows:

SAMPLE TYPES

AS Auger sample
CS Chunk sample
DO Drive open (split spoon)
DS Denison type sample
FS Foil sample
RC Rock core (with size and percentage recovery)
ST Slotted tube
TO Thin-walled, open
TP Thin-walled, piston
WS Wash sample

PENETRATION RESISTANCE

Dynamic Cone Penetration Resistance:

A continuous profile showing the number of blows for each foot of penetration of a 2-inch diameter, 90° point cone driven by a 140-pound hammer falling 30 inches.

Plotted as '—●—'

Standard Penetration Resistance or 'N' Value:

The number of blows of a 140-pound hammer falling 30 inches required to advance a 2-inch O.D. drive open sampler one foot into undisturbed soil.

Plotted as '○'

WH Sampler advanced by static weight
PH Sampler advanced by hydraulic pressure
PM Sampler advanced by manual pressure
NP No penetration

SOIL DESCRIPTION

Cohesionless Soils:

'N' (blows/ft)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
over 50	very dense

Cohesive Soils:

Undrained Shear Strength (ksf)	'N' (blows/ft)	Consistency
less than 0.25	0 to 2	very soft
0.25 to 0.50	2 to 4	soft
0.50 to 1.0	4 to 8	firm
1.0 to 2.0	8 to 16	stiff
2.0 to 4.0	16 to 32	very stiff
over 4.0	over 32	hard

Method of Determination of Undrained Shear Strength of Cohesive Soils:

x 0.0 Field vane test in borehole; the number denotes the sensitivity to remoulding

△ Laboratory vane test

☐ Compression test in laboratory

For a saturated cohesive soil, the undrained shear strength is taken as one half of the undrained compressive strength

METRIC CONVERSION FACTORS

1 ft = 0.3048 metres
1lb = 0.454 kg
1 inch = 25.4 mm
1ksf = 47.88 kPa

JOB NO.: 2205-S231

LOG OF BOREHOLE: 1

FIGURE NO.: 1

PROJECT DESCRIPTION: Erosion Control Study and Rehabiitation

METHOD OF BORING: Hand Hammer

PROJECT LOCATION: Falcon Creek - Enfield Road and Willowbrook Road
City of Burlington

DRILLING DATE: December 7, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
100.5	Ground Surface							
0.0	**EARTH FILL** Reddish brown and dark brown silty sand occ. clay pockets and topsoil inclusions	1	DO	4	0		19	W.L. @ El. 96.8 m upon completion
				7				
		2	DO	7	1		13	
				13				
		3	DO	17			19	
98.6					2			
1.9	Brown, compact to dense **SAND** fine to medium grained occ. gravel and cobbles			26				
		4	DO	23			21	
				45	3			
97.4								
3.1	Grey, hard **SILTY CLAY TILL** traces of sand and gravel occ. sand seams and layers	5	DO	46			15	
				49				
96.5		6	DO	50	4		16	
4.0	**END OF BOREHOLE** **DUE TO REFUSAL TO HAND HAMMER**				5			
					6			
					7			
					8			

JOB NO.: 2205-S231

LOG OF BOREHOLE: 2

FIGURE NO.: 2

PROJECT DESCRIPTION: Erosion Control Study and Rehabiitation

METHOD OF BORING: Hand Hammer

PROJECT LOCATION: Falcon Creek - Enfield Road and Willowbrook Road
City of Burlington

DRILLING DATE: December 7, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
100.3	Ground Surface							
0.0	**EARTH FILL** Reddish brown and dark brown silty sand occ. clay pockets and topsoil inclusions	1	DO	4	0		24	W.L. @ El. 96.8 m upon completion
				4				
		2	DO	4	1		28	
				7				
98.4		3	DO	6			22	
1.9	Grey, stiff to hard **SILTY CLAY TILL** traces of sand and gravel occ. sand seams and layers			13	2			
		4	DO	31			22	
				50	3			
		5	DO	48			17	
96.6				52				
3.7	**END OF BOREHOLE** **DUE TO REFUSAL TO HAND HAMMER**				4			
					5			
					6			
					7			
					8			

Soil Engineers Ltd.

JOB NO.: 2205-S231

LOG OF BOREHOLE: 3

FIGURE NO.: 3

PROJECT DESCRIPTION: Erosion Control Study and Rehabiitation

METHOD OF BORING: Solid-stem Auger

PROJECT LOCATION: Falcon Creek - Enfield Road and Willowbrook Road
City of Burlington

DRILLING DATE: December 6, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
99.9	Ground Surface							
0.0	**EARTH FILL** Reddish brown and dark brown silty sand occ. clay pockets and topsoil inclusions	1	DO	6 4	0		14	
		2	DO	3 4	1		17	
		3	DO	4 4	2		18	
		4	DO	3 5	3		15	
96.4		5	DO	6 11			16	
3.5	Brown, compact **SAND** fine to medium grained occ. gravel				4			
95.7								
4.2	Grey, very stiff to hard **SILTY CLAY TILL** traces of sand and gravel occ. sand seams and layers	6	DO	22 38	5		16	
		7	DO	34	6		18	
93.5					7			
6.4	**END OF BOREHOLE**				8			

Dry upon Completion

JOB NO.: 2205-S231

LOG OF BOREHOLE: 4

FIGURE NO.: 4

PROJECT DESCRIPTION: Erosion Control Study and Rehabiitation

METHOD OF BORING: Solid-stem Auger

PROJECT LOCATION: Falcon Creek - Enfield Road and Willowbrook Road
City of Burlington

DRILLING DATE: December 6, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
99.8 / 0.0	Ground Surface				
0.0	**EARTH FILL** Reddish brown and dark brown silty sand occ. clay pockets and topsoil inclusions	1	DO	3	0
				3	
		2	DO	3	1
				4	
		3	DO	4	2
				6	
		4	DO	5	3
96.7				6	
3.1	Brown, compact **SAND** fine to medium grained occ. gravel and cobbles	5	DO	15	4
				22	
95.6					
4.2	Grey, very stiff **SILTY CLAY TILL** traces of sand and gravel occ. sand seams and layers	6	DO	18	5
				28	
		7	DO	24	6
93.1					
6.7	**END OF BOREHOLE**				7
					8

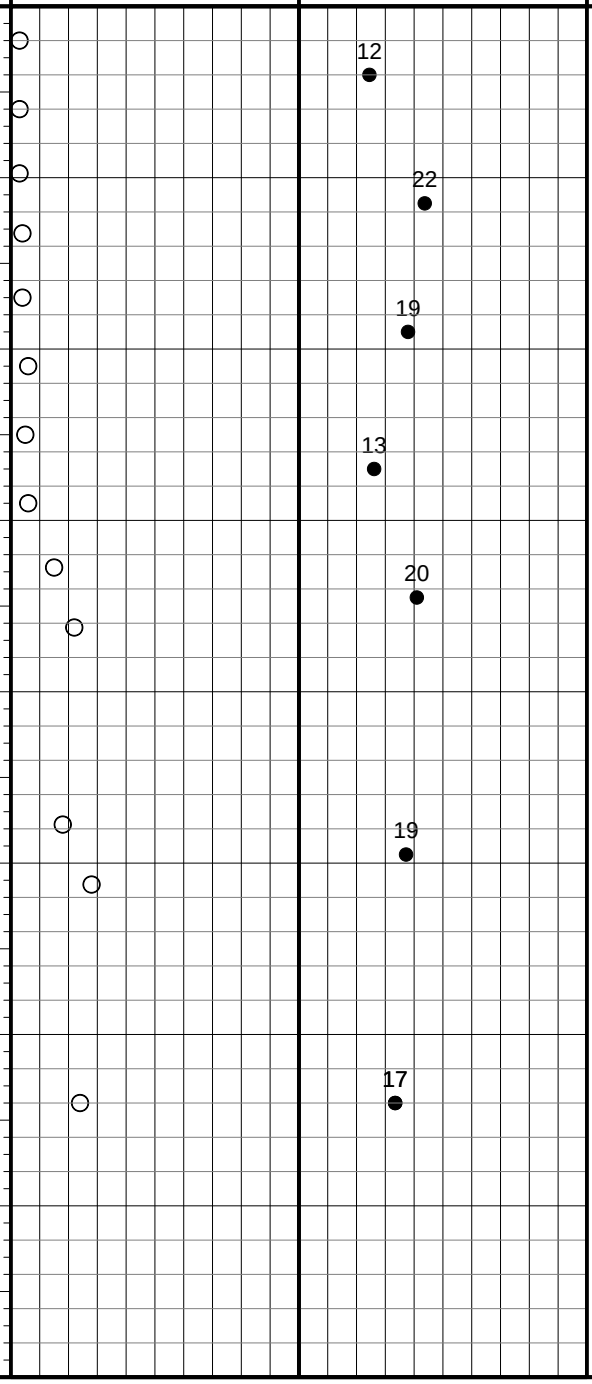
Dynamic Cone (blows/30 cm) 10 30 50 70 90

Shear Strength (kN/m²) 50 100 150 200

Penetration Resistance (blows/30 cm) 10 30 50 70 90

Atterberg Limits PL LL

Moisture Content (%) 10 20 30 40



WATER LEVEL

W.L. @ El. 99.8 m upon completion

Soil Engineers Ltd.

JOB NO.: 2205-S231

LOG OF BOREHOLE: 5

FIGURE NO.: 5

PROJECT DESCRIPTION: Erosion Control Study and Rehabiitation

METHOD OF BORING: Solid-stem Auger

PROJECT LOCATION: Falcon Creek - Enfield Road and Willowbrook Road
City of Burlington

DRILLING DATE: December 5, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
98.3	Ground Surface							
0.0	**EARTH FILL** Reddish brown and dark brown silty sand some granular occ. clay pockets and topsoil inclusions	1	DO	7 12	0		13	
		2	DO	6 12	1		11	
		3	DO	7 8	2		25	
96.0								
2.3	Brown, compact **SAND** fine to medium grained occ. gravel and cobbles	4	DO	11 21	3		21	
		5	DO	16 30			19	
94.8					4			
3.5	Grey, very stiff to hard **SILTY CLAY TILL** traces of sand and gravel occ. sand seams and layers	6	DO	31 36	5		15	
		7	DO	43	6		13	
91.7					7			
6.6	**END OF BOREHOLE**				8			

W.L. @ El. 98.2 m upon completion

Soil Engineers Ltd.

JOB NO.: 2205-S231

LOG OF BOREHOLE: 6

FIGURE NO.: 6

PROJECT DESCRIPTION: Erosion Control Study and Rehabiitation

METHOD OF BORING: Solid-stem Auger

PROJECT LOCATION: Falcon Creek - Enfield Road and Willowbrook Road
City of Burlington

DRILLING DATE: December 5, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
98.2	Ground Surface							
0.0	**EARTH FILL** grey to dark brown, gravellysand to silty sand occ. clay pockets and topsoil inclusions	1	DO	10	0		7	
				12				
		2	DO	14	1		13	
				9				
		3	DO	3	2		8	
				3				
		4	DO	3			17	
95.1				4	3			
3.1	Stiff to hard **SILTY CLAY TILL** — — brown / grey traces of sand and gravel occ. sand seams and layers	5	DO	12			19	
				18	4			
		6	DO	18			17	
				25	5			
		7	DO	41	6		14	W.L. @ El. 98.1 m upon completion ▽
91.8								
6.4	**END OF BOREHOLE**				7			
					8			

Soil Engineers Ltd.

JOB NO.: 2205-S231

LOG OF BOREHOLE: 7

FIGURE NO.: 7

PROJECT DESCRIPTION: Erosion Control Study and Rehabiitation

METHOD OF BORING: Solid-stem Auger

PROJECT LOCATION: Falcon Creek - Enfield Road and Willowbrook Road
City of Burlington

DRILLING DATE: December 5, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
98.2	Ground Surface							
0.0	**EARTH FILL** Grey to dark brown, gravelly sand to silty sand occ. clay pockets and topsoil inclusions	1	DO	3	0		7	
				5				
		2	DO	13	1		12	
				23				
		3	DO	20			12	
				19	2			
95.5		4	DO	8			20	
2.7	Brown, compact **SAND** fine to medium grained occ. gravel and cobbles			13	3			
		5	DO	16			18	
				18				
94.0					4			
4.2	Grey, very stiff to hard **SILTY CLAY TILL** traces of sand and gravel occ. sand seams and layers	6	DO	16			17	
				30	5			
					6		16	
91.8		7	DO	39				▽
6.4	**END OF BOREHOLE**				7			W.L. @ El. 98.0 m upon completion
					8			

Soil Engineers Ltd.

JOB NO.: 2205-S231

LOG OF BOREHOLE: 8

FIGURE NO.: 8

PROJECT DESCRIPTION: Erosion Control Study and Rehabiitation

METHOD OF BORING: Solid-stem Auger

PROJECT LOCATION: Falcon Creek - Enfield Road and Willowbrook Road
City of Burlington

DRILLING DATE: December 6, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
98.1 / 0.0	Ground Surface				
0.0	**EARTH FILL** Grey to dark brown, gravelly sand to silty sand occ. brick fragments, wood debris and topsoil inclusions	1	DO	7 8	0
		2	DO	5 14	1
		3	DO	6 8	2
		4	DO	6 11	
95.2 / 2.9	Brown, compact **SAND** fine grained some gravel with occ. cobbles	5	DO	12 20	3
93.9 / 4.2	Grey, very stiff to hard **SILTY CLAY TILL** traces of sand and gravel occ. sand seams and layers	6	DO	19 34	4 5
		7	DO	39	6
91.5 / 6.6	**END OF BOREHOLE**				7 8

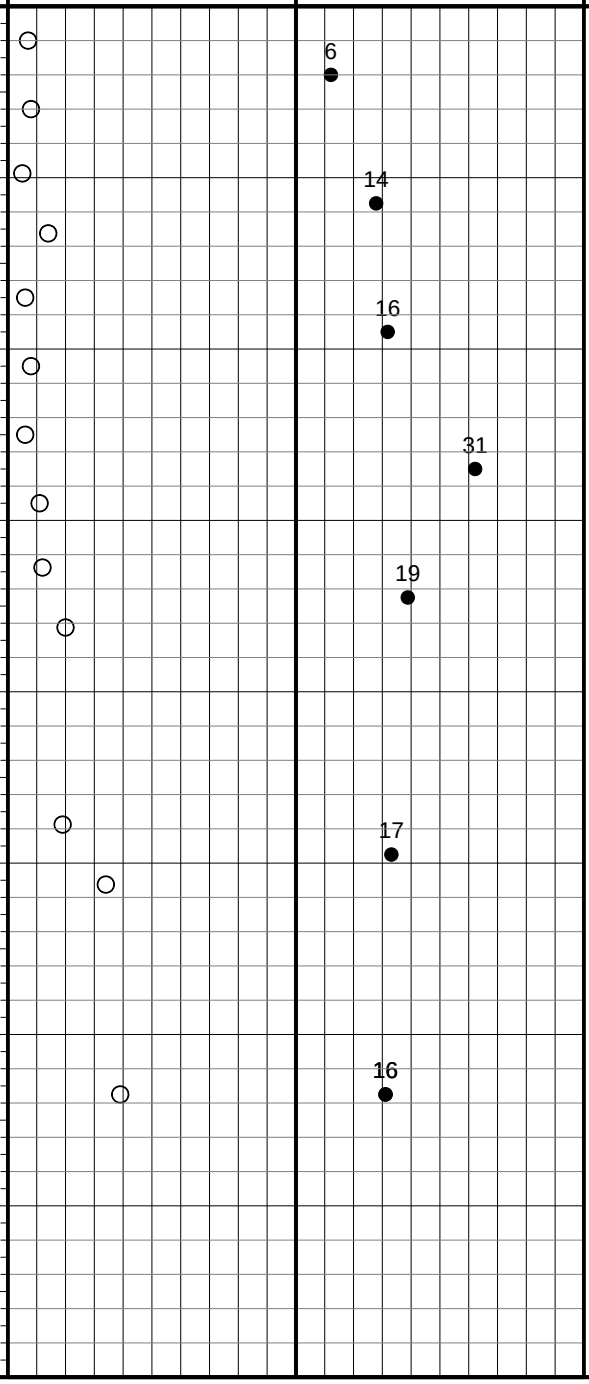
Dynamic Cone (blows/30 cm) 10 30 50 70 90

Shear Strength (kN/m²) 50 100 150 200

Penetration Resistance (blows/30 cm) 10 30 50 70 90

Atterberg Limits PL LL

Moisture Content (%) 10 20 30 40



WATER LEVEL

W.L. @ El. 97.9 m upon completion

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

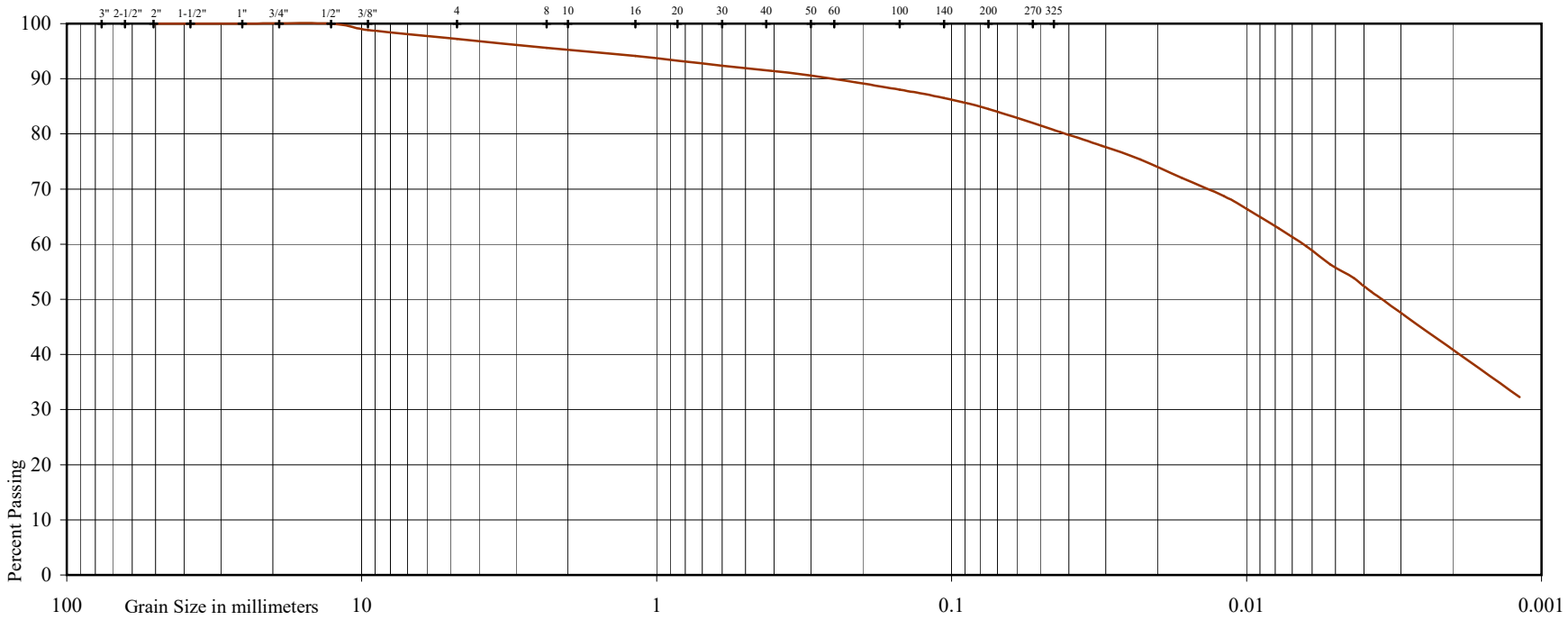
Reference No: 2205-S231

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Erosion Control Study and Rehabiitation

Location: Falcon Creek - Enfield Road and Willowbrook Road, City of Burlington

Borehole No: 6

Sample No: 6

Depth (m): 4.1

Elevation (m): 94.1

Liquid Limit (%) = 40

Plastic Limit (%) = 21

Plasticity Index (%) = 19

Moisture Content (%) = 17

Estimated Permeability (cm./sec.) = 10^{-7}

Classification of Sample [& Group Symbol]: SILTY CLAY, TILL
some sand, a trace of gravel

Figure 9

Soil Engineers Ltd.

GRAIN SIZE DISTRIBUTION

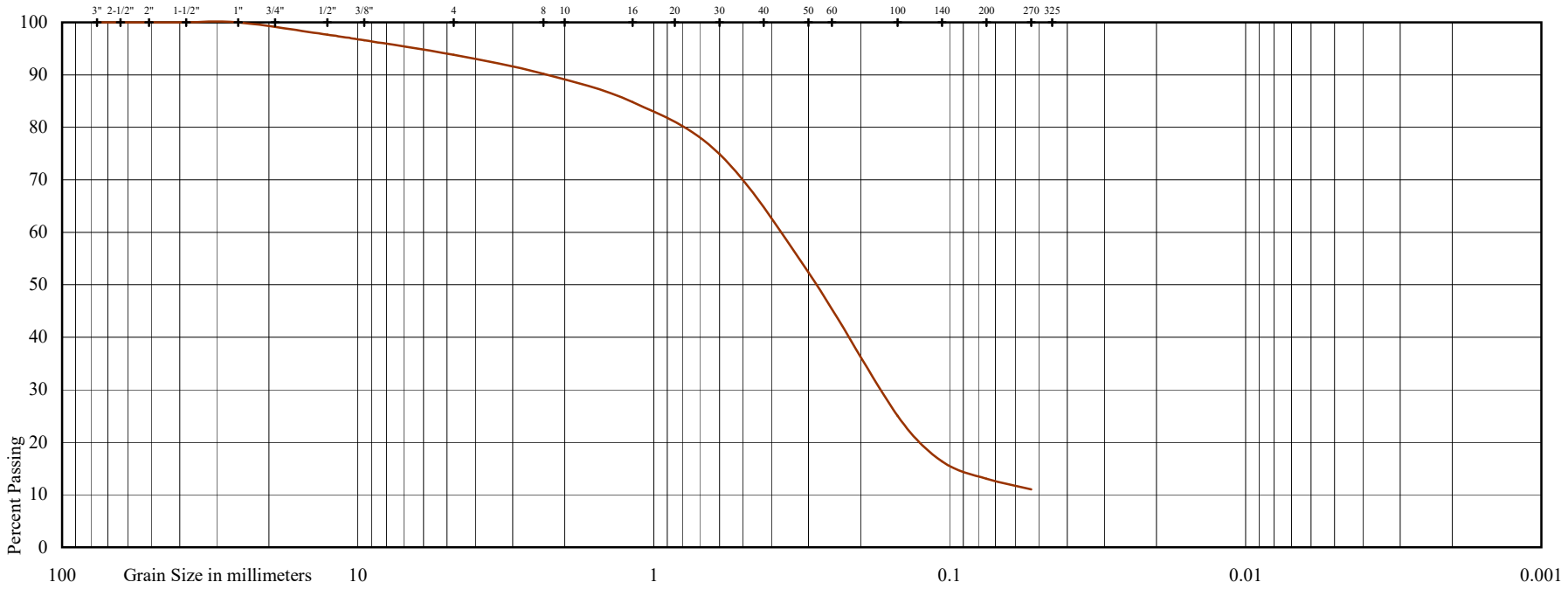
Reference No: 2205-S231

U.S. BUREAU OF SOILS CLASSIFICATION

GRAVEL		SAND				SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	V. FINE		

UNIFIED SOIL CLASSIFICATION

GRAVEL		SAND			SILT & CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	



Project: Somewhere — Erosion Control Study and Rehabiitation

Location: Someplace — Falcon Creek - Enfield Road and Willowbrook Road, City of Burlington

Borehole No: 1

Sample No: 4

Depth (m): 2.3

Elevation (m): 98.2

Liquid Limit (%) = -

Plastic Limit (%) = -

Plasticity Index (%) = -

Moisture Content (%) = 21

Estimated Permeability (cm./sec.) = 10^{-3}

Classification of Sample [& Group Symbol]: FINE TO MEDIUM SAND
a trace of silt, occ. gravel

Figure 10

BH-1

BH-2

PROFILE

CB

423

417

415

SMCULVERT

DITCH

BOTTOM OF BANK

LEGEND

Borehole

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CONSULTING ENGINEERS
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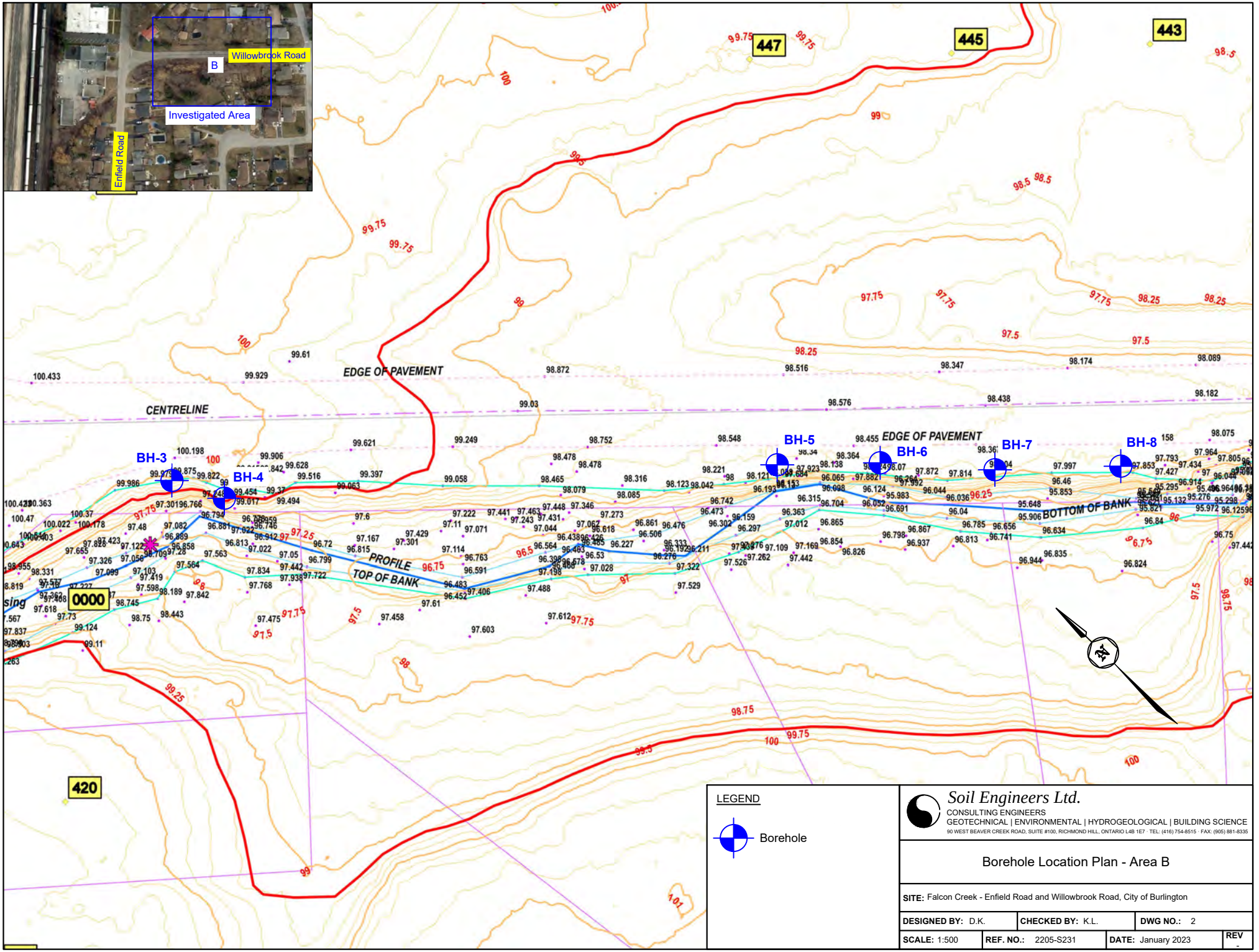
90 WEST BEAVER CREEK ROAD, SUITE #100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

Borehole Location Plan - Area A

SITE: Falcon Creek - Enfield Road and Willowbrook Road, City of Burlington			
DESIGNED BY: D.K.	**CHECKED BY:** K.L.	**DWG NO.:** 1	
SCALE: 1:300	**REF. NO.:** 2205-S231	**DATE:** January 2023	**REV**



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Borehole Location Plan - Area B

SITE: Falcon Creek - Enfield Road and Willowbrook Road, City of Burlington			
DESIGNED BY: D.K.	**CHECKED BY:** K.L.	**DWG NO.:** 2	
SCALE: 1:500	**REF. NO.:** 2205-S231	**DATE:** January 2023	**REV**

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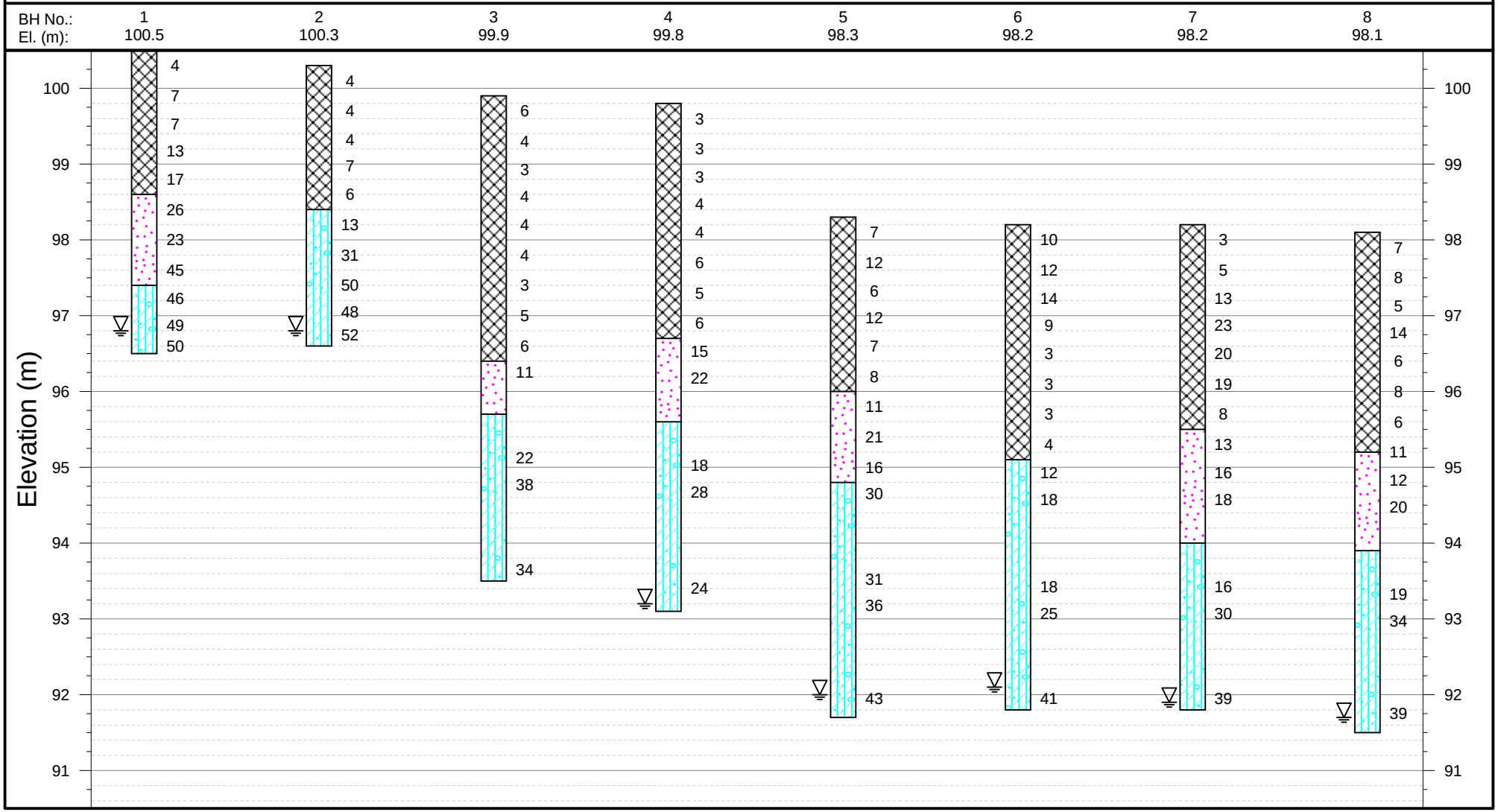
SUBSURFACE PROFILE
DRAWING NO. 3
SCALE: AS SHOWN

JOB NO.: 2205-S231
REPORT DATE: January 2023
PROJECT DESCRIPTION: Erosion Control Study and Rehabiitation

PROJECT LOCATION: Falcon Creek - Enfield Road and Willowbrook Road
City of Burlington

LEGEND
FILL | SAND | SILTY CLAY TILL
WATER LEVEL (END OF DRILLING)



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BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	GRAVENHURST	PETERBOROUGH	HAMILTON
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FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 725-1315	FAX: (905) 542-2769

February 14, 2023

Reference No. 2205-E231

Valdor Engineering Inc.
571 Chrislea Road, Unit 4
Vaughan, On
L4L 8A2

Attention: Mr. Bill Coffey

Re: Soil Characterization Report
Erosion Control Study and Rehabilitation
Falcon Creek
City of Burlington

Dear Sir:

Soil Engineers Ltd. (SEL) was retained by Valdor Engineering Inc. to complete soil sampling program at the captioned project. The investigation was carried along Falcon Creek, between the CN Railway and Dorset Avenue, in the City of Burlington (hereinafter referred to as the 'subject site'). The investigation was conducted in conjunctive with geotechnical investigation. The purpose of the compiling program is to determine the environmental quality of the soil at the site and to meet the applicable Ministry of the Environment, Conservation and Parks (MECP) Standards.

The subject site is located along the Falcon Creek, between the CN Railway and Dorset Avenue, in the City of Burlington. Based on the topographic survey, the bottom of creek is approximately 1 to 3 m lower than the street level. At the time of investigation, the vicinity of the creek is well vegetated with weeds, trees and shrubs. In addition, the creek was dry and weed-covered. The surrounding areas were residential and commercial properties.

Representative soil samples were collected from boreholes to determine the environmental quality of material and herein present our findings and recommendations.

Field Work

The field work, consisting of the drilling of six (6) geotechnical boreholes at the subject site was conducted on December 5 and 7, 2022. The boreholes were drilled to depth of 3.7 to 6.7 m below ground surface. The borehole locations are shown on the Borehole Location Plan, Drawing No. 1, 2.
The boreholes were drilled to the sampling depths by a drilling rig. Soil samples were retrieved from the boreholes using a split spoon, for soil classification and visual and olfactory observations. The sampling tool (i.e., split spoon) is decontaminated prior to initial use, between the sampling locations and at the completion of sampling activities.

The sampling tool is manually scrubbed with a brush using a phosphate-free solution and washed to remove any adhered soils, foreign material and potential contaminants. The field work was conducted by a Soil Engineers Ltd. environmental technician who recorded the findings and observations in the field.

Subsurface Condition

The investigation revealed that beneath a layer of earth fill extending to the depths from 1.9 to 3.5 m, the site is underlain by silty clay till with localized sand deposit in some borehole locations.. Detailed descriptions of the encountered subsurface conditions are presented on the Borehole Logs, comprising Figures 1 to 6, inclusive.

Site Condition Standard

For the purposes of assessing off-site re-use and/or off-site disposal options the results of the chemical analyses were assessed against the following Standards contained in the document "Rules for Soil Management and Excess Soil Quality Standards", published by the Ministry of Environment, Conservation and Parks (2020), and adopted by reference in O.Reg.406/19 (On-Site and Excess Soil Management) made under the Environmental Protection Act, R.S.O. 1990:

- Table 1 RPIICC: Full Depth Background Site Condition Standards for Residential/Parkland/ Institutional/Industrial/Commercial/Community Use (hereinafter referred to as "Table 1 ESQS RPIICC Standards").

- Table 2.1 RPI: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition for Residential/Parkland/Institutional Property uses (hereinafter referred to as "Table 2.1 ESQS RPI Standards").

- Table 2.1 ICC: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition for Industrial/Community/Commercial Property uses (hereinafter referred to as "Table 2.1 ESQS ICC Standards").

Soil Sampling and Soil Quality

Representative samples were retrieved from six (6) geotechnical boreholes drilled at the captioned site. Evidence of potential contamination was documented in the retrieved soil samples from all borehole locations. Head space vapour screening was also conducted for the retrieved soil samples using combustible gas detector (RKI Eagle) in methane elimination mode, having a minimum detection of 2 ppm (parts per million by volume). Soil vapour measurements of 0 ppm were recorded for the soil samples, indicating insignificant combustible gases in the soil samples retrieved from the sampling locations.

Based on the soil vapour measurements and visual and olfactory observations, representative soil samples from the sampling locations were submitted to the laboratory for chemical analyses.

The samples were sent to AGAT Laboratories, accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA), for chemical analysis of Metals and Inorganics (M&I), Polycyclic Aromatic Hydrocarbons (PAHs) and Petroleum Hydrocarbons (PHCs) parameters

As part of the Quality Assurance/Quality Control (QA/QC) program, two (2) QC sample in the form of a field duplicate soil sample was collected and submitted to the laboratory for chemical analysis.

The soil sampling program is as follows:

Borehole No.	Sample ID	Laboratory ID	Soil Type	Depth (*mbs)	Gas Reading (**ppm)	Test Conducted
1	BH-1/3	4600757	Earth Fill	1.5 - 2.3	0	M&I
	BH-1/4	4600758	Sand	2.3 - 3.1	0	PHCs, PAHs
2	BH-3/2	4600759	Earth Fill	0.8 - 1.5	0	M&I, PAHs
	BH-3/3	4600760	Earth Fill	1.5 - 2.3	0	PHCs
3	BH-4/1	4600761	Earth Fill	0.2 - 0.8	0	M&I
	BH-4/5	4600762	Sand	3.1 - 3.8	0	PHCs, PAHs
4	BH-5/3	4600764	Earth Fill	1.5 - 2.3	0	M&I
	BH-5/4	4600767	Sand	2.3 - 3.1	0	PAHs
	BH-5/5	4600770	Silty Clay Till	3.1 - 3.8	0	PHCs
5	BH-7/2	4600772	Earth Fill	0.8 - 1.5	0	M&I
	BH-7/5	4600774	Sand	3.1 - 3.8	0	PHCs, PAHs
6	BH-8/3	4600775	Earth Fill	1.5 - 2.3	0	M&I
	BH8/4	4600776	Sand	2.3 - 3.1	0	PHCs, PAHs
-	DUP S1	4600778	-	-	0	M&I
-	DUP S2	4600779	-	-	0	M&I

*mbs = meters below ground surface

A review of the results of the soil samples indicates that, the tested parameters at the tested locations meet the Table 1 ESQS Standards with the exception of the following parameters:

Sample Name	Parameter	Unit	Table 1 Standards	Table 2.1 RPI Standards	Table 2.1 ICC Standards	Measured Value
BH-3/2	Sodium Adsorption Ratio	-	2.4	5	12	4.52
BH-4/1	Sodium Adsorption Ratio	-	2.4	5	12	5.33
BH-5/3	Electrical Conductivity	mS/cm	0.57	0.7	1.4	0.979
	Sodium Adsorption Ratio	-	2.4	5	12	6.91
BH-7/2	Electrical Conductivity	mS/cm	0.57	0.7	1.4	6.05
BH-8/3	Sodium Adsorption Ratio	-	2.4	5	12	5.71
DUP S1	Barium	µg/g	220	390	670	248
DUP S2	Electrical Conductivity	mS/cm	0.57	0.7	1.4	0.713
	Sodium Adsorption Ratio	-	2.4	5	12	8.95

A review of the results of the soil samples indicates that, the tested parameters at the tested locations meet the Table 2.1 ICC ESQS Standards.

The results of the analysis for the field duplicate sample (DUP S1) yielded concentration of Barium of 248 µg/g which exceeds the Table 1 Standards value of 220 µg/g. The original sample (BH1/3) yielded concentration of Barium of 206 µg/g which meets the Table 1 Standards. Based on the findings, the concentration of Barium may be an isolated concentration within the sample collected at BH1. The overall concentration of Barium meets Table 2.1 RPI Standards.

One must be aware that soil conditions at the subject site may vary between sampling locations. Please note that the acceptance of material along with the frequency of sampling and testing are at the discretion of the receiving site.

Should any queries arise, please feel free to contact this office.

Yours very truly,

SOIL ENGINEERS LTD.

Arezoo Karimian, PhD. P.Eng.

Ahmed Hassan, P.Eng.
AK/AH:ak

LICENSED PROFESSIONAL ENGINEER
A. KARIMIAN
100506906
Feb 14,2023
PROVINCE OF ONTARIO

LICENSED PROFESSIONAL ENGINEER
A. M. HASSAN
100124527
Feb. 14, 2023
PROVINCE OF ONTARIO

Enclosed

- Sample Location Plan (2 Pages)
- Borehole Location Logs (6 Pages)
- Certificate of Analysis (17 Pages)

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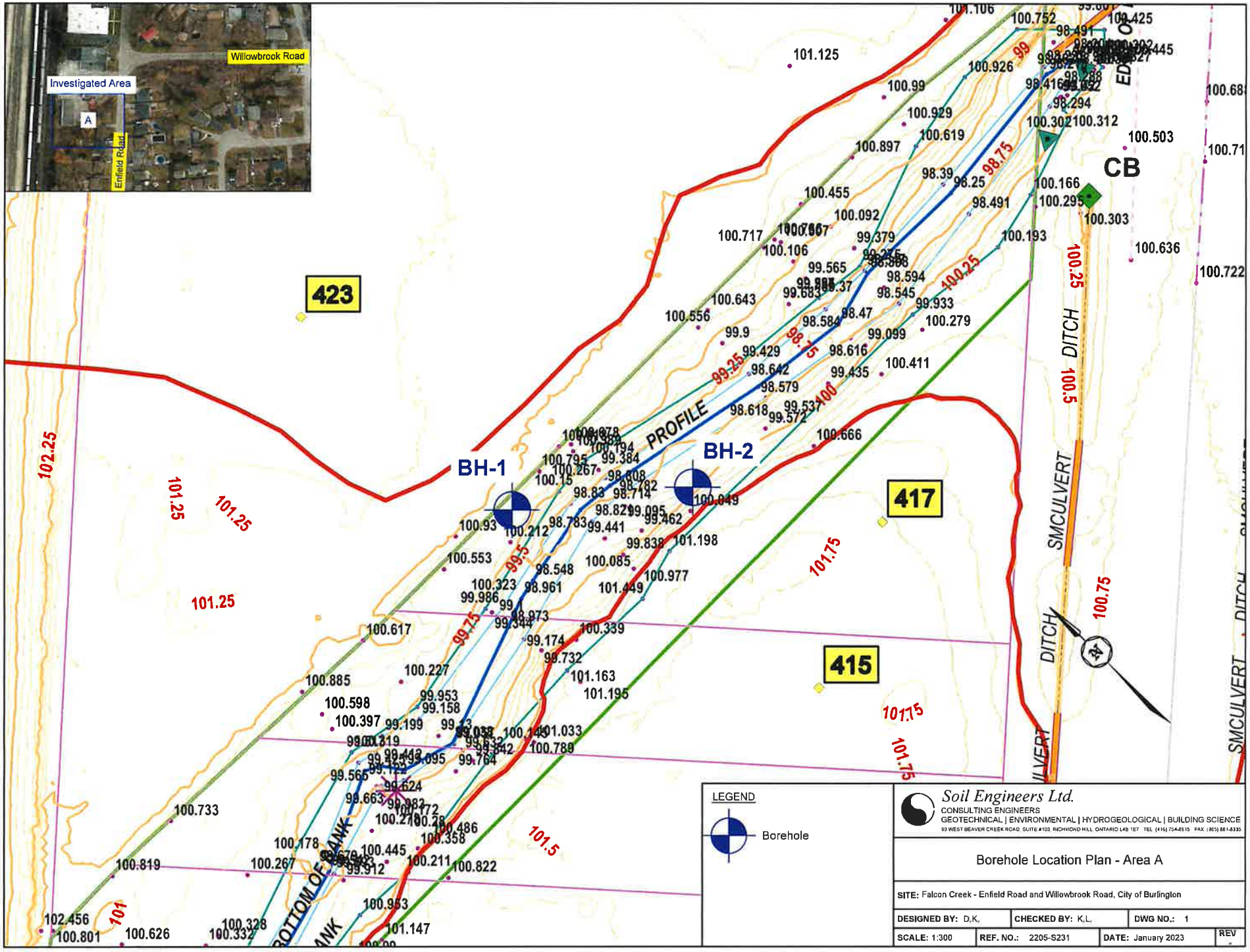
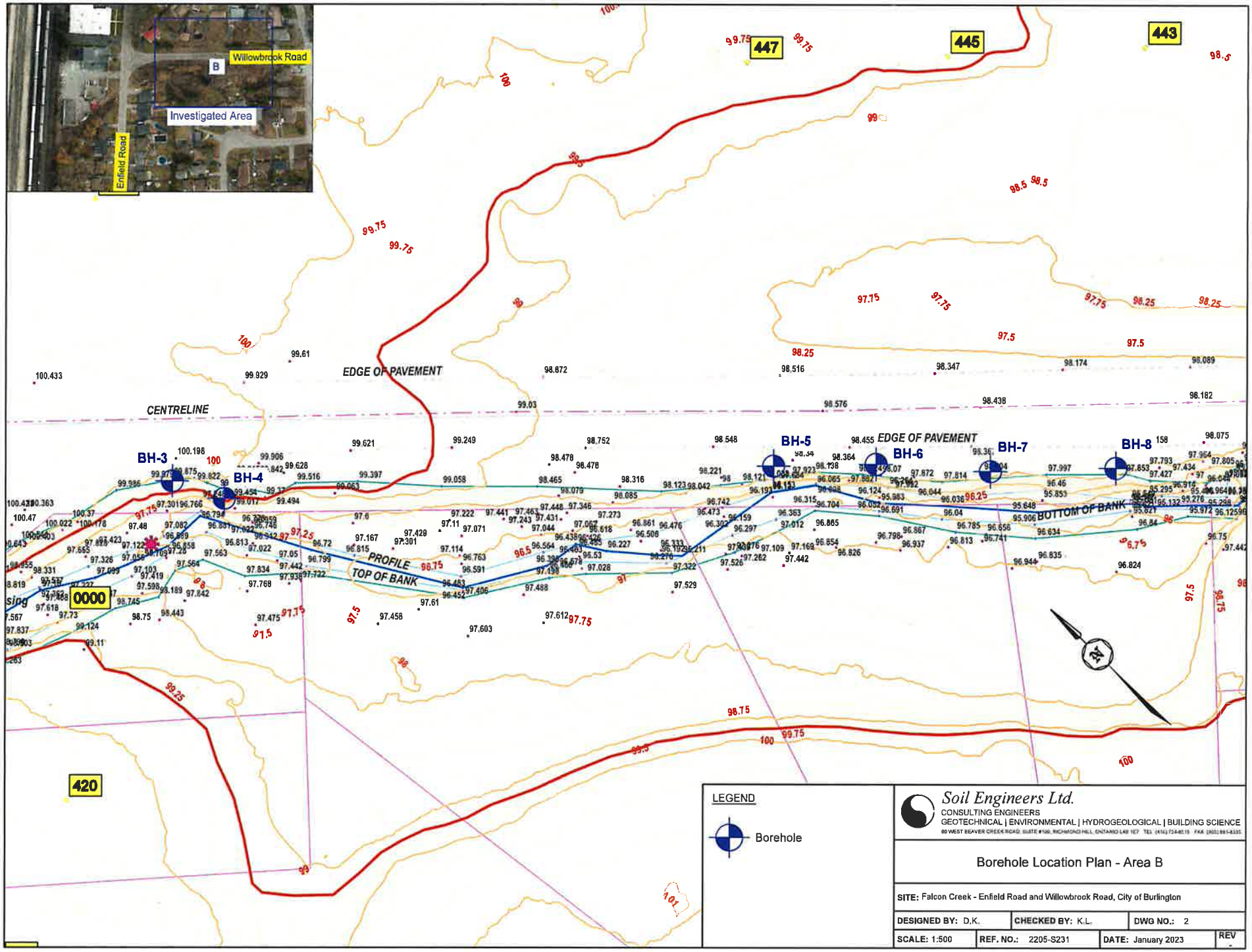
Sampling Location Plan


Willowbrook Road
Investigated Area
A
Enfield Road
423
417
415
BH-1
BH-2
PROFILE
CB
SMCULVERT
DITCH
BOTTOM OF BANK
LEGEND
Borehole
Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | HYDROGEOLOGICAL | BUILDING SCIENCE
Borehole Location Plan - Area A
SITE: Falcon Creek - Enfield Road and Willowbrook Road, City of Burlington
DESIGNED BY: D.K. CHECKED BY: K.L. DWG NO.: 1
SCALE: 1:300 REF. NO.: 2205-S231 DATE: January 2023 REV



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Borehole Location Plan - Area B

SITE: Falcon Creek - Enfield Road and Willowbrook Road, City of Burlington			
DESIGNED BY: D.K.	**CHECKED BY:** K.L.	**DWG NO.:** 2	
SCALE: 1:500	**REF. NO.:** 2205-S231	**DATE:** January 2023	**REV**

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Borehole Logs

JOB NO.: 2205-S231

LOG OF BOREHOLE: 1

FIGURE NO.: 1

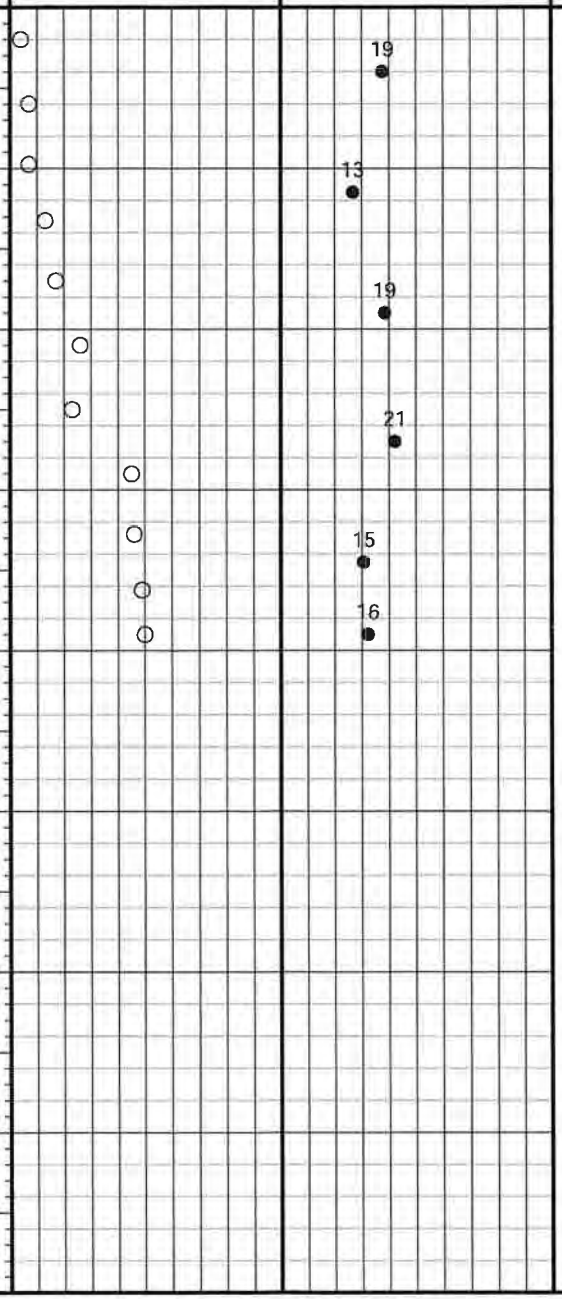
PROJECT DESCRIPTION: Erosion Control Study and Rehabiitation

METHOD OF BORING: Hand Hammer

PROJECT LOCATION: Falcon Creek - Enfield Road and Willowbrook Road
City of Burlington

DRILLING DATE: December 7, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
100.5	Ground Surface				
0.0	**EARTH FILL** Reddish brown and dark brown silty sand occ. clay pockets and topsoil inclusions	1	DO	4	0
				7	
		2	DO	7	1
				13	
98.6		3	DO	17	
1.9	Brown, compact to dense **SAND** fine to medium grained occ. gravel and cobbles				2
				26	
		4	DO	23	
97.4				45	3
3.1	Grey, hard **SILTY CLAY TILL** traces of sand and gravel occ. sand seams and layers	5	DO	46	
				49	
96.5		6	DO	50	4
4.0	**END OF BOREHOLE** **DUE TO REFUSAL TO HAND HAMMER**				5
					6
					7
					8



WATER LEVEL

W.L. @ El. 96.8 m upon completion

Soil Engineers Ltd.

JOB NO.: 2205-S231

LOG OF BOREHOLE: 3

FIGURE NO.: 3

PROJECT DESCRIPTION: Erosion Control Study and Rehabiitation

METHOD OF BORING: Solid-stem Auger

PROJECT LOCATION: Falcon Creek - Enfield Road and Willowbrook Road
City of Burlington

DRILLING DATE: December 6, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
99.9	Ground Surface							
0.0	**EARTH FILL** Reddish brown and dark brown silty sand occ. clay pockets and topsoil inclusions	1	DO	6 4	0		14	Dry upon Completion
		2	DO	3 4	1		17	
		3	DO	4 4	2		18	
		4	DO	3 5	3		15	
96.4		5	DO	6			16	
3.5	Brown, compact **SAND** fine to medium grained occ. gravel			11	4			
95.7								
4.2	Grey, very stiff to hard **SILTY CLAY TILL** traces of sand and gravel occ. sand seams and layers	6	DO	22 38	5		16	
		7	DO	34	6		18	
93.5								
6.4	**END OF BOREHOLE**				7			
					8			

Soil Engineers Ltd.

JOB NO.: 2205-S231

LOG OF BOREHOLE: 4

FIGURE NO.: 4

PROJECT DESCRIPTION: Erosion Control Study and Rehabilitation

METHOD OF BORING: Solid-stem Auger

PROJECT LOCATION: Falcon Creek - Enfield Road and Willowbrook Road, City of Burlington

DRILLING DATE: December 6, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)	Dynamic Cone (blows/30 cm) 10 30 50 70 90 / Shear Strength (kN/m²) 50 100 150 200 / Penetration Resistance (blows/30 cm) 10 30 50 70 90	Atterberg Limits PL LL / Moisture Content (%) 10 20 30 40	WATER LEVEL
99.8	Ground Surface							
0.0	**EARTH FILL** Reddish brown and dark brown silty sand occ. clay pockets and topsoil inclusions	1	DO	3	0		12	
				3				
		2	DO	3	1		22	
				4				
		3	DO	4	2		19	
				6				
		4	DO	5			13	
96.7				6	3			
3.1	Brown, compact **SAND** fine to medium grained occ. gravel and cobbles	5	DO	15			20	
				22				
95.6					4			
4.2	Grey, very stiff **SILTY CLAY TILL** traces of sand and gravel occ. sand seams and layers	6	DO	18			19	
				28	5			
					6			
		7	DO	24			17	
93.1					7			
6.7	**END OF BOREHOLE**				8			

W.L. @ El. 99.8 m upon completion

JOB NO.: 2205-S231

LOG OF BOREHOLE: 5

FIGURE NO.: 5

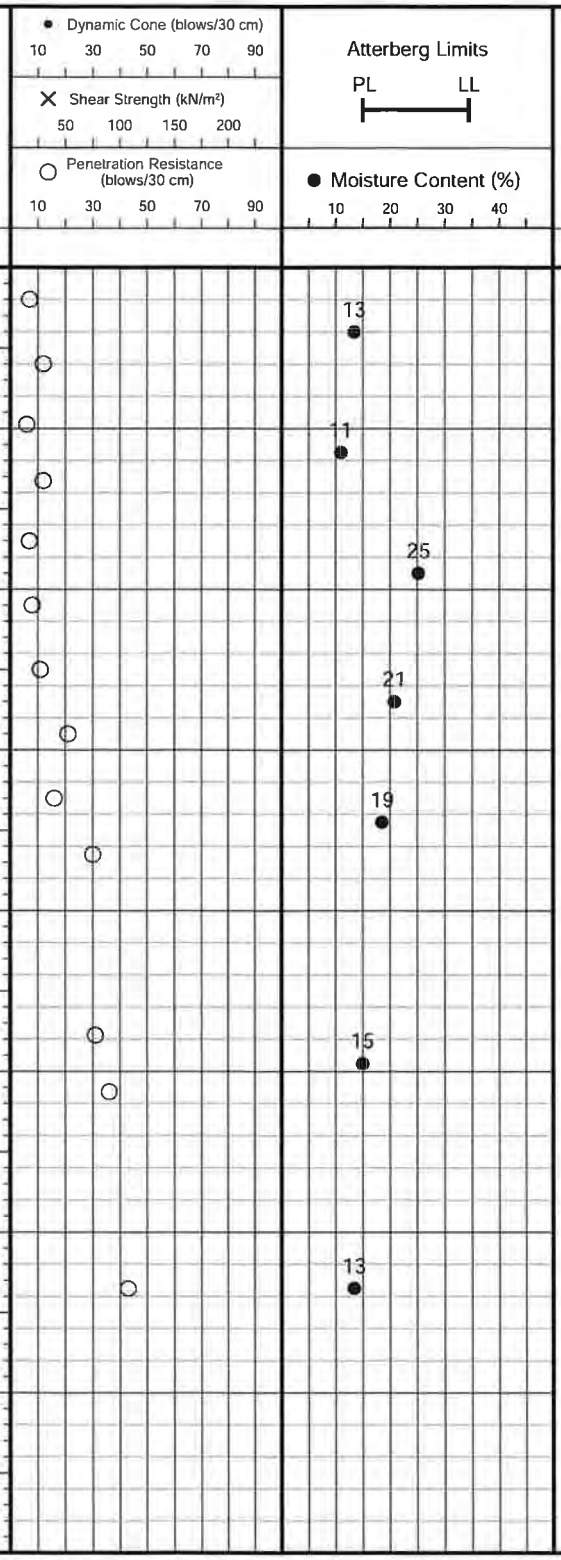
PROJECT DESCRIPTION: Erosion Control Study and Rehabiitation

METHOD OF BORING: Solid-stem Auger

PROJECT LOCATION: Falcon Creek - Enfield Road and Willowbrook Road
City of Burlington

DRILLING DATE: December 5, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
98.3	Ground Surface				
0.0	**EARTH FILL** Reddish brown and dark brown silty sand some granular occ. clay pockets and topsoil inclusions	1	DO	7 12	0
		2	DO	6 12	1
		3	DO	7 8	2
96.0 2.3	Brown, compact **SAND** fine to medium grained occ. gravel and cobbles	4	DO	11 21	3
94.8 3.5	Grey, very stiff to hard **SILTY CLAY TILL** traces of sand and gravel occ. sand seams and layers	5	DO	16 30	
		6	DO	31 36	4
		7	DO	43	5
91.7 6.6	**END OF BOREHOLE**				6 7 8



WATER LEVEL

W.L. @ El. 98.2 m upon completion

Soil Engineers Ltd.

JOB NO.: 2205-S231

LOG OF BOREHOLE: 7

FIGURE NO.: 7

PROJECT DESCRIPTION: Erosion Control Study and Rehabiitation

METHOD OF BORING: Solid-stem Auger

PROJECT LOCATION: Falcon Creek - Enfield Road and Willowbrook Road
City of Burlington

DRILLING DATE: December 5, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
98.2	Ground Surface				
0.0	**EARTH FILL** Grey to dark brown, gravelly sand to silty sand occ. clay pockets and topsoil inclusions	1	DO	3	0
				5	
		2	DO	13	1
				23	
		3	DO	20	2
				19	
95.5		4	DO	8	
2.7	Brown, compact **SAND** fine to medium grained occ. gravel and cobbles			13	3
		5	DO	16	
				18	
94.0					4
4.2	Grey, very stiff to hard **SILTY CLAY TILL** traces of sand and gravel occ. sand seams and layers	6	DO	16	
				30	5
					6
91.8		7	DO	39	
6.4	**END OF BOREHOLE**				7
					8

Dynamic Cone (blows/30 cm) 10 30 50 70 90

Shear Strength (kN/m²) 50 100 150 200

Penetration Resistance (blows/30 cm) 10 30 50 70 90

Atterberg Limits PL LL

Moisture Content (%) 10 20 30 40

7 12 12 20 18 17 16

WATER LEVEL

W.L. @ El. 98.0 m upon completion

Soil Engineers Ltd.

JOB NO.: 2205-S231

LOG OF BOREHOLE: 8

FIGURE NO.: 8

PROJECT DESCRIPTION: Erosion Control Study and Rehabiitation

METHOD OF BORING: Solid-stem Auger

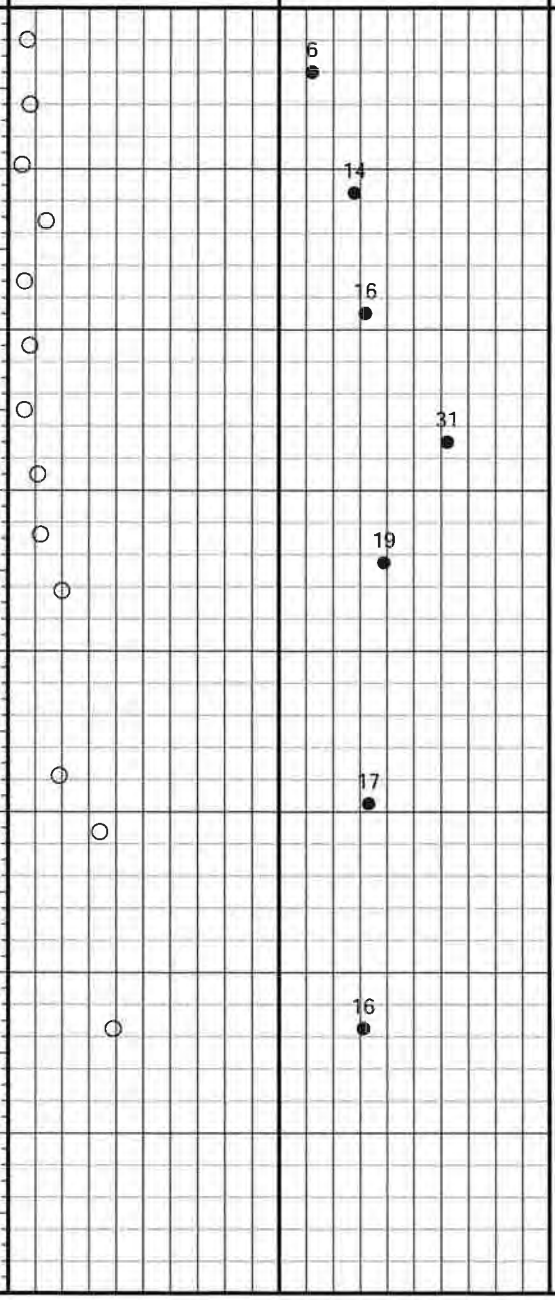
PROJECT LOCATION: Falcon Creek - Enfield Road and Willowbrook Road
City of Burlington

DRILLING DATE: December 6, 2022

El. (m) / Depth (m)	SOIL DESCRIPTION	SAMPLES Number	Type	N-Value	Depth Scale (m)
98.1	Ground Surface				
0.0	**EARTH FILL** Grey to dark brown, gravelly sand to silty sand occ. brick fragments, wood debris and topsoil inclusions	1	DO	7 8	0
		2	DO	5 14	1
		3	DO	6 8	2
95.2		4	DO	6 11	
2.9	Brown, compact **SAND** fine grained some gravel with occ. cobbles	5	DO	12 20	3
93.9					4
4.2	Grey, very stiff to hard **SILTY CLAY TILL** traces of sand and gravel occ. sand seams and layers	6	DO	19 34	5
					6
91.5		7	DO	39	
6.6	**END OF BOREHOLE**				7 8

Dynamic Cone (blows/30 cm): 10 30 50 70 90
Shear Strength (kN/m²): 50 100 150 200
Penetration Resistance (blows/30 cm): 10 30 50 70 90

Atterberg Limits: PL — LL
Moisture Content (%): 10 20 30 40



WATER LEVEL

W.L. @ El. 97.9 m upon completion

Soil Engineers Ltd.

Soil Engineers Ltd.
CONSULTING ENGINEERS
GEOTECHNICAL • ENVIRONMENTAL • HYDROGEOLOGICAL • BUILDING SCIENCE
90 WEST BEAVER CREEK ROAD, SUITE #100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL (416) 754-8515 · FAX (905) 881-8335

BARRIE	MISSISSAUGA	OSHAWA	NEWMARKET	GRAVENHURST	PETERBOROUGH	HAMILTON
TEL: (705) 721-7863	TEL: (905) 542-7605	TEL: (905) 440-2040	TEL: (905) 853-0647	TEL: (705) 684-4242	TEL: (905) 440-2040	TEL: (905) 777-7956
FAX: (705) 721-7864	FAX: (905) 542-2769	FAX: (905) 725-1315	FAX: (905) 881-8335	FAX: (705) 684-8522	FAX: (905) 725-1315	FAX: (905) 542-2769

Certificate of Analysis

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FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: SOIL ENGINEERS LIMITED
90 WEST BEAVER CREEK ROAD, UNIT 100
RICHMOND HILL , ON L4B 1E7
(416) 754-8515
ATTENTION TO: Ahmed Hassan
PROJECT: 2205-E231
AGAT WORK ORDER: 22T978890
SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Lab Manager
TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist
DATE REPORTED: Dec 15, 2022
PAGES (INCLUDING COVER): 17
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days after receipt unless a Long Term Storage Agreement is signed and returned. Some specialty analysis may be exempt, please contact your Client Project Manager for details.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This Certificate shall not be reproduced except in full, without the written approval of the laboratory.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
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- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*

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AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2022-12-08

DATE REPORTED: 2022-12-15

		SAMPLE DESCRIPTION:		BH-1/3	BH-3/2	BH-4/1	BH-5/3	BH-7/2	BH-8/3	DUP S1	DUP S2
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2022-12-07	2022-12-06	2022-12-06	2022-12-05	2022-12-05	2022-12-06	2022-12-06	2022-12-07
Parameter	Unit	G / S	RDL	4600757	4600759	4600761	4600764	4600772	4600775	4600778	4600779
Antimony	µg/g	1.3	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	7	5	7	4	4	6	8	5
Barium	µg/g	220	2.0	206	72.5	64.4	45.1	30.6	37.1	**248**	26.8
Beryllium	µg/g	2.5	0.4	0.5	0.6	0.5	<0.4	<0.4	<0.4	0.6	<0.4
Boron	µg/g	36	5	14	10	8	<5	<5	<5	11	6
Boron (Hot Water Soluble)	µg/g	NA	0.10	0.41	0.20	0.24	0.27	0.12	<0.10	0.53	0.14
Cadmium	µg/g	1.2	0.5	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g	70	5	19	16	14	8	10	11	20	12
Cobalt	µg/g	21	0.5	11.5	7.1	6.3	4.1	5.1	6.1	11.7	6.3
Copper	µg/g	92	1.0	41.4	20.2	21.2	22.2	22.6	29.5	39.3	21.0
Lead	µg/g	120	1	34	23	14	14	10	11	11	21
Molybdenum	µg/g	2	0.5	0.8	0.6	0.5	<0.5	<0.5	0.6	1.3	0.7
Nickel	µg/g	82	1	30	18	17	9	11	13	28	13
Selenium	µg/g	1.5	0.8	0.9	<0.8	<0.8	<0.8	<0.8	<0.8	1.0	<0.8
Silver	µg/g	0.5	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thallium	µg/g	1	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Uranium	µg/g	2.5	0.50	0.55	0.55	0.55	<0.50	<0.50	<0.50	0.66	<0.50
Vanadium	µg/g	86	0.4	28.9	23.3	21.7	14.3	17.2	18.0	32.1	21.8
Zinc	µg/g	290	5	63	71	51	36	30	56	55	67
Chromium, Hexavalent	µg/g	0.66	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cyanide, WAD	µg/g	0.051	0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g	0.27	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity (2:1)	mS/cm	0.57	0.005	0.391	0.476	0.501	**0.979**	**0.605**	0.528	0.438	**0.713**
Sodium Adsorption Ratio (2:1) (Calc.)	N/A	2.4	N/A	1.33	**4.52**	**5.33**	**6.91**	2.11	**5.71**	1.38	**8.95**
pH, 2:1 CaCl2 Extraction	pH Units		NA	6.89	6.47	6.99	7.37	7.34	7.33	7.41	7.39

Certified By:

Amanjot Bhela

CHARTERED CHEMIST AMANJOT BHELA

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Certificate of Analysis

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2022-12-08

DATE REPORTED: 2022-12-15

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4600757-4600779 EC was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio. SAR is a calculated parameter.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By:

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AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - PAHs (Soil)

DATE RECEIVED: 2022-12-08

DATE REPORTED: 2022-12-15

		SAMPLE DESCRIPTION:		BH-1/4	BH-3/2	BH-4/5	BH-5/4	BH-7/5	BH-8/4
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2022-12-07	2022-12-06	2022-12-06	2022-12-05	2022-12-05	2022-12-06
Parameter	**Unit**	**G / S**	**RDL**	**4600758**	**4600759**	**4600762**	**4600767**	**4600774**	**4600776**
Naphthalene	µg/g	0.09	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthylene	µg/g	0.093	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthene	µg/g	0.072	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluorene	µg/g	0.12	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	µg/g	0.69	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Anthracene	µg/g	0.16	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoranthene	µg/g	0.56	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	µg/g	1	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benz(a)anthracene	µg/g	0.36	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chrysene	µg/g	2.8	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(b)fluoranthene	µg/g	0.47	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	µg/g	0.48	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(a)pyrene	µg/g	0.3	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-cd)pyrene	µg/g	0.23	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dibenz(a,h)anthracene	µg/g	0.1	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(g,h,i)perylene	µg/g	0.68	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1 and 2 Methlynaphthalene	µg/g	0.59	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Moisture Content	%		0.1	14.7	13.7	15.2	22.2	16.8	20.0
Surrogate	**Unit**	**Acceptable Limits**							
Naphthalene-d8	%	50-140		100	80	80	100	85	90
Acridine-d9	%	50-140		80	80	73	85	84	65
Terphenyl-d14	%	50-140		76	88	80	83	80	75

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4600758-4600776 Results are based on the dry weight of the soil.
Note: The result for Benzo(b)Fluoranthene is the total of the Benzo(b)&j)Fluoranthene isomers because the isomers co-elute on the GC column.
2- and 1-Methyl Naphthalene is a calculated parameter. The calculated value is the sum of 2-Methyl Naphthalene and 1-Methyl Naphthalene.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnickoff

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Certificate of Analysis

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - PHCs F1 - F4 (Soil)

DATE RECEIVED: 2022-12-08

DATE REPORTED: 2022-12-15

		SAMPLE DESCRIPTION:		BH-3/3	BH-5/5
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2022-12-06	2022-12-05
Parameter	Unit	G / S	RDL	4600760	4600770
Benzene	µg/g	0.02	0.02	<0.02	<0.02
Toluene	µg/g	0.2	0.05	<0.05	<0.05
Ethylbenzene	µg/g	0.05	0.05	<0.05	<0.05
m & p-Xylene	µg/g		0.05	<0.05	<0.05
o-Xylene	µg/g		0.05	<0.05	<0.05
Xylenes (Total)	µg/g	0.05	0.05	<0.05	<0.05
F1 (C6 - C10)	µg/g	25	5	<5	<5
F1 (C6 to C10) minus BTEX	µg/g	25	5	<5	<5
F2 (C10 to C16)	µg/g	10	10	<10	<10
F3 (C16 to C34)	µg/g	240	50	<50	<50
F4 (C34 to C50)	µg/g	120	50	<50	<50
Gravimetric Heavy Hydrocarbons	µg/g	120	50	NA	NA
Moisture Content	%		0.1	15.0	15.0
Surrogate	**Unit**	**Acceptable Limits**			
Toluene-d8	% Recovery	60-140		83	81
Terphenyl	%	60-140		69	83

Certified By: N Popnikolof

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Certificate of Analysis

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - PHCs F1 - F4 (Soil)

DATE RECEIVED: 2022-12-08

DATE REPORTED: 2022-12-15

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4600760-4600770 Results are based on sample dry weight.
The C6-C10 fraction is calculated using Toluene response factor.
Xylenes is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contribution.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.
Quality Control Data is available upon request.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnikolof

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - PHCs F1 - F4 (with PAHs) (Soil)

DATE RECEIVED: 2022-12-08

DATE REPORTED: 2022-12-15

		SAMPLE DESCRIPTION:		BH-1/4	BH-4/5	BH-7/5	BH-8/4
		SAMPLE TYPE:		Soil	Soil	Soil	Soil
		DATE SAMPLED:		2022-12-07	2022-12-06	2022-12-05	2022-12-06
Parameter	Unit	G / S	RDL	4600758	4600762	4600774	4600776
Benzene	µg/g	0.02	0.02	<0.02	<0.02	<0.02	<0.02
Toluene	µg/g	0.2	0.05	<0.05	<0.05	<0.05	<0.05
Ethylbenzene	µg/g	0.05	0.05	<0.05	<0.05	<0.05	<0.05
m & p-Xylene	µg/g		0.05	<0.05	<0.05	<0.05	<0.05
o-Xylene	µg/g		0.05	<0.05	<0.05	<0.05	<0.05
Xylenes (Total)	µg/g	0.05	0.05	<0.05	<0.05	<0.05	<0.05
F1 (C6 - C10)	µg/g	25	5	<5	<5	<5	<5
F1 (C6 to C10) minus BTEX	µg/g	25	5	<5	<5	<5	<5
F2 (C10 to C16)	µg/g	10	10	<10	<10	<10	<10
F2 (C10 to C16) minus Naphthalene	µg/g		10	<10	<10	<10	<10
F3 (C16 to C34)	µg/g	240	50	<50	<50	<50	<50
F3 (C16 to C34) minus PAHs	µg/g		50	<50	<50	<50	<50
F4 (C34 to C50)	µg/g	120	50	<50	<50	<50	<50
Gravimetric Heavy Hydrocarbons	µg/g	120	50	NA	NA	NA	NA
Moisture Content	%		0.1	14.7	15.2	16.8	20.0
Surrogate	**Unit**	**Acceptable Limits**					
Toluene-d8	% Recovery	60-140		81	74	89	80
Terphenyl	%	60-140		73	74	68	85

Certified By: N Popnikolof

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AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - PHCs F1 - F4 (with PAHs) (Soil)

DATE RECEIVED: 2022-12-08

DATE REPORTED: 2022-12-15

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to Table 1: Full Depth Background Site Condition Standards - Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4600758-4600776 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX and PAH contributions.
C>10 – C16 (F2- Naphthalene) is a calculated parameter. The calculated value is F2 - Naphthalene.
C>16 - C34 (F3-PAH) is a calculated parameter. The calculated value is F3-PAH (PAH: sum of Phenanthrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-c,d)pyrene and Pyrene).
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnikolof

AGAT Laboratories

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Exceedance Summary

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Hassan

SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
4600759	BH-3/2	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.)	N/A	2.4	4.52
4600761	BH-4/1	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.	N/A	2.4	5.33
4600764	BH-5/3	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity (2:1)	mS/cm	0.57	0.979
4600764	BH-5/3	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.	N/A	2.4	6.91
4600772	BH-7/2	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity (2:1)	mS/cm	0.57	0.605
4600775	BH-8/3	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.	N/A	2.4	5.71
4600778	DUP S1	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Barium	µg/g	220	248
4600779	DUP S2	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Electrical Conductivity (2:1)	mS/cm	0.57	0.713
4600779	DUP S2	ON T1 S RPI/ICC	O. Reg. 153(511) - Metals & Inorganics (Soil)	Sodium Adsorption Ratio (2:1) (Calc.)	N/A	2.4	8.95

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Quality Assurance

CLIENT NAME: SOIL ENGINEERS LIMITED

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Dec 15, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	4605565		<0.8	<0.8	NA	< 0.8	71%	70%	130%	86%	80%	120%	89%	70%	130%
Arsenic	4605565		7	8	13.3%	< 1	116%	70%	130%	102%	80%	120%	103%	70%	130%
Barium	4605565		74.1	75.9	2.4%	< 2.0	95%	70%	130%	96%	80%	120%	101%	70%	130%
Beryllium	4605565		0.7	0.7	NA	< 0.4	81%	70%	130%	106%	80%	120%	92%	70%	130%
Boron	4605565		9	9	NA	< 5	70%	70%	130%	101%	80%	120%	77%	70%	130%
Boron (Hot Water Soluble)	4605726		<0.10	<0.10	NA	< 0.10	99%	60%	140%	101%	70%	130%	100%	60%	140%
Cadmium	4605565		<0.5	<0.5	NA	< 0.5	112%	70%	130%	109%	80%	120%	107%	70%	130%
Chromium	4605565		24	24	NA	< 5	102%	70%	130%	100%	80%	120%	115%	70%	130%
Cobalt	4605565		11.1	11.3	1.8%	< 0.5	100%	70%	130%	100%	80%	120%	99%	70%	130%
Copper	4605565		24.4	24.8	1.6%	< 1.0	90%	70%	130%	103%	80%	120%	95%	70%	130%
Lead	4605565		14	14	0.0%	< 1	106%	70%	130%	101%	80%	120%	98%	70%	130%
Molybdenum	4605565		<0.5	<0.5	NA	< 0.5	105%	70%	130%	108%	80%	120%	107%	70%	130%
Nickel	4605565		23	24	4.3%	< 1	98%	70%	130%	103%	80%	120%	103%	70%	130%
Selenium	4605565		<0.8	<0.8	NA	< 0.8	98%	70%	130%	114%	80%	120%	116%	70%	130%
Silver	4605565		<0.5	<0.5	NA	< 0.5	94%	70%	130%	100%	80%	120%	96%	70%	130%
Thallium	4605565		<0.5	<0.5	NA	< 0.5	106%	70%	130%	109%	80%	120%	107%	70%	130%
Uranium	4605565		0.64	0.62	NA	< 0.50	110%	70%	130%	97%	80%	120%	103%	70%	130%
Vanadium	4605565		35.4	35.3	0.3%	< 0.4	103%	70%	130%	99%	80%	120%	107%	70%	130%
Zinc	4605565		88	92	4.4%	< 5	103%	70%	130%	109%	80%	120%	124%	70%	130%
Chromium, Hexavalent	4599666		<0.2	<0.2	NA	< 0.2	104%	70%	130%	89%	80%	120%	78%	70%	130%
Cyanide, WAD	4600757	4600757	<0.040	<0.040	NA	< 0.040	92%	70%	130%	94%	80%	120%	104%	70%	130%
Mercury	4605565		<0.10	<0.10	NA	< 0.10	113%	70%	130%	104%	80%	120%	108%	70%	130%
Electrical Conductivity (2:1)	4611827		2.51	2.65	5.4%	< 0.005	103%	80%	120%	NA			NA		
Sodium Adsorption Ratio (2:1) (Calc.)	4611827		12.9	13.3	3.1%	N/A	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	4600757	4600757	6.89	6.98	1.3%	NA	98%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.
Duplicate NA: results are under 5X the RDL and will not be calculated.

O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	4605695		<0.8	<0.8	NA	< 0.8	96%	70%	130%	88%	80%	120%	90%	70%	130%
Arsenic	4605695		4	4	NA	< 1	118%	70%	130%	107%	80%	120%	95%	70%	130%
Barium	4605695		61.5	65.4	6.2%	< 2.0	100%	70%	130%	92%	80%	120%	103%	70%	130%
Beryllium	4605695		0.6	0.6	NA	< 0.4	78%	70%	130%	95%	80%	120%	77%	70%	130%
Boron	4605695		18	30	NA	< 5	75%	70%	130%	99%	80%	120%	97%	70%	130%
Cadmium	4605695		0.7	0.6	NA	< 0.5	109%	70%	130%	107%	80%	120%	99%	70%	130%
Chromium	4605695		12	13	NA	< 5	108%	70%	130%	99%	80%	120%	122%	70%	130%
Cobalt	4605695		6.1	6.5	5.9%	< 0.5	109%	70%	130%	97%	80%	120%	107%	70%	130%
Copper	4605695		11.5	12.1	4.9%	< 1.0	97%	70%	130%	102%	80%	120%	98%	70%	130%

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CLIENT NAME: SOIL ENGINEERS LIMITED

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis (Continued)

RPT Date: Dec 15, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Lead	4605695		46	45	1.6%	< 1	111%	70%	130%	101%	80%	120%	97%	70%	130%
Molybdenum	4605695		1.0	0.9	NA	< 0.5	115%	70%	130%	107%	80%	120%	117%	70%	130%
Nickel	4605695		12	13	4.2%	< 1	110%	70%	130%	104%	80%	120%	105%	70%	130%
Selenium	4605695		<0.8	<0.8	NA	< 0.8	99%	70%	130%	109%	80%	120%	97%	70%	130%
Silver	4605695		<0.5	<0.5	NA	< 0.5	110%	70%	130%	109%	80%	120%	92%	70%	130%
Thallium	4605695		<0.5	<0.5	NA	< 0.5	117%	70%	130%	107%	80%	120%	108%	70%	130%
Uranium	4605695		0.89	0.91	NA	< 0.50	117%	70%	130%	96%	80%	120%	109%	70%	130%
Vanadium	4605695		18.7	20.1	7.5%	< 0.4	113%	70%	130%	95%	80%	120%	116%	70%	130%
Zinc	4605695		313	253	21.2%	< 5	100%	70%	130%	106%	80%	120%	126%	70%	130%
Mercury	4605695		<0.10	<0.10	NA	< 0.10	95%	70%	130%	105%	80%	120%	100%	70%	130%

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.
Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By:

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CLIENT NAME: SOIL ENGINEERS LIMITED

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date: Dec 15, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - PHCs F1 - F4 (with PAHs) (Soil)															
Benzene	4600788		<0.02	<0.02	NA	< 0.02	97%	60%	140%	90%	60%	140%	100%	60%	140%
Toluene	4600788		<0.05	<0.05	NA	< 0.05	107%	60%	140%	90%	60%	140%	97%	60%	140%
Ethylbenzene	4600788		<0.05	<0.05	NA	< 0.05	85%	60%	140%	105%	60%	140%	101%	60%	140%
m & p-Xylene	4600788		<0.05	<0.05	NA	< 0.05	104%	60%	140%	101%	60%	140%	95%	60%	140%
o-Xylene	4600788		<0.05	<0.05	NA	< 0.05	108%	60%	140%	106%	60%	140%	96%	60%	140%
F1 (C6 - C10)	4600788		<5	<5	NA	< 5	87%	60%	140%	95%	60%	140%	89%	60%	140%
F2 (C10 to C16)	4579231		190	175	8.1%	< 10	102%	60%	140%	100%	60%	140%	103%	60%	140%
F3 (C16 to C34)	4579231		532	498	6.5%	< 50	102%	60%	140%	104%	60%	140%	90%	60%	140%
F4 (C34 to C50)	4579231		<50	<50	NA	< 50	81%	60%	140%	111%	60%	140%	88%	60%	140%
O. Reg. 153(511) - PAHs (Soil)															
Naphthalene	4604721		<0.05	<0.05	NA	< 0.05	66%	50%	140%	120%	50%	140%	100%	50%	140%
Acenaphthylene	4604721		<0.05	<0.05	NA	< 0.05	81%	50%	140%	80%	50%	140%	100%	50%	140%
Acenaphthene	4604721		<0.05	<0.05	NA	< 0.05	88%	50%	140%	100%	50%	140%	75%	50%	140%
Fluorene	4604721		<0.05	<0.05	NA	< 0.05	94%	50%	140%	118%	50%	140%	78%	50%	140%
Phenanthrene	4604721		<0.05	<0.05	NA	< 0.05	91%	50%	140%	95%	50%	140%	70%	50%	140%
Anthracene	4604721		<0.05	<0.05	NA	< 0.05	102%	50%	140%	98%	50%	140%	80%	50%	140%
Fluoranthene	4604721		<0.05	<0.05	NA	< 0.05	118%	50%	140%	115%	50%	140%	85%	50%	140%
Pyrene	4604721		<0.05	<0.05	NA	< 0.05	119%	50%	140%	115%	50%	140%	85%	50%	140%
Benz(a)anthracene	4604721		<0.05	<0.05	NA	< 0.05	107%	50%	140%	118%	50%	140%	95%	50%	140%
Chrysene	4604721		<0.05	<0.05	NA	< 0.05	71%	50%	140%	108%	50%	140%	85%	50%	140%
Benzo(b)fluoranthene	4604721		<0.05	<0.05	NA	< 0.05	88%	50%	140%	95%	50%	140%	113%	50%	140%
Benzo(k)fluoranthene	4604721		<0.05	<0.05	NA	< 0.05	82%	50%	140%	73%	50%	140%	88%	50%	140%
Benzo(a)pyrene	4604721		<0.05	<0.05	NA	< 0.05	103%	50%	140%	93%	50%	140%	95%	50%	140%
Indeno(1,2,3-cd)pyrene	4604721		<0.05	<0.05	NA	< 0.05	90%	50%	140%	98%	50%	140%	113%	50%	140%
Dibenz(a,h)anthracene	4604721		<0.05	<0.05	NA	< 0.05	100%	50%	140%	75%	50%	140%	98%	50%	140%
Benzo(g,h,i)perylene	4604721		<0.05	<0.05	NA	< 0.05	106%	50%	140%	78%	50%	140%	98%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

O. Reg. 153(511) - PHCs F1 - F4 (Soil)															
F2 (C10 to C16)	4579231	190	175	8.1%	< 10	102%	60%	140%	100%	60%	140%	103%	60%	140%
F3 (C16 to C34)	4579231	532	498	6.5%	< 50	102%	60%	140%	104%	60%	140%	90%	60%	140%
F4 (C34 to C50)	4579231	<50	<50	NA	< 50	81%	60%	140%	111%	60%	140%	NA	60%	140%

Certified By: NPopnikolof

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Method Summary

CLIENT NAME: SOIL ENGINEERS LIMITED

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Arsenic	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Barium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Beryllium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	modified from EPA 6010D and MSA PART 3, CH 21	ICP/OES
Cadmium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Cobalt	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Copper	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Lead	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Molybdenum	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Nickel	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Selenium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Silver	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Thallium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Uranium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Vanadium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Zinc	MET 93 -6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium, Hexavalent	INOR-93-6068	modified from EPA 3060 and EPA 7196	SPECTROPHOTOMETER
Cyanide, WAD	INOR-93-6052	modified from ON MOECC E3015, SM 4500-CN- I, G-387	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	modified from EPA 7471B and SM 3112 B	ICP-MS
Electrical Conductivity (2:1)	INOR-93-6075	modified from MSA PART 3, CH 14 and SM 2510 B	PC TITRATE
Sodium Adsorption Ratio (2:1) (Calc.)	INOR-93-6007	modified from EPA 6010D & Analytical Protocol	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6075	modified from EPA 9045D, MCKEAGUE 3.11 E3137	PC TITRATE

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Method Summary

CLIENT NAME: SOIL ENGINEERS LIMITED

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Naphthalene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Acenaphthylene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Acenaphthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Fluorene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Phenanthrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Anthracene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Fluoranthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Pyrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benz(a)anthracene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Chrysene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(b)fluoranthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(k)fluoranthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(a)pyrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Indeno(1,2,3-cd)pyrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Dibenz(a,h)anthracene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(g,h,i)perylene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
1 and 2 Methlynaphthalene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Naphthalene-d8	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Acridine-d9	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Terphenyl-d14	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Moisture Content	VOL-91-5009	modified from CCME Tier 1 Method	BALANCE
Benzene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Toluene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Ethylbenzene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
m & p-Xylene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
o-Xylene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Xylenes (Total)	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
F1 (C6 - C10)	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/FID
F1 (C6 to C10) minus BTEX	VOL-91-5009	modified from CCME Tier 1 Method	P&T GC/FID
Toluene-d8	VOL-91-5009	modified from EPA SW-846 5030C & 8260D	(P&T)GC/MS
F2 (C10 to C16)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F3 (C16 to C34)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F4 (C34 to C50)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID

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Method Summary

CLIENT NAME: SOIL ENGINEERS LIMITED

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

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PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Gravimetric Heavy Hydrocarbons	VOL-91-5009	modified from CCME Tier 1 Method	BALANCE
Terphenyl	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F2 (C10 to C16) minus Naphthalene	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F3 (C16 to C34)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F3 (C16 to C34) minus PAHs	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID

AGAT Laboratories

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Laboratory Use Only
Work Order #: 22T978890

Cooler Quantity:
Arrival Temperatures: 6.2 / 6.0 / 6.5
Custody Seal Intact: ☐Yes ☐No ☐N/A
Notes: 1 Log / Ice ice

Report Information:
Company: Soil Engineers Ltd. (SEL)
Contact: Ahmed Hassan
Address: 90 West Beaver Creek Road, Richmond Hill, Ontario L4B1E7
Phone: 4167548515 Fax:
Reports to be sent to:
1. Email: A.Hassan@soilengineersltd.com / Arezoo.Karimian@...
2. Email: Adam.Gale@soilengineersltd.com /ankita.patel@

Project Information:
Project: 2205 E231
Site Location: Willowbrook road Burlington
Sampled By: Ankita Patel
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:
Bill to Same: Yes ☑ No ☐
Company:
Contact:
Address:
Email:

Regulatory Requirements:
(Please specify all applicable regulations)

☑ Regulation 153/04
Table 1 (Indicate One)
☐ Ind/Com
☑ Res/Park
☐ Agriculture
Soil Texture (Check One)
☐ Coarse
☐ Fine

☐ Excess Soils R406
Table (Indicate One)
Sample from APEC?
☐ Yes
☐ No
☐ Stockpile ☐ In-situ

☐ Regulation 558

☐ Sewer Use
☐ Sanitary ☐ Storm
Region
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a Record of Site Condition? ☐ Yes ☑ No

Report Guideline on *Certificate of Analysis* ☑ Yes ☐ No

Turnaround Time (TAT) Required:
Regular TAT ☑ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays
For 'Same Day' analysis, please contact your AGAT CPM

Sample Matrix Legend
B	Biota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC Y/N	O. Reg 153: Metals & Inorganics, inc. EC/SAR	Metals ICPMS, ☐ CrVI, ☐ Hg, ☐ HWSB	BTEX, F1-F4 PHCs Analyze F4G if required ☐ Yes ☐ No	PAHs	PCBs	VOC	Landfill Disposal Characterization TCLP: ☐ Mtls ☐ VOCs ☐ ABNs ☐ B(a)P ☐ PCBs	Excess Soils SPLP Rainwater Leach SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	Excess Soils Characterization Package pH, ICPMS Metals, BTEX, F1-F4	Salt - EC/SAR	Organochlorine Pesticides	Potentially Hazardous or High Concentration (PHC)
BH-1/3	07 Dec	AM PM	1	S			☑			☑								
BH-1/4	07 Dec	AM PM	3	S					☑	☑								
BH 3/2	06 Dec	AM PM	2	S			☑			☑								
BH-3/3	06 Dec	AM PM	2	S					☑									
BH-4/1	06 Dec	AM PM	1	S			☑											
BH-4/5	06 Dec	AM PM	3	S					☑	☑								
BH-5/3	05 Dec	AM PM	1	S			☑											
BH 5/4	05 Dec	AM PM	1	S						☑								
BH 5/5	05 Dec	AM PM	2	S					☑									
BH-7/2	05 Dec	AM PM	1	S			☑											
BH 7/5	05 Dec	AM PM	3	S					☑	☑								

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Ankita patel	08 Dec				
Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time
Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time

Pink Copy - Client | Yellow Copy - AGAT | White Copy- AGAT

AGAT Laboratories

Chain of Custody Record

If this is a Drinking Water sample, please use Drinking Water Chain of Custody Form (potable water consumed by humans)

Report Information:

Company: Soil Engineers Ltd. (SEL)
Contact: Ahmed Hassan
Address: 90 West Beaver Creek Road, Richmond Hill, Ontario L4B1E7
Phone: 4167548515 Fax:
Reports to be sent to:
1 Email: A.Hassan@soilengineersltd.com / Arezoo Karimian@~
2 Email: Adam.Gale@soilengineersltd.com /ankira.patel@

Project Information:

Project: 2205 E231
Site Location: Willowbrook
Sampled By: Ankita Patel
AGAT Quote #: PO:
Please note: If quotation number is not provided, client will be billed full price for analysis.

Invoice Information:

Bill To Same: Yes ☑ No ☐
Company:
Contact:
Address:
Email:

Regulatory Requirements:

(Please check all applicable boxes)

☑ Regulation 153/04
Table 1 (Indicate One)
☐ Ind/Com
☑ Res/Park
☐ Agriculture
Soil Texture (Check One)
☐ Coarse
☐ Fine

☐ Excess Soils R406
Table ____ (Indicate One)
Sample from APEC?
☐ Yes
☐ No
☐ Stockpile ☐ In-situ

☐ Regulation 558

☐ Sewer Use
☐ Sanitary ☐ Storm
Region
☐ CCME
☐ Prov. Water Quality Objectives (PWQO)
☐ Other
(Indicate One)

Is this submission for a Record of Site Condition? ☐ Yes ☑ No

Report Guideline on *Certificate of Analysis* ☑ Yes ☐ No

Sample Matrix Legend

B	Blota
GW	Ground Water
O	Oil
P	Paint
S	Soil
SD	Sediment
SW	Surface Water

Laboratory Use Only

Work Order #:
Cooler Quantity: Secc Pg 1
Arrival Temperatures:
Custody Seal Intact: ☐ Yes ☐ No ☐ N/A
Notes:

Turnaround Time (TAT) Required:

Regular TAT ☑ 5 to 7 Business Days
Rush TAT (Rush Surcharges Apply)
☐ 3 Business Days ☐ 2 Business Days ☐ Next Business Day
OR Date Required (Rush Surcharges May Apply):
Please provide prior notification for rush TAT
*TAT is exclusive of weekends and statutory holidays

For 'Same Day' analysis, please contact your AGAT CPM

Sample Identification	Date Sampled	Time Sampled	# of Containers	Sample Matrix	Comments/ Special Instructions	Field Filtered - Metals, Hg, CrVI, DOC (Y/N)	O. Reg 153: Metals & Inorganics, inc. EC/SAR	Metals: ICPMS, CrVI, Hg, HWSB	BTEX, F1-F4 PHCs: Analyze F4G if required ☐ Yes ☐ No	PAHs	PCBs	VOC	Landfill Disposal Characterization TCLP: ☐ MeI ☐ VOCs ☐ ABNs ☐ BaP ☐ PCBs	Excess Soils SPLP Rainwater Leach: SPLP: ☐ Metals ☐ VOCs ☐ SVOCs	Excess Soils Characterization Package: pH, ICPMS Metals, BTEX, F1-F4	Salt: EC/SAR	Organochlorine Pesticides	Potential: Hazardous or High Concentration (Y/N)
BH-8/3	06 Dec	AM PM	1	S			☑										
BH-8/4	06 Dec	AM PM	3	S					☑	☑							
DUP S1	06 Dec	AM PM	1	S			☑										
DUP S2	07 Dec	AM PM	1	S			☑										
		AM PM															
		AM PM															
		AM PM															
		AM PM															
		AM PM															
		AM PM															
		AM PM															

Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time	
Ankita patel	08 Dec					
Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time	Page 2 of 2
Samples Relinquished By (Print Name and Sign)	Date	Time	Samples Received By (Print Name and Sign)	Date	Time	N°:

Pink Copy - Client | Yellow Copy - AGAT | White Copy - AGAT

AGAT Laboratories

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MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: SOIL ENGINEERS LIMITED
90 WEST BEAVER CREEK ROAD, UNIT 100
RICHMOND HILL , ON L4B 1E7
(416) 754-8515
ATTENTION TO: Ahmed Hassan
PROJECT: 2205-E231
AGAT WORK ORDER: 22T978890
SOIL ANALYSIS REVIEWED BY: Amanjot Bhela, Inorganic Lab Manager
TRACE ORGANICS REVIEWED BY: Neli Popnikolova, Senior Chemist
DATE REPORTED: Dec 15, 2022
PAGES (INCLUDING COVER): 14
VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

Notes

Disclaimer:

- *All work conducted herein has been done using accepted standard protocols, and generally accepted practices and methods. AGAT test methods may incorporate modifications from the specified reference methods to improve performance.*
- *All samples will be disposed of within 30 days following analysis, unless expressly agreed otherwise in writing. Please contact your Client Project Manager if you require additional sample storage time.*
- *AGAT's liability in connection with any delay, performance or non-performance of these services is only to the Client and does not extend to any other third party. Unless expressly agreed otherwise in writing, AGAT's liability is limited to the actual cost of the specific analysis or analyses included in the services.*
- *This report shall not be reproduced or distributed, in whole or in part, without the prior written consent of AGAT Laboratories.*
- *The test results reported herewith relate only to the samples as received by the laboratory.*
- *Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, warranties of merchantability, fitness for a particular purpose, or non-infringement. AGAT assumes no responsibility for any errors or omissions in the information contained in this document.*
- *All reportable information as specified by ISO/IEC 17025:2017 is available from AGAT Laboratories upon request.*

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Certificate of Analysis

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2022-12-08

DATE REPORTED: 2022-12-15

		SAMPLE DESCRIPTION:		BH-1/3	BH-3/2	BH-4/1	BH-5/3	BH-7/2	BH-8/3	DUP S1	DUP S2
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2022-12-07	2022-12-06	2022-12-06	2022-12-05	2022-12-05	2022-12-06	2022-12-06	2022-12-07
Parameter	Unit	G / S	RDL	4600757	4600759	4600761	4600764	4600772	4600775	4600778	4600779
Antimony	µg/g	40	0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8
Arsenic	µg/g	18	1	7	5	7	4	4	6	8	5
Barium	µg/g	670	2.0	206	72.5	64.4	45.1	30.6	37.1	248	26.8
Beryllium	µg/g	8	0.4	0.5	0.6	0.5	<0.4	<0.4	<0.4	0.6	<0.4
Boron	µg/g	120	5	14	10	8	<5	<5	<5	11	6
Boron (Hot Water Soluble)	µg/g	2	0.10	0.41	0.20	0.24	0.27	0.12	<0.10	0.53	0.14
Cadmium	µg/g	1.9	0.5	0.9	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chromium	µg/g	160	5	19	16	14	8	10	11	20	12
Cobalt	µg/g	80	0.5	11.5	7.1	6.3	4.1	5.1	6.1	11.7	6.3
Copper	µg/g	230	1.0	41.4	20.2	21.2	22.2	22.6	29.5	39.3	21.0
Lead	µg/g	120	1	34	23	14	14	10	11	11	21
Molybdenum	µg/g	40	0.5	0.8	0.6	0.5	<0.5	<0.5	0.6	1.3	0.7
Nickel	µg/g	270	1	30	18	17	9	11	13	28	13
Selenium	µg/g	5.5	0.8	0.9	<0.8	<0.8	<0.8	<0.8	<0.8	1.0	<0.8
Silver	µg/g	40	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Thallium	µg/g	3.3	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Uranium	µg/g	33	0.50	0.55	0.55	0.55	<0.50	<0.50	<0.50	0.66	<0.50
Vanadium	µg/g	86	0.4	28.9	23.3	21.7	14.3	17.2	18.0	32.1	21.8
Zinc	µg/g	340	5	63	71	51	36	30	56	55	67
Chromium, Hexavalent	µg/g	8	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Cyanide, WAD	µg/g	0.051	0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040
Mercury	µg/g	0.27	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Electrical Conductivity (2:1)	mS/cm	1.4	0.005	0.391	0.476	0.501	0.979	0.605	0.528	0.438	0.713
Sodium Adsorption Ratio (2:1) (Calc.)	N/A	12	N/A	1.33	4.52	5.33	6.91	2.11	5.71	1.38	8.95
pH, 2:1 CaCl2 Extraction	pH Units		NA	6.89	6.47	6.99	7.37	7.34	7.33	7.41	7.39

Certified By:

AGAT Laboratories

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FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - Metals & Inorganics (Soil)

DATE RECEIVED: 2022-12-08

DATE REPORTED: 2022-12-15

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON 406/19 T2.1 IC
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4600757-4600779 EC was determined on the DI water extract obtained from the 2:1 leaching procedure (2 parts DI water:1 part soil). pH was determined on the 0.01M CaCl2 extract prepared at 2:1 ratio. SAR is a calculated parameter.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: Amanjot Bhela

CHARTERED CHEMIST AMANJOT BHELA

AGAT Laboratories
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Certificate of Analysis

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - PAHs (Soil)

DATE RECEIVED: 2022-12-08

DATE REPORTED: 2022-12-15

		SAMPLE DESCRIPTION:		BH-1/4	BH-3/2	BH-4/5	BH-5/4	BH-7/5	BH-8/4
		SAMPLE TYPE:		Soil	Soil	Soil	Soil	Soil	Soil
		DATE SAMPLED:		2022-12-07	2022-12-06	2022-12-06	2022-12-05	2022-12-05	2022-12-06
Parameter	Unit	G / S	RDL	4600758	4600759	4600762	4600767	4600774	4600776
Naphthalene	µg/g	0.2	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthylene	µg/g	0.093	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Acenaphthene	µg/g	2.5	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluorene	µg/g	6.8	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phenanthrene	µg/g	12	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Anthracene	µg/g	0.16	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Fluoranthene	µg/g	2.8	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Pyrene	µg/g	28	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benz(a)anthracene	µg/g	0.92	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Chrysene	µg/g	9.4	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(b)fluoranthene	µg/g	3.2	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(k)fluoranthene	µg/g	3.1	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(a)pyrene	µg/g	0.31	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-cd)pyrene	µg/g	0.76	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Dibenz(a,h)anthracene	µg/g	0.7	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(g,h,i)perylene	µg/g	13	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1 and 2 Methlynaphthalene	µg/g	0.59	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Moisture Content	%		0.1	14.7	13.7	15.2	22.2	16.8	20.0
Surrogate	**Unit**	**Acceptable Limits**							
Naphthalene-d8	%	50-140		100	80	80	100	85	90
Acridine-d9	%	50-140		80	80	73	85	84	65
Terphenyl-d14	%	50-140		76	88	80	83	80	75

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON 406/19 T2.1 IC
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4600758-4600776 Results are based on the dry weight of the soil.
Note: The result for Benzo(b)Fluoranthene is the total of the Benzo(b)&j)Fluoranthene isomers because the isomers co-elute on the GC column.
2- and 1-Methyl Naphthalene is a calculated parameter. The calculated value is the sum of 2-Methyl Naphthalene and 1-Methyl Naphthalene.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnikolof

AGAT Laboratories

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FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - PHCs F1 - F4 (Soil)

DATE RECEIVED: 2022-12-08

DATE REPORTED: 2022-12-15

		SAMPLE DESCRIPTION:		BH-3/3	BH-5/5
		SAMPLE TYPE:		Soil	Soil
		DATE SAMPLED:		2022-12-06	2022-12-05
Parameter	Unit	G / S	RDL	4600760	4600770
Benzene	µg/g	0.02	0.02	<0.02	<0.02
Toluene	µg/g	0.2	0.05	<0.05	<0.05
Ethylbenzene	µg/g	0.05	0.05	<0.05	<0.05
m & p-Xylene	µg/g		0.05	<0.05	<0.05
o-Xylene	µg/g		0.05	<0.05	<0.05
Xylenes (Total)	µg/g	0.091	0.05	<0.05	<0.05
F1 (C6 - C10)	µg/g		5	<5	<5
F1 (C6 to C10) minus BTEX	µg/g	25	5	<5	<5
F2 (C10 to C16)	µg/g	26	10	<10	<10
F3 (C16 to C34)	µg/g	240	50	<50	<50
F4 (C34 to C50)	µg/g	3300	50	<50	<50
Gravimetric Heavy Hydrocarbons	µg/g		50	NA	NA
Moisture Content	%		0.1	15.0	15.0
Surrogate	**Unit**	**Acceptable Limits**			
Toluene-d8	% Recovery	60-140		83	81
Terphenyl	%	60-140		69	83

Certified By: N Popnikolof

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - PHCs F1 - F4 (Soil)

DATE RECEIVED: 2022-12-08

DATE REPORTED: 2022-12-15

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON 406/19 T2.1 IC
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4600760-4600770 Results are based on sample dry weight.
The C6-C10 fraction is calculated using Toluene response factor.
Xylenes is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX contribution.
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC6 and nC10 response factors are within 30% of Toluene response factor.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.
Fractions 1-4 are quantified with the contribution of PAHs. Under Ontario Regulation 153, results are considered valid without determining the PAH contribution if not requested by the client.
Quality Control Data is available upon request.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnikolof

AGAT Laboratories

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MISSISSAUGA, ONTARIO
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Certificate of Analysis

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - PHCs F1 - F4 (with PAHs) (Soil)

DATE RECEIVED: 2022-12-08

DATE REPORTED: 2022-12-15

		SAMPLE DESCRIPTION:		BH-1/4	BH-4/5	BH-7/5	BH-8/4
		SAMPLE TYPE:		Soil	Soil	Soil	Soil
		DATE SAMPLED:		2022-12-07	2022-12-06	2022-12-05	2022-12-06
Parameter	Unit	G / S	RDL	4600758	4600762	4600774	4600776
Benzene	µg/g	0.02	0.02	<0.02	<0.02	<0.02	<0.02
Toluene	µg/g	0.2	0.05	<0.05	<0.05	<0.05	<0.05
Ethylbenzene	µg/g	0.05	0.05	<0.05	<0.05	<0.05	<0.05
m & p-Xylene	µg/g		0.05	<0.05	<0.05	<0.05	<0.05
o-Xylene	µg/g		0.05	<0.05	<0.05	<0.05	<0.05
Xylenes (Total)	µg/g	0.091	0.05	<0.05	<0.05	<0.05	<0.05
F1 (C6 - C10)	µg/g		5	<5	<5	<5	<5
F1 (C6 to C10) minus BTEX	µg/g	25	5	<5	<5	<5	<5
F2 (C10 to C16)	µg/g	26	10	<10	<10	<10	<10
F2 (C10 to C16) minus Naphthalene	µg/g		10	<10	<10	<10	<10
F3 (C16 to C34)	µg/g	240	50	<50	<50	<50	<50
F3 (C16 to C34) minus PAHs	µg/g	240	50	<50	<50	<50	<50
F4 (C34 to C50)	µg/g	3300	50	<50	<50	<50	<50
Gravimetric Heavy Hydrocarbons	µg/g		50	NA	NA	NA	NA
Moisture Content	%		0.1	14.7	15.2	16.8	20.0
Surrogate	**Unit**	**Acceptable Limits**					
Toluene-d8	% Recovery	60-140		81	74	89	80
Terphenyl	%	60-140		73	74	68	85

Certified By: N Pomnikof

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Certificate of Analysis

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

CLIENT NAME: SOIL ENGINEERS LIMITED

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

O. Reg. 153(511) - PHCs F1 - F4 (with PAHs) (Soil)

DATE RECEIVED: 2022-12-08

DATE REPORTED: 2022-12-15

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to ON 406/19 T2.1 IC
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

4600758-4600776 Results are based on sample dry weight.
The C6-C10 fraction is calculated using toluene response factor.
Xylenes total is a calculated parameter. The calculated value is the sum of m&p-Xylene and o-Xylene.
C6–C10 (F1 minus BTEX) is a calculated parameter. The calculated value is F1 minus BTEX.
The calculated parameters are non-accredited. The parameters that are components of the calculation are accredited.
The C10 - C16, C16 - C34, and C34 - C50 fractions are calculated using the average response factor for n-C10, n-C16, and n-C34.
Gravimetric Heavy Hydrocarbons are not included in the Total C16-C50 and are only determined if the chromatogram of the C34 - C50 hydrocarbons indicates that hydrocarbons >C50 are present.
The chromatogram has returned to baseline by the retention time of nC50.
Total C6 - C50 results are corrected for BTEX and PAH contributions.
C>10 – C16 (F2- Naphthalene) is a calculated parameter. The calculated value is F2 - Naphthalene.
C>16 - C34 (F3-PAH) is a calculated parameter. The calculated value is F3-PAH (PAH: sum of Phenanthrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Fluoranthene, Dibenzo(a,h)anthracene, Indeno(1,2,3-c,d)pyrene and Pyrene).
This method complies with the Reference Method for the CWS PHC and is validated for use in the laboratory.
nC10, nC16 and nC34 response factors are within 10% of their average.
C50 response factor is within 70% of nC10 + nC16 + nC34 average.
Linearity is within 15%.
Extraction and holding times were met for this sample.

Analysis performed at AGAT Toronto (unless marked by *)

Certified By: N Popnikolof

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Quality Assurance

CLIENT NAME: SOIL ENGINEERS LIMITED

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis

RPT Date: Dec 15, 2022			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	4605565		<0.8	<0.8	NA	< 0.8	71%	70%	130%	86%	80%	120%	89%	70%	130%
Arsenic	4605565		7	8	13.3%	< 1	116%	70%	130%	102%	80%	120%	103%	70%	130%
Barium	4605565		74.1	75.9	2.4%	< 2.0	95%	70%	130%	96%	80%	120%	101%	70%	130%
Beryllium	4605565		0.7	0.7	NA	< 0.4	81%	70%	130%	106%	80%	120%	92%	70%	130%
Boron	4605565		9	9	NA	< 5	70%	70%	130%	101%	80%	120%	77%	70%	130%
Boron (Hot Water Soluble)	4605726		<0.10	<0.10	NA	< 0.10	99%	60%	140%	101%	70%	130%	100%	60%	140%
Cadmium	4605565		<0.5	<0.5	NA	< 0.5	112%	70%	130%	109%	80%	120%	107%	70%	130%
Chromium	4605565		24	24	NA	< 5	102%	70%	130%	100%	80%	120%	115%	70%	130%
Cobalt	4605565		11.1	11.3	1.8%	< 0.5	100%	70%	130%	100%	80%	120%	99%	70%	130%
Copper	4605565		24.4	24.8	1.6%	< 1.0	90%	70%	130%	103%	80%	120%	95%	70%	130%
Lead	4605565		14	14	0.0%	< 1	106%	70%	130%	101%	80%	120%	98%	70%	130%
Molybdenum	4605565		<0.5	<0.5	NA	< 0.5	105%	70%	130%	108%	80%	120%	107%	70%	130%
Nickel	4605565		23	24	4.3%	< 1	98%	70%	130%	103%	80%	120%	103%	70%	130%
Selenium	4605565		<0.8	<0.8	NA	< 0.8	98%	70%	130%	114%	80%	120%	116%	70%	130%
Silver	4605565		<0.5	<0.5	NA	< 0.5	94%	70%	130%	100%	80%	120%	96%	70%	130%
Thallium	4605565		<0.5	<0.5	NA	< 0.5	106%	70%	130%	109%	80%	120%	107%	70%	130%
Uranium	4605565		0.64	0.62	NA	< 0.50	110%	70%	130%	97%	80%	120%	103%	70%	130%
Vanadium	4605565		35.4	35.3	0.3%	< 0.4	103%	70%	130%	99%	80%	120%	107%	70%	130%
Zinc	4605565		88	92	4.4%	< 5	103%	70%	130%	109%	80%	120%	124%	70%	130%
Chromium, Hexavalent	4599666		<0.2	<0.2	NA	< 0.2	104%	70%	130%	89%	80%	120%	78%	70%	130%
Cyanide, WAD	4600757	4600757	<0.040	<0.040	NA	< 0.040	92%	70%	130%	94%	80%	120%	104%	70%	130%
Mercury	4605565		<0.10	<0.10	NA	< 0.10	113%	70%	130%	104%	80%	120%	108%	70%	130%
Electrical Conductivity (2:1)	4611827		2.51	2.65	5.4%	< 0.005	103%	80%	120%	NA			NA		
Sodium Adsorption Ratio (2:1) (Calc.)	4611827		12.9	13.3	3.1%	N/A	NA			NA			NA		
pH, 2:1 CaCl2 Extraction	4600757	4600757	6.89	6.98	1.3%	NA	98%	80%	120%	NA			NA		

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.
Duplicate NA: results are under 5X the RDL and will not be calculated.

O. Reg. 153(511) - Metals & Inorganics (Soil)															
Antimony	4605695		<0.8	<0.8	NA	< 0.8	96%	70%	130%	88%	80%	120%	90%	70%	130%
Arsenic	4605695		4	4	NA	< 1	118%	70%	130%	107%	80%	120%	95%	70%	130%
Barium	4605695		61.5	65.4	6.2%	< 2.0	100%	70%	130%	92%	80%	120%	103%	70%	130%
Beryllium	4605695		0.6	0.6	NA	< 0.4	78%	70%	130%	95%	80%	120%	77%	70%	130%
Boron	4605695		18	30	NA	< 5	75%	70%	130%	99%	80%	120%	97%	70%	130%
Cadmium	4605695		0.7	0.6	NA	< 0.5	109%	70%	130%	107%	80%	120%	99%	70%	130%
Chromium	4605695		12	13	NA	< 5	108%	70%	130%	99%	80%	120%	122%	70%	130%
Cobalt	4605695		6.1	6.5	5.9%	< 0.5	109%	70%	130%	97%	80%	120%	107%	70%	130%
Copper	4605695		11.5	12.1	4.9%	< 1.0	97%	70%	130%	102%	80%	120%	98%	70%	130%

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Quality Assurance

CLIENT NAME: SOIL ENGINEERS LIMITED

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

Soil Analysis (Continued)

RPT Date: Dec 15, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Lead	4605695		46	45	1.6%	< 1	111%	70%	130%	101%	80%	120%	97%	70%	130%
Molybdenum	4605695		1.0	0.9	NA	< 0.5	115%	70%	130%	107%	80%	120%	117%	70%	130%
Nickel	4605695		12	13	4.2%	< 1	110%	70%	130%	104%	80%	120%	105%	70%	130%
Selenium	4605695		<0.8	<0.8	NA	< 0.8	99%	70%	130%	109%	80%	120%	97%	70%	130%
Silver	4605695		<0.5	<0.5	NA	< 0.5	110%	70%	130%	109%	80%	120%	92%	70%	130%
Thallium	4605695		<0.5	<0.5	NA	< 0.5	117%	70%	130%	107%	80%	120%	108%	70%	130%
Uranium	4605695		0.89	0.91	NA	< 0.50	117%	70%	130%	96%	80%	120%	109%	70%	130%
Vanadium	4605695		18.7	20.1	7.5%	< 0.4	113%	70%	130%	95%	80%	120%	116%	70%	130%
Zinc	4605695		313	253	21.2%	< 5	100%	70%	130%	106%	80%	120%	126%	70%	130%
Mercury	4605695		<0.10	<0.10	NA	< 0.10	95%	70%	130%	105%	80%	120%	100%	70%	130%

Comments: NA signifies Not Applicable.
pH duplicates QA acceptance criteria was met relative as stated in Table 5-15 of Analytical Protocol document.
Duplicate NA: results are under 5X the RDL and will not be calculated.

Certified By:

AGAT Laboratories

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Quality Assurance

CLIENT NAME: SOIL ENGINEERS LIMITED

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

Trace Organics Analysis

RPT Date: Dec 15, 2022			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
O. Reg. 153(511) - PHCs F1 - F4 (with PAHs) (Soil)															
Benzene	4600788		<0.02	<0.02	NA	< 0.02	97%	60%	140%	90%	60%	140%	100%	60%	140%
Toluene	4600788		<0.05	<0.05	NA	< 0.05	107%	60%	140%	90%	60%	140%	97%	60%	140%
Ethylbenzene	4600788		<0.05	<0.05	NA	< 0.05	85%	60%	140%	105%	60%	140%	101%	60%	140%
m & p-Xylene	4600788		<0.05	<0.05	NA	< 0.05	104%	60%	140%	101%	60%	140%	95%	60%	140%
o-Xylene	4600788		<0.05	<0.05	NA	< 0.05	108%	60%	140%	106%	60%	140%	96%	60%	140%
F1 (C6 - C10)	4600788		<5	<5	NA	< 5	87%	60%	140%	95%	60%	140%	89%	60%	140%
F2 (C10 to C16)	4579231		190	175	8.1%	< 10	102%	60%	140%	100%	60%	140%	103%	60%	140%
F3 (C16 to C34)	4579231		532	498	6.5%	< 50	102%	60%	140%	104%	60%	140%	90%	60%	140%
F4 (C34 to C50)	4579231		<50	<50	NA	< 50	81%	60%	140%	111%	60%	140%	88%	60%	140%
O. Reg. 153(511) - PAHs (Soil)															
Naphthalene	4604721		<0.05	<0.05	NA	< 0.05	66%	50%	140%	120%	50%	140%	100%	50%	140%
Acenaphthylene	4604721		<0.05	<0.05	NA	< 0.05	81%	50%	140%	80%	50%	140%	100%	50%	140%
Acenaphthene	4604721		<0.05	<0.05	NA	< 0.05	88%	50%	140%	100%	50%	140%	75%	50%	140%
Fluorene	4604721		<0.05	<0.05	NA	< 0.05	94%	50%	140%	118%	50%	140%	78%	50%	140%
Phenanthrene	4604721		<0.05	<0.05	NA	< 0.05	91%	50%	140%	95%	50%	140%	70%	50%	140%
Anthracene	4604721		<0.05	<0.05	NA	< 0.05	102%	50%	140%	98%	50%	140%	80%	50%	140%
Fluoranthene	4604721		<0.05	<0.05	NA	< 0.05	118%	50%	140%	115%	50%	140%	85%	50%	140%
Pyrene	4604721		<0.05	<0.05	NA	< 0.05	119%	50%	140%	115%	50%	140%	85%	50%	140%
Benz(a)anthracene	4604721		<0.05	<0.05	NA	< 0.05	107%	50%	140%	118%	50%	140%	95%	50%	140%
Chrysene	4604721		<0.05	<0.05	NA	< 0.05	71%	50%	140%	108%	50%	140%	85%	50%	140%
Benzo(b)fluoranthene	4604721		<0.05	<0.05	NA	< 0.05	88%	50%	140%	95%	50%	140%	113%	50%	140%
Benzo(k)fluoranthene	4604721		<0.05	<0.05	NA	< 0.05	82%	50%	140%	73%	50%	140%	88%	50%	140%
Benzo(a)pyrene	4604721		<0.05	<0.05	NA	< 0.05	103%	50%	140%	93%	50%	140%	95%	50%	140%
Indeno(1,2,3-cd)pyrene	4604721		<0.05	<0.05	NA	< 0.05	90%	50%	140%	98%	50%	140%	113%	50%	140%
Dibenz(a,h)anthracene	4604721		<0.05	<0.05	NA	< 0.05	100%	50%	140%	75%	50%	140%	98%	50%	140%
Benzo(g,h,i)perylene	4604721		<0.05	<0.05	NA	< 0.05	106%	50%	140%	78%	50%	140%	98%	50%	140%

Comments: When the average of the sample and duplicate results is less than 5x the RDL, the Relative Percent Difference (RPD) will be indicated as Not Applicable (NA).

O. Reg. 153(511) - PHCs F1 - F4 (Soil)															
F2 (C10 to C16)	4579231		190	175	8.1%	< 10	102%	60%	140%	100%	60%	140%	103%	60%	140%
F3 (C16 to C34)	4579231		532	498	6.5%	< 50	102%	60%	140%	104%	60%	140%	90%	60%	140%
F4 (C34 to C50)	4579231		<50	<50	NA	< 50	81%	60%	140%	111%	60%	140%	NA	60%	140%

Certified By: NPopovkof

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Method Summary

CLIENT NAME: SOIL ENGINEERS LIMITED

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Antimony	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Arsenic	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Barium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Beryllium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Boron (Hot Water Soluble)	MET-93-6104	modified from EPA 6010D and MSA PART 3, CH 21	ICP/OES
Cadmium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Cobalt	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Copper	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Lead	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Molybdenum	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Nickel	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Selenium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Silver	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Thallium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Uranium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Vanadium	MET-93-6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Zinc	MET 93 -6103	modified from EPA 3050B and EPA 6020B and ON MOECC	ICP-MS
Chromium, Hexavalent	INOR-93-6068	modified from EPA 3060 and EPA 7196	SPECTROPHOTOMETER
Cyanide, WAD	INOR-93-6052	modified from ON MOECC E3015, SM 4500-CN- I, G-387	TECHNICON AUTO ANALYZER
Mercury	MET-93-6103	modified from EPA 7471B and SM 3112 B	ICP-MS
Electrical Conductivity (2:1)	INOR-93-6075	modified from MSA PART 3, CH 14 and SM 2510 B	PC TITRATE
Sodium Adsorption Ratio (2:1) (Calc.)	INOR-93-6007	modified from EPA 6010D & Analytical Protocol	ICP/OES
pH, 2:1 CaCl2 Extraction	INOR-93-6075	modified from EPA 9045D, MCKEAGUE 3.11 E3137	PC TITRATE

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Method Summary

CLIENT NAME: SOIL ENGINEERS LIMITED

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Trace Organics Analysis			
Naphthalene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Acenaphthylene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Acenaphthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Fluorene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Phenanthrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Anthracene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Fluoranthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Pyrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benz(a)anthracene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Chrysene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(b)fluoranthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(k)fluoranthene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(a)pyrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Indeno(1,2,3-cd)pyrene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Dibenz(a,h)anthracene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Benzo(g,h,i)perylene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
1 and 2 Methlynaphthalene	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Naphthalene-d8	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Acridine-d9	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Terphenyl-d14	ORG-91-5106	modified from EPA 3570 and EPA 8270E	GC/MS
Moisture Content	VOL-91-5009	modified from CCME Tier 1 Method	BALANCE
Benzene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Toluene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Ethylbenzene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
m & p-Xylene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
o-Xylene	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
Xylenes (Total)	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/MS
F1 (C6 - C10)	VOL-91-5009	modified from CCME Tier 1 Method	(P&T)GC/FID
F1 (C6 to C10) minus BTEX	VOL-91-5009	modified from CCME Tier 1 Method	P&T GC/FID
Toluene-d8	VOL-91-5009	modified from EPA SW-846 5030C & 8260D	(P&T)GC/MS
F2 (C10 to C16)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F3 (C16 to C34)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F4 (C34 to C50)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID

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Method Summary

CLIENT NAME: SOIL ENGINEERS LIMITED

AGAT WORK ORDER: 22T978890

PROJECT: 2205-E231

ATTENTION TO: Ahmed Hassan

SAMPLING SITE:

SAMPLED BY:

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Gravimetric Heavy Hydrocarbons	VOL-91-5009	modified from CCME Tier 1 Method	BALANCE
Terphenyl	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F2 (C10 to C16) minus Naphthalene	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F3 (C16 to C34)	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID
F3 (C16 to C34) minus PAHs	VOL-91-5009	modified from CCME Tier 1 Method	GC/FID

May 2024

Natural Heritage Existing Conditions and Constraints Analysis Report

Falcon Creek Erosion Control Project

Prepared for
Valdor Engineering Inc.

north-south ENVIRONMENTAL

North-South Environmental Inc. • 101B King Street West • Cambridge, Ontario • N3H 1B5

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Table of Contents

List of Tables

List of Appendices

1. Introduction

North-South Environmental Inc. (NSE) was retained as part of the project team, led by Valdor Engineering Inc. to conduct natural environment studies in support of the Falcon Creek Erosion Control Project between the CN Railroad and Dorset Avenue, City of Burlington, Ontario (the "study area"). Ecological work was conducted to inform a Schedule B Municipal Class Environmental Assessment (EA). The EA will identify and evaluate alternatives to address erosion concerns.

Willowbrook Road runs adjacent to Falcon Creek, south of Enfield Road, in the City of Burlington, and is at risk from ongoing erosion. Willowbrook Road is located on an outside meander bend of Falcon Creek. The top of bank is approximately 2 m from the guardrail, and 3 m from the pavement of Willowbrook Road. The bank slope is comprised of unconsolidated soils and is highly erodible. There are several large trees located along the slope between the road and the watercourse that are at risk of failure due to erosion (Aquafor Beech 2021).

The study area is located within a primarily low-density residential area. Residences are present immediately west of the creek corridor, and to the east, across Willowbrook Road. Business / industrial is present to the north.

The study area includes a reach of Falcon Creek (approximately 275 m in length) and adjacent riparian habitat. As part of this study, adjacent lands, defined as within 120 m, have also been included. The study area is shown in **Figure 1** of **Appendix 1.**

2. Regulatory Agency Consultation

Natural heritage data relevant to the study area was received from the City of Burlington and Conservation Halton. The Ministry of Northern Development, Mines, Natural Resources and Forest (MNDMNRF) also provided information intended to guide the project team in identifying and assessing natural features and resources. A request for natural heritage data relevant to the study area were sent to the Ministry of the Environment, Conservation, and Parks (MECP) on June 1, 2022, however, to date, no response has been received.

Agency correspondence is included as **Appendix 2**.

3. Public Consultation

A Notice of Study Commencement and solicitation for comments was provided to nearby landowners by mail on May 27, 2022. A Public Information Centre (PIC) was held on March 8, 2023.

4. Policy and Legislative Framework

4.1. Fisheries Act (1985)

The federal *Fisheries Act* regulates the harm and destruction of fish and fish habitat in Canadian waterways. Under the *Fisheries Act*, certain work, undertakings or activities taking place in or near water that occurs within or near water may require review or authorization from the Department of Fisheries and Oceans (DFO). The DFO encourages proponents to implement measures to avoid impacts to fish and fish habitat. If avoidance is not possible, the DFO recommends mitigating impacts to fish and fish habitat and has prepared codes of practice for common works, undertakings, and activities.

4.2. Migratory Birds Convention Act (1994)

The *Migratory Birds Convention Act* (MBCA) and its *Regulations* protect listed migratory birds in Canada through the conservation of populations, individuals, and their nests. Article I of the MBCA identifies migratory species that are protected under this act. It is a contravention of this act to harass, harm, or kill protected migratory birds, remove, or disrupt their nests, and/or eggs.

4.3. Species at Risk Act (2002)

The federal *Species at Risk Act* (SARA) provides legal protection for federally listed Species at Risk (SAR) on federally owned lands; for aquatic species; and for any federally listed SAR anywhere they occur (including private lands, provincial and territorial lands) when the species is also protected by the MBCA. Species and habitat of species listed on Schedule 1 of SARA are protected from harm or destruction. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) recommends species to be listed on Schedule 1 of SARA.

4.4. Endangered Species Act (2007)

The *Endangered Species Act* (ESA) provides regulatory protection for SAR and their habitat in Ontario. Species listed as Endangered and Threatened, and habitat for those species, is protected from development under the ESA. Habitat for Special Concern species is not protected under the ESA but is considered Significant Wildlife Habitat (SWH) and is protected under Section 2.1 of the 2020 *Provincial Policy Statement* (PPS).

4.5. Provincial Policy Statement (2020)

Section 2 of the Provincial Policy Statement (PPS; 2020) provides direction for the wise use and management of resources, including the protection of natural areas and features. Natural heritage policies are described in Section 2.1.

Section 2.1.1 of the PPS outlines protection needs related to biodiversity and connectivity, including protection of both ecological features and function required to maintain biodiversity and functional ecological connectivity.

Section 2.1.4 lists significant natural heritage features where development and site alteration are not permitted, including:

- Significant wetlands in Ecoregions 5E, 6E, and 7E, and
- Significant coastal wetlands.

Section 2.1.5 lists significant natural heritage features were development and site alteration are not permitted, unless it has been demonstrated that there will be no negative impact on the natural features or their ecological functions, including:

- Significant woodlands in Ecoregions 6E and 7E,
- Significant valleylands in Ecoregions 6E and 7E,
- Significant wildlife habitat,
- Significant areas of natural and scientific interest, and
- Coastal wetlands in Ecoregions 5E, 6E, and 7E (that are not subject to Policy 2.1.4).

Section 2.1.7 states that development and site alteration shall not be permitted in habitat of endangered and threatened species, except in accordance with provincial and federal requirements.

Section 2.1.8 states that development and site alteration are not permitted on adjacent lands to the natural heritage features and areas identified in policies 2.1.4, 2.1.5, and 2.1.6 (fish habitat) unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions.

4.6. Greenbelt Plan (2017)

The Greenbelt Plan area extends from Niagara Falls to Durham Region (i.e., the Golden Horseshoe) and identifies where development should not occur in order to protect agricultural lands and lands that support ecological features and functions. The Greenbelt Plan includes land designated as Protected Countryside, and lands within the Niagara Escarpment Plan Area, Oak Ridges Moraine Area and the Parkway Belt West Plan Area. The Protected Countryside is further divided into three categories: the Agricultural System, the Natural System, and Settlement Areas.

The study area is outside of the Greenbelt Plan Area.

4.7. Halton Region Official Plan (Office Consolidation 2022)

Halton Region's Official Plan sets out its long-term vision for the physical form and community character of the region. It implements its duties under the provincial PPS to protect natural heritage

features and functions, including identifying a Natural Heritage System (NHS). The regional Natural Heritage System is shown on Map 1G (Key Features within the Greenbelt and Regional Natural Heritage Systems). The Halton Region OP outlines development and site alteration policies within the Regional NHS and outlines the objectives of the NHS. Any proposed development or site alteration requires the proponent to demonstrate that the proposed works will have no negative impacts to the natural features and areas or their ecological functions.

No part of the study area is mapped as a Key Feature within the Greenbelt, or as part of the Regional Natural Heritage System.

4.8. City of Burlington Official Plan (Office Consolidation 2021)

The policies of the City of Burlington's Official Plan guide economic, environmental, and community building decisions to manage growth. The Plan establishes several land use designations and sets forth specific goals and policies applicable to each designation. Official Plan Schedule C depicts environmental land designations, including Niagara Escarpment Area, Environmentally Sensitive Area, and Greenlands.

No part of the study area has an environmental land designation, as per the Official Plan, Schedule C.

4.9. Conservation Halton Regulation

Ontario Regulation (O.Reg.) 41/24 under the *Conservation Authorities Act* gives Conservation Authorities, including Conservation Halton, the authority to regulate development, interference with wetlands and alterations to shorelines and watercourses. Generally, Conservation Authorities regulate floodplains, hazard lands, wetlands, and wetland buffers.

The study area is within an area regulated by Conservation Halton. A permit from Conservation Halton will be required.

5. Background Review and Secondary Sources

A background review of existing data relevant to the study area was completed, which included a review of the following:

- Falcon Creek Hydrology and Hydraulic Study (Valdor Engineering Inc. 2012)
- Falcon Creek Erosion Assessment (Parish Geomorphic 2012)
- City of Burlington 2020 Creeks Inventory and Erosion Assessment (Aquafor Beech 2021)
- Plan and Profile Drawing. Index No. D79-1. Enfield Road 700' +- Maplehurst to 800' +- Willowbrook (City of Burlington 1972)
- Plan and Profile Drawing. Index No. V25. Willowbrook Road (City of Burlington 1974)
- Easement Documents for Falcon Creek Reach (City of Burlington, various dates)

- Falcon Creek Assorted shapefile data (City of Burlington 2022)
- Assorted orthophotos (City of Burlington, various dates)
- Falcon Creek Assorted shapefile data, including: Floodplain Limit, Hydraulic Model, Model Cross Sections, Hydrologic Model, Triangular Irregular Network (TIN), Approximate Regulation Limit, Regulated Hazards, Contours – 1 m, Fisheries Occurrence, Hydraulic Model – Approved, Hydraulic Model – Draft, Approved HEC-RAS Model, ELC, Fisheries, Monitoring, LiDAR DEM, Spills
- Halton Natural Areas Inventory. Volumes 1 and 2 (Dwyer, J.K. 2006)
- Natural Heritage Information Centre (NHIC) mapping (MNRF 2010)
- Land Information Ontario (LIO) mapping (Government of Ontario 2011)
- Department of Fisheries and Oceans (DFO) Aquatic Species at Risk mapping (DFO 2022)
- Conservation Halton mapping
- Aerial imagery (current and historic)
- Mapping in the Official Plans of Halton Region and the City of Burlington
- Species atlas data including the Atlas of the Breeding Birds of Ontario, the Ontario Reptile and Amphibian Atlas, the Ontario Butterfly Atlas, the Ontario Moth Atlas, eBird, iNaturalist

6. Existing Conditions

6.1. Past and Present Land Use

The study area is located within the City of Burlington. Surrounding land use is low-density residential, with business/industrial use to the north. Based on a review of background material (easement documents, historic and current aerial and street view imagery, historic City of Burlington drawings) the surrounding residences appear to have been constructed in the late 1960s and early 1970s. Previous to development, the immediate area around Falcon Creek (within the study area) was in agricultural use (see historic aerial imagery on **Figure 5** of **Appendix 1**).

6.2. Physiography, and Soils

The study area is within the Iroquois Plain physiographic region. The Iroquois Plain extends from as a band around Lake Ontario, from Niagara Falls to the Trent River near Belleville. It is a lowland area previously flooded by glacial Lake Iroquois.

Surficial deposits are of coarse-textured glaciolacustrine deposits of sand and gravel, with minor components of silt and clay (Chapman and Putnam 1984; Crins 2009; Ontario Geological Society 2003-2009).

6.3. Surface Water and Groundwater

The drainage area to Falcon Creek is approximately 380 hectares in size, of which the majority is within the City of Burlington, with the remainder in the City of Hamilton. The watershed begins above the Niagara Escarpment and has an outlet to the south at Hamilton Harbour (Valdor Engineering Inc. 2012).

No groundwater discharge is known to be present within the study area.

6.4. Field Investigations

Ecological field investigations were conducted by NSE staff according to **Table 1**, below. Incidental species records, Species at Risk, and Significant Wildlife were recorded during all field surveys.

Table 1. Field Surveys

Date	Survey Type	Weather
June 8, 2022	• Breeding Bird Survey - Visit 1	15 to 16˚C, sunny, light wind, no precipitation
June 10, 2022	• Bat Presence Screening Assessment – Visit 1	23 (start) to 17 ˚C (end), no cloud cover, light wind, no precipitation
June 13, 2022	• Bat Presence Screening Assessment – Visit 2	22 (start) to 18 ˚C (end), 90% cloud cover, light wind, no precipitation
June 27, 2022	• Breeding Bird Survey – Visit 2 • Ecological Land Classification • Vegetation Inventory	16˚C, mostly sunny, light wind, no precipitation
July 7, 2022	• Aquatic Habitat Assessment • Fish Survey	20 to 23˚C, mostly sunny, no precipitation
December 7, 2022	• Bat Habitat Suitability Assessment	N/A

6.4.1. Aquatic Habitat Assessment

An aquatic habitat assessment was completed on July 7, 2022, for the stretch of Falcon Creek within the study area. This assessment included observations of fish, substrates, instream-cover, wetted and bankfull width, water and bankfull depth, and in-stream (as applicable) and riparian / bank vegetation. Through the assessment specific consideration was given to identify existing constraints and opportunities to improve fish habitat and fish passage.

Falcon Creek originates above the Niagara Escarpment, enters the study area from the northwest and flows southeast, eventually draining into Hamilton Harbour, Lake Ontario. Within the study area, Falcon Creek extends from the C.N. Rail line, flows through a circular concrete culvert under Enfield Road after which the channel meanders towards Willowbrook Road. Falcon Creek is a permanent creek with a warm water thermal regime.

The aquatic habitat assessment was completed along two sections of Falcon Creek within the study area. The downstream reach ('Reach 1') is located south of Enfield Road, and the upstream reach ('Reach 2') is located north of Enfield Road. Each Reach is shown on **Figure 2**, in **Appendix 1**. Further detailed aquatic habitat conditions observed throughout the survey of both reaches can be found in **Appendix 3**. Datasheets and photographs of Falcon Creek during surveys on July 7, 2022 can be found in **Appendix 3**.

Downstream of Enfield Road – Reach 1

Within the study area, the downstream conditions ('Reach 1'), approximately 152 m southwest of Enfield Rd running along Willowbrook Rd, consists mainly of heavy bank erosion on both the right and left banks. At the Enfield Rd culvert, boulder stabilization has been incorporated into both banks. At the southeast culvert near Willowbrook Rd and Dorset Ave both banks are comprised of a vertical stabilization wall leading into the culvert.

At the time of observation, the mean depth wetted ranged from 1 to 20 cm, mean width wetted ranged from 1.4 to 2 m, mean bankfull width ranged from 5.3 to 6 m, and mean bankfull depth was approximately 85 cm. Substrate consists of natural material including boulders, cobble, gravel, sand, and silt.

There was no instream vegetation. Dominant riparian vegetation consisted of primarily Black Walnut (*Juglans nigra*) and Crack Willow (*Salix fragilis*) which provides approximately 30% overhanging vegetation shade cover within the downstream reach.

Fish barriers within the downstream reach included downed woody debris, rock debris, and the closed-bottom culverts leading under Enfield Rd, and a closed-bottom culvert and culvert grate leading under Willowbrook Rd.

Upstream of Enfield Road – Reach 2

The upstream reach ('Reach 2'), approximately 125 m northwest of Enfield Rd, consists mainly of heavy bank erosion on both the right and left banks, near Enfield Rd a vertical headwall on the right upstream bank has been installed.

At the time of observation, the mean depth wetted ranged from 4 to 21 cm, mean width wetted ranged from 1.2 to 2.5 m, mean bankfull width ranged from 4.5 to 6.5 m, and mean bankfull depth was approximately 1 m. Substrate consists of natural material including boulders, cobble, gravel, sand, and silt.

There was no instream vegetation. Dominant riparian vegetation consisted of Crack Willow (*Salix fragilis*) and Black Walnut (*Juglans nigra*) which provides approximately 40% overhanging vegetation shade cover within the upstream reach.

Fish barriers within the upstream reach included downed woody debris and the closed-bottom culverts at low flow.

6.4.2. Fish Community

The downstream ('Reach 1') and upstream ('Reach 2') reaches of Falcon Creek within the study area were surveyed on July 7, 2022 by two ecologists with Class 2 Backpack Electrofishing certification to assess fish community composition and aquatic habitat characteristics including the thermal regime. The survey of the downstream reach ("Reach 1") spanned approximately 152 m. The survey of the upstream reach ("Reach 2") spanned approximately 94 m.

Fish community composition was assessed using the single pass electrofishing using methods outlined in the Ontario Stream Assessment Protocol (Stanfield L. 2010). Electrofishing was carried out with Smith-Root LR-20B (Smith-Root Vancouver, WA) backpack electrofishing with a voltage setting of 225 V, frequency of 35 Hz, and duty cycle of 5. The electrofishing survey of the Reach 1 of Falcon Creek began at 11:15, ended at 12:00 and comprised an effort of 534 s. The survey of Reach 2 began at 12:30, ended at 13:15 and comprised an effort of 262 s.

Fish collected during each survey were kept in a plastic bucket with cool, well-oxygenated water until the end of each reach survey. Upon survey completion of each reach, fish were sorted and identified to species. An average length (± 1 mm) was collected for each fish species. After metrics were collected, fish were released back into the creek.

Land Information Ontario (LIO) mapping does not provide information on fish species present within the study area, however LIO mapping does note one species, Spottail Shiner (*Notropis hudsonius*), downstream from the study area, south of Plains Rd E. Additionally, Conservation Halton provided data from 1982-2016 which indicate 10 fish species known to be present within Falcon Creek. These species include Bluntnose Minnow (*Pimephales* notatus), Common Carp (*Cyprinus carpio*), Creek Chub (*Semotilus atromaculatus*), Fathead Minnow (*Pimephales promelas*), Goldfish (*Carassius auratus*), Mimic Shiner (*Notropis volucellus*), Spottail Shiner (*Notropis hudsonius*), Threespine Stickleback (*Gasterosteus aculeatus*), Western Blacknose Dace (*Rhinichthys obtusus*), and White Sucker (*Catostomus commersoni*) (Conservation Halton 2022).

During NSE aquatic habitat assessment on July 7, 2022, 2 species were recorded residing in the study area. These species were Western Blacknose Dace and Creek Chub. For Reach 1, captured individuals included 6 adult Western Blacknose Dace ranging from 35 – 55 mm in total length, 2 adult Creek Chub, ranging from 40 – 123 mm in total length, and 40 young of the year fish ranging from 8 – 15 mm

in total length. For Reach 2, captured individuals included 11 adult Western Blacknose Dace ranging from 40 – 55 mm in total length, 5 adult Creek Chub ranging from 60 – 110 mm in total length, and 70 young of the year ranging from 8 – 15 mm in total length. No fish species were collected to be identified or sampled off site. Young of the year species were listed as being either Western Blacknose Dace or Creek Chub.

No known SAR fish species occur within the study area or Falcon Creek.

Historical occurrences of fish species in Falcon Creek can be found in **Appendix 3**. Fish species, length, and number from the survey completed on July 7, 2022 can be found in **Appendix 3**

6.4.3. Ecological Land Classification (ELC)

Vegetation communities in the study area were assessed using the Ecological Land Classification (ELC) system for Southern Ontario (Lee *et al*. 1998) by a qualified practitioner. Vegetation community mapping is shown in **Figure 4** of **Appendix 1**.

One vegetation community type (two units) and one anthropogenic area was identified on the study area. These are described below.

Fresh-Moist Willow Lowland Deciduous Forest (FOD7-3)

This vegetation community type is present in two units within the study area – one north of Enfield Road, and the other south of Enfield Road. The emergent layer is dominated by scattered Crack Willow (*Salix fragilis*) that covers 35-60% of the community and ranges from 15-25 m in height. The canopy is dominated by Black Walnut (*Juglans nigra*) and Crack Willow in the canopy (>60% cover, 10-25 m in height). The sub-canopy is dominated by Sugar Maple (*Acer saccharum*), White Mulberry (*Morus alba*), dead standing ash (*Fraxinus* sp.) covered with Riverbank Grape (*Vitis riparia*), and the occasional American Basswood (*Tilia americana*) (35-60% cover, 10-15 m in height). The understory is dominated by tree saplings including Norway Maple (*Acer platanoides*), American Elm (*Ulmus americana*) and Manitoba Maple (*Acer negundo)*, and scattered Tartarian Honeysuckle (*Lonicera tatarica*) (35-60% cover, 1-2 m in height). The ground layer is dominated Riverbank Grape, Virginia Creeper (*Parthenocissus quinquefolia*), and Coltsfoot (*Tussilago farfara*). Ground layer vegetation is 0.2-0.5 m in height and covers more than 60% of the community.

Ash trees appear to have been one of the dominant trees in this community until recently. The dead standing ash trees appear to have succumbed to damage from the non-native Emerald Ash Borer (*Agrilus planipennis*). The resulting gaps in the canopy and sub-canopy have led to the understory primarily containing tree saplings and non-native shrubs (i.e., Honeysuckle, European Buckthorn).

Manicured

The anthropogenic community includes a manicured lawn and ornamental garden at the corner boulevard of Enfield Road and the westside of Willowbrook Road. The garden includes Orange Day-lily (*Hemerocallis fulva*), ornamental roses (*Rosa* sp.) and other commonly planted non-native ornamental species.

6.4.4. Botanical Inventory

A single-season flora inventory was conducted by a qualified vegetation ecologist. The locations of any Species at Risk, provincially rare species, or regionally rare species were recorded. Incidental vegetation records were also recorded during other field surveys.

A total of 53 plant species were recorded within the study area during surveys (a list of species is included in **Appendix 4**).

Of the plant species documented:

- 31 (58%) are native, and 22 (42%) species are non-native
- No Species at Risk (SAR) were recorded
- No species are provincially rare
- Two (2) species are regionally uncommon in Halton Region: Canada Garlic (*Allium canadense var. canadense*), Eastern Red Cedar (*Juniperus virginiana var. virginiana*)

The Species at Risk status was determined by referencing Schedule 1 of the Species at Risk Act (federal) and O. Reg. 230/08: Species at Risk in Ontario List (provincial). The provincial conservation status of plant species was determined from the NHIC's vascular plant species list (2022). The regional status of plant species for Halton Region was determined from the Halton Natural Areas Inventory List (Crins *et al.* 2006).

6.4.5. Wildlife

6.4.5.1. Breeding Birds

Breeding bird surveys were conducted by a qualified avian ecologist using the OBBA survey protocol (OBBA 2001). Two visits were conducted in Spring/Summer of 2022, separated by at least 14 days. Ten-minute point counts were conducted at the same points on each visit. Breeding codes were assigned to each bird species observed using the Ontario Breeding Bird Atlas standard codes and the probability of breeding will be determined (e.g., Confirmed, Probable or Possible).

A total of 25 species of birds were noted during breeding bird surveys and incidentally during other field surveys. A list of species recorded with breeding evidence is included as **Appendix 4**. Species at risk, Area Sensitive, and regionally rare bird species are summarized in **Table 2**.

Four Barn Swallow (*Hirundo rustica*) and two Chimney Swift (*Chaetura pelagica*), both Species at Risk, were observed foraging along the creek north of Enfield Road.

Table 2. Species at Risk, Area Sensitive, and Regionally Rare Bird Species

Common Name	SARA[1]	SARO[1]	Breeding Status[2]	Area Sensitive (Y/N)	Halton NAI Status
Barn Swallow (*Hirundo rustica*)	THR	SC	O		
Chimney Swift (*Chaetura pelagica*)	THR	THR	PO		Uncommon
Cooper's Hawk (*Accipter cooperi*)		NAR	O	Yes	Uncommon
Tufted Titmouse (*Baeolophys bicolor*)			PO	Yes	Uncommon
Red-bellied Woodpecker (*Melanerpes carolinus*)			O		Uncommon
Red-breasted Nuthatch (*Sitta canadensis*)			O	Yes	Uncommon

[1]The Species at Risk status was determined by referencing Schedule 1 of the Species at Risk Act (SARA, federal) and *O. Reg. 230/08:* Species at Risk in Ontario List (SARO, provincial).
[2]Breeding Bird Status; O = Observed, PO = possible.

6.4.5.2. Bat Presence Screening Assessment

Methodology

The bat screening assessments were completed by a qualified ecologist from NSE. Two visits were conducted on June 10 and June 13, 2022. The survey was a screening-level assessment to determine potential presence of bat species in the area. The bat screening assessment does not meet criteria of the Ministry of Environment, Conservation and Parks (MECP) protocol (i.e., a minimum 10 nights of acoustic surveys).

The following methodology was employed:

- Pre-set stations were spaced along the length of the study area at intervals of approximately 50 m, for a total of six stations (see **Figure 2** of **Appendix 1**).
- Survey time begun one half-hour (30 minutes) before sunset and ended two hours (120 minutes) after sunset.
- Each station was surveyed for a minimum of five minutes before moving on to the next station, each station was surveyed twice per survey for a total of ten minutes per station. Any visual observations were noted.
    - The area between stations was considered a 'wandering transect' and any calls or visual observations were recorded.

- An Echo Meter Touch 2 Bat Detector was used to record bat calls for each station and wandering transect. The detector microphone was angled towards the study area during each survey.

Once surveys were completed, NSE analyzed the recordings using Wildlife Acoustics Kaleidoscope Pro software, which allows for automatic and manual identification of bat calls based on frequency and pattern (the "acoustic signature"). All of Ontario's SAR bat species call at high frequencies (typically over 40 kilohertz), any recordings of bat calls above this range were treated as potential SAR and analyzed in greater detail.

Results

A total of 51 bat recordings were made during the bat screening surveys conducted. These recordings represent 'passes' past the acoustic recording device and do not necessarily represent 51 individuals.

Of the bat passes recorded, there were three different bat species:

- Big Brown Bat (*Eptesicus fuscus*)
- Eastern Red Bat (*Lasiurus borealis*)
- Hoary Bat (*Lasiurus cinereus*)

All three bat species are considered of secure status in Ontario, and none are listed under the provincial *Endangered Species Act*.

Big Brown Bat breeds in maternity colonies. The locations of confirmed bat maternity colonies of Big Brown Bat are Significant Wildlife Habitat. No bat maternity colonies have been identified on site.

Station 4 recorded Big Brown Bats, Eastern Red Bat and Hoary Bats. The wandering transect between Station 1 and Station 2 recorded Big Brown Bat and Eastern Red Bat, and the wandering transect between Station 4 and Station 5 recorded Big Brown Bat.

The majority of the calls recorded were Big Brown Bat (44 recordings), followed by Hoary Bat (5 recordings), then Eastern Red Bat (2 recordings).

The presence of bats represents 'passes' past the acoustic recording device. It does not confirm that bats roost within the study area.

Table 3 summarizes the results of acoustic surveys at each of the six stations and the wandering transects between each station. Station 1 and Station 5 recorded Big Brown Bats.

Table 3. Bat Screening Assessment Results

Species	Number of Calls by Stations / Wandering Transect Location[1]											
	S1	WT	S2	WT	S3	WT	S4	WT	S5	WT	S6	Total (calls by species)
Big Brown Bat *Eptesicus fuscus*	5	1					25	6	7			44
Eastern Red Bat *Lasiurus borealis*		1					1					2
Hoary Bat *Lasiurus cinereus*							5					5
TOTAL (calls by location)	**5**	**2**	**0**	**0**	**0**	**0**	**31**	**6**	**7**	**0**	**0**	**51**

[1]S = Station, WT = Wandering transect

6.4.5.3. Bat Habitat Suitability Assessment

Methodology

The tree bat habitat assessment was completed by a qualified ecologist from NSE on December 7, 2022. The survey followed the MNRF Maternity Roost Survey Protocol (MNRF, 2017) to determine trees with potential bat habitat within the study area. The survey was completed during 'leaf off' conditions, suitable for assessing tree attributes (i.e., hollows, cracks, etc.). which may provide potential habitat for Little Brown Myotis/Northern Myotis. No surveys were completed during 'leaf-on' conditions, suitable for assessing foliage characteristics (i.e., dead/dying leaves) which may provide potential habitat for Tri-colored bats.

All standing live or dead trees >10 DBH with cracks, crevices, hollows, cavities, and/or loose or naturally exfoliating bark within the area of potential impact were documented. All relevant information was recorded, including:

- Tree number
- Tree species
- DBH (cm)
- Height class
- Snag attributes (i.e., cavity, loose bark, crack, knot hole, other snag within 10 m, and decay class)
- Tree location
- Notes

Results

Thirty-three (33) trees in the area of possible impact have potential to provide suitable bat habitat. This indicates habitat potential, and does not confirm whether roosting is present or absent.

A map illustrating trees with potential bat habitat is provided in **Appendix 1, Figure 6**.

Of the habitat assessed, many of the trees provide multiple forms of habitat, with most providing habitat consisting of loose bark. Sixteen (16) trees supported cavities, twenty-four (24) had flakey/loose bark, sixteen (16) had cracks, twenty-three (23) had knots, and twenty-eight (28) had another snag tree within 10 m. A table summarizing trees with potential bat habitat within the study area is provided in **Appendix 5 – Table 6**.

6.4.5.4. Other Wildlife (Incidental Observations)

Six additional wildlife species were recorded within the study area. Species observed include five mammals and one insect species: Eastern Grey Squirrel (*Sciurus caroliniensis*), Eastern Chipmunk (*Tamias striatus*), Green Frog (*Lithobates clamitans*), Red Squirrel (*Tamiasciurus hudsonicus*), Raccoon (*Procyon lotor*), and Ebony Jewelwing (*Calopteryx maculata*). None of these species are Species at Risk or provincially rare.

6.5. Species at Risk Screening

A list of Species at Risk (SAR) which could potentially occur in the area was compiled based on the background review. The SAR screening includes species which are listed under the provincial *Endangered Species Act* (ESA) (2007), and / or the federal *Species at Risk Act* (SARA) (2002), plus species that have been assessed as SAR by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) but have not yet been listed. Presence of habitat which could support potential SAR species within the study area was verified during the site visits.

All federally listed aquatic SAR species receive protection under SARA. All provincially listed Endangered or Threatened species (aquatic and terrestrial) receive protection under the ESA. Provincially listed Special Concern species do not receive protection under the ESA, however, the species and their habitat are protected as Significant Wildlife Habitat, which municipalities are required to protect from incompatible development per the direction of the Provincial Policy Statement (2020). The probability that SAR could occur in the study area was determined by identifying whether suitable habitat for those species is present in the study area.

Four Barn Swallow (*Hirundo rustica*) and two Chimney Swift (*Chaetura pelagica*), both SAR, were observed foraging along the creek north of Enfield Road. There was no indication that either species was breeding within the study area.

An additional seven SAR (Endangered, Threatened, and Special Concern) have moderate to high potential to be present: Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), Tri-coloured Bat (*Pipistrellus subflavus*), Monarch (*Danaus plexippus*), Yellow-banded Bumblebee (*Bombus terricola*), Midland Painted Turtle (*Chrysemys picta marginata*), and Snapping Turtle (*Chelydra serpentina*).

The SAR screening table is included in **Appendix 6**.

6.6. Significant Wildlife Habitat

The presence or potential presence of SWH in the study area was assessed using the SWH Criteria Schedules for Ecoregion 7E (OMNRF 2015). Where ecosites or combinations of ecosites of suitable size occurred in the study area, the presence or potential presence of the necessary indicator species was evaluated. Areas of potential SWH were identified as "candidate" SWH and areas with confirmed indicator species were assessed as "confirmed SWH".

One type of confirmed SWH was identified:

- Habitat for Special Concern or Provincially Rare Species
    - Barn Swallow, a species of Special Concern, was recorded. Four individuals were observed foraging over the study area. No nesting within the study area was observed. There is potential for additional Special Concern or Provincially Rare species to use the study area, though not observed (e.g., Monarch, Yellow-banded Bumblebee).

Five types of candidate SWH were identified:

- Bat Maternity Colonies
    - Potential bat maternity roost cavity trees may be present.
    - Big Brown Bat, a species that roosts in maternity colonies, was recorded during June 2022 acoustic surveys.
    - An assessment of potential roost trees will be conducted in Fall 2022 during 'leaf-off' conditions
- Turtle Wintering Areas
    - No turtles were observed during site visits
    - Water was up to 1 m deep, with a soft substrate, and permanently flowing water.
    - Habitat may support overwintering turtles, though this has not been confirmed. Potential is considered highly unlikely due to the limited water depth.
- Reptile Hibernacula
    - Though no snakes were observed, and no hibernacula were observed, snake hibernacula can occur in a wide variety of habitats. No favourable snake hibernacula habitat is present (i.e., talus, rock piles, karst).
- Migratory Butterfly Stopover Areas
    - The study area is within 5 km of Lake Ontario which is a migratory corridor for certain butterfly species, including Monarch
    - A stopover area must be a minimum of 10 hectares in size and include field and forest. The study area, in combination with contiguous habitat to the north meets the size threshold.
    - High concentrations of migratory butterflies have not been reported from this location.

    - None of the migratory butterfly species (Monarch, Painted Lady, Red Admiral) were recorded during field surveys.
- Turtle Nesting Areas
    - Soil along Falcon Creek is sandy.
    - Nesting habitat is limited and constrained by the urban nature of the site.
    - No turtles or turtle nests were observed during field surveys, but it is possible that turtles may occasionally use Falcon Creek.

The Significant Wildlife Habitat Assessment Table is included in **Appendix 7**.

6.7. Significant Woodland

The City of Burlington Official Plan (Office Consolidation 2021), Definitions, provides the definition of a '**woodland**' as "land with at least one thousand (1000) trees of any size per hectare, or seven hundred and fifty (750) trees over twelve (12) cm in diameter per hectare, or two hundred and fifty trees (250) trees over twenty (20) cm in diameter per hectare, but does not include an active cultivated fruit or nut orchard, or Christmas tree plantation, a plantation certified by the Region of Halton, a tree nursery, or a narrow linear strip of trees that defines a laneway or boundary between fields. For the purposes of this definition, all measurements of the trees are to be taken at 1.37 m from the ground and trees in regenerating fields must have achieved that height to be counted."

The City of Burlington Official Plan (Office Consolidation 2021), Definitions, provides the definition of a '**significant woodland**' as "a woodland 0.5 hectares or larger, determined through a Watershed Plan, a sub-watershed study, or a site-specific Environmental Impact Assessment to meet one or more of the four following criteria:

1. The woodland contains forest patches over ninety-nine (99) years old;
2. The patch size of the woodland is two (2) hectares or larger if it is located within an Urban Planning Area or four (4) hectares or larger if it is located outside the Urban Area but below the Escarpment Brow; or ten (10) hectares or larger if it is located outside the Urban Area but above the Escarpment Brow;
3. The woodland has an interior core of four (4) hectares or larger, measured one hundred (100) m from the edge; OR
4. The woodland is wholly or partially within fifty (50) m of a *major creek* or *certain headwater creek* or within one hundred and fifty (150) m of the Escarpment Brow.

Further to the above, the City of Burlington Official Plan (Office Consolidation 2021), Definitions, provides the definition of a '**major creek or certain headwater creek**' as it applies to the 'significant woodlands' definition as "all *watercourses* within a Conservation Authority Regulation Limit as of the date of the adoption of this Plan, and those portions of a *watercourse* that extend beyond the limit of the Conservation Authority Regulation Limit to connect a woodland considered significant based on

criteria (1), (2), or (3) of the 'significant woodland' definition of this Plan and/or *wetland* feature within the Regional Natural Heritage System. The extent and location of major creeks or certain headwater creeks will be updated from time to time by the Conservation Authority and as a result may lead to refinements to the boundaries of 'significant woodlands'.

Further to the above, the City of Burlington Official Plan (Office Consolidation 2021), Definitions, provides the definition of a '**watercourse**' as "an identifiable depression in the ground in which a flow of water regularly or continuously occurs."

The two treed units along Falcon Creek within the study area (one located north of Enfield Road, and the other south of Enfield Road) are believed to meet the stand density threshold to be considered **'woodland'** though field measurements were not undertaken to confirm this. However, as both units are less than 0.5 ha in size they do not meet criteria to be considered 'significant woodland'.

Significant woodland is <u>not</u> present.

6.8. Summary of Natural Heritage Constraints

Based on background review, existing conditions, and policy review and assessment, as described, the following summary of ecological constraints is provided below in **Table 4**.

Table 4. Summary of Natural Heritage Constraints

Constraint	Assessment
Fish and Fish Habitat	**Present.** Falcon Creek is fish habitat. Depending on the alternative selected, there may be potential for impact to fish and fish habitat. A DFO Request for Review may be required once the design alternative has been selected.
Species at Risk	**Present** (Barn Swallow and Chimney Swift). Additional SAR may be present (see **Appendix 6**).
Significant Wildlife Habitat	**Present** One type of confirmed SWH is present: Habitat for Special Concern and Rare Wildlife Species. There are six types of candidate (i.e., 'potential') SWH: Bat Maternity Colonies, Turtle Wintering Areas, Reptile Hibernacula, Migratory Butterfly Stopover Areas, and Turtle Nesting Areas (see **Appendix 7**).
Significant Woodland	None present.
Significant Valleyland	None present.
Life Science Area of Natural and Scientific Interest (ANSI)	None present.
Natural Heritage System	None present.
Savannah, Tallgrass Prairie, Alvar	None present.
Provincially Significant Wetlands or Other Wetlands	None present.
Migratory Bird Nesting Habitat	**Present** The study area supports migratory birds that could be disturbed during erosion control works.
Conservation Halton Regulated Area	**Present** The study area is within Conservation Halton's regulated limit. A permit from Conservation Halton is required.
Conservation Halton Hazard Lands	**Present** Conservation Halton has hazard lands mapped within the study area (floodplain hazard, stable top of slope hazard, and meander belt hazard). A permit from Conservation Halton is required.

7. Description of Erosion Concerns

Willowbrook Road is located on an outside meander bend of Falcon Creek. The top of bank is approximately 2 m from the guardrail, and 3 m from the pavement of Willowbrook Road. The bank slope is comprised of unconsolidated soils and is highly erodible. There are several large trees located along the slope between the road and the watercourse that are at risk of failure due to erosion (Aquafor Beech 2021). As noted elsewhere in this report, soils are sandy, and susceptible to erosion.

Parish Geomorphic assessed Falcon Creek as part of erosion assessment field investigations in 2010. For this reach of Falcon Creek (the reach identified as FC-5), they described the banks as "heavily scoured throughout the majority of the reach". The channel is "unstable with rapidly eroding banks and recruiting woody debris. The channel appears to be entrenched and over-widened" (Parish Geomorphic 2011).

Without implementation of erosion protection measures, there are infrastructure risks to Willowbrook Road, and potentially nearby structures. Additionally, eroding poor vegetated banks are likely to contribute to additional fine sediment entering the creek resulting in poor water quality and loss of fish habitat.

8. Opportunities for Enhancement and Restoration

8.1. Bank Stabilization and Channel Design

Bank stabilization will improve aquatic fish and wildlife habitat. By preventing banks from eroding into the watercourse, siltation and its detrimental effect on water quality will be improved. Improved water quality will benefit fish and other aquatic wildlife. Further, bank stabilization will benefit terrestrial species and habitat by eliminating / reducing loss of trees and other vegetation from erosion. Ongoing erosion of land creates habitat loss for terrestrial plant and animal species.

Where banks can be stabilized and incorporate gently sloped banks, additional terrestrial habitat could be created to support plants and wildlife. Sloped banks also facilitate wildlife use to the watercourse to enter / exit or otherwise access it (i.e., to drink). Further, utilizing a gentle slope into the watercourse (i.e., below water level) would increase the size of the littoral zone, create various depths to support a more heterogenous vegetation community, and improve wildlife use. This would be particularly helpful in allowing SAR turtles, if present, to access nesting sites. The feasibility of creating gently sloped banks requires engineer review in consideration of topography, width of easements, and erosion concerns.

8.2. Invasive Species Management

The study area is impacted by invasive species. During the construction phase it is anticipated that some vegetation clearing will be required. This presents an opportunity to remove invasive species. Invasive species should be disposed of carefully to avoid spreading them into uncontaminated areas. Invasive species should be disposed of in a landfill or buried on site at an appropriate depth. The Ontario Invasive Plant Council provides a series of free Best Management Practices guides (OIPC, 2022) for managing and disposing of invasive species.

Invasive species known to occur within the study area include: European Buckthorn, Norway Maple, Japanese Knotweed, Purple Loosestrife, Reed Canary Grass, Tartarian Honeysuckle, Multiflora Rose, Autumn Olive, Periwinkle, and Garlic Mustard.

8.3. Restoration Plantings / Seeding

It is anticipated that vegetation clearing will be required during construction. This presents an opportunity to restore the cleared area via plantings and seedings. As the site is within a conservation authority regulated area, the conservation authority generally mandates the use of native species that are common within its jurisdiction for planting plans.

Conservation Halton has a number of applicable guidance documents including: Guidelines for Landscaping and Rehabilitation Plans (2021), Seed Mixes Suitable for our Watershed (2020), and its Native Species List (2018). These documents contain recommended species for restoration plantings and seed mixes. Tree plantings and restoration seeding will help stabilize the soil and promote infiltration. Over time, as the trees become established and grow, they will provide shade to the watercourse to further stabilize the banks and to reduce high temperatures stressful to aquatic species.

8.4. Garbage Cleanup

Near-shore and in-water works are anticipated during channel restoration. This presents an opportunity to remove garbage (especially larger items if present). Removing garbage improves water quality and aesthetics. In addition, it removes barriers to species movement, especially movement of fish and turtles.

9. Impact Assessment and Recommended Mitigation

The proposed activities have the potential to impact species and their habitats. These potential impacts are itemized below, along with their corresponding mitigation measures.

9.1. Surface Water

Impact Assessment

Construction could lead to a short-term increase in sediment inputs into the creek if erosion and sediment control (ESC) measures are not implemented during construction. In addition, there is potential for fuel spills and spillage of related substances during construction.

Mitigation

- **Erosion and Sediment Control Measures**: ESC measures should be used as required during construction. ESC measures may include silt fencing, flow checks (e.g., fibre filtration tubes) and surface treatments to protect soil on slopes until vegetation has re-established. Netted erosion control blankets and other netted materials should not be used because they can pose an entanglement risk to snakes and other wildlife. All exposed soil should be reseeded as soon as possible after construction.
- **Fuel and Related Substance Control Measures:** Handling of potentially harmful substances (e.g., fuels, oils, etc.) should be conducted at least 30 m away from the watercourse. A spill kit should be accessible anywhere where deleterious substances are stored or handled.

9.2. Fish and Fish Habitat

Impact Assessment

In-water work is anticipated to be required. In-water work can harm fish directly (i.e., by construction equipment) and indirectly (e.g., by alterations to their spawning, foraging and/or sheltering habitats).

Mitigation

In addition to the mitigation measures described under Surface Water (above):

- **Fish Exclusion Measures:** In order to prevent harm to fish, in-water work areas should be isolated during construction using pea gravel bags wrapped in impermeable plastic. Fish will be removed from isolated areas by a qualified fisheries biologist and relocated to the watercourse at least 50 m downstream of the work area. Dewatering pump intakes will have screens in place to prevent entrapment of fish during dewatering. Fish passage will be maintained within the watercourse at all times.

- **Timing window:** Works should occur outside of the timing windows for warmwater fish spring spawning (March 15 to July 15). Timing should be verified with the local conservation authority in advance of works.
- **DFO Review:** A Request for Review (RFR) from the DFO will be required if the proposed works will require in-water work as this could harm fish and fish habitat. If the review identifies that the death of fish and / or harmful alteration, disruption or destruction of fish habitat will likely result from the project, a DFO Authorization under the *Fisheries Act* will be required.

9.3. Significant Wildlife Habitat

Impact Assessment

One type of Significant Wildlife Habitat was confirmed, and five types of candidate ('potential') Significant Wildlife Habitat was also identified.

While significant wildlife habitat has not been confirmed within the study area, there is potential for habitat to be present (i.e., candidate significant wildlife habitat), as discussed in **Section 6.6**. Significant wildlife habitat is protected under the PPS.

Significant Wildlife Habitat was confirmed for Species of Species Concern and Rare Species due to the presence of foraging Barn Swallows. No nesting habitat was observed.

Mitigation

No specific mitigation measures are required for Barn Swallow as it was not observed nesting within the study area.

Mitigation for other Species of Special Concern and Rare species that may be present, as well as for the five types of candidate SWH, are as follows:

Tree removals should be limited and conducted outside of the breeding bird and active bat seasons (generally April 1 to September 30). Please see additional mitigation measures in **Sections 9.4** and **9.5**.

9.4. Species at Risk Habitat

Impact Assessment

Two SAR are known to occur within the study area as foraging birds (Barn Swallow, Chimney Swift). There is moderate to high potential for SAR turtles, insects, and bats to be present. SAR and their habitat are protected under SARA (2002), ESA (2007), and (for species of Special Concern) the municipal Official Plans (Halton Region 2022, City of Burlington 2021).

Mitigation

- **SAR birds**: Chimney Swift receives species and habitat protection under the ESA. This species was observed foraging, with no evidence of breeding on site. It is expected that Chimney Swift uses a nearby building for nesting and roosting. Likelihood on any other SAR birds using the study area is considered 'low'. However, timing windows as recommended below for nesting birds, will avoid, or mitigate any impacts to nesting SAR birds, if present. Barn Swallow, a species of Special Concern, is addressed in the preceding section (SWH).
- **SAR turtles**: No SAR turtles were recorded during field surveys. However, there is potential for turtles to be present. Midland Painted Turtle and Snapping Turtle do not receive protection under the ESA, but their habitat is protected under Significant Wildlife Habitat policies. SAR turtles may use the watercourse for life processes and may also use near-bank areas as nesting habitat (though potential nesting habitat is considered marginal). For land-based works, exclusionary fencing is recommended to be installed around the work area to prevent turtles from entering the construction zone. If a SAR turtle enters the work zone it should be permitted to leave on its own, or if that is not possible, the environmental inspector or contract administrator should be contacted for guidance. Active nests must be protected. If that is not possible, the environmental inspector or contract administrator should be contacted for guidance.
- **SAR bats**: No SAR bats were recorded during surveys. However, there is potential for them to be present. Tri-coloured Bat, Little Brown Myotis, and Northern Long-eared Myotis receive species and protection under the ESA. Timing windows for tree clearing are recommended to avoid potential impacts to maternity or day roosts of SAR bats. This also protects any potential bat maternity colonies of bat species that are protected under Significant Wildlife Habitat policies (e.g. Big Brown Bat). Tree clearing is recommended to occur outside of the active bat season (April 1 – September 30). Consultation with the MECP to determine if additional acoustic surveys are required in advance of any potential tree removals is recommended to support compliance with the ESA.
- **SAR in general:** Should a SAR species be identified within or near the work site with potential to be impacted by the works, all work must cease, and the environmental inspector or contract administrator should be contacted for guidance. Consultation with MECP may be required.

9.5. Nesting Birds

Impact Assessment

Vegetation clearing could result in the harm, harassment, or killing of migratory birds that receive protection under the *Migratory Birds Convention Act* (MBCA) and its Regulations. The MBCA protects adults, their young, and their nests.

Mitigation

Vegetation clearing should occur outside of the typical nesting bird season (April 1 – August 31) to avoid contravention of the MBCA and its Regulations.

9.6. Spread of Invasive Species

Impact Assessment

Highly invasive species are present within the study area (e.g., European Buckthorn, Tartarian Honeysuckle, Japanese Knotweed). Construction activities have the potential to spread invasive species by transporting seeds or vegetative material capable of regeneration to new locations. Invasive species can be spread via the intentional removal of 'waste' vegetation from the construction area to an on-site or off-site location; the unintentional removal of 'waste' vegetation from one location to another on equipment (such as muddy tires) or via other means (e.g., seeds and vegetative material entering an adjacent watercourse).

Mitigation

The Clean Equipment Protocol for Industry (Halloran *et al*. 2016) should be followed to limit the spread of invasive species. Invasive species that are removed during construction should be disposed of off-site in a landfill or buried at an appropriate depth on-site. Vegetative waste should not be permitted to enter the watercourse.

9.7. Timing Window Summary

A summary of timing windows when species are active is provided below. These windows are approximate as activity fluctuates from year-to-year based on weather conditions and other variables. Protected species, and species engaged in protected activities, are protected even if encountered outside of these timing windows.

Species Group	Sensitive Period	Considerations for Construction
Bats (roosting)	April 1 – September 30	Tree removal should occur outside of the sensitive period. **Construction Timing Window: October 1 to March 31.**
Birds (nesting)	April 1 – August 31	Vegetation removal (trees, shrubs, ground layer) should occur outside of the nesting period. Where construction must occur within the sensitive period, if the area of disturbance is small and is considered 'simple habitat[1],' a due diligence nest search can be completed. Compliance with *Migratory Birds Convention Act* is required. **Construction Timing Window: September 1 to March 31.**
Fish (spawning)	Warmwater: March 15 to July 15	**Construction Timing Window: July 16 – March 14** In-water works are to occur within the construction timing window.

To respect the sensitive periods for bats and birds, **all land-based vegetation clearing and grading should occur between October 1 and March 31.**

To respect the sensitive period for fish spawning, **all in-water works should occur between July 16 and March 14.**

10. Review of Erosion Mitigation Options

Four erosion sites have been identified by the project team for consideration as part of the EA process. These erosion sites are shown on **Figure 7** in **Appendix 1**.

A description of the mitigation options being considered for each erosion site is provided below. Please refer to drawings prepared by Valdor Engineering Inc for further details.

[1] Simple habitat is defined by the Government of Canada, Guidelines to avoid harm to migratory birds - Canada.ca

10.1. Erosion Site #1

Erosion Site #1 is located on the north side of Enfield Road, along the east side of Falcon Creek.

The following five (5) options are being considered:

- Option #1: Do Nothing (Existing Conditions)
- Option #2: Vegetated Slope (3:1 to 4:1)
- Option #3: Vegetated Sub-angular Riverstone Slope (2:1) or Vegetated Earth-Anchoring System (e.g. Terrafirm) at 2:1 Slope
- Option #4: Vegetated Slope Stabilization System (e.g. Terra Slope 45)
- Option #5: Implement Monitoring Program

10.2. Erosion Site #2

Erosion Site #2 is located on the north side of Enfield Road, along the west side of Falcon Creek.

The following five (5) options are being considered:

- Option #1: Do Nothing (Existing Conditions)
- Option #2: Vegetated Slope (3:1 to 4:1)
- Option #3: Vegetated Sub-angular Riverstone Slope (2:1) or Vegetated Earth-Anchoring System (e.g. Terrafirm) at 2:1 Slope
- Option #4: Vegetated Slope Stabilization System (e.g. Terra Slope 45)
- Option #5: Implement Monitoring Program

10.3. Erosion Site #3

Erosion Site #3 is located on the south side of Enfield Road, along the east side of Falcon Creek.

The following six (6) options are being considered:

- Option #1: Do Nothing (Existing Conditions)
- Option #2: Vegetated Slope (3:1 to 4:1)
- Option #3: Vegetated Earth-Anchoring System (e.g. Terrafirm) at 2:1 Slope and Vegetated Bank Stabilization System (e.g. Scourlok) at 0.125:1 Slope
- Option #4: Vegetated Slope Stabilization System (e.g. Terra Slope 45)
- Option #5: Partial Height Armourstone Retaining Wall
- Option #6: Full Height Armourstone Retaining Wall

10.4. Erosion Site #4

Erosion Site #4 is located on the south side of Enfield Road, along the east side of Falcon Creek, south of Erosion Site #3.

The following six (6) options are being considered:

- Option #1: Do Nothing (Existing Conditions)
- Option #2: Vegetated Slope (3:1 to 4:1)
- Option #3: Vegetated Earth-Anchoring System (e.g. Terrafirm) at 2:1 Slope and Vegetated Bank Stabilization System (e.g. Scourlok) at 0.125:1 Slope
- Option #4: Vegetated Slope Stabilization System (e.g. Terra Slope 45)
- Option #5: Partial Height Armourstone Retaining Wall
- Option #6: Full Height Armourstone Retaining Wall

10.5. Assessment of Mitigation Options for Each Erosion Site

Table 5.: Summary of Mitigation Options – Falcon Creek - Erosion Site #1

Mitigation Option	Description	Advantages	Disadvantages
1	Do Nothing (Existing Conditions) – No mitigation work to be completed	• Cost savings (avoids potential additional natural heritage field investigations, avoids potential *Fisheries Act*, *Species at Risk Act* and *Endangered Species Act* authorizations or permits, avoids Conservation Authority permit) • No tree or vegetation removal required • No disruptions/impacts during construction (e.g. potential sediment impacts on fish, potential fish relocation, potential impacts to Species at Risk and Significant Wildlife Habitat, potential impacts to nesting birds) • No site restoration required post-construction (e.g. costs related to tree planting and seeding)	• Erosion issues may continue to become worse, including sedimentation downstream, which could impact fish and fish habitat, as well as habit for other aquatic species (e.g. turtles, frogs, invertebrates) • Erosion issues may continue to become worse, including destruction/loss of trees and other vegetation from flood scour. This in turn could reduce/impair terrestrial and aquatic wildlife habitat (e.g. less trees for nesting birds, less shade causing higher water temperatures that could affect aquatic organisms). • Loss of an opportunity to improve conditions through bank stabilization, and restoration planting/seeding with native species.
2	Vegetated slope (3:1 to 4:1) with riverstone toe protection to the 2-yr water surface elevation with or without channel realignment and cut or fill to achieve the requisite slope	• Very naturalized long-term solution • May improve natural channel sinuosity, creating habitat for fish and aquatic organisms • Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation) • Removal of non-native vegetation and replacement with native plantings	• Requires realignment of Falcon Creek, which would require temporary disturbance to fish and other aquatic species. • Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act* • Costs are involved with obtaining an authorization/permit under the *Fisheries Act*, as well as costs for fish rescue/relocation from upstream to downstream of the in-water works • Potential bat habitat trees are present that are likely to require removal to accommodate this design option. Consultation with the Ministry of the Environment, Conservation and Parks (MECP) is recommended to ensure compliance with the *Endangered Species Act* (may require additional field investigations, a letter of advice/authorization/permit). Could delay the commencement of construction. • Tree and vegetation removal required, though the majority of the trees are non-native Willows.
3	Vegetated sub-angular riverstone slope (2:1) or vegetated earth-anchoring system (e.g. Terrafirm) at 2:1 slope with geogrid and turf reinforcement mat and including riverstone toe protection to the 2-yr water surface elevation with or without channel realignment and cut or fill to achieve the requisite slope	• Less impact to fish and aquatic species compared to Option 2. Option 3 would only widen the creek, rather than re-align it. • Tree removal requirements may be reduced compared to Options 2 or 4. • Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation)	• Requires widening of Falcon Creek, which would require temporary disturbance to fish and other aquatic species. • Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act* • Costs are involved with obtaining an authorization/permit under the *Fisheries Act*, as well as costs for fish rescue/relocation from upstream to downstream of the in-water works • Potential bat habitat trees are present that are likely to require removal to accommodate this design option. Consultation with the Ministry of the Environment, Conservation and Parks (MECP) is recommended to ensure compliance with the *Endangered Species Act* (may require

Mitigation Option	Description	Advantages	Disadvantages
		• Removal of non-native vegetation and replacement with native plantings	additional field investigations, a letter of advice/authorization/permit). Could delay the commencement of construction. Tree and vegetation removal required, though the majority of the trees are non-native Willows.
4	Vegetated slope stabilization system (e.g. Terra Slope 45) with geogrid and erosion mat at 1:1 slope and including riverstone toe protection to the 2-yr water surface elevation	• This option would not realign or widen the creek. Therefore, the potential of direct impact to fish and aquatic species is significantly reduced. • In-water works may not be required if slope stabilization activities cannot be fully completed from the land. Therefore, the potential of direct impact to fish and aquatic species is significantly reduced. • Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation) • Removal of non-native vegetation and replacement with native plantings	• Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act* • If in-water works are required, there are costs are involved for fish rescue/relocation from upstream to downstream of the in-water works • Potential bat habitat trees are present that are likely to require removal to accommodate this design option. Consultation with the Ministry of the Environment, Conservation and Parks (MECP) is recommended to ensure compliance with the *Endangered Species Act* (may require additional field investigations, a letter of advice/authorization/permit). This could delay the commencement of construction. • Tree and vegetation removal required, though the majority of the trees are non-native Willows. •
5	Implement monitoring program (e.g. using erosion pins) to track and assess erosion risk and the requirement for mitigation	• Cost savings (if erosion risk is low and if mitigation is not required) • Provides more certainty whether mitigation is required • Minimal natural heritage impact (restricted to installation, monitoring, and removal of erosion pins)	• Ultimate repair costs will be higher (if mitigation is required) at a later time • Any existing erosion may continue which would result in continued degradation of the terrestrial and aquatic habitat

Table 6: Summary of Mitigation Options – Falcon Creek - Erosion Site #2

Mitigation Option	Description	Advantages	Disadvantages
1	Do Nothing (Existing Conditions) – No mitigation work to be completed	• Cost savings (avoids potential additional natural heritage field investigations, avoids potential *Fisheries Act*, *Species at Risk Act* and *Endangered Species Act* authorizations or permits, avoids Conservation Authority permit) • No tree or vegetation removal required • No disruptions/impacts during construction (e.g. potential sediment impacts on fish, potential fish relocation, potential impacts to Species	• Erosion issues may continue to become worse, including sedimentation downstream, which could impact fish and fish habitat, as well as habit for other aquatic species (e.g. turtles, frogs, invertebrates) • Erosion issues may continue to become worse, including destruction/loss of trees and other vegetation from flood scour. This in turn could reduce/impair terrestrial and aquatic wildlife habitat (e.g.

Mitigation Option	Description	Advantages	Disadvantages
		at Risk and Significant Wildlife Habitat, potential impacts to nesting birds) • No site restoration required post-construction (e.g. costs related to tree planting and seeding)	less trees for nesting birds, less shade causing higher water temperatures that could affect aquatic organisms). • Loss of an opportunity to improve conditions through bank stabilization, and restoration planting/seeding with native species.
2	Vegetated slope (3:1 to 4:1) with riverstone toe protection to the 2-yr water surface elevation with or without channel realignment and cut or fill to achieve the requisite slope	• Very naturalized long-term solution • May improve natural channel sinuosity, creating habitat for fish and aquatic organisms • Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation) • Removal of non-native vegetation and replacement with native plantings	• Requires realignment of Falcon Creek, which would require temporary disturbance to fish and other aquatic species. • Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act* • Costs are involved with obtaining an authorization/permit under the *Fisheries Act*, as well as costs for fish rescue/relocation from upstream to downstream of the in-water works • Potential bat habitat trees are present that are likely to require removal to accommodate this design option. Consultation with the Ministry of the Environment, Conservation and Parks (MECP) is recommended to ensure compliance with the *Endangered Species Act* (may require additional field investigations, a letter of advice/authorization/permit). Could delay the commencement of construction. • Tree and vegetation removal required, though the majority of the trees are non-native Willows.
3	Vegetated sub-angular riverstone slope (2:1) or vegetated earth-anchoring system (e.g. Terrafirm) at 2:1 slope with geogrid and turf reinforcement mat and including riverstone toe protection to the 2-yr water surface elevation with or without channel realignment and cut or fill to achieve the requisite slope	• This option would not realign the creek. Therefore, the potential of direct impact to fish and aquatic species is significantly reduced compared to Option 2. • Tree removal requirements may be reduced or avoided. • Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation) • Removal of non-native vegetation and replacement with native plantings	• Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act* • If in-water works are required, there are costs are involved for fish rescue/relocation from upstream to downstream of the in-water works • Potential bat habitat trees are present that are likely to require removal to accommodate this design option. Consultation with the Ministry of the Environment, Conservation and Parks (MECP) is recommended to ensure compliance with the *Endangered Species Act* (may require additional field investigations, a letter of advice/authorization/permit). Could delay the commencement of construction. • Tree and vegetation removal may be required, though the majority of the trees are non-native Willows.
4	Vegetated slope stabilization system (e.g. Terra Slope 45) with geogrid and erosion mat at 1:1 slope and including riverstone toe protection to the 2-yr water surface elevation	• This option would not realign or widen the creek. Therefore, the potential of direct impact to fish and aquatic species is significantly reduced. • In-water works may not be required if slope stabilization activities cannot be fully completed from the land. Therefore, the potential of direct impact to fish and aquatic species is significantly reduced. • Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation) • Removal of non-native vegetation and replacement with native plantings	• Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act* • If in-water works are required, there are costs are involved for fish rescue/relocation from upstream to downstream of the in-water works • Potential bat habitat trees are present that are likely to require removal to accommodate this design option. Consultation with the Ministry of the Environment, Conservation and Parks (MECP) is recommended to ensure compliance with the *Endangered Species Act* (may require additional field investigations, a letter of advice/authorization/permit). This could delay the commencement of construction. • Tree and vegetation removal required, though the majority of the trees are non-native Willows.

Mitigation Option	Description	Advantages	Disadvantages
5	Implement monitoring program (e.g. using erosion pins) to track and assess erosion risk and the requirement for mitigation	• Cost savings (if erosion risk is low and if mitigation is not required) • Provides more certainty whether mitigation is required • Minimal natural heritage impact (restricted to installation, monitoring and removal of erosion pins)	• Ultimate repair costs will be higher (if mitigation is required) at a later time • Any existing erosion may continue which would result in continued degradation of the terrestrial and aquatic habitat

Table 7: Summary of Mitigation Options – Falcon Creek - Erosion Site #3

Mitigation Option	Description	Advantages	Disadvantages
1	Do Nothing (Existing Conditions) – No mitigation work to be completed	• Short-term cost savings (postpones potential additional natural heritage field investigations, potential *Fisheries Act*, *Species at Risk Act* and *Endangered Species Act* authorizations or permits, Conservation Authority permit) • Postpones tree and vegetation removal • Postpones disruptions/impacts during construction (e.g. potential sediment impacts on fish, potential fish relocation, potential impacts to Species at Risk and Significant Wildlife Habitat, potential impacts to nesting birds) • Postpones site restoration required post-construction (e.g. costs related to tree planting and seeding)	• Erosion issues will continue to become worse, including sedimentation downstream, which could impact fish and fish habitat, as well as habit for other aquatic species (e.g. turtles, frogs, invertebrates) • Erosion issues will continue to become worse, including destruction/loss of trees and other vegetation from flood scour. This in turn could reduce/impair terrestrial and aquatic wildlife habitat (e.g. less trees for nesting birds, less shade causing higher water temperatures that could affect aquatic organisms). • Loss of an opportunity to improve conditions through bank stabilization, and restoration planting/seeding with native species.
2	Vegetated slope (3:1 to 4:1) with riverstone toe protection to the 2-yr water surface elevation with or without channel realignment and cut or fill to achieve the requisite slope	• Very naturalized long-term solution • May improve natural channel sinuosity, creating habitat for fish and aquatic organisms • Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is	• Requires realignment of Falcon Creek, which would require temporary disturbance to fish and other aquatic species. • Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act*

Mitigation Option	Description	Advantages	Disadvantages
		currently causing the destruction of trees and other vegetation) • Removal of non-native vegetation and replacement with native plantings	• Costs are involved with obtaining an authorization/permit under the *Fisheries Act*, as well as costs for fish rescue/relocation from upstream to downstream of the in-water works • Tree and vegetation removal required.
3	Vegetated earth-anchoring system (e.g. Terrafirm) at 2:1 slope with geogrid and turf reinforcement mat and bank stabilization system (e.g. Scourlok) at 0.125:1 slope with earth anchors with cut to achieve the requisite slope	• Channel realignment may be avoided. If it can be avoided, the potential of direct impact to fish and aquatic species is significantly reduced compared to Option 2. • Tree removal requirements may be reduced compared to Options 4, 5, and 6. • Provides a more naturalized solution compared to armourstone (Options 5 and 6). • Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation) • Removal of non-native vegetation and replacement with native plantings	• Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act* • If in-water works are required, there are costs are involved for fish rescue/relocation from upstream to downstream of the in-water works • Tree and vegetation removal required (but less than Options 4, 5 or 6).
4	Vegetated slope stabilization system (e.g. Terra Slope 45) with geogrid and erosion mat at 1:1 slope and including riverstone toe protection to the 2-yr water surface elevation	• This option would not realign the creek. Therefore, the potential of direct impact to fish and aquatic species is significantly reduced compared to Option 2. • Tree removals may be reduced compared to Option 2. • Provides a more naturalized solution compared to armourstone (Options 5 and 6). • Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation) • Removal of non-native vegetation and replacement with native plantings	• Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act* • If in-water works are required, there are costs are involved for fish rescue/relocation from upstream to downstream of the in-water works • Tree and vegetation removal required to a greater extent than Option 3.
5	Partial height armourstone retaining wall for bottom portion of the slope including riverstone toe protection with the top portion of the slope either with vegetated sub-angular riverstone (2:1 slope) or vegetated earth anchoring system (e.g. Terrafirm) at 2:1 slope with geogrid and turf reinforcement mat or vegetated slope stabilization system (e.g. Terra Slope 45) with geogrid and erosion mat at 1:1 slope	• This option would not realign the creek. Therefore, the potential of direct impact to fish and aquatic species is significantly reduced compared to Option 2. • Less armourstone than Option 6. • Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation) • Removal of non-native vegetation and replacement with native plantings	• Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act* • If in-water works are required, there are costs are involved for fish rescue/relocation from upstream to downstream of the in-water works • Tree and vegetation removal required. • The armourstone will present a hardened environment that is not suitable to support most types of vegetation. • Trees and shrubs may grow from gaps between armoustone blocks and require occasional removal.

Mitigation Option	Description	Advantages	Disadvantages
			• The armourstone will restrict some wildlife movement (e.g., restrict turtles and frogs from entering and exiting the creek, restrict movement of mammals that seek to access the creek for water or food). • The armourstone will retain heat that could cause localized temperature changes for terrestrial vegetation, and also minor changes to aquatic water temperatures. This could damage or degrade terrestrial and aquatic habitat.
6	Full height armourstone retaining wall with riverstone toe protection	• This option would not realign the creek. Therefore, the potential of direct impact to fish and aquatic species is significantly reduced compared to Option 2. • Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation) • Removal of non-native vegetation and replacement with native plantings	• Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act* • If in-water works are required, there are costs are involved for fish rescue/relocation from upstream to downstream of the in-water works • Tree and vegetation removal required. • The armourstone will present a hardened environment that is not suitable to support most types of vegetation. • Trees and shrubs may grow from gaps between armoustone blocks and require occasional removal. • The armourstone will restrict some wildlife movement (e.g., restrict turtles and frogs from entering and exiting the creek, restrict movement of mammals that seek to access the creek for water or food). • The armourstone will retain heat that could cause localized temperature changes for terrestrial vegetation, and also minor changes to aquatic water temperatures. This could damage or degrade terrestrial and aquatic habitat.

Table 8: Summary of Mitigation Options – Falcon Creek - Erosion Site #4

Mitigation Option	Description	Advantages	Disadvantages
1	Do Nothing (Existing Conditions) – No mitigation work to be completed	• Short-term cost savings (postpones potential additional natural heritage field investigations, potential *Fisheries Act*, *Species at Risk Act* and *Endangered Species Act* authorizations or permits, Conservation Authority permit) • Postpones tree and vegetation removal • Postpones disruptions/impacts during construction (e.g. potential sediment impacts on fish, potential fish relocation, potential impacts to Species at Risk and Significant Wildlife Habitat, potential impacts to nesting birds) • Postpones site restoration required post-construction (e.g. costs related to tree planting and seeding)	• Erosion issues will continue to become worse, including sedimentation downstream, which could impact fish and fish habitat, as well as habit for other aquatic species (e.g. turtles, frogs, invertebrates) • Erosion issues will continue to become worse, including destruction/loss of trees and other vegetation from flood scour. This in turn could reduce/impair terrestrial and aquatic wildlife habitat (e.g. less trees for nesting birds, less shade causing higher water temperatures that could affect aquatic organisms). • Loss of an opportunity to improve conditions through bank stabilization, and restoration planting/seeding with native species.
2	Vegetated slope (3:1 to 4:1) with riverstone toe protection to the 2-yr water surface elevation with or without channel realignment and cut or fill to achieve the requisite slope	• Very naturalized long-term solution • Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation) • Removal of non-native vegetation and replacement with native plantings	• Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act* • If in-water works are required, there are costs are involved for fish rescue/relocation from upstream to downstream of the in-water works • Potential bat habitat trees are present that will require removal to accommodate this design option. Consultation with the Ministry of the Environment, Conservation and Parks (MECP) is recommended to ensure compliance with the *Endangered Species Act* (may require additional field investigations, a letter of advice/authorization/permit). Could delay the commencement of construction. • Tree and vegetation removal required, though the majority of the trees are non-native Siberian Elm. • More tree removals than Option 3.
3	Vegetated earth-anchoring system (e.g. Terrafirm) at 2:1 slope with geogrid and turf reinforcement mat and bank stabilization system (e.g. Scourlok) at 0.125:1 slope with earth anchors with cut to achieve the requisite slope	• Tree removal requirements may be reduced compared to Option 6. • Channel realignment may be avoided. • Provides a more naturalized solution than armourstone (Options 5 or 6). • Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation) • Removal of non-native vegetation and replacement with native plantings	• Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act* • If in-water works are required, there are costs are involved for fish rescue/relocation from upstream to downstream of the in-water works • Potential bat habitat trees are present that will require removal to accommodate this design option. Consultation with the Ministry of the Environment, Conservation and Parks (MECP) is recommended to ensure compliance with the *Endangered Species Act* (may require additional field investigations, a letter of advice/authorization/permit). Could delay the commencement of construction. • Tree and vegetation removal required, though the majority of the trees are non-native Siberian Elm. Less tree removal than Option 6.
4	Vegetated slope stabilization system (e.g. Terra Slope 45) with geogrid and erosion mat at 1:1 slope and including riverstone toe protection to the 2-yr water surface elevation	• Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is	• Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act*

Mitigation Option	Description	Advantages	Disadvantages
		currently causing the destruction of trees and other vegetation) • Removal of non-native vegetation and replacement with native plantings	• If in-water works are required, there are costs are involved for fish rescue/relocation from upstream to downstream of the in-water works • Potential bat habitat trees are present that will require removal to accommodate this design option. Consultation with the Ministry of the Environment, Conservation and Parks (MECP) is recommended to ensure compliance with the Endangered Species Act (may require additional field investigations, a letter of advice/authorization/permit). Could delay the commencement of construction. • Tree and vegetation removal required, though the majority of the trees are non-native Siberian Elm. • More tree removals than Option 3.
5	Partial height armourstone retaining wall for bottom portion of the slope including riverstone toe protection with the top portion of the slope either with vegetated sub-angular riverstone (2:1 slope) or vegetated earth anchoring system (e.g. Terrafirm) at 2:1 slope with geogrid and turf reinforcement mat or vegetated slope stabilization system (e.g. Terra Slope 45) with geogrid and erosion mat at 1:1 slope	• Less armourstone than Option 6. • Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation) • Removal of non-native vegetation and replacement with native plantings	• Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act* • If in-water works are required, there are costs are involved for fish rescue/relocation from upstream to downstream of the in-water works • Tree and vegetation removal required. • The armourstone will present a hardened environment that is not suitable to support most types of vegetation. • Trees and shrubs may grow from gaps between armoustone blocks and require occasional removal. • The armourstone will restrict some wildlife movement (e.g., restrict turtles and frogs from entering and exiting the creek, restrict movement of mammals that seek to access the creek for water or food). • The armourstone will retain heat that could cause localized temperature changes for terrestrial vegetation, and also minor changes to aquatic water temperatures. This could damage or degrade terrestrial and aquatic habitat.
6	Full height armourstone retaining wall with riverstone toe protection	• Will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation) • Removal of non-native vegetation and replacement with native plantings	• Requires consultation with the Department of Fisheries and Oceans, and is likely to require an authorization or permit issued under the *Fisheries Act* • If in-water works are required, there are costs are involved for fish rescue/relocation from upstream to downstream of the in-water works • Tree and vegetation removal required. • The armourstone will present a hardened environment that is not suitable to support most types of vegetation. • Trees and shrubs may grow from gaps between armoustone blocks and require occasional removal. • The armourstone will restrict some wildlife movement (e.g., restrict turtles and frogs from entering and exiting the creek, restrict movement of mammals that seek to access the creek for water or food). • The armourstone will retain heat that could cause localized temperature changes for terrestrial vegetation, and also minor changes to aquatic water temperatures. This could damage or degrade terrestrial and aquatic habitat.

10.6. Discussion on the Preferred Options for Each Erosion Site

10.6.1. Erosion Site #1

Preferred Option: **Option 5 – Implement Monitoring Program.**

The preferred option will implement a monitoring program that utilizes erosion pins to measure the rate of erosion over time. This option is preferred as it provides more certainty on whether erosion control measures are required. If the erosion risk is low then erosion control measures will not be required, therein, avoiding unnecessary financial cost, and disturbance to the natural environment.

As summarized in **Section 6.8**, the following natural heritage constraints are present: Fish and Fish Habitat, Species at Risk, Significant Wildlife Habitat, Migratory Bird Nesting Habitat, Conservation Halton Regulated Area, and Conservation Halton Hazard Lands.

This option poses very minimal risk of impact to the natural environment as works are restricted to the installation, monitoring, and removal of erosion pins.

No mitigation measures to address potential environmental impacts are required for Erosion Site #1.

10.6.2. Erosion Site #2

Preferred Option: **Option 5 – Implement Monitoring Program.**

The preferred option will implement a monitoring program that utilizes erosion pins to measure the rate of erosion over time. This option is preferred as it provides more certainty on whether erosion control measures are required. If the erosion risk is low then erosion control measures will not be required, therein, avoiding unnecessary financial cost, and disturbance to the natural environment.

As summarized in **Section 6.8**, the following natural heritage constraints are present: Fish and Fish Habitat, Species at Risk, Significant Wildlife Habitat, Migratory Bird Nesting Habitat, Conservation Halton Regulated Area, and Conservation Halton Hazard Lands.

This option poses very minimal risk of impact to the natural environment as works are restricted to the installation, monitoring, and removal of erosion pins.

No mitigation measures to address potential environmental impacts are required for Erosion Site #2.

10.6.3. Erosion Site #3

Preferred Option: **Option 3 – Vegetated Earth-Anchoring System (e.g. Terrafirm) at 2:1 slope with geogrid and turf reinforcement mat and bank stabilization system (e.g. Scourlok) at 0.125:1 slope.**

The preferred option will implement a vegetated earth-anchoring system and a geogrid and turf reinforcement mat and bank stabilization system. This option will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation). This option will remove non-native vegetation, and the site will be restored with native plantings.

This option is preferred, in part, as a channel realignment may be avoided. If it can be avoided, the potential of direct impact to fish and aquatic species is significantly reduced compared to Option 2. Further, tree removal requirements may be reduced compared to Options 4, 5 and 6. Further, this option provided a more naturalized solution compared to armourstone (Options 5 and 6).

As summarized in **Section 6.8**, the following natural heritage constraints are present: Fish and Fish Habitat, Species at Risk, Significant Wildlife Habitat, Migratory Bird Nesting Habitat, Conservation Halton Regulated Area, and Conservation Halton Hazard Lands.

All of the potential impacts to the natural environment and recommended mitigation measures discussed in **Section 9** apply to Erosion Site #3. A summary of recommendations, including construction timing windows, is included in **Section 11**.

10.6.4. Erosion Site #4

Preferred Option: **Option 3 – Vegetated Earth-Anchoring System (e.g. Terrafirm) at 2:1 slope with geogrid and turf reinforcement mat and bank stabilization system (e.g. Scourlok) at 0.125:1 slope.**

The preferred option will implement a vegetated earth-anchoring system and a geogrid and turf reinforcement mat and bank stabilization system. This option will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation). This option will remove non-native vegetation, and the site will be restored with native plantings.

This option is preferred, in part, as a channel realignment may be avoided. If it can be avoided, the potential of direct impact to fish and aquatic species is significantly reduced. Further, tree removal requirements may be reduced compared to Option 6. Further, this option provided a more naturalized solution compared to armourstone (Options 5 and 6).

As summarized in **Section 6.8**, the following natural heritage constraints are present: Fish and Fish Habitat, Species at Risk, Significant Wildlife Habitat, Migratory Bird Nesting Habitat, Conservation Halton Regulated Area, and Conservation Halton Hazard Lands.

All of the potential impacts to the natural environment and recommended mitigation measures discussed in **Section 9** apply to Erosion Site #4. A summary of recommendations, including construction timing windows, is included in **Section 11**.

11. Summary of Recommendations for the Preferred Options

It is recommended that the mitigation measures described in **Section 9** be incorporated into the site plan and/or implemented during construction, and/or post construction, as appropriate. A summary of these recommendations is provided in **Table 9**, below.

These recommendations assume that the Preferred Options have been adopted.

Table 9. Summary of Recommendations

ITEM	RECOMMENDATION
1	**Erosion Sites 1 and 2**: Installation, monitoring, and subsequent removal of erosion pins at Erosion Sites 1 and 2 presents very minimal risk to the natural environment. No specific mitigation measures are recommended.
2	**Erosion Sites 3 and 4:** An Erosion and Sediment Control Plan should be prepared and implemented to mitigate the potential of sedimentation entering Falcon Creek. The Plan should include details on fencing, inspections, and maintenance. Fencing should not be removed until after soils have stabilized (i.e., revegetated).
3	**Erosion Sites 3 and 4:** Handling of potentially harmful substances (e.g., fuels, oils, etc.) should not occur within 30 m of Falcon Creek. A Spills Management Plan should be considered.
4	**Erosion Sites 3 and 4:** Wildlife exclusion fencing should be installed around the construction site to keep wildlife from entering the construction area (e.g. nesting turtles). This can consist of ESC silt fencing.
5	**Erosion Sites 3 and 4:** Wildlife that enter the construction site should be permitted to leave on their own accord.
6	**Erosion Sites 3 and 4:** Submit a 'Request for Review' to the Department of Fisheries and Oceans to determine if an Authorization under the *Fisheries Act* is required. If an authorization is required, this must be received before any works occur that could impact fish or fish habitat.
7	**Erosion Sites 3 and 4:** Any in-water works must occur outside of the sensitive period for warmwater fish spring spawning (i.e., in-water works are not to occur between March 15 and July 15). At detailed design, the timing window should be verified with the local conservation authority and DFO.
8	**Erosion Sites 3 and 4:** Vegetation removal (including trees) and grading activities are recommended to occur outside of the active bird breeding window (i.e., not between April 1-August 31) to minimize the potential of contravention of the *Migratory Birds Convention Act* and its Regulations. Nests of protected species are protected even if encountered outside of the

ITEM	RECOMMENDATION
	active bird nesting season. If protected birds, their nests or eggs are encountered during clearing /grading, all work shall cease and the contract administrator or environmental inspector be contacted for advice. Generally, a protective buffer will be placed around the nest and work will be prohibited within the buffer until the young have fledged. Further, vegetation removal (including trees) and grading activities are recommended to occur outside of the active bat roosting season (i.e. not between April 1 and September 30) to minimize the potential of contravention of the *Endangered Species Act*, and/or destruction of bat maternity colonies that receive protection as Signfiicant Wildlife Habitat under the Provincial Policy Statement. Any vegetation removals or grading in **Erosion Sites 3 and 4** should therefore occur between **October 1 and March 31** in order to respect the sensitive periods for both birds and bats. Note: Due diligence nest searches for birds are discouraged by Environment Canada and should only be considered in 'simple habitat[2]'. These two erosion sites are within forest and would not qualify as simple habitat. Potential bat habitat trees are present in Erosion Site 4 and thus bats may be present. There are no due diligence pre-clearing search protocols for bats.
9	**Erosion Site 4:** Potential bat habitat trees are present. Consultation with the Ministry of the Environment, Conservation, and Parks (MECP) is recommended. This consultation will determine the need for additional field investigations (e.g., 10 or more nights of acoustic calling surveys to determine species presence/absence and abundance), and to determine if a Letter of Advice, Permit, or other Authorization is required. This process may take a number of months to over a year and should be considered in project planning.
10	**Summary on Timing Windows:** To respect the sensitive periods for bats and birds, **all land-based vegetation clearing and grading should occur between September 1 and March 31 (Erosion Site 3) and October 1 and March 31 (Erosion Site 4).** To respect the sensitive period for fish spawning, **all in-water works should occur between July 16 and March 14.**
11	**Erosion Sites 3 and 4:** An Invasive Species Management Plan should be considered at detailed design. To prevent the spread of invasive plant species, the Clean Equipment Protocol for Industry (Halloran et al, 2016) should be implemented. Invasive species that are removed during construction should be disposed of off-site in a landfill or buried at an

[2] Simple habitat is defined by the Government of Canada, Guidelines to avoid harm to migratory birds - Canada.ca

ITEM	RECOMMENDATION
	appropriate depth on-site. Vegetative waste should not be permitted to enter the watercourse. The Ontario Invasive Plants Council provides a series of free Best Management Practices guides that can be referenced for advice on managing and disposing of invasive species.
12	**Erosion Sites 3 and 4:** A Restoration Planting Plan should be prepared at detailed design. Conservation Halton has a number of applicable guidance documents including: Guidelines for Landscaping and Rehabilitation Plans (2021), Seed Mixes Suitable for our Watershed (2020), and its Native Species List (2018). These documents contain recommended species for restoration plantings and seed mixes.
13	**Erosion Sites 3 and 4:** A Fish Relocation Plan should be prepared at detailed design. Further, any in-water works will require Fish Exclusion Measures to prevent harm to fish during construction. Please refer to Section 9.2. Additional guidance may be provided by the Department of Fisheries and Oceans following the submission for a Request for Review.
14	**Erosion Sites 3 and 4:** A Tree Inventory and Arborist Report should be prepared at detailed design.
15	**Erosion Sites 3 and 4:** Garbage cleanup within these two erosion sites, as well as within Falcon Creek, should be considered as part of restoration of the sites. Removing garbage improves soil quality and water quality. In addition, it removes barriers to species movement.

12. Permits and Other Authorizations

Table 10 provides a list of permits and other authorizations that may be required.

Table 10. Summary of Permits and Other Authorizations

Legislation or Policy Document	Comment
Fisheries Act	There is potential to harm fish and fish habitat. A DFO Request for Review is required (for Erosion Sites 3 and 4). An Authorization under the *Fisheries Act* may be required.
Species at Risk Act	No aquatic Species at Risk are known to occur in Falcon Creek. A SARA permit is not expected to be required.
Endangered Species Act	No aquatic Species at Risk are known to occur in Falcon Creek. Terrestrial SAR (Barn Swallow, Chimney Swift) observed during surveys were foraging individuals with no breeding evidence observed within the study area. No SAR bats were encountered during two nights of handheld acoustic screening surveys. Trees with the potential to provide bat roosting habitat were recorded in Erosion Site 4 (they were absent in Erosion Site 3). Consultation with the MECP is recommended to determine if additional field investigations are required (e.g. 10 nights of acoustic calling surveys) and to determine any other requirements (such as issuance of a Letter of Advice, Permit, or other Authorization). This process may take multiple months to over a year and should be considered for project planning. Based on surveys completed to date, an ESA permit is not required.
Conservation Halton Regulation	A development permit will be required as the project site is within a Conservation Halton regulated area.

13. Conclusions and Next Steps

Information provided in this Natural Heritage Existing Conditions and Constraints Analysis Report supports EA documentation requirements and informs the design and natural environment elements and opportunities.

Erosion control measures along this reach of Falcon Creek would improve terrestrial and aquatic habitat by eliminating or reducing the erosion of land into the watercourse which not only results in a loss of terrestrial habitat but also introduces sediment pollution which can detrimentally impact fish and other aquatic species.

During erosion control works to stabilize the banks, there is an opportunity to enhance and restore the natural environment by channel design, removing invasive species, restoring habitat with native plants, and cleaning up garbage.

Implementing erosion control measures has the potential to negatively impact the natural environment without mitigation. Impacts and recommended mitigation measures have been identified and described to inform the evaluation of alternatives and the design.

A Preferred Option has been identified by the Project Team for each of the four Erosion Sites.

Erosion Sites 1 and 2: The preferred option will implement a monitoring program that utilizes erosion pins to measure the rate of erosion over time. This option is preferred as it provides more certainty on whether erosion control measures are required. If the erosion risk is low then erosion control measures will not be required, therein, avoiding unnecessary financial cost, and disturbance to the natural environment. The following natural heritage constraints are present: Fish and Fish Habitat, Species at Risk, Significant Wildlife Habitat, Migratory Bird Nesting Habitat, Conservation Halton Regulated Area, and Conservation Halton Hazard Lands. This option poses very minimal risk of impact to the natural environment as works are restricted to the installation, monitoring, and removal of erosion pins. No mitigation measures to address potential environmental impacts are required for Erosion Sites 1 and 2.

Erosion Sites 3 and 4: The preferred option will implement a vegetated earth-anchoring system and a geogrid and turf reinforcement mat and bank stabilization system. This option will improve bank stabilization and reduce sedimentation downstream, resulting in improvements to aquatic and terrestrial habitat (e.g., less sedimentation impacting fish and other aquatic organisms, less flood scour that is currently causing the destruction of trees and other vegetation). This option will remove non-native vegetation, and the site will be restored with native plantings. This option is preferred, in part, as a channel realignment may be avoided. If it can be avoided, the potential of direct impact to fish and aquatic species is significantly reduced compared to alternative options. Further, tree removal requirements may be reduced compared to alternative options. Further, this option provided

a more naturalized solution compared to alternative options utilizing armourstone. The following natural heritage constraints are present: Fish and Fish Habitat, Species at Risk, Significant Wildlife Habitat, Migratory Bird Nesting Habitat, Conservation Halton Regulated Area, and Conservation Halton Hazard Lands. All of the potential impacts to the natural environment and recommended mitigation measures discussed in **Section 9** apply to Erosion Sites 3 and 4. A summary of recommendations, including construction timing windows, is included in **Section 11**. A summary of Permits and Other Authorizations that may be required is included in **Section 12**.

This Natural Heritage Report supports the adoption of the Preferred Options for each of the four Erosion Sites.

14. References

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Appendix 1 | Figures

Figure 1 | Falcon Creek
Study Area

Legend

- Study Area
- Falcon Creek
- Regulation Limit
- Erosion Sites

Conservation Halton (Approximate Hazard & Regulation Limits)

- Floodplain Hazard
- Meander Belt Hazard
- Stable Top of Bank (STOB) Hazard

0 25 50 75 Meters

N

Project Number	Date:	
22-1288	2024-04-24	

north-south ENVIRONMENTAL

Figure 2 | Falcon Creek
Field Investigations

Legend

- Study Area
- Falcon Creek
- Breeding Bird Stations (BBS1 - 3)
- Bat Assessment Stations (S1 - 6)

Species at Risk Observations

- Barn Swallow
- Chimney Swift

0 25 50 75 Meters

Project Number	Date:	N
21-1288	2024-04-24	

north-south ENVIRONMENTAL

Figure 3 | Falcon Creek
Fish Sampling Locations

Legend

- Study Area
- Watercourses
- Conservation Halton - Fish Sampling Location

0 100 200 300 400 Meters

Project Number	Date:	N
21-1288	2024-04-24	

north-south ENVIRONMENTAL

Figure 4 | Falcon Creek
Ecological Land Classification

Legend

Study Area

Ecological Land Classification

Vegetation Communities

FOD7-3 - Fresh-Moist Willow Lowland Deciduous Forest

0 25 50 75 Meters

Project Number	Date:	N
22-1288	2024-04-24	

north-south ENVIRONMENTAL

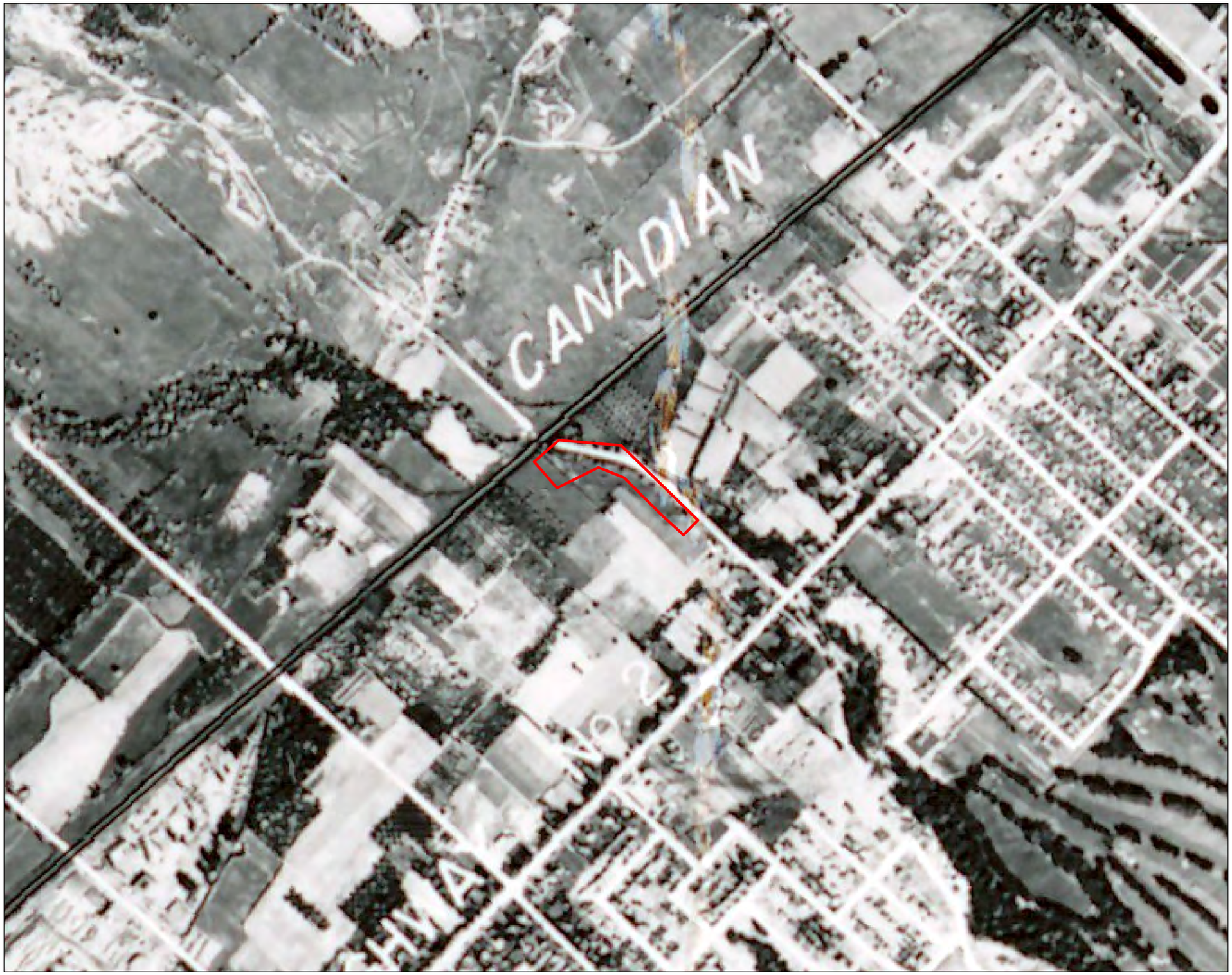

Figure 5 | Falcon Creek
1954 Aerial Imagery

Legend

Study Area

0 100 200 300 400 Meters

Project Number	Date:	N
22-1288	2024-04-24	

north-south ENVIRONMENTAL

Falcon Creek

Bat Habitat Suitability Assessment

Legend

- Study Area
- Potential Bat Habitat Tree

0 25 50 75 Meters

Project Number	Date:	
22-1288	2022-12-14	N

north-south ENVIRONMENTAL

Appendix 2 | Agency Correspondence

From: Kristen Harrison
To: Leanne Wallis
Subject: FW: Falcon Creek Erosion Control - CNR to Willowbrook Road
Date: Friday, June 3, 2022 12:32:21 PM
Attachments: 22118 - 26 May 2022 Meeting Agenda.pdf

north-south ENVIRONMENTAL
www.nsenvironmental.com
Kristen Harrison
Principal | Senior Ecologist
P: 905-854-1112 • Ext. 203

From: Bill Coffey <BCoffey@Valdor-Engineering.com>
Sent: Monday, May 16, 2022 8:22 PM
To: Shahzad, Arif <arif.shahzad@burlington.ca>; Braden Fleming <bfleming@hrca.on.ca>; Lisa Jennings <ljennings@hrca.on.ca>; David Irwin <dirwin@hrca.on.ca>; Giangregorio, Teresa <teresa.giangregorio@burlington.ca>; ed@watersedge-est.ca; Kristen Harrison <kharrison@nsenvironmental.com>
Subject: Falcon Creek Erosion Control - CNR to Willowbrook Road

Dear Study Review Committee/Consultant Team,

Please find attached the Agenda for our Start-up Meeting scheduled for 26 May 2022.

City and Conservation Halton - Please note we have included a list of required materials (if available) that is attached to the Meeting Agenda and includes the following:

1. Current orthophotos
2. Historic orthophotos and/or air photos extending back to 1960 or earlier
3. Parcel fabric (shp file) including municipal and other easements
4. City Creeks Inventory and Erosion Assessment Report (2020)
5. Aldershot Go Major Transit Station Area (MTSA) Study
6. Hydrology and Hydraulics Study for the Falcon Creek Watershed (2012)
7. Current approved digital hydrology model for Falcon Creek
8. Current approved digital hydraulic model for Falcon Creek
9. Current approved floodplain mapping for Falcon Creek
10. Digital Elevation Model (DEM) with a 0.5 m contour interval
11. Available topographic mapping from previous studies
12. Available geotechnical information from previous studies
13. As-constructed drawings for culverts, storm sewers, sanitary sewers within the study area

14. Available geomorphic information from previous studies
15. Available previous studies such as EIS's which considered natural features and areas proximal to or along Falcon Creek, watershed/subwatershed or related reports
16. Available ecological datasets (e.g. GIS files, Excel files, or similar information) including aquatic community information, Ecological Land Classification, wildlife species list, SAR, etc. from all potential sources (including Conservation Halton Long-Term Monitoring Program)

If it is possible to provide any of this information in advance of our meeting, that would be appreciated. Thank you.

Regards,

Bill Coffey, M.Sc., P.Eng.
Head of Water Resources

VALDOR ENGINEERING INC.

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571 Chrislea Road, Unit 4
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26 May 2022
File: **22118**

AGENDA
Meeting #1 with the City and Conservation Authority

EA Study and Detailed Design for Erosion Control Works at Falcon Creek
CN Railroad to Willowbrook Road
Virtual (Microsoft Teams) Meeting – 26 May 2022 (9h30 to 11h00)

1. Introductions – Conservation Halton (CH), City of Burlington, Valdor Team.

2. Administrative Items:

    a. Engineering Agreement
    b. Recording of Meeting Minutes
    c. Insurance documentation and requirements
    d. Invoicing

3. Review Work Plan and Work Schedule and discuss any questions regarding the work plan and items for clarification/revision.

4. Confirm with the City and CH any specific project requirements or EA requirements.

5. Transfer of Information – City and CH to provide Valdor with all available relevant background materials (*e.g.* studies/reports/engineering drawings related to the site, hydrologic/hydraulic models, topographic mapping/surveys, terrestrial, aquatic, geotechnical data, etc.). *A preliminary list of required information is attached to this Agenda*.

6. Review information gathered and field work completed to date.

7. Select Date for Creek Walk - Identify key areas requiring stabilization and discuss stabilization options and specific requirements of CH. The approach envisioned is to consist of site-specific repairs where required. Discuss bioengineered solutions vs "hard" solutions and where appropriate to implement. Discuss preliminary screening of erosion site candidates completed to date for further discussion and review during Creek Walk.

8. Discuss timing for next meeting with the Study Review Committee.

9. Other items of business.

List of Required Information (if available)

1. Current orthophotos
2. Historic orthophotos and/or air photos extending back to 1960 or earlier
3. Parcel fabric (shp file) including municipal and other easements
4. City Creeks Inventory and Erosion Assessment Report (2020)
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14. Available geomorphic information from previous studies
15. Available previous studies such as EIS's which considered natural features and areas proximal to or along Falcon Creek, watershed/subwatershed or related reports
16. Available ecological datasets (e.g. GIS files, Excel files, or similar information) including aquatic community information, Ecological Land Classification, wildlife species list, SAR, etc. from all potential sources (including Conservation Halton Long-Term Monitoring Program)

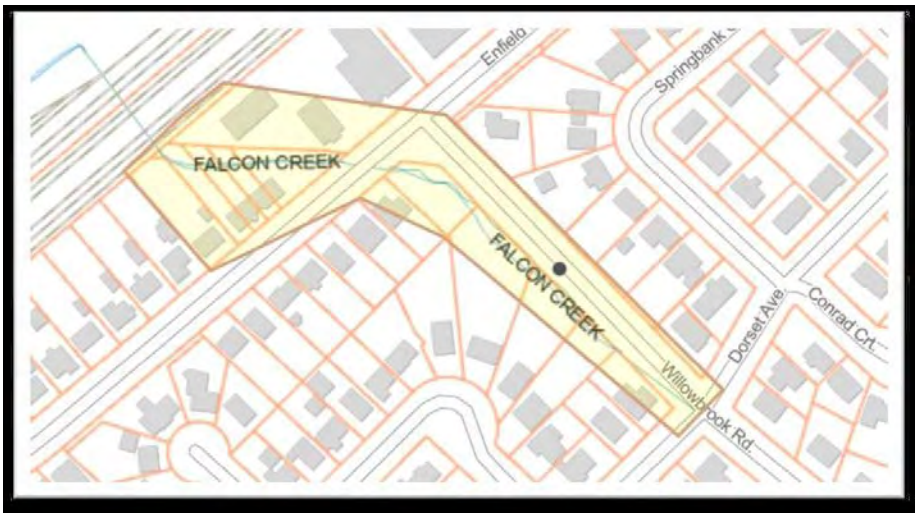

Figure 1: Falcon Creek Erosion Control Study Area

From: Kristen Harrison
To: Leanne Wallis
Subject: FW: Falcon Creek Erosion Control - CNR to Willowbrook Road
Date: Friday, June 3, 2022 12:32:03 PM
Attachments: image002.png
CH Digital Information Request Form 20181130 - Valdor Completed.pdf

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north-south ENVIRONMENTAL
www.nsenvironmental.com

Kristen Harrison
Principal | Senior Ecologist
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From: Bill Coffey <BCoffey@Valdor-Engineering.com>
Sent: Friday, May 20, 2022 11:55 AM
To: Braden Fleming <bfleming@hrca.on.ca>
Cc: Kristen Harrison <kharrison@nsenvironmental.com>; Lisa Jennings <ljennings@hrca.on.ca>; ed@watersedge-est.ca; Abdul Baten <ABaten@Valdor-Engineering.com>; David Irwin <dirwin@hrca.on.ca>; Giangregorio, Teresa <Teresa.Giangregorio@burlington.ca>; Shahzad, Arif <Arif.Shahzad@burlington.ca>
Subject: RE: Falcon Creek Erosion Control - CNR to Willowbrook Road

Hi Braden,

Please find attached the completed data request form and attachments, as requested. Please let me know should you have any questions or require any clarification.

Please note that this project is being initiated and completed by the City of Burlington for the purpose of creek erosion mitigation. In the past, data sharing requests between municipal / CA partners has typically not incurred fees. I'm hopeful that fees will be waived for this project.

Thank you and wishing you a nice long weekend!

Regards,

Bill Coffey, M.Sc., P.Eng.
Head of Water Resources

VALDOR ENGINEERING INC.
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Branch Office: Peterborough & The Kawarthas
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Peterborough, Ontario, K9J 7H2

From: Braden Fleming <bfleming@hrca.on.ca>
Sent: Thursday, May 19, 2022 11:16 AM
To: Bill Coffey <BCoffey@Valdor-Engineering.com>
Cc: Kristen Harrison <kharrison@nsenvironmental.com>; Lisa Jennings <ljennings@hrca.on.ca>; ed@watersedge-est.ca; Abdul Baten <ABaten@Valdor-Engineering.com>; David Irwin <dirwin@hrca.on.ca>; Giangregorio, Teresa <Teresa.Giangregorio@burlington.ca>; Shahzad, Arif <Arif.Shahzad@burlington.ca>
Subject: RE: Falcon Creek Erosion Control - CNR to Willowbrook Road

Good morning Bill,

Thank you for reaching out to Conservation Halton (CH) regarding the Falcon Creek Erosion Control EA and for your information request.

To obtain digital GIS data (not included in Open Data) from Conservation Halton, please fill out the Digital Information Request Form (*first attachment*) with the specific data sets that you wish to obtain. Once completed and submitted to **gis@hrca.on.ca**, CH staff will develop a Data Licensing Agreement (DLA) that lists the data requested, and any fees that will be applied to complete your request. Upon payment of fees and the signed DLA, work will commence to prepare the data for the client.

Our digital Data Holdings and Availability document (*second attachment*) will assist you in determining what data is available from Conservation Halton, and information on where to go for "third party datasets" (data Conservation Halton cannot provide due to licensing restrictions). Our fee schedule is also described in this document.

Typically, requests are processed within 5 days of receipt of the signed DLA, however, capacity and the size of the data request will have an impact on timelines. Staff will provide with an anticipated delivery date during correspondence.

Thank you and please let me know if you have any questions.

Braden

Braden Fleming, B.Sc. (Hons), EPt, ESCP
Environmental Planner
Pronouns: he/him

Conservation Halton

2596 Britannia Road West, Burlington, ON L7P 0G3
905.336.1158 x2335 | Fax 905.336.6684 | bfleming@hrca.on.ca
conservationhalton.ca

momentum
Green • Resilient • Connected

Click here to learn about Conservation Halton's new strategic plan.

From: Bill Coffey <BCoffey@Valdor-Engineering.com>
Sent: May 17, 2022 3:36 PM
To: Shahzad, Arif <Arif.Shahzad@burlington.ca>; Braden Fleming <bfleming@hrca.on.ca>; David Irwin <dirwin@hrca.on.ca>; Giangregorio, Teresa <Teresa.Giangregorio@burlington.ca>
Cc: Kristen Harrison <kharrison@nsenvironmental.com>; Lisa Jennings <ljennings@hrca.on.ca>; ed@watersedge-est.ca; Abdul Baten <ABaten@Valdor-Engineering.com>
Subject: RE: Falcon Creek Erosion Control - CNR to Willowbrook Road

Hi Arif,

Thank you for sending the download link. This is to confirm we have successfully downloaded the information provided to date.

Regards,

Bill Coffey, M.Sc., P.Eng.
Head of Water Resources

VALDOR ENGINEERING INC.

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E-Mail: bcoffey@valdor-engineering.com
URL: www.valdor-engineering.com

Branch Office: Peterborough & The Kawarthas
580 The Queensway, Unit 1
Peterborough, Ontario, K9J 7H2

From: Shahzad, Arif <Arif.Shahzad@burlington.ca>
Sent: Tuesday, May 17, 2022 1:47 PM
To: Bill Coffey <BCoffey@Valdor-Engineering.com>; Braden Fleming <bfleming@hrca.on.ca>; David Irwin <dirwin@hrca.on.ca>; Giangregorio, Teresa <Teresa.Giangregorio@burlington.ca>

Cc: Kristen Harrison <kharrison@nsenvironmental.com>; Lisa Jennings <ljennings@hrca.on.ca>; ed@watersedge-est.ca
Subject: RE: Falcon Creek Erosion Control - CNR to Willowbrook Road

Hi Bill: Thank you for providing the agenda and putting together the list of required material. The items highlighted below are uploaded to the FTP site for download. Please use the following link to access the files. The password is [redacted]

http://2big4email.burlington.ca/en/downloadfiles.aspx?param=RQbG8eTzW2buHGORmXxGmQeQuAleQuAl

Teresa: Please request GIS to provide the remaining available information.

CH staff to confirm the validity of the models approved as part of the Hydrology and Hydraulics Study for the Falcon Creek Watershed (2012).

Thank you,

Arif

From: Bill Coffey <BCoffey@Valdor-Engineering.com>
Sent: Monday, May 16, 2022 8:22 PM
To: Shahzad, Arif <Arif.Shahzad@burlington.ca>; Braden Fleming <bfleming@hrca.on.ca>; Lisa Jennings <ljennings@hrca.on.ca>; David Irwin <dirwin@hrca.on.ca>; Giangregorio, Teresa <Teresa.Giangregorio@burlington.ca>; ed@watersedge-est.ca; Kristen Harrison <kharrison@nsenvironmental.com>
Subject: Falcon Creek Erosion Control - CNR to Willowbrook Road

Dear Study Review Committee/Consultant Team,

Please find attached the Agenda for our Start-up Meeting scheduled for 26 May 2022.

City and Conservation Halton - Please note we have included a list of required materials (if available) that is attached to the Meeting Agenda and includes the following:

1. Current orthophotos
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5. Aldershot Go Major Transit Station Area (MTSA) Study
6. Hydrology and Hydraulics Study for the Falcon Creek Watershed (2012)
7. Current approved digital hydrology model for Falcon Creek (included with Item 6, CH to confirm the validity)

8. Current approved digital hydraulic model for Falcon Creek (included with Item 6, CH to confirm the validity
9. Current approved floodplain mapping for Falcon Creek (included with Item 6, CH to confirm the validity)
10. Digital Elevation Model (DEM) with a 0.5 m contour interval
11. Available topographic mapping from previous studies
12. Available geotechnical information from previous studies (Not available)
13. As-constructed drawings for culverts, storm sewers, sanitary sewers within the study area
14. Available geomorphic information from previous studies
15. Available previous studies such as EIS's which considered natural features and areas proximal to or along Falcon Creek, watershed/subwatershed or related reports
16. Available ecological datasets (e.g. GIS files, Excel files, or similar information) including aquatic community information, Ecological Land Classification, wildlife species list, SAR, etc. from all potential sources (including Conservation Halton Long-Term Monitoring Program)

If it is possible to provide any of this information in advance of our meeting, that would be appreciated. Thank you.

Regards,

Bill Coffey, M.Sc., P.Eng.
Head of Water Resources

VALDOR ENGINEERING INC.

Head Office: Greater Toronto Area
571 Chrislea Road, Unit 4
Vaughan, Ontario, L4L 8A2
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Conservation Halton
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Phone: 905.336-1158
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Geographic Information Systems
Protecting the natural environment from lake to escarpment

REQUEST FOR DIGITAL MAPPING OR DATA LICENSING

This application must be completed in full for all digital mapping and data requests. Incomplete applications will be returned to the applicant and may result in significant delays to processing your request. Data licenses are issued for all approved requests, typically on a project-by-project basis. Conservation Halton's Data Distribution Policy will determine if data licensing fees or staff time recovery fees will be charged.

A typical information request will take approximately 5 to 15 business days to process, from the time a signed licensing agreement is received by Conservation Halton. Additional time may be required for large data orders or requests that require staff time in excess of one hour to complete. Requests are processed in the order that they are received. Enquires regarding the status of any information request should be directed to gis@hrca.on.ca

A. STUDY AREA

DATE	DATE DATA REQUIRED BY
20 May 2022	ASAP

PROJECT TITLE OR STUDY NAME

EA Study and Detailed Design for Erosion Control Works at Falcon Creek between the CN Railroad and Willowbrook Road

PROJECT LOCATION OR STUDY AREA (BE SPECIFIC)

Falcon Creek between CN Railroad and Willowbrook Road including limits indicated on the attached Location Plan

STUDY AREA MAP ATTACHED? No Yes

B. INFORMATION USE

PLEASE PROVIDE SPECIFIC INFORMATION ON HOW THE DATA WILL BE USED IN THE PROJECT OR STUDY

Valdor Engineering Inc. has been retained by the City of Burlington to complete the EA Study and Detailed Design for Erosion Control Works at Falcon Creek between the CN Railroad and Willowbrook Road. The information will be used in completing the EA investigations and other requirements regarding the EA and detailed design.

C. TYPE OF INFORMATION REQUEST

WHAT TYPE OF DATA ARE YOU REQUESTING?

PRINTED PUBLICATIONS, REPORTS, MAPPING, DATABASE SUMMARIES	No	Yes
DIGITAL GIS DATA OR DATABASES	No	Yes
ENGINEERING HYDRAULIC/HYDROLOGIC MODELS	No	Yes

OTHER (PLEASE SPECIFY BELOW)

Revision Date: November 26, 2018

Conservation Halton
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gis@hrca.on.ca

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Extension: 2327
Fax: 905.336.7014
www.conservationhalton.on.ca

Geographic Information Systems
Protecting the natural environment from lake to escarpment

D. INFORMATION REQUESTED - PACKAGES

PLEASE CIRCLE THE DATA PACKAGE REQUIRED OR CREATE A CUSTOM LIST ON PAGE 2.

Planning Package A B Floodplain Package A B C Ecology Package A B

D. INFORMATION REQUESTED - INDIVIDUAL LAYERS

PLEASE LIST OTHER SPECIFIC MAPPING, DATA OR INFORMATION REQUIRED HERE.

- See attached list with highlighted data layers required.
In addition to the attached highlighted data layers, we also require the following:
- Current approved hydraulic model for Falcon Creek
- Current approved hydrology model for Falcon Creek
- Historic aerial photos, if available

E. CONTACT INFORMATION OF INDIVIDUAL OR ORGANIZATION INITIATING THE PROJECT

(Note: This contact will be a licensee, required to sign and be bound by the terms and conditions of the Data Licensing Agreement. Typically, this is the **individual landowner or Municipality who hired a consultant** to undertake the works.)

NAME Arif Shahzad, M.Eng., P.Eng.	CITY/PROVINCE Burlington, Ontario	POSTAL CODE L7R 3Z6
POSITION TITLE Senior Project Manager - Stormwater Engineering	TELEPHONE NO. 905-335-7600	
AGENCY/AFFILIATION City of Burlington	EXTENSION x7486	
BRANCH/DIVISION (IF APPLICABLE) Engineering Services	FAX NO.	
MAILING ADDRESS (STREET/P.O. BOX/SUITE) 426 Brant Street P.O. Box 5013	EMAIL ADDRESS Arif.Shahzad@burlington.ca	

F. CONTACT INFORMATION OF THE ORGANIZATION WHO WILL RECEIVE THE DATA

(Note: This contact will be a licensee, required to sign and be bound by the terms and conditions of the Data Licensing Agreement. Typically this individual is the **project manager/coordinator**.)

NAME Bill Coffey, M.Sc., P.Eng.	CITY/PROVINCE Woodbridge, Ontario	POSTAL CODE L4L 8A2
POSITION TITLE Head of Water Resources	TELEPHONE NO. (905) 264-0054	
AGENCY/AFFILIATION Valdor Engineering Inc.	EXTENSION x232	
BRANCH/DIVISION (IF APPLICABLE)	FAX NO.	
MAILING ADDRESS (STREET/P.O. BOX/SUITE) 571 Chrislea Road, Suite 4	EMAIL ADDRESS bcoffey@valdor-engineering.com	

G. CONTACT INFORMATION OF INDIVIDUAL FROM ORGANIZATION F WHO WILL RECEIVE THE DATA

(Note: Typically this is the **technician who will receive the data**. If this section is blank, data will be delivered to the attention of the individual listed in F above.)

NAME See above Section F.	CITY/PROVINCE	POSTAL CODE
POSITION TITLE	TELEPHONE NO.	
AGENCY/AFFILIATION	EXTENSION	
BRANCH/DIVISION (IF APPLICABLE)	FAX NO.	
MAILING ADDRESS (STREET/P.O. BOX/SUITE)	EMAIL ADDRESS	

Revision Date: November 26, 2018

Conservation Halton
2596 Britannia Road West Burlington, ON 7P 0G3
Phone: 905.336-1158 Fax: 905.336.7014
Extension: 254 gis@hrca.on.ca

Geographic Information Systems Program
Protecting the natural environment
from lake to escarpment
www.conservationhalton.on.ca

Summary Of Conservation Halton GIS Data Holdings and Availability

NOTE:

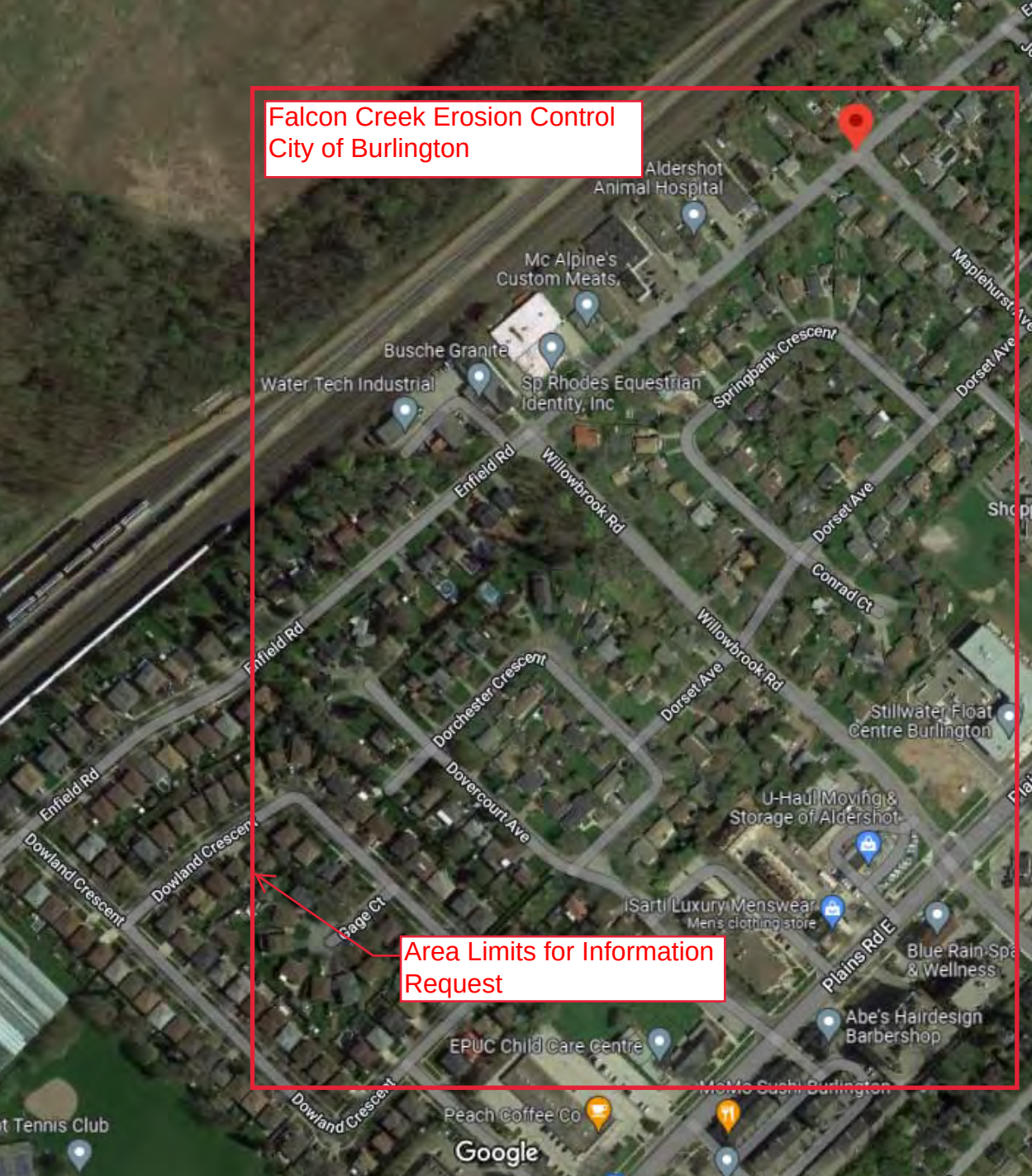
1) Before contacting Conservation Halton (CH), Municipal consultants should determine if required project data is available from their client.
2) Conservation Halton does not redistribute third party datasets to external clients. Please contact the appropriate OWNER to obtain this data.
3) A Data Request form must be completed, in full, for all requests **and** a Data Licensing Agreement must be signed before work begins on your data request.
4) Charges for staff time, data handling costs and licensing fees may apply to some data sets; these must be paid by the client before any data is released by Conservation Halton.

Conservation Halton Data Layer	OWNER	SHORT DESCRIPTION	UPDATED
Approximate Regulation Limit (ARL)	CH	Approximated area regulated by CH	14-May-2012
Floodplain (Regulated Hazard)	CH	Estimated polygon of Floodplain hazard associated with ARL	14-May-2012
Ponds (Regulated Hazard)	CH	Estimated polygon of Pond hazard associated with ARL	14-May-2012
Meander Belt (Regulated Hazard)	CH	Estimated polygon of Meander Belt hazard associated with ARL	14-May-2012
Shoreline (Regulated Hazard)	CH	Estimated polygon of Shoreline hazard associated with ARL	14-May-2012
Stable Top of Bank (Regulated Hazard)	CH	Estimated polygon of Stable Top of Bank hazard associated with ARL	14-May-2012
Wetland (Regulated Hazard)	CH	Estimated polygon of Wetland hazard associated with ARL	14-May-2012
Flood Lines / Flood Plains	CH	Engineered Flood Plains	varies
Regulated Watercourses & Hydrologic Linkages (e.g., Creeks)	CH	Waterflow showing regulated creeks and additional hydrologic linkages	14-May-2012
Ecological Land Classification (ELC)	CH	Ecological Land Classification	2014
Fisheries Occurrence	CH	Aquatic ecology monitoring program	Yearly
Monitoring Stations (FBMP, MMP)	CH	Forest Bird Monitoring Program and Marsh Monitoring Program Locations	Yearly
Watershed Boundary	CH	HRCA delineated watersheds	22-Oct-07
Subwatersheds: Sixteen Mile, Bronte and Grindstone Creeks	CH	HRCA delineated sub watersheds	22-Oct-07
*Landcover	CH	HRCA derived from orthophoto interpretation	2011, 2012
Orthophotography, 2002 (Orthorectified)	CH	April 2002 Orthophoto flight, colour, 20cm resolution	15-Apr-2002
Digital Elevation Model, 2002	CH	April 2002 DEM, 10m spaced spot elevations and breaklines with elevations	15-Apr-2002
Triangular Irregular Network, 2002	CH	April 2002 TIN, derived from DEM noted above	15-Apr-2002
Digitial Terrain Model, 2002	CH	April 2002 DTM, derived from DEM noted above, raster grid with 5m grid cells	15-Apr-2002
Contours, 2002	CH	Contours, interval choice of 10m, 5, 1m or 0.5m.	15-Apr-2002

Third Party Datasets (not available from CH)	OWNER	SHORT DESCRIPTION	
Orthophotography, 2000, orthorectified	GRCA	April 2000 Orthophoto flight, B&W, 50 cm resolution	2000
Orthophotography, 1999, orthorectified	RoH	April 1999 Orthophoto flight, colour, 50 cm resolution	1999
Real-Time Hydrometric Data	WSC	Water level/gauge data	2013
Candidate Significant Woodlands	varies	Contact the local Municipality (RoH, CoH, CoW) *	varies
Pits and Quarries	MNR	NRVIS Pits and Quarries	Varies
Contours (5m; 2.5m intermittent)	MNR	NRVIS Contours	Varies
Waterbodies	MNR	NRVIS lakes	Varies
ANSIs - Life Science and/or Earth Science	MNR	NRVIS ANSIS layer (2003)	Varies
Other Environmental Designations	MNR		
Wetlands - Provincially Significant	MNR	NRVIS Wetland Layer	Varies
Wetlands - Locally Significant	MNR	NRVIS Wetland Layer	Varies
Wildlife Habitat or Significant Wildlife Habitat	MNR	NRVIS Habitat Ranges	Varies
Species Observation Records for Protected Flora and Fauna	MNR	Please contact MNR's Natural Heritage Information Centre (NHIC).	Varies
Environmentally Significant Areas (ESAs) - Hamilton	CoH	ESAs	1995
Environmentally Sensitive Areas (ESAs) - Halton	RoH	ESAs	1998
Greenlands Systems - County of Wellington	CoW	County equivalent to ESAs	1997
Soils: Wellington, Hamilton, Halton, Peel	OMAF	Soil data derived from soils surveys	1985
Landcover: Bronte Creek Watershed Only	OMAF	Agricultural Resource Inventory	1980

* OWNER INFORMATION		GIS DATA CONTACTS
Conservation Halton	CH	Conservation Halton - Coordinator, Geomatics Information Management Program (905) 336-1158 x2254 - gis@hrca.on.ca
Ontario Ministry of Agricuture and Food	OMAF	Ontario Ministry of Agriculture and Food - www.omafra.gov.on.ca
Ontario Ministry of Natural Resources	MNR	Ministry of Natural Resources - www.lio.gov.on.ca
Natural Heritage Information Centre	NHIC	The Natural Heritage Information Centre (NHIC) http://nhic.mnr.gov.on.ca/
Grand River Conservation Authority	GRCA	Grand River Conservation Authority - www.grandriver.ca/grin/grin.cfm
Water Survey of Canada	WSC	Water Survey Canada - www.wsc.ec.gc.ca/applications/H2O/index-eng.cfm
Region of Halton	RoH	Region of Halton - www.halton.ca
City of Hamilton	CoH	City of Hamilton - www.hamilton.ca (GIS Services)
County of Wellington	CoW	County of Wellington - www.wellington.ca

GIS Layers Not Available	Posssible Alternate Layer
Crest of Slope or Fill Line	Stable Top of Bank
Landcover	Contact the GIS Cooordinator to determine availability for your study area.
Significant Valley Lands	ESA layer + Stable Top of Bank or MMAH Greenbelt valley lands layer


Falcon Creek Erosion Control
City of Burlington
Aldershot Animal Hospital
Mc Alpine's Custom Meats
Busche Granite
Water Tech Industrial
Sp Rhodes Equestrian Identity, Inc
Springbank Crescent
Dorset Ave
Enfield Rd
Willowbrook Rd
Conrad Ct
Dorchester Crescent
Dovercourt Ave
Stillwater Float Centre Burlington
U-Haul Moving & Storage of Aldershot
Dowland Crescent
Sage Ct
Plains Rd E
Blue Rain Spa & Wellness
Abe's Hairdesign Barbershop
EPUC Child Care Centre
Peach Coffee Co
Google
Area Limits for Information Request

Taylor North

From: Taylor North
Sent: Wednesday, June 1, 2022 9:05 AM
To: Species at Risk (MECP)
Subject: SAR Records Request for Falcon Creek at Enfield and Willowbrook Roads, City of Burlington
Attachments: Figure 1 - Falcon Creek.jpg; Preliminary SAR Screening - Falcon Creek.pdf

Hello,

My name is Taylor North and I am an Ecologist at North-South Environmental Inc. I am reaching out today to request SAR records and natural heritage data to complete a background review for proposed erosion restoration of Falcon Creek near Enfield and Willowbrook Roads in Burlington, ON (See Figure 1).

I have explored all applicable information sources and have contacted Conservation Halton (response pending). There have been no field surveys conducted on site as of present, but surveys will include ELC, botanical inventory, breeding bird surveys, incidental wildlife, and a cavity tree assessment. I have included a preliminary SAR screening in the document attached. Please let me know if you would like any additional information from me.

Many thanks,

Taylor

north-south ENVIRONMENTAL
101B King Street West
Cambridge ON • N3H 1B5
www.nsenvironmental.com

Taylor North, M.Sc.
Project Ecologist/Project Coordinator

tnorth@nsenvironmental.com
P: 905-854-1112 • Ext.

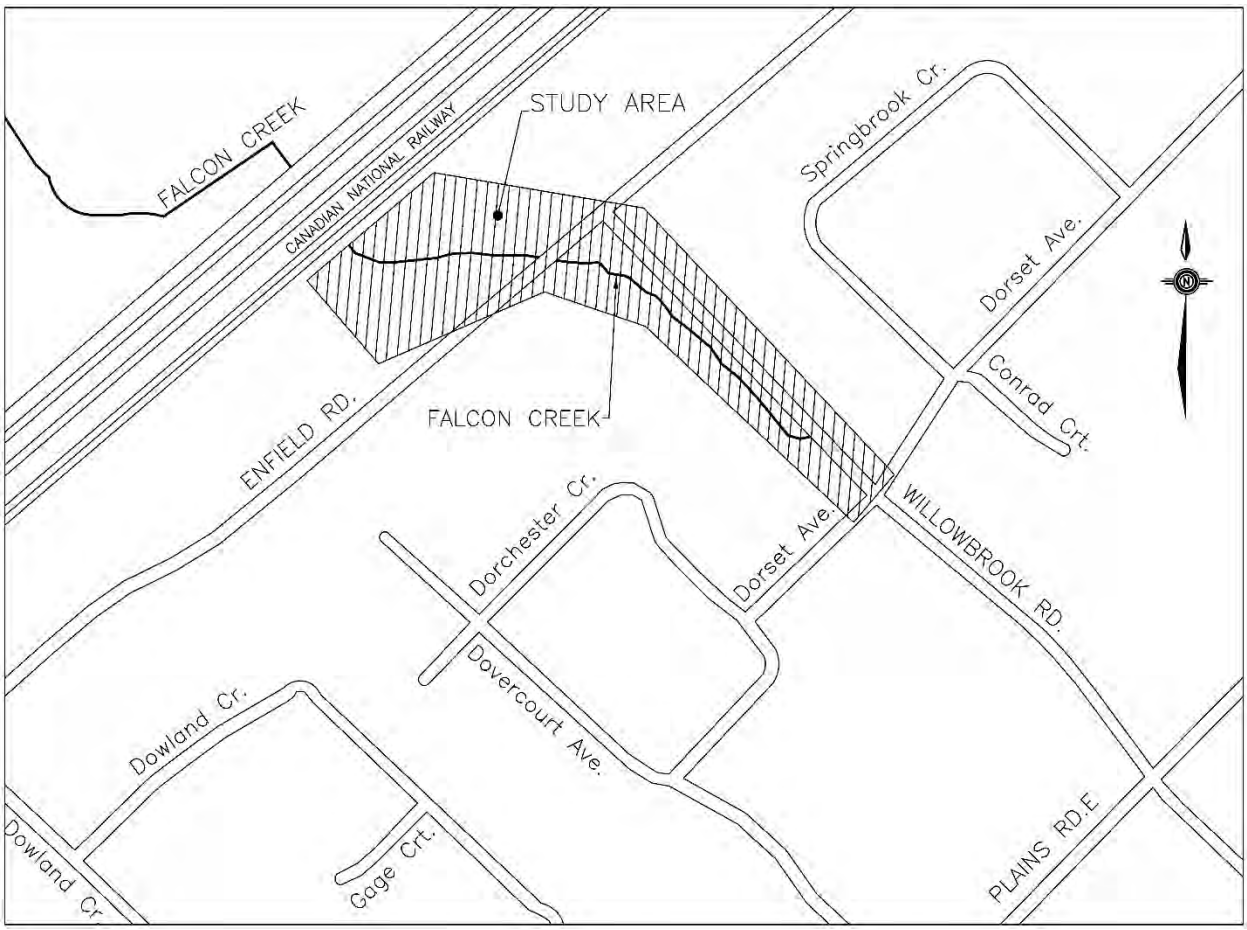

FALCON CREEK
CANADIAN NATIONAL RAILWAY
STUDY AREA
Springbrook Cr.
Dorset Ave.
Conrad Crt.
ENFIELD RD.
FALCON CREEK
Dorchester Cr.
Dorset Ave.
WILLOWBROOK RD.
Dovercourt Ave.
Dowland Cr.
Gage Crt.
PLAINS RD.E

Figure 1

Common Name	Source	Taxa
American Eel	iNaturalist (2019)	Actinopterygii
Jefferson Salamander	iNaturalist (2015)	Amphibia
Unisexual Ambystoma (Jefferson Salamander dependent population)	NHIC	Amphibia
Western Chorus Frog	CWS Critical Habitat	Amphibia
Acadian Flycatcher	iNaturalist (2019)	Aves
American Horned Grebe	iNaturalist (2018)	Aves
American White Pelican	iNaturalist (2013)	Aves
Bald Eagle	iNaturalist (2017), eBird (2022)	Aves
Bank Swallow	iNaturalist (2021)	Aves
Barn Owl	CWS Critical Habitat	Aves
Barn Swallow	iNaturalist (2018), NHIC, OBBA, eBird (2020)	Aves
Black Tern	iNaturalist (2011)	Aves
Bobolink	iNaturalist (2018), NHIC, OBBA	Aves
Canada Warbler	iNaturalist (2020)	Aves
Cerulean Warbler	iNaturalist (2021)	Aves
Chimney Swift	iNaturalist (2018), OBBA	Aves
Common Nighthawk	iNaturalist (2018), eBird (2020)	Aves
Eastern Meadowlark	iNaturalist (2013), NHIC, OBBA	Aves
Eastern Whip-poor-will	iNaturalist (2019)	Aves
Eastern Wood-Pewee	iNaturalist (2019), NHIC, OBBA	Aves
Evening Grosbeak	iNaturalist (2021)	Aves
Golden Eagle	iNaturalist (2021)	Aves
Golden-winged Warbler	iNaturalist (2021), OBBA	Aves
Grasshopper Sparrow	iNaturalist (2013)	Aves
Horned Grebe	iNaturalist (2017)	Aves
Hudsonian Godwit	iNaturalist (2018)	Aves
Least Bittern	iNaturalist (2019), OBBA	Aves
Loggerhead Shrike	iNaturalist (2017)	Aves
Louisiana Waterthrush	iNaturalist (2013)	Aves
Olive-sided Flycatcher	iNaturalist (2020)	Aves
Peregrine Falcon	iNaturalist (2019), OBBA	Aves
Piping Plover	iNaturalist (2016)	Aves
Red Knot	iNaturalist (2016)	Aves
Red-headed Woodpecker	iNaturalist (2021), OBBA, eBird (2014)	Aves
Rusty Blackbird	iNaturalist (2016)	Aves
Savannah Sparrow	OBBA	Aves
Wood Thrush	iNaturalist (2018), OBBA	Aves
Northern Bush Katydid	NHIC	Insecta
Yellow-banded Bumble Bee	iNaturalist (2021)	Insecta
Monarch	iNaturalist (2017), Butterfly Atlas (2021)	Insecta

Little Brown Bat	iNaturalist (2020)	Mammalia
Lilliput	iNaturalist (2021)	Mollusk
Mapleleaf	iNaturalist (2020)	Mollusk
American chestnut	iNaturalist (2016)	Plantae
American columbo	iNaturalist (2017), NHIC	Plantae
Black Ash	iNaturalist (2019)	Plantae
Brainerd's Hawthorn	NHIC	Plantae
Butternut	iNaturalist (2018), NHIC	Plantae
Common Hoptree	iNaturalist (2017)	Plantae
Cucumber-tree	iNaturalist (2016)	Plantae
dense blazing star	iNaturalist (2020)	Plantae
Eastern Flowering Dogwood	CWS Critical Habitat, iNaturalist (2017)	Plantae
Eastern Pricklypear	iNaturalist (2021)	Plantae
Forked Panicgrass	NHIC	Plantae
Green Dragon	iNaturalist (2021)	Plantae
Hoary Mountainmint	iNaturalist (2017), CWS Critical Habitat	Plantae
Kentucky coffeetree	iNaturalist (2018)	Plantae
Midland Sedge	NHIC	Plantae
Northern Hawthorn	NHIC	Plantae
Perfoliate Bellwort	NHIC	Plantae
Shiny Wedge Grass	NHIC	Plantae
Spotted Wintergreen	NHIC	Plantae
swamp rose mallow	iNaturalist (2020)	Plantae
sweet birch	iNaturalist (2021)	Plantae
Wood Poppy	iNaturalist (2021)	Plantae
Blanding's Turtle	iNaturalist (2021), CWS Critical Habitat	Reptilia
Common Snapping Turtle	iNaturalist (2017)	Reptilia
Eastern Milksnake	iNaturalist (2014), NHIC	Reptilia
Midland Painted Turtle	NHIC	Reptilia
Northern Map Turtle	iNaturalist (2018)	Reptilia
Snapping Turtle	NHIC	Reptilia
Spiny Softshell	NHIC, CWS Critical Habitat	Reptilia
Timber Rattlesnake	NHIC	Reptilia

Ministry of Northern Development, Mines, Natural Resources and Forestry

Land Use Planning and Strategic Issues Section
Southern Region

Regional Operations Division
300 Water Street
Peterborough, ON K9J 3C7

Tel.: 705 761-4839
Fax.: 705 755-3233

Ministère du Développement du Nord, des Mines, des Richesses naturelles et des Forêts

Section de l'aménagement du territoire et des questions stratégiques
Région du Sud

Division des opérations régionales
300, rue Water
Peterborough (ON) K9J 3C7

Tél. : 705 761-4839
Téléc. : 705 755-3233

Ontario

June 23, 2022

To Bill Coffey

SUBJECT: Falcon Creek Erosion Control Environmental Assessment Study

The Ministry of Northern Development, Mines, Natural Resources and Forestry (NDMNRF) received the Notice of Study Commencement for the Falcon Creek Erosion Control Environmental Assessment Study on June 1, 2022. Thank you for circulating this to our office. Please note that we have not competed a screening of natural heritage or other resource values for the project at this time. This response, however, does provide information to guide you in identifying and assessing natural features and resources as required by applicable policies and legislation, as well as engaging with the Ministry for advice as needed.

Please also note that it is the proponent's responsibility to be aware of, and comply with, all relevant federal or provincial legislation, municipal by-laws or other agency approvals.

Natural Heritage

NDMNRF's natural heritage and natural resources GIS data layers can be obtained through the Ministry's Land Information Ontario (LIO) website. You may also view natural heritage information online (e.g., Provincially Significant Wetlands, ANSI's, woodlands, etc.) using the Make a Map: Natural Heritage Areas tool.

We recommend that you use the above-noted sources of information during the review of your project proposal.

Natural Hazards

A series of natural hazard technical guides developed by NDMNRF are available to support municipalities and conservation authorities implement the natural hazard policies in the Provincial Policy Statement (PPS). For example, standards to address flood risks and the potential impacts and costs from riverine flooding are addressed in the *Technical Guide River and Stream Systems: Flooding Hazard Limit (2002)*. We recommend that you consider these technical guides as you assess specific improvement projects that can be undertaken to reduce the risk of flooding.

Petroleum Wells & Oil, Gas and Salt Resources Act

There may be petroleum wells within the proposed project area. Please consult the Ontario Oil, Gas and Salt Resources Library website (www.ogsrlibrary.com) for the best-known data on any wells recorded by NDMNRF. Please reference the 'Definitions and Terminology Guide' listed in the publications on the library website to better understand the well information available. Any oil and gas wells in your project area are regulated by the *Oil, Has and Salt Resource Act*, and the supporting regulations and operating standards. If any unanticipated wells are encountered during development of the project, or if the proponent has questions regarding petroleum operations, the proponent should contact the Petroleum Operations Section at POSRecords@ontario.ca or 519-873-4634.

Fish and Wildlife Conservation Act

Please note, that should the project require:

- The relocation of fish outside of the work area, a Licence to Collect Fish for Scientific Purposes under the *Fish and Wildlife Conservation Act* will be required.
- The relocation of wildlife outside of the work area (including amphibians, reptiles, and small mammals), a Wildlife Collector's Authorization under the *Fish and Wildlife Conservation Act* will be required.

Public Lands Act & Lakes and Rivers Improvement Act

Some Project may be subject to the provisions of the *Public Lands Act* or *Lakes and River Improvement Act*. Please review the information on NDMNRF's web pages provided below regarding when an approval is, or is not, required. Please note that many of the authorizations under the *Lakes and Rivers Improvement Act* are administered by the local Conservation Authority.

- For more information about the *Public Lands Act*: https://www.ontario.ca/page/crown-land-work-permits

- For more information about the *Lakes and Rivers Improvement Act*: https://www.ontario.ca/page/lakes-and-rivers-improvement-act-administrative-guide

After reviewing the information provided, if you have not identified any of NDMNRF's interests stated above, there is no need to circulate any subsequent notices to our office. If you have identified any of NDMNRF's interests and/or may require permit(s) or further technical advice, please direct your specific questions to the undersigned.

If you have any questions or concerns, please feel free to contact me.

Best Regards,

Sam Short
Regional Planner
sam.short@ontario.ca
Ph: 705-772-9329
Land Use Planning and Strategic Issues Section – Southern Region
Ministry of Northern Development, Mines, Natural Resources and Forestry