

December 20, 2021

Rob Stovel  
Stovel and Associates Inc.  
651 Orangeville Road  
Fergus, Ontario  
N1M 1T9

sent via email to: stovel.associates@sympatico.ca

Dear Mr. Stovel:

**RE: Audrey Meadows Subdivision  
Nitrate Impact Analysis and Water Supply Assessment**

As requested, we are providing a nitrate impact analysis and water supply assessment for the proposed 22 lot infill development associated with the Audrey Meadows Subdivision. The overall development area is within Lot 17, 18 & 19, Concession 8, Township of Puslinch, Wellington County. The proposed infill development is within Lots 17 and 18. The existing development and infill area is shown on **Figure 1** (attached).

The existing Audrey Meadows subdivision consists of 49 residential lots within an approximate 27 hectare (ha) area. Lot sizes vary from approximately 0.36 to 0.62 ha. Residential house construction and occupation began in 2009, and continues to date. Currently there are 45 completed residences, each with an individual water well and tertiary treatment septic system.

The proposed Audrey Meadows infill development consists of 22 residential lots, each with a minimum area of 0.3 hectares (ha), within an overall area of approximately 11.17 ha. Each lot would be serviced with a private well and individual (expected tertiary treatment level) septic system. The proposal includes approximately 3.15 ha designated as open space, including a 0.58 ha stormwater management and infiltration area (Block B).

The nitrate impact analysis and water supply assessment was requested on behalf of the Township of Puslinch by Harden Environmental Services Ltd. (letter dated August 23, 2021, Re: Zoning Bylaw Amendment Application Part Lots 17, 18 Con 8).

**Hydrogeologic Setting**

The proposed development area currently consists of the agricultural fields immediately north of the existing subdivision.

Extensive hydrogeological analysis has been completed for the existing Audrey Meadows subdivision. The current summary is based on a review of available data, including published geological mapping and publically available water well record information, in addition to previous characterization and impact assessments, such as:

- Naylor Engineering Associates Ltd (Naylor), October 2004: *Geotechnical Investigation, Proposed Audrey Meadows Estate Subdivision, Part of Lots 18 and 19 Concession 8, Township of Puslinch, Ontario*;

- Naylor Engineering Associates Ltd (Naylor), October 2004: *Draft Stage 1 Hydrogeology Study, Proposed Audrey Meadows Estate Subdivision, Part of Lots 18 and 19 Concession 8, Township of Puslinch, Ontario*; and,
- Hydrogeology Consulting Services (HCS), April 9, 2021: *2019-2020 Annual Report, Groundwater And Surface Water Monitoring Program, Audrey Meadows Subdivision, Lot 18 & 19, Concession 8, Township of Puslinch, Ontario*.

### Geologic Setting

The study site is located at the southern edge of the Paris Moraine, as defined by available Quaternary (geology) mapping. Surficial soils are described as (Wentworth) Till (stone-poor, sandy silt to silty sand-textured till on Paleozoic terrain).

Extensive drilling and test pitting in 2004 within the existing subdivision confirmed the local overburden consist of: *silt, sand, sand and gravel, and glacial till* (Naylor, 2004). Drilling at 4 locations in 2019 (HCS, 2021) along the perimeter of the current proposed development area reported primarily sand and gravel with some silty clay layers. We anticipate that additional soils information will be collected interior to the proposed development area through additional geotechnical studies that are expected as a result of Draft Plan approval, when that occurs.

Drilling locations and borehole logs (as reported by Naylor, 2004; and, HCS, 2021) are attached for reference in **Appendix A**. Note that several of the original boreholes have been decommissioned by a licenced water well contractor (see well record information). The site drilling results indicate a surficial water table system (varying from sand/gravel to silt and/or silt/sand till) is present within the upper overburden over much of the site.

### Topography and Drainage

According to topographic surveys completed at the site (see Triton Engineering *Existing Elevation Plan*), topography within the subject development area varies from a high of approximately 340.7 to 343.5 metres above sea level (mASL) along a north-south trending knoll/ridge system bisecting the property, to 329.3 mASL near the south corner of the proposed development area.

The stormwater management plan is expected to delineate surface water drainage at the site in detail. However, based on our review of the site topographic contours, most drainage at the site appears to be directed southward, toward the existing development area. Some small portions of the site may have the potential to contribute flow to the woodlot/wetland areas.

Additional stormwater management studies, required as part of Zoning and Draft Plan approval process, will provide a more detailed analysis of overland flow at the site and provide recommendations as needed to maintain both on-site recharge and off-site discharge conditions. We note that the maintenance of site recharge is an expected stormwater management plan target.

According to mapping available from GRCA and the Ministry of Natural Resources and Forestry (MNRF), identified wetlands are reported primarily within wooded areas generally outside of, and northwest, west and southwest of the development area.

According to the site elevation plan, the closest wetland northwest of the site is shown at approximately 333.9 mASL (and higher). The closest wetland areas shown to the west of the site is at approximately 329.2 mASL (and higher). These wetlands are generally associated with a tributary drainage system of

Mill Creek, which is mapped as starts at estimated elevation of approximately 334 mASL northwest of the site and declines to approximately 326 mASL southwest of the site.

A small wetland area occurs at the edge of the farm field (proposed development area), at an elevation of approximately 330.2 mASL (and higher).

Wetlands also occur east, south and west of the existing subdivision (extending northeast of Victoria Road South and southwest to Wellington Road 34). This wetland occurs at reported elevations generally below 322 mASL south of the site. The main branch of Mill Creek flows through this wetland system from northeast to southwest, and occurs at estimated elevations of 322.5 mASL near Victoria Road South, and, 318 mASL near Wellington Road 34.

### Well Record Review

Reported water well records for all 51 properties between the site and Mill Creek (all downgradient properties including the existing 49 lot subdivision, plus single lots at 4550 and 4506 Victoria Road South), were reviewed.

As shown on **Figure 2**, a total of 44 records were correlated to specific addresses using well record location maps, noted subdivision plan lot, or, reported 911 address numbers. Within the subdivision 4 lots have not yet been developed. One lot (80 Old Ruby Lane) corresponds to an original farm house currently used as a site office. The office is supplied by a drilled well (reported to date from the 1960's), however no well record is available. Well records could also not be located for two additional residences (43 Old Ruby Lane, and 91 Old Ruby Lane).

According to the well record information, all of the 44 wells reviewed were completed in the bedrock aquifer at depths between 11.6 and 43.6 m. At almost all locations the predominant overburden material was described as including "clay" (assumed to be representative of Till). Sand and gravel is occasionally noted over bedrock, however at those locations a significant thickness (5.5 m or more) of clay till occurs at surface.

The well records indicate that the bedrock wells are highly productive, with reported pumping rates from 38 to 114 Litres per minute and limited drawdown (maximum reported drawdown 4.3 m however over 90% of wells having less than 1 m drawdown). Calculated specific capacities are all above 12 L/min/m and commonly range above 90 L/min/m.

### Well Water Sampling

Four water quality samples from bedrock wells within the existing subdivision were obtained on October 28, 2021 in order to assess water quality from the bedrock aquifer. The samples were obtained from residential wells at subdivision Lot 1, Lot 10, Lot 21 and Lot 36. General chemistry samples were obtained from a tap bypassing all treatment (generally water softener) and the bacteriological sample (obtained by the homeowner through the standard Health Unit testing program) was taken from a drinking water tap. The laboratory analysis results are attached in **Appendix B**. Analysis results have been shared with the respective homeowners.

The respective homeowners have shared their individual results, and each sample came back showing zero Total Coliform and zero E.coli (0 UFC/100 mL), indicating the water is safe to drink.

We note that samples at Lot 1 and Lot 10 represent locations upgradient of the existing subdivision and downgradient of the proposed subdivision. Samples at Lot 21 and 36 represent locations downgradient of existing developed areas. As shown by the analysis results, as compared to the parameters tested the

bedrock aquifer produces relatively hard water that meets Ontario drinking water criteria. Very slightly elevated sodium levels (26.1 and 23.9 mg/L) are noted at two wells.

We note that the nitrate concentrations observed were very low (0.7, 1.0, 1.2 and 0.2 mg/L), indicating existing septic system use and agricultural loading has not resulted in any observable impact within the bedrock aquifer. This is supported by the bacteriological sampling results. While agricultural loading and concentrations at the water table may vary according to seasonal application of fertilizer, septic system loading can be expected to remain relatively constant from season to season, therefore impacts within deeper flow systems, if they occur, would be expected to be relatively consistent over time.

### Hydrogeologic Setting

In order to illustrate the setting two cross-sections have been developed across the proposed development, and extending to the adjacent subdivision and natural environment areas. The section locations are shown on **Figure 2**. The sections are included as **Figure 3** and **Figure 4**. The sections illustrate the topography, overburden thickness and depth to bedrock, thickness of the till unit as present, and the interpreted upper water table system. As shown, Mill Creek north of the site appears to be a losing stream (enhanced recharge area), and groundwater discharge can be expected at the creek south of the existing subdivision.

The water table elevation and groundwater flow direction has been characterized as generally north to south across the property (HCS, 2021, see **Appendix A**). Shallow groundwater flow is generally from the creek/wetland system north of the site toward the existing subdivision south of the site. The reported groundwater elevations and flow direction indicates the northern creek/wetland system is a losing feature which provides a groundwater recharge function. Groundwater discharge is expected at surface water features (e.g. Mill Creek) south of the existing subdivision.

Based on the reported site characteristics the subject development will have a groundwater recharge function, supporting the southward shallow groundwater flow system that moves below the existing subdivision and toward distance surface water features. There does not appear to be any groundwater contribution from the proposed development area toward the adjacent surface water features to the north or to the west. Based on a preliminary review of the reported site topography there may be some potential surface water runoff from the site to the woodlot/wetlands.

GRCA online mapping indicates the annual recharge rate at the site is on the order of 357 mm/yr, which is considered reasonable given the surficial soils, vegetative cover and topographic slope. GRCA indicates annual runoff volumes of 0 mm/yr, which is likely a low estimate.

The annual groundwater monitoring program (HCS, 2021) provides September 2019 and September 2020 water quality sampling results at BH03-19 and BH04-19, located on the southeast edge of the subject development area. A summary of the results is included in **Appendix A**.

The recent reported nitrate concentrations within the water table system below the farm fields (proposed development area) range from approximately 6 to 7 mg/L at BH03-09, to 7 to 8 mg/L at BH04-19. Based on the monitor location and land use, the elevated nitrates are likely a result of agricultural fertilizer use on the farm fields. Sampling completed at the south (downgradient) edge of the existing subdivision area reports nitrate concentrations of approximately 3.6 mg/L at BH01-19 and <0.1 mg/L at BH02-19, indicating that the residential development has decreased nitrate loading at the site, and, that natural recharge significantly dilutes nitrate concentrations across the site.

Surface water sampling of Mill Creek also occurs upstream and downstream of the Audrey Meadows development area. Observed nitrate concentrations are low at the creek (0.5 mg/L or less). Some



slightly elevated Total Phosphorus (above PWQO limits) are observed at the upstream location, but not at the downstream location. The Total Phosphorus loading at the creek is therefore related to upstream land-use, potentially agricultural inputs.

### **Nitrate Impact Analysis**

Harden states:

*3) A nitrate impact analysis is required. We recommend following MECP Procedure D5-4 to assess density of lots for this development. It must be also shown that wells downgradient of the site will not be impacted by the introduction of septic systems. We require that all private wells between the site and Mill Creek be evaluated for potential impact. The potential connection between the overburden aquifer system and deeper bedrock aquifer should be considered as a potential pathway for effluent.*

MECP Procedure D-5-4 (*Technical Guideline For Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment*, August 1996) indicates that for the proposed Audrey Meadows infill development a 3 step process is appropriate, consisting generally of:

1. Determination of lot size.
2. System isolation identification.
3. Contaminant attenuation (risk) assessment.

We note that this is a risk assessment, and not a predictor of actual nitrate concentrations in the groundwater system. This type of methodology acknowledges that it does not account for all dilution and denitrification processes, and therefore we can consider the method as an approximation that allows for relative risk to be determined. If the nitrate loading calculation has a result of 10 mg/L (drinking water limit) or less, the “risk” of associated environmental impact to groundwater systems associated with the proposed development is considered relatively low.

### **Lot Size**

The proposed 22 residential lots range in size from 0.30 hectares (ha) to 0.77 ha. In addition, two open blocks are proposed within the development area. The total proposed development area is approximately 11.17 ha. A summary is provided in **Table 1**.

Lot #	Size (ha)	Lot #	Size (ha)	Lot #	Size (ha)
1	0.33	9	0.30	17	0.32
2	0.30	10	0.30	18	0.38
3	0.30	11	0.33	19	0.32
4	0.31	12	0.38	20	0.42
5	0.77	13	0.38	21	0.41
6	0.40	14	0.32	22	0.43
7	0.41	15	0.31	Block B	0.58
8	0.30	16	0.30	Block C	2.57
Total:					11.17

**Table 1: Proposed Lot and Block Areas**

### System Isolation

System isolation can be considered in the context of the hydrogeologic setting.

The shallow water table system is the primary “receiver” for septic system impacts. The water table system flows southward, below the existing subdivision, and is expected to discharge to the surface water system.

Overall vertical flow through the till layer to the bedrock system will be limited due to the geologic setting. The till sequence will promote horizontal flow within any shallow (water table) flow systems associated with either sand/gravel or weathered till horizons at, or near surface.

Each house between the proposed development and Mill Creek to the south (e.g. within the existing subdivision and residential lots on Victoria Road South) is reportedly serviced by a bedrock well. Based on the water well information review, the primary water source, and recommended water supply aquifer for this development, is the confined bedrock system. The bedrock aquifer is protected by the overlying till sequence. Therefore the water supply aquifer in use in the area, and proposed to be used at the site, is relatively isolated from septic system impacts.

The private well water quality sampling within the existing subdivision confirms that the bedrock aquifer is relatively isolated from nitrate loading impacts associated with both agricultural loading and local septic system use.

Based on system isolation considerations, and assuming well construction meets applicable provincial regulations and standards, local bedrock water supplies are interpreted to be at relatively low “risk” from septic loading impacts within the overburden system due to the proposed development. However, for completeness a contaminant attenuation assessment is also provided.

### Contaminant Attenuation Assessment

The following nitrate loading calculation (predictive assessment) is provided as part of the risk assessment. It is our understanding that tertiary treatment septic systems are in use within the existing subdivision and are proposed as part of this development. As noted above, the shallow water table system is the primary receptor of septic loading impacts, however consideration is also given to any potential vertical migration to the deeper bedrock aquifer system.

Based on the proposed 22 residential lot subdivision, each with individual tertiary treatment septic systems (1,000 L/day) achieving 10 mg/L nitrate concentration at the septic bed, the daily nitrate loading would be expected to be 220,000 mg/day. Assuming 0.357 m/yr recharge (to be maintained post development) over 11.17 ha, and incorporating septic volumes, total site recharge would be 131,252 L/day. Therefore expected nitrate loading due to the proposed development would result in nitrate concentrations of 1.68 mg/L at the water table.

The resulting nitrate concentration related to the proposed septic systems would be well below 10 mg/L within the shallow water table system, indicating that according to a predictive assessment the proposal satisfies the MECP Procedure D-5-4 septic loading risk assessment criteria. Given that additional dilution and can be expected if groundwater does move vertically to depth, both within the overburden aquitard and due to aquifer flow, potential impact to the bedrock water supply aquifer supplying both existing and planned new wells is also projected to be low.

Procedure D-5-4 also indicates that where existing development has occurred monitoring assessments can be considered. While the current site sampling does not constitute a full seasonal monitoring

assessment, the results do confirm that the existing development does not have a negative impact on either the bedrock water supply aquifer or on the shallow water table flow system between the subdivision and Mill Creek. Overall nitrate concentrations are observed to decrease from the active agricultural area (proposed development) to the existing subdivision. Therefore the same can be expected as land use changes from agricultural to residential within the proposed development.

### **Water Supply Assessment**

Harden states:

*4) We recommend following MECP Procedure D5-5 as a method of confirming that there will be adequate water supply for the development. We recommend a minimum of three water supply wells be installed to confirm that quantity and quality of the underlying aquifer and the potential for interference with existing wells in the area. It may be beneficial to consider drilling wells into the Goat Island or Gasport Formations to limit the potential for shallow system contamination.*

The proposed subdivision area is approximately 11 ha in size. The existing subdivision area, immediately adjacent to the proposed development, is approximately 27 ha, giving a total area of 38 ha. Procedure D-5-5 indicates that for developments up to 15 ha in size 3 test wells be constructed and tested. For developments from 25 to 40 ha in size 5 test wells are recommended.

To date a total of 45 water wells have been successfully constructed, and are in use, within the 38 ha total Audrey Meadows development area. Additional water wells have been constructed, and are in use, in the immediate area (including one at 4550 Victoria Road South). Two bedrock test wells (TW1 and TW2) were constructed at the site and tested in 2005. The wells were pumped at 64 L/min for 1 hour, and, 114 L/min for 6 hours respectively. Measured drawdown at both wells was less than 0.2 m.

Available well records show that the existing wells within the overall Audrey Meadows subdivision have a typical capacity of over 56.8 L/min (with less than 1 m drawdown). Assuming a peak demand rate of 3.75 L/min for each person (as per D-5-5), each well could theoretically support a 15 person household. Typical occupancy rates are expected to be much lower.

The local bedrock aquifer in this area is well known source of good quality water capable of providing adequate water quantity to residences. The site testing completed to date, as part of both the approval process for the existing subdivision and as part of this study has established the water supply capacity within the bedrock aquifer. Mutual interference is not a current issue and is not expected to be an issue in the future based on typical household demand.

Procedure D-5-5 also indicates water quality samples should be obtained from the proposed water supply aquifer to determine the physical, chemical and bacteriological quality of the water. As noted previously, water quality samples were obtained in October 2021 at 4 bedrock wells within the existing subdivision in order to show current water quality. The bedrock aquifer water quality results are considered typical of this area, and no water quality issues are noted.

We recommend that the bedrock aquifer continue to be used for residential water supply at the Audrey Meadows Subdivision. Based on these results, no specific (additional) well construction or water treatment recommendations are made. Any future water wells at the site should be constructed by licenced water well contractors and the construction should meet all applicable standards.

**Potential For Groundwater Impact**

Our June 20, 2021 letter report *RE: Audrey Meadows Subdivision, Wellington County Official Plan – Section 4.9.7 Paris and Galt Moraine Policy Area* examined potential for development related impacts related to the Paris and Galt Moraine Policy Area groundwater protection objectives. The findings of this Nitrate Impact Analysis and Water Supply Assessment support the findings of our June 20<sup>th</sup> report.

To reiterate, based on the development proposal:

- the development is not expected to include significant landform alterations (e.g. the development of the Draft Plan will generally conform to the current site landform);
- construction activities are not expected to directly impinge on the water table or groundwater system (e.g. excavations and foundations will remain above the water table);
- stormwater management targets are expected to include the maintenance of site recharge volumes and distribution (i.e. no significant water balance changes are expected);
- normal individual residential water taking and water return through individual septic systems is not expected to result in any significant water quantity impacts on the overburden or bedrock aquifers (e.g. as per existing developments in the area); and,
- the proposed tertiary treatment septic systems are expected to reduce potential nitrate loading at the site, and therefore maintain or enhance local groundwater quality.

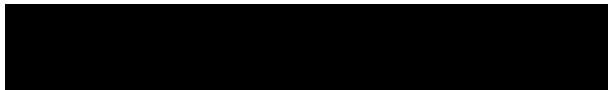
Therefore we can conclude that the proposed development will not significantly alter local groundwater conditions on-site. In addition, we would also not anticipate any potential off-site effects to either the local groundwater systems, or features in the area that rely on groundwater (such as wetlands, creeks, springs, discharge areas, or, private water wells).

**Conclusions**

Based on: the site characteristics; current development proposal; results of this impact assessment; expected implementation of standard development controls; use of tertiary treatment septic systems; and, continued water well construction within the bedrock aquifer by licenced water well contractors according to all applicable standards (including standard separation distances), the proposed development satisfies MECP Procedure D-5-4 and D-5-5 objectives.

If you have any questions, or require further information, please do not hesitate to contact us.

Sincerely,



Andrew Pentney, P.Geo.  
Hydrogeologist






Attached:      Figure 1: Site Location  
                    Figure 2: Well Record Locations  
                    Figure 3: Cross-Section A  
                    Figure 4: Cross-Section B  
                    Appendix A: Borehole Logs and Groundwater Monitoring Program Results  
                    Appendix B: Private Well Water Quality Sample Results





Figure 1:  
Proposed Development  
Site Location

**Legend**

-  Municipal Boundary (GRCA)
-  Watercourse - Local (GRCA)
-  Parcel - Assessment Public (MPAC/MNRF)
-  Waterbody - Local (GRCA)
-  Great Lakes - Local (GRCA)



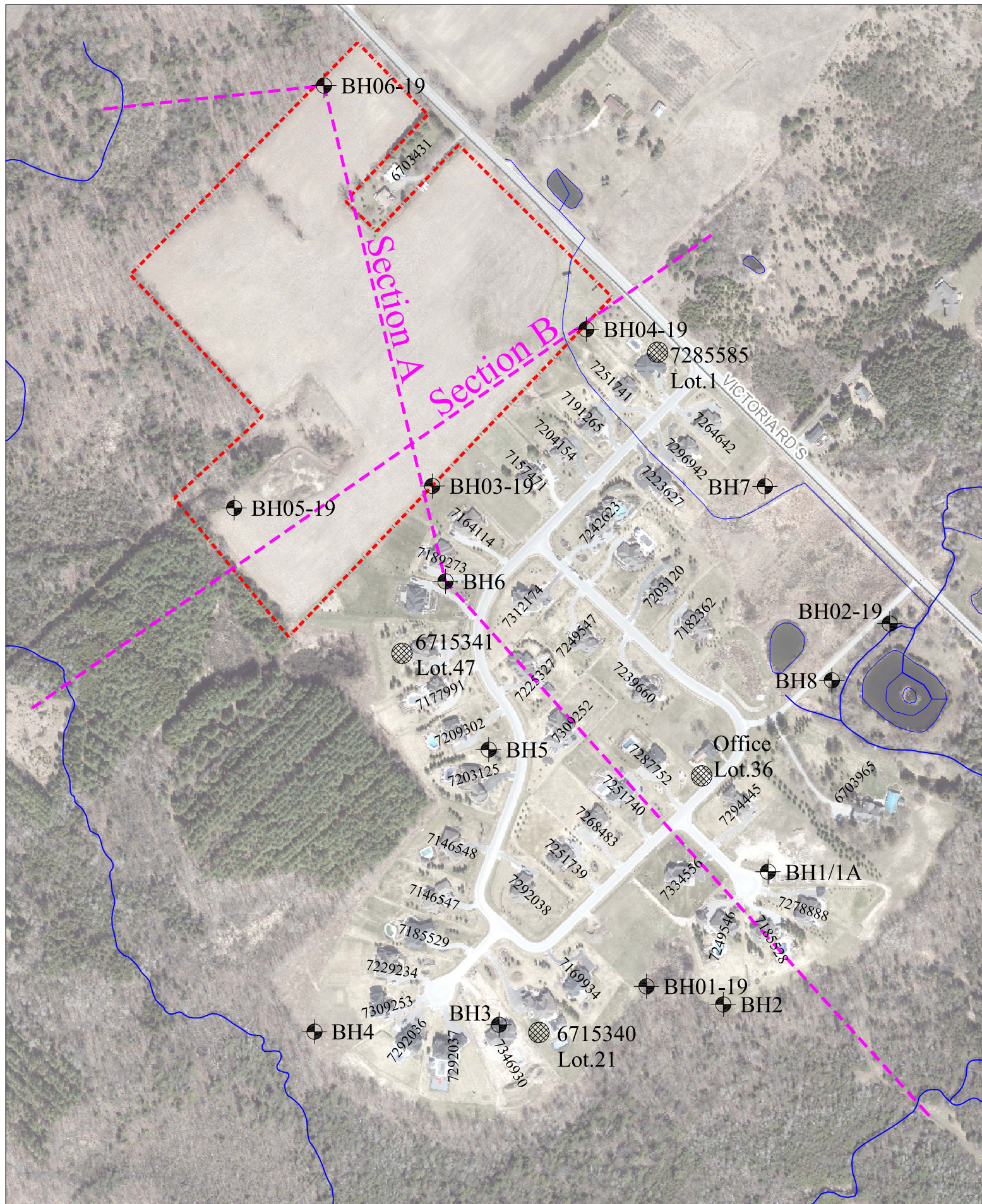
Audrey Meadows  
Nitrate Impact Analysis and  
Water Supply Assessment

Groundwater Science Corp.

Modified From:  
GRCA as noted below

Copyright Grand River Conservation Authority, 2021.  
Disclaimer: This map is for illustrative purposes only. Information contained herein is not a substitute for professional review or a site survey and is subject to change without notice. The Grand River Conservation Authority takes no responsibility for, nor guarantees, the accuracy of the information contained on this map. Any interpretations or conclusions drawn from this map are the sole responsibility of the user.  
The source for each data layer is shown in parentheses in the map legend. For a complete listing of sources and citations go to: <https://maps.grandriver.ca/Sources-and-Citations.pdf>





--- Site (approximate)  
 ● drilling location (approximate)  
 ● water well location confirmed, sample obtained  
 ● well record location matched to lot  
 air photo: GRCA

modified from: OBM mapping, Site Plan  
 UNDER LICENSE, WITHOUT PREJUDICE OR ENDORSEMENT,  
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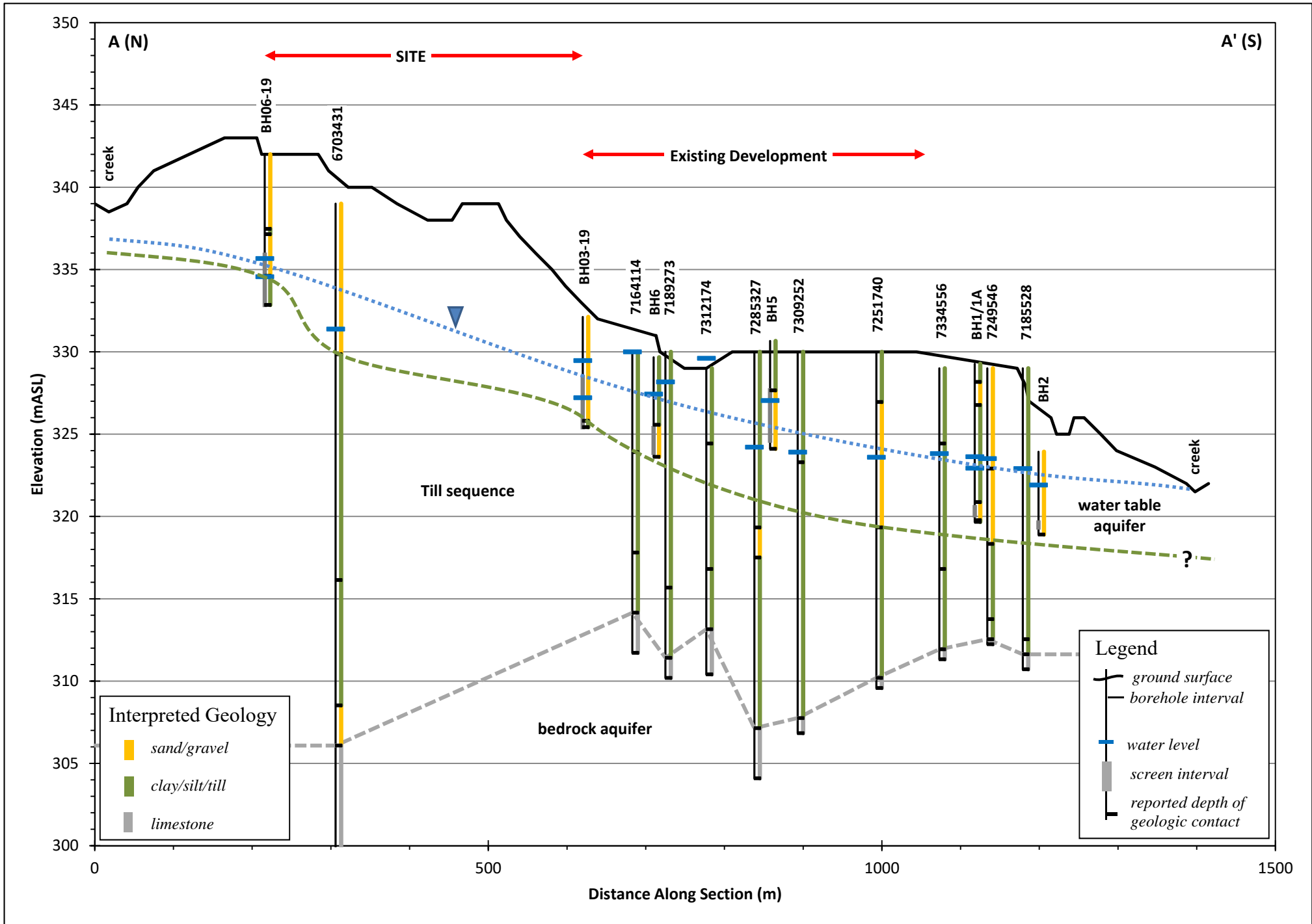
November 2021  
 Scale: as shown

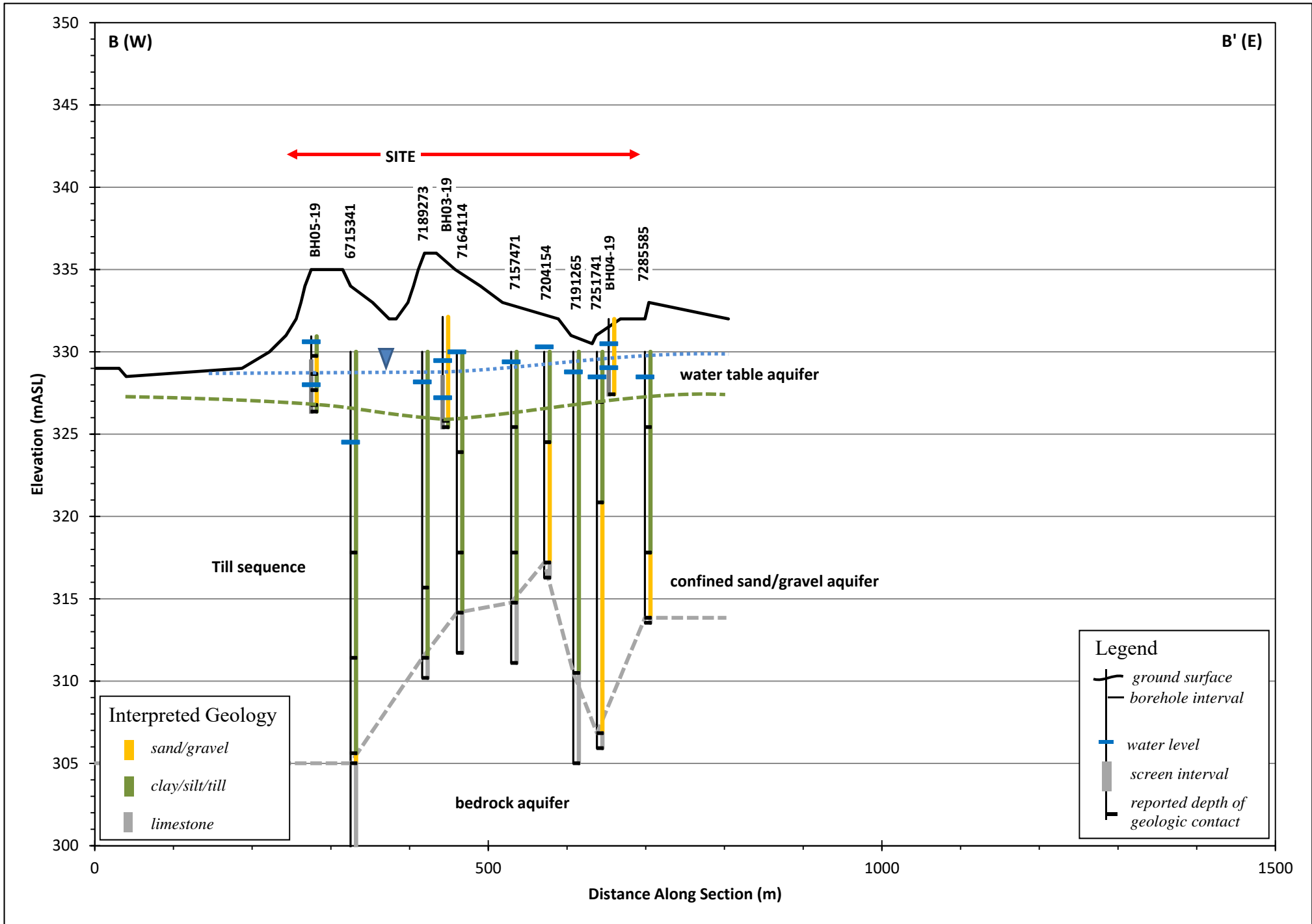
Groundwater  
 Science Corp.

Figure 2: Well Record Locations

Audrey Meadows Development  
 Nitrate Loading and Water Supply









## **Appendix A: Borehole Logs and Groundwater Monitoring Program Results**

Excerpts from:

Naylor Engineering Associates Ltd.

October 19, 2004

*DRAFT Geotechnical Investigation*

*Proposed Audrey Meadows Estate Subdivision*

*Part of Lots 18 and 19, Concession 8*

*Township of Puslinch, Ontario*

Hydrogeology Consulting Services (HCS)

April 9, 2021

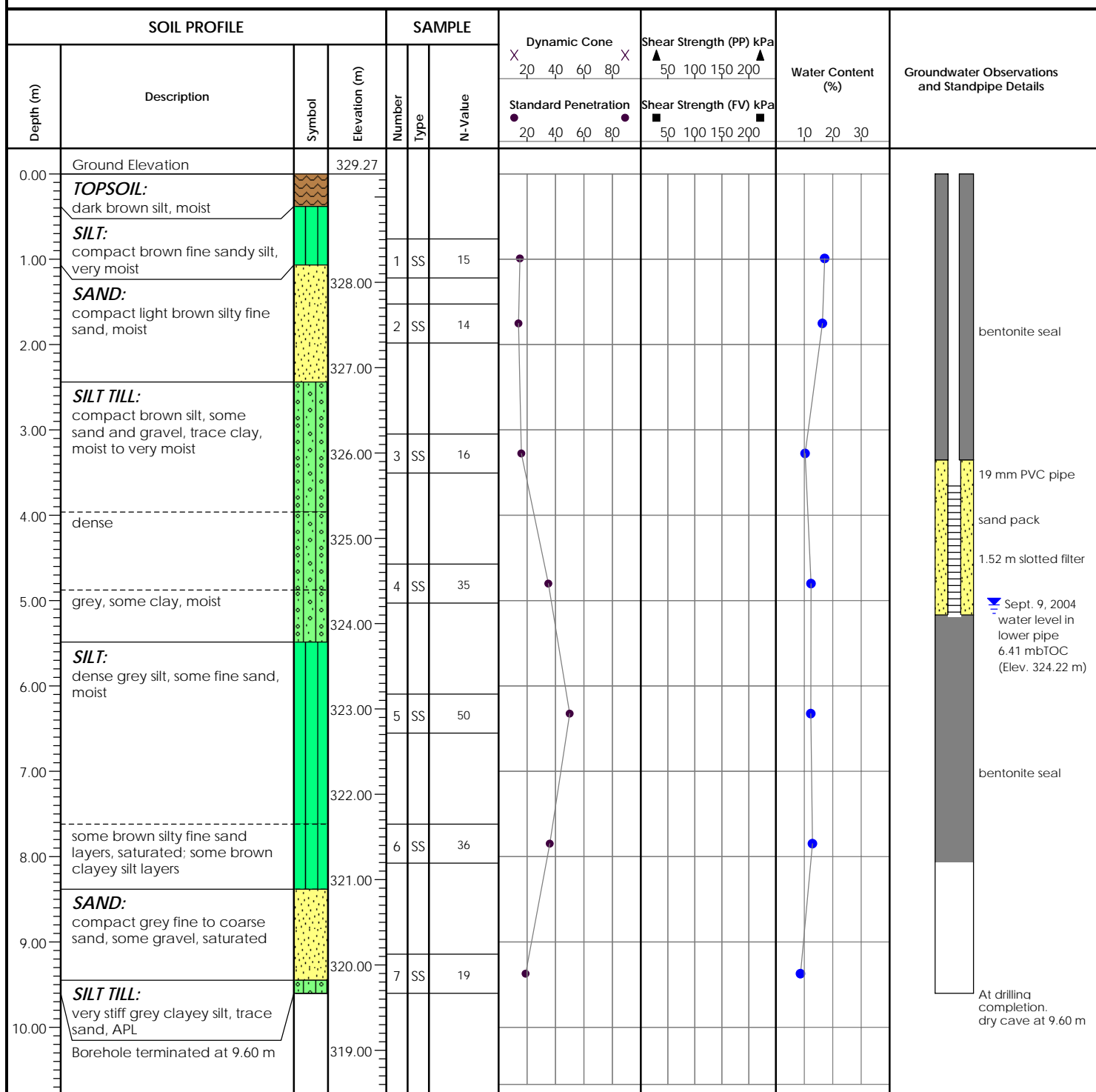
*2019-2020 Annual Report,*

*Groundwater and Surface Water Monitoring Program,*

*Audrey Meadows Subdivision,*

*Lot 18 & 19, Concession 8,*

*Township of Puslinch, Ontario*



**Reviewed by: DK**

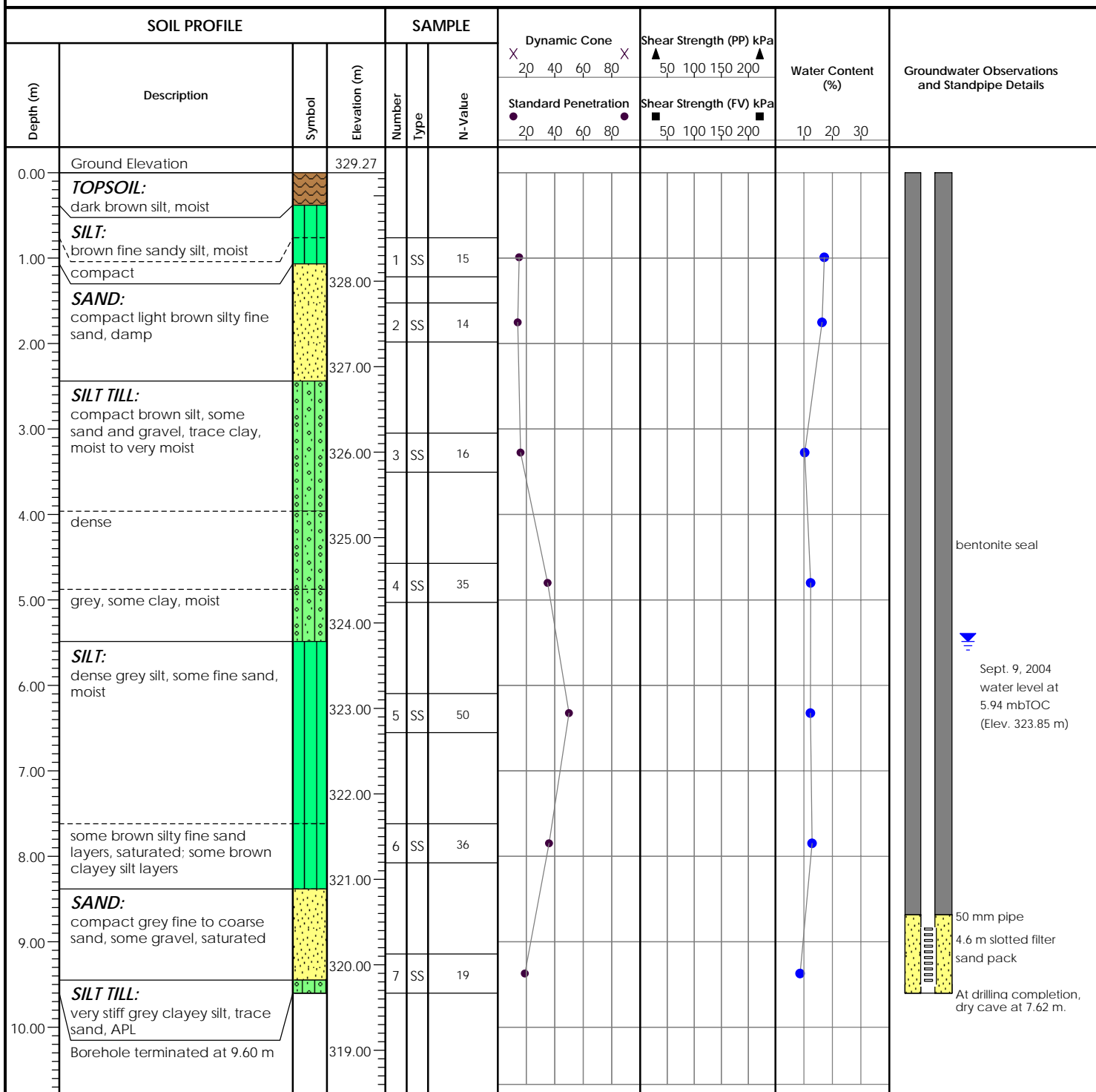
**Field Tech.: RM**

**Drill Method: Hollow Stem Auger**

**Sheet: 1 of 1**

**Notes:**

**Drafted by: DC (01a)**



**Reviewed by: DK**

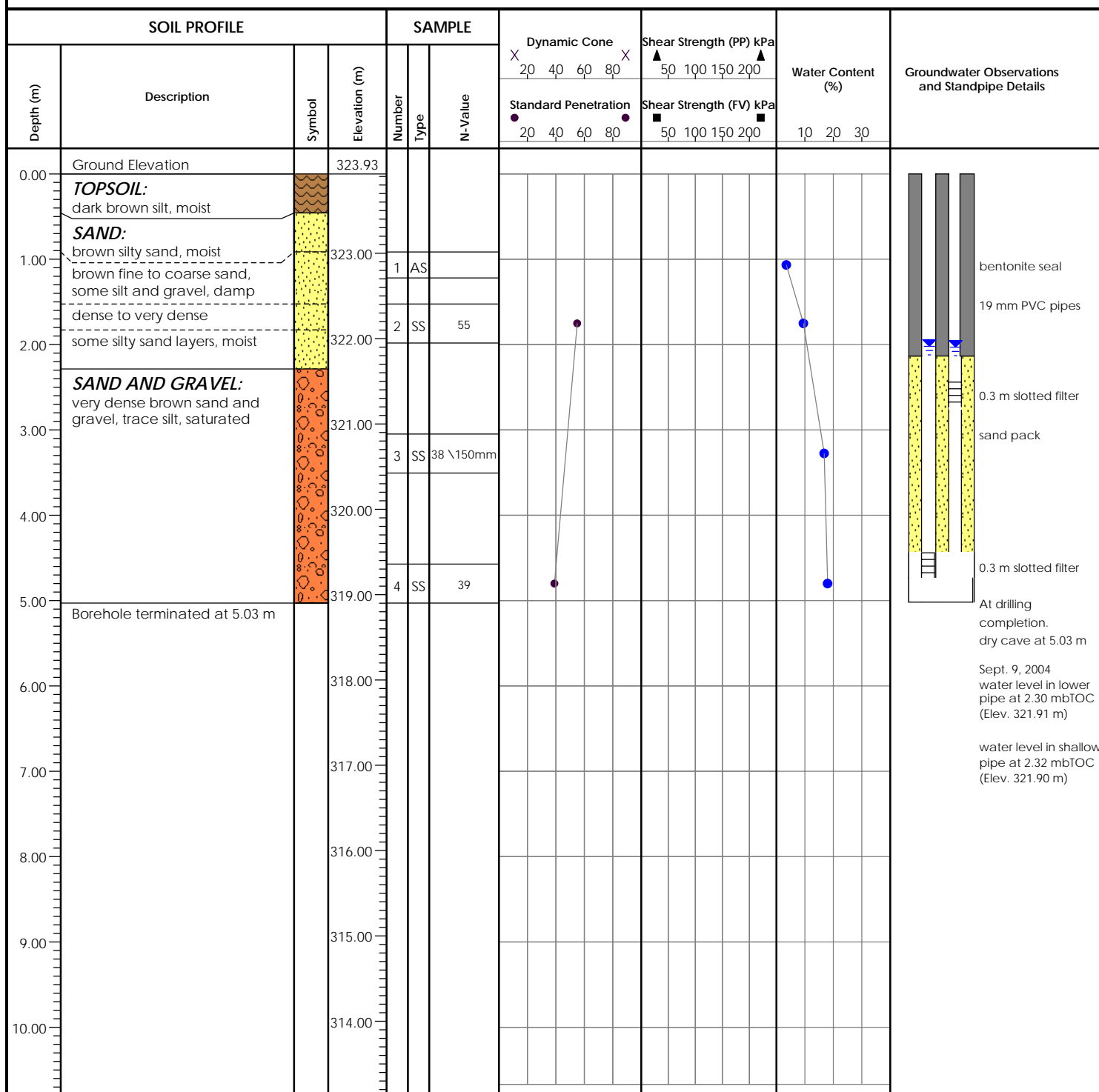
**Field Tech.: RM**

**Drill Method: Hollow Stem Auger**

**Sheet: 1 of 1**

**Notes: Soil profile interpreted from Borehole 1.**

**Drafted by: DC (01a)**



**Reviewed by: DK**

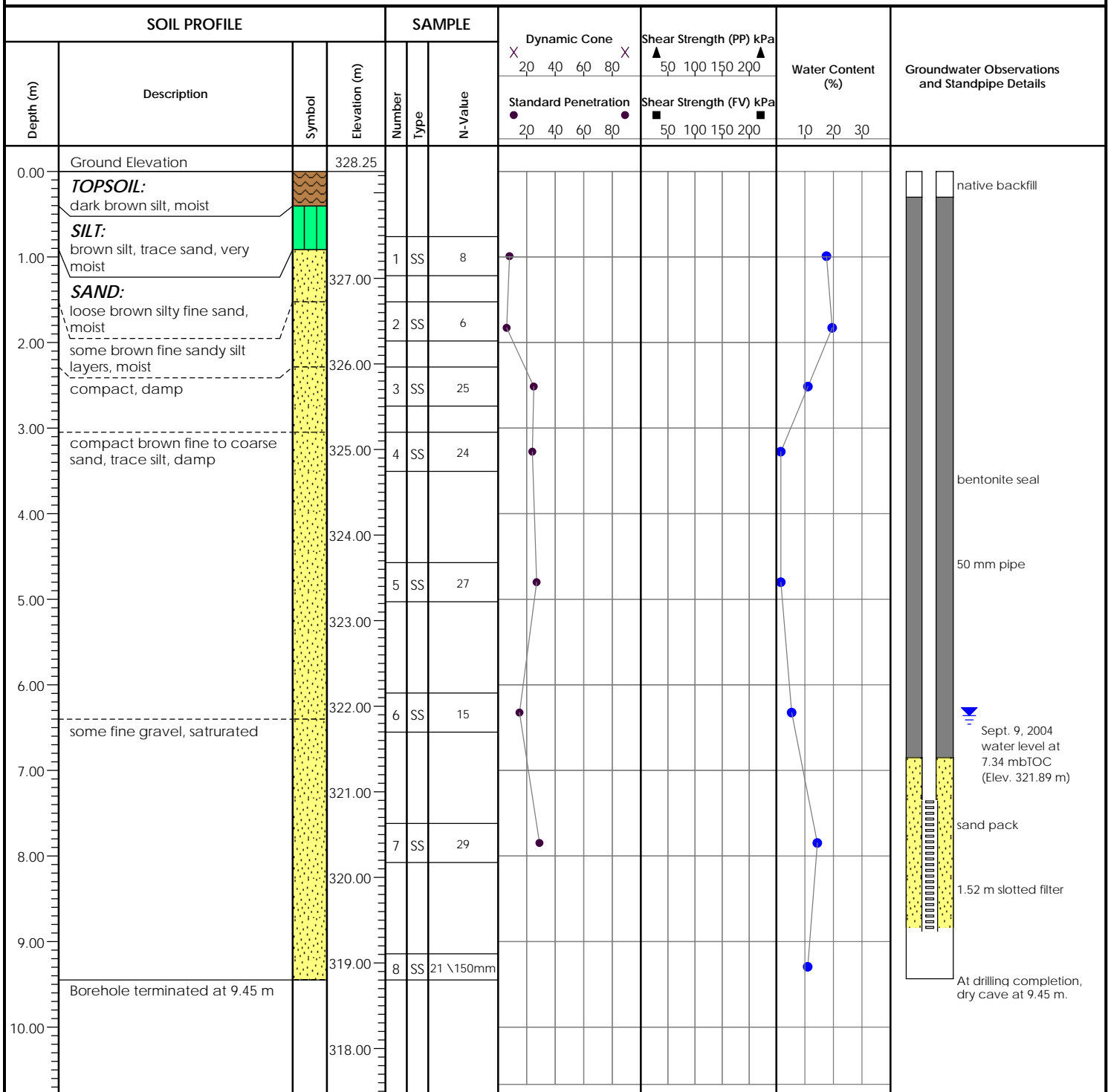
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**Drill Method: Hollow Stem Auger**

**Sheet: 1 of 1**

**Notes:**

**Drafted by: DC (01a)**



**Reviewed by: DK**

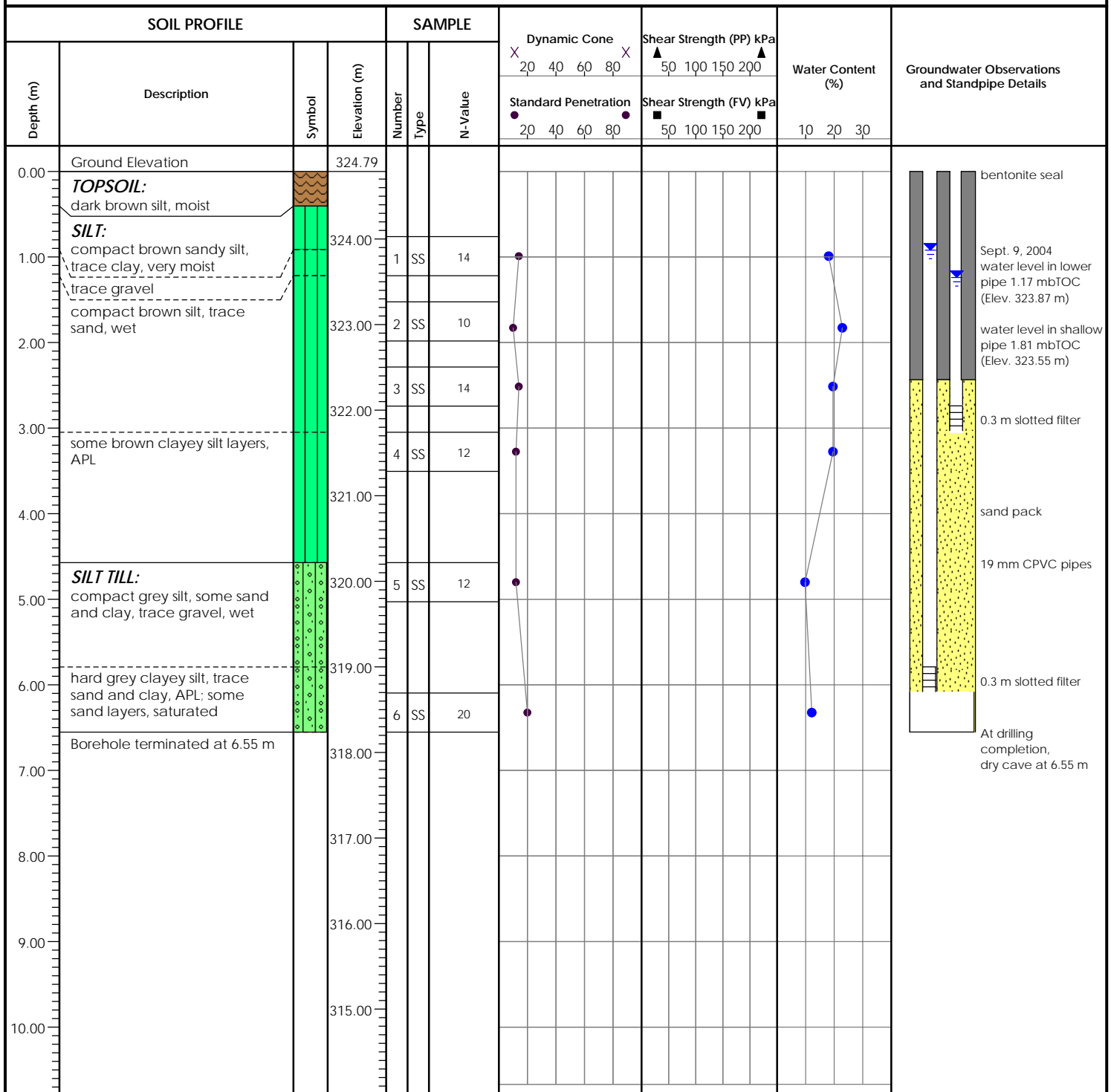
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**Drill Method: Hollow Stem Auger**

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**Drafted by: DC (01a)**



**Reviewed by: DK**

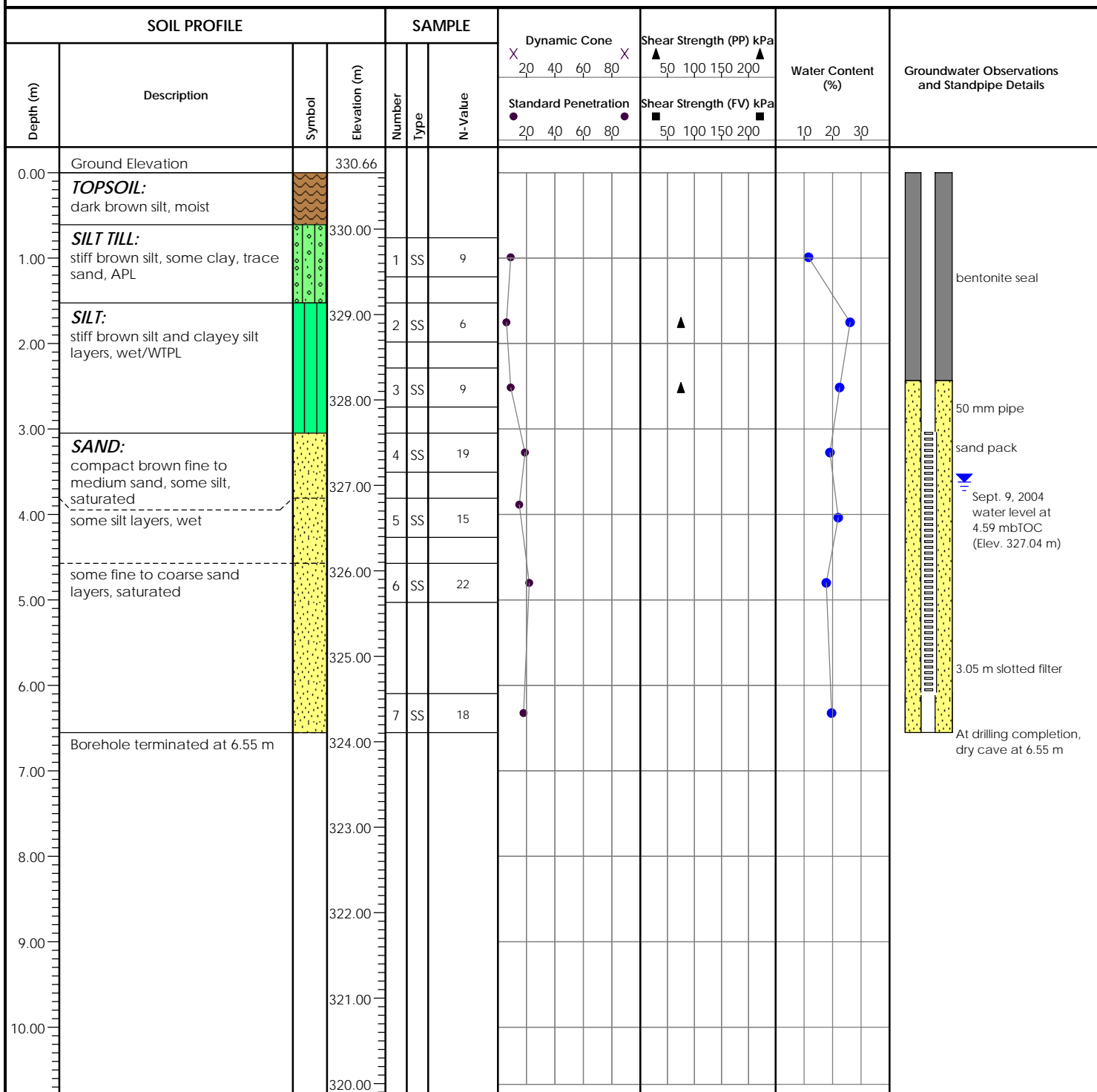
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**Drill Method: Hollow Stem Auger**

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**Reviewed by: DK**




**Field Tech.: RM**

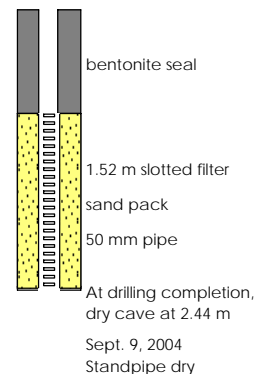
**Drill Method: Hollow Stem Auger**

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**Notes:**

**Drafted by: DC (01a)**

SOIL PROFILE				SAMPLE			Dynamic Cone X 20 40 60 80 X	Shear Strength (PP) kPa ▲ 50 100 150 200 ▲	Water Content (%) 10 20 30	Groundwater Observations and Standpipe Details
Depth (m)	Description	Symbol	Elevation (m)	Number	Type	N-Value				
0.00	Ground Elevation		330.77							
	<b>TOPSOIL:</b> dark brown silt, moist									
1.00	<b>SILT TILL:</b> stiff brown silt, some clay, trace sand, APL		330.00							
2.00	<b>SILT:</b> stiff brown silt and clayey silt layers, wet/WTPL		329.00							
	Borehole terminated at 2.44 m									
3.00			328.00							
4.00			327.00							
5.00			326.00							
6.00			325.00							
7.00			324.00							
8.00			323.00							
9.00			322.00							
10.00			321.00							



**Reviewed by: DK**

**Field Tech.: RM**

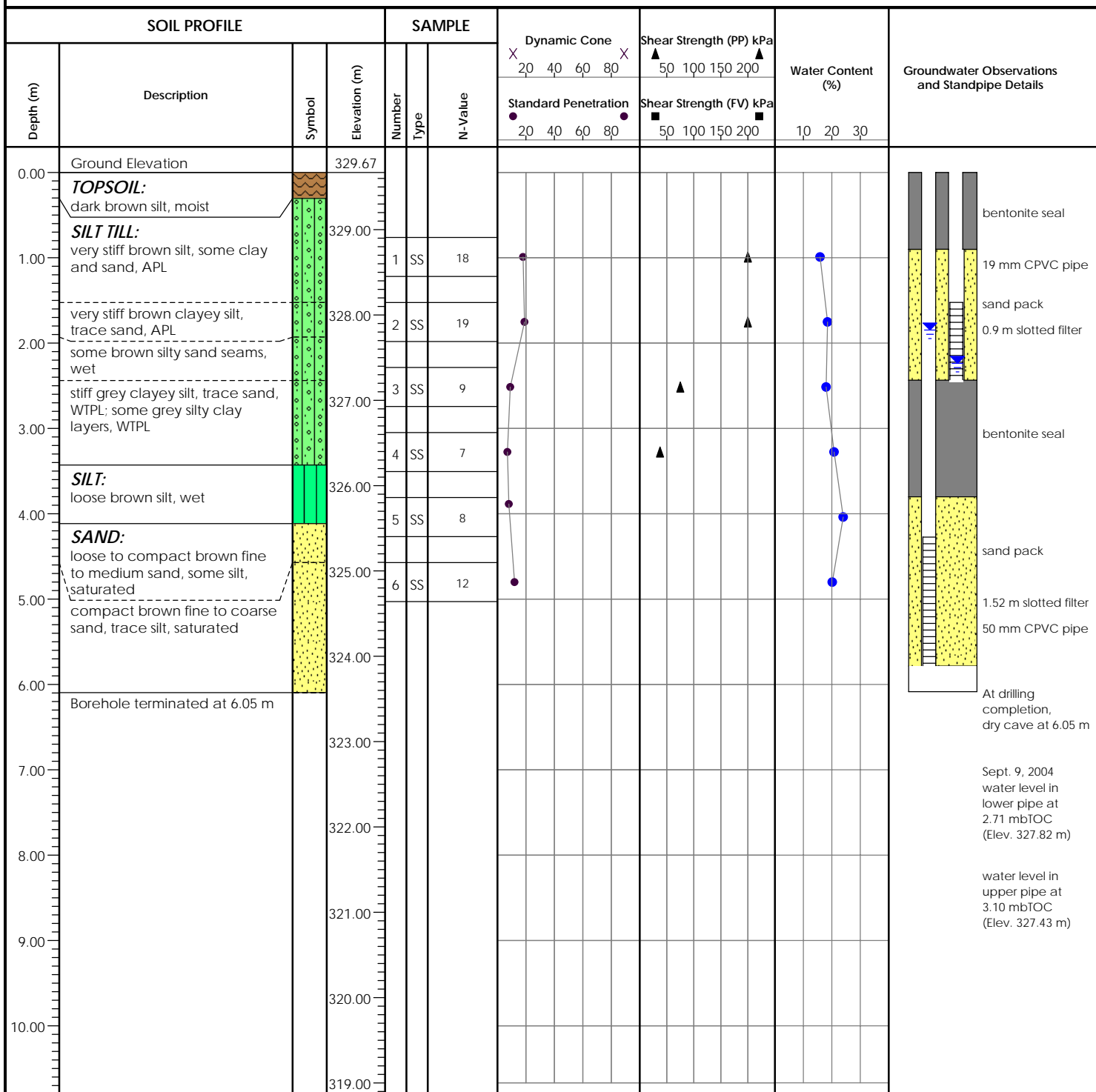
**Drill Method: Hollow Stem Auger**

**Sheet: 1 of 1**

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**Drafted by: DC (01a)**





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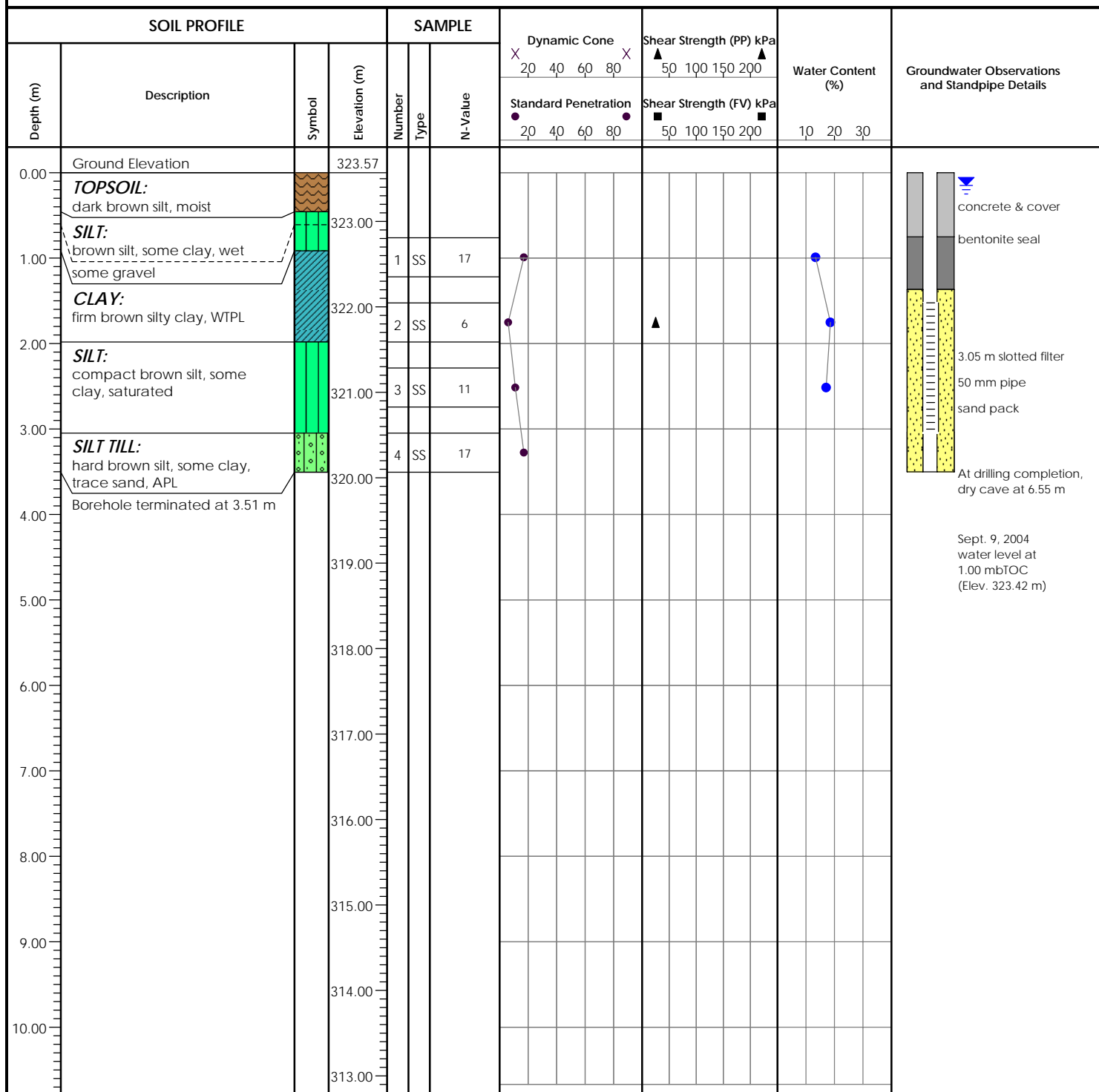
**Field Tech.: RM**

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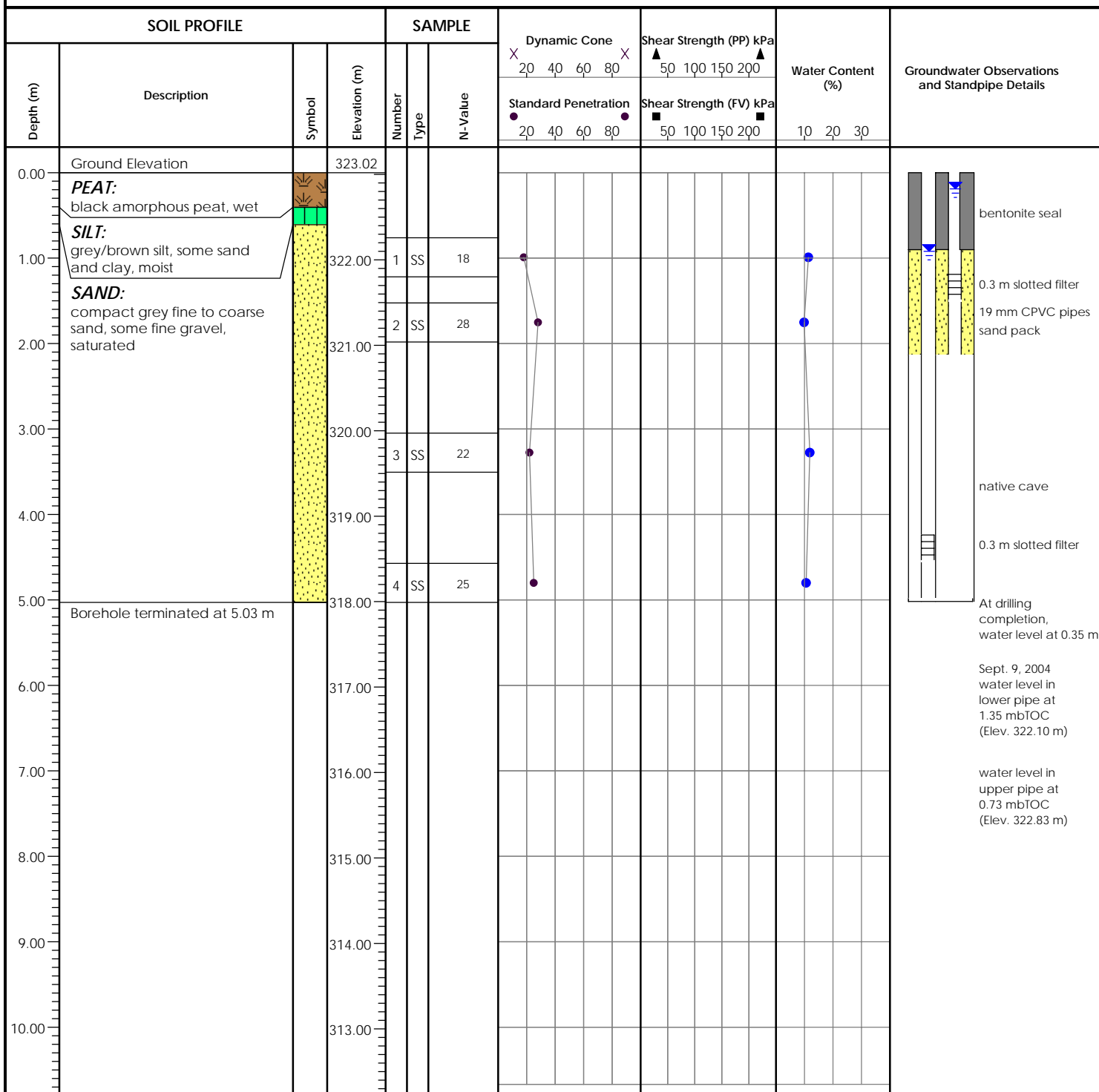
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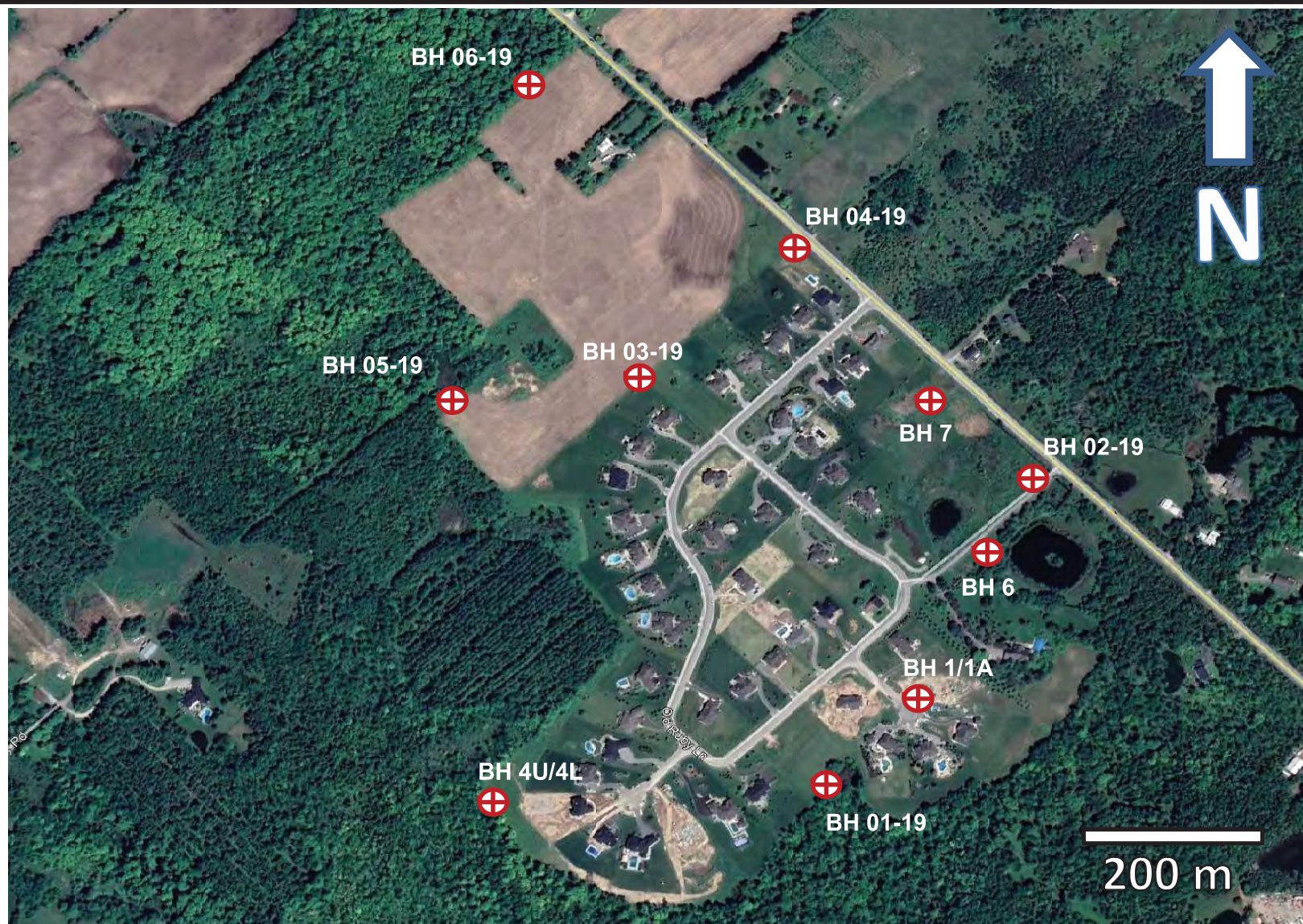
**Drill Method: Hollow Stem Auger**

**Sheet: 1 of 1**

**Notes:**


**Drafted by: DC (01a)**





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**Drawing 2 - Site Plan**  
**Audrey Meadows Subdivision - Puslinch**

LEGEND	
	Borehole Location (approximate)



Drawn:	CFH
Date:	14-Feb-21

Project: **Proposed Land Development**  
 Location: **Old Ruby Lane**  
**Guelph, Ontario**

Name: **BH 03-19**  
 Drill Date: **17-Sep-19**  
 Field Tech: **SS**  
 Drilling Method:  
**CMT 75 - Hollow Stem**

Ground Elevation: **not surveyed**

Location (UTM Zone 17): Easting: **not surveyed**

Northing: **not surveyed**

SPT Testing (blow counts)	Elevation (mASL)	Depth (mBGS)	Soil Description	Soil Symbol	Monitoring Well Completion (50 mm diameter Schedule 40 PVC pipe and well screen)
		0			
1,3,5,6		0.5	TOPSOIL - black soil, fine sand, dry.	0.17 m	Bentonite seal
0,2,2,3		1	SAND - dark brown fine silty sand, large cobbles, loose, low moisture.		
		1.5			
3,5,16,18		2	-light brown, no cobbles.		
		2.5			
9,13,12,16		3	-some silt.		
		3.5			3.35 m
26,17,15,15		4	-saturated.		3.65m
		4.5			
		5			Well sand pack
10,12,9,12		5.5			
		6			
		6.5		6.31 m	
6,6,10,13		7	CLAY - silty light brown clay, dense, saturated.	6.70 m	3.05 m well screen
		7.5			6.70 m

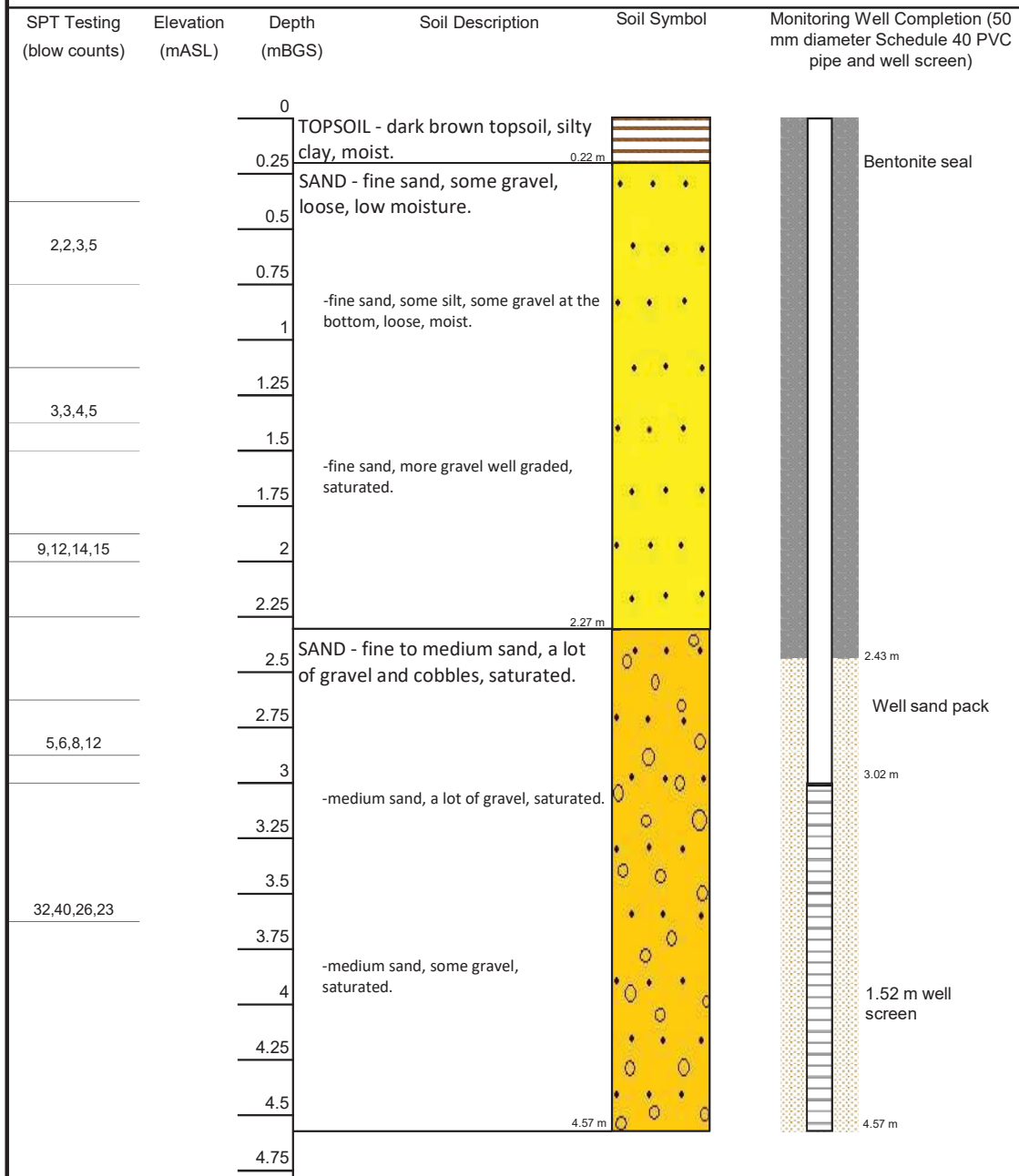
Notes:

MECP Well Tag No. A270527  
 Well Casing Stickup: 1.03 m  
 Measured Water Level: 4.11 mBGS (24-Sep-19)



Project:	Proposed Land Development	Name: <b>BH 04-19</b>
Location:	Old Ruby Lane Guelph, Ontario	Drill Date: <b>17-Sep-19</b>
		Field Tech: <b>SS</b>
		Drilling Method: <b>CMT 75 - Hollow Stem</b>

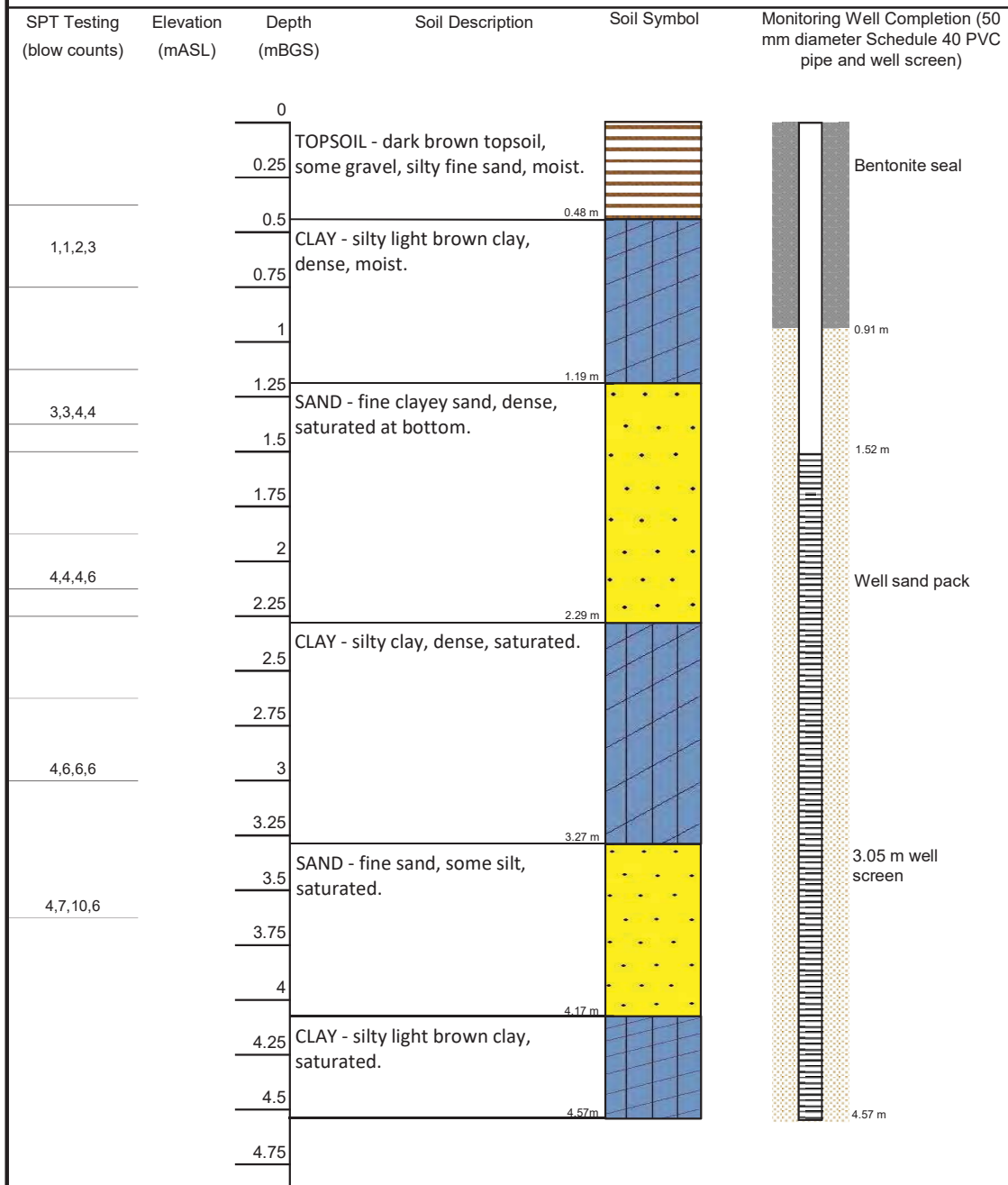
Ground Elevation:	<b>nor surveyed</b>		
Location (UTM Zone 17)	Easting: <b>not surveyed</b>	Northing: <b>not surveyed</b>	



Notes:	MOECC Well Tag No. A270526	
	Well Casing Stickup: 1.01 m	
	Measured Water Level: 1.94 mBGS (24-Sep-19)	

Project:	Proposed Land Development	Name: <b>BH 05-19</b>
Location:	Old Ruby Lane	Drill Date: <b>18-Sep-19</b>
	Guelph, Ontario	Field Tech: <b>SS</b>
		Drilling Method:
		<b>CMT 75 - Hollow Stem</b>

Ground Elevation:	<b>nor surveyed</b>	
Location (UTM Zone 17)	Easting: <b>not surveyed</b>	Northing: <b>not surveyed</b>

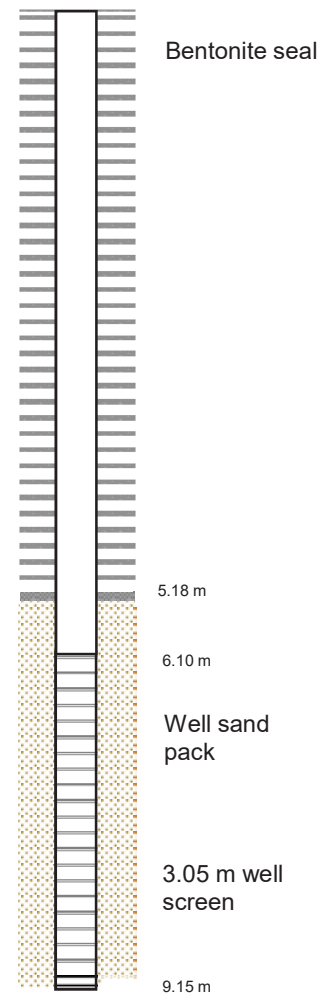


Notes:	MOECC Well Tag No. A282625	
	Well Casing Stickup: 0.95 m	
	Measured Water Level: 2.36 mBGS (24-Sep-19)	

Project:	Proposed Land Development	Name:	BH 06-19
Location:	Old Ruby Lane	Drill Date:	18-Sep-19
	Guelph, Ontario	Field Tech:	SS
		Drilling Method:	CMT 75 - Hollow Stem

Ground Elevation:	not surveyed		
Location (UTM Zone 17):	Easting:	not surveyed	
		Northing:	not surveyed

SPT Testing (blow counts)	Elevation (mASL)	Depth (mBGS)	Soil Description	Soil Symbol	Monitoring Well Completion (50 mm diameter Schedule 40 PVC pipe and well screen)
		0			
1,3,3,6		0.5	TOPSOIL - black soil, fine sand, dry.	0.38 m	
		1	SAND - fine sand, gravel, stones at 24 cm, dry.		
20,50,x,x 4"		1.5	-silty sand, some gravel, loose, dry.		
17,17,15,19		2			
		2.5	-light gray, medium to fine sand, dry.		
15,15,13,16		3	-fine sand, some gravel, loose, dry.		
		3.5			
15,17,13,16		4	-saturated.		
		4.5		4.53 m	
		5	CLAY - silty light brown clay, dense, saturated.	4.85 m	
9,13,13,17		5.5	SAND - fine sand, gravel, well packed, moist.		
		6	-dry.		
13,8,13,15		6.5	-fine to medium sand, gravel, loose, well sorted, wet.		
		7			
		7.5		7.39 m	
		8	CLAY - silty clay, dense, wet.		
10,8,17,21		8.5			
		9			
		9.5		9.15 m	



Notes:

MECP Well Tag No.	A282626
Well Casing Stickup:	1.01 m
Measured Water Level:	6.70 mBGS (24-Sep-19)





LEGEND



Monitoring Well

Drawing 3 - Groundwater Contours - September 2019  
Audrey Meadows Subdivision - Puslinch



imagery from Google Earth © 2021

Drawn: CFH  
Date: ###





#### LEGEND

 Monitoring Well

**Drawing 3 - Groundwater Contours - September 2020**  
**Audrey Meadows Subdivision - Puslinch**



imagery from Google Earth © 2021

Drawn: CFH  
 Date: ###

**TABLE 3**  
**GROUNDWATER & SURFACE WATER CHEMISTRY ANALYSIS RESULTS**  
**Audrey Meadows Subdivision**  
**Old Ruby Lane, Puslinch**

BH-01-19	Parameter <sup>(i)</sup>	PWQO	2019 <sup>(ii)</sup> 29-Sep	2020 <sup>(ii)</sup> 25-Sep
	Chloride	--	88.3	80.2
	Nitrate	--	3.63	3.59
	Nitrite	--	<0.010	<0.010
	Total Kjeldahl Nitrogen (TKN)	--	0.33	2.00
	Nitrogen (T)	--	3.96	5.59
	E.coli (CFU)	100	730	<10
	Total Coliforms (CFU)	--	28,000	500
	Phosphorus (T)	0.01	1.18	1.46
	Sodium (T)	--	40.4	39.3

i - All values in mg/L unless specified

ii - Concentrations in **red text** exceed the PWQO maximum acceptable concentrations for microbiological and chemical standards.

(T) - Total concentration

(CFU) - Coliform units/100 ml

BH-02-19	Parameter <sup>(i)</sup>	PWQO	2019 <sup>(ii)</sup> 29-Sep	2020 <sup>(ii)</sup> 25-Sep
	Chloride	--	189	189
	Nitrate	--	<0.10	<0.10
	Nitrite	--	<0.050	<0.050
	Total Kjeldahl Nitrogen (TKN)	--	1.2	9.10
	Nitrogen (T)	--	1.2	9.10
	E.coli (CFU)	100	24	<10
	Total Coliforms (CFU)	--	64,000	<100
	Phosphorus (T)	0.01	0.505	1.76
	Sodium (T)	--	88.9	89.6

i - All values in mg/L unless specified

ii - Concentrations in **red text** exceed the PWQO maximum acceptable concentrations for microbiological and chemical standards.

(T) - Total concentration

(CFU) - Coliform units/100 ml

**TABLE 3, Continued**  
**GROUNDWATER & SURFACE WATER CHEMISTRY ANALYSIS RESULTS**  
**Audrey Meadows Subdivision**  
**Old Ruby Lane, Puslinch**

BH-03-19	Parameter <sup>(i)</sup>	PWQO	2019 <sup>(ii)</sup> 29-Sep	2020 <sup>(ii)</sup> 25-Sep
	Chloride	--	24.7	9.76
	Nitrate	--	8.4	7.08
	Nitrite	--	0.079	<0.010
	Total Kjeldahl Nitrogen (TKN)	--	0.31	0.540
	Total Nitrogen	--	8.79	7.62
	E.coli (CFU)	100	53	<2
	Total Coliforms (CFU)	--	60,000	300
	Phosphorus (T)	0.01	0.368	0.198
	Sodium (T)	--	5.34	1.98

i - All values in mg/L unless specified

ii - Concentrations in **red text** exceed the PWQO maximum acceptable concentrations for microbiological and chemical standards.

(T) - Total concentration

(CFU) - Coliform units/100 ml

BH-04-19	Parameter <sup>(i)</sup>	PWQO	2019 <sup>(ii)</sup> 29-Sep	2020 <sup>(ii)</sup> 25-Sep
	Chloride	--	23.8	19.5
	Nitrate	--	5.82	6.96
	Nitrite	--	0.025	<0.010
	Total Kjeldahl Nitrogen (TKN)	--	0.29	2.50
	Nitrogen (T)	--	6.14	9.46
	E.coli (CFU)	100	<2	<10
	Total Coliforms (CFU)	--	20,000	100
	Phosphorus (T)	0.01	0.77	1.62
	Sodium (T)	--	9.23	6.44

i - All values in mg/L unless specified

ii - Concentrations in **red text** exceed the PWQO maximum acceptable concentrations for microbiological and chemical standards.

(T) - Total concentration

(CFU) - Coliform units/100 ml



**TABLE 3, Continued**  
**GROUNDWATER & SURFACE WATER CHEMISTRY ANALYSIS RESULTS**  
**Audrey Meadows Subdivision**  
**Old Ruby Lane, Puslinch**

UPGRADIENT SURFACE WATER INLET	Parameter <sup>(i)</sup>	PWQO	2019 <sup>(ii)</sup> 29-Sep	2020 <sup>(ii)</sup> 25-Sep
	Chloride	--	23.5	41.4
	Nitrate	--	0.024	0.450
	Nitrite	--	<0.010	<0.010
	Total Kjeldahl Nitrogen (TKN)	--	0.79	0.260
	Nitrogen (T)	--	0.81	0.710
	E.coli (CFU)	100	300	6
	Total Coliforms (CFU)	--	29,000	2,600
	Phosphorus (T)	0.01	0.0303	0.0117
	Sodium (T)	--	11	22.1

i - All values in mg/L unless specified

ii - Concentrations in **red text** exceed the PWQO maximum acceptable concentrations for microbiological and chemical standards.

(T) - Total concentration

(CFU) - Coliform units/100 ml

DOWNGRADIENT SURFACE WATER OUTLET	Parameter <sup>(i)</sup>	PWQO	2019 <sup>(ii)</sup> 29-Sep	2020 <sup>(ii)</sup> 25-Sep
	Chloride	--	40.1	41.8
	Nitrate	--	0.465	0.519
	Nitrite	--	<0.010	<0.010
	Total Kjeldahl Nitrogen (TKN)	--	<0.15	0.190
	Nitrogen (T)	--	0.47	0.709
	E.coli (CFU)	100	37	33
	Total Coliforms (CFU)	--	1,800	1,600
	Phosphorus (T)	0.01	0.0058	<0.0030
	Sodium (T)	--	20.6	21.8

i - All values in mg/L unless specified

ii - Concentrations in **red text** exceed the PWQO maximum acceptable concentrations for microbiological and chemical standards.

(T) - Total concentration

(CFU) - Coliform units/100 ml

## **Appendix B: Private Well Water Quality Sample Results**



GROUNDWATER SCIENCE CORP. (Waterloo)  
ATTN: ANDREW PENTNEY  
465 Kingscourt Drive  
UNIT 2  
WATERLOO ON N2K 3R5

Date Received: 28-OCT-21  
Report Date: 03-NOV-21 11:02 (MT)  
Version: FINAL

Client Phone: 519-746-6916

## Certificate of Analysis

Lab Work Order #: L2656705  
Project P.O. #: NOT SUBMITTED  
Job Reference: RUBY LANE  
C of C Numbers:  
Legal Site Desc:

  
Costas Farassoglou  
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ADDRESS: 60 Northland Road, Unit 1, Waterloo, ON N2V 2B8 Canada | Phone: +1 519 886 6910 | Fax: +1 519 886 9047  
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2656705-1	LOT 1							
Sampled By: AP on 28-OCT-21								
Matrix: WATER								
<b>Physical Tests</b>								
Colour, Apparent		<2.0		2.0	CU		28-OCT-21	R5632173
Conductivity		673		1.0	umhos/cm		29-OCT-21	R5633211
Hardness (as CaCO3)		333	HTC	1.3	mg/L		29-OCT-21	
pH		7.98		0.10	pH units		29-OCT-21	R5633211
Total Dissolved Solids		365	DLDS	20	mg/L		31-OCT-21	R5633831
Turbidity		0.36		0.10	NTU	29-OCT-21	29-OCT-21	R5634859
<b>Anions and Nutrients</b>								
Alkalinity, Total (as CaCO3)		314		1.0	mg/L		29-OCT-21	R5633211
Ammonia, Total (as N)		<0.010		0.010	mg/L		29-OCT-21	R5632641
Chloride (Cl)		24.2		0.50	mg/L		29-OCT-21	R5633530
Fluoride (F)		0.073		0.020	mg/L		29-OCT-21	R5633530
Nitrate (as N)		0.703		0.020	mg/L		29-OCT-21	R5633530
Nitrite (as N)		<0.010		0.010	mg/L		29-OCT-21	R5633530
Orthophosphate-Dissolved (as P)		<0.0030		0.0030	mg/L		29-OCT-21	R5632433
Sulfate (SO4)		20.8		0.30	mg/L		29-OCT-21	R5633530
<b>Total Metals</b>								
Aluminum (Al)-Total		<0.0050		0.0050	mg/L	28-OCT-21	29-OCT-21	R5632529
Antimony (Sb)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Arsenic (As)-Total		0.00022		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Barium (Ba)-Total		0.0580		0.00020	mg/L	28-OCT-21	29-OCT-21	R5632529
Beryllium (Be)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Bismuth (Bi)-Total		<0.000050		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529
Boron (B)-Total		0.010		0.010	mg/L	28-OCT-21	29-OCT-21	R5632529
Cadmium (Cd)-Total		0.000114		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
Calcium (Ca)-Total		82.5		0.50	mg/L	28-OCT-21	29-OCT-21	R5632529
Cesium (Cs)-Total		<0.000010		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
Chromium (Cr)-Total		<0.00050		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
Cobalt (Co)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Copper (Cu)-Total		0.0036		0.0010	mg/L	28-OCT-21	29-OCT-21	R5632529
Iron (Fe)-Total		<0.050		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
Lead (Pb)-Total		0.00020		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Magnesium (Mg)-Total		30.8		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
Manganese (Mn)-Total		<0.00050		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
Molybdenum (Mo)-Total		0.000444		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529
Nickel (Ni)-Total		0.00106		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
Phosphorus (P)-Total		<0.050		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
Potassium (K)-Total		1.25		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
Rubidium (Rb)-Total		0.00139		0.00020	mg/L	28-OCT-21	29-OCT-21	R5632529
Selenium (Se)-Total		0.000151		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529
Silicon (Si)-Total		5.93		0.10	mg/L	28-OCT-21	29-OCT-21	R5632529
Silver (Ag)-Total		<0.000050		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.



ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2656705-1    LOT 1 Sampled By:    AP on 28-OCT-21 Matrix:        WATER								
<b>Total Metals</b>								
Sodium (Na)-Total		12.5		0.50	mg/L	28-OCT-21	29-OCT-21	R5632529
Strontium (Sr)-Total		0.100		0.0010	mg/L	28-OCT-21	29-OCT-21	R5632529
Sulfur (S)-Total		7.55		0.50	mg/L	28-OCT-21	29-OCT-21	R5632529
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	28-OCT-21	29-OCT-21	R5632529
Thallium (Tl)-Total		0.000021		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
Thorium (Th)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Tin (Sn)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Titanium (Ti)-Total		<0.00030		0.00030	mg/L	28-OCT-21	29-OCT-21	R5632529
Tungsten (W)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Uranium (U)-Total		0.000679		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
Vanadium (V)-Total		<0.00050		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
Zinc (Zn)-Total		0.126		0.0030	mg/L	28-OCT-21	29-OCT-21	R5632529
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	28-OCT-21	29-OCT-21	R5632529
L2656705-2    LOT 10 Sampled By:    AP on 28-OCT-21 Matrix:        WATER								
<b>Physical Tests</b>								
Colour, Apparent		<2.0		2.0	CU		28-OCT-21	R5632173
Conductivity		742		1.0	umhos/cm		29-OCT-21	R5633211
Hardness (as CaCO3)		338	HTC	1.3	mg/L		29-OCT-21	
pH		8.14		0.10	pH units		29-OCT-21	R5633211
Total Dissolved Solids		377	DLDS	20	mg/L		31-OCT-21	R5633831
Turbidity		0.17		0.10	NTU	29-OCT-21	29-OCT-21	R5634859
<b>Anions and Nutrients</b>								
Alkalinity, Total (as CaCO3)		311		1.0	mg/L		29-OCT-21	R5633211
Ammonia, Total (as N)		0.015		0.010	mg/L		29-OCT-21	R5632641
Chloride (Cl)		49.9		0.50	mg/L		29-OCT-21	R5633530
Fluoride (F)		<0.020		0.020	mg/L		29-OCT-21	R5633530
Nitrate (as N)		1.03		0.020	mg/L		29-OCT-21	R5633530
Nitrite (as N)		<0.010		0.010	mg/L		29-OCT-21	R5633530
Orthophosphate-Dissolved (as P)		<0.0030		0.0030	mg/L		29-OCT-21	R5632433
Sulfate (SO4)		21.3		0.30	mg/L		29-OCT-21	R5633530
<b>Total Metals</b>								
Aluminum (Al)-Total		<0.0050		0.0050	mg/L	28-OCT-21	29-OCT-21	R5632529
Antimony (Sb)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Arsenic (As)-Total		0.00019		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Barium (Ba)-Total		0.0651		0.00020	mg/L	28-OCT-21	29-OCT-21	R5632529
Beryllium (Be)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Bismuth (Bi)-Total		<0.000050		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529
Boron (B)-Total		0.011		0.010	mg/L	28-OCT-21	29-OCT-21	R5632529
Cadmium (Cd)-Total		0.000127		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
Calcium (Ca)-Total		85.3		0.50	mg/L	28-OCT-21	29-OCT-21	R5632529

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2656705-2    LOT 10 Sampled By:    AP on 28-OCT-21 Matrix:        WATER								
<b>Total Metals</b>								
Cesium (Cs)-Total		<0.000010		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
Chromium (Cr)-Total		<0.00050		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
Cobalt (Co)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Copper (Cu)-Total		<0.0010		0.0010	mg/L	28-OCT-21	29-OCT-21	R5632529
Iron (Fe)-Total		<0.050		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
Lead (Pb)-Total		0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Magnesium (Mg)-Total		30.4		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
Manganese (Mn)-Total		<0.00050		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
Molybdenum (Mo)-Total		0.000474		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529
Nickel (Ni)-Total		0.00055		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
Phosphorus (P)-Total		<0.050		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
Potassium (K)-Total		1.28		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
Rubidium (Rb)-Total		0.00144		0.00020	mg/L	28-OCT-21	29-OCT-21	R5632529
Selenium (Se)-Total		0.000168		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529
Silicon (Si)-Total		5.55		0.10	mg/L	28-OCT-21	29-OCT-21	R5632529
Silver (Ag)-Total		<0.000050		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529
Sodium (Na)-Total		26.1		0.50	mg/L	28-OCT-21	29-OCT-21	R5632529
Strontium (Sr)-Total		0.112		0.0010	mg/L	28-OCT-21	29-OCT-21	R5632529
Sulfur (S)-Total		7.47		0.50	mg/L	28-OCT-21	29-OCT-21	R5632529
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	28-OCT-21	29-OCT-21	R5632529
Thallium (Tl)-Total		0.000030		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
Thorium (Th)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Tin (Sn)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Titanium (Ti)-Total		<0.00030		0.00030	mg/L	28-OCT-21	29-OCT-21	R5632529
Tungsten (W)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Uranium (U)-Total		0.000639		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
Vanadium (V)-Total		<0.00050		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
Zinc (Zn)-Total		0.152		0.0030	mg/L	28-OCT-21	29-OCT-21	R5632529
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	28-OCT-21	29-OCT-21	R5632529
L2656705-3    LOT 21 Sampled By:    AP on 28-OCT-21 Matrix:        WATER								
<b>Physical Tests</b>								
Colour, Apparent		3.0		2.0	CU		28-OCT-21	R5632173
Conductivity		733		1.0	umhos/cm		29-OCT-21	R5633217
Hardness (as CaCO3)		338	HTC	1.3	mg/L		29-OCT-21	
pH		8.07		0.10	pH units		29-OCT-21	R5633217
Total Dissolved Solids		388	DLDS	20	mg/L		31-OCT-21	R5633831
Turbidity		<0.10		0.10	NTU	29-OCT-21	29-OCT-21	R5634859
<b>Anions and Nutrients</b>								
Alkalinity, Total (as CaCO3)		320		1.0	mg/L		29-OCT-21	R5633217
Ammonia, Total (as N)		0.014		0.010	mg/L		29-OCT-21	R5632641

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2656705-3	LOT 21							
Sampled By:	AP on 28-OCT-21							
Matrix:	WATER							
Anions and Nutrients								
Chloride (Cl)		45.4		0.50	mg/L		29-OCT-21	R5633530
Fluoride (F)		0.030		0.020	mg/L		29-OCT-21	R5633530
Nitrate (as N)		1.17		0.020	mg/L		29-OCT-21	R5633530
Nitrite (as N)		<0.010		0.010	mg/L		29-OCT-21	R5633530
Orthophosphate-Dissolved (as P)		<0.0030		0.0030	mg/L		29-OCT-21	R5632433
Sulfate (SO4)		21.0		0.30	mg/L		29-OCT-21	R5633530
Total Metals								
Aluminum (Al)-Total		<0.0050		0.0050	mg/L	28-OCT-21	29-OCT-21	R5632529
Antimony (Sb)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Arsenic (As)-Total		0.00022		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Barium (Ba)-Total		0.0643		0.00020	mg/L	28-OCT-21	29-OCT-21	R5632529
Beryllium (Be)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Bismuth (Bi)-Total		<0.000050		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529
Boron (B)-Total		0.012		0.010	mg/L	28-OCT-21	29-OCT-21	R5632529
Cadmium (Cd)-Total		0.000108		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
Calcium (Ca)-Total		85.8		0.50	mg/L	28-OCT-21	29-OCT-21	R5632529
Cesium (Cs)-Total		<0.000010		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
Chromium (Cr)-Total		<0.00050		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
Cobalt (Co)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Copper (Cu)-Total		0.0054		0.0010	mg/L	28-OCT-21	29-OCT-21	R5632529
Iron (Fe)-Total		<0.050		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
Lead (Pb)-Total		0.00023		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Magnesium (Mg)-Total		30.1		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
Manganese (Mn)-Total		<0.00050		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
Molybdenum (Mo)-Total		0.000466		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529
Nickel (Ni)-Total		0.00057		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
Phosphorus (P)-Total		<0.050		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
Potassium (K)-Total		1.29		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
Rubidium (Rb)-Total		0.00142		0.00020	mg/L	28-OCT-21	29-OCT-21	R5632529
Selenium (Se)-Total		0.000168		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529
Silicon (Si)-Total		5.63		0.10	mg/L	28-OCT-21	29-OCT-21	R5632529
Silver (Ag)-Total		<0.000050		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529
Sodium (Na)-Total		23.9		0.50	mg/L	28-OCT-21	29-OCT-21	R5632529
Strontium (Sr)-Total		0.116		0.0010	mg/L	28-OCT-21	29-OCT-21	R5632529
Sulfur (S)-Total		7.72		0.50	mg/L	28-OCT-21	29-OCT-21	R5632529
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	28-OCT-21	29-OCT-21	R5632529
Thallium (Tl)-Total		0.000029		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
Thorium (Th)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Tin (Sn)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Titanium (Ti)-Total		<0.00030		0.00030	mg/L	28-OCT-21	29-OCT-21	R5632529
Tungsten (W)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2656705-3 Sampled By: LOT 21 AP on 28-OCT-21 Matrix: WATER								
	Total Metals							
	Uranium (U)-Total	0.000678		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
	Vanadium (V)-Total	<0.00050		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
	Zinc (Zn)-Total	0.145		0.0030	mg/L	28-OCT-21	29-OCT-21	R5632529
	Zirconium (Zr)-Total	<0.00030		0.00030	mg/L	28-OCT-21	29-OCT-21	R5632529
L2656705-4 Sampled By: LOT 36 AP on 28-OCT-21 Matrix: WATER								
	Physical Tests							
	Colour, Apparent	9.1		2.0	CU		28-OCT-21	R5632173
	Conductivity	640		1.0	umhos/cm		29-OCT-21	R5633217
	Hardness (as CaCO3)	312	HTC	1.3	mg/L		29-OCT-21	
	pH	8.20		0.10	pH units		29-OCT-21	R5633217
	Total Dissolved Solids	321	DLDS	20	mg/L		31-OCT-21	R5633831
	Turbidity	2.73		0.10	NTU	29-OCT-21	29-OCT-21	R5634859
	Anions and Nutrients							
	Alkalinity, Total (as CaCO3)	269		1.0	mg/L		29-OCT-21	R5633217
	Ammonia, Total (as N)	0.012		0.010	mg/L		29-OCT-21	R5632641
	Chloride (Cl)	27.4		0.50	mg/L		29-OCT-21	R5633530
	Fluoride (F)	0.088		0.020	mg/L		29-OCT-21	R5633530
	Nitrate (as N)	0.159		0.020	mg/L		29-OCT-21	R5633530
	Nitrite (as N)	<0.010		0.010	mg/L		29-OCT-21	R5633530
	Orthophosphate-Dissolved (as P)	<0.0030		0.0030	mg/L		29-OCT-21	R5632433
	Sulfate (SO4)	20.1		0.30	mg/L		29-OCT-21	R5633530
	Total Metals							
	Aluminum (Al)-Total	0.0059		0.0050	mg/L	28-OCT-21	29-OCT-21	R5632529
	Antimony (Sb)-Total	<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
	Arsenic (As)-Total	0.00014		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
	Barium (Ba)-Total	0.0551		0.00020	mg/L	28-OCT-21	29-OCT-21	R5632529
	Beryllium (Be)-Total	<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
	Bismuth (Bi)-Total	<0.000050		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529
	Boron (B)-Total	0.016		0.010	mg/L	28-OCT-21	29-OCT-21	R5632529
	Cadmium (Cd)-Total	0.000078		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
	Calcium (Ca)-Total	76.2		0.50	mg/L	28-OCT-21	29-OCT-21	R5632529
	Cesium (Cs)-Total	<0.000010		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
	Chromium (Cr)-Total	<0.00050		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
	Cobalt (Co)-Total	0.00025		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
	Copper (Cu)-Total	0.0378		0.0010	mg/L	28-OCT-21	29-OCT-21	R5632529
	Iron (Fe)-Total	0.164		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
	Lead (Pb)-Total	0.00257		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
	Magnesium (Mg)-Total	29.6		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
	Manganese (Mn)-Total	0.00355		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
	Molybdenum (Mo)-Total	0.000625		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Sample Details/Parameters		Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2656705-4	LOT 36							
Sampled By:	AP on 28-OCT-21							
Matrix:	WATER							
Total Metals								
Nickel (Ni)-Total		0.0262		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
Phosphorus (P)-Total		<0.050		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
Potassium (K)-Total		1.29		0.050	mg/L	28-OCT-21	29-OCT-21	R5632529
Rubidium (Rb)-Total		0.00133		0.00020	mg/L	28-OCT-21	29-OCT-21	R5632529
Selenium (Se)-Total		0.000075		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529
Silicon (Si)-Total		5.12		0.10	mg/L	28-OCT-21	29-OCT-21	R5632529
Silver (Ag)-Total		<0.000050		0.000050	mg/L	28-OCT-21	29-OCT-21	R5632529
Sodium (Na)-Total		14.2		0.50	mg/L	28-OCT-21	29-OCT-21	R5632529
Strontium (Sr)-Total		0.137		0.0010	mg/L	28-OCT-21	29-OCT-21	R5632529
Sulfur (S)-Total		7.12		0.50	mg/L	28-OCT-21	29-OCT-21	R5632529
Tellurium (Te)-Total		<0.00020		0.00020	mg/L	28-OCT-21	29-OCT-21	R5632529
Thallium (Tl)-Total		0.000033		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
Thorium (Th)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Tin (Sn)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Titanium (Ti)-Total		<0.00030		0.00030	mg/L	28-OCT-21	29-OCT-21	R5632529
Tungsten (W)-Total		<0.00010		0.00010	mg/L	28-OCT-21	29-OCT-21	R5632529
Uranium (U)-Total		0.000582		0.000010	mg/L	28-OCT-21	29-OCT-21	R5632529
Vanadium (V)-Total		<0.00050		0.00050	mg/L	28-OCT-21	29-OCT-21	R5632529
Zinc (Zn)-Total		0.170		0.0030	mg/L	28-OCT-21	29-OCT-21	R5632529
Zirconium (Zr)-Total		<0.00030		0.00030	mg/L	28-OCT-21	29-OCT-21	R5632529

\* Refer to Referenced Information for Qualifiers (if any) and Methodology.