HYDROGEOLOGICAL STUDY

Wateridge Village – Phase 4
Ottawa, Ontario

CO947.02

FINAL REPORT

Project Date: September 18, 2024
Revised: February 10, 2025
Revised: March 7, 2025

Prepared for:

ROHIT COMMUNITIES,
15 FITZGERALD RD., SUITE 200
OTTAWA, ONTARIO

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1.0 EXECUTIVE SUMMARY

Terrapex Environmental Ltd. (Terrapex) has been retained by Rohit to carry out a hydrogeological study to address the City of Ottawa request to determine if a full Hydrogeological Impact Assessment (HIA) is necessary.

The Fairhaven Area is located approximately 0.5 kms to the south of the Subject Areas defined as Block 4 (1275 Hemlock Rd), Block 5 (1255 Hemlock Road), and Block 6 (Building B – 125 Oshedina St; Building C – 135 Oshedina St). Hydrogeological investigations carried out by Terrapex observed that groundwater flowed from the subject area toward the Ottawa River, and away from the Fairhaven Area. Topography on the Subject Area was also noted to direct surface water away from the Fairhaven Area, and toward the Ottawa River. Depths of anticipated excavations would not be sufficient to create a dewatering Zone of Influence of significance to the Fairhaven Area. The Fairhaven Area is essentially 'upstream' from groundwater and surface water influence.

As such, based on the topography, direction of groundwater flow, vibration attenuation assessment, and the proposed depths of the planned excavations for the Rohit development, it is the opinion of Terrapex that a full HIA is not required for this project.

2.0 BACKGROUND

Terrapex Environmental Ltd. (Terrapex) has been retained by Rohit to carry out a hydrogeological study to address the City of Ottawa request to determine if a full Hydrogeological Impact Assessment (HIA) is necessary.

This review herein was prepared in accordance with the Ontario Water Resources Act, and Ontario Regulation 387/04. In addition, it is intended to satisfy the August 2018 edition of the hydrological requirements of the City of Ottawa that define hydrogeological aspects, as part of the development application process.

A concurrent geotechnical study for the Site was undertaken by Terrapex, which has been submitted under separate cover.

3.0 SUBJECT AREA AND PHYSICAL CONTEXT

3.1 SUBJECT AREA AND PROPOSED CONDITIONS

The subject area is irregular in shape and is located in north of Hemlock Road at 1076 Hemlock Private, Wateridge Community, Ottawa, Ontario. The subject area studied consists of the areas defined as Block 4 (1275 Hemlock Rd), Block 5 (1255 Hemlock Road), and Block 6 (Building B – 125 Oshedina St; Building C – 135 Oshedina St). The subject area is approximately 5.05 acres in area. A visual representation, including the monitoring well locations, is provided as **Figure 1** and **Figure 2**.

3.2 PHYSIOLOGY AND DRAINAGE

The ground surface elevations at the locations of the boreholes and monitoring wells were established by Terrapex using a Topcon Hiper V Global Navigation Satellite System (GNSS) Receiver. The accuracy of the Topcon unit is in the centimetre scale. The ground surface elevation of the monitoring wells ranged between 82.82 masl (MW6-1) and 88.41 (MW4-1). Topography is generally highest at the south part of the subject area, and lowest at the north part of the subject area.

The nearest surface water body is identified as the Ottawa River, located approximately 0.75 km to the north of the subject area.

3.3 GEOLOGY

Available mapping indicates that the subject area is situated over fine-textured glacio-marine deposits, over shallow bedrock.

Block 5 - 1255 Hemlock Rd
Block 6, Building B - 125 Oshedina St and Building C - 135 Oshedina St.
Block 4 - 1275 Hemlock Rd

4.0 METHODOLOGY

4.1 GROUNDWATER MONITORING WELL CONSTRUCTION

Drilling operations were carried out as part of historical investigations and drilled in 2023. Groundwater monitoring well construction dates are provided in **Table 1**, below.

4.2 ENCOUNTERED SUBSURFACE CONDITIONS

Review of the borehole reports generated from the cumulative drilling events, indicates that the encountered overburden is generally comprised of sandy silt to silty clay materials overlying bedrock. The relevant borehole logs are provided in **Appendix I**.

TABLE 1: GROUNDWATER MONITORING WELL CONSTRUCTION SPECIFICATIONS

Well ID	Construction Date	Approximate Location (UTM Zone 17)		Approximate Ground Surface Elevation	Top of Pipe	Approximate Screened Interval	Soils Reported at Screened Interval	SPT N-Value at Screened Interval
		Easting (m)	Northing (m)	(masl)	(masl)	(mbg)		
MW4-1	Aug 11, 2023	450268	5033514	88.14	89.105	2.7 to 4.7	Bedrock	-
MW5-1	Aug 11, 2023	450192	5033509	87.71	88.624	2.5 to 4.4	Bedrock	-
MW5-2	Aug 11, 2023	450216	5033464	86.90	88.108	2.7 to 4.6	Bedrock	RQD = 32% to 79%
MW6-1	Aug 10, 2023	450070	5033727	82.82	83.802	2.7 to 4.7	Bedrock	RQD = 15% to 45%
MW6-3	Sept 11, 2023	450119	5033677	85.7	86.688	2.7 to 4.7	Bedrock	RQD = 16% to 30%
MW6-6	Oct 11, 2023	450125	5033580	85.87	86.85	2.7 to 4.7	Bedrock	RQD = 74% to 84%

masl – indicates Metres Above Sea Level

5.0 CHARACTERIZATION OF GROUNDWATER

5.1 WATER LEVEL MONITORING

Groundwater elevations were measured at five monitoring events carried out in November of 2023 and July of 2024.

TABLE 2: RELEVANT GROUNDWATER MONITORING WELL MEASUREMENTS

Well ID	Ground Surface Elevation (masl)	Well Stickup (masl)	Bottom of Well mbTOP (masl)	Groundwater Measurements 2023 Nov 16 mbTOP (masl)	2024 July 19 mbTOP (masl)	2024 July 22 mbTOP (masl)	2024 July 23 mbTOP (masl)	2024 July 24 mbTOP (masl)
MW4-1	88.14	89.10	5.56 (82.58)	4.99 (84.44)	5.07 (84.03)	5.07 (84.03)	5.05 (84.05)	5.06 (84.04)
MW5-1	87.71	88.62	5.29 (82.42)	4.98 (83.64)	4.98 (83.64)	5.19 (83.43)	dry	dry
MW5-2	86.90	88.10	5.74 (81.16)	4.59 (83.52)	4.70 (83.40)	4.75 (83.36)	4.76 (83.35)	4.77 (83.34)
MW6-1	82.82	83.80	5.54 (77.28)	5.21 (78.56)	4.92 (78.88)	5.08 (78.72)	5.03 (78.77)	5.14 (78.66)
MW6-3	85.70	86.68	5.54 (80.16)	4.32 (82.37)	destroyed	destroyed	destroyed	destroyed
MW6-6	85.87	86.85	5.54 (80.33)	4.49 (82.36)	4.46 (82.39)	4.46 (82.39)	4.46 (82.39)	4.49 (82.36)

DNE – indicates that the well did not exist at that time
NC – indicates 'not constructed at that time'
Shaded cells indicate groundwater high and groundwater low levels.

As summarized in **Table 2**, groundwater elevations ranged from approximately 78.56 masl to 84.44 masl (roughly equivalent to 3.94 mbg to 4.07 mbg). These values are within the bedrock, but it is worth noting that groundwater may exist periodically, flowing over the bedrock/overburden interface in the direction of bedrock topography (northward).

5.2 GROUNDWATER FLOW DIRECTION

Groundwater flow directions were estimated using manual piezometric head measurements recorded on July 22, 2024, as referenced in **Table 2.** Based on these measurements, the groundwater is interpreted to be generally flowing from the south toward the north.

The horizontal gradient was estimated to be 0.0001 m/m. It is noted that groundwater within bedrock does not strictly follow a horizontal gradient, because groundwater flow is controlled by fracture systems, and not porosity.

5.3 HYDRAULIC CONDUCTIVITY TESTING

Hydraulic conductivity is a parameter for quantifying the ability of a soil unit to transmit water. This parameter is necessary for predicting the rate of seepage into excavations to be intercepted or collected by dewatering efforts during construction.

To estimate the hydraulic conductivity (K) of the soil materials adjacent to the screened intervals at the tested monitoring wells, single well response tests were carried out at locations MW4-1, MW5-2, and MW6-1.

The tests were carried out by rapidly adding a volume of water from a well (Falling Head Test) and monitoring the subsequent water level recovery to the static water level conditions. The Bouwer and Rice (1976) method was applied to test data, using the unconfined solution. The data was analyzed using the AQTESOLV™ (v. 4.50). A summary of the single well response tests carried out is presented below in **Table 3,** below, and Single Well Response Test Reports are provided in **Appendix II**.

TABLE 3: SUMMARY OF HYDRAULIC CONDUCTIVITY ESTIMATES

Well ID	Screened Interval (mbg)	Soils at Screened Interval	Hydraulic Conductivity (m/s)
MW4-1	2.7 to 4.7	Bedrock	1.9×10^{-6}
MW5-2	2.7 to 4.6	Bedrock RQD = 32% to 79%	1.06×10^{-6}
MW6-1	2.7 to 4.7	Bedrock RQD = 15% to 45%	4.02×10^{-7}

Based on the tests carried out at the three locations , *in-situ* hydraulic conductivities ranged from 1.02×10^{-7} m/s to 1.9×10^{-6} m/s. For the purposes of flow rate estimates, the “fastest” hydraulic conductivity is of 1.9×10^{-6} m/s was used.

5.4 HYDRAULIC ZONE OF INFLUENCE

Based on the hydraulic conductivity, flow direction and hydraulic gradient provided above, groundwater was interpreted to be flowing toward the northwest at a rate of approximately 2.91 m^3/s, with a linear velocity of 2.85×10^{-4} m/year.

6.0 VIBRATION ATTENUATION ASSESSMENT

In response to comments provided to Terrapex by the City of Ottawa (dated December 20. 2024), an assessment of the Peak Particle Velocity (PPV) for a distance of 500 metres from the subject property was requested of M-ROC to address the 'Zone of Influence' for anticipated blasting operations to be carried out as part of construction operations. M-ROC is a specialist drilling and blasting contractor, located in Ottawa and Internationally. The assessment was provided to Terrapex by M-ROC, and is included in **Appendix III** of this report.

Theoretical PPV (mm/s) were predicted at distances of 100 m, 200 m, 400 m, and 500 m from the epicentre of the project. PPV levels at 500 metres distance were estimated to be 0.03 mm/s to 0.06 mm/s. For the purposes of context, it is understood that the typical Peak Particle Velocity for background vehicles vibration (passive over calming road humps) are in the range of 0.1 mm/s to 2 mm/s (source: https://www.campbell-associates.co.uk/post/peak-particle-velocity-why-do-we-monitor-it). Based on the report provided by M-ROC, the PPV anticipated from the proposed blasting operations would be analogous to background vehicle vibration approximately 400 metres from the site epicentre. As such, proposed blasting operations are not anticipated to loosen materials into the existing water supply wells.

7.0 SUMMARY OF KEY FINDINGS

The following points summarize the key findings of this hydrogeological peer review:

- **Groundwater elevations** ranged from approximately 78.56 masl to 84.44 masl (roughly equivalent to 3.94 mbg to 4.07 mbg). These values are within the bedrock, but it is worth noting that groundwater may exist periodically, flowing over the bedrock/overburden interface in the direction of bedrock topography (northward).

- **Groundwater flow direction** is interpreted to be generally flowing from the southeast toward the northwest with a horizontal gradient of approximately 0.0001 m/m. It is noted that groundwater within bedrock does not strictly follow a gradient, because groundwater flow is controlled by fracture systems, and not porosity.

- Based on the tested locations, ***in-situ*** **hydraulic conductivities** ranged from 1.02×10^{-7} m/s to 1.9×10^{-6} m/s. For the purposes of flow rate estimates, the "fastest" hydraulic conductivity is of 1.9×10^{-6} m/s was used.

  Hydraulic zone of influence was assessed using the groundwater elevations, groundwater flow direction, and hydraulic conductivities.

  Based on the information, groundwater is interpreted to be flowing generally northward at a rate of approximately 2.91 m^3/s, with a linear velocity of 2.85×10^{-4} m/year.

- A **Vibration Attenuation Assessment** was carried out by M-ROC consultants. Based on the report provided by M-ROC, the PPV anticipated from the proposed blasting operations would be analogous to background vehicle vibration approximately 400 metres from the site epicentre. As such, vibration associated with blasting operations would not be anticipated to loosen materials into existing water supply wells.

It is understood that the Fairhaven Area is located approximately 0.5 kms to the south of the subject area. As such, based on the topography, direction of groundwater flow assessed above, the Vibration Attenuation Assessment, and the proposed depths of the planned excavations for the Rohit development, the proposed development is not anticipated to impact the general groundwater conditions or quality at Fairhaven Area. Therefore, it is the opinion of Terrapex that a full HIA is not required for this project.

8.0 CLOSURE

This report has been completed in accordance with the terms of reference for this project as agreed upon by Rohit Communities (the Client) and Terrapex Environmental Ltd. (Terrapex) and generally accepted hydrogeological consulting practices in this area.

The reported information is believed to provide a reasonable representation of the general hydrogeological conditions at the site; however, studies of this nature have inherent limitations. The data were collected at specific locations and conditions may vary at other locations, or with the passage of time. Where applicable, the assessment of the environmental quality of groundwater was limited to a study of those chemical parameters specifically addressed in this report.

Terrapex has relied in good faith on information and representations obtained from the Client and third parties and, except where specifically identified, has made no attempt to verify such information. Terrapex accepts no responsibility for any deficiency or inaccuracy in this report as a result of any misstatement, omission, misrepresentation, or fraudulent act of those providing information. Terrapex shall not be responsible for conditions or consequences arising from relevant facts that were concealed, withheld, or not fully disclosed at the time of the study.

This report has been prepared for the sole use of Rohit Communities. Terrapex accepts no liability for claims arising from the use of this report, or from actions taken or decisions made as a result of this report, by parties other than Rohit Communities.

Respectfully submitted,

TERRAPEX ENVIRONMENTAL LTD.

Andrew Durbano, M.Sc., P.Geo.
Hydrogeologist

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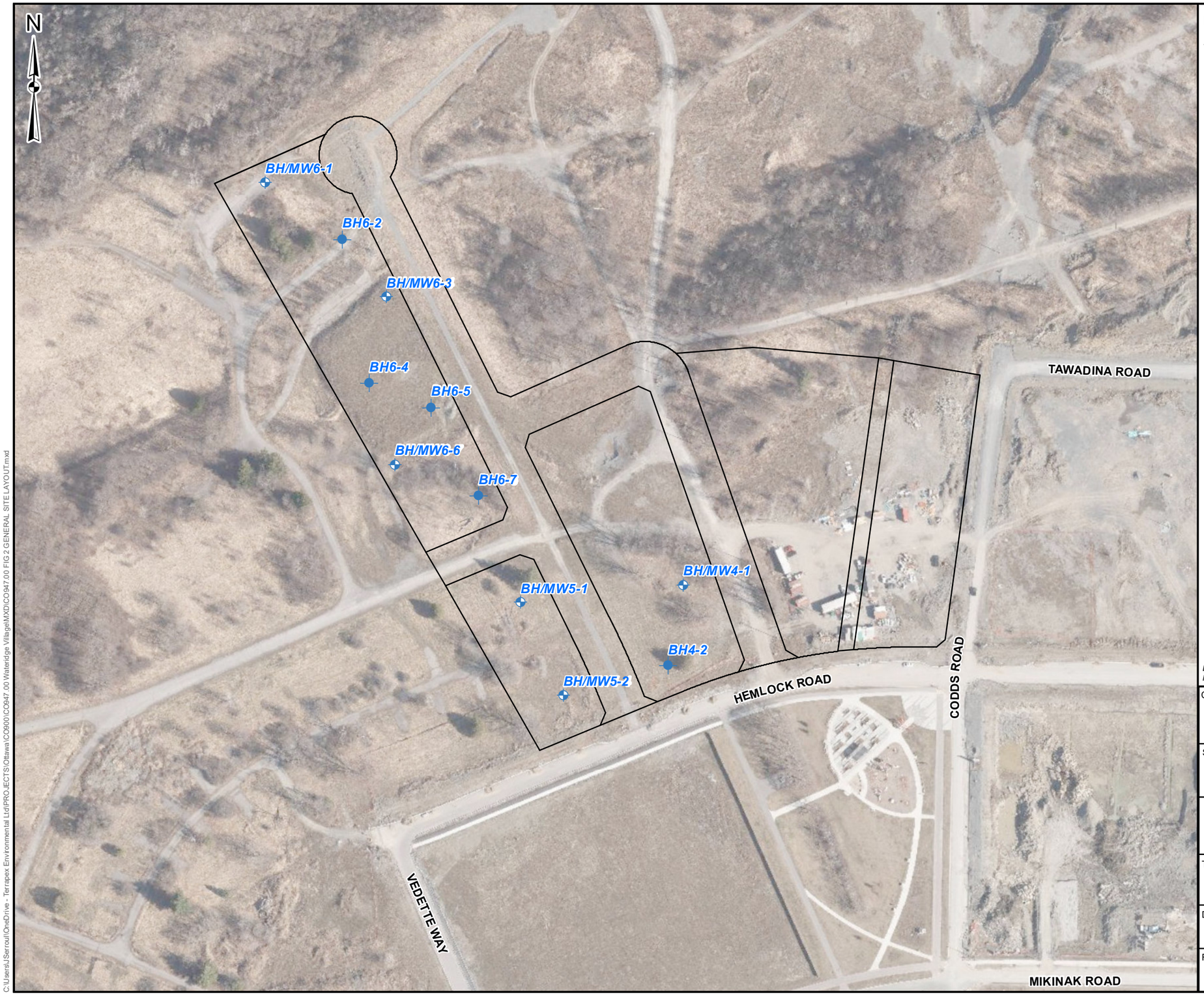
Senior Hydrogeologist

FIGURES



LEGEND

- PROPOSED PLAN OF SUBDIVISION
- BOREHOLE
- MONITORING WELL

0 25 50 75
Metres

DATA SOURCE: CITY OF OTTAWA
MAP PROJECTION: NAD 1983 UTM ZONE 18N

CLIENT:
CLC

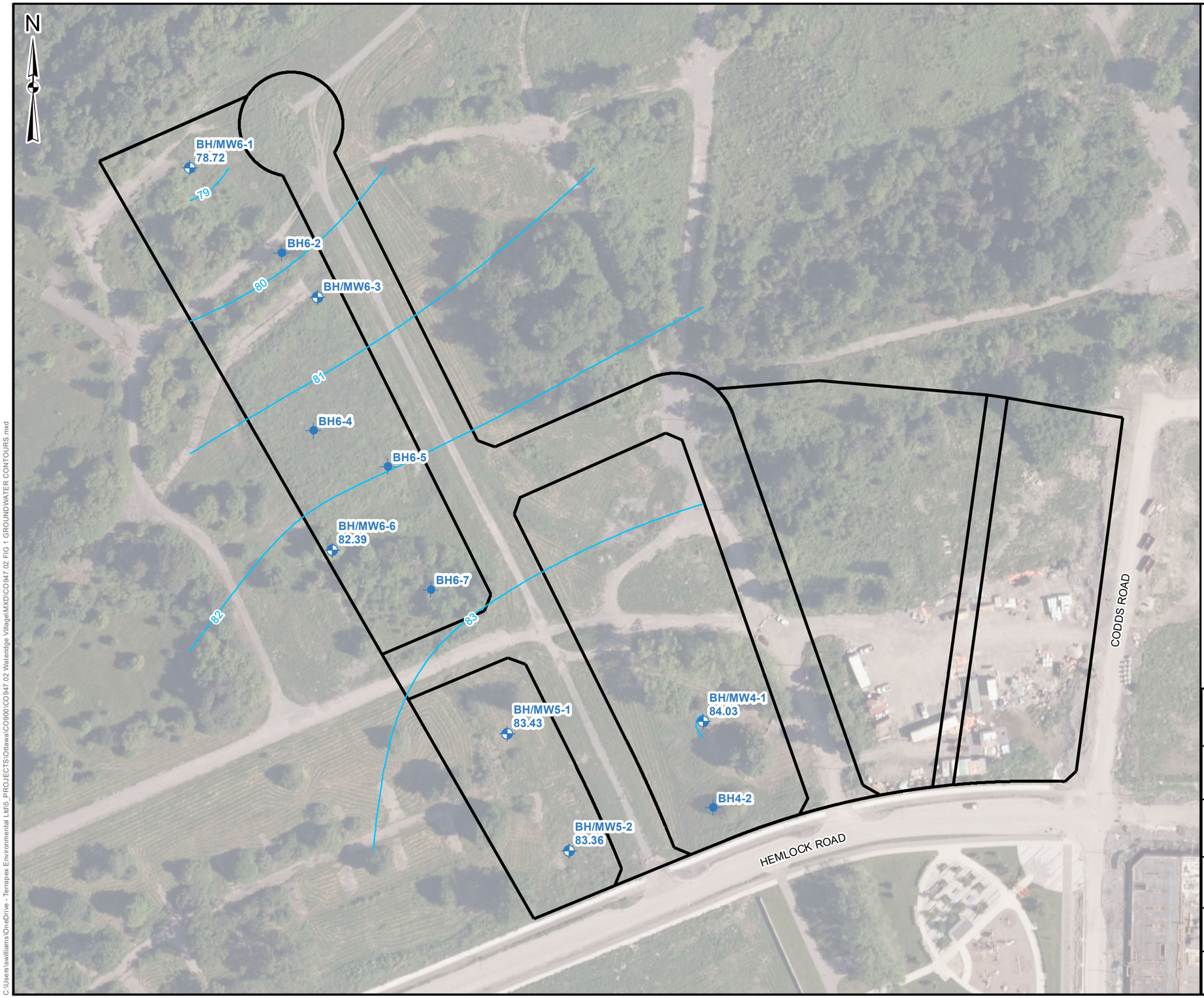
SITE LOCATION:
WATERIDGE VILLAGE
OTTAWA, ONTARIO

TERRAPEX

TITLE:
GENERAL SITE LAYOUT

DRAWN BY:	PROJECT NO.:	CHECKED BY:
JS	CO947.00	CB
REVISION:	DATE:	FIGURE:
00	OCTOBER 2023	1

C:\Users\JSerrouit\OneDrive - Terrapex Environmental Ltd\PROJECTS\Ottawa\CO900\CO947.00 Wateridge Village\MXD\CO947.00 FIG 2 GENERAL SITE LAYOUT.mxd



LEGEND

- PROPOSED SUBDIVISION BOUNDARY
- BOREHOLE
- MONITORING WELL
- EQUIPOTENTIAL CONTOUR
- GROUNDWATER FLOW DIRECTION
- **88.76** STATIC WATER LEVEL (22 July 2024) (m ASL)

0 10 20 30 40 50
Metres

DATA SOURCE: CITY OF OTTAWA
MAP PROJECTION: NAD 1983 UTM ZONE 18N

CLIENT:
ROHIT COMMUNITIES

SITE LOCATION:
WATERIDGE VILLAGE
1255 HEMLOCK ROAD
OTTAWA, ONTARIO

TERRAPEX

TITLE:
GROUNDWATER CONTOURS

DRAWN BY:	PROJECT NO.:	CHECKED BY:
SW	CO947.02	XX
REVISION: 00	DATE: AUGUST 2024	FIGURE: 2

C:\Users\swilliams\OneDrive - Terrapex Environmental Ltd\5_PROJECTS\Ottawa\CO900\CO947.02 Wateridge Village\MXD\CO947.02 FIG 1 GROUNDWATER CONTOURS.mxd

APPENDIX I
Borehole Log Reports

CLIENT: Rohit Communities	PROJECT NO.: CO947.00	**RECORD OF: BH/MW4-1**
ADDRESS: Wateridge Village / Hemlock Road Area	STATION:	
CITY/PROVINCE: Ottawa, ON	NORTHING (m): 5033514.04	EASTING (m): 450267.99 ELEV. (m) 88.15
CONTRACTOR: George Downing Estate Drilling Ltd	METHOD:	
BOREHOLE DIAMETER (cm): 20	WELL DIAMETER (cm): 5	SCREEN SLOT #: 10 SAND TYPE: 2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON | GRAB

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	CSV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		FILL hard, brown, moist sandy silty clay trace organics	0	88	75	18	1		100			Bentonite	50 mm monitoring well was installed and the water level measured on November 24, 2023: 4.0 mbgs
		Bedrock Cored to depth of 4.63 m.	0.5 1 1.5	87.5 87 86.5			R1						
			2 2.5	86 85.5			R2					Sand	
			3 3.5	85 84.5								Screen + Sand	
			4	84			R3						
		END OF BOREHOLE	4.5										END OF BOREHOLE: 4.65 mbgs ELEV.(m) = 83.5

TERRAPEX

LOGGED BY: UB	DRILLING DATE: 08-11-2023
INPUT BY: RR	MONITORING DATE: 24-11-2023
REVIEWED BY: TY	PAGE 1 OF 1

CLIENT: Rohit Communities	PROJECT NO.: CO947.00	**RECORD OF: BH4-2**
ADDRESS: Wateridge Village / Hemlock Road Area	STATION:	
CITY/PROVINCE: Ottawa, ON	NORTHING (m): 5033481.01	EASTING (m): 450271.84 ELEV. (m) 87.91
CONTRACTOR: George Downing Estate Drilling Ltd	METHOD:	
BOREHOLE DIAMETER (cm):	WELL DIAMETER (cm):	SCREEN SLOT #: SAND TYPE: SEALANT TYPE:

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON | GRAB

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	CSV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		FILL firm to hard, dark brown, moist sandy silty clay trace gravel, trace organics ---- Gr=8.7%, Sa=33.5%, Si=35.9%, Cl=21.9% LL=49.8%, PI=21.	0 0.5 1	87.5 87	N-value: 6, 57	PL: 23.6, 14.7	1 2		100 100				
		Bedrock END OF BOREHOLE											END OF BOREHOLE: 1.32 mbgs ELEV.(m) = 86.6

TERRAPEX

LOGGED BY: UB	DRILLING DATE: 08-11-2023
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CLIENT: Rohit Communities	PROJECT NO.: CO947.00	**RECORD OF: BH/MW5-1**
ADDRESS: Wateridge Village / Hemlock Road Area	STATION:	
CITY/PROVINCE: Ottawa, ON	NORTHING (m): 5033509.37	EASTING (m): 450192.60 ELEV. (m) 87.72
CONTRACTOR: George Downing Estate Drilling Ltd	METHOD:	
BOREHOLE DIAMETER (cm): 20	WELL DIAMETER (cm): 5	SCREEN SLOT #: 10 SAND TYPE: 2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON | GRAB

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	CSV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		FILL compact to very dense, brown, moist sandy silt some sand, some clay, trace gravel, trace organics ---- Gr=9.0%, Sa=13.0%, Si=66.5%, Cl=11.5% ---- crushed rock pieces	0 0.5 1 1.5 2	87.5 87 86.5 86	36 10 57	25.4 4.9 7.5	1 2 3		100 100 100			Bentonite 50 mm monitoring well was installed and the water level measured on November 24, 2023: 4.24 mbgs	
		Bedrock Cored to depth of 4.39 m.	2.5 3 3.5 4	85.5 85 84.5 84 83.5			R1 R2					Sand Screen + Sand	
		END OF BOREHOLE											END OF BOREHOLE: 4.39 mbgs ELEV.(m) = 83.3

TERRAPEX

LOGGED BY: UB	DRILLING DATE: 08-11-2023
INPUT BY: RR	MONITORING DATE: 24-11-2023
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CLIENT: Rohit Communities	PROJECT NO.: CO947.00	**RECORD OF: BH/MW5-2**
ADDRESS: Wateridge Village / Hemlock Road Area	STATION:	
CITY/PROVINCE: Ottawa, ON	NORTHING (m): 5033464.36	EASTING (m): 450216.33 ELEV. (m) 86.91
CONTRACTOR: George Downing Estate Drilling Ltd	METHOD:	
BOREHOLE DIAMETER (cm): 20	WELL DIAMETER (cm): 5	SCREEN SLOT #: 10 SAND TYPE: 2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON | GRAB

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	CSV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		FILL very dense, brown, moist sandy silt trace clay, trace organics	0	86.5	50/125	17 4	1		100				Bentonite 50 mm monitoring well was installed and the water level measured on November 24, 2023: 3.52 mbgs
		Bedrock Cored to depth of 4.57 m.	0.5										
		TCR(1) = 100% RQD(1) = 32%	1	86			R1						
			1.5	85.5									
			2	85									
		TCR(2) = 100% RQD(2) = 79%	2.5	84.5			R2						Sand Screen + Sand
			3	84									
			3.5	83.5									
		TCR(3) = 100% RQD(3) = 72%	4	83			R3						
			4.5	82.5									
		END OF BOREHOLE											END OF BOREHOLE: 4.57 mbgs ELEV.(m) = 82.3

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CLIENT: Rohit Communities	PROJECT NO.: CO947.00	**RECORD OF: BH/MW6-1**
ADDRESS: Wateridge Village / Hemlock Road Area	STATION:	
CITY/PROVINCE: Ottawa, ON	NORTHING (m): 5033727.08	EASTING (m): 450070.46 ELEV. (m) 82.82
CONTRACTOR: George Downing Estate Drilling Ltd	METHOD:	
BOREHOLE DIAMETER (cm): 20	WELL DIAMETER (cm): 5	SCREEN SLOT #: 10 SAND TYPE: 2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON | GRAB

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) / N-VALUE (Blows/300mm)	WATER CONTENT (%) PL W.C. LL	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	CSV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		FILL stiff, grey, moist sandy silty clay, trace gravel & organics ---- Gr=8.7%,Sa=21.5%,Si=26.6%,Cl=43.2%.	0 0.5	82.5	12	20.7 16.8	1A 1B		50				Bentonite 50 mm monitoring well was installed and the water level measured on November 24, 2023: 4.30 mbgs
		very dense, light brown, moist SILTY GRAVELLY SAND trace to some clay, rock pieces ---- Gr=29.2%, Sa=37.5%, Si=23.5%, Cl=9.8%.	1 1.5 2	82 81.5 81	53 50/125	10.7 11.5	2 3		40 100				
		Bedrock Cored to depth of 4.67 m. TCR(1) = 100% RQD(1) = 15% TCR(2) = 100% RQD(2) = 45%	2.5 3 3.5 4 4.5	80.5 80 79.5 79 78.5			R1 R2						Sand Screen + Sand
		END OF BOREHOLE											END OF BOREHOLE: 4.67 mbgs ELEV.(m) = 78.1

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LOGGED BY: UB	DRILLING DATE: 10-11-2023
INPUT BY: RR	MONITORING DATE:
REVIEWED BY: TY	PAGE 1 OF 1

CLIENT: Rohit Communities	PROJECT NO.: CO947.00	**RECORD OF:**
ADDRESS: Wateridge Village / Hemlock Road Area	STATION:	**BH6-2**
CITY/PROVINCE: Ottawa, ON	NORTHING (m): 5033694.44	EASTING (m): 450105.97 ELEV. (m) 84.19
CONTRACTOR: George Downing Estate Drilling Ltd	METHOD:	
BOREHOLE DIAMETER (cm):	WELL DIAMETER (cm):	SCREEN SLOT #: SAND TYPE: SEALANT TYPE:

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON | GRAB

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	CSV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		FILL compact to dense, grey, moist sandy silty clay trace gravel, trace oxidation	0	84	▲ 30	■ 8.0 2.7	1A		50				
		Bedrock Cored to depth of 1.15 m.	0.5 1	83.5			1B 2						
		END OF BOREHOLE											END OF BOREHOLE: 1.15 mbgs ELEV.(m) = 83.0

TERRAPEX

LOGGED BY: UB	DRILLING DATE: 10-11-2023
INPUT BY: RR	MONITORING DATE:
REVIEWED BY: TY	PAGE 1 OF 1

CLIENT: Rohit Communities	PROJECT NO.: CO947.00	**RECORD OF:**
ADDRESS: Wateridge Village / Hemlock Road Area	STATION:	**BH/MW6-3**
CITY/PROVINCE: Ottawa, ON	NORTHING (m): 5033677.45	EASTING (m): 450119.58 ELEV. (m) 85.70
CONTRACTOR: George Downing Estate Drilling Ltd	METHOD:	
BOREHOLE DIAMETER (cm):	WELL DIAMETER (cm):	SCREEN SLOT #: SAND TYPE: SEALANT TYPE:

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON | GRAB

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	CSV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		FILL very stiff, brown, moist silty clay some gravel, some sand	-1 to 0.5	86.5 to 86	22	24.8	1		50				
		Bedrock Cored to depth of 3.50 m. TCR(1) = 100% RQD(1) = 16% TCR(2) = 100% RQD(2) = 30%	0.5 to 4.5	85.5 to 81.5			R1 R2						
		END OF BOREHOLE											END OF BOREHOLE: 4.64 mbgs ELEV.(m) = 81.0

TERRAPEX

LOGGED BY: UB	DRILLING DATE: 09-11-2023
INPUT BY: RR	MONITORING DATE:
REVIEWED BY: TY	PAGE 1 OF 1

CLIENT: Rohit Communities		PROJECT NO.: CO947.00	**RECORD OF: BH6-4**
ADDRESS: Wateridge Village / Hemlock Road Area		STATION:	
CITY/PROVINCE: Ottawa, ON	NORTHING (m): 5033626.16	EASTING (m): 450118.00	ELEV. (m) 87.36
CONTRACTOR: George Downing Estate Drilling Ltd		METHOD:	
BOREHOLE DIAMETER (cm):	WELL DIAMETER (cm):	SCREEN SLOT #:	SAND TYPE: / SEALANT TYPE:

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON | GRAB

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	CSV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		FILL soft to firm, grey, moist silty clay trace gravel, trace sand, trace organics --- Gr=6.0%, Sa=7.8%, Si=25.4%, Cl=60.8%. LL=58.3%, PI=28.	0 0.5 1 1.5	87 86.5 86	7 6	29.4 32.1	1 2		42 33				
		--- stiff	2 2.5	85.5 85	4 11	34.9 38.1	3 4		50 50				
		END OF BOREHOLE											END OF BOREHOLE: 2.77 mbgs ELEV.(m) = 84.6

TERRAPEX

LOGGED BY: UB	DRILLING DATE: 10-11-2023
INPUT BY: RR	MONITORING DATE:
REVIEWED BY: TY	PAGE 1 OF 1

CLIENT: Rohit Communities		PROJECT NO.: CO947.00	**RECORD OF: BH6-5**
ADDRESS: Wateridge Village / Hemlock Road Area		STATION:	
CITY/PROVINCE: Ottawa, ON	NORTHING (m): 5033612.15	EASTING (m): 450146.62	ELEV. (m) 87.34
CONTRACTOR: George Downing Estate Drilling Ltd		METHOD:	
BOREHOLE DIAMETER (cm):	WELL DIAMETER (cm):	SCREEN SLOT #:	SAND TYPE: / SEALANT TYPE:

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON | GRAB

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	CSV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		FILL soft, grey, moist silty clay trace gravel, trace sand, trace organics ---- Gr=7.3%, Sa=7.5%, Si=24.6%, Cl=60.6%. ---- stiff	0 0.5 1 1.5 2 2.5	87 86.5 86 85.5 85 84.5	3 2 2 13	32.8 34.6 32.9 30.5	1 2 3 4		58 42 50 100				
		Bedrock Core to depth of 2.97 m. END OF BOREHOLE											END OF BOREHOLE: 2.97 mbgs ELEV.(m) = 84.5

TERRAPEX

LOGGED BY: UB	DRILLING DATE: 10-11-2023
INPUT BY: RR	MONITORING DATE:
REVIEWED BY: TY	PAGE 1 OF 1

CLIENT: Rohit Communities	PROJECT NO.: CO947.00	**RECORD OF:**
ADDRESS: Wateridge Village / Hemlock Road Area	STATION:	**BH/MW6-6**
CITY/PROVINCE: Ottawa, ON	NORTHING (m): 5033580.10	EASTING (m): 450125.25 ELEV. (m) 85.87
CONTRACTOR: George Downing Estate Drilling Ltd	METHOD:	
BOREHOLE DIAMETER (cm): 20	WELL DIAMETER (cm): 5	SCREEN SLOT #: 10 SAND TYPE: 2 SEALANT TYPE: Bentonite

SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON | GRAB

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	CSV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		FILL loose, grey, moist sandy silt some gravel, some clay, trace organics	0	85.5	8	20.4	1		58			Bentonite	
			0.5										50 mm monitoring well was installed and the water level measured on November 24, 2023: 3.67 mbgs
			1	85	5	18.1	2		42				
		---- Gr=17.8%, Sa=33.2%, Si=36.3%, Cl=12.7%.	1.5	84.5									
		---- rock pieces	2	84	8	12.8	3		50				
		Bedrock Cored to depth of 4.64 m.	2.5	83.5									
		TCR(1) = 100% RQD(1) = 84%	3	83			R1					Sand	
			3.5	82.5								Screen + Sand	
		TCR(2) = 100% RQD(2) = 74%	4	82			R2						
		END OF BOREHOLE	4.5	81.5									END OF BOREHOLE: 4.64 mbgs ELEV.(m) = 81.2

TERRAPEX

LOGGED BY: UB	DRILLING DATE: 10-11-2023
INPUT BY: RR	MONITORING DATE: 24-11-2023
REVIEWED BY: TY	PAGE 1 OF 1

CLIENT: Rohit Communities	PROJECT NO.: CO947.00	**RECORD OF: BH6-7**
ADDRESS: Wateridge Village / Hemlock Road Area	STATION:	
CITY/PROVINCE: Ottawa, ON	NORTHING (m): 5033564.86	EASTING (m): 450163.18 ELEV. (m) 86.75
CONTRACTOR: George Downing Estate Drilling Ltd	METHOD:	
BOREHOLE DIAMETER (cm):	WELL DIAMETER (cm):	SCREEN SLOT #: SAND TYPE: SEALANT TYPE:

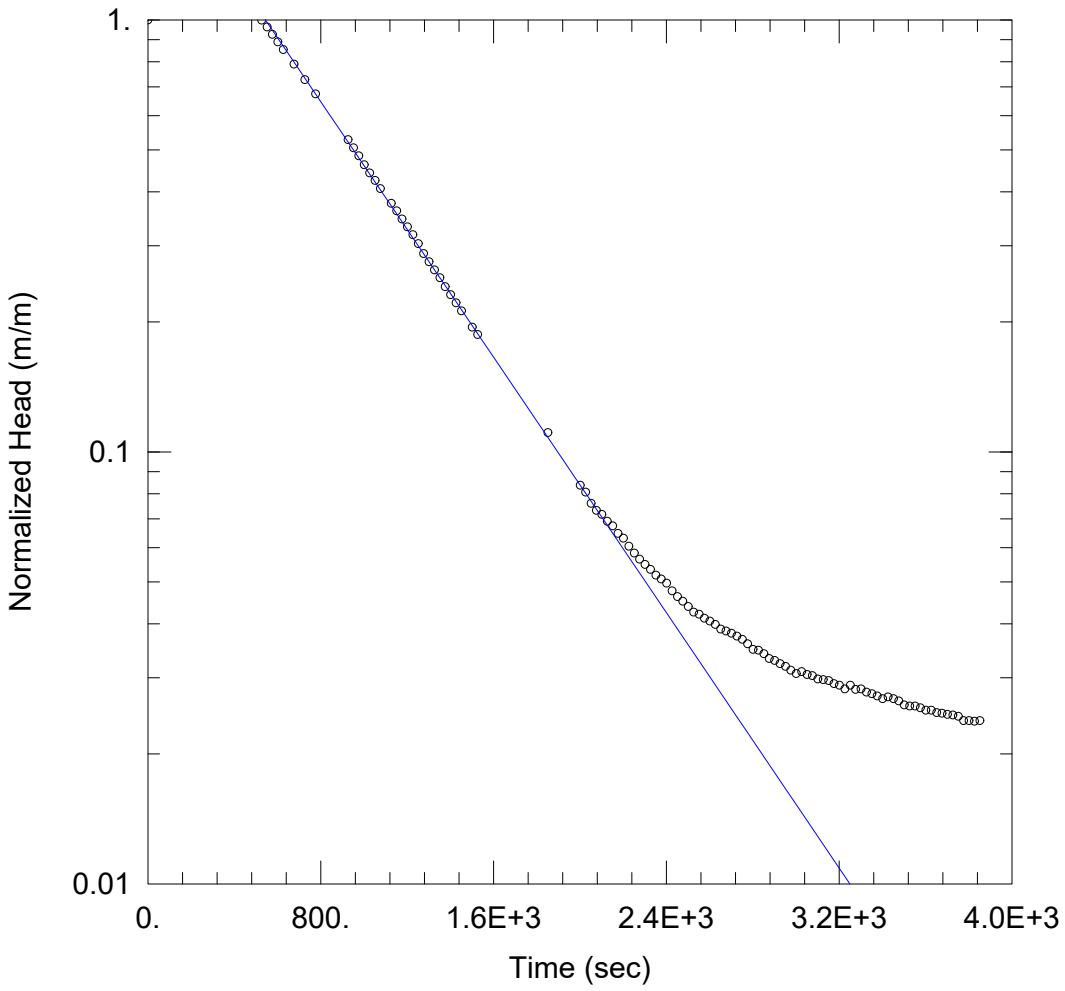
SAMPLE TYPE: AUGER | DRIVEN | CORING | DYNAMIC CONE | SHELBY | SPLIT SPOON | GRAB

GWL (m)	SOIL SYMBOL	SOIL DESCRIPTION	DEPTH (m)	ELEVATION (m)	SHEAR STRENGTH (kPa) 40 80 120 160 / N-VALUE (Blows/300mm) 20 40 60 80	WATER CONTENT (%) PL W.C. LL 20 40 60 80	SAMPLE NO.	SAMPLE TYPE	RECOVERY (%)	CSV/TOV (ppm or %LEL)	LABORATORY TESTING	WELL INSTALLATION	REMARKS
		FILL very dense, brown, moist sand and gravel some silt, trace clay	0 0.5 1 1.5	86.5 86 85.5 85	N-VALUE: 50	PL: 19.4	1		100				
		Bedrock Cored to depth of 1.80 m. END OF BOREHOLE			N-VALUE: 50/125	PL: 8.9	2		42				END OF BOREHOLE: 1.80 mbgs ELEV.(m) = 84.9

TERRAPEX

LOGGED BY: UB	DRILLING DATE: 08-11-2023
INPUT BY: RR	MONITORING DATE:
REVIEWED BY: TY	PAGE 1 OF 1

APPENDIX II
Hydrological Analyses



WELL TEST ANALYSIS

Data Set: C:\...\MW4_1_CO947.02.aqt
Date: 08/14/24 Time: 14:16:50

PROJECT INFORMATION

Company: Terrapex Environmental Limited
Client: Rohit Communities
Project: CO947.02
Location: Wateridge Village
Test Well: MW4-1
Test Date: July 23, 2024

AQUIFER DATA

Saturated Thickness: 0.996 m Anisotropy Ratio (Kz/Kr): 1.

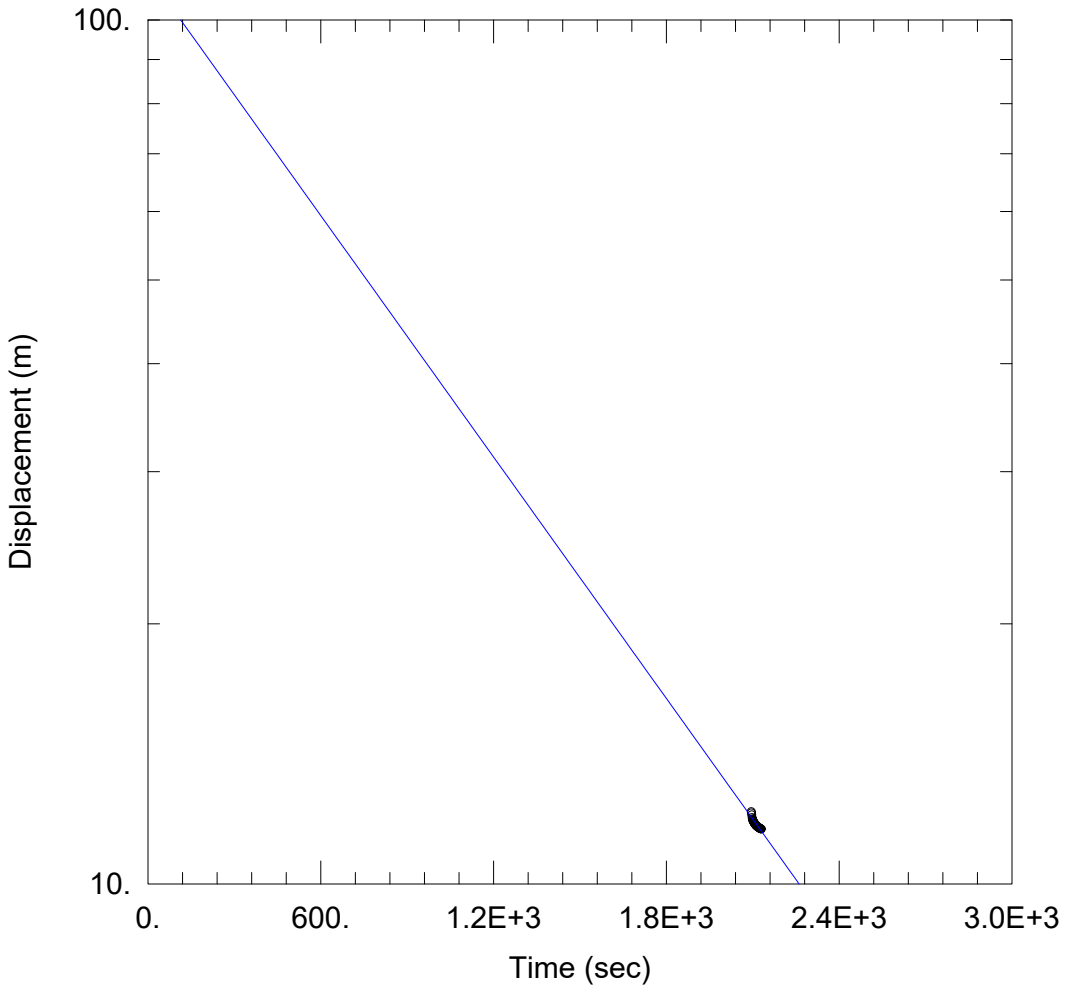
WELL DATA (MW4-1)

Initial Displacement: 1.252 m
Total Well Penetration Depth: 3.36 m
Casing Radius: 0.026 m
Static Water Column Height: 0.996 m
Screen Length: 0.996 m
Well Radius: 0.033 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.904E-6 m/sec y0 = 3.159 m



WELL TEST ANALYSIS

Data Set: C:\...\MW5_2_CO947.02.aqt
Date: 08/14/24 Time: 13:05:18

PROJECT INFORMATION

Company: Terrapex Environmental Limited
Client: Rohit Communities
Project: CO947.02
Location: Wateridge Village
Test Well: MW5-2
Test Date: July 23, 2024

AQUIFER DATA

Saturated Thickness: 1.007 m Anisotropy Ratio (Kz/Kr): 1.

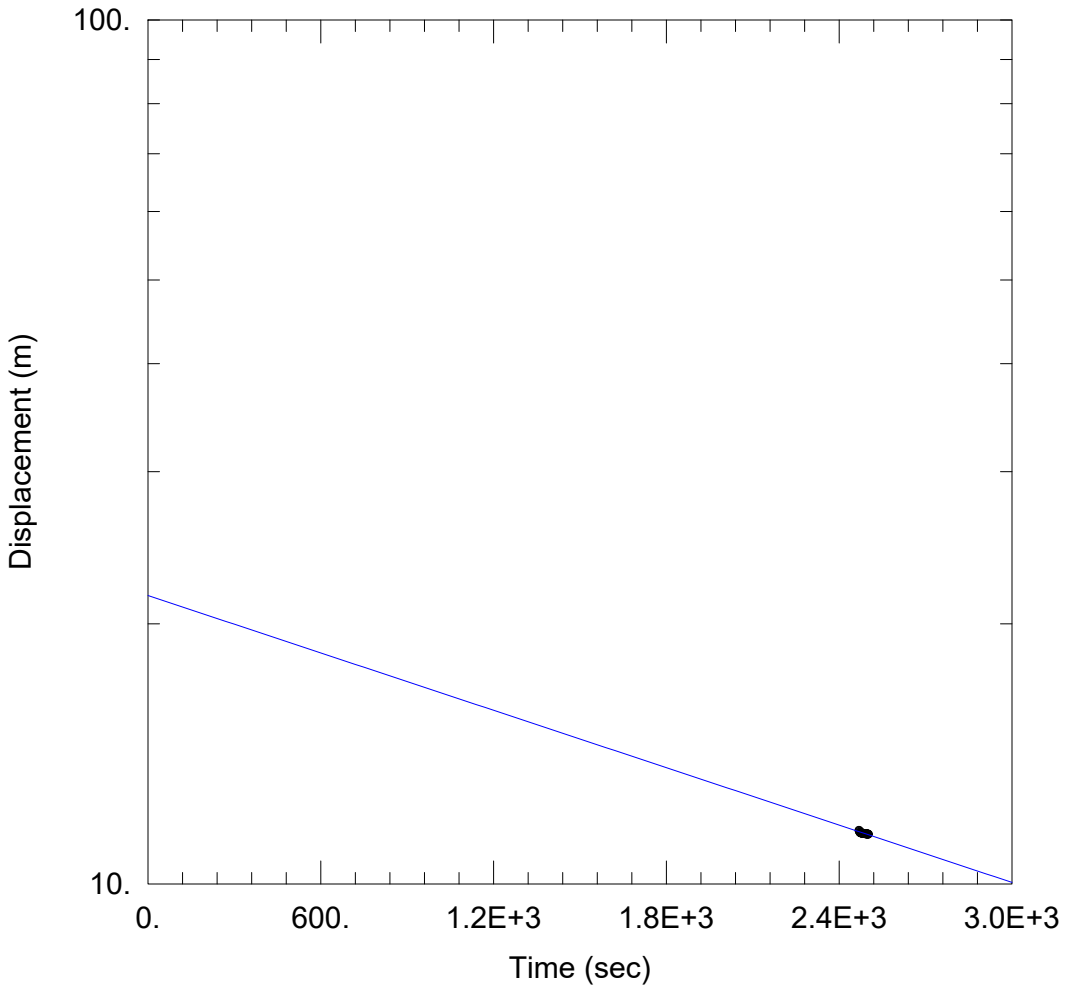
WELL DATA (MW5-2)

Initial Displacement: 0.9199 m
Total Well Penetration Depth: 1.87 m
Casing Radius: 0.026 m
Static Water Column Height: 1.007 m
Screen Length: 1.87 m
Well Radius: 0.033 m

SOLUTION

Aquifer Model: Unconfined Solution Method: Bouwer-Rice

K = 1.066E-6 m/sec y0 = 113. m



WELL TEST ANALYSIS

Data Set: C:\...\MW6_1_CO947.02.aqt
Date: 08/14/24 Time: 14:17:49

PROJECT INFORMATION

Company: Terrapex Environmental Limited
Client: Rohit Communities
Project: CO947.02
Location: Wateridge Village
Test Well: MW6-1
Test Date: July 23, 2024

AQUIFER DATA

Saturated Thickness: 0.595 m Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW6-1)

Initial Displacement: 0.1683 m
Total Well Penetration Depth: 1.9 m
Casing Radius: 0.026 m
Static Water Column Height: 0.595 m
Screen Length: 1.9 m
Well Radius: 0.033 m

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 4.021E-7 m/sec
y0 = 21.57 m

APPENDIX III Appended Assessments

130 SPINDRIFT CIRCLE
OTTAWA, ONTARIO
K4M 0G4
P. (613) 838-4666
C. (613) 791-9222
OFFICE@M-ROC.CA

PPV Assessment R1
Wateridge
Block 4, 5, & 6

Submitted by:
M-Roc Ltd
130 Spindrift Circle
Ottawa, Ontario
K4M 0G4
Phone: 613-791-9222
Jeff.corace@m-roc.ca
Contact: Jeff Corace, P.Eng

Submission Date:
November 26, 2024

130 SPINDRIFT CIRCLE
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BLAST PLAN
70 Richmond Road – Development Project

Scope of Work:

The following is a brief commentary on the predicted PPV levels expected to be encountered as part of the Wateridge Block 5, 6, & 7 development.

We have looked at the PPV levels predicted at 100m, 200m and 400m from the epicentre of the project, and have used the following expected rock depths.

Block 4 – Max of 2.0m Rock Cut – Max Charge weight of 5kg
Block 5 – Max of 2.5m Rock Cut – Max Charge weight of 6.5kg
Block 6 – Max of 3.5m Rock Cut – Max Charge weight of 11.5kg

Vibration Limits:

Blasting will be performed in compliance to City of Ottawa SP-F1201 as shown below.

Element	Frequency Hz	Peak Particle Velocity (PPV) mm/s
Structures and Pipelines	≤ 40	20
	> 40	50
Concrete and Grout < 72 hours from placement	N/A	10

Figure 1- F-1201 Vibration Limits

High frequency vibrations (Hz>40) are expected to be the guiding limit on this project due to the close proximity of the sensitive structures. Low total weight of explosives will contain sufficient high frequency energy to break the rock locally but will dissipate very quickly with distance. Typically, low frequency vibration occurs at greater distances and will largely not be the limiting factor for surrounding structures. Blasting will strive to be below both high frequency and low frequency vibration limits.

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Vibration Prediction

Peak Particle Velocity (PPV) values may be approximated using the following propagation formula:

$$PPV = k\left(\frac{R}{\sqrt{W}}\right)^{-e}$$

where:

k = 1730 (upper limit with heavy confinement)
e = -1.85 attenuation rate (typical for City of Ottawa)
W = charge weight/delay of powder (kg)
R = distance to blast (m)

Table 1 – Predicted PPV per Block

Block	Distance (m)	PPV (mm/s)
4	100	1.53
4	200	0.42
4	400	0.12
4	500	0.03
5	100	1.95
5	200	0.54
5	400	0.15
5	500	0.03
6	100	3.31
6	200	0.92
6	400	0.25
6	500	0.06

Conclusion:

We trust that the above satisfies the request for information regarding PPV assessment. However, should any additional information be required please do not hesitate to contact the undersigned at your convenience.

Jeff Corace, P.Eng.
M-Roc Ltd
Drilling and Blasting

Wsateridge Block 5 and 6

PPV Assessment vs Distance from Epicentre

Table 1 – Predicted PPV per Block		
Block	Distance (m)	PPV (mm/s)
4	100	1.53
4	200	0.42
4	400	0.12
4	500	0.03
5	100	1.95
5	200	0.54
5	400	0.15
5	500	0.03
6	100	3.31
6	200	0.92
6	400	0.25
6	500	0.06

Legend

- Block 4 - 100m
- Block 4 - 200m
- Block 4 - 400m
- Block 4 - 500m
- Block 5 - 100m
- Block 5 - 200m
- Block 5 - 400m
- Block 5 - 500m
- Block 6 - 100m
- Block 6 - 200m
- Block 6 - 400m
- Block 6 - 500m

Google Earth

200 m

N