

# HYDROGEOLOGICAL INVESTIGATION CALDER INDUSTRIAL SUBDIVISION

Part of Lots 25 & 26, Concession 11 Township of North Dumfries

#### SUBMITTED TO:

Mr. Brian Calder D5D Enterprises Limited 45 Dobbie Drive Cambridge, Ontario N1T 1S9

FILE NO / H18100 / June 5, 2020



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June 5, 2020 FILE NO.: H8100

Mr. Brian Calder D5D Enterprises Limited 45 Dobbie Drive Cambridge, Ontario N1T 1S9

Dear Mr. Calder:

# RE: HYDROGEOLOGICAL INVESTIGATION CALDER INDUSTRIAL SUBDIVISION Part Lots 25 & 26, Concession 11, North Dumfries Township

This report summarizes the results of a hydrogeological investigation completed in support of a proposed 6-lot industrial subdivision located on Cedar Creek Road in a former gravel pit located at Part of Lots 25 & 26, Concession 11, Township of North Dumfries.

The lots would be supplied with individual water supply wells and wastewater treatment systems and all stormwater would be handled through a combination of a municipal SWM facility within the proposed roadway and private SWM facilities on individual lots. The Preliminary Stormwater Management and Functional Servicing Report by Meritech Engineering Ltd. provides technical details regarding the municipal SWM facility. This investigation characterizes the hydrogeological setting and assesses the feasibility and potential impacts of these servicing matters.

If you have any questions or concerns regarding the report, please contact the undersigned.

Yours truly, CHUNG & VANDER DOELEN ENGINEERING LTD.

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William (Sandy) Anderson, M.Sc., P.Eng. Senior Hydrogeologist and Engineer

# TABLE OF CONTENTS

1.0	INTRODUCTION	2
2.0	INVESTIGATION SCOPE	2
2.1	Background Data Review	2
2.2	Borehole Drilling & Monitoring Well Installation	2
2.3	Drive-Point Piezometer Installation	3
2.3	Well Development & Water Level Monitoring	3
3.0	SITE CHARACTERIZATION	4
3.1	Topography, Drainage & Wetland Features	4
3.2	Geologic Setting	5
3.3	Hydrogeologic Setting	5
3.	.3.1 Water Table Configuration	5
3.	.3.2 Groundwater Infiltration and Recharge	6
3.	.3.3 Groundwater / Surface Water / Wetland Interaction	6
3.4	Groundwater Use	7
4.0	SITE SERVICING REQUIREMENTS & IMPACT ASSESSMENT	8
4.1	Wastewater Systems & Potential Impact of Effluent	8
4.2	Water Supply & Potential Impact of Water Taking	
4.3	Stormwater Management & Potential Impact to Groundwater Recharge	9
5.0	CONCLUSIONS & RECOMMENDATIONS	9
6.0	REFERENCES	11

## LIST OF FIGURES

Figure 1	Site Location	Арр А
Figure 2	Quaternary Geology	Арр А
Figure 3	Site and Monitoring Well Location Plan	Арр А
Figure 4	Site Water Table Interpretation, Spring	Арр А
Figure 5	Site Water Table Interpretation, Summer	Арр А
Figure 6	Water Table Interpretation, Upper Cedar Creek Subwatershed Study	Арр А
Figure 7	Groundwater Recharge Interpretation, Upper Cedar Creek Subwatershed	Арр А

# LIST OF TABLES

Table 1Summary of Monitoring Well Water Levels & ElevationsApp A

# APPENDICES

Appendix A	Table 1 and Figures 1 to 7
Appendix B	Draft Plan of Subdivision (Dryden Smith Head, January 2020) and
	Site Survey Plan (MacDonald Tamblyn Lord, June 20, 2019)
Appendix C	Water Well Records
Appendix D	Borehole Logs and Grain Size Analyses



## 1.0 INTRODUCTION

This report presents the findings of a hydrogeological investigation for a proposed 6-lot industrial subdivision of a former gravel pit located on Cedar Creek Road east of Highway 401 (Figure 1). The legal description of the subject property is Part of Lots 25 & 26, Concession 11, Township of North Dumfries, Regional Municipality of Waterloo. The Proposed Draft Plan of Subdivision (Dryden, Smith Head, January 30, 2020) is provided in Appendix B.

The objectives of the investigation are as follows:

- 1. To characterize the hydrogeological setting at the property.
- 2. To assess the hydrogeological conditions in respect to proposed water supply, sewage servicing and stormwater management and make recommendations in this regard.
- 3. To identify and evaluate potential impacts and enhancement opportunities to groundwater and surface water receptors from the proposed development services and make recommendations in this regard.

## 2.0 INVESTIGATION SCOPE

#### 2.1 BACKGROUND DATA REVIEW

The following background information (Section 6.0 lists the specific information) has been considered as part of this investigation:

- Regional-scale topographic mapping (Figure 1)
- Quaternary (surficial overburden) geology mapping for the area (Figure 2)
- MECP Water Well Records (Figure 3 and Appendix B)
- The hydrogeological characterization report for the recently-completed Upper Cedar Creek Subwatershed Study (Matrix Solutions Inc., 2019)
- Natural feature delineations of the Site provided by Aboud & Associates Inc. (February 2020)
- Draft Plan of Subdivision provided by Dryden Smith & Head Planning Consultants Ltd. (January 2020)

#### 2.2 BOREHOLE DRILLING & MONITORING WELL INSTALLATION

Borehole drilling and monitoring well installation were completed on April 10-12, 2019. A total of nine (9) boreholes (BH1 to BH9, Figure 3) were advanced on the Site to depths ranging from 5 to 12 m. Monitoring wells were installed at each location (BH1 to BH9). These boreholes/wells were drilled/installed to investigate the shallow subsurface geological and water table conditions at the property.



Standard hollow stem auger (HSA) drilling and installation methods were employed using a trackmounted Diedrich D50-T drill rig operated by Direct Environmental Drilling of London, Ontario. No water was introduced during drilling. Five (5) representative soil samples were later analysed for grain size distribution at the CVD soils laboratory. Appendix C provides borehole logs, well installation details and grain size analysis results.

All monitoring well locations were surveyed for location and geodetic elevation by MacDonald Tamblyn Lord Surveying on June 17, 2019.

# 2.3 DRIVE-POINT PIEZOMETER INSTALLATION

Shallow drive-point piezometers were installed at four (4) wetland or water course locations (DP1 to DP4, Figure 3) on April 24, 2019. The piezometers were installed to investigate the hydrogeological conditions of the surface water features on the property.

The procedure for installing each drive-point piezometer was as follows: 1) auger a 5-cm hole through the upper soil layers to observe the nature and thickness of the organic soil layers down to the mineral soil layer, 2) attach a 0.30-m long, 1.9-cm diameter stainless steel piezometer tip (or screen) to a length of 1.9-cm threaded steel riser pipe, 3) drive the assembled piezometer from the bottom of the auger hole to the depth desired using a post hammer, and 4) fill the annular space around the pipe with bentonite to prevent surface water from moving directly along the annulus to the piezometer screen.

The following details summarize each piezometer installation:

Piezometer	Auger Depth & Materials Encountered*	Depth Driven
DP1 (southern wetland)	0.55 (peat/muck to 0.25, silty sand trace-some gravel to 0.55)	1.4 m
DP2 (northern wetland)	0.53 (peat/muck 0.25, silt tr. clay 0.43, silty sand tr. gravel 0.53	s) 1.4 m
DP3 (tributary)	0 (driven into creek bed sediment, silty sand and gravel)	1.4 m
DP4 (southern wetland)	0.71 (peat/muck to 0.50, sandy silt tr. gravel tr. clay to 0.71)	1.4 m
*All depths listed are in meters	s below ground surface.	

All piezometers were surveyed for location and geodetic elevation by MacDonald Tamblyn Lord Surveying on June 17, 2019.

#### 2.3 WELL DEVELOPMENT & WATER LEVEL MONITORING

Each monitoring well was developed using Waterra polyethylene tubing and foot-valve hand pumps on April 12, 2019. The piezometers were developed using the same method following installation on April 24, 2019.



Water level monitoring was conducted on five (5) occasions between April 24, 2019 and October 9, 2019. Water levels were obtained at all monitoring well and piezometer locations on each occasion. Table 1 provides a summary of the groundwater levels and calculated elevations.

# 3.0 SITE CHARACTERIZATION

# 3.1 TOPOGRAPHY, DRAINAGE & WETLAND FEATURES

The 60.70-hectare Site is a former gravel pit located near the northwest corner of Cedar Creek Road and Dumfries Road (Figure 1) in the Township of North Dumfries. The property is bounded by a CP Railway to the west, industrial land use to the north, and Cedar Creek Road, Dumfries Road, and a community land use to the south and east.

The Site is located in the upper Cedar Creek subwatershed with elevations on the order of 300 to 340 mASL surrounding the property. Regional topography and drainage features are shown in Figure 1. Topography to the south and east is hummocky but generally falls northward and westward toward Cedar Creek, which is located 0-500 m west of, and about 1 km north of the Site at elevations of 300 to 310 mASL.

Site topography is variable but generally slopes down to the west, ranging from ±315 mASL on the east side to ±300 mASL in wetlands along the west side (see Survey Plan, Appendix B, MacDonald Tamblyn Lord, June 20, 2019). Steeply sloped overburden and topsoil berms are present along the north and east property boundaries, and along a portion of the east edge of the wetlands (in the vicinity of DP2).

Surface features at the Site such as watercourses, wetland features and woodlot are shown in Figure 3. These features were delineated by Aboud & Associates Inc. as part of a concurrent Environmental Impact Study. These include an area of wetland along the west side of the property, a ±0.5-ha pond near the northwest corner, and a tributary of Cedar Creek that commences near DP3. Data from the current hydrogeological study indicates the tributary is a permanent watercourse and flows in a westerly direction, discharging to Cedar Creek.

The majority of the Site is a former gravel pit and consists of open soils or fields. In this area it is expected that the majority of precipitation either infiltrates or evapotranspires, with surface runoff following topography and draining to the west side of the property. In the wetlands on the west side of the Site, the water table was encountered at or near the surface. As such, the infiltration capacity of this area is low relative to the rest of the property. Regardless, the majority of precipitation falling on this portion of the Site is expected to either infiltrate, evapotranspire, or temporarily pond as surface water in the wetland. Significant off-Site drainage from surface runoff is not expected given the flat topography of the wetlands.



## 3.2 GEOLOGIC SETTING

Surface geological mapping for the area (by Karrow, 1987) is presented in Figure 2. The mapping indicates the Site consists primarily of three (3) deposits. The eastern half of the property is shown to be underlain by outwash gravel (Deposit 7, Figure 2), while the western portion is underlain primarily by lacustrine and outwash sand (Deposit 12, Figure 2). A small area near the west property boundary is mapped as recent peat and muck deposits (Deposit 15, Figure 2).

The well record data (Appendix C) and borehole data (Appendix D) are generally consistent with the geological mapping and confirm that the Site and surrounding area are underlain primarily by sand and gravel/gravelly sand deposits. However, much of the Site has been altered from its original state by the former gravel pit operation.

Little gravel was encountered around the central and eastern parts of the Site relative to the west. Based on the subsurface conditions encountered during the drilling program, topsoil and/or overburden (including shallow sand and gravel deposits) were stripped across much of the property, particularly in the central area. In the southeast of the property at BH2 and BH4, layers of finer grained silts and even clayey silts were encountered.

At some locations, fill material was encountered near the surface. Notably, a substantial layer of fill material was encountered from the surface at BH6, to the east of the pond. A substantial layer of fill material (topsoil) was also encountered from the surface at BH5. It is anticipated that this is reworked native material that was placed as part of regrading during or following the former gravel pit operation.

Peat and muck deposits were encountered at the surface during the advancement of piezometers DP1, DP2 and DP4 on the west side of the property. It is likely that these recent peat and muck deposits may become more prominent in the wetlands with proximity to Cedar Creek's main branch, as the mapping in Figure 2 suggests.

#### 3.3 HYDROGEOLOGIC SETTING

#### **3.3.1** Water Table Depth and Configuration

An unconfined aquifer exists within the sand and gravel deposits at the Site, and also in finer sandy silt/sand and silt deposits in the southeast of the property. Table 1 and Figures 4 & 5 present on-Site water level depth and water table elevation data. During the spring-to-fall 2019 monitoring period, the depths to the water table across the upland parts of the property (BH1 to BH5) range from about 3.5 to 10 m, while the depths fall to 1.5 to 2.3 m at BH6 east of the pond and less than 0.6 m at locations close to the western wetlands. The seasonal water table fluctuations (Table 1) are relatively modest, generally in the 0.1 to 0.6 m range.



Water table elevations from the spring of 2019 to fall of 2019 range from about 299 to 306 mASL. The water table generally slopes to the west, indicating groundwater flow is in a westerly direction toward the main branch of Cedar Creek. The interpreted water table configuration also suggests some localized groundwater flow towards the pond in the northwest corner of the property.

The Site water table data are generally consistent with the 'regional-scale' interpretation of the water table configuration and westerly flow direction toward Cedar Creek, as interpreted in the Upper Cedar Creek Subwatershed Study (Figure 6).

## 3.3.2 Groundwater Infiltration and Recharge

Groundwater infiltration rates will vary across the Site, though high infiltration rates are expected across the majority of the property given the open sandy soils. Based on the grain size analyses, the correlating estimated infiltration rates for the various surficial soils at the property range as follows:

- Gravelly sand: 75 to 300 mm/hr
- Sand: 50 to 170 mm/hr
- Silty Sand: 20 to 50 mm/hr
- Sand and Silt: 10 to 20 mm/hr
- Sandy Silt: 5 to 10 mm/hr
- Clayey Silt: 1 mm/hr

As noted in Section 3.1, decreased infiltration capacity can be expected within and near the wetland due to the proximity of the water table to the ground surface (especially during the spring season), though the infiltration rate of the gravelly sands encountered in the wetland and wetland setback (BH8 and BH9) are expected to be higher during the summer and fall period when the water table drops.

The rate of groundwater recharge at the Site is undoubtedly high across much of the property given the very permeable 'open' soil conditions, though some of the property is also currently sloped (steeply in some locations), vegetated and/or tree covered, all of which will affect groundwater recharge rates. The Upper Cedar Creek Subwatershed Study computer modelling has estimated recharge at the Site to be between 250-500 mm/year, with the majority averaging 350-400 mm/year (Figure 7).

#### 3.3.3 Groundwater / Surface Water / Wetland Interaction

The surface water and groundwater level data at the four (4) piezometer locations (Figure 3) provide good insight on the nature of vertical groundwater flow and the inter-relationship between shallow groundwater and the watercourse and wetland features at the Site.

At DP3, located in a tributary of Cedar Creek near the western property boundary, there is a consistent upward vertical hydraulic gradient throughout the monitoring events. Not surprisingly, this data indicates the tributary is a groundwater discharge feature.



Upward vertical hydraulic gradients were also observed at DP2 and DP4, located in the central and northern portions of the wetland in spring and early summer. The ground surface at these locations was observed to be dry from the late spring or early summer onwards. This information confirms that the wetland receives 'spring' seasonal groundwater discharge. Conversely, during the August and October monitoring events, groundwater levels fell below the surface, and as such no vertical hydraulic gradient can be determined at these times. Nevertheless, with the dry surface and falling water table, it is interpreted that these parts of the wetland have a recharge condition in the 'summer-fall'.

In the southern portion of the wetland at DP1 a slight downward vertical hydraulic gradient was observed during the spring. Dry surface conditions were also encountered at this location during the summer and fall, so again no vertical hydraulic gradient was observed. This indicates that this part of the wetland has a groundwater recharge condition throughout the year.

The water table configuration (Figures 4 & 5) with respect to the wetland suggests that groundwater flows through the wetland in a westerly direction towards Cedar Creek. Localized draw between the 'branches' of the wetland was not evident based on the water table configuration. As noted in Section 3.3.1, the water table configuration does suggest some localized groundwater flow towards the pond in the northwest corner of the property.

## 3.4 GROUNDWATER USE

The MECP well record database indicates that there are several water supply wells in the area surrounding the subject property, servicing neighbouring properties for uses including light industry, public supply, and a gravel pit operation.

Water supply wells within the study area are identified in Figure 3 and the well records are provided in Appendix B. These wells obtain water from a confined sand and gravel aquifer at depths ranging from 88 to 184 feet (6508189, 6506103, 6506102, 6500625, 6503476). The wells were pumped at rates of 10 to 30 gpm for durations of 1 to 10 hours with most having modest water level drawdown. The pumping test for one (1) of the wells (6508189) showed more substantial drawdown with a specific well capacity of 0.47 gpm/m of drawdown. However, the specific well capacities of all other reviewed wells ranged from 3.75 to 20 gpm/m of drawdown. This is considered excellent well yield for light industrial requirements.

The well record database identifies two (2) shallow dug wells located within the study area (6504540, 6508532). These wells obtain water from the sand and gravel unconfined aquifer at depths of 19 to 25 feet. A pumping test was performed on one (1) of the wells (6504540) at a rate of 60 gpm for 1.5 hours and though drawdown data was not provided, the recommended pumping rate was 40 gpm suggesting ample water supply.



## 4.0 SITE SERVICING REQUIREMENTS & IMPACT ASSESSMENT

#### 4.1 WASTEWATER SYSTEMS & POTENTIAL IMPACT OF EFFLUENT

Each of the six proposed lots will require an individual wastewater treatment system. Each system is expected to be a small conventional system approved under the Ontario Building Code. The designer of each septic system and leaching bed will need to consider the flow volumes for the particular facility and the soil percolation time at the particular location where the leaching bed is desired. It is not anticipated that any of the leaching beds will be particularly large given the permeable soils at most locations on the property and the modest daytime worker washroom usage at each facility.

Given the limited number of septic systems and proposed ±20 acre lots, it is anticipated that there will be a large distance between leaching beds. Given this separation and the expected large groundwater crossflow through and recharge to the aquifer, it is not anticipated that there would be any water quality impacts from these systems. Additionally, no shallow water supply wells are in close proximity to the expected downgradient flow from the proposed lots. Locations where native soil percolation times are greater than 1 min/cm should have an appropriate layer of less-permeable sand incorporated into the leaching bed design to slow the effluent percolation.

The height of the water table will also need to be considered with regards to septic design, particularly for Lots 4, 5 and 6 on the west side of the property where the water table is within the top 1 to 2 m throughout the year. Regrading may need to be considered for lots on the west side of the property to allow sufficient separation (>1.0 m) between the septic leaching beds and high water table, though some may have sufficient depth on the east side of the lot.

#### 4.2 WATER SUPPLY & POTENTIAL IMPACT OF WATER TAKING

Each of the six proposed lots will also require an individual water supply well. Each lot owner will need to contract a licensed water well driller to drill and test a well to meet the owner's requirements. It is our understanding that the proposed industrial lots will be for 'dry' industry and will not be heavy water takers.

Based on the excellent well yields described in Section 3.4, it is anticipated that adequate water for each lot will be easily obtained. Given the high well capacities, anticipated high aquifer transmissivity and the large distance between wells, no well interference issues are expected. It is also expected that the majority of the water taken will be reintroduced to the aquifer via the septic systems and so it is not anticipated that there would be any regional impacts to groundwater flow reaching Cedar Creek.



### 4.3 STORMWATER MANAGEMENT & POTENTIAL IMPACT TO GROUNDWATER RECHARGE

The hydrogeological conditions at the property, particularly towards the middle of the property, are expected to easily accommodate stormwater management and infiltration. It is our understanding that no stormwater management pond is proposed for the site and that individual lot owners will be responsible for stormwater management on their respective lots.

As discussed in Section 3.3.2, infiltration rates are expected to range across the property with the variation in surficial soils, from 1 mm/hr for clayey silt up to 75-300 mm/hr for gravelly sand. As the soil conditions vary between and even within the proposed lots, lot owners will need to select an appropriate rate for the soil conditions where their infiltration facility is to be located, for use in its design.

The water table elevation also varies between and within the proposed lots. It is recommended that the base of any infiltration facilities be situated no less than 1 m above the seasonally high water table to ensure reliable infiltration conditions. This separation will need to be considered for the design of infiltration facilities on individual lots (particularly for Lots 4, 5 and 6) and in the proposed roadway, and should be considered during any future regrading of the Site.

In general, the opportunities to maintain the already high level of recharge at the Site to the underlying aquifer are excellent. Any combination of open ditches and swales constructed into the sandy soils, clean water infiltration facilities on individual lots, and septic leaching beds are anticipated to result in maintenance of the existing recharge rates. Furthermore, a 30-m setback will act as a constraint to development in proximity to the wetland, and so the existing recharge rates within that boundary are expected to be maintained.

# 5.0 CONCLUSIONS & RECOMMENDATIONS

Based on the results of the hydrogeological investigation described in this report, the following conclusions and recommendations are provided.

- The subject property is underlain primarily by sand or sand and gravel deposits, with smaller portions of the property underlain by finer grained silts and fill. The water table depth across the property ranges from about 3.5 to 10 m in the eastern and central upland areas to less than 0.6 m within and adjacent to wetlands located along the western edge of the property.
- 2. Shallow groundwater flow is in a westerly direction across the property toward Cedar Creek, where it is expected to discharge, and this is consistent with the findings of the Upper Cedar Creek Subwatershed Study. The on-Site wetlands and tributary of Cedar Creek along the western edge of the property exhibit spatially and temporally variable recharge-discharge conditions. Groundwater discharge is consistent to the tributary and occurs during the spring season along much of the wetland fringe. Other portions of the wetland fringe show groundwater recharge conditions either consistently or during the drier summer-fall seasons only.



- 3. The predominantly open sandy soils create high recharge (350-400 mm/year) and high infiltration (50 300 mm/hr) conditions in the upland areas of the property, and this is consistent with the findings of the Upper Cedar Creek Subwatershed Study. These conditions, along with the relatively deep water table in most areas, support the construction of both on-site sewage system leaching beds and infiltration facilities for stormwater management. Due to the variable soil textures, confirmatory soil testing is required at the location of any individual leaching bed or infiltration facilities on Lots 4, 5 or 6, will need to account for the shallower water table depth on the west edge of these lots and adjust the location and grading of beds/facilities for the appropriate regulatory offset distances from the seasonally high water table. Locations where native soil percolation times are less than (i.e., faster than) 1 min/cm should have an appropriate layer of less-permeable sand incorporated into the leaching bed design to slow the effluent percolation.
- 4. Data from local well records and pumping tests of wells located on neighbouring properties confirm the viability of the deep unconfined sand and gravel aquifer to support individual supply wells for each development lot, without concern for interference with existing neighbouring wells or the future wells on the development property.
- 5. Conventional wastewater treatment systems, designed in accordance with the Ontario Building Code, are recommended for each development lot. No adverse water quality impact to shallow groundwater or Cedar Creek is anticipated, based on the limited number of proposed sewage systems, the modest sewage volumes from the planned 'dry' industries, the recommendation for deep aquifer wells on each lot, and the absence of existing shallow wells in the immediate downgradient area.
- 6. To maintain the high pre-development groundwater recharge, it is recommended that grassed swales/ditches be utilized along roadways and lot lines to promote infiltration of runoff and, where possible, runoff from building rooftops, be directed to subsurface infiltration facilities and/or open swales/ditches for enhanced recharge.

Respectfully submitted, CHUNG & VANDER DOELEN ENGINEERING LTD.



Lauren Curnow, B.Sc. (Hons) Environmental Scientist

A. Cuduson.

William (Sandy) Anderson, M.Sc., P.Eng. Senior Hydrogeologist and Engineer



### **6.0 REFERENCES**

The following documents, maps, or other publications have been used in the preparation of this report.

- "Quaternary Geology of the Cambridge Area", Karrow, P. F. (1987).
- "Draft Plan of Subdivision, Part of Lots 25 & 26, Concession 11, Township of North Dumfries, Regional Municipality of Waterloo", Dryden Smith & Head Planning Consultants Ltd. (January 30, 2020).
- "Preliminary Design Stormwater Management Report, Calder Industrial Subdivision, Township of North Dumfries", Meritech Services Inc. (July 10, 2019).
- "Phase 1 Hydrogeological Characterization Upper Cedar Creek Scoped Subwatershed Study", Matrix Solutions Inc. (November 2, 2018).



Hydrogeological Investigation Calder Industrial Subdivision D5D Enterprises Limited June 5, 2020 FILE NO.: H18100 Page A

**APPENDIX A** 

Table 1 and Figures 1 to 7



	Ground	Top Pipe		١	Vater Leve	l			Wa	ter Elevati	on		Fluctuation
	Elevation	Elevation		(m Belov	w Ground	Surface)				(mASL)			(m)
Location	(mASL)	(mASL)	24-Apr-19	16-May-19	17-Jun-19	14-Aug-19	09-Oct-19	24-Apr-19	16-May-19	17-Jun-19	14-Aug-19	09-Oct-19	24-Apr-19 to 19-Oct-19
BH1	310.91	311.72	6.61	6.43	6.47	6.72	6.92	304.30	304.48	304.44	304.19	303.99	-0.31
BH2	315.24	316.07	9.61	9.46	9.39	9.60	9.78	305.63	305.78	305.85	305.64	305.46	-0.17
BH3	308.15	309.05	4.60	4.42	4.59	4.89	5.03	303.55	303.73	303.56	303.26	303.12	-0.43
BH4	313.98	314.78	8.51	8.35	8.35	8.56	8.72	305.47	305.63	305.63	305.42	305.26	-0.21
BH5	308.03	308.92	3.72	3.67	3.84	4.05	4.18	304.31	304.36	304.19	303.98	303.85	-0.46
BH6	304.96	305.86	1.69	1.47	1.60	1.94	2.29	303.27	303.49	303.36	303.02	302.67	-0.60
BH7	301.76	302.60	0.21	0.16	0.29	0.50	0.45	301.55	301.60	301.47	301.26	301.31	-0.24
BH8	301.24	302.04	0.49	0.49	0.56	0.65	0.61	300.75	300.75	300.68	300.59	300.63	-0.12
BH9	300.31	301.23	0.13	0.18	0.29	0.50	0.39	300.18	300.13	300.02	299.81	299.92	-0.26
DP1	299.79	300.36	0.07	0.06	0.13	0.34	0.23	299.72	299.73	299.66	299.45	299.56	-0.16
DP1 (s/w)	299.79	300.36	0.00	0.00	D	D	D	299.79	299.79	D	D	D	-
DP2	302.29	302.89	-0.16	-0.19	-0.19	0.25	0.25	302.45	302.48	302.42	302.04	302.04	-0.41
DP2 (s/w)	302.29	302.89	0.00	-0.03	D	D	D	302.29	302.32	D	D	D	-
DP3	300.01	300.69	-0.53	-0.53	-0.50	-0.45	-0.51	300.54	300.54	300.51	300.46	300.52	-0.02
DP3 (s/w)	300.01	300.69	-0.10	-0.10	-0.10	-0.07	-0.07	300.11	300.11	300.11	300.08	300.08	-0.03
DP4	301.02	301.60	-0.08	-0.08	-0.01	0.16	0.07	301.10	301.10	301.03	300.86	300.95	-0.15
DP4 (s/w)	301.02	301.60	0.00	D	D	D	D	301.02	D	D	D	D	-
SW1 (s/w)	-	302.07	-	-	-	-	-	300.70	300.72	300.58	300.28	300.25	-0.45

## Table 1: Summary of Water Levels, Elevations & Fluctuations

Notes: 1) All Elevations Referenced to Geodetic Survey

3) Negative Water Level Fluctuation is a <u>Decline</u> in Water Elevation

2) Negative Water Level is Height <u>Above</u> Ground

4) D- Dry Well or Dry Surface Location







	LEGEND
<b>\</b>	Borehole / Monitoring Well
0	Drive Point Piezometer
•	Surface Water Staff Gauge
<b>0</b> 6506186	Water Supply Well & MECP Well Record # (location approximate)
	Subject Property
	Study Area
	Wetland Delineation
	Wetland Setback (30 m)
	Woodlan Delineation
	Woodland Setback (10 m)
—	Watercourse
[]]]	Regulatory Floodplain









001       002       003       004       005				
000       001       002       002       003       003       004       004       005       0		Project St	udv Area	
Model Domain       Water Body       Water Body       Water Body       Read       Recharge (mm/year)       0 0 <t< th=""><td>5000</td><td>C Detailed S</td><td>Study Area</td><td></td></t<>	5000	C Detailed S	Study Area	
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000       001       002       002       003		S Water Bo	dy	
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Hydrogeological Investigation Calder Industrial Subdivision D5D Enterprises Limited June 5, 2020 FILE NO.: H18100 Page B

**APPENDIX B** 

Draft Plan Site Survey Plan







SKETCH SHOWING BOREHOLES & PIEZOMETERS PART OF LOTS 25, 26 AND 27 CONCESSION 11 GEOGRAPHIC TOWNSHIP OF NORTH DUMFRIES
TOWNSHIP OF NORTH DUMFRIES REGIONAL MUNICIPALITY OF WATERLOO
MacDONALD TAMBLYN LORD SURVEYING SCALE 1 : 1500 90

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**APPENDIX C** 

Well Records



(i) UTM j / 17 12 15 48 10100 1E	<sup>'84</sup>	ĺ.		65Nº	122 722
Elev. 14 R 27055 WATEL	rio Water Resources	REC	Act DRD	65 N?	6/25
Basin County or District AY ATE Con. XI Lot. 2:	Towns	ship, Village, To completed	own or City. 8 (day V. SEC TR	NoV Month DEAS. RR4	1965 year)
Owner.	e	ss	Pumpin	a Test	
Casing and Screen Record         Inside diameter of casing       %         Total length of casing       %         Type of screen		atic level est-pumping ra umping level uration of test p ater clear or clo ecommended p ith pump settin	te bumping budy at end of umping rate g of 70 f	$ \begin{array}{c} g & \text{lest} \\ F + . \\ 30 \\ F + . \\ 6 \\ HRS \\ \text{test} \\ C \\ 1 \\ 2 \\ 5 \\ \text{or} \\ \text{fet below} \end{array} $	G.P.M.
Well Log				Water	Record
Overburden and Bedrock Record <b>Fop</b> CLAY 4, 5	SOIL	From ft. <b>O</b>	To ft. 10	Depth(s) at which water(s) found	Kind of water (fresh, salty, sulphur)
CLAY & SA LOOSE HARP GRAVE	Y PAN	10 25 85 89	25 85 89 90	89 Ft.	FRESH
For what purpose(s) is the water to be used? SCHOOL Is well on upland, in valley, or on hillside? $4DL$ Drilling or Boring Firm $MLAUGHLIN$ WELLS & SUPPLICATION WELLS & SUPPLICATION WELLS & SUPPLICATION TO A SUPPLICATION OF THE SUPPLICATION	AND. ATER D.	In diagram road and	Location n below show lot line. Inc	of Well distances of wel licate north by	l from arrow.
Address product of the second	IREX 20 hlin ractor)	Hev	2000 4.97	150 No 7 /	T 4
VRC COPY					S.C.

0P8d 62. UTM ND WA Ontario Water Resources Commission Act Elev. RECOR Basin .Township, V County Date completed 0 Con.... Lot. (day Owner Address. **Casing and Screen Record Pumping Test** Static level Inside diameter of casing .... Test-pumping rate G.P.M. Total length of casing 20/ Pumping level Type of screen ... Duration of test pumping. Length of screen Water clear or cloudy at end of test Depth to top of screen Recommended pumping rate 145 ......G.P.M. Diameter of finished hole with pump setting of  $25^{-1}$  feet below ground surface Well Log Water Record Kind of water (fresh, salty, sulphur) Depth(s) at which water(s) From To Overburden and Bedrock Record ft. ft. found 2 6 Location of Well For what purpose(s) is the water to be used? In diagram below show distances of well from nelar road and lot line. Indicate north by arrow. Is well on upland, in valley, or on hillside! Drilling or Boring Firm 10 1892 Address. 6 Licence Number Name of Driller or Borer Address ..... Date Dfilling or Boring Contractor) (Signature of License Form 7 5M-61-3852 CSS.28 OWRC COPY

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АТ - ГЕЕТ 10-13 1 1 10-13 1 1 20-23 1 1	KIND OF WATER           KIND OF WATER           SALTY         MINERAL           JSALTY         MINERAL           JFRESH         SULPHUR           ZANILER         ØØØØ           VMATER         Z2-24           JS MINUTES         Z3           JSA-11         PUMPING           JSA-12         JS           JSA-14         JS	INSIDE         MATERIAL           INSIDE         MATERIAL           INCUES         MATERIAL           INCUES         MATERIAL           INCUES         MATERIAL           INCUES         ALANAIZED           3         CONCRETE           4         OPEN HOLE           10         STEEL           2         GALVANIZED           3         CONCRETE           4         OPEN HOLE           24-25         1           2         GALVANIZED           3         CONCRETE           4         OPEN HOLE           24-25         1           STEEL         2           20         GALVANIZED           3         CONCRETE           4         OPEN HOLE           25         GPM           28         GPM           29         JO MINUTES           30         MATERIAL           28         SET AT           WATER AT EN	WALL           THICKNESS           12           12           13           19           26           19           26           19           26           19           26           19           26           19           26           19           26           19           26           19           26           27           19           26           27           28           29           29           20085           2009           210085           22000           221           2221           223           224           225           225           226           226           221           2221           2232           224           225           224           225           224           224	JLE RE           DEPTH           FROM           Ø           Ø           7-18           INS           5-37           7-42	- FEET TO 13-16 1554 20-23 27-30 27-30	GI PLUGG DEPTH SET AT - FI FROM TC 10-13 18-21 26-29 LOCAT	TYPE FING & S EET 14-17 22-25 30-33 BO ION OF W DISTANCES OF WEL H BY ARROW.	EALING R AND TYPE LEAD	41-44 FEET MENT GROUT PACKER, ETC
AT - FEET           8 II- 72ET           9 II- 73           10-13           11           20-23           20-23           20-23           20-23           20-23           20-23           20-23           20-23           20-23           20-23           20-23           10           20-23           20-23           20-23           20-23           10           10           11           12           20-33           11           12           20-33           11           11           12           20-33           13           14           15           15           16           17           18           19           19           11           11           12           13           14           15           16           17	KIND OF WATER           RESH         3           SALTY         4           MINERAL           PRESH         3           SULPHUR         20           PARSH         3           SULPHUR         20           PRESH         3           SULPHUR         20           PRESH         3           SULPHUR         20           PRESH         3           SULPHUR         24           MINERAL         10           PUNFING         20           WATER         20           VATER         20           VATER         25           WATER         25           WATER         25           WATER         25           WATER         25           WATER         28           PEET         28	INSIDE         MATERIAL           INSIDE         MATERIAL           INCLUS         INCLUS		JLE RE           DEPTH           FROM           Ø           Ø           7.18           S           5-37           FEET           42           9Y	- FEET TO 13-16 1844 20-23 27-30 27-30 IN DI LOT L	GI PLUGG DEPTH SET AT - FI FROM TO 10-13 18-21 26-29 LOCAT	TYPE FING & SI EET MATERIAL 14-17 22-25 30-33 80 ION OF W DISTANCES OF WEL H BY ARROW.	EALING R AND TYPE LEAD	41-44 FEET ECORE MENT GROUT PACKER, ETC
AT - FEET           8 II - FEET           8 II - G           9 II - G           20-23           20-23           20-23           20-23           20-23           20-23           20-23           20-23           20-23           20-23           20-23           10           90 MP NG TEST MET           11 PUMP NG TEST MET           12 PUMP           STATIC           LEVEL           0 38 -21           11 FLOWING, GIVE RATE           11 FLOWING, SHALLOW	KIND OF WATER         RESH       3       SULPHUR         SALTY       MINERAL         FRESH       3       SULPHUR         SALTY       MINERAL         FRESH       3       SULPHUR         SALTY       MINERAL         JFRESH       3       SULPHUR         SALTY       MINERAL	INSIDE         MATERIAL           INSIDE         MATERIAL           INCHES         MATERIAL           INCHES         MATERIAL           INCHES         CONCRETE           I OPEN HOLE         I STEEL           I OPEN HOLE         I OPEN HOLE           I OPEN H		7-18 5-37 22 22 24 22 24 24 25 35 37 25 37 25 37 25 37 25 37 25 37 25 37 25 37 25 37 25 37 25 37 25 37 25 37 25 37 25 37 37 37 37 37 37 37 37 37 37 37 37 37	- FEET TO 13-16 184 20-23 27-30 IN DI LOT L	GI PLUGG DEPTH SET AT - FI FROM TC 10-13 18-21 26-29 LOCAT	TYPE	EALING R AND TYPE LEAD	AT-44 FEET ECORE MENT GROUT.
AT - FEET       10-13       10-13       11       20-23       20-33       20-33       20-33       20-33       20-33       20-33       20-33       20-33       20-33       20-33       20-33       20-33       20-33       20-33       20-33       20-33	KIND OF WATER           KIND OF WATER           SALTY         SULPHUR           SALTY         MINERAL           FRESH         SULPHUR           SALTY         MINERAL           FRESH         SULPHUR           SALTY         MINERAL           JERESH         SULPHUR           JALTY         MINERAL           JERESH         SULPHUR           JALTY         MINERAL           JERESH         SULPHUR           SALTY         MINERAL           JERESH         SULPHUR           SALTY         MINERAL           JERESH         SULPHUR           SALTY         MINERAL           SALTY         MINERAL	INSIDE         MATERIAL           INSIDE         MATERIAL           INCUSS         ALVANIZED           INCUSS         INCUSS		JLE RE           DEPTH           FROM           Ø           Ø           7-18           INS.           5           5-37           FEET           42           DY           6-49           IPM	- FEET TO 13-16 13-16 13-16 13-16 13-16 20-23 27-30 27-30 IN DI LOT 1 2,5 2,0 2,0 2,0 2,0 1,0 1,0 1,0 1,0 1,0 1,0 1,0 1	GI PLUGG DEPTH SET AT - FI FROM TC 10-13 18-21 28-29 LOCAT	TYPE	EALING R AND TYPE LEAD	
AT - FEET     10-13     1	KIND OF WATER           RESH         3           SALTY         4           MINERAL           SALTY         4           MINERAL           FRESH         3           SALTY         4           MINERAL           SALTY         4           MINERA	INSIDE         MATERIAL           INSIDE         MATERIAL           INCUS         INCUS		JLE KE           DEPTH           FROM           Ø	- FEET TO 13-16 13-16 13-16 13-16 13-16 20-23 27-30 27-50 27-5	GI PLUGG DEPTH SET AT - FI FROM TO 10-13 28-29 LOCAT AGRAM BELOW SHOW INE. INDICATE NORTH	TYPE TYPE TYPE THING & SI TA-17 22-25 30-33 80 TON OF W DISTANCES OF WEL H BY ARROW.	EALING R DEPTN TO TOP OP SCREEN EALING R AND TYPE LEAD VELL L FROM ROAD AND Mite 4/3	AT-44 FEET ECORE MENT GROUT. PACKER. ETC
AT - FEET           8 14 - 7667           9 10-13           10           20-23           20-33           20-33           20-33           20-33           20-33           20-33           20-33           20-33           20-33           20-33           20-33           20-33           20-33           20-33 <t< td=""><td>KIND OF WATER         KRESH       3       SULPHUR         SALTY       MINERAL         FRESH       3       SULPHUR         SALTY       MINERAL         FRESH       3       SULPHUR         SALTY       MINERAL         JFRESH       3       SULPHUR         SALTY       MINERAL         SALTY       MINERAL</td><td>Inside         MATERIAL           Inside         MATERIAL           JOCHS         GALVANIZED           JOCONCRETE         GALVANIZED           JOCHS         GALVANIZED           JOCONCRETE         JOCONCRETE           JOCONCRETE         JOCONCRETE</td><td></td><td>JLE RE           DEPTH           FROM           Ø</td><td>- FEET TO 13-16 184 20-23 27-30 IN DI LOT I 25 200 200 200 200 200 200 200</td><td>GI PLUGG DEPTH SET AT - FI FROM TC 10-13 18-21 26-29 LOCAT AGRAM BELOW SHOW INE. INDICATE NORTI</td><td>TYPE TYPE TING &amp; SI TA-17 22-25 30-33 00 TON OF W DISTANCES OF WEL W ARROW.</td><td>EALING R AND TYPE LEAD</td><td>AT-44 FEET ECORU MENT GROUT. PACKER, ETC</td></t<>	KIND OF WATER         KRESH       3       SULPHUR         SALTY       MINERAL         FRESH       3       SULPHUR         SALTY       MINERAL         FRESH       3       SULPHUR         SALTY       MINERAL         JFRESH       3       SULPHUR         SALTY       MINERAL	Inside         MATERIAL           Inside         MATERIAL           JOCHS         GALVANIZED           JOCONCRETE         GALVANIZED           JOCHS         GALVANIZED           JOCONCRETE         JOCONCRETE		JLE RE           DEPTH           FROM           Ø	- FEET TO 13-16 184 20-23 27-30 IN DI LOT I 25 200 200 200 200 200 200 200	GI PLUGG DEPTH SET AT - FI FROM TC 10-13 18-21 26-29 LOCAT AGRAM BELOW SHOW INE. INDICATE NORTI	TYPE TYPE TING & SI TA-17 22-25 30-33 00 TON OF W DISTANCES OF WEL W ARROW.	EALING R AND TYPE LEAD	AT-44 FEET ECORU MENT GROUT. PACKER, ETC
AT - FRET           8 II- 13           10-13           10           20-23           20-23           20-23           20-23           20-23           20-23           20-23           20-23           20-23           20-23           20-23           20-23           10           20-33           20-23           20-23           20-23           20-23           20-23           20-23           20-23           20-24           20-25           20-25           20-27           20-28           20-29           20-29           20-29           20-20           20-20           20-20           20-21           20-21           20-22           20-23           20-21           20-21           20-22           20-21           20-22           20-22           20-22           20-22           20-22	KIND OF WATER       KIND OF WATER       SALTY     SULPHUR       SALTY     MINERAL       FRESH     SULPHUR       SALTY     MINERAL       FRESH     SULPHUR       SALTY     MINERAL       JERESH     SULPHUR       SALTY     MINERAL       JERESH     SULPHUR	INSIDE         MATERIAL           INSIDE         MATERIAL           INCUSE         MATERIAL           INCUSE         MATERIAL           INCUSE         MATERIAL           INCUSE         CONCRETE           4         OPEN HOLE           10         STEEL           2         GALVANIZED           3         CONCRETE           4         OPEN HOLE           24-25         I           2         GALVANIZED           3         CONCRETE           4         OPEN HOLE           24-25         I           25         GPM           6         OPEN HOLE           23         CONCRETE           4         OPEN HOLE           25         GPM           38         GPM           25         GPM           38         GPM           26         APA           27         GPM           28         APA           29         APA           20         APA           21         GALVANIZED           22         GALVANIZED           38         APA		JLE RE           DEPTH           FROM           Ø           Ø           7-18           INS.           5-5-37           FEET           42           DY           F49           PM.           LY	- FEET TO 13-16 1894 20-23 27-30 27-30 IN DI LOT L 2,5 2,0 2,5 2,0 2,5 2,0 2,5 2,0 2,5 2,0 2,5 2,0 2,5 2,0 2,5 2,0 2,5 2,0 2,5 2,0 2,5 2,0 2,5 2,0 2,5 2,0 2,5 2,0 2,5 2,5 2,5 2,5 2,5 2,5 2,5 2,5	GI PLUGG DEPTH SET AT - FI FROM TO 10-13 18-21 26-25 LOCAT AGRAM BELOW SHOW INE. INDICATE NORT	TYPE FING & SI TATERIAL TATERITATION TATERIAL TATER	EALING R DEPTN TO TOP OP SCREEN EALING R AND TYPE LEAD VELL L FROM ROAD AND MAIN YS MAIN YS M	AT-44 FEET ECORI MENT GROUT. PACKER. ETC
AT - FREET 10-13 1 10-13 1	KIND OF WATER         KRESH       3         SALTY       4         MINERAL         SALTY       4	INSIDE         MATERIAL           UNSIDE         MATERIAL           UNCUES         MATERIAL           UNCUES         MATERIAL           UNCUES         CONCRETE           4         OPEN HOLE           17-18         I           3         CONCRETE           4         OPEN HOLE           24-25         I           3         CONCRETE           4         OPEN HOLE           2         GALVANIZED           3         CONCRETE           4         OPEN HOLE           2         GALVANIZED           5         STEND           4         OPEN HOLE           2         GALVANIZED           5         A		DEPTH FROM FROM 0 7-18 5-37 185-37 5-37 7-18 5-37 19 42 42 42 42 42 42 42 42 42 42 42 42 42	- FEET TO 13-16 13-16 13-16 13-16 13-16 20-23 27-30 27-3	GI PLUGG DEPTH SET AT - FI FROM TO 10-13 28-29 LOCAT AGRAM BELOW SHOW INE. INDICATE NORTH	TYPE EING & SI 14-17 22-25 30-33 80 ION OF W DISTANCES OF WEL WARROW.	EALING R DEPTN TO TOP OF SCREEN EALING R AND TYPE LEAD VELL L FROM ROAD AND Smith 4	AT-44 FEET ECORI MENT GROUT, PACKER, ETC
AT - FRET 10-13 1 10-13 1 10 20-23 1 20-23	KIND OF WATER         KIND OF WATER         FRESH       3         SALTY       4         MINERAL         SALTY       4         MINERAL       7         SALTY       4         MINERAL       7         MINERAL       7         SALTY       4         WATER       7	Inside         MATERIAL           Inside         MATERIAL           JOCHS         GALVANIZED           JOCONCRETE         JOCONCRETE		7-18 5-37 7-18 5-37 7-18 5-37 7-18 10 5-37 10 10 10 10 10 10 10 10 10 10	- FEET TO 13-16 1584 20-23 27-30 27-30 IN DI LOT I 2,5 200 2,5 200 5,2 M-	GI PLUGG DEPTH SET AT - FI FROM TO 10-13 26-29 LOCAT AGRAM BELOW SHOW INE. INDICATE NORT	TYPE TYPE TYPE THING & SI TA-17 22-25 30-33 00 TON OF W DISTANCES OF WELL DISTANCES OF WELL WHY - 3 X	EALING R AND TYPE LEAD	AT-44 FEET ECORE MENT GROUT, PACKER, ETC
AT - FRET 10-13 10-13 10 20-23 20-23 10 20-23 20-25	KIND OF WATER         KIND OF WATER         SALTY 4 MINERAL         FRESH 3 SULPHUR       19         SALTY 4 MINERAL       19         SALTY 4 MINERAL       24         JERESH 3 SULPHUR       25         SALTY 4 MINERAL       19         JERESH 3 SULPHUR       25         JALTY 4 MINERAL       19         PARENDER       22         MINERAL       22         MINERAL       22         VALTER       2000         VALTER       22         VALTER       22         VALTER       22         VALTER       22         VALTER       22         VALTER       22         VALTER       23         VALTER       24         VALTER       24         POWP INTANE         ANTER SUPPLY          25	INSIDE         MATERIAL           INSIDE         MATERIAL           INCUS         GALVANIZED           INCUS         INCUS           INCUS         INCUS     <		DEPTH FROM	- FEET TO 13-16 1894 20-23 27-30 27-30 IN DI LOT 1 255 200 Cheol-17 52 M-	GI PLUGG DEPTH SET AT - FI FROM TO 10-13 18-21 26-29 LOCAT AGRAM BELOW SHOW INE. INDICATE NORTH 2444 2444 2444 2444 2444 2444 2444 24	TYPE FING & SI EET MATERIAL 14-17 22-25 30-33 80 ION OF W DISTANCES OF WEL M BY ARROW.	EALING R DEPTH TO TOP OP SCREEN EALING R AND TYPE LEAD VELL L FROM ROAD AND Mit y	AT-44 FEET ECORE MENT GROUT, PACKER, ETC
AT - FREET 10-13 1 10-13 1 10-13 1 20-23 1	KIND OF WATER         KRESH       3         SALTY       4         MINERAL         FRESH       3         SALTY       4         MINERAL         SALTY       4         WATENERAL       22         WATENERAL       23         BALER       22         MINERAL       3	INSIDE         MATERIAL           INSIDE         MATERIAL           JACHES         MATERIAL           JACHES         MATERIAL           JACHES         MATERIAL           JCONCRETE         CONCRETE           JOOPEN HOLE         30 CONCRETE           JOOPEN HOLE         21-18           ZA-25         STEEL           ZONCRETE         40 OPEN HOLE           ZA-25         STEEL           ZONCRETE         40 OPEN HOLE           ZA-25         STEEL           ZONCRETE         40 OPEN HOLE           ZA-25         GALVANIZED           ZA         ODEN HOLE           ZA         OPEN HOLE		DEPTH FROM G 7-18 5-37 185- 195- 195- 197- 185- 197- 197- 197- 197- 197- 197- 197- 197	- FEET TO 13-16 13-16 13-16 13-16 13-16 13-16 13-16 13-16 20-23 27-30 27-3	GI PLUGG DEPTH SET AT - FI FROM TO 10-13 28-29 LOCAT AGRAM BELOW SHOW INE. INDICATE NORTH 244 244 244 244 244 244 244 244 244 24	TYPE FING & SI TA-17 TA-17 22-25 30-33 00 ION OF W DISTANCES OF WEL DISTANCES OF WEL WARROW MAROW MAROW MAROW MAROW MAROW MARROW MARROW MARRO	EALING R DEPTN TO TOP OF SCREEN EALING R AND TYPE LEAD VELL L FROM ROAD AND Somite 45	AT-44 FEET ECORI MENT GROUT PACKER, ETC
AT - FREET 10-13 1 10-13 1 10-13 1 20-23 1	KIND OF WATER         KIND OF WATER         ARESH       3         SALTY       MINERAL         FRESH       3         SALTY       MINERAL         SA	Inside         MATERIAL           Inc. Ins.         MATERIAL           JOC MAR         MATERIAL           JOC MAR         CONCRETE           4         OPEN HOLE           17-18         1           3         CONCRETE           4         OPEN HOLE           24-25         I STEEL           2         GALVANIZED           3         CONCRETE           4         OPEN HOLE           24-25         I STEEL           2         GALVANIZED           3         CONCRETE           4         OPEN HOLE           24-25         GRUNANIZED           3         CONCRETE           4         OPEN HOLE           2         GALVANIZED           3         CONCRETE           4         OPEN HOLE           2         GALVANIZED           3         GRUNANIZED           2         GALVANIZED           3         GRUNANIZED           2         GALVANIZED           3         GRUNANIZED           4         OPEN HOLE           3         GRUNANIZED           5         GALVANIZED <td></td> <td>27.18 7.18 7.18 5-37 22 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 42 42 42 42 42 42 42 42 42</td> <td>- FEET TO 13-16 1584 20-23 27-30 27-30 IN DI LOT I 25 200 Cheol-A 20 20 20 Cheol-A 20 Cheol-A 20 20 Cheol-A Cheol-Che</td> <td>GI PLUGG DEPTH SET AT - FI FROM TO 10-13 28-29 LOCAT ACRAM BELOW SHOW INC. INDICATE NORT</td> <td>TYPE TYPE TYPE THING &amp; SI TA-17 TA-17 TA-17 TA-17 TON OF WELL TON OF WELL</td> <td>EALING R AND TYPE LEAD VELL L FROM ROAD AND MATE 440</td> <td>AT-44 FEET ECORUL MENT GROUT. PACKER, ETC</td>		27.18 7.18 7.18 5-37 22 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 27 42 42 42 42 42 42 42 42 42 42	- FEET TO 13-16 1584 20-23 27-30 27-30 IN DI LOT I 25 200 Cheol-A 20 20 20 Cheol-A 20 Cheol-A 20 20 Cheol-A Cheol-Che	GI PLUGG DEPTH SET AT - FI FROM TO 10-13 28-29 LOCAT ACRAM BELOW SHOW INC. INDICATE NORT	TYPE TYPE TYPE THING & SI TA-17 TA-17 TA-17 TA-17 TON OF WELL TON OF WELL	EALING R AND TYPE LEAD VELL L FROM ROAD AND MATE 440	AT-44 FEET ECORUL MENT GROUT. PACKER, ETC
AT - FRET         8 H - FRET         8 H - FRET         8 H - FRET         9 - 18         10-13         11         20-23         21         20-23         21         20-33         21         20-33         21         20-33         21         20-33         21         22-23         21         22-23         21         22-23         21         22-23         21         22-23         21         22-23         21         22-24         21         22-25         21         22-25         21         22-25         21         22-25         23         24         25-25         25-25         22         23         24         25-25         25-25         25-25         25-25         25-25	KIND OF WATER         KIND OF WATER         SALTY       SULPHUR         SALTY       MINERAL         FRESH       SULPHUR         SALTY       MINERAL         FRESH       SULPHUR         SALTY       MINERAL         JERESH       SULPHUR         SCALTY       SULPHUR         GPM       <	INSIDE         MATERIAL           INSIDE         MATERIAL           JACHES         GRUVANZED           JOENCONCETE         GALVANIZED           JOENCONCETE         GALVANIZED           JOENCONCETE         GONCRETE           GONCRETE         GONCRETE           JOENCONCETE         GALVANIZED           JOENCONCETE         GONCRETE           GONCRETE         GONCRETE           JOENCONCETE         GONCRETE           GONCRETE         GONCRETE           GONTANTES         GENING           GONTION         GONTIONED, IN           SI AT         TECONMERCIAL           GONTIONAL <td< td=""><td></td><td>DEPTH FROM 0 7-118 5-37 7-18 5-37 7-18 5-37 7-18 5-37 7-18 5-37 7-18 5-37 7-18 5-37 7-18 6-49 10 10 10 10 10 10 10 10 10 10 10 10 10</td><td>- FEET TO 13-16 184 20-23 27-30 27-30 IN DI LOT L 25 200 24 52 M- MARKE</td><td>Contractor</td><td>TYPE TYPE TING &amp; SI TA-17 22-25 30-33 80 TON OF W DISTANCES OF WELL MATERIAL DISTANCES OF WELL MATERIAL STATE REM STATE REM STATE</td><td>EALING R AND TYPE LEAD</td><td></td></td<>		DEPTH FROM 0 7-118 5-37 7-18 5-37 7-18 5-37 7-18 5-37 7-18 5-37 7-18 5-37 7-18 5-37 7-18 6-49 10 10 10 10 10 10 10 10 10 10 10 10 10	- FEET TO 13-16 184 20-23 27-30 27-30 IN DI LOT L 25 200 24 52 M- MARKE	Contractor	TYPE TYPE TING & SI TA-17 22-25 30-33 80 TON OF W DISTANCES OF WELL MATERIAL DISTANCES OF WELL MATERIAL STATE REM STATE	EALING R AND TYPE LEAD	
AT - FREET 10-13 1 10-13 1	KIND OF WATER         KRESH       3         SALTY       4         MINERAL         SALTY       4	INSIDE         MATERIAL           INSIDE         MATERIAL           INCIDE         MATERIAL           INCIDE         MATERIAL           INCIDE         CONCRETE           INCIDE         Incide           Incincincide         Incide           <		DEPTH FROM FROM C 7-18 5-37 FBET 42 5-37 FEET 42 5-37 FEET 42 5-37 FEET 42 5-37 FEET 42 FROM C C C C C C C C C C C C C	- FEET TO 13-16 13-1	Contractor	TYPE FING & SI TATERIAL 14-17 22-25 30-33 80 ION OF W DISTANCES OF WEL DISTANCES OF WEL WARROW. FIND S9-62 DATE RE 08 NESPECTOR	EALING R DEPTH TO TOP OF SCREEN EALING R AND TYPE LEAD VELL L FROM ROAD AND 5 mit 43 CEIVED 14107	AT-44 FEET ECORI MENT GROUT PACKER, ETC
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NAME OF WELL T	ONT.		ELL TECHNICIA	USE Sur					
SIGNATURE OF THE	INS	SUBMISSION DATE	CENCE NUMBE		1				

MINISTRY OF THE ENVIRONMENT COPY

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Waler / bog     Ling / Ling / Ling     Ling / Ling     Ling / Ling     Ling <thling< th="">     Ling     &lt;</thling<>	County or District	0.1.6.1	Township/Borough/City/	Towq/Village	survey, etc. Lot		
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LOG OF OVERBURDEN AND BEDROCK MATERIALS (see instructions)         Open-16       Open-16       Open-16         Brauk       Open-16       Open-16       Open-16         Brauk       Open-16       Stand       Stand       Open-16       Stand       Stand       Open-16       Stand	21						1.1
General color     Mode concern matrixed     Other matrixed       Brownell     gravel     sand       Greek     sift       Greek     sift       Greek     sift       Greek     sift       Greek     gravel       Greek     sift       Greek     gravel       Greek     sift       Greek     gravel		LOG	OF OVERBURDEN AND BED	ROCK MATERIALS (see inst	ructions)	De	oth - fe
Chrowen       gravel       sand       30         Crey       sitt       Fine sand       30         Crey       sand       gravel       sitt         Sitt       Sitt       Sitt       Sitt       Sitt         Sitt       Sitt       Sitt       Sitt       Sitt       Sitt         Sitt       Sitt       Sitt       Sitt       Sitt       Sitt       Sitt         Sitt       S	General colour	Most common material	Other materials	Ge	General description		
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Name       Nonder value       Nonder	41 WA	TER RECORD 51	CASING & OPEN HOL Wall	ERECORD Size	es of opening 31-33 Dia ot No.)	meter 34-38 Leng	th //
Image: State is and image: State is a state in the state is a state	at - feet	Kind of water diam inches	Material thickness inches	From To Mai	terial and type	Depth at top	of scree
Image: Static weight of the state of th	87.1	Salty : Gas	Galvanized Galvanized Concrete	0 81 52	ainless Steel	93	feet
Product State       Contraction       Contraction <td>2</td> <td>C Y Fresh <sup>4</sup> □ Minerals Salty <sup>6</sup> □ Gas</td> <td>A C Open hole Plastic</td> <td>20-23 61</td> <td>PLUGGING &amp; SE</td> <td>ALING RECOR</td> <td>D</td>	2	C Y Fresh <sup>4</sup> □ Minerals Salty <sup>6</sup> □ Gas	A C Open hole Plastic	20-23 61	PLUGGING & SE	ALING RECOR	D
Image: Static low gives ate method       Image: Static l	20-23 1 [	Fresh <sup>3</sup> Sulphur <sup>24</sup> A Minerals	2 Galvanized Screen	71. 90 Depths	set at – feet Material and ty	/pe (Cement grout, b	entonite,
1       Set	25-28 1	Fresh 3 🗌 Sulphur 29	Open hole     Plastic     Fiftings	10-1	10 14-17		
Image: State       Image: State <td< td=""><td>30-33</td><td>Salty 6 Gas</td><td>2 Galvanized 3 Concrete</td><td>27-30</td><td>22-25</td><td></td><td></td></td<>	30-33	Salty 6 Gas	2 Galvanized 3 Concrete	27-30	22-25		
Pumping test method       Pumping test method<	. 2	Saity 8 Gas	Open hole     S    Plastic				-
Static level and pumping       Water level and pumping       In diagram below show distances of well from road and lot line. Indicate north by arrow.         If the intervent and pumping       If an index and pumping       20 minutes and pumping       45 minutes and pumping       45 minutes and pumping       40 minutes and	71 Pumping test r	nethod <sup>10</sup> Pumping rate	PM Hours Om Mins		LOCATION OF WELL		
1937       10 minutes       30 minutes       32 Minutes	Static level	Water level end of pumping 25 Water levels during	Pumping      Precovery	In diagram below s Indicate north by a	how distances of well fro rrow.	om road and lot	line.
Image: Top Teet       The teet       Teet       Teet <tht< td=""><td>19-21</td><td>22-24 15 minutes 30 minute</td><td>29-31 45 minutes 60 minutes 35-37</td><td>1</td><td></td><td></td><td></td></tht<>	19-21	22-24 15 minutes 30 minute	29-31 45 minutes 60 minutes 35-37	1			
GPM       feet       K Clear       Cloudy         Hecommended pump type       Recommended       Accommended       Recommended       Recharged         Shallow & Deep       Deep       Building Street       Opp       Performended       Recharged         Kas       Shallow & Deep       Deep       Market supply       Abandoned, Insufficient supply       Untinished         *       Water supply       Abandoned, Insufficient supply       Untinished       Performended       Performended         *       Water supply       Abandoned, Insufficient supply       Untinished       Performended       Performended         *       Name of Weil Contracting       *       Abandoned (Cheri)       *       Nature of the Institution	It flowing give	To feet Lereet LA	teet X feet X feet	Wavdom Rd.		XI	_
Important       Shallow & Deep       pump setting       pump rate       0         Important       Shallow & Deep       pump setting       0       0         Important       Abandoned insufficient supply       Important       0       0         Important       Abandoned insufficient supply       Important       0       0       0         Important       Important       Abandoned insufficient supply       Important       0       0       0       0         Important       Important       Important       Important       Important       0<	Idw Becommender	GPM GPM	feet Clear Cloudy		HWY	. 97	
FixAL       Stardoned, insufficient supply       Untinished         *       Abandoned, insufficient supply       Intinished         *       Observation well       Abandoned, insufficient supply       Peplacement well         *       Doservation well       Abandoned, insufficient supply       Peplacement well         *       Doservation well       Abandoned, coor quality       Peplacement well         *       Doservation well       Downstric       The well is boalds scale house at sintrance to gravel pit         *       Domestic       *       Correctial       *       Not used         *       Domestic       *       Other       The well is boalds scale house at sintrance to gravel pit         *       Domestic       *       Other       *       Inspector         *       Domestic       *       Doties upply       *       Inspector         *       Industrial       *       Cooling & air conditioning       *       Driving         *       Industrial       *       Driving       *       Digging         *       Rotary (reverse)       *       Dinanond       *       Digging         *       Rotary (reverse)       *       Jetting       Contractor       JAN 1 4 1998	G □ Shallow	© Deep pump setting 85	feet // GPM	HWY. 401		Mell	
* Water supply       * Abandoned, insufficient supply * Unifinished         * Observation well       * Abandoned, foor quality       * Replacement well         * Observation well       * Abandoned, foor quality       * Replacement well         * Recharge well       * Dewatering         WATER USE       * Abandoned (Other)         * Domestic       * Dewatering         * Other       * Other         * Stock       * Municipal         * Inigation       * Public supply         * Colling & air conditioning       * Other         * Cable tool       * Ali percussion         * Rotary (air)       * Jetting         * Rotary (air)       * Jetting         * Rectarge well       * Other         * Cable tool       * Ali percussion         * Rotary (air)       * Jetting         * Rotary (air)       * Jetting         * Rotary (air)       * Jetting         * Mater starge well       * Other         * Rotary (air)       * Jetting         * Rotary (air)       * Jetting <td< td=""><td></td><td>S OF WELL <sup>14</sup></td><td></td><td></td><td></td><td>X</td><td></td></td<>		S OF WELL <sup>14</sup>				X	
*       Pest noise       Construct (perturned)         *       Recharge well       •       Dewatering         *       Recharge well       •       Dewatering         *       Recharge well       •       Dewatering         *       Bonnestic       •       Onmestic       •         •       Stock       •       Municipal       *       Other         •       Irrigation       *       Cooling & air conditioning       *       Other         •       Industrial       •       Cooling & air conditioning       *       Inspector         •       Retary (conventional)       •       Diamond       *       Diaging         •       Retary (conventional)       •       Diamond       *       Diaging         •       Retary (conventional)       •       Diamond       *       Diaging         •       Retary (conventional)       •       Diamond       *       Image: Contractor       Image: Contractor         •       Retary (conventional)       •       Jetting       Well Contractor's Licence No.       Image: Contractor	2 Water su 2 Observa	pply 5 Abandoned, insuffici tion well 6 Abandoned, poor qu	ient supply <sup>a</sup> [] Unfinished ality <sup>10</sup> [] Replacement well				-
WATER USE       5-54            1	<ul> <li>I fest hole</li> <li>Recharg</li> </ul>	e well 8  Dewatering				wei hit	
*       Stock       *       Municipal       *       Other         *       Inrigation       *       Public supply       *       Other         *       *       Industrial       *       Cooling & ar conditioning         *       *       Industrial       *       Cooling & ar conditioning         *       *       Industrial       *       Cooling & ar conditioning         *       *       Cooling & ar conditioning       *       Diamond         *       Rotary (conventional)       *       Boring       *       Diagoing         *       Rotary (conventional)       *       Diamond       *       Diagoing         *       Diamond       *       Jeting       *       Other       *         *       Rotary (verse)       *       Jeting       *       Other       *         *       Rotary (verse)       *       Jeting       *       Other       *         *       Rotary (verse)       *       Jeting       *       Other       *         *       Address       *       Diamond       *       *       Date contractor       *         *       Address       *       Address </td <td>WATER USE</td> <td>SS-S6</td> <td>Not used</td> <td></td> <td>The well is been at entrance</td> <td>ide scale hour to gravel pit.</td> <td>•</td>	WATER USE	SS-S6	Not used		The well is been at entrance	ide scale hour to gravel pit.	•
* X industrial       * Country is an consumming         METHOD OF CONSTRUCTION       *         * Cable tool       * Air percussion         * Cable tool       * Boring         * Rotary (conventional)       * Diamond         * Rotary (conventional)       * Diamond         * Rotary (conventional)       * Diamond         * Rotary (air)       * Diamond	2 Stock 3 Irrigation	Municipal     Public supply	10 🗍 Other				
METHOD OF CONSTRUCTION       *       Air percussion       *       Diving         *       Cable tool       *       Diring       Digging         *       Diatary (conventional)       *       Boring       *       Digging         *       Rotary (conventional)       *       Diamond       *       Digging       *       186226         *       Rotary (conventional)       *       Jetting       *       Other       *       186226         *       Rotary (air)       *       Jetting       *       Other       *       *       186226         Name of Well Contractor       Well Contractor's Licence No.       #       207       942       Data source       Yo       Data source	Y Industria			-			
Industry conversion       Image: Conversion	METHOD OF	CONSTRUCTION "	Driving     Dissing			400	
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Name of Well Contractor & Uell Drilling Inc. 4207 Address Address Add					increase in the second	ate received	65-
Address H#2 Oncoster Ontario Name of Well Technician Well Technician's Licence No. Mervyn Packhami T0058 Signature of Technician/Contractor // Subprission date 97	Name of Well Con	am Well Drilling I	Inc. 4207		1207	JAN 1 4	1998
Name of Well Technician's Licence No. Merry N. Packhami Signatury of Technician's Signatury of Technician's Licence No. Signatury of	Address P. #.	n Anesta A.	tario	Date of inspection	Inspector		
Signature of Technician/Contractor // Subprission date 97	Name of Well Tech	nician DII	Well Technician's Licence N	o. Remarks	in the second		Ž
	Herv	in Packhani	10050	I SP		CSS.58	1

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ntario Environi and Ene	ment ergy				11	WATER WEL	L REC	ORD
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ounty or Distric	LATEDI	16	Township/Borough/Ci	ty/Town/Village		Con block tract surve	y, etc. Lot	25-2/
	DATERAC	0	Address	Jun FRIE	<u> </u>	Date		· 48-53
			RR#0 Northing	2 CAM	BAIDGE Elevation RC	Basin Code ii	day mi	iv
	11	10 12	17 18	24 25	× 30		ليتيا	111
Seneral colour	Most common m	LOG OF OVE	RBURDEN AND BE	DROCK MATER	IALS (see instrue	ctions)	Der	oth - feet
Real	Tao S	. /	Other materials	,	Gener	a description	From	To
Drown	210		-		/		0	1
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LAU		ILLI	Lullu	بليبيال	<u>lilili.</u>			LUU
		<u>lilili</u>	<u></u>		ليليا ليب			LJ U
WA ater found	TER RECORD	51 C Inside	ASING & OPEN HO Wall	Depth - feet	Z Sizes of (Slot No	opening <sup>31-33</sup> Diameter	34-38 Lengt	29-40
- feet	Fresh 3 D Sulphur 14	diam Mi inches	teel 12	From To	Material	and type	Depth at top o	feet
1-25 20	Salty 6 Gas	48"	alvanized 4"	0 75	5 54	nd		feet
2 [	☐ Fresh 4 ☐ Minerals ☐ Salty 6 ☐ Gas		lastic		61	PLUGGING & SEALIN	G RECORI	)
20-23 1 [ 2 [	Fresh <sup>3</sup> Sulphur <sup>24</sup> Salty <sup>4</sup> Minerals	3 0 0	ialvanized ioncrete		Depth set at	Annular space	Abandonme	nt
25-28 1 [	Fresh <sup>3</sup> Sulphur <sup>29</sup> Salby <sup>4</sup> Minerals	4 0 C 5 0 P	pen hole lastic		From O <sup>13</sup>	To material and type (Cer	l Cen	seg /
30-33 I C	Fresh <sup>3</sup> Sulphur <sup>34</sup>	60 2 G	alvanized		18-21	2-2 MIX		
2 🗆	] Salty ≰ ☐ Minerals ≰ ☐ Gas	4 0 O > 0 P	pen hole lastic	~	26-29	sact R.E	- Jain	ł
Pumping test m	nethod <sup>10</sup> Pumping rate	9 11-14 Durat GPM	ion of pumping 15-18 t7-18 Hours Mins		LO	CATION OF WELL		
Static level W	Water level 25 and of pumping Water lev	els during 1 🗌 Pump	ing ? 🗌 Recovery	In dia Indica	gram below show ate north by arrow	distances of well from roa	d and lot lin	e.
10-21	22-24 15 minutes 26-28	30 minutes 45 m	inutes 60 minutes 32-34 35-37		2	A lon to	11	
feet If flowing give ra	feet feet ate 38-41 Pump intake	feet set at Water	feet feet	-1	/	10 "		
Recommended	GPM Becommend	feet l	Clear Cloudy	4	//	A	1	er hon
Shallow	Deep pump setting	20 pump	rate 5 GPM	1	51	N/	Re	gion
	S OF WELL 9			In In		<i>I</i> V	4	17
Vater super 2 Observation	oply 5 Abandon on well 6 Abandon	ed, insufficient supply <sup>9</sup> ed, poor quality <sup>10</sup>	Unfinished Replacement well	To Londo				
I lest hole     Acharge	well # Dewateri	ing			Ri	e ri		
	55-56	niai a		1 =				3
2 Stock 3 Irrigation	<ul> <li>Municipa</li> <li>Municipa</li> <li>Public su</li> </ul>	il io ipply	Other	HA	IL I			
		a air conditioning						Xr
Cable tool	ONSTRUCTION <sup>37</sup>	ssion e	Driving		÷		IK	
Hotary (co     Rotary (re-     Gary (re-     Gary (ai)	eventional) 6 (B-Boring evense) 7 [] Diamond ir) 8 [] Jetting	10	Digging Other		Ϋ́.	UT?	2020	69
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Idress	MT. PEAC	AAT		Date of inspec	ction	nspector	1 3 13	
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me of Well Techni	Chair A							
me of Well Techni CCY nature Technic	Aver /	- <b>9</b>	9- <b>6</b> 854 bmission date	NISTF			<i>k</i>	

Hydrogeological Investigation Calder Industrial Subdivision D5D Enterprises Limited June 5, 2020 FILE NO.: H18100 Page D

**APPENDIX D** 

**Borehole Logs & Grain Size Analyses** 







Enclosure No.: 2







CVD BOREHOLE (2017)

![](_page_40_Figure_0.jpeg)

CVD BOREHOLE (2017)

![](_page_41_Figure_0.jpeg)

H18100 2224 CEDAR CREEK ROAD.GPJ CVD ENG.GDT 20-3-25 CVD BOREHOLE (2017)

![](_page_42_Figure_0.jpeg)

H18100 2224 CEDAR CREEK ROAD.GPJ CVD ENG.GDT 20-3-25 CVD BOREHOLE (2017)

![](_page_43_Figure_0.jpeg)

H18100 2224 CEDAR CREEK ROAD.GPJ CVD ENG.GDT 20-3-25 CVD BOREHOLE (2017)

![](_page_44_Figure_0.jpeg)

![](_page_45_Figure_0.jpeg)

![](_page_46_Figure_0.jpeg)

![](_page_47_Figure_0.jpeg)

![](_page_48_Figure_0.jpeg)