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Hydrogeological Assessment and Terrain Analysis

Proposed Residential Subdivision
1240 Old Prescott Road,
Geographic Township of Osgoode,
Ottawa (Greely), Ontario

Prepared For

2099116 Ontario Inc.

October 17, 2013

Report: PH2095-REP.01

Paterson Group Inc.
Consulting Engineers
154 Colonnade Road South
Ottawa (Nepean), Ontario
Canada K2E 7J5

Tel: (613) 226-7381
Fax: (613) 226-6344
www.patersongroup.ca

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APPENDICES

1.0 INTRODUCTION

1.1 Terms of Reference

Paterson Group (Paterson) was retained by 2099116 Ontario Inc. to conduct a detailed hydrogeological assessment and terrain analysis on a 20.2 hectare (50 acre) vacant parcel of land having the legal identity of Part of Lot 4, Concession 4, former Village of Greely, now the City of Ottawa, Ontario and known, municipally, as 1240 Old Prescott Road, hereafter referred to as the subject property. (Refer to Figure 1-Site Location Plan, located in Appendix 5)

The purpose of this study has been to ascertain and assess the specific hydrogeological conditions and surficial terrain features that currently exist beneath the subject property as they relate to the suitability of the site for residential development on private services with minimal impact on groundwater resources.

These works have been completed in general accordance with the present City of Ottawa industry standard which seeks to utilize the following Ontario Ministry of Environment (MOE) guidance documents in the completion of hydrogeological assessments:

- Guideline D-5: Planning for Sewage and Water Services (August 1996)
- Procedure D-5-4: Technical Guideline for Individual On-site Sewage Systems: Water Quality Impact Risk Assessment (August 1996)
- Procedure D-5-5: Technical Guideline for Private Wells: Water Supply Assessment (August 1996)

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and recommendations pertaining to the private services for the subject development as understood at the time of writing this report.

1.2 Existing Zoning and Description of Proposed Development

The subject property is currently designated Development Reserve (DR) in the City of Ottawa Official Plan. It is proposed to rezone the subject property to permit the creation of a Plan of Subdivision which would be developed on individual on site water and wastewater services.

The subject property encompasses a total area of approximately 20.2 hectares (50 acres) and is located within the southern limits of the existing Village of Greely, Ontario.

The average minimum lot size for each of the proposed lots has been assigned at approximately 0.27 hectares (0.69 acres) with a total of 46 lots being evaluated as part of this terms of reference. Permissible minimum lot size within the former Village of Greely, as referenced by the City of Ottawa Official Plan (OP) is set for this site at 0.2 hectare (0.5 acre).

It is proposed that the subdivision will be serviced by individual onsite wells and onsite wastewater treatment systems (OWTS). This form of servicing is consistent with the established hierarchy prescribed in Section _____ of the Ontario Provincial Policy Statement and is consistent with the established development within the Village of Greely and surrounding rural areas.

2.0 BACKGROUND

2.1 Site Setting

The subject property is located on the west side of Old Prescott Road and to the north of McKeown Drive (refer to Figure 1). It is further bound to the west and north by existing residential developments.

The parcel of land is generally rectangular in shape extending deep into the Lot beyond the eastern road boundary. The lot is considered to be relatively flat to slightly sloping and is primarily treed, save for two (2) areas: a hydro and drainage easement located in the western quadrant, and cleared area located immediately to the west of Old Prescott Road. Drainage of the property is considered to be imperfect to good and appears to be dictated by the local surficial topography.

Historically, it would appear that the site was used for modest agricultural purposes as evidenced by the existing cleared area where there is evidence of small field crop plantings. In addition, there is an existing large diameter dug well present in the cleared area which would appear to have been the primary source of water for irrigation purposes. Considering the small size of the cleared area, it is opined that the farming operation was extremely small scale, consistent with organic vegetable production.

With respect to the dug well, the well was measured in the field to be approximately 6 m deep and 1.2 m in diameter. It was observed to be constructed of precast concrete well tiles set on top of one another and backfilled in place. The cover of the well was noted to be precast concrete and a 50 mm diameter hole was observed to have been cored in the middle of the cover. The interior conditions of the well were considered to be, based on field observations, unacceptable for potable water use.

In addition to the existing well, a small, steel clad, rectangular outbuilding is present at the site. Adjacent to the outbuilding, it was noted that a steel shipping crate present several metres to the west. A narrow, gravel driveway extends from Old Prescott Road to the outbuilding.

2.2 Hydrology

The subject property is located in a temperate climatic zone consisting of warm, humid summers and cold, dry winters. The mean annual precipitation for this area is approximately _____ mm (Environment Canada- Climatic Services).

The site is relatively flat to gently sloping from east to west across the site with an obvious modest depression located near the approximate centre of the parcel. The average elevation of the site is approximately ____ m amsl. There are no defined drainage structures present within, or along the perimeter of the site, with the exception of a drainage ditch that bisects the property in the western quadrant. The drainage ditch follows an existing hydro easement and appears to transmit stormwater from the existing ponds located to the north and west of the site, southward to existing water courses located beyond the site. Drainage patterns within the subject property boundaries, itself, appear to direct runoff water into the wooded area within the central quadrant where it appears to infiltrate into the subsurface.

2.3 Regional Geology and Hydrogeology

Published surficial geology mapping for the area within the vicinity of the subject property indicate that the overburden consists of various Post Champlain Sea deposits however the subject property is generally shown to be overlain by a narrow band of organic deposits to glaciofluvial materials consisting of stratified sand and silt. The relevant sections of the available surficial geology mapping has been reproduced for reference purposes and appears in Figure 2 located in Appendix 5.

Published geological mapping (Refer to Figure 3 located in Appendix 5), provided by the Ontario Geologic Survey, reveals that the site and immediate surroundings are underlain by limestone of the Oxford Formation of the Paleozic Period. Based on available bedrock lithology data, the Oxford Formation is, historically, underlain by a thin layer of March Formation limestone-sandstone, which, in turn, is underlain by Nepean Formation Sandstone.

A cursory review of the MOE Water Well Records also confirms that the significant majority of the wells drilled in the immediate area have been constructed into the limestone of the Oxford Formation, and a fewer number have been advanced to the March or Nepean Formations.

Water Well Construction and Aquifer Interception

A search of the available MOE Water Well Records (WWRs) as undertaken as part of the background works in order to prepare a conceptual hydrogeological model for the subject property. The search returned over 100 individual MOE WWRs within a 500 m radius of the centre of the subject property.

Analysis of the individual MOE WWRs resulted in approximately 51 individual WWR's which could be identified as being within the immediate vicinity of the subject property. The majority of these WWRs were located in the adjacent subdivisions located immediately to the north of the subject property. One (1) WWR was noted to lack sufficient aquifer intercept information to be included in the regional analysis and one (1) WWR was noted to be a WWR abandonment record. In total, 49 MOE WWR's were analysed for well construction characteristics and aquifer intercept depths within the underlying bedrock strata. These WWRs are included for reference purposes in Appendix 2.

Of the 49 MOE WWRs included in the analysis, 100% of the wells were noted to drilled wells with the casings completed into bedrock. The choice of grouting compounds were identified to be either a neat cement, or sodium bentonite slurry.

With respect to the depth of aquifer interception, 10 of the WWRs reported intercepting a water supply aquifer within the shallow portion of the Oxford Formation at a depth of less than 23 m below the existing ground surface. Of these 10 WWRs, three (3) were noted to have also intercepted a lower water supply aquifer within the Oxford Formation limestone at depths of the order of 35 m to 39 m below ground surface. In all instances, the length of well casing reported on the WWRs indicated that the casings terminated into only the upper few metres of the bedrock surface.

Conversely, the remaining 39 MOE WWRs were noted to intercept a combination of the lower Oxford Formation limestone and the limestone-sandstone interbeds associated with the March Formation. A total of 5 WWRs intercepted the lower Oxford Formation between 35 m and 45 m below ground surface (bgs) and the March Formation water supply aquifer at a depth of between 52 and 70 m bgs. The remaining 26 WWR's intercepted only the March Formation at depths of between 52 and 70 m bgs and did not report encountering the Oxford Formation water supply aquifers. In all instances, the length of well casing reported on these WWRs indicated that the casings terminated into only the upper few metres of the bedrock surface.

With respect to well yields, all of the 49 WWRs reported yields in excess of 23 L/min (5 Igpm).

Although most of the available MOE WWRs within the adjacent developments are completed into the lower Oxford Formation limestone or the March Formation water supply aquifers, all of the WWR's reviewed indicated that the well casings terminated into only the first few metres of the surface of the bedrock. As such, given that several wells intercept the upper and lower Oxford Formation limestone aquifers, these aquifers can be considered to be hydraulically interconnected. Moreover, upwards of 5 of the 49 WWRs reviewed (10%) reported intercepted both the lower Oxford Formation and March Formation water supply aquifers.

2.4.1 Recharge/Discharge Areas

A detailed visual assessment of the subject property was completed and there were no observed area of groundwater discharge located within the limits of the property.

With respect to recharge, the site, as detailed in Section 2.2, has surficial topographic characteristics which seek to promote infiltration into the shallow overburden groundwater regime. However, Paterson's experience in the area is such that the permeable surficial soils are underlain by a series of strata containing thick, cohesive, or very dense non-cohesive soils which are of extremely low in situ hydraulic conductivity. As such, while the site is considered to be conducive to the recharge of the shallow, overburden groundwater regime, it is not considered to be a significant recharge area to the deep bedrock aquifer system present beneath the site.

Rather, based on the available aquifer information, contained within both the Shield's Creek Subwatershed Study, and the Groundwater Impact Assessment for the Village of Greely, the Oxford, March, and Nepean Formation water supply aquifers are generally thought to be recharged from shallow or at surface bedrock present in the far west end of the City of Ottawa, extending into Beckwith Township.

2.4.2 Hydrogeologically Sensitive Areas

As the subject site is overlain by at least 14 m of overburden, approximately 60% of which is known to be of low hydraulic conductivity, the site is not considered to be hydrogeologically sensitive. A detailed discussion of the surficial soils present beneath the subject property is contained in Section ____.

2.4.3 Potential Sources of Contamination

For the purposes of the hydrogeological assessment, potential sources of contamination, located within a radius of approximately 500 m of the subject property, have been grouped into three categories according to their relative degree of risk of contaminating or otherwise adversely affecting the bedrock aquifers beneath the subject property:

Low

The neighbouring residential and commercial developments are all privately serviced with onsite water wells and sewage systems. The long term operation of the sewage systems in the vicinity, and located upgradient of the subject property, has been identified as being a potential source of contamination to the water supply aquifers.

Medium

The commercial/light industrial development to the south of the property has some automotive repair uses which have been identified as having a medium risk of being a potential source of contamination.

Works completed by Paterson in the close proximity to the subject property related to a commercial lot severance, however, did not find any evidence of contamination in the bedrock aquifer system from either petroleum hydrocarbons or volatile organic compounds. These findings are discussed in greater detail in Section ____.

In addition to the commercial operations, etc. portions of the existing residential development, located to the east and northeast of the subject property were constructed prior to the adoption of the Osgoode By-Law regarding water well construction. This By-Law was considered to be instrumental in ensuring a consistent minimum construction standard for water well construction, which went beyond the minimum of Ontario Regulation 903, the Provincial legislation regarding water well construction. As such, poorly constructed wells may be present in these areas which may allow for the short circuiting of contaminants (mainly sewage system effluent) directly into the water supply aquifers in the area.

High

Based on the visual assessment of the lands located beyond the subject property, there are no identified sources of contamination which present a high risk of contaminating or otherwise adversely affecting the bedrock water supply aquifers beneath the subject site.

2.4.4 Large Water Uses and PTTW Review

Based on a review of large water taking uses in the vicinity of the site, there are no single large water uses presently operating at the time of preparation of this report. Individual well operation, however, has been identified as an overall large water use of the bedrock water supply aquifers and potential well interference effects on the wells proposed on the property, albeit temporary and of minimal amplitude, are likely to occur. Potential well interference is discussed in greater detail in Section ____ of this report.

Beyond the vicinity of the subject property, Paterson is aware of a registered Permit To Take Water located at the Shadow Ridge residential development located approximately 1800 m south of the subject property on Old Prescott Road and another PTTW issued for dewatering operations in one of the pit/quarry operations located approximately 3000 m north by northwest on Albion Road. Neither of these water uses are considered to have any measurable impacts on potential aquifer yield due, primarily, to their distance away from the proposed development.

3.0 HYDROGEOLOGICAL ASSESSMENT

In order to evaluate the water supply aquifer(s) underlying the site, a total of four (4) test wells, hereafter denoted as TW1 to TW4, inclusive, were constructed across the site. The locations of the wells were selected by Paterson to ensure that the spacing of the wells was adequate to obtain representative lot coverage for aquifer testing. The general well locations were chosen in order to ensure adequate areal coverage across the site, while, at the same time, endeavoring to maintain sufficient proximity such that response could be measured in observation wells during the pumping tests. Reference should be made to Paterson Drawing No. PH2095-1- Test Hole Location Plan, located in Appendix 5.

A rigorous review of available Water Well Records for the immediate area, published by the Ontario Ministry of the Environment (MOE) was undertaken prior to the placement of the test wells. Overburden thickness, depth of casing, aquifer interception points and reported well yields were reviewed in detail in order to establish a conceptual hydrogeological model for the site. Based on Paterson's previous experience in the area, and combined with the available Water Well Records, a conceptual hydrogeological model was established. A comprehensive well construction protocol was subsequently established based on the conceptual model and field results.

3.1 Conceptual Hydrogeologic Model

As the subsurface geology and aquifer system in the area has been well studied by Paterson and others over the past few decades, the derivation of the conceptual hydrogeologic model for the subject property is generally straight forward.

Bedrock of the Oxford Formation is present beneath a thick glacial till layer which overlies marine sediments and glaciofluvial overburden soils deposits. The Oxford Formation, comprised of carbonate limestone, has several intermittent water supply aquifers present in the upper and lower portions of the Formation.

Below the Oxford Formation, there is a water supply aquifer with broad presence within the March Formation, present between the Oxford and Nepean Formations, respectively. Beneath the March Formation, the Nepean Formation contains the only recognized regional aquifer system.

Water quality and quantity are considered to be good to excellent in all of the water supply aquifers present in the vicinity of the subject property.

3.2 Test Well Construction Protocol

The test well installation program was carried out by Air Rock Drilling Company Ltd. between May 2013 and August 2013. A engineer from Paterson was present during the creation of the casing hole, installation of the casing and grouting of the annular space for each test well. The Ministry of the Environment (MOE) Water Well Records for each test well appear in Appendix 2.

Based on the intermittent nature of the bedrock aquifer within the vicinity of the subject area, it was decided, that the casing hole should be extended through the overburden and seated upwards of 3.0 m into the Oxford Formation limestone and at least 1.0m into competent bedrock. Thereafter, the open borehole would be extended downward until a suitable water supply aquifer was encountered.

TW1

A 228 mm diameter casing hole was advanced using a rotary tri-cone bit through the shallow overburden, to the underlying limestone bedrock. The casing hole was advanced into the bedrock an additional 1.8 m to ensure that each casing was seated into competent (i.e. unfractured) bedrock.

A new, 150 mm diameter steel casing, having an approximate length of 14 m, was installed in the casing hole, thereby providing for a casing stickup of approximately 0.6m. The annular space was grouted utilizing a neat cement and sodium bentonite slurry introduced into the bottom of the annular space and pumped, using pressure grouting equipment, to the surface of the ground. The return of the grout to the surface of the ground, was visually observed by Paterson staff. As such, the casing installation and grouting of the annular space is considered to be in compliance with Ontario Regulation 903, the current regulation governing water well construction in the Province of Ontario.

After the completion of the casing installation and seating into the bedrock, the open borehole was advanced using a 150 mm diameter air percussion button bit. The well contractor reported, as shown on the WWR for TW1, that there were no aquifer intercepts encountered within the Oxford Formation limestone. Rather, a suitable water supply aquifer was located within the March Formation located beneath the Oxford Formation limestone and the Nepean Formation sandstone.

Once the water supply aquifer was encountered, the formation was repeatedly surged with air and allowed to clear. Preliminary well yield was estimated and the well was purged until the water was observed to be in a sand free state.

Following completion of the drilling and purging process, the static water level was allowed to stabilize. Air Rock, in accordance with Ontario Regulation 903, proceeded to chlorinate the well and a one hour constant rate pumping test was carried out. The rate chosen for the one hour pumping test was based on the preliminary findings of the well contractor at the time of installation and are those which are reflected on the published MOE Water Well Records.

Construction of TW2, TW3, and TW4

After TW1 was constructed successfully, thereby validating the well construction protocol and supporting the previously established conceptual hydrogeological model, the remaining test wells were constructed.

Each of the remaining test wells, with the exception of TW3, were constructed utilizing the same construction protocol as in TW1. In each case, the casing was advanced into the limestone bedrock a sufficient depth in order to ensure that the minimum casing length extended 6.2 m below ground surface. A copy of the MOE Water Well Record for each of the test wells is provided, for reference purposes, in Appendix 2.

Open borehole construction, surging and well development activities were carried out in conformity to the well construction program, as detailed in the construction of TW1. Each well was sufficiently chlorinated and subjected to a one hour constant rate pumping test by Air Rock, prior to Paterson carrying out any detailed testing.

3.3 Aquifer Analysis Methodology

Each of the four (4) test wells were subjected to a constant rate pumping test set at the pumping rate recommended by Air Rock during their one hour constant rate pumping test, as noted in Section 2.2. The duration for each test was specified to be the greater of the time in which steady state was achieved, or after six (6) hours of continuous pumping.

Each of the wells were pumped using a 1.5 HP electric submersible pump and portable generator package supplied by Air Rock. The pumping test configuration consisted of the submersible pump assembly discharging through a 10 m long discharge hose. The discharge hose was directed into a discharge piping system consisting of upwards of 20 m of 75mm dia. solid bell and spigot PVC piping contiguously connected and laid over the ground surface to direct the discharge water a sufficient distance away from the pumped well. In all cases, the discharge point for each pumping test was downgradient of the subject well at a sufficient distance to utilize the natural surface drainage features (ie. roadside ditch, or sloping terrain. Given the locations of the discharge points, combined with the duration of pumping, the pumping test configuration is believed to have minimized the potential effects of recharge into the overburden aquifer.

For each of the test wells, the test rate was selected based on the drawdown observed and reported by Air Rock during the mandatory one hour pumping test. Based on the drawdown over the one hour period, a test rate was set with the expectation that the rate would s tress the aquifer enough to result in a demonstrable reduction in potentiometric head (ie. a lowering of the static water levels) within the observation wells intercepting the water supply aquifer being tested. In all cases, the design test rates were several times higher than the minimum volumes required by Section 4.3.2 of Procedure D-5-5 which provides for an increased factor of safety in interpretation of the anticipated well yield and potential well interference models presented and discussed in Section 7.0 of this report.

During the pumping test, the pumping rate was constantly monitored using the timed volume correlation method at 60 minute intervals in order to ensure that the rate of discharge of the pumped water did not vary by more than 5%.

A series of chemical analyses of the pumped water were carried out at the well head during each pumping test. The parameters tested at the well head included: turbidity, free chlorine residual, total dissolved solids, pH, temperature and electrical conductivity. The turbidity and free chlorine residuals were monitored utilizing a Hanna C114 turbidity meter and the remaining parameters were analysed using a Hach combination multimeter. The field water quality results are tabulated and presented in Appendix 3.

Observation wells were closely monitored during each pumping test, in order to attempt to utilize the drawdown data in the observation wells to accurately estimate the aquifer storativity. The observation well data and accompanying hydrographs are tabulated and provided in Appendix 4.

Recovery data was collected for each of the test wells following the completion of

pumping. Recovery times varied from well to well with all wells achieving at least 95% recovery within a few short hours after the completion of each pumping test.

Pumping test data was analyzed using Aquifer Test v. 2.5 aquifer analysis software package, by Waterloo Hydrogeologic. The following analytical methods were applied (where relevant data was available):

- Transmissivity Parameters: (Theis & Jacob Recovery); and
- Storativity Parameters: Cooper Jacob's Time Drawdown and Theis (Curve Matching).

The results of the aquifer analysis are presented and discussed in Section 7 of this report.

3.4 Aquifer Analysis

The results of the pumping tests performed on the test wells are presented in the following sections.

3.4.1 Aquifer Characteristics

The aquifer characteristics determined from the compilations of the pumping tests for the four (4) test wells are summarized in Appendix 4 along with the detailed aquifer analysis. It is prudent to note that the test wells were not reported to have intercepted large enough quantities of water within the Oxford Formation, itself, during drilling. Based on the MOE WWR's prepared by the driller, it would appear that all of the test wells intercepted the water supply aquifers within the March Formation and possibly the Nepean Formations also.

3.4.2 Groundwater Geochemistry Assessment

As detailed in the previous sections, the raw groundwater was sampled at two (2) key milestones for each pumping test for each test well. During each sampling event, the free chlorine residual was measured in the field and confirmed to be below the hand held unit's detection limit prior to collection of the samples. The handheld unit utilized by Paterson is a Hanna C-114 Turbidimeter/free chlorine meter.

For each sampling event, the raw water was poured into the sampling bottles via a

secondary stopcock valve fitted onto Air Rock's discharge hose. This stopcock allows for the sampling of laminar water while it is forced through the discharge at a much higher pressure. This ensures accurate sampling for hydrogen sulfide and phenols.

Each of the set of sample bottles for each sampling event were preserved on ice for immediate transportation to the Ottawa Branch of Exova Accutest Laboratories Ltd. Exova is an accredited laboratory which has the relevant accreditation to perform analyses on drinking water samples. Each sample was submitted for analysis for bacteriological, chemical and physical water quality parameters consistent with a "subdivision package". A subdivision package is a suite of water quality parameters recognized by the City of Ottawa a being the minimum industry standard with respect to water quality analysis for residential development within the City of Ottawa.

The groundwater geochemistry for each of the test wells is conveniently summarized on Table 3-2 below:

TABLE:1 SUMMARY OF GROUNDWATER GEOCHEMISTRY OBTAINED THROUGH PUMPING OF TEST WELLS

PARAMETER	UNITS	MDL	TW1		TW2		TW3		TW4		Ontario Drinking Water Standards	
			3 HR	6 HR	3 HR	6 HR	3 HR	6 HR	3 HR	6 HR	TYPE	LIMIT
MICROBIOLOGICAL												
Total Coliforms	CFU/100mL	0	0	0	0	0	0	0	0	0	MAC	0
Eschirichia Coli	CFU/100mL	0	0	0	0	0	0	0	0	0	MAC	0
Heterotrophic Place	mg/L	0.48	23	38	23	38	23	38	/	/	-	-
Faecal Coliforms	mg/L	<0.10	0	0	0	0	0	0	/	/	-	-
Faecal Streptococcus	mg/L	2.52	/	/	/	/	/	/	0	0	-	-
GENERAL CHEMICAL - HEALTH RELATED												
Fluoride	mg/L	0.1	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.12	MAC	2.4
Ammonia	mg/L	0.02	0.03	<0.02	0.03	<0.02	0.03	<0.02	<0.02	0.03	-	-
Nitrite	mg/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	MAC	1
Nitrate	mg/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	MAC	10
Total Kjeldahl Nitrogen	mg/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.14	-	-
Turbidity	mg/L	0.1	1.3	1.4	1.3	1.4	1.3	1.4	0.3	0.5	MAC/AO	1.0/5.0
GENERAL CHEMICAL - AESTHETIC RELATED												
Alkalinity	mg/L	5	226	225	226	225	226	225	224	237	OG	500
Chloride	mg/L	1	73	73	73	73	73	73	71	72	AO	250
Colour	TCU	2	2	2	2	2	2	2	3	2	AO	5
DOC	mg/L	0.5	1.3	1.6	1.3	1.6	1.3	1.6	1.6	1.5	AO	5
Sulfide	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	AO	0.05
pH	unitless	1	7.97	7.93	7.97	7.93	7.97	7.93	8.02	8.21	AO	6.5-8.5
Sulphate	mg/L	3	68	68	68	68	68	68	66	66	AO	500
Hardness	mg/L	1	320	320	320	320	320	320	329	348	OG	100
Sodium	mg/L	2	27	27	27	27	27	27	26	28	AO	20(200)
Iron	mg/L	0.03	0.21	0.21	0.21	0.21	0.21	0.21	0.15	0.18	AO	0.3
Manganese	mg/L	0.01	0.03	0.03	0.03	0.03	0.03	0.03	26	0.03	AO	0.05
Total Dissolved Solids	mg/L	1	465	465	465	465	465	465	494	492	AO	500
Conductivity	uS/cm	5	761	763	761	763	761	763	760	757	-	-
Phenols	mg/L	0.005	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	-	-
Tannin & Lignin	mg/L	0.1	0.1	<0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1	-	-
Ion Balance	unitless	0.01	0.95	0.96	0.95	0.96	0.95	0.96	0.99	1.01	-	-
Calcium	mg/L	1	87	87	87	87	87	87	89	95	-	-
Magnesium	mg/L	1	25	25	25	25	25	25	26	27	-	-
Potassium	mg/L	1	2	0	2	0	2	0	0	2	-	-

3.4.3 Aquifer Analysis Summary

Water Quantity Assessment

Using the procedure summarized in the document entitled, "*Procedure D-5-5 Technical Guideline for Private Wells: Water Supply Assessment",* prepared by the Ontario Ministry of the Environment, last revised August 2006, an analysis of the suitability of the aquifer to supply the proposed development can be completed. Using the values contained with in Procedure D-5-5, the per-person water requirement is set at 450 L/day. The peak demand, which occurs over a 120 minute period each day, equates to a peak demand rate of 3.75 L/min per person. Procedure D-5-5 suggest the utilization of the number of bedrooms plus one, to determine the minimum number of people per house. As the proposed development will likely witness three bedroom single family homes, using the Procedure D-5-5 methodology, the number of persons would be four (4) and the total peak demand rate is calculated to be 15 L/min.

Analysis of Table 3-2, reveals that the pumping rates chosen for each of the pumping wells are above this minimum pumping rate. Furthermore, all of the test wells were reported to have utilized less than 15% of the available drawdown during the pumping tests. This information, combined with the calculated 20 year long term safe yield values, suggests that the specified well yields are representative of the yields which residents of the development are likely to obtain from future wells put down on the site.

Water Quality

A review of the water quality analysis data from Table 3.4.2, which represents the water supply aquifer located within the limestone in the upper portion of the Oxford Formation, reveals that the raw water meets all health related parameters of the Ontario Drinking Water Standards (ODWS).

With respect to aesthetic objectives and operational guidelines, the water contains modestly elevated concentrations of hardness and sodium.

Hardness, an operational guideline, does not appear in the ODWS. Rather it appears in the Technical Support Documents for Drinking Water Standards, Objectives and Guidelines (Technical Support Documents) as a parameter with an operational guideline of 100 mg/L. At the measured concentrations, the water is considered to be hard to very hard. TW2 and the HW reported hardness concentrations below the reasonable treatable limit of 500 mg/L specified in Table 3 of the guidance document, entitled, "Procedure D-5-5: Technical Guideline for Private Wells: Water Supply Assessment", published by the MOE in 1995.

Sodium (Na) concentrations in all of the test wells reported to be present above a concentration of 20 mg/L. The sodium concentration did not show significant reductions during the pumping tests. Although sodium is not toxic and no maximum acceptable concentration has been set, concentrations above 20 mg/L require that the Medical Officer of Health be notified so that this information may be passed on to local physicians for use in treatment of those requiring a sodium-restricted diet.

3.4 Water Treatment

Based on the groundwater geochemistry summarized in Table 3-2, there may be a desire by future homeowners to reduce the hardness concentrations in the raw water. Given that the measured concentrations appear to peak at around 348 mg/L, the water is considered to be hard to very hard at approximately 20 grains of hardness. (17.1 mg/L hardness reported as calcium carbonate equals 1 “grain” of hardness in water treatment vernacular). As such, a standard residential grade water softener will be sufficient to remove the hardness concentrations in the water.

While a water softener will remove effectively remove the hardness from the raw water, the treated water produced by the softener will have increased sodium concentrations. Based on the hardness concentrations, the anticipated post treatment sodium concentrations may approach 200 mg/L. As such, it is prudent for a separate tap be installed at each location where water will be consumed. That tap should be plumbed only to the raw water system, effectively bypassing the water softener. This is considered standard practice in the water treatment industry in Ontario.

4.0 TERRAIN ANALYSIS

As part of this study, a series of test holes, consisting of a combination of boreholes, and hand excavated test holes, were put down on the subject property to delineate the subsurface soil conditions beneath the site. The field investigations took place between November 2012 and September 2013. During this investigation, a total of six (6) boreholes and eight (8) test holes were constructed within the limits of the study area. The test pit locations were selected by Paterson personnel to ensure that adequate representation of the subsurface soil profile was delineated across the site.

Summary of Borehole Construction

A series of three (3) boreholes, BH1-BH3 inclusive, were put down across the subject property in November 2012. The boreholes were constructed with a CME- 55 power auger, attached to a track mounted drilling rig, and were advanced to refusal on inferred bedrock. The purpose of the construction of these initial boreholes was to evaluate the composition of the parent material beneath the site from a hydrogeological perspective.

In March, 2013, an additional three (3) boreholes, BH4 to BH6, inclusive, were put down within selected areas on the subject propety. The locations of these additional boreholes were selected to fill in gaps in the subsurface profile created by the initial drilling program.

Each of the boreholes were constructed under the full time supervision by Paterson and samples were recovered from split spoons every 1.5 m for field assessment and classification. Following the completion of the tactile evaluation of each sample, the samples were transferred to a storage bag and catalogued for transportation to the laboratory for further analysis. The depths at which the soil samples were recovered from the test holes are shown as “SS” on the Soil Profile and Test Data sheets provided in Appendix 1. The locations of the test pits put down on the subject property are referenced on Drawing No. PH2095-1, entitled “Test Hole Location Plan”, and is located in Appendix 2 of this report.

Summary of Test Hole Construction and In Situ Testing

To complement the borehole works, a series of test holes were put down within the treed areas across the remainder of the site in the areas where the boreholes were absent. The purpose of the test holes, excavated using hand equipment only, was to delineate the surficial soils located within the upper 2 m of the surface of the ground and to better define the overburden groundwater table beneath the site.

A total of eight (8) test holes were put down on the subject property in September 2013. Each hole was advanced to a depth of approximately 2.0 m below ground surface by a member of the hydrogeological department of Paterson. The surficial soils were visually and tactually classified in the field and representative samples were recovered and stored for further laboratory analysis. The depths at which the soil samples were recovered from the test holes are noted as a "G" on the Soil Profile and Test Data Sheets located in Appendix 1. The locations of the test holes put down on the subject property are referenced on Drawing No. PH2095-1, entitled "Test Hole Location Plan", and is located in Appendix 2 of this report.

Sample Storage

All samples will be stored in the laboratory for a period of one (1) month after issuance of this report. They will then be discarded unless we are otherwise directed.

4.1 Summary of Surficial Soil Stratigraphy

The surficial soils in the vicinity of the subject area generally consist of glacio-fluvial deposits of sand and glacial till associates with the glacial outwashes from the Champlain Sea. Typically, a shallow to thick deposit of medium to fine grained silty sand is present overlying a cohesive layer of silt or silty clay beneath the broader lands beyond the subject property. A cohesive to very dense non-cohesive till is typically present beneath the shallower deposits and rests atop bedrock.

Test hole locations and corresponding stratigraphy of the main soil types are summarized on the Test Hole Location Plan (Drawing No. PH2095-2 in Appendix 2) and a detailed discussion of each dominant soil strata is advanced below:

Organic Deposits (Topsoil)

The site is generally overlain by a thick layer of topsoil having a thickness of between 0.15 m and 0.45 m. The topsoil layer was noted to have significant organic content but has an overal loamy texture and composition. This is generally reflective of the sand, parent material underlying the organic layer. Of note is the fact that thickness of the organic layer increases moving east to west across the site until the hydro easement and drainage ditch. Beyond the drainage ditch to the west, the topsoil layer thins somewhat and has an average consistent thickness of approximately 0.2 m.

Silty Sand

A transition zone of silty sand is present directly beneath the topsoil across the subject property. The vertical migration of silt from the thick organic layer has resulted in the silt contamination of the underlying clean sand strata. While still considered to be a medium sand, the presence of silt is sufficient to classify, using the Unified Soil Classification System (USCS), as a silty sand. The layer has varying degrees of natural soil compaction with the most compact areas of this layer present within the heavily treed areas within the central quadrant of the site. The layer is heavily oxidized in the eastern quadrant of the site while in the central and western portions of the site, this layer is greyish-brown to brown. This suggests the this layer is influenced by the overburden groundwater levels within these central and western quadrants.

Sand

A layer of medium to coarse sand is present beneath the silty sand transition layer. The sand has a USCS classification of an SP, poorly graded sand and has a combination of coarse to medium sand grain sizes. The layer was noted to have a moisture content in the order of 20 to 35 % in the upper portions of the strata. The moisture content increases to over 40% at the lower portions of the layer. A review of published literature sources related to the moisture content of sand and the water holding capacity, suggest the sand is at, or near field capacity at the base of the layer. This is corroborated by the presence of overburden groundwater at the transitional interface between the base of the sand layer and the upper edge of the underlying soil layer.

Coarse Sand

Underlying the medium to coarse sand is a coarse sand with some fine gravel present, with little to no fines. The layer was noted to be present in each of the test holes and was also noted to be completely saturated at the time of the September 2013 works.

Silty Clay

A layer of silty clay, having variable thickness, was present thoughout the western limits of the site. The clay pinches out in portions of the central quadrant of the site, in the area of BH2 on Drawing No. PH2095-1 (see Appendix A), and thickens somewhat again moving further to the east to the edges of the study limit.

The composition of the clay was consistent with that of a silty clay of low plasticity (USCS classification of CL). The silty clay was present in a firm consistency when first encountered. The consistency changed to soft approaching the base of the layer.

Silt

A layer of compact to very dense silt was present beneath the silty clay layer in the eastern quadrant of the site and is present directly beneath the coarse sand layer where the silty clay pinches out in the central quadrant of the site. The silty clay layer, itself, pinches out to the east of the hydro easement where the silty clay is present directly beneath the coarse sand.

The consistency of the silty is such that it exhibits significant degrees of natural compaction which has significantly reduced the saturated hydraulic conductivity of the layer.

Till

A layer of very dense till was encountered in each of the boreholes put down on the subject property. The till layer appears to be significantly dense across much of the site such that practical refusal (i.e. greater than 50 blow counts per 300 mm of penetration) was encountered throughout most of the property.

Any information pertaining to soils and all test hole logs are furnished as a matter of general information only, and test hole descriptions or logs are not to be interpreted as descriptive of conditions at locations other than those described by the test holes themselves.

4.2 Groundwater

Overburden Aquifer

At the time of the fieldwork, the overburden groundwater levels were measured and are recorded as shown, where applicable, on the Soil Profile and Test Data sheets. Groundwater infiltration into the test holes varied across the site from to 0.95 m to 1.65 m bgs.

The overburden groundwater appears to be perched within the coarse sand layer present above the silty clay and silt strata. The rate of infiltration into the ground appears to be limited by these lower layers of very low hydraulic conductivity.

With respect to the seasonal high groundwater levels, the soil analysis suggests that the central portion of the site, where the sand layer is grey-brown to grey within the lower portions of the layer, reasonably reflects the overburden groundwater. As such, it is opined that the overburden groundwater levels are shallowest in the central quadrant of the site, due to the bowl shaped topography and shallowness of the layers of low hydraulic conductivity.

With respect to the direction of overburden groundwater flow, analysis of the water levels reported in the test holes and monitoring wells suggests the flow is in a south to southwest direction beneath the site.

Bedrock Aquifer

The bedrock aquifer, contained within the Oxford Formation has an interpreted direction of groundwater flow towards the east to northeast. The March/Nepean formation has an interpreted direction of groundwater flow towards the east.

5.0 DEVELOPMENT RECOMMENDATIONS

The following sections outline the recommendations for development which have been formulated from the data collected in this study.

5.1 Site Development

Based on the results of our study, this site is considered to be suitable for the development of more than 40 lots as described in Section 1.0 of this report. The on-site sewage disposal needs can be accommodated with standard Class 4 sewage systems consisting of a septic tank and fully raised leaching bed, as per Part 8 of the Ontario Building Code. Furthermore, an adequate water supply aquifer of sufficient quality and quantity is located beneath the subject property and can be intercepted by private wells drilled in accordance with Ontario Regulation 903.

5.2 Lot Development Plan

One objective of the hydrogeological study is to enhance development and minimize the effects of sewage systems on the surrounding environment. This is achieved through prevention of the accumulation of surface water near sewage systems, by ensuring the proper construction of water supply wells and sewage systems, and by coordinating the overall positioning of the services to maximize separations. A minimum separation of 18 m for fully-raised systems is required between a well and a Class 4 sewage system. Clearance distances also apply to wells and septic systems located on neighbouring lots.

The proposed Lot Development Plan (Drawing No. PH2095-2) in Appendix 5 shows the proposed lot development plan for the site. The purpose of this drawing is to show that a typical home and private services will fit onto the proposed lot, and can meet all pertinent regulations without causing environmental constraints. The houses shown in this drawing covers a plan area of 400 m^2, assuming a four (4) bedroom, two-storey 300 m^2 (3,500 ft^2) home, and including a garage of 50 m^2, and is serviced by a sewage system with the capacity of 3,000 L/day. In actuality, the daily sewage flows will likely be significantly lower than this value.

In all instances, careful, site specific analysis of the soil morphology in the area of each proposed leaching bed is required during the design stages of the leaching bed in order to determine if sufficient soil exists to facilitate the use of native soil for subgrade preparation. Detailed soil morphology should only be determined by a qualified geotechnical specialist.

It is not the intent of the Lot Development Plan (Drawing No. PH2095-2) to restrict placement of a dwelling on each lot. While the actual configuration and position of the home may change, the relative position of the home, sewage system and well should be maintained. In all cases, the separation criteria for the immediate and neighbouring lots should be followed.

The required separation distance from a fully raised leaching bed to a surface water body or drilled well is 18 m. Furthermore, in accordance with Ontario Regulation 903, all drilled wells, in addition to the prescribed separation distances to the sewage system, must also be located a minimum of 15 m from a potential source of contamination. (i.e. fuel oil tanks, Regional Roads, etc.)

5.3 Predictive Impact Assessment

Hydrogeolocial Sensitivity

In accordance with Section 5.0 of the MOE publication, entitled, "Procedure D-5-4 Technical Guidelines for Individual On-site Sewage Systems: Water Quality Impact Risk Assessment", the groundwater impacts from on-site sewage systems must be addressed in a step-wise manner. In order to establish the initial step, it is essential to demonstrate whether or not the site is considered hydrogeologically sensitive.

Based on the thickness and low permeability of the lower soil strata present beneath the site, as detailed in Section 4.0 and observed on the published MOE WWR's, combined with the shallow, perched water table conditions present across most of the site, the subject property is not considered to be hydrogeologically sensitive.

Predictive Impact Assessment for Nitrate

The groundwater within the bedrock aquifers will be protected from sewage system effluent by the considerable overburden thickness combined with the massive layer of Oxford Formation limestone above the shallowest point of groundwater interception. The general overburden groundwater flow direction will be controlled by the undulating topography on the site, due to the relative impervious nature of the overburden soils. However, the flow would tend to be contained onsite through the construction of a series of best management practices for stormwater management. A discussion on the stormwater management considerations is advanced in Section 5.8 .

In conducting an assessment of the impact of the proposed development, the estimate of groundwater recharge, by infiltration of precipitation, is the primary site-specific input parameter. In this regard, assumptions are required to be made with respect to evaporation and evapotranspiration, as well as infiltration and runoff rates.

The rate of infiltration will be dependent upon the following:

- surficial soil type(s), especially within the depth of influence of the sewage systems;
- ground covers and their distribution;
- site topography, especially after development; and
- stormwater management approach.

Based on the findings of the site specific soil infiltration rate assay, a water holding capacity was derived for each of the dominant soil types. The surficial soil descriptions and estimated water holding capacities were submitted to Environment Canada's Climate Services department to produce a site specific water balance. Based on the results of the site specific water balance (refer to Appendix 4 for the received data set) the surplus water data for the in situ coarse to medium sand layer, constituting the receiving soil has been calculated to be of the order of 376 mm/m of soil per year.

With respect to the selection of appropriate runoff/infiltration coefficients, the following summaries are provided:

Topography

Predevelopment Conditions

The site, while generally flat, has several existing land features that require a weighted average approach to the derivation of the predevelopment infiltration factors. The eastern quadrant of the site is open and has a rolling topography. Moreover, the hydro easement is open and considered rolling due to the presence of the drainage ditch bisecting the corridor. The remaining portions of the site are heavily wooded and flat. The weighted average predevelopment topographic factor was calculated to be 0.253. The calculations are provided for reference purposes in Appendix 4.

Post Development Conditions

Development of the site will see most of the site retain the flat nature of the site, but will see lot specific grade raises of the order of 1 m to 2 m above existing grades at the building envelopes. Similarly, the shallow overburden water table present in the central quadrant (flattest area) will result in the requirements for partially raised leaching beds which will result in grade raises of the order of 1 m above existing values. As such, the calculated post-development topographic factor for the site is 0.2. Reference can be made to the calculations in Appendix 4.

Soil

Predevelopment Conditions

The existing sand layer, present beneath the existing sandy silt, organic topsoil layer, is a clean medium to coarse grained sand. As such, the weighted soil factor has been calculated to be 0.48 based on 1.2 m thickness of soil horizons between the surface of the ground and the normal high water table (i.e. 1.2 m below ground surface).

Post Development Conditions

The placement of fill material around the foundations, if site excavated material is used and the topsoil is stripped from the excavation areas, should result in only a slightly reduced long term infiltration value. This also assumes typical even natural compaction of the backfill material achieved through good construction practice. As such, the post development soil infiltration value has been adjusted to 0.45.

Cover

Predevelopment Conditions

The predevelopment cover factor has been calculated to be 0.19. This value factors in the bulk of the subject property being wooded with the two (2) open areas associated with the hydro easement and previously cultivated areas.

Post Development Conditions

The post development cover for the subject property will consist primarily of urban lawn with retained areas for tree preservation along the side and rear lot lines. The anticipated lot coverage for retained trees, based on the adjacent developments is of he order of 25 to 30%. As such, the new factored cover value is calculated, based on a weighted area average to be 0.13.
Based on the predevelopment conditions, the calculated volume of infiltration water anticipated to occur on the subject property is of the order of 342.5 mm/m of soil per annum. The post development water surplus, as calculated based on the assumptions detailed above and in the spreadsheet analysis summarized in Appendix 4, is of the order of 300.8 mm/m of soil per annum. Based on the results of an iterative analysis, the site is capable of attenuating effluent for approximately 46 individual sewage systems through only dilution processes.

5.4 Sewage System Design

Sewage systems must be designed according to Part 8 of the Ontario Building Code (OBC). The OBC sets out minimum design and construction standards for all approved classes of sewage systems. It is proposed that this site be serviced with traditional Class 4 sewage systems consisting of a septic tank and separate leaching bed.

OBC requirements state that the there must be a minimum of 900 mm of suitable soil or leaching bed fill present between the base of the absorption trenches and the high groundwater table, bedrock or soil with a percolation rate greater than 50 min/cm. Some lots are located in areas with permeable cover which may permit either in-ground or partially raised leaching beds. Where lots are located in areas with moderately low permeable silty clayey sand and silty sand within the overburden soils, combined with the flat topography, most Class 4 absorption trench style leaching beds are expected to be fully raised above the existing ground surface. An imported sand mantle having a minimum thickness of 250 mm and extending a minimum of 15 m beyond the absorption trenches in the direction of effluent flow would also be required.

Based on OBC design sewage flow tables, a large 4 bedroom luxury residence with a finished floor area of 300 m^2 may produce in the order of 3,000 L/day of sewage effluent per day. Based on the quality of the sand deposits available in the local pits, imported sand is anticipated to have a percolation rate (a.k.a. T-time) of between 6 and 8 min/cm. Considering the design flows and percolation rate of the available imported sand, a tile length of 140 metres is required. The Lot Development Plan (PH1276-2) illustrates the size of such tile beds, complete with minor alternative configurations due

to irregular lot shapes and other constraints.

The sewage system layouts detailed in Drawing No. PH2095-2 are shown to be fully raised leaching beds with a 15 m imported sand mantle. With due consideration to the more permeable terrain unit which dominates the subject property, the Lot Development Plan (Drawing No. PH2095-2) has been prepared to illustrate that the maximum foreseeable size of leaching bed utilized on any given lot, can be easily accommodated. Moreover, the purpose of the drawing is to illustrate that adequate space exists on each lot to accommodate such a sewage system. The end, or toe, of the mantles will be required to be unobstructed and free draining; the existing topsoil layer is likely to receive the polished effluent from the toe.

5.5 Potential Well Interference

It is anticipated that a series of individual water supply wells, in addition to the existing test wells, will be constructed at the subject property in order to provide individual water supplies for each lot. As these wells are anticipated to intercept aquifers located in March Formation, and considering the inherent intermittent nature of pumping, potential well interference with offsite uses is anticipated to be negligible. This is further corroborated by the 20 year safe yield estimates established earlier in this report.

As the pumping is anticipated to be intermittent with several wells in operation at any given time, a potential well interference model was created to reflect a hypothetical worst case scenario for drawdown at the site. The model, assumes series of wells, located along concentric circular spacings extending outward from one central well, each pumping continuously at a rate of 2000 L/day (average peak water demand) over a period of 20 years. The analytical model is presented in Appendix 4.

In the long term model, the maximum anticipated drawdown, based on a total of 71 wells pumping continuously for 20 years at 2,000L/day, is 13.8 m. As the average anticipated well depth is approximately 55 m, this drawdown represents a removal of approximately 25% of the available drawdown. Given that a conservative, but reasonable Transmissivity value was utilized (10 m^2/day and the overall conservative approach of the model, this drawdown is considered to be an acceptable worst case scenario.

In the second model, a single well having an average available drawdown of 55 m was modeled to be pumped at 50,000L for 24 hours. This is the maximum allowable volume of pumping before a Permit to Take Water is required by the MOE. In this model, again a transmissivity of 10 m^2/day and a storativity of 5×10^{-5} was chosen. At a radial distance of 50 m, a distance approximately one half of the closest distance

between future adjacent wells, a drawdown of 2.1 m is anticipated. This corresponds to a reduction in available drawdown of only 4%, based on an average well depth of approximately 55 m.

Given the very conservative nature of the models presented above, it is opined that the potential well interference between wells, and beyond the property limits is acceptable in the worst case scenario models. Considering the intermittent pumping, rapid recovery values and significant 20 year safe yield estimates, actual drawdown in offsite wells is anticipated to be negligible.

5.6 Future Water Well Design

Drilled wells, completed in the bedrock aquifer, should be used for the water supply in this development. The wells should be drilled by a licensed well contractor experienced in the study area, and should be completed in accordance with Ontario Regulation 903, as amended.

A minimum well yield of 5 IGPM is recommended for an average residence and is considered to be readily obtainable on this site. As it is desirable to drill the future wells to achieve the highest quality water, the wells should be isolated from the Oxford Formation. As the Oxford Formation limestone water supply aquifer is located at a depth of between 12 to 20 m below the ground surface in the northern quadrant of the site where it was encountered, all wells should be pilot drilled by first installing a 250 mm diameter working casing seated into the bedrock and extending a 150 mm diameter open borehole through the Oxford Formation and to the completion depth at the March Formation water supply aquifer. If the Oxford Formation water supply aquifer is intercepted in the borehole, the well contractor should record the depth of the interception(s) and, using a 200 mm diameter tricone bit, ream a 200 mm diameter casing hole to a depth of a minimum of 2 m below the deepest recorded aquifer intercept. In most instances, it is recommended that a minimum casing length of 40 m be specified for all future wells. This recommendation is considered to be very conservative, however, it will provide a simple specification for well contractors to follow and reduce the reliance on solely assessing the rock cuttings during the casing hole construction.

The casing should then be installed and grouted in place utilizing either a neat cement grout or sodium bentonite grout slurry introduced from the bottom of the annular space to the surface of the ground in accordance with Ontario Regulation 903 (wells). The creation of the casing hole, the installation of the casing and the grouting of the annular space should be inspected by a qualified Professional Engineer from Paterson Group Inc.

The well should be developed by surging or pumping until the water is developed to a sand free state at the time of construction in accordance with Ontario Regulation 903. If the water is observed to be cloudy at the completion of the prescribed well development, extended well development should be performed until all visible turbidity is removed.

Chlorine should be introduced at the completion of well development in sufficient quantity to produce a free chlorine residual of at least 50 mg/L (ppm). The chlorine should be mixed with the standing water in the casing using a procedure that will result in the thorough vertical mixing of the chlorine over the entire depth of the well.

The well should be completed with a submersible pump, pitless adaptor and vermin proof well cap. All such mechanical work connected to the well is to be completed by a qualified well contractor possessing a valid Class 4 pump installer's license. After completion of the mechanical work in the well, the well should be disinfected as described above.

The grading around the well casing should be slightly elevated to direct surface runoff away from the well. The casing should project approximately 400 mm above the mounded soil within 3 m in all directions from the casing.

With respect to the existing test wells, it is recommended that TW3 be either decommissioned or properly deepened and sleeved as per TW2A. The remaining wells which intercept the March Formation without intercepting a water supply aquifer within the Oxford Formation in the open borehole, are considered to be acceptable for reuse as future wells as they meet the intent of the well construction specifications presented above.

5.7 Water Conditioning Considerations

As the water within the preferred zone of aquifer interception contains elevated hardness and, to a lesser extent, iron, the raw water can be suitably conditioned to remove these two aesthetic parameters. A standard residential grade water softener can be installed to remove both the hardness and iron concentrations in the raw water. Regeneration rates may be slightly higher given the concentration of iron in a few of the test wells, however the iron concentrations are not anticipated to substantially contribute to a reduction in resin capacity.

As the water is considered to be very hard, it is strongly recommended that should a water softener be selected for installation, that consideration be made to installing a separate tap for drinking water which bypasses the softener. This will minimize the consumption of an increased sodium concentration resulting from the ion exchange process.

With respect to the slightly increased turbidity in both the field and laboratory samples, as there is no need for water treatment to control bacteriological parameters, the turbidity values are considered to be within the acceptable range of values contained within Procedure D-5-5. It is anticipated that extended well development, at a rate of not more than 5 L/min for at least 24 hours, will be sufficient to remove any residual turbidity resulting from well construction for each newly constructed well at the site.

5.8 Stormwater Management Considerations

The subject property is directly underlain by a medium to coarse sand overlying lower permeable silt and silty clay deposits. From a hydrologic perspective, the site can be assigned a hydrologic soil classification of A-AB corresponding to soils which have low to medium runoff potential.

It is anticipated that the post development water surplus will be reduced by approximately 13% (345.5 mm/year to 300.8 mm/year). Given the excellent infiltration capacity of the sand layer overlying the lower permeable strata beneath the site, best management practices for promoting infiltration in a post development scenario are applicable for this site. These practices include:

- infiltration trenches;
- shallow grade swales complete with perforated subdrains; and
- shallow grade road side ditches complete with perforated subdrains.

It is anticipated that the implementation any combination of these best management practices, especially the shallow graded swales and ditches (i.e. 0.5% and 0.3%, respectively) will achieve pre-development infiltration values thereby further reducing the theoretical long term nitrate concentrations generated beneath the site.

6.0 CONCLUSIONS

Based on the information contained within the body of this report, the following conclusions can be drawn:

1. The subject property is located in a relatively flat to slightly sloping setting with all areas exhibiting excellent infiltration and imperfect surficial drainage characteristics in pre-development condition.
2. There is minimal potential impacts from surrounding land uses within 500 m of the site, based on available information. Moreover, offsite impacts from the proposed density of residential development are considered to be negligible.
3. The surficial geology of the subject property generally consists of coarse to medium grained sand overlying silt and silty clay deposits of low hydraulic conductivity.
4. The bedrock geology beneath the site consists of limestone of the Oxford Formation. The Oxford Formation is underlain by the March Formation,and Nepean Formation, respectively. The direction of groundwater flow is interpreted to be towards the south west in the March Formation.
5. The construction of the test wells on the subject property appear have intercepted at a water supply aquifer within the Oxford and March Formations that has sufficient quality and quantity of groundwater for use by the proposed development.
6. The most consistent zones of aquifer intercept is within the March Formation as reported in the test wells and neighbouring wells is between 47.5 and 66 m below ground surface.
7. Significant confining pressures are present on the water supply aquifer at the interception points. An adequate quantity of water is present in all of the encountered aquifers
8. Water quality of the Oxford and March Formation water supply aquifers,based on the analyses conducted in this report, is considered to be excellent for domestic use.
9. Potential well interference with neighbouring, offsite wells, is considered to be minimal and, based on the aquifer parameters determined by this study, the anticipated water demand from this subdivision will have minimal impact on the safe yield of the water supply aquifers.
10. Sewage systems, containing fully raised leaching beds, are easily accommodated on each of the proposed lots. Several areas of the proposed development may be serviced using sewage systems which are either in-ground or partially raised also. Site specific soil morphology analysis, carried out by a qualified geotechnical engineer, should be completed for each individual sewage system design.

11. The subject property is suitable for development as a residential subdivision at the proposed density. Impacts to the neighbouring low density residential development area is expected to be minimal.

7.0 RECOMMENDATIONS

Based on the information presented in the body of this report, the following recommendations can be made:

1. In accordance with the intent of Procedure D-5-5, the Medical Officer of Health must be notified where sodium concentrations in the new wells exceed 20 mg/L. This requirement is specified in order for the information to be disseminated to local physicians in order to treat persons with sodium reduced dietary needs.
2. If the use of water softeners are considered, it is recommended that a separate water supply tap be installed. This tap should bypass the water softener to prevent the increased sodium concentration which will result by softening the water with sodium chloride.
3. Wells should be constructed such that the casing hole extends into sound bedrock at least 3 m into the Oxford Formation. A minimum casing length, per well, of 25 m, should be specified for the casing hole to account for variations of elevation of the underlying bedrock. The well contractor should review the proposed well construction methodology specified in this report prior to proceeding with any site works.
4. The preferred zone of aquifer interception for future wells should be set at approximately 47 m to 66 m measured below the ground surface. Wells should be constructed with a rotary air drilling rig and should be surged and purged to a sand free state prior to completion of the well.
5. The recommended minimum range of well yields is set at between 15 L/min and 23 L/min.
6. The creation of the casing hole, installation of the casing, and grouting of the annular space, should be inspected by a qualified Professional Engineer of Ontario. Furthermore, it is recommended that a qualified Professional Engineer of Ontario oversee the construction of the open borehole in order to ensure well depths do not exceed those recommended in this study. All well construction must be carried out by a qualified, and experienced well technician.

7. Wells should be developed to a sand free state in order to ensure that the residual turbidity created by the well drilling activities is completely purged from the well. Additional well development, prior to placing the well into use, is strongly recommended in order to provide adequate development of the formation and remove extraneous rock debris from the aquifer pathways. It is likely that future wells at this site will require additional well development. The additional well development should take place during well construction, or alternatively, take place during the mandatory pumping test set forth by Ontario Regulation 903. If the additional well development takes place during the pumping test, the duration of pumping at the design rate should be increased to at least a minimum of three (3) hours.
8. All future water wells be completed such that the top of well casing is a minimum of 450 mm above the finished grade within a 3 m radius of the wellhead. Moreover, the grade should slope away from the wellhead for a distance of at least 3 m.
9. Individual future well owner should carry out semi annual verification of potability of the raw water supply. Moreover, the well owner should ensure that the maintain the wellhead and immediate area in accordance with the requirements of Ontario Regulation 903.

In summary, it is our professional opinion that this site is suitable for development as a residential subdivision at the proposed lot density. The hydrogeological recommendations contained within this report, if followed, will ensure that the development takes place in an effective manner, with a minimal impact on the natural environment.

PATERSON GROUP INC.

Robert A. Passmore, P.Eng.
Senior Environmental Engineer

APPENDIX 1

- ❑ SOIL PROFILE & TEST DATA SHEETS
- ❑ SYMBOLS AND TERMS

patersongroup

Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Hydrogeological Study
Proposed Residential Development - Old Prescott Road
Ottawa, Ontario

DATUM Datum provided by Stantec Geomatics Limited.

FILE NO. PH2095

REMARKS

HOLE NO. BH 1

BORINGS BY CME 55 Power Auger **DATE** November 19, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	102.00
TOPSOIL 0.25		AU	1				
Very loose, brown medium to coarse **SAND**						1	101.00
- grey by 1.5m depth						2	100.00
2.70		SS	2	75	2		
Grey **SILTY CLAY,** trace sand 3.15		SS	3	75	2	3	99.00
		SS	4	50	8	4	98.00
		SS	5	75	17	5	97.00
		SS	6	71	19		
		SS	7	75	19	6	96.00
Compact to very dense, grey **SILT**		SS	8	71	34	7	95.00
		SS	9	79	48	8	94.00
		SS	10	83	70	9	93.00
		SS	11	42	105	10	92.00
10.72		SS	12		50+		
Practical refusal to augering on inferred glacial till at 10.72m depth							
(GWL @ 1.2m depth)							

Pen. Resist. Blows/0.3m
● **50 mm Dia. Cone**
○ **Water Content %**

20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup

Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Hydrogeological Study
Proposed Residential Development - Old Prescott Road
Ottawa, Ontario

DATUM Datum provided by Stantec Geomatics Limited.

FILE NO. PH2095

REMARKS

HOLE NO. BH 2

BORINGS BY CME 55 Power Auger **DATE** November 19, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.80
Loose, grey **SAND,** some silt		SS	1	62	5	1	100.80
		SS	2	67	16	2	99.80
2.60		SS	3	88	4		
Grey **SILTY CLAY**		SS	4	58	2	3	98.80
3.80		SS	5	58	13	4	97.80
Compact, grey **SILTY SAND** to **SANDY SILT**		SS	6	71	24	5	96.80
		SS	7	54	15	6	95.80
6.80		SS	8	62	14		
		SS	9	62	24	7	94.80
Compact to dense, grey **SILT,** trace sand		SS	10	75	28	8	93.80
		SS	11	92	44	9	92.80
		SS	12		88		
9.91							
Practical refusal to augering on inferred glacial till at 9.91m depth.							
(GWL @ 1.5m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup

Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Hydrogeological Study
Proposed Residential Development - Old Prescott Road
Ottawa, Ontario

DATUM Datum provided by Stantec Geomatics Limited.

FILE NO. PH2095

REMARKS

HOLE NO. BH 3

BORINGS BY CME 55 Power Auger **DATE** November 19, 2012

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	100.90
						1	99.90
Loose to compact, grey **SILTY SAND** to **SANDY SILT**		SS	1	79	3	2	98.90
		SS	2	58	11		
		SS	3	58	9	3	97.90
		SS	4	83	18	4	96.90
5.30						5	95.90
Grey **SILTY CLAY**		SS	5	83	27		
		SS	6	33	3	6	94.90
6.90						7	93.90
		SS	7		3		
GLACIAL TILL: Grey silty clay with sand, gravel, cobbles		SS	8		8	8	92.90
						9	91.90
						10	90.90
10.67							
Practical refusal to augering on inferred glacial till at 10.67m depth							
(GWL @ 1.5m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %

20 40 60 80

Piezometer Construction

20 40 60 80 100

Shear Strength (kPa)

▲ Undisturbed △ Remoulded

patersongroup

Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Hydrogeological Study
Proposed Residential Development - Old Prescott Road
Ottawa, Ontario

DATUM Datum provided by Stantec Geomatics Limited.

FILE NO. PH2095

REMARKS

HOLE NO. BH 4

BORINGS BY CME 55 Power Auger **DATE** March 14, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	103.10
TOPSOIL 0.30							
Loose, brown **SAND**		SS	1	80	5	1	102.10
3.00						2	101.10
Soft, brown **SILTY CLAY**		SS	2	100	2	3	100.10
4.60						4	99.10
		SS	3	70	30	5	98.10
		SS	4	70	34	6	97.10
Compact to dense, brown **SILTY SAND/SANDY SILT**		SS	5	60	21	7	96.10
		SS	6	60	22	8	95.10
		SS	7	60	42	9	94.10
						10	93.10
						11	92.10
11.89							
Practical refusal to augering on inferred glacial till at 11.89m depth							
(GWL @ 1.65m depth)							

Pen. Resist. Blows/0.3m
● 50 mm Dia. Cone
○ Water Content %
20 40 60 80

Piezometer Construction

20 40 60 80 100
Shear Strength (kPa)
▲ Undisturbed △ Remoulded

patersongroup

Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Hydrogeological Study
Proposed Residential Development - Old Prescott Road
Ottawa, Ontario

DATUM Datum provided by Stantec Geomatics Limited.

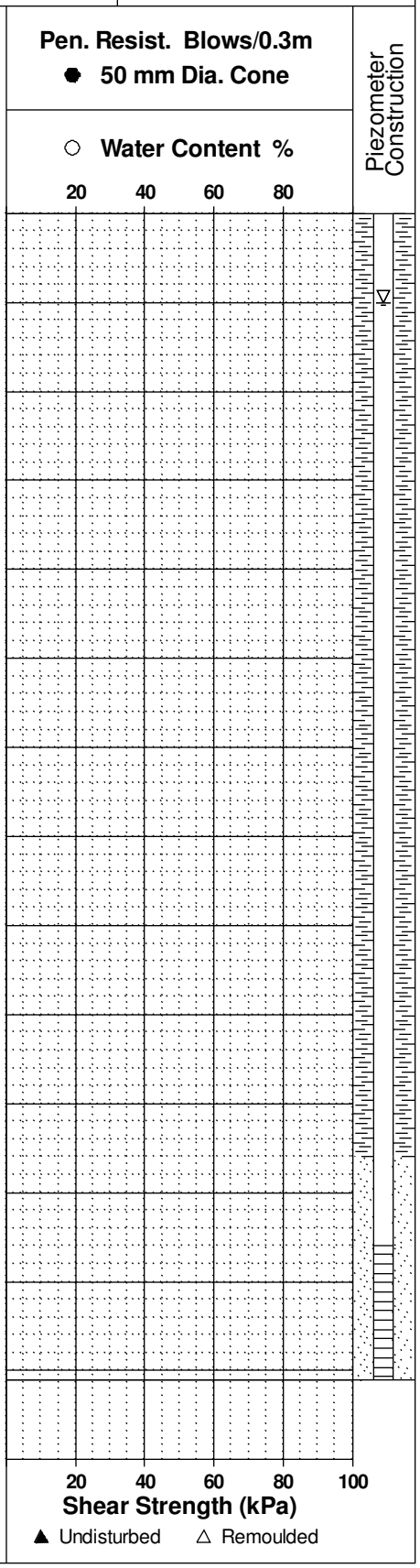
FILE NO. PH2095

REMARKS

HOLE NO. BH 5

BORINGS BY CME 55 Power Auger **DATE** March 14, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.75
TOPSOIL 0.30							
Compact, brown **SAND**		SS	1	60	16	1	100.75
- with clayey silt by 3.0m depth		SS	2	80	41	2	99.75
4.60		SS	3	80	66	3	98.75
Very dense to dense, blue-grey **SILT**		SS	4	80	42	4	97.75
		SS	5	80	22	5	96.75
9.10		SS	6	90	7	6	95.75
Loose, brown **SANDY SILT** with gravel		SS	7	40	4	7	94.75
12.20		SS	8	50	50	8	93.75
Dense, brown **SAND** with gravel 13.11						9	92.75
Practical refusal to augering on inferred glacial till at 13.11m depth (GWL @ 1.0m depth)						10	91.75
						11	90.75
						12	89.75
						13	88.75



patersongroup

Consulting Engineers

154 Colonnade Road South, Ottawa, Ontario K2E 7J5

SOIL PROFILE AND TEST DATA

Hydrogeological Study
Proposed Residential Development - Old Prescott Road
Ottawa, Ontario

DATUM Datum provided by Stantec Geomatics Limited.

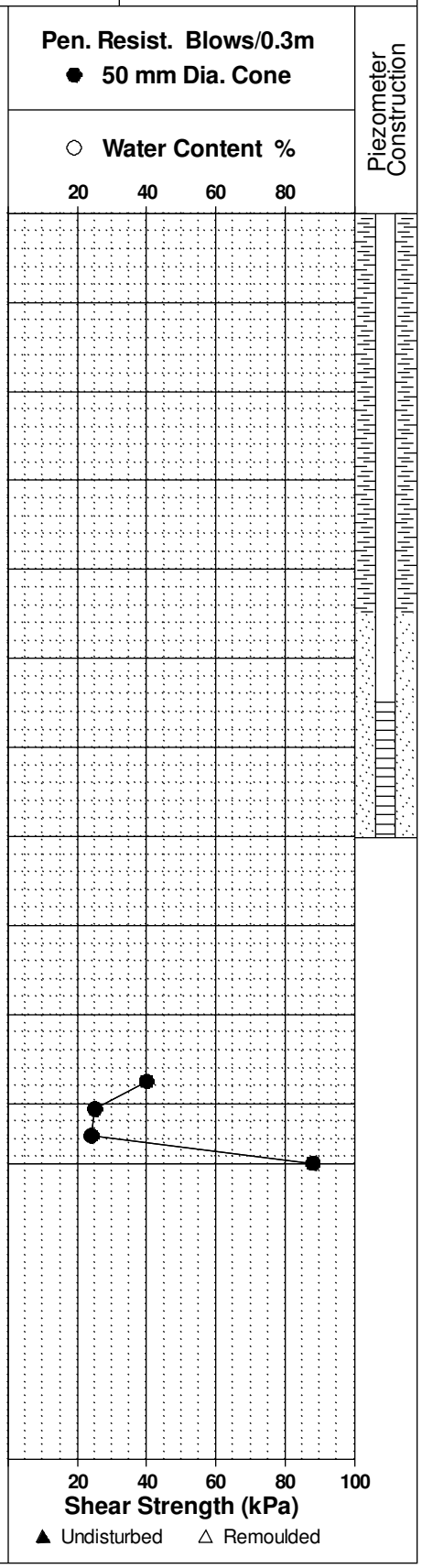
FILE NO. PH2095

REMARKS

HOLE NO. BH 6

BORINGS BY CME 55 Power Auger **DATE** March 15, 2013

SOIL DESCRIPTION	STRATA PLOT	SAMPLE TYPE	SAMPLE NUMBER	SAMPLE % RECOVERY	SAMPLE N VALUE or RQD	DEPTH (m)	ELEV. (m)
GROUND SURFACE						0	101.40
TOPSOIL 0.30							
Compact, brown **SAND**		SS	1	50	15	1	100.40
2.40						2	99.40
Brown **SILTY CLAY** with some sand		SS	2	80	5	3	98.40
- blue-grey by 4.0m depth		SS	3	80	W	4	97.40
		SS	4	70	1	5	96.40
		SS	5	70	5	6	95.40
7.62						7	94.40
Dynamic Cone Penetration Test commenced at 7.62m depth						8	93.40
Inferred **GLACIAL TILL**						9	92.40
						10	91.40
10.67							
Practical DCPT refusal at 10.67m depth.							



APPENDIX 2

- PUBLISHED MOE WATER WELL RECORDS FOR TEST WELLS

Air Rock Drilling

From: Air Rock Drilling <air-rock@sympatico.ca>
Sent: June-06-13 3:21 PM
To: 'rpassmore@patersongroup.ca'; 'Brandon Aubin (baubin@patersongroup.ca)'
Subject: AIR ROCK - Test Well # 1 - 1240 Old Prescott
Attachments: CCE06062013_00000.pdf

Good Afternoon

Please find enclosed MOE WWR & Compliance for

1384341 Ontario Limited

1240 Old Prescott Road – TEST WELL # 1

Have a good day !

Debbie

Ottawa

CERTIFICATE OF WELL COMPLIANCE

I, Ken Desaulniers DO HEREBY CERTIFY that I am licensed to drill wells in the Province of Ontario, and that I have supervised the drilling of a well on the

property of # 1384341 Ontario limited

located at # 1240 OLD PRESCOTT ROAD

Lot/Plan No.) in the City of Ottawa (Geographical Township of Osgoode).

Part Lot 4 Conc 4S Plan# X S/L# TEST WELL# 1

CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and City Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

Signed this 27TH day of MAY 2013

Kenny Air Rock Drilling Co. Ltd.

Well Driller/Company

The Engineer on behalf of the landowner set out above Certifies that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg.903, this report and the Hydrogeological Report with regards to casing length and grouting requirements.

SIGNED this _____ day of _____, _____.

_____

Engineer

Test well # 1
2013189
A128140

2001
International Year of Volunteers
Année internationale des volontaires

Shaping our future together
Ensemble, formons notre avenir

City of Ottawa
Client Service Centre
8243 Victoria Street
Ottawa, ON K0A 2P0

Ville d'Ottawa
Centre de service
8243, rue Victoria
Ottawa, ON K0A 2P0

Please Fax 838-3274

Ontario — Ministry of the Environment

Well Record

Regulation 903 Ontario Water Resources Act

Tag#: A128140

Wel A128140 (nt Below)

Page ____ of ____

Measurements recorded in: ☐ Metric ☒ Imperial

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	1384341 Ontario Limited (c/o Cavanagh Const)		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
9094 Cavanagh Road	Ashton	On	K0A 1B0	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
1240 Old Prescott Road	Osgoode	P/L 4	4S

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa-Carleton	Greely	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	18	455133	5012245		TEST WELL # 1

Overburden and Bedrock Materials/Abandonment Sealing Record (see instructions on the back of this form)

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	Sand			0'	11'
Grey	Sand y	Silt		11'	34'
	Sand - Course	+ Gravel & Boulders		34'	60'
Grey & Brown	Limestone			60'	125'
White	Sandstone			125'	136'
Grey	Limestone			136'	161'
Grey & White	Sandstone	& Limestone	mix	161'	292'
Grey & White	Sandstone	+ Limestone	mix	292'	300'

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³)
70'	60'	Neat cement	10.9
60'	0'	Bentonite slurry	25.2

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4"	Steel	.188"	+2'	70'
6 1/8"	Open Hole		70'	300'

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Water Details

Water found at Depth (m/ft)	Kind of Water	Hole Diameter Depth From	Depth To	Diameter (cm/in)
292 (m/ft) ☐ Gas	☐ Fresh ☒ Untested ☐ Other, specify	0'	70'	9 3/4"
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify	70'	300'	6 1/8"
(m/ft) ☐ Gas	☐ Fresh ☐ Untested ☐ Other, specify			

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify Not tested

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 290

Pumping rate (l/min / GPM): 12

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 85.4"

If flowing give rate (l/min / GPM): X

Recommended pump depth (m/ft): 150' (1HP - 10GPM)

Recommended pump rate (l/min / GPM): 12

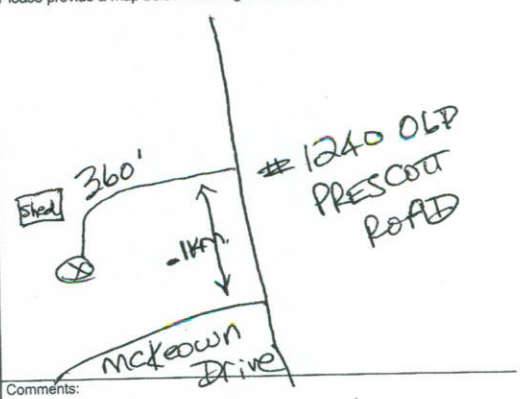
Well production (l/min / GPM): 12

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	34.2'		85.4"
1	42.2	1	74.5
2	44.8	2	63.4
3	47.2	3	55.4
4	49.3	4	50.4
5	53.6	5	47.5
10	57.4	10	38.6
15	66.4	15	34.2
20	74.8	20	34.2
25	74.8	25	34.2
30	78.7	30	34.2
40	80.2	40	34.2
50	82.3	50	34.2
60	85.4"	60	34.2"

Map of Well Location

Please provide a map below following instructions on the back.



Comments: TEST WELL # 1

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	1119

Business Address (Street Number/Name)	Municipality	Province	Postal Code	Business E-mail Address
6659 Franktown Road, RR#1	Richmond	ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)	Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted Y Y Y Y M M D D
6138382170	Graham, Ryan	T3484		2013 05 31

Well owner's information package delivered	Date Package Delivered Y Y Y Y M M D D	Date Work Completed Y Y Y Y M M D D
☒ Yes ☐ No	2013 05 29	2013 05 27

Ministry Use Only

Audit No. Z155095

Received

Ministry's Copy

Air Rock Drilling

From: Air Rock Drilling <air-rock@sympatico.ca>
Sent: June-06-13 4:14 PM
To: 'rpassmore@patersongroup.ca'; 'Brandon Aubin (baubin@patersongroup.ca)'
Subject: AIR ROCK - Test Well # 2 - 1240 Old Prescott
Attachments: CCE06062013_00000.pdf

Good Afternoon

Please find enclosed MOE WWR & Compliance for

1384341 Ontario Limited

1240 Old Prescott Road – TEST WELL # 2

Have a good day !

Debbie

Ottawa

CERTIFICATE OF WELL COMPLIANCE

I, Ken Desaulniers DO HEREBY CERTIFY that I am licensed to drill wells in the Province of Ontario, and that I have supervised the drilling of a well on the

property of # 1384341 Ontario limited

located at # 1240 OLD PRESCOTT ROAD

Lot/Plan No.) in the City of Ottawa (Geographical Township of Osgoode).

Part Lot 4 Conc 4S Plan# X S/L# TEST WELL#2

CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and City Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

Signed this 30TH day of MAY 2013

Kenny Air Rock Drilling Co. Ltd.

Well Driller/Company

The Engineer on behalf of the landowner set out above Certifies that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg.903, this report and the Hydrogeological Report with regards to casing length and grouting requirements.

SIGNED this _____ day of _____, _____.

_____

Engineer

Test Well #2
2013197
A128132

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Année internationale des volontaires

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City of Ottawa
Client Service Centre
8243 Victoria Street
Ottawa, ON K0A 2P0

Ville d'Ottawa
Centre de service
8243, rue Victoria
Ottawa, ON K0A 2P0

Blanco FAX 838-3274

Ontario — Ministry of the Environment

Tag#: A128132

A128132 (Print Below)

Well Record

Regulation 903 Ontario Water Resources Act

Measurements recorded in: ☐ Metric ☒ Imperial

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	1384341 Ontario Limited (c/o Cavanagh Const)		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
9094 Cavanagh Road	Ashton	On	K0A 1B0	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
1240 Old Prescott Road	Osgoode	P/L 4	4S

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa-Carleton	Greely	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	18	454826	5012227		TEST WELL # 2

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	Sand			0	14
Grey	Sandy Silt			14	38
	Sand & Gravel	&	Boulders	38	47
Grey	Limestone			47	132
Grey & White	Limestone	&	Sandstone Mix	132	158
Grey & White	Limestone	&	Sandstone Mix	158	189
Grey & White	Limestone	&	Sandstone Mix	189	200

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³)
58	48	Neat cement	10.9
48	0	Bentonite slurry	25.2

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4"	Steel	.188"	+2'	58'
6 1/8"	Open Hole		58'	200'

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Water Details

Water found at Depth (m/ft)	Gas	Kind of Water	Other, specify
158	☐	☐ Fresh ☐ Untested ☒	
189	☐	☐ Fresh ☒ Untested	
	☐	☐ Fresh ☐ Untested	

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0	58'	9 3/4"
58'	200'	6 1/8"

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify **Not tested**

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 190'

Pumping rate (l/min / GPM): 12

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 98.7'

If flowing give rate (l/min / GPM): X

Recommended pump depth (m/ft): 190'

Recommended pump rate (l/min / GPM): 12

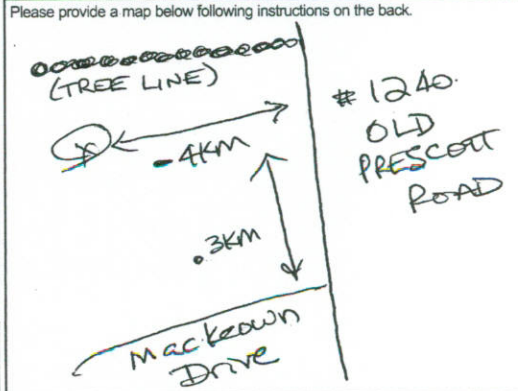
Well production (l/min / GPM): 12

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	34.3'		98.7'
1	42.8	1	79
2	48	2	74.7
3	52.3	3	65.4
4	55.9	4	59.8
5	58.2	5	55.1
10	71.1	10	40.1
15	77.2	15	36
20	83.2	20	34.3
25	86	25	34.3
30	88.9	30	34.3
40	92	40	34.3
50	95.5	50	34.3
60	98.7	60	34.3

Map of Well Location

Please provide a map below following instructions on the back.



Comments:
3/4 HP - 10 GPM SET AT 190 FT TESTWELL#2

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	1119

Business Address (Street Number/Name)	Municipality
6659 Franktown Road, RR#1	Richmond

Province	Postal Code	Business E-mail Address
ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6138382170	Graham, Ryan

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted Y Y Y Y M M D D
T3484		2013 06 28

Well owner's information package delivered	Date Package Delivered Y Y Y Y M M D D	Ministry Use Only
☒ Yes ☐ No	2013 06 04	Audit No. z155104
	Date Work Completed 2013 05 30	Received

Air Rock Drilling

From: Air Rock Drilling <air-rock@sympatico.ca>
Sent: September-05-13 3:31 PM
To: Rob Passmore (rpassmore@patersongroup.ca); 'Brandon Aubin (baubin@patersongroup.ca)'
Subject: AIR ROCK - TEST WELL 3 - 1240 Old Prescott
Attachments: CCE05092013_00000.pdf

Good Afternoon ~

Copy of TEST WELL # 3 – 1240 Old Prescott Road

Well Compliance & MOE WWR for

1384341 Ontario Limited (Tag A144873)

Have a gOod afternoon

Debbie

Ottawa

CERTIFICATE OF WELL COMPLIANCE

I, Ken Desaulniers DO HEREBY CERTIFY that I am licensed to drill wells in the Province of Ontario, and that I have supervised the drilling of a well on the property of 1384341 Ontario limited (c/o Cavanagh construction) located at #1240 OLD PRESCOTT ROAD Lot/Plan No.) in the City of Ottawa (Geographical Township of Osgoode).

Pt Lot 4 Conc 4S Plan# Test well S/L# #3

CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and City Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

Signed this 14TH day of AUGUST 2013

Kenny Air Rock Drilling Co. Ltd.

Well Driller/Company

The Engineer on behalf of the landowner set out above Certifies that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg.903, this report and the Hydrogeological Report with regards to casing length and grouting requirements.

SIGNED this _____ day of _____, _____

_____

Engineer

#2013393
TAG A144873
TEST WELL #3

2001
International Year of Volunteers
Année internationale des volontaires

Shaping our future together
Ensemble, formons notre avenir

City of Ottawa
Client Service Centre
8243 Victoria Street
Ottawa, ON K0A 2P0

Ville d'Ottawa
Centre de service
8243, rue Victoria
Ottawa, ON K0A 2P0

Please Fax 838-3274

Ontario — Ministry of the Environment

Tag#: A144873

Well Tag No. (Print Below): A144873

Well Record

Regulation 903 Ontario Water Resources Act

Page ____ of ____

Measurements recorded in: ☐ Metric ☒ Imperial

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	1384341 Ontario Limited (c/o Cavanagh Const)		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
9094 Cavanagh Road	Ashton	On	K0A 1B0	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
1240 Old Prescott Road	Osgoode	P/L 4	4S

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa-Carleton	Greely	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	18	454433	5012012		TEST WELL #3

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	To
Brown	Sand			0	44
	Sand & Gravel	+	Boulders	44	48
Grey	Limestone			48	127
Grey	Limestone			127	170
Grey	Limestone	+	Sandstone Mix	170	236
Grey	Limestone	+	Sandstone Mix	236	250

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
58	48	Neat cement	12.5
48	0	Bentonite slurry	37.8

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	To
6 1/4"	Steel	.188"	+2	58
6 1/8"	Open hole		58	250

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	To
	~~Open Hole~~		~~58~~	~~250~~

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Water Details

Water found at Depth (m/ft)	Kind of Water	Hole Diameter Depth From	To	Diameter (cm/in)
170 ☐ Gas	☐ Fresh ☒ Untested ☐ Other, specify	0	58	9 3/4
Water found at Depth 236 (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☒ Untested ☐ Other, specify	58	250	6 1/8"
Water found at Depth (m/ft) ☐ Gas	Kind of Water: ☐ Fresh ☐ Untested ☐ Other, specify			

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify **Not tested**

If pumping discontinued, give reason: ☒

Pump intake set at (m/ft): 240

Pumping rate (l/min / GPM): 14

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 57.7

If flowing give rate (l/min / GPM): ☒

Recommended pump depth (m/ft): 150

Recommended pump rate (l/min / GPM): 14

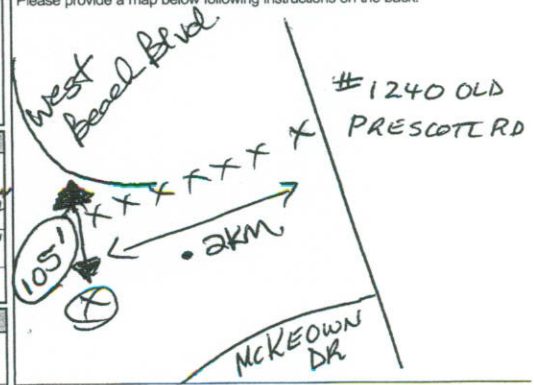
Well production (l/min / GPM): 14

Disinfected? ☒ Yes ☐ No

	Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level		15.6		57.7
1		22.6	1	49.6
2		27.5	2	41.8
3		31.4	3	37.5
4		34.2	4	34.2
5		35.6	5	31.8
10		40.5	10	24.5
15		45.4	15	18.2
20		47.3	20	15.6
25		48.7	25	15.6
30		50.1	30	15.6
40		52.7	40	15.6
50		55.3	50	15.6
60		57.7	60	15.6

Map of Well Location

Please provide a map below following instructions on the back.



Comments: 1 HP - 10 gpm @ 150'

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	1119

Business Address (Street Number/Name)	Municipality	Province	Postal Code	Business E-mail Address
6659 Franktown Road, RR#1	Richmond	ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)	Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
6138382170	Grant, Andrew	13438		2013 08 30 (Y Y Y Y M M D D)

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☒ Yes ☐ No	2013 08 19 (Y Y Y Y M M D D)	2013 08 14 (Y Y Y Y M M D D)

Ministry Use Only

Audit No. Z 155193

Received

Ministry's Copy

Air Rock Drilling

From: Air Rock Drilling <air-rock@sympatico.ca>
Sent: September-06-13 12:39 AM
To: Rob Passmore (rpassmore@patersongroup.ca)
Cc: 'baubin@patersongroup.ca'
Subject: AIR ROCK - test well # 4
Attachments: CCE06092013_00000.pdf

Good Evening

Please find enclosed copy of MOE WWR & Compliance

1384341 Ontario Ltd (Cavanagh Construction)

1240 OLD PRESCOTT ROAD – TEST WELL # 4

Thanks

Debbie

Ottawa

CERTIFICATE OF WELL COMPLIANCE

I, Ken Desaulniers DO HEREBY CERTIFY that I am licensed to drill wells in the Province of Ontario, and that I have supervised the drilling of a well on the property of 1384341 ONTARIO LIMITED (c/o Cavanagh Construction) located at #1240 OLD PRESCOTT ROAD Lot/Plan No.) in the City of Ottawa (Geographical Township of Osgoode). PART LOT 4 CONC 4S PLAN# TEST WELL S/L# #4

CERTIFY FURTHER that, I am aware of the well drilling requirements, the guidelines, recommendations and regulations of the Ministry of the Environment governing well installations in the Province of Ontario, and the standards specified in any subdivision agreement and hydrogeological report applicable to this site and City Standards.

AND DO HEREBY CERTIFY THAT the said well has been drilled, cased, grouted (cement or bentonite) as applicable and constructed in strict conformity with the standards required.

Signed this 22ND day of AUGUST 2013

Kenny Air Rock Drilling Co. Ltd.
Well Driller/Company

The Engineer on behalf of the landowner set out above Certifies that he/she has inspected the well and it was constructed in accordance with the specifications in O.Reg.903, this report and the Hydrogeological Report with regards to casing length and grouting requirements.

SIGNED this _____ day of _____, _____.

_____
Engineer

#2013420
TAG A135367
TEST WELL #4

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City of Ottawa
Client Service Centre
8243 Victoria Street
Ottawa, ON K0A 2P0

Ville d'Ottawa
Centre de service
8243, rue Victoria
Ottawa, ON K0A 2P0

2001 International Year of Volunteers / Année internationale des volontaires

Please Fax 838-3277

Ontario — Ministry of the Environment

Tag#: A135367

A135367

Well Record

Regulation 903 Ontario Water Resources Act

Measurements recorded in: ☐ Metric ☒ Imperial

Page ____ of ____

Well Owner's Information

First Name	Last Name / Organization	E-mail Address	☐ Well Constructed by Well Owner
	1384341 Ontario Limited (c/o Cavanagh Const)		

Mailing Address (Street Number/Name)	Municipality	Province	Postal Code	Telephone No. (inc. area code)
9094 Cavanagh Road	Ashton	On	K0A 1B0	

Well Location

Address of Well Location (Street Number/Name)	Township	Lot	Concession
1240 Old Prescott Road	Osgoode	P/L 4	4S

County/District/Municipality	City/Town/Village	Province	Postal Code
Ottawa-Carleton	Greely	Ontario	

UTM Coordinates	Zone	Easting	Northing	Municipal Plan and Sublot Number	Other
NAD 8 3	18	454896	5012107		TEST WELL # 4

Overburden and Bedrock Materials/Abandonment Sealing Record *(see instructions on the back of this form)*

General Colour	Most Common Material	Other Materials	General Description	Depth (m/ft) From	Depth (m/ft) To
	Sand			0′	20′
	Sand & Gravel	+ Boulders		20′	48′
Grey	Limestone			48′	69′
Grey	Limestone			69′	139′
Grey & White	Sandstone			139′	147′
Grey & White	Sandstone			147′	170′
Grey & White	Sandstone			170′	180′

TEST WELL #4

Annular Space

Depth Set at (m/ft) From	To	Type of Sealant Used (Material and Type)	Volume Placed (m³/ft³)
58′	48′	Neat cement	12.5
48′	0′	Bentonite slurry	29.4

Method of Construction

☐ Cable Tool ☐ Diamond
☐ Rotary (Conventional) ☐ Jetting
☐ Rotary (Reverse) ☐ Driving
☐ Boring ☐ Digging
☒ Air percussion
☐ Other, specify

Well Use

☐ Public ☐ Commercial ☐ Not used
☒ Domestic ☐ Municipal ☐ Dewatering
☐ Livestock ☐ Test Hole ☐ Monitoring
☐ Irrigation ☐ Cooling & Air Conditioning
☐ Industrial
☐ Other, specify

Construction Record - Casing

Inside Diameter (cm/in)	Open Hole OR Material (Galvanized, Fibreglass, Concrete, Plastic, Steel)	Wall Thickness (cm/in)	Depth (m/ft) From	Depth (m/ft) To
6 1/4"	Steel	.188	+2′	58′
6 1/8"	Open Hole		58′	180′

Construction Record - Screen

Outside Diameter (cm/in)	Material (Plastic, Galvanized, Steel)	Slot No.	Depth (m/ft) From	Depth (m/ft) To

Status of Well

☒ Water Supply
☐ Replacement Well
☐ Test Hole
☐ Recharge Well
☐ Dewatering Well
☐ Observation and/or Monitoring Hole
☐ Alteration (Construction)
☐ Abandoned, Insufficient Supply
☐ Abandoned, Poor Water Quality
☐ Abandoned, other, specify
☐ Other, specify

Water Details

Water found at Depth (m/ft)	Kind of Water	
69	☐ Fresh ☐ Untested ☒	☐ Gas ☐ Other, specify
147	☐ Fresh ☒ Untested	☐ Gas ☐ Other, specify
170	☐ Fresh ☒ Untested	☐ Gas ☐ Other, specify

Hole Diameter

Depth (m/ft) From	To	Diameter (cm/in)
0′	58′	9 3/4"
58′	180′	6 1/8"

Results of Well Yield Testing

After test of well yield, water was:
☐ Clear and sand free
☐ Other, specify **Not tested**

If pumping discontinued, give reason: X

Pump intake set at (m/ft): 170

Pumping rate (l/min / GPM): 20

Duration of pumping: 1 hrs + 0 min

Final water level end of pumping (m/ft): 14.8′

If flowing give rate (l/min / GPM): X

Recommended pump depth (m/ft): 100′ (3/4HP-15GPM)

Recommended pump rate (l/min / GPM): 20

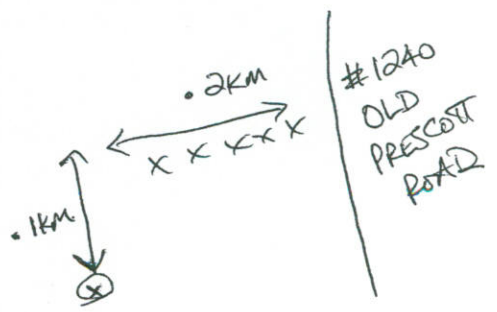
Well production (l/min / GPM): 20

Disinfected? ☒ Yes ☐ No

Draw Down Time (min)	Draw Down Water Level (m/ft)	Recovery Time (min)	Recovery Water Level (m/ft)
Static Level	12′		14.8′
1	12.9	1	12
2	13.2	2	12
3	13.3	3	12
4	13.5	4	12
5	13.7	5	12
10	14.4	10	12
15	14.6	15	12
20	14.8	20	12
25	14.8	25	12
30	14.8	30	12
40	14.8	40	12
50	14.8	50	12
60	14.8′	60	12′

Map of Well Location

Please provide a map below following instructions on the back.



Comments:
3/4 HP - 15 GPM SET @ 100 FT

Well Contractor and Well Technician Information

Business Name of Well Contractor	Well Contractor's Licence No.
Air Rock Drilling Co. Ltd.	1119

Business Address (Street Number/Name)	Municipality
6659 Franktown Road, RR#1	Richmond

Province	Postal Code	Business E-mail Address
ON	K0A 2Z0	air-rock@sympatico.ca

Bus. Telephone No. (inc. area code)	Name of Well Technician (Last Name, First Name)
6138382170	Hanna, Jeremy

Well Technician's Licence No.	Signature of Technician and/or Contractor	Date Submitted
T3632		2013 08 30

Well owner's information package delivered	Date Package Delivered	Date Work Completed
☒ Yes ☐ No	2013 08 26	2013 08 22

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Audit No. Z 155202

Received

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Ministry's Copy

APPENDIX 3

- SOIL LABORATORY TEST RESULTS
- WATER LABORATORY TEST RESULTS
  - Water Samples from Test Wells

Certificate of Analysis

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13032
Invoice to: Paterson Group

Report Number: 1316635
Date Submitted: 2013-08-03
Date Reported: 2013-08-06
Project: PH2095
COC #: 161388

Dear Robert Passmore:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____

Lorna Wilson
Laboratory Supervisor, Inorganics

Certificate of Analysis

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13032
Invoice to: Paterson Group

Report Number: 1316635
Date Submitted: 2013-08-03
Date Reported: 2013-08-06
Project: PH2095
COC #: 161388

Group	Analyte	MRL	Units	Guideline	Lab I.D. 1047695 Sample Matrix Water Sample Type Sampling Date 2013-08-01 Sample I.D. WS - /01/08/13
Calculations	Hardness as CaCO3	1	mg/L		170
	Ion Balance	0.01			0.94
	TDS (COND - CALC)	1	mg/L		458
General Chemistry	Alkalinity as CaCO3	5	mg/L		205
	Cl	1	mg/L		68
	Colour	2	TCU		<2
	Conductivity	5	uS/cm		704
	DOC	0.5	mg/L		1.0
	F	0.10	mg/L		0.66
	N-NO2	0.10	mg/L		<0.10
	N-NO3	0.10	mg/L		<0.10
	pH	1.00			8.16
	S2-	0.01	mg/L		0.18
	SO4	3	mg/L		50
	Turbidity	0.1	NTU		0.5
Metals	Ca	1	mg/L		32
	Fe	0.03	mg/L		<0.03
	K	1	mg/L		7
	Mg	1	mg/L		22
	Mn	0.01	mg/L		0.01
	Na	2	mg/L		71
Nutrients	N-NH3	0.02	mg/L		0.21
	Phenols	0.001	mg/L		<0.001
	Tannin & Lignin	0.1	mg/L		<0.1
	Total Kjeldahl Nitrogen	0.10	mg/L		0.17

Guideline = *** = Guideline Exceedence**
** = Analysis completed at Mississauga, Ontario.
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13032
Invoice to: Paterson Group

Report Number: 1316635
Date Submitted: 2013-08-03
Date Reported: 2013-08-06
Project: PH2095
COC #: 161388

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 0 **Analysis Date** 2013-08-06 **Method** C SM2340B			
Hardness as CaCO3			
Ion Balance			
TDS (COND - CALC)			
Run No 255451 **Analysis Date** 2013-08-03 **Method** C SM2130B			
Turbidity	<0.1 NTU	105	73-127
Run No 255453 **Analysis Date** 2013-08-06 **Method** C SM2120C			
Colour	<2 TCU	105	90-110
Run No 255455 **Analysis Date** 2013-08-06 **Method** C SM4500-Norg-C			
Total Kjeldahl Nitrogen	<0.10 mg/L	110	77-123
Run No 255457 **Analysis Date** 2013-08-06 **Method** SM 4110C			
Cl	<1 mg/L	100	90-112
SO4	<3 mg/L	96	90-110
Run No 255462 **Analysis Date** 2013-08-06 **Method** C SM5530D			
Phenols	<0.001 mg/L	88	73-127

Guideline = *** = Guideline Exceedence**
** = Analysis completed at Mississauga, Ontario.
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13032
Invoice to: Paterson Group

Report Number: 1316635
Date Submitted: 2013-08-03
Date Reported: 2013-08-06
Project: PH2095
COC #: 161388

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 255465 **Analysis Date** 2013-08-06 **Method** C SM4500-NH3D			
N-NH3	<0.02 mg/L	98	85-115
Run No 255471 **Analysis Date** 2013-08-06 **Method** C SM5550B			
Tannin & Lignin	<0.1 mg/L	104	80-120
Run No 255475 **Analysis Date** 2013-08-06 **Method** C SM5310C			
DOC	<0.5 mg/L	99	84-116
Run No 255478 **Analysis Date** 2013-08-06 **Method** C SM4500-S2-D			
S2-	<0.01 mg/L	107	
Run No 255482 **Analysis Date** 2013-08-06 **Method** EPA 200.8			
Fe	<0.03 mg/L	103	88-112
Mn	<0.01 mg/L	99	91-109
Run No 255483 **Analysis Date** 2013-08-06 **Method** SM 2320B			
Alkalinity as CaCO3	<5 mg/L	100	95-105
Conductivity	<5 uS/cm	100	95-105
F	<0.10 mg/L	100	90-110
pH	6.01	100	90-110
Run No 255485 **Analysis Date** 2013-08-06 **Method** C SM4500-NO3-F			

Guideline = *** = Guideline Exceedence**
** = Analysis completed at Mississauga, Ontario.
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13032
Invoice to: Paterson Group

Report Number: 1316635
Date Submitted: 2013-08-03
Date Reported: 2013-08-06
Project: PH2095
COC #: 161388

QC Summary

Analyte	Blank	QC % Rec	QC Limits
N-NO2	<0.10 mg/L	113	80-120
N-NO3	<0.10 mg/L	93	80-120
Run No 255495 **Analysis Date** 2013-08-06 **Method** M SM3120B-3500C			
Ca	<1 mg/L	90	80-120
K	<1 mg/L	96	80-120
Mg	<1 mg/L	91	80-120
Na	<2 mg/L	93	80-120

Guideline = *** = Guideline Exceedence**
** = Analysis completed at Mississauga, Ontario.
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Certificate of Analysis

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13043
Invoice to: Paterson Group

Report Number: 1320693
Date Submitted: 2013-09-20
Date Reported: 2013-09-24
Project: PH2095
COC #: 172593

Dear Robert Passmore:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____

Lorna Wilson
Laboratory Supervisor, Inorganics

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13043
Invoice to: Paterson Group

Report Number: 1320693
Date Submitted: 2013-09-20
Date Reported: 2013-09-24
Project: PH2095
COC #: 172593

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.
					1059112 / Water / / 2013-09-19 / TW4 - WS - 6HR
Calculations	Hardness as CaCO3	1	mg/L	OG-100	348*
	Ion Balance	0.01			1.01
	TDS (COND - CALC)	1	mg/L	AO-500	492
General Chemistry	Alkalinity as CaCO3	5	mg/L	OG-500	237
	Cl	1	mg/L	AO-250	72
	Colour	2	TCU	AO-5	2
	Conductivity	5	uS/cm		757
	DOC	0.5	mg/L	AO-5	1.5
	F	0.10	mg/L	MAC-1.5	0.12
	N-NO2	0.10	mg/L	MAC-1.0	<0.10
	N-NO3	0.10	mg/L	MAC-10.0	<0.10
	pH	1.00		6.5-8.5	8.21
	S2-	0.01	mg/L	AO-0.05	<0.01
	SO4	3	mg/L	AO-500	66
	Turbidity	0.1	NTU	MAC-1.0	0.5
Metals	Ca	1	mg/L		95
	Fe	0.03	mg/L	AO-0.3	0.18
	K	1	mg/L		2
	Mg	1	mg/L		27
	Mn	0.01	mg/L	AO-0.05	0.03
	Na	2	mg/L	AO-200	28
Nutrients	N-NH3	0.02	mg/L		0.03
	Phenols	0.001	mg/L		<0.001
	Tannin & Lignin	0.1	mg/L		<0.1
	Total Kjeldahl Nitrogen	0.10	mg/L		0.14

Guideline = ODWSOG *** = Guideline Exceedence**
** = Analysis completed at Mississauga, Ontario.
Results relate only to the parameters tested on the samples submitted.
Methods references and/or additional QA/QC information available on request.

MRL = Method Reporting Limit, AO = Aesthetic Objective, OG = Operational Guideline, MAC = Maximum Acceptable Concentration, IMAC = Interim Maximum Acceptable Concentration, STD = Standard, PWQO = Provincial Water Quality Guideline, IPWQO = Interim Provincial Water Quality Objective, TDR = Typical Desired Range

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13043
Invoice to: Paterson Group

Report Number: 1320693
Date Submitted: 2013-09-20
Date Reported: 2013-09-24
Project: PH2095
COC #: 172593

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 0 **Analysis Date** 2013-09-24 **Method** C SM2340B			
Hardness as CaCO3			
Ion Balance			
TDS (COND - CALC)			
Run No 257956 **Analysis Date** 2013-09-20 **Method** C SM2130B			
Turbidity	<0.1 NTU	100	73-127
Run No 257971 **Analysis Date** 2013-09-23 **Method** C SM4500-Norg-C			
Total Kjeldahl Nitrogen	<0.10 mg/L	103	77-123
Run No 257972 **Analysis Date** 2013-09-23 **Method** C SM2120C			
Colour	<2 TCU	100	90-110
Run No 257977 **Analysis Date** 2013-09-23 **Method** C SM4500-NH3D			
N-NH3	<0.02 mg/L	103	85-115
Run No 257990 **Analysis Date** 2013-09-23 **Method** C SM5550B			
Tannin & Lignin	<0.1 mg/L	99	80-120
Run No 257995 **Analysis Date** 2013-09-23 **Method** C SM5530D			

Guideline = ODWSOG *** = Guideline Exceedence**
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Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13043
Invoice to: Paterson Group

Report Number: 1320693
Date Submitted: 2013-09-20
Date Reported: 2013-09-24
Project: PH2095
COC #: 172593

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Phenols	<0.001 mg/L	88	73-127
Run No 258018 **Analysis Date** 2013-09-23 **Method** EPA 200.8			
Fe	<0.03 mg/L	108	88-112
Mn	<0.01 mg/L	107	91-109
Run No 258019 **Analysis Date** 2013-09-23 **Method** M SM3120B-3500C			
Ca	<1 mg/L	99	80-120
K	<1 mg/L	104	80-120
Mg	<1 mg/L	99	80-120
Na	<2 mg/L	103	80-120
Run No 258029 **Analysis Date** 2013-09-23 **Method** C SM4500-S2-D			
S2-	<0.01 mg/L	104	
Run No 258030 **Analysis Date** 2013-09-23 **Method** C SM4500-NO3-F			
N-NO2	<0.10 mg/L	113	80-120
N-NO3	<0.10 mg/L	110	80-120
Run No 258048 **Analysis Date** 2013-09-23 **Method** SM 4110C			
Cl	<1 mg/L	100	90-112
SO4	<3 mg/L	101	90-110

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Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13043
Invoice to: Paterson Group

Report Number: 1320693
Date Submitted: 2013-09-20
Date Reported: 2013-09-24
Project: PH2095
COC #: 172593

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 258062 **Analysis Date** 2013-09-24 **Method** SM 2320B			
Alkalinity as CaCO3	<5 mg/L	101	95-105
Conductivity	<5 uS/cm	100	95-105
F	<0.10 mg/L	97	90-110
pH	5.94	100	90-110
Run No 258091 **Analysis Date** 2013-09-24 **Method** C SM5310C			
DOC	<0.5 mg/L	98	84-116

Guideline = ODWSOG *** = Guideline Exceedence**
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EXOVA OTTAWA

Certificate of Analysis

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13043
Invoice to: Paterson Group

Report Number: 1320714
Date Submitted: 2013-09-20
Date Reported: 2013-09-23
Project: PH2095
COC #: 172593

Dear Robert Passmore:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____

Krista Quantrill
Laboratory Supervisor, Microbiology

Exova (Ottawa) is certified and accredited for specific parameters by:
CALA, Canadian Association for Laboratory Accreditation (to ISO 17025), OMAFRA, Ontario Ministry of Agriculture, Food and Rural Affairs (for farm soils), Licensed by Ontario MOE for specific tests in drinking water.

Exova (Mississauga) is accredited for specific parameters by:
SCC, Standards Council of Canada (to ISO 17025)

Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only.

EXOVA OTTAWA

Certificate of Analysis

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13043
Invoice to: Paterson Group

Report Number: 1320714
Date Submitted: 2013-09-20
Date Reported: 2013-09-23
Project: PH2095
COC #: 172593

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D. 1059217 Water 2013-09-19 TW4-WS-6HR
Microbiology	Escherichia Coli	0	ct/100mL	MAC-0	0
	Faecal Coliforms	0	ct/100mL		0
	Total Coliforms	0	ct/100mL	MAC-0	0

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EXOVA OTTAWA

Certificate of Analysis

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13032
Invoice to: Paterson Group

Report Number: 1320648
Date Submitted: 2013-09-19
Date Reported: 2013-09-22
Project: PH2095
COC #: 174025

Dear Robert Passmore:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____

Dragana Dzeletovic
Team Leader, Microbiology

EXOVA OTTAWA

Certificate of Analysis

Exova

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13032
Invoice to: Paterson Group

Report Number: 1320648
Date Submitted: 2013-09-19
Date Reported: 2013-09-22
Project: PH2095
COC #: 174025

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D. 1058964 Water 2013-09-19 TW 4-WS-3HR
Microbiology	Escherichia Coli	0	ct/100mL	MAC-0	0
	Faecal Streptococcus	0	ct/100mL		0
	Total Coliforms	0	ct/100mL	MAC-0	0

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EXOVA OTTAWA

Certificate of Analysis

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13045
Invoice to: Paterson Group

Report Number: 1322004
Date Submitted: 2013-10-04
Date Reported: 2013-10-07
Project: PH2095
COC #: 174111

Dear Robert Passmore:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____

Lorna Wilson
Laboratory Supervisor, Inorganics

Certificate of Analysis

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13045
Invoice to: Paterson Group

Report Number: 1322004
Date Submitted: 2013-10-04
Date Reported: 2013-10-07
Project: PH2095
COC #: 174111

Group	Analyte	MRL	Units	Guideline	Lab I.D. / Sample Matrix / Sample Type / Sampling Date / Sample I.D.	1063350 Water 2013-10-04 TW4-WS1	1063351 Water 2013-10-04 TW4-WS2	1063352 Water 2013-10-04 TW1-WS131004	1063353 Water 2013-10-04 TW2-WS131004
Calculations	Hardness as CaCO3	1	mg/L	OG-100		320*	320*		
	Ion Balance	0.01				0.95	0.96		
	TDS (COND - CALC)	1	mg/L	AO-500		495	496		
General Chemistry	Alkalinity as CaCO3	5	mg/L	OG-500		226	225		
	Cl	1	mg/L	AO-250		73	73		
	Colour	2	TCU	AO-5		2	2		
	Conductivity	5	uS/cm			761	763		
	DOC	0.5	mg/L	AO-5		1.3	1.6		
	F	0.10	mg/L	MAC-1.5		0.11	0.11		
	N-NO2	0.10	mg/L	MAC-1.0		<0.10	<0.10		
	N-NO3	0.10	mg/L	MAC-10.0		<0.10	<0.10		
	pH	1.00		6.5-8.5		7.97	7.93		
	S2-	0.01	mg/L	AO-0.05		<0.01	<0.01		
	SO4	3	mg/L	AO-500		68	68		
	Turbidity	0.1	NTU	MAC-1.0		1.3*	1.4*		
Metals	Ca	1	mg/L			87	87		
	Fe	0.03	mg/L	AO-0.3		0.21	0.21		
	K	1	mg/L			2	2		
	Mg	1	mg/L			25	25		
	Mn	0.01	mg/L	AO-0.05		0.03	0.03		
	Na	2	mg/L	AO-200		27	27		
Nutrients	N-NH3	0.02	mg/L			0.03	<0.02		
	Phenols	0.001	mg/L			<0.001	<0.001		
	Tannin & Lignin	0.1	mg/L			0.1	<0.1		
	Total Kjeldahl Nitrogen	0.10	mg/L			<0.10	<0.10	<0.10	<0.10

Guideline = ODWSOG *** = Guideline Exceedence**
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Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13045
Invoice to: Paterson Group

Report Number: 1322004
Date Submitted: 2013-10-04
Date Reported: 2013-10-07
Project: PH2095
COC #: 174111

				Lab I.D.	1063354	1063355
				Sample Matrix	Water	Water
				Sample Type		
				Sampling Date	2013-10-04	2013-10-04
				Sample I.D.	TW3-WS131004	TW4-WS131004
Group	**Analyte**	**MRL**	**Units**	**Guideline**		
Nutrients	Total Kjeldahl Nitrogen	0.10	mg/L		<0.10	0.12

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Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13045
Invoice to: Paterson Group

Report Number: 1322004
Date Submitted: 2013-10-04
Date Reported: 2013-10-07
Project: PH2095
COC #: 174111

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 0 **Analysis Date** 2013-10-07 **Method** C SM2340B			
Hardness as CaCO3			
Ion Balance			
TDS (COND - CALC)			
Run No 258787 **Analysis Date** 2013-10-05 **Method** C SM2130B			
Turbidity	<0.1 NTU	100	73-127
Run No 258789 **Analysis Date** 2013-10-07 **Method** C SM4500-Norg-C			
Total Kjeldahl Nitrogen	<0.10 mg/L	104	77-123
Run No 258791 **Analysis Date** 2013-10-07 **Method** SM 4110C			
Cl	<1 mg/L	101	90-112
SO4	<3 mg/L	100	90-110
Run No 258793 **Analysis Date** 2013-10-07 **Method** C SM2120C			
Colour	<2 TCU	105	90-110
Run No 258794 **Analysis Date** 2013-10-07 **Method** C SM4500-NH3D			
N-NH3	<0.02 mg/L	101	85-115

Guideline = *** = Guideline Exceedence**
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Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13045
Invoice to: Paterson Group

Report Number: 1322004
Date Submitted: 2013-10-04
Date Reported: 2013-10-07
Project: PH2095
COC #: 174111

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Run No 258810 **Analysis Date** 2013-10-07 **Method** C SM5530D			
Phenols	<0.001 mg/L	94	73-127
Run No 258814 **Analysis Date** 2013-10-07 **Method** C SM5550B			
Tannin & Lignin	<0.1 mg/L	86	80-120
Run No 258816 **Analysis Date** 2013-10-07 **Method** C SM4500-S2-D			
S2-	<0.01 mg/L	107	
Run No 258817 **Analysis Date** 2013-10-07 **Method** C SM5310C			
DOC	<0.5 mg/L	97	84-116
Run No 258819 **Analysis Date** 2013-10-07 **Method** SM 2320B			
Alkalinity as CaCO3	<5 mg/L	99	95-105
Conductivity	<5 uS/cm	99	95-105
F	<0.10 mg/L	101	90-110
pH	5.92	100	90-110
Run No 258823 **Analysis Date** 2013-10-07 **Method** EPA 200.8			
Fe	<0.03 mg/L	106	88-112
Mn	<0.01 mg/L	102	91-109
Run No 258826 **Analysis Date** 2013-10-07 **Method** M SM3120B-3500C			

Guideline = *** = Guideline Exceedence**
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Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13045
Invoice to: Paterson Group

Report Number: 1322004
Date Submitted: 2013-10-04
Date Reported: 2013-10-07
Project: PH2095
COC #: 174111

QC Summary

Analyte	Blank	QC % Rec	QC Limits
Ca	<1 mg/L	91	80-120
K	<1 mg/L	96	80-120
Mg	<1 mg/L	90	80-120
Na	<2 mg/L	97	80-120
Run No 258829 **Analysis Date** 2013-10-07 **Method** C SM4500-NO3-F			
N-NO2	<0.10 mg/L	100	80-120
N-NO3	<0.10 mg/L	92	80-120

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EXOVA OTTAWA

Certificate of Analysis

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13045
Invoice to: Paterson Group

Report Number: 1322002
Date Submitted: 2013-10-04
Date Reported: 2013-10-07
Project: PH2095
COC #: 174111

Dear Robert Passmore:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____

Krista Quantrill
Laboratory Supervisor, Microbiology

EXOVA OTTAWA

Certificate of Analysis

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13045
Invoice to: Paterson Group

Report Number: 1322002
Date Submitted: 2013-10-04
Date Reported: 2013-10-07
Project: PH2095
COC #: 174111

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1063345 Water Composite 2013-10-04 TW4-WS1	1063346 Water Composite 2013-10-04 TW4-WS2
Microbiology	Escherichia Coli	0	ct/100mL	MAC-0		0	0
	Faecal Coliforms	0	ct/100mL			0	0
	Heterotrophic Plate Count	0	ct/1mL			23	38
	Total Coliforms	0	ct/100mL	MAC-0		0	0

Guideline = ODWSOG *** = Guideline Exceedence**
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EXOVA OTTAWA

Certificate of Analysis

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13047
Invoice to: Paterson Group

Report Number: 1322638
Date Submitted: 2013-10-11
Date Reported: 2013-10-15
Project: PH 2095
COC #: 174113

Dear Robert Passmore:

Please find attached the analytical results for your samples. If you have any questions regarding this report, please do not hesitate to call (613-727-5692).

Report Comments:

APPROVAL: _____

Krista Quantrill
Laboratory Supervisor, Microbiology

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EXOVA OTTAWA

Certificate of Analysis

Client: Paterson Group
154 Colonnade Rd. South
Nepean, ON
K2E 7T7
Attention: Mr. Robert Passmore
PO#: 13047
Invoice to: Paterson Group

Report Number: 1322638
Date Submitted: 2013-10-11
Date Reported: 2013-10-15
Project: PH 2095
COC #: 174113

Group	Analyte	MRL	Units	Guideline	Lab I.D. Sample Matrix Sample Type Sampling Date Sample I.D.	1064917 Water 2013-10-10 TW2-WS1 13-10-03	1064918 Water 2013-10-10 TW2-WS2 13-10-03
Microbiology	Escherichia Coli	0	ct/100mL	MAC-0		0	0
	Faecal Coliforms	0	ct/100mL			0	0
	Heterotrophic Plate Count	0	ct/1mL			18	16
	Total Coliforms	0	ct/100mL	MAC-0		0	0

Guideline = ODWSOG *** = Guideline Exceedence**
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APPENDIX 4

- ❑ AQUIFER ANALYSIS DATA FOR TEST WELLS
- ❑ PREDICTIVE IMPACT ASSESSMENT AND WATER BUDGET ANALYSIS

Nitrate Impact Assessment

Project: 1240 Old Prescott Road
File: PH2095
Condition: Scenario No. 1: Straight Dilution (no infiltration through SWM - 46 lots)

Groundwater Flow Calculation

Background Nitrate Concentration (C_b) =	0	mg/L
Hydraulic Conductivity (k) =	0	m/s
Horizontal Gradient (i) =	0	
Length (L) =	0	m
Aquifer Thickness (t) =	0	m
Groundwater Flow (Q_b) =	0	m3/day

Infiltration Calculation

Nitrate Concentration in Precipitation (C_i) =	0	mg/L
Surplus Water (Environment Canada)	376	mm/yr
Factored Water Surplus =	342.54	mm/yr
Additional Surplus from Landscape Runoff =	0	mm/yr
Infiltration Flow Entering the System (Q_i) =	189.57	m^3/day

Mass Balance Model (MOEE 1995)

$C_T = (Q_bC_b+Q_eC_e+Q_iC_i)/(Q_b+Q_e+Q_i)$ = Cumulative Nitrate Concentration

where:

Q_b = flow entering the system across the upgradient area =	0	m^3/day
C_b = background nitrate concentration =	0	mg/L
Q_e = flow entering the system from the septic drainfield =	0	m^3/day
C_e = concentration of nitrates in the septic effluent =	0	mg/L
Q_i = flow entering the system from infiltration =	189.57	m^3/day
C_i = Concentration of nitrates in the infiltrate =	0	mg/L

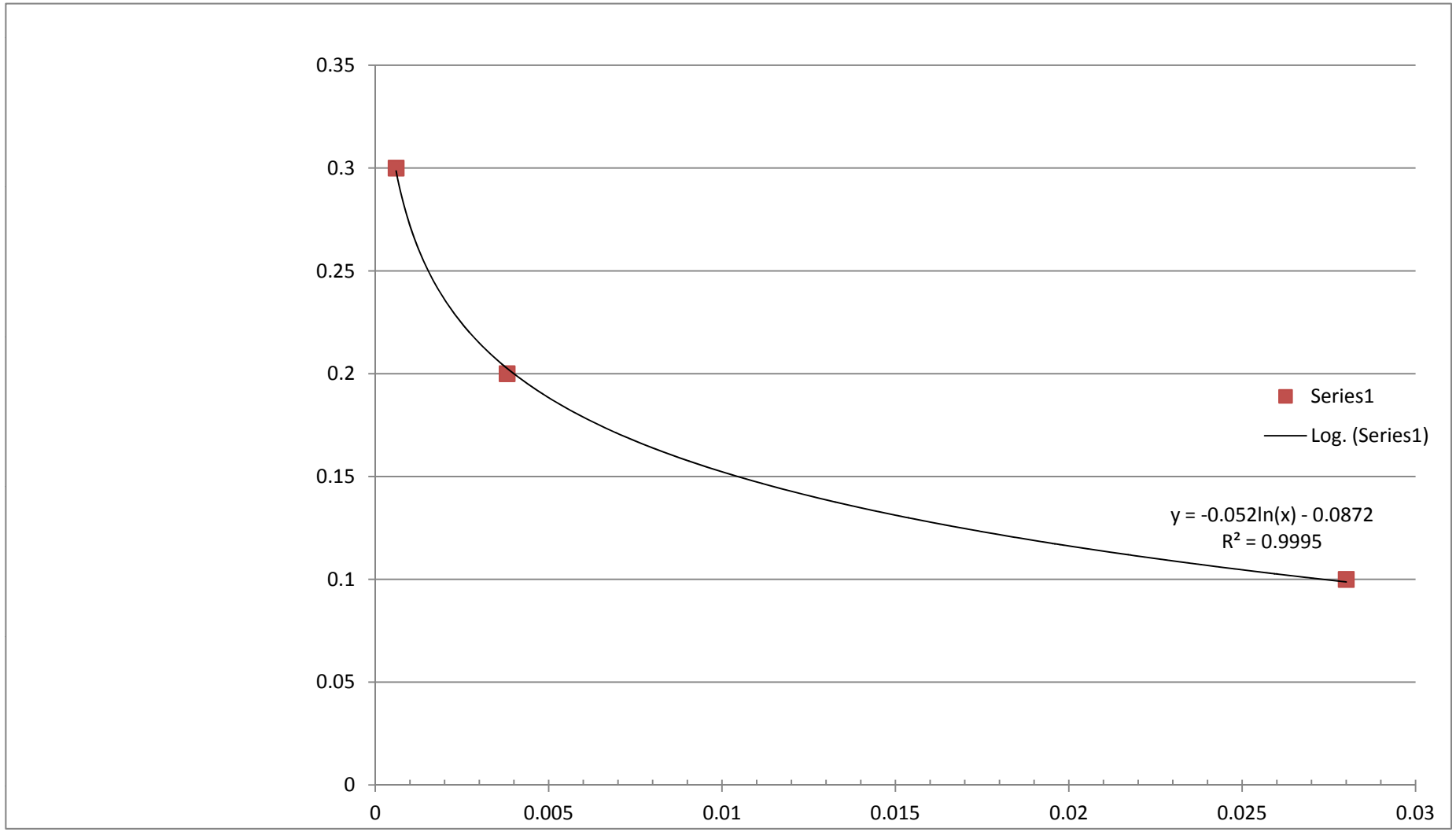
Therefore: **C_T = 0.000 mg/L**

Weighted Infiltration Factors

Topography	0.221
Soil	0.5
Cover	0.19
Total	**0.911**

Site Characteristics

Area of Site :	202000	m^2
Roof and Driveway Areas:	0	m^2
Length of Roadways:	0	m
Impervious Area	0	m^2
Percent Impervious Area =	0.00	%
Infiltration Area =	202000	m^2


0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
0.005
0.01
0.015
0.02
0.025
0.03
Series1
Log. (Series1)
y = -0.052ln(x) - 0.0872
R² = 0.9995

Nitrate Impact Assessment

Project: 1240 Old Prescott Road
File: PH2095
Condition: Scenario No. 1: Straight Dilution (no infiltration through SWM - 46 lots)

Groundwater Flow Calculation

Background Nitrate Concentration (C_b) =	0	mg/L
Hydraulic Conductivity (k) =	0	m/s
Horizontal Gradient (i) =	0	
Length (L) =	0	m
Aquifer Thickness (t) =	0	m
Groundwater Flow (Q_b) =	0	m3/day

Infiltration Calculation

Nitrate Concentration in Precipitation (C_i) =	0	mg/L
Surplus Water (Environment Canada)	376	mm/yr
Factored Water Surplus =	293.28	mm/yr
Additional Surplus from Landscape Runoff =	0	mm/yr
Infiltration Flow Entering the System (Q_i) =	142.30	m^3/day

Mass Balance Model (MOEE 1995)

$C_T = (Q_bC_b+Q_eC_e+Q_iC_i)/(Q_b+Q_e+Q_i)$ = Cumulative Nitrate Concentration

where:	Q_b = flow entering the system across the upgradient area =	0	m^3/day
	C_b = background nitrate concentration =	0	mg/L
	Q_e = flow entering the system from the septic drainfield =	46	m^3/day
	C_e = concentration of nitrates in the septic effluent =	40	mg/L
	Q_i = flow entering the system from infiltration =	142.30	m^3/day
	C_i = Concentration of nitrates in the infiltrate =	0	mg/L

Therefore: **C_T = 9.772 mg/L**

Weighted Infiltration Factors

Topography	0.22
Soil	0.45
Cover	0.11
Total	**0.78**

Septic Effluent

Concentration of Effluent (Cs) =	40	mg/L
Number of Lots:	46	
Daily Sewage Flow (Qs)=	46	m^3

Site Characteristics

Area of Site :	202000	m^2
Roof and Driveway Areas:	420	m^2
Length of Roadways:	930	m
Impervious Area	24900	m^2
Percent Impervious Area =	12.33	%
Infiltration Area =	177100	m^2

Weighted Topo

Pre	area	20.2	ha						
	Area	Area (ha)	slope M/M	%	factor		Cover		
	A1	4.8	0.01875	0.237624	0.2	0.047525	0.2	0.047525	
	A2	0.5	0.169230769	0.024752	0.1	0.002475	0.1	0.002475	
	A3	13.1	0.00109375	0.648515	0.25	0.162129	0.2	0.129703	
	A4	1.8	0.042465753	0.089109	0.1	0.008911	0.1	0.008911	
		20.2				0.22104		0.188614	

Post	area	20.2	ha			
	Area	Area (ha)	slope M/M	%	factor	
	A1	4.8	0.003	0.237624	0.214875	0.05106
	A2	0.5	0.169230769	0.024752	0.005178	0.000128
	A3	13.1	0.033333333	0.648515	0.089662	0.058147
	A4	1.8	0.028767123	0.089109	0.097323	0.008672
		20.2				0.118007

Post Development Cover

Average lot area	0.287	ha		
%retained trees	10	%		
retained tree area	0.0287	ha		
Weighted Cover Factor	0.0287	0.2	0.02	
	0.2583	0.1	0.09	
			0.11	

APPENDIX 5

- ❏ FIGURE 1 - SITE LOCATION PLAN
- ❏ FIGURE 2- TERRAIN UNIT DELINEATION
- ❏ FIGURE 3- BEDROCK MAPPING
- ❏ TEST HOLE LOCATION PLAN - Drawing No. PH2095-1
- ❏ LOT DEVELOPMENT PLAN - Drawing No. PH2095-2

Client:

1384341 ONTARIO LTD.

Consultant:

patersongroup
consulting engineers

Project:

OLD PRESCOTT ROAD SUBDIVISION

1240 OLD PRESCOTT ROAD OTTAWA (GREELY), ONTARIO

Drawing:

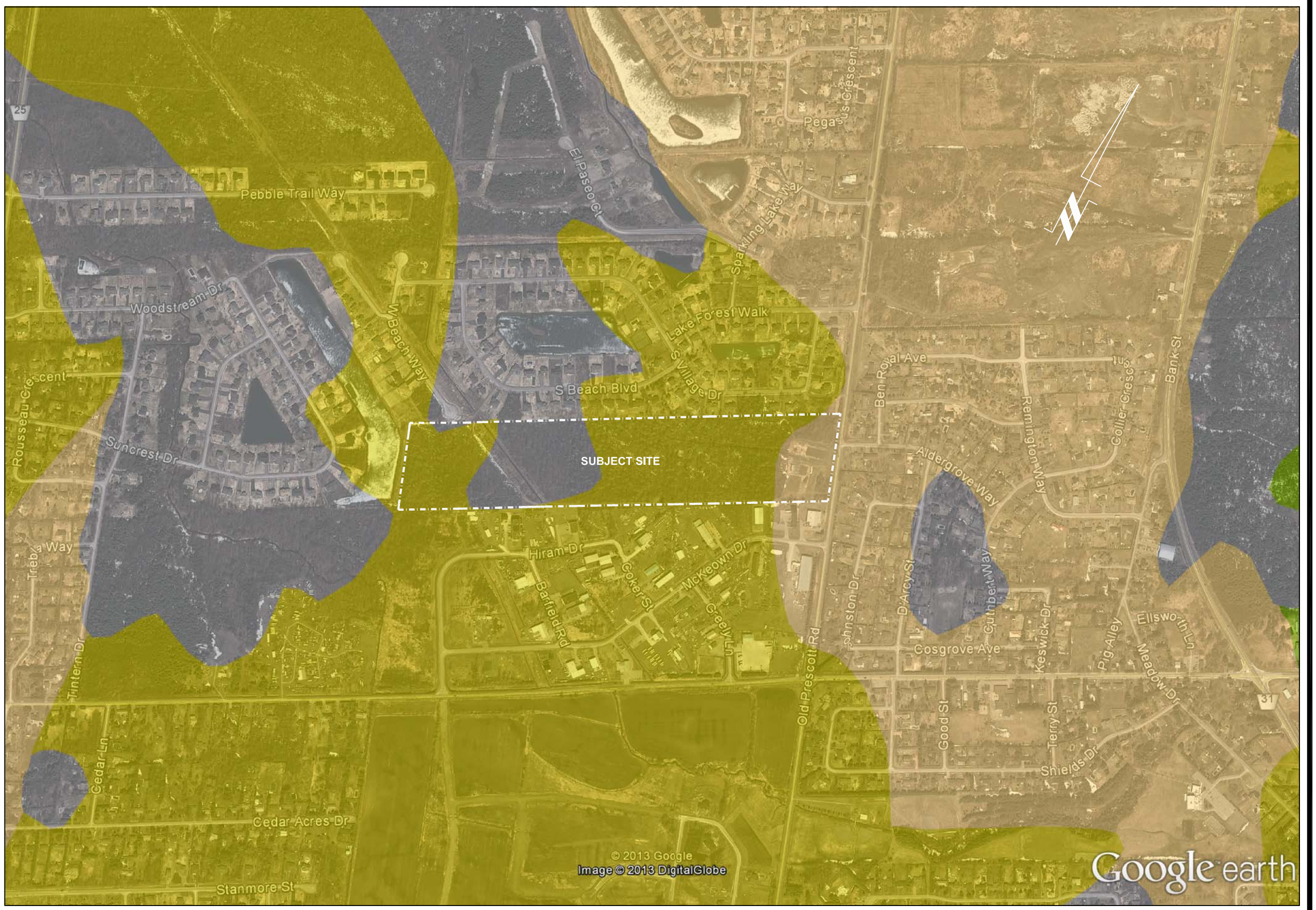
SITE LOCATION PLAN

Scale: N.T.S	Seal:
Date: 09/2013	
Drawn by: BA	
Checked by: RAP	
File: PH2095	

Drawing No.:

PH2095-FIG.1

Storage No.:PH20xx/PH2095-FIG.1.DWG



NOTE: INFORMATION REPRODUCED FROM ONTARIO GEOLOGICAL SURVEY G.I.S. OVERLAY FOR GOOGLE EARTH
REFERENCE SHOULD BE MADE TO SITE SPECIFIC GEOTECHNICAL INVESTIGATION FINDINGS BY PATERSON GROUP INC.

LEGEND:

- GLACIOFLUVIAL DEPOSITS
- COARSE-TEXTURED GLACIOMARINE DEPOSITS
- ORGANIC DEPOSITS
- TILL

Client:

1384341 ONTARIO LTD.

Consultant:

patersongroup
consulting engineers

Project:

OLD PRESCOTT ROAD SUBDIVISION

1240 OLD PRESCOTT ROAD OTTAWA (GREELY), ONTARIO

Drawing:

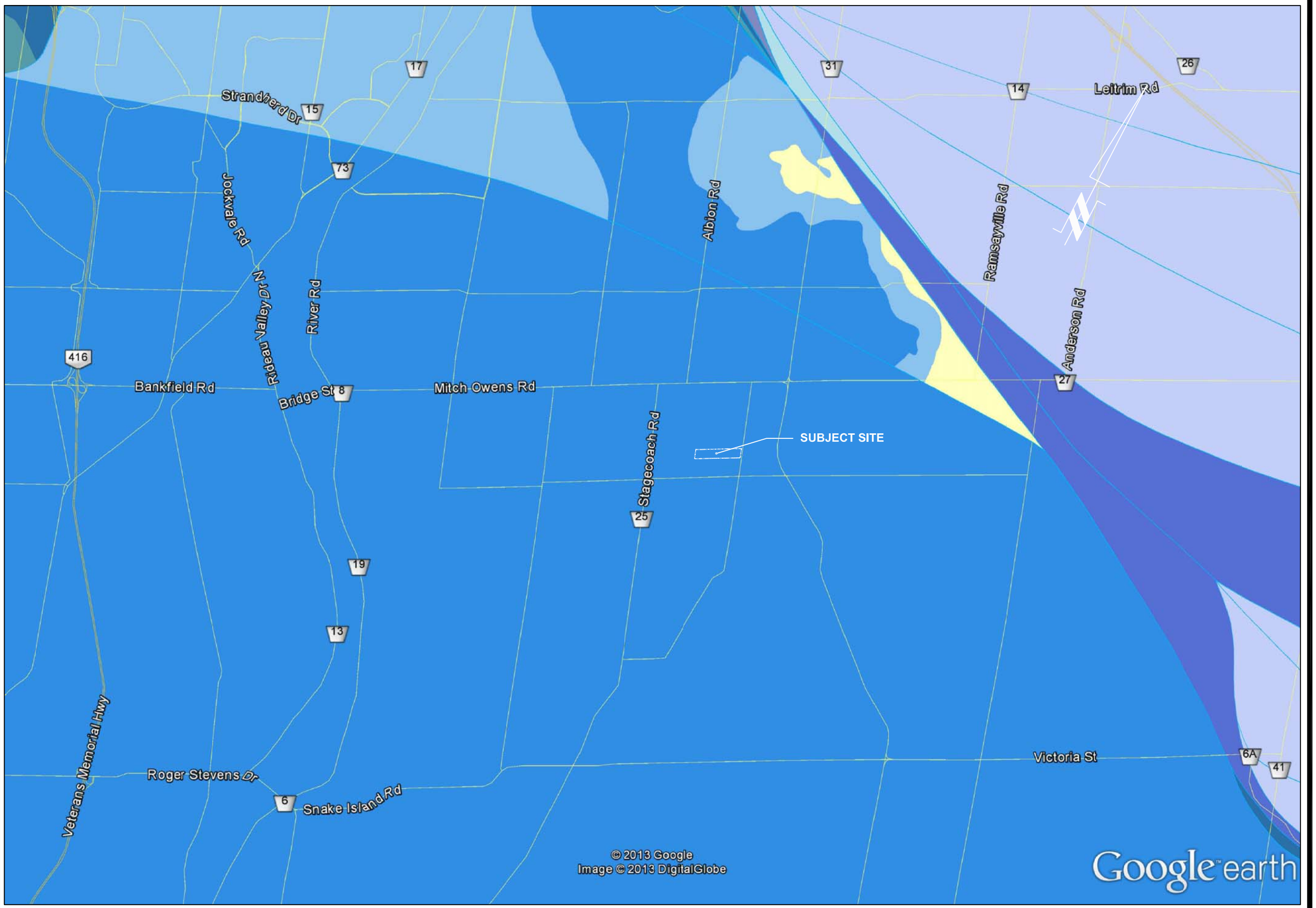
SURFICIAL SOIL DELINEATION MAPPING

Scale: N.T.S	Seal:
Date: 09/2013	
Drawn by: BA	
Checked by: RAP	
File: PH2095	

Drawing No.:

PH2095-FIG.2

Storage No.:PH20xx/PH2095-FIG.2.DWG



NOTE: BEDROCK INFORMATION REPRODUCED FROM ONTARIO GEOLOGICAL SURVEY G.I.S. OVERLAY FOR GOOGLE EARTH

LEGEND:

- OXFORD
- MARCH
- NEPEAN
- CARLSBAD
- QUEENSTON
- BOBCAYGEON
- GULL RIVER
- ROCKCLIFFE
- BILLINGS

Client:

1384341 ONTARIO LTD.

Consultant:

patersongroup
consulting engineers

Project:

OLD PRESCOTT ROAD SUBDIVISION

1240 OLD PRESCOTT ROAD
OTTAWA (GREELY), ONTARIO

Drawing:

REGIONAL BEDROCK MAPPING

Scale: N.T.S	Seal:
Date: 09/2013	
Drawn by: BA	
Checked by: RAP	
File: PH2095	

Drawing No.:

PH2095-FIG.3

Storage No.:PH20xx/PH2095-FIG.3.DWG

NOTE: WATER WELL INFORMATION REPRODUCED FROM THE ONTARIO GROUND WATER INFORMATION NETWORK (GIN)

LEGEND:

1536297 WATER WELL RECORD
(PUBLISHED MOE RECORDS)

Client:

1384341 ONTARIO LTD.

Consultant:

patersongroup
consulting engineers

Project:

OLD PRESCOTT ROAD SUBDIVISION

1240 OLD PRESCOTT ROAD
OTTAWA (GREELY), ONTARIO

Drawing:

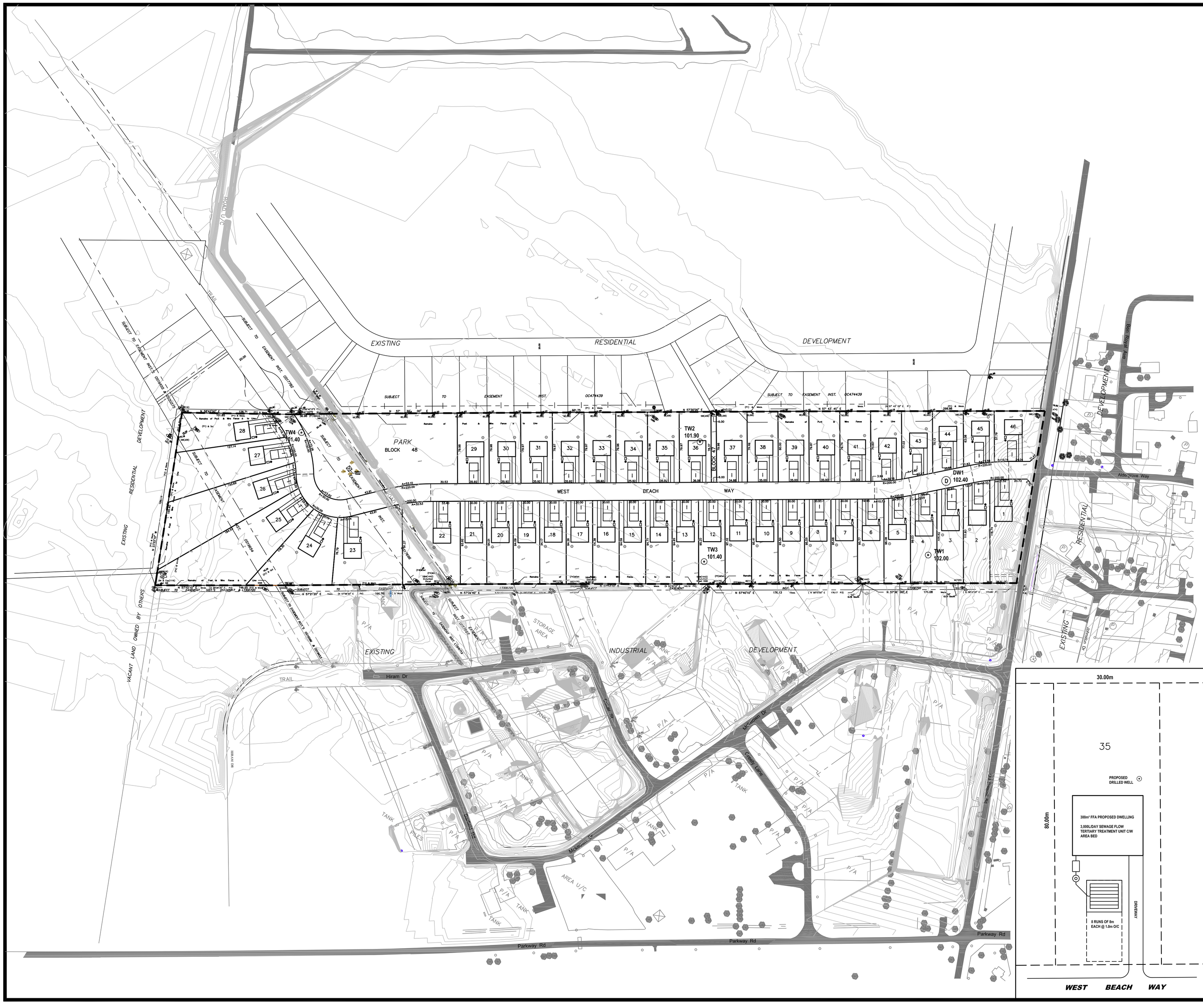
REGIONAL WELLS PLAN

Scale: N.T.S	Seal:
Date: 09/2013	
Drawn by: BA	
Checked by: RAP	
File: PH2095	

Drawing No.:

PH2095-FIG.4

Storage No.:PH20xx/PH2095-FIG.4.DWG



LEGEND:

- TW1 — TEST WELL LOCATION
- D — EXISTING DUG WELL

NOTE: BASEPLAN AND TOPOGRAPHIC INFORMATION PROVIDED BY ANNIS O'SULLIVAN VOLLEBEKK.

NO.	DESCRIPTION	DATE

DESIGNED BY: RAP
DRAWN BY: BA
CHECKED BY: RAP
SCALE: 1:2000
DATE: 01/2013

CLIENT

1384341 ONTARIO LTD.

PROJECT/LOCATION

OLD PRESCOTT ROAD SUBDIVISION

1240 OLD PRESCOTT ROAD
OTTAWA (GREELY), ONTARIO

DRAWING

LOT DEVELOPMENT PLAN

DRAWING NO. **PH2095-2**

REVISION NO.

paterson group
consulting engineers
28 Concourse Gate, Unit 1, Ottawa, Ontario K2E 7T7

LEGEND:

- TW1 — TEST WELL LOCATION
- D — EXISTING DUG WELL
- BH2 — BOREHOLE LOCATION WITH MONITORING WELL INSTALLED
- TH3 — TEST HOLE LOCATION

NOTE: BASEPLAN AND TOPOGRAPHIC INFORMATION PROVIDED BY ANNIS O'SULLIVAN VOLLEBEKK.

NO.	DESCRIPTION	DATE

DESIGNED BY:	RAP
DRAWN BY:	BA
CHECKED BY:	RAP
SCALE:	1:2000
DATE:	01/2013

CLIENT

1384341 ONTARIO LTD.

PROJECT/LOCATION

OLD PRESCOTT ROAD SUBDIVISION

1240 OLD PRESCOTT ROAD
OTTAWA (GREELY), ONTARIO

DRAWING

TEST WELL LOCATION PLAN

DRAWING NO.	REVISION NO.
PH2095-1	

paterson group
consulting engineers
28 Concourse Gate, Unit 1, Ottawa, Ontario K2E 7T7