

Terrain Analysis and Hydrogeological Study Proposed Residential Development

1934 Stagecoach Road Ottawa, Ontario

Prepared for 7773226 Canada Inc.

Report PH3745-1 dated June 21, 2023 Updated June 1, 2024



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1.0 Introduction

1.1. Terms of Reference

Paterson Group (Paterson) was commissioned by Fotenn Consultants Inc. (Fotenn) in 2007 to conduct a Terrain Analysis and Hydrogeological Study for a proposed rural residential subdivision on a 63 ha parcel of land, hereafter denoted as subject property, located on Part of the Rear of Lot 12, Concession 3, Parts 1-9, Plan 4R-19474 and as Part of the East Half of Lot 12, Concession 3, Part 1, Plan 5R2820, former Township of Osgoode, now in the City of Ottawa (Refer to Paterson Drawing PH4734-1 - Site Plan, located in Appendix 5). The subject site currently has a municipal address of 1934 Stagecoach Road, in Ottawa.

Work began on this subdivision in 2006, with an original Terrain Analysis and Hydrogeological Study Report being prepared and issued in April 2007. Several rounds of comments were addressed by Paterson pertaining to the review of the report by the South Nation Conservation (SNC) by means of an addendum report and several correspondence letters. However, in January 2008, work ceased on the site pending a change in ownership of the subject property.

In November 2009, Paterson was re-engaged by the new owner, Velika Realty Corporation of Ottawa, Ontario, to address the remaining concerns of the SNC and finalize the Hydrogeological Study.

An updated Terrain Analysis and Hydrogeological Study was released on June 23, 2011 titled Paterson Report PH0482-REP.02 – Terrain Analysis and Hydrogeological Study – Dated April 2, 2007 and updated June 23, 2011.

A Draft Plan of Submission Application was submitted on August 5, 2022 to address the clearance of conditions for the application. City of Ottawa comments regarding the submission were received on October 7, 2022. The applicants company changed to 7773226 Canada Inc. at that time.

Paterson Group completed an updated Geotechnical Investigation titled Paterson Report PG6532-1- Geotechnical Investigation dated December 14, 2022. The results of the Geotechnical Investigation were used to update this Terrain Analysis and Hydrogeological Study Report.

Paterson Group completed a Hydrogeological Study & Water Budget Assessment titled Paterson Report PH4734 - Hydrogeological Study & Water Budget Assessment dated June 21, 2023. The results of this Study were used to update this Terrain Analysis and Hydrogeological Study Report.



The purpose of this study has been to ascertain and assess the specific terrain and hydrogeological conditions which 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. This report summarizes all of the additional works carried out and summarizes all of the associated findings. The current report updated the PH0482-7 phasing alignment.

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 it is understood at the time of writing this report.

Paterson has also completed a Phase I - Environmental Site Assessment (ESA) for the subject lands, the results of which are recorded under in Paterson Report PE0969-REP.01

1.2. Background

The subject property encompasses a total area of approximately 62.57 ha (GeoOttawa) and is proposed to be subdivided into 66 residential lots and one stormwater management pond having a minimum lot size of approximately 0.8 ha. It is proposed that the subdivision will be serviced by individual onsite wells and septic systems.

Paterson has conducted extensive hydrogeological investigations in the vicinity of the subject property in recent years, especially in the Greely Village area. Paterson has carried out hydrogeological studies for the South Village and Woodstream Subdivisions located to the north of the subject site (G8105) and for lands to the east of Hwy. 31 for a combination commercial and residential developments (Paterson Project No. PH0145). This local expertise has been incorporated into this study, where applicable.

2.0 Method of Study

2.1. Terrain Analysis

As part of this study, a series of test pits were put down on the subject property to delineate the subsurface soil conditions beneath the site. The initial field investigation was conducted on August 29, 2006. During this investigation a total of 13 test pits were put down in the area of the residential lots, by means of a backhoe. The test pit locations were selected by Paterson personnel to ensure adequate representation of the subsurface soil profile that was delineated across the site. The test pit locations were recorded and the subsurface conditions,



including the soil morphology and depth to the groundwater table (where encountered), were carefully observed and recorded by Paterson personnel as the test pits were advanced. Representative samples of the soils were recovered from the test pits. All samples were classified texturally in the field and sealed in proper containers for further review in our laboratory. The depths at which the soil samples were recovered from the test holes are shown as "G" on the Soil Profile and Test Data sheets provided in Appendix 1.

On September 26, 2006, an additional seven (7) hand auger holes were put down in the area located along the central to western quadrant of the site, due to access limitations encountered with the backhoe during the initial field investigation. The subsurface conditions observed at both the test pits and auger hole locations are shown on the Soil Profile and Test Data sheets, in Appendix 1 of this report, and the locations are referenced on the Drawing No. PH0482-7 – Lot Development Plan in Appendix 5.

On August 6, 2010, a series of additional test pits were put down on the subject property to augment the original terrain analysis fieldwork program with specific focus on determining the surficial soil profiles within the southern central and southeastern quadrants of the site. During this investigation a total of ten (10) additional test pits were put down. Reference should be made to Appendix 1 for the Soil Profile and Test Data sheets for each of these test pits and their locations can be reference on the Lot Development Plan Drawing No. PH0482 - 7 located in Appendix 5.

A permeameter testing investigation was conducted using a Pask (Constant Head) Permeameter between October and November 2022. An 83 mm diameter hole was excavated using a Riverside/Bucket auger to the desired testing depth. Permeameter testing was conducted at 12 locations across the subject site. Two tests were conducted at each location, one at the invert elevation of the drainage ditch and another 0.5 m below the invert elevation. The permeameter testing locations were placed to provide general coverage of the proposed drainage ditch system. Additional information regarding the Pask Permeameter testing can be found in Paterson Report PH4734 - Hydrogeological Study & Water Budget Assessment dated June 21, 2023.

2.2. Test Well Installation

A rigorous review of available Water Well Records for the immediate area, published by the Ontario Ministry of the Environment (MECP) 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.

The general well locations were chosen in order to ensure adequate coverage across the site, while, at the same time, endeavoring to maintain sufficient proximity such that responses could be measured in observation wells during the pumping tests. The test well installation program was carried out by Air Rock Drilling Company Ltd. between February 9 to February 22, 2007 for TW1 to TW4. TW7 was constructed on December 19, 2008. TW4 was deepened on August 31, 2010 and TW8 and TW9 were constructed on August 23, 2010 and August 31, 2010, respectively. An 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 constructed at the site. The Ministry of the Environment, Conservation and Parks (MECP) Water Well Records (WWR) for each test well can be found in Appendix 2.

2.3. Test Well Construction

TW 5 (Existing Well)

An existing, onsite well, hereafter referred to as TW5 for this study, is an existing drilled well which used to service a small residential dwelling, which was recently demolished, on the subject property. A water well record was obtained for this well (reference should be made to Appendix 2).

Based on the MECP WWR, the well was constructed in 1978 by Henry Mains Well Drilling. The well consisted of 30 m of casing set approximately 6.1 m into the March Formation, which was intercepted at a depth of approximately 24 m bgs. Cement grout was utilized to seal the annular space.

The aquifer intercept was reported to be located at a depth of approximately 51.5 m bgs. The reported well yield was upwards of 10 gallons per minute (gpm) (45.4 L/min), based on the one (1) hour pumping test.

TW 6 (Existing Well)

An existing offsite well, hereafter referred to as TW6 and located at 1897 Stagecoach Road, was identified to be accessible for testing and was subjected to a pumping test. An MECP WWR was obtained for this well (refer to the published WWR located in Appendix 2) as a result of the comprehensive WWR background search.



Based on the information contained within the published MECP WWR, the well was constructed using a 150 mm diameter casing having a length of 17.7 m and set approximately 1.5 m into the underlying limestone bedrock. The open borehole was extended to a depth of 22.9 m bgs. The aquifer intercept was noted to be within the Oxford Formation limestone at a depth of 18.3 m bgs. A recommended pumping rate of 5 gpm was set for this well.

TW1, TW2, and TW3 (New Wells)

With respect to the construction of TW1, TW2 and TW3, which took place in 2007, similar well construction methodology was utilized. First, a 228 mm diameter casing hole for each test well was advanced using a rotary tri-cone bit through the overburden, to the underlying limestone. The casing hole was advanced into the bedrock an additional 2.4 to 4.3 m to ensure that each casing was seated into competent bedrock.

Each casing hole was filled with a combination of neat cement and bentonite grout slurry having an observed consistency of at least 20% bentonite solids (by weight). A neat cement slurry was introduced into the lower 2 to 3 m of the casing hole through the tri-cone bit resting at the bottom of the casing hole. The tri-cone bit was raised 2.5 m off the bottom of the casing hole and the bentonite slurry was introduced down the drill stem and through the tri-cone bit and pumped upwards through the hole to the ground surface.

A new, 150 mm diameter steel casing, equipped with a drive shoe, was installed in the bentonite column. The density of the slurry in the casing hole was sufficient to prevent lateral movement of the casing as it was lowered into the hole, thereby ensuring proper casing alignment. The casing was seated into the bedrock and bentonite slurry. The inside of the casing was blown out prior to advancing the bit into the bedrock.

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 complete the mandatory one hour constant rate pumping test. The rate chosen for the one (1) 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 MECP Water Well Records.



TW4

TW4 was constructed in the same manner as that described above for TW1, TW2 and TW3. TW4 was completed at, or near the base of the Oxford Formation at a depth of approximately 18.3 m bgs when it was constructed in 2007.

TW4 was deepened by Air Rock on August 31, 2010 in order to delineate the depth of the Oxford Formation/March Formation in relation to the rest of the site and to ensure that the water supply located within the March Formation could be adequately intercepted in the northwest quadrant of the site.

Air Rock deepened the well by utilizing a 150 mm diameter button bit and slowly advancing the open borehole through the Oxford Formation and into the March Formation. The water supply aquifer located within the March Formation was intercepted at a depth of approximately 44.5 m bgs and the open hole was advanced to 48.8 m bgs to provide for an adequate water column for testing and development purposes. Reference should be made to the amended WWR for TW4 which is located in Appendix 2.

TW7

TW7 was constructed by Air Rock on December 19, 2008. The construction methodology followed that of the other test wells, with the casing being installed upwards of 2.5 m into the Oxford Formation limestone. The open hole was extended through the Oxford Formation and intercepted a water supply aquifer contained within the March Formation.

During the original pumping test of TW7, it was noted that the water column could not be drawn down below the bottom of the casing. Furthermore, water quality results from the pumping test contained elevated concentrations of dissolved organic carbon, tannins and lignins, iron and colour.

Based on the apparent well yield, combined with the proximity of TW7 to the area of poor drainage containing peat and a high water table and the elevated parameters commonly associated with surface water interactions, a detailed investigation was undertaken in October 2009. Paterson undertook a detailed site investigation of TW7. The purpose of this investigation was to isolate the source of the surface water influx into the open borehole. The well was first purged using a high-capacity submersible pump in an attempt to draw the water column down and past the bottom of the casing so that a camera could be utilized to examine the casing shoe seating in the bedrock to look for evidence of surface water inflow. However, despite pumping at rates exceeding 120 L/min for upwards of four



(4) hours, the static water level of the water column in the well did not drop below the bottom of the casing.

Paterson then retained Air Rock to carry out a series of intrusive investigations of the existing well. Upon their initial arrival to the site, Air Rock proceeded to check that the casing was seated into the bedrock. The methodology of this work consisted of placing a hammer collar onto the existing well casing and attempt to move the casing using the 150 mm diameter button bit with moderate air pressure applied to hammer the casing. The casing stickup was measured before and after the casing evaluation. A difference of approximately 17 mm was noted upon completion of the casing evaluation. This indicated that the casing has moved 17 mm downward into the ground upon completion of the short duration of applied pressure.

Air Rock then proceeded to lower a surge block into the well. The surge block consisted of a series of rubber plates clamped together onto a drilling rod, thereby creating a thick rubber plug. The diameter of the block was measured to be approximately 160 mm in diameter which is generally sufficient to seal the block against the casing at is lowered down the well. The surge block was lowered down the existing well casing and the static water level was measured to be absent from the surge block after it had been lowered to a depth of approximately 6 m below the top of casing and let sit for upwards of 10 minutes. Next, the surge block was lowered to the bottom of the casing. As the surge block was pushed past the bottom of the casing, at a depth of approximately 9.7 m below the top of casing, a vacuum like suction sound was audibly detected from the hole. The surge block was retracted and a volume of black coloured, mal-odorous water was discharged from atop the block. Moreover, a gray and black silty clay was observed to be present on the top of the surge block upon visual inspection when it had been retracted.

The works carried out by Air Rock during the intrusive investigation, based on the findings presented above, confirmed that the surface water was entering into the well at the bottom of the casing. Moreover, based on the casing movement, it is likely that the casing was initially seated onto the bedrock and either the grout column did not adequately seal the annular space at that zone, or the bedrock became fractured as the open borehole was advanced after the casing was installed and the annular space had been grouted.

Air Rock then installed a 100 mm diameter Schedule 40 PVC sleeve into the well. Air Rock proceed to install the PVC sleeve to a depth of approximately 13 m, measured from the top of the casing (approximately 6 m below the bedrock surface and 4 m deeper than the original casing) and the annular space between the PVC and the existing well casing and bedrock face was sealed with a neat cement



slurry. The slurry was introduced using a tremie pipe and was pumped to the top of the well casing. The method of installation and grouting appears consistent with the requirements of Ontario Regulation 903.

Upon the completion of the updated pumping test, Air Rock subsequently abandoned the well in accordance with Ontario Regulation 903 requirements. All attempts were made to remove the existing casing, however the steel casing could not be removed from the ground. In light of this, the casing and PVC sleeve were cut back a total of 1.5 m bgs during the abandonment. The abandonment record for TW7 is included in Appendix 2.

TW8 and TW9

TW8, constructed on August 23, 2010 and August 31, 2010, respectively, were constructed utilizing the same general methodology as the other test wells.

During the construction of TW8, it was noted that the surface of the bedrock was much more fractured and less competent than in the other areas of the site. In order to ensure the casing was seated in competent bedrock and not subject to the same problems as had been experienced at TW7, the casing hole was extended until competent rock was encountered for a thickness of approximately 2 m. As such, the total length of casing is 11.5 m bgs. This compares to a length of PVC sleeve of 13 m in TW7.

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.

2.4. Aquifer Analysis

Each of the nine (9) 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. 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 horsepower (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 75 mm diameter 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 (i.e. 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 O.Reg 903 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 stress the aquifer enough to result in a demonstrable reduction in potentiometric head (i.e. 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%. There were no variations of more than 5% measured for any of the pumping tests during the course of pumping of each test well.

A series of physical and geochemical 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 graphically presented in Appendix 4.

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 is tabulated in Appendix 4 associated with the pumping test of each test well.

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 24 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 data was available):

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

These analytical models are well recognized to be applicable based on the aquifer system within the subject area. The results of the aquifer analysis are presented and discussed in Section 7 of this report.

2.5. Topographical Survey

A field survey was carried out of the subject property by J.D. Barnes. The ground surface elevations are referenced to a geodetic datum. The test pit elevations and well head elevations have been interpolated based on this survey data provided.

2.6. Laboratory Testing

Gradation of Soils

The soil samples recovered from the test holes were returned to our laboratory and visually examined to review the results of the field logging. Four (4) representative samples were selected for grain size analyses in our laboratory. The results of the soil testing are provided on the Grain Size Distribution curves in Appendix 3.

2.7. Overburden Groundwater Assessment

At the time of the fieldwork, the 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 0.5 m to 2.2 m bgs at TP 1 and TP 9, respectively. Several of the test holes were reported to be dry upon completion (in the raised portion of the site).

Monitoring wells were installed in selected areas across the site in order to more accurately delineate the direction of flow within the overburden. The static water level measurements for the monitoring wells installed on the site, are summarized in Table 1, below.



SUMMARY OF WATER LEVELS MEASURED WITHIN THE SHALLOW OVERBURDEN GROUNDWATER AQUIFER ACROSS											
THE SUBJECT PROPERTY											
Monitoring Wall No.	Wate	Water Level Measurement (Referenced to Geodetic Datum)									
Worldoning weil No.	2010-08-26	2010-09-07	2010-09-14	2010-09-22							
MW1-10	95.21	95.18	95.23	95.2							
MW2-10	95.92	<mark>9</mark> 5.91	95.94	95.91							
MW3-10	95.85	95.84	95.82	95.85							
MW4-10	95.32	95.33	95.31	95.31							
MW5-10	93.87	93.85	93.88	98.88							
MW6-10	95.22	95.23	95.23	95.21							

Table 1: Summary of water levels measured within the shallow overburden groundwater across the subject property

In addition to the quantitative and qualitative groundwater assessment in each test pit, groundwater samples were recovered from TP1-10, TP3-10, and TP13-10. Specifically, groundwater samples were recovered from each test pit while being excavated, under dry conditions. Each groundwater sample was extracted directly from the overburden groundwater and is considered to be directly indicative of the overburden groundwater in the sampled locations. The individual locations for sampling of the overburden groundwater were chosen in order to evaluate the background nitrate concentrations associated with areas where the existing sewage system is located (TP1-10) and in areas where there was the previous potential for agricultural uses (i.e. pasture land (TP1-10/TP3-10). In addition, TP13-10 was chosen as it reflects the central area of the subject property where existing drainage tends to focus the overburden groundwater.

These samples were submitted to Exova Accutest Laboratories, located in Ottawa, Ontario, for chemical analysis for relevant nitrogen species (i.e. nitrite and nitrate). The results of this analysis are summarized in Table 2, below and the laboratory report is provided in Appendix 3. The additional sampling carried out on the monitoring wells put down on the subject site, appear in Table 1, also.

SUMMARY OF BACKGROUND NITRATE CONCENTRATIONS REPORTED WITHIN THE SHALLOW OVERBURDEN									
GROUNDWATER AQUIFER									
Monitoring Well Location	TP1-10	TP3-10	TP13-10						
N-NO2 (Nitrite) (mg/L)	<0.10	<0.10	<0.10						
N-NO3 (Nitrate) (mg/L)	0.16	0.16	0.16						

Table 2: Summary of background nitrate concentrations reported within the shallow overburden groundwater aquifer

A detailed discussion on the results of the overburden groundwater assessment can be found in Section 8.3 of this report.



2.8. Bedrock Aquifer Groundwater Assessment

Raw water samples were collected from each of the nine (9) test wells during the pumping tests. Specifically, one (1) sample was collected after three (3) hours of pumping and one (1) sample was collected at the completion of pumping.

Prior to collection of the water samples, the free chlorine residual was verified to be non detectable using the Hanna C-114 handheld turbidity/free chlorine multimeter. After collection, the water samples were properly stored in a refrigerated cooler and transported to Exova Accutest Laboratories, located in Ottawa, Ontario. The samples were submitted for comprehensive testing of bacteriological, chemical and physical water quality parameters consistent with a standard "Subdivision Assessment Package". The results of the bedrock aquifer assessment are summarized in Section 7.0 of this report.

3.0 Site Description

3.1. Surface Conditions

At the time of the field investigations, the subject site was vacant and covered by shrubs and mature trees.

The site generally slopes from northeast to southwest with an undulating profile generally varying between 92 to 99 m asl with a localized high point located in the central to rear west quadrant of the property. From this high point, the land slopes off to areas of low topographical relief to the central quadrant of the subject property and westward towards a municipal drainage ditch located along the western property line. These low areas are heavily treed and have poor drainage characteristics.

3.2. Surrounding Land Uses with 500 m

The site, as previously mentioned is located in a rural setting. It is bordered to the east by Stagecoach Road followed by residential properties, and to the west by a municipal drain followed by recreational property. The neighbouring lands to the north and east consist of low-density residential dwellings. Undeveloped lands are present to the south.

One residence and accessory outbuildings is present on the subject site, situated approximately 100 to 150 m west of Stagecoach Road.



Based on the available information, there are no obvious indicators of potential groundwater contamination present on the surrounding lands within 500 m of the subject property, which may negatively impact the proposed development.

With respect to the recharge areas for the Oxford Formation Limestone aquifer, published information has accurately identified the location of the recharge area for the limestone aquifer(s) to be located west of Richmond, Ontario. Similarly, the March Formation limestone-sandstone composite, and Nepean Formation sandstone, both regional aquifers, have been previously documented by Paterson and others, to obtain recharge waters from Mississippi Lake and the eastern portions of Beckwith Township/western portions of Goulbourn Township, respectively.

A search of the MECP Permit to Take Water (PTTW) database provided no active PTTW within 500 m of the subject site. A search of the MECP Environmental Activity and Sector Registry (EASR) database provided no water taking permits within 500 m of the subject site.

In consideration of the identification of sources of potential contamination of the deep bedrock aquifers, the Phase 1-Environmental Site Assessment, completed by Paterson in 2007 (Paterson Report No. PE0969-REP.01) did not identify any potential contaminant sources. As the locations of the recharge areas for the bedrock aquifers are located a considerable distance away from the subject property, it is anticipated that no surficial impacts, at the time of preparation of the original report to the date of issuance of this report, are present within the immediate vicinity of the subject property which would impair or compromise the safety of the water supply aquifer in the long term.

4.0 Geology

4.1. Surficial Geology

A review of available surficial soils mapping for the area in the vicinity of the subject property indicates that the site is located in an area known to be covered with several different soil types ranging from peat to silty clay.

Based on surficial mapping prepared by the Ontario Geological Survey, the subject site is located in an area where surficial geology consists of sand, gravel, minor silt and clay, and till. Please refer to Drawing PH4734-3 – Surficial Geology Plan in Appendix 5 for additional details.

Based on the results of the test pit excavation program, surficial soil deposits which were encountered onsite coincide with the available surficial geological mapping.

Silty clay was encountered in the central quadrant of the site where the drainage is poor, and the area remains heavily treed. The western quadrant was noted to contain silty sand to sandy gravel deposits. Pockets of sand, glacial till, and organic peat soils were encountered in the eastern quadrant of the site, which is consistent with the available soils mapping.

Based on the test pit excavation program and onsite WWR's, overburden thickness across the site is in excess of 4 m. Using well recognized techniques for the field identification of soils, five (5) unique stratigraphic units were identified in the areas investigated. The soils were classified using the Unified Soil Classification System (USCS). The stratigraphic units are summarized in Table 3, and the grain size distribution curves are provided in Appendix 3. As detailed in this report, the area of peat and organic material is limited to the southeast quadrant of the site and is relatively shallow in nature. It is underlain by a coarse sand which, in turn, is underlain by silty clay and a localized perched groundwater table is present.

The test hole locations are presented on Drawing PH0482 – 7 – Lot Development Plan, included in Appendix 5. The test pit logs are provided in Appendix 1. The surficial soils encountered during the onsite investigations are generally consistent with the published mapping.

SUMMARY OF UNIQUE STRATIGRAPHIC UNITS ENCOUNTERED ON SUBJECT PROPERTY BASED ON TEST PIT EXCAVATIONS* IN STUDY AREA									
Terrain Unit	USCS Classification	General Thickness (m)*							
1	SM - compact to dense silty sand	0.2 to 2.2							
2	SM-SC- compact to dense silty sand to sand-clay mixture	more than 3.0							
3	GW-SM - compact well graded gravelly sand to silty sand	0.8 to 2.2							
4	SC-CL- stiff silty clay to sandy clay	more than 2.4							
5	5 Organic- peat								
Maximum depth of test pit excavation of 4.2 m. Organic deposit explored with hand auger equipment only.									

Table 3: Summary of unique stratigraphic units encountered on subject property based on test pit excavations in study area

4.2. Bedrock Geology

Published geological mapping (Refer to Paterson Drawing PH4734 – 4 - Bedrock Geology Plan located in Appendix 5) (OGS MRD219) reveals that the site and immediate surroundings are underlain by dolostone of the Oxford Formation. 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.

Although the overall maximum thickness of the Oxford Formation ranges from 69 m to 70 m in the Ottawa area, the formation is somewhat thinner in the subject area, based on available MECP Water Well Records. Available information indicates that the Oxford formation has an onsite overall thickness of approximately 10 to 30 m.

The March Formation, based on published data, is believed to have an estimated thickness of between 8 and 9 m in much of the Ottawa area. The March Formation is comprised of thick beds of grey sandstone alternating with thick beds of sandy blue-grey dolomite. The contact with the Nepean formation is generally placed at the lowest dolomitic layer, however it is often difficult to differentiate the Nepean and March formations due to similarities in appearance.

The Nepean Formation, the oldest member of the Paleozoic strata, consists of a cream coloured, coarse-grained sandstone with a weathered grey and irregular brown stained appearance. Near the top of the formation, the cement is either calcareous or of iron oxide, and the overall thickness of the formation varies considerably beneath the Ottawa area.

The MECP Water Well records, detailing the construction of the test wells, confirm the presence of limestone which is underlain by sandstone. Published MECP Water Well records in close proximity to the site substantiate the published bedrock mapping for the subject property.

A cursory review of the published MECP 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.

5.0 Regional Hydrogeology

5.1. Water Well Construction and Aquifer Interception

A search of the available MECP 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 MECP WWR search was completed within a search area consisting of a radial search centred on the subject property and extending to a radial length of 1500 m. The search returned over 180 individual MECP WWRs. Analysis of the individual MECP WWRs resulted in approximately 30 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 situated immediately to the north of the subject property. The WWR search did confirm the WWR's for the existing drilled wells at the site (one of which is TW5) as well as the WWR for 1897 Stagecoach Road (TW6).

Several WWR were noted to lack sufficient aquifer intercept information to be included in the regional analysis and a couple of WWR's were noted to be a WWR abandonment record. In total, 30 MECP 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 30 MECP WWRs included in the analysis, 100% of the wells were noted to be 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 bgs. 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 MECP 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 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 gpm).

Summary

Although most of the available MECP 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. Moreover,



upwards of 5 of the 30 WWRs reviewed (10%) reported intercepted both the lower Oxford Formation and March Formation water supply aquifers.

5.2. Neighbouring Water Quality

The existing well located at 1897 Stagecoach Road (TW6) was the only well accessible and with a published water well record in which the construction methodology could be verified to be included in the study.

In addition to the residences located within the immediate vicinity of the site, Paterson approached the owners of the Sleepy Cedars Family Campground (Sleepy Cedars) located to the west of the subject property beyond the tributary of the Castor River. Sleepy Cedars, which is located at 1893 Manotick Station Road, Ottawa, Ontario, operates a seasonal campsite which utilizes a private well and onsite sewage system. Paterson has carried out analytical aquifer analysis and groundwater geochemistry testing, under J.D. Paterson & Associates Ltd. in 2001. The work was carried out in conjunction with a Provincial Order issued by the MECP and pertained to the existing water works at the site, in order to assess the applicability of Ontario Regulation 459/00.

The existing drilled well (refer to Appendix 2 for WWR) was constructed in 1978 to a depth of 50.3 m bgs. Based on the published information, the well intercepts the March Formation aquifer at a depth of approximately 48.8 m bgs. Well yield was reported to be of the order of 12 gpm.

Sleepy Cedars confirmed with Paterson that the original peak values of upwards of 10,000 L/day during summer periods remain valid for the purpose of carrying out well interference modelling. The maximum rate of supply of water, based on the configuration of the water system is only 34 L/min (48,960 L/day). As such, the well at this particular site acts as a single house well for the purposes of interference analysis.

The aquifer analysis carried out in 2001 utilized the data obtained from a 250 minute pumping test to fit a Cooper & Jacobs Time-Drawdown graphical analysis model. A transmissivity of 4.40 x 10-3 m²/minute was calculated. The graphical analysis and information contained within the original MECP Provincial Offences order is provided in Appendix 2.

6.0 Site Hydrogeology

As previously stated in this report, a total of seven (7) test wells were constructed at the subject site during the well construction program and two (2) existing wells were utilized as part of the aquifer analysis (refer to Drawing No. PH0482 - 1- Test



Hole Location Plan in Appendix 5 for well locations). Hydrogeological details of the construction of each test well, based on the MECP Water Well Records, and engineering site notes, are graphically presented in the Generalized Hydrogeological Cross Section of the Subject Property- Drawing No. PH0482 - 4 in Appendix 5.

A review of Drawing No. PH0482 - 4 reveals that the hydrogeology of the test well construction is consistent with the other wells constructed in the immediate vicinity of the site. The water supply aquifer located within the Oxford Formation limestone appears, based on the finding of the pumping test program which are discussed in detail in Section 7.0, to be intermittent throughout the site and immediate area. Conversely, the March Formation was consistently intercepted by eight (8) of the nine (9) test wells at the site. TW6 (1897 Stagecoach Road) was not advanced to the March Formation as it intercepted a water supply aquifer present in the lower section of the Oxford Formation. The available water well records for wells located to the immediate vicinity of the site, including the well for Sleepy Cedars Campground to the West (refer to Section 5.2 for more information) of the subject property indicated that many of the surrounding wells have been advanced to the March Formation also.

The confining pressure and aguifer response of TW8 and TW9 to the pumping test, suggest that the preferred water supply aquifer system is behaving as a confined aquifer present between two (2) aquitards. By definition, "...the term aquitard has been coined to describe the less-permeable beds in a stratigraphic sequence." (Freeze & Cherry, 1979). The lower Oxford Formation, and underlying March/Nepean interface, if acting as aguitards, would explain the confining pressure measured in the wells and the corresponding Theis-like response to pumping. Analysis of the available MECP Water Well Records within a 500 m radius of the site indicate significant thicknesses of limestone are present between the surface of the ground and the depth of the water supply aguifer on most, if not all of the drilled wells. This fact, combined with the absence of nitrates in the preferred water supply aguifer zone (Lower Oxford and March Formations) further suggest the preferred water supply aquifer is hydraulically isolated from surficial impacts. However, the scope of this Hydrogeological Study did not include a detailed analysis of the preferred aquifer system focussed on demonstrating hydraulic isolation. As such, the information presented in this section adds a degree of security to the natural protection of the preferred aquifer system and only infers the system is hydraulically isolated, but does not corroborate this.



Direction of Groundwater Flow within the Combined Oxford and March Aquifer System

Typically, the static water levels in at least three (3) wells intercepting the same water supply aquifer is utilized to provide an interpolated direction of groundwater flow. In this instance, a total of seven (7) test wells (TW3 and TW6 omitted) were utilized to interpolate the direction of groundwater flow within the March Formation beneath the site. Based on an analysis of the static water levels found within these wells, the interpolated direction of groundwater flow within the water supply aquifer located in the March Formation, is in a south-southwest direction beneath the site.

7.0 Aquifer Analysis

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

7.1. Aquifer Characteristics

The aquifer characteristics determined from the compilations of the pumping tests for the nine (9) test wells are summarized below:

SUMMARY OF AQUIFER CHARACTERISTICS RESULTING FROM ANALYSIS OF PUMPING TEST DATA OBTAINED FROM CONSTANT RATE TESTING											
Parameter		Test Well Number									
Parameter	TW1	TW2	TW3	TW4	TW5	TW6	TW7	TW8	TW9		
Transmissivity* (m2/d)	4.1	2.4	684	56.7	118	66	0.8	13.3	485		
Storativity**	n/a	n/a	n/a	1.0 x 10-4	4.0 x 10-5	3.9 x 10-4	1.0 x 10-4	6.8 x 10-4	1.1 x 10-4		
Pumping Rate (L/min)	24	36	114	75.7	42	44	22.8	45.4	75.6		
Available Drawdown (m)	27.15	47.7	65.04	48.8	49	22.5	44.7	48.8	71.3		
Maximum Drawdown (m)	5.28	10.46	0.34	0.67	0.49	1	19.8	13.8	0.47		
% Drawdown	8.4	21.9	0.5	1.4	1	4.5	44.3	28.3	0.7		
Specific Capacity (L/min/m dd)	4	3	228	113	86	43.8	0.7	3	161		
20 Year Safe Yield (m3/day)	479	78	30251	1882	3932	1010	24	441	23416		
* Transmissivity values calculated from numerical averages of values derived from the Theis & Jacobs Recovery method of analysis. In the case of TW3, transmissivity was calculated as											
the numerical average of the three (3) analytical results through the use of observation well data.											
(* Storativity values calculated based on the numerical averages of all storativity values obtained from both Theis and Cooper & Jacobs Time-Drawdown analytical methods.											

Table 4: Summary of aquifer characteristics resulting from analysis of pumping test data obtained from constant rate testing

7.2. Groundwater Geochemistry Assessment

As three (3) distinct water supply aquifers/aquifer combinations were encountered within the bedrock beneath the subject property, and the well construction program resulted in at least one (1) well intercepting each formation in isolation, the water quality data for each of the water supply aquifers is presented in tabular formation in each subsection, summarized below.

Data obtained from active well head water quality monitoring during the pumping tests is summarized, graphically, in Appendix 4.



Oxford Formation

Table 5 and Table 6, presented in this section, summarize the overall laboratory geochemistry of the Oxford Formation water supply aquifer located beneath the subject property. The water quality of this aquifer is presented based on the analysis of raw water recovered from TW1 and TW6.

SUMMARY OF HEALTH AND AESTHET		PARAIVIETERS	FOR THE OXFOR		WATER SUPPLY		and Ivvoj
Parameter	Units	TW1		TW6		Ontario Drinking Water Standards*	
		3 Hour	6 Hour	3 Hour	6 Hour	Type	Limit
Vicrobiological Parameters**							
Escherichia Coli	ct/100 mL	0	0	0	0	MAC	0
Faecal Coliforms	ct/100 mL	0	0	0	0	-	-
Faecal Strep.	ct/100 mL	0	0	0	0	-	-
HPC	ct/1 mL	0	0	0	1	-	-
Total Coliforms	ct/100 mL	0	0	0	0	MAC	0
hemical Parameters (Health Related)	•					•	
Fluoride	mg/L	0.36	0.39	0.32	0.32	MAC	2.4
Nitrite	mg/L	<0.10	<0.10	<0.10	<0.10	MAC	1
Nitrate	mg/L	<0.10	<0.10	<0.10	<0.10	MAC	10
hemical Parameters with Aesthetic Objectiv	es/ Operational G	iuidelines		•			•
Alkalinity	mg/L	242	243	227	226	OG	500
Chloride	mg/L	7	8	7	7	AO	250
Colour	TCU	2	<2	3	3	AO	5
DOC	mg/L	1.7	1.5	2	2.1	AO	5
Hydrogen Sulfide	mg/L	0.01	< 0.01	0.01	< 0.01	AO	0.05
pH		8.13	8.13	8.11	8.14	AO	6.5-8.5
Sulphate	mg/L	34	33	24	24	AO	500
Hardness	mg/L	232	211	222	229	OG	100
Sodium	mg/L	22	25	6	7	AO	20(200)
Iron	mg/L	0.86	0.47	0.17	0.18	AO	0.3
Manganese	mg/L	0.02	0.02	0.01	0.01	AO	0.05
TDS	mg/L	343	343	310	309	AO	500
Turbidity (laboratory)	NTU	12	4.6	1	1	AO/MAC	5/1
Turbidity (field)	NTU	9.15	0.92	0.09	0.06	AO/MAC	5/1

** Free Chlorine residuals verified to be non-detectable prior to collection of water samples

Table 5: Summary of Health and Aesthetic/Operational Parameters for the Oxford Formation Water Supply Aquifer (TW1 and TW6)

SUMMARY OF GENERAL CHEMISTRY PARAMETERS FOR THE OXFORD FORMATION AS DEFINED BY THE RAW WATER										
QUALITY OBTAINED FROM TW1 AND TW6										
Denementer	1 In the	T۱	W1	T۱	V6					
Parameter	Units	3 Hour	6 Hour	3 Hour	6 Hour					
General Parameters										
Conductivity	uS/cm	527	527	477	476					
N-NH3 (Ammonia)	mg/L	0.1	0.09	0.15	0.15					
Phenols	mg/L	< 0.001	< 0.001	<0.001	< 0.001					
Tannin & Lignin	mg/L	0.2	0.2	0.2	0.2					
Total Kjeldahl Nitrogen	mg/L	0.15	0.15	n/a	n/a					
Ion Balance	Unitless	0.99	0.94	0.9	0.95					
Calcium	mg/L	50	45	46	47					
Magnesium	mg/L	26	24	26	27					
Potassium	mg/L	5	4	3	3					

Table 6: Summary of the General Chemistry Parameters for the Oxford Formation as defined by the Raw Water Quality obtained from TW1 and TW6.



Combined Oxford/March Formation

Table 7 and Table 8, presented in this section, summarize the overall laboratory geochemistry of the raw water resulting from the mixing of the upper Oxford Formation and the lower March Formation water supply aquifers located beneath the subject property. The water quality of this aquifer is presented based on the analysis of raw water recovered from TW2, TW4, TW5, and TW8. TW7, in which the water quality was suspected to be impacted by a short-circuiting of overburden groundwater into the water well through the base of the casing (refer to Section 2.3), was not included in the evaluation of the water quality from the Oxford/March Formation. The water quality summary for TW7 appears in Tables 11 and 12 and is included to demonstrate the degree of impact of the overburden groundwater on the combined water quality from the bedrock aquifers.

In addition to the reported water quality analysis for these wells, TW8 was sampled for heavy metals and select herbicides/pesticides during the 24th hour of the test. The results are provided for reference purposes in Appendix 3 for the TW8 data set. Analysis of the chemical analysis reveals an absence of both heavy metals and herbicides/pesticides in the combined Oxford/March Formation aquifer system.

SUMMARY OF HEALTH AND AESTHETIC	/ OPERATIONA	L PARAMETER	S FOR THE COM	MBINED OXFOR	D FORMATION	AND MARCH	FORMATION W	ATER SUPPLY A	QUIFERS AS DI	EFINED BY TW2	TW4, TW5, AM	ID TW8
		Т	W2	Т	W4	T	W5		TW8		0	OWS
Parameter	Units	3 Hour	6 Hour	3 Hour	6 Hour	3 Hour	6 Hour	12 Hour	24 Hour	12h Repump	Туре	Limit
Microbiological Parameters												
Escherichia Coli	ct/100 mL	0	0	0	0	0	0	0	0	0	MAC	0
Faecal Coliforms	ct/100 mL	0	0	0	0	0	0	0	0	0	-	
Faecal Strep.	ct/100 mL	0	0	0	0	0	0	0	0	0	-	-
HPC	ct/1 mL	>500	185	82	58/0	17	21	88	85	0	-	
Total Coliforms	ct/100 mL	0	0	OG	OG/0	0	0	2	1	0	MAC	0
Chemical Parameters (Health Related)												
Fluoride	mg/L	0.43	0.42	0.34	0.33	0.71	0.71	0.36	0.48	0.36	MAC	2.4
Nitrite	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	MAC	1
Nitrate	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	MAC	10
Chemical Parameters with Aesthetic Objectives/	Operational G	uidelines										
Alkalinity	mg/L	193	199	195	195	178	178	294	286	207	OG	500
Chloride	mg/L	6	6	45	44	4	4	13	13	59	AO	250
Colour	TCU	<2	2	<2	2	2	3	13	12	2	AO	5
DOC	mg/L	2.8	2.4	1.4	1.5	1.7	1.7	5	4.9	1.7	AO	5
Hydrogen Sulfide	mg/L	0.02	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	AO	0.05
рН		8.29	8.33	8.18	8.21	8.19	8.2	8.16	8.18	8.07	AO	6.5-8.5
Sulphate	mg/L	20	20	34	36	15	15	76	70	47	AO	500
Hardness	mg/L	204	213	217	215	121	127	248	233	254	OG	100
Sodium	mg/L	12	11	36	34	31	31	51	46	40	AO	20(200)
Iron	mg/L	1.47	0.33	0.26	0.12	0.05	0.05	0.41	0.41	0.21	AO	0.3
Manganese	mg/L	0.03	0.02	0.04	0.02	<0.01	<0.01	0.03	0.03	0.02	AO	0.05
TDS	mg/L	269	272	376	375	244	244	462	450	433	AO	500
Turbidity (laboratory)	NTU	23.4	15.6	0.6	0.4	0.3	0.6	0.9	0.7	1.1	AO/MAC	5/1
Turbidity (field)	NTU	17.7	0.94	0	0	0.09	0.06	0.1	0	0	AO/MAC	5/1

Table 7: Summary of Health and Aesthetic / Operational Parameters for the combined Oxford Formation and March Formation Water Supply Aquifers as defined by TW2, TW4, TW5, and TW8.



SUMMARY OF THE GENERAL CHEMISTRY PARAMETERS FOR THE COMBINED OXFORD FORMATION AND MARCH FORMATION WATER SUPPLY AQUIFERS DEFINED BY TW2, TW4, TW5, AND TW8											
		٦V	V2	T۱	V4	T\	N5	TW8			
Parameter	Units	3 Hour	6 Hour	3 Hour	6 Hour	3 Hour	6 Hour	12 Hour	24 Hour	12H Repump	
General Parameters											
Conductivity	uS/cm	414	419	527	527	376	376	711	693	666	
N-NH3 (Ammonia)	mg/L	0.23	0.23	0.1	0.09	0.14	0.14	0.21	0.21	0.07	
Phenols	mg/L	< 0.001	<0.001	<0.001	< 0.001	< 0.001	<0.001	<0.001	<0.001	<0.001	
Tannin & Lignin	mg/L	0.2	0.1	0.2	0.2	0.1	0.1	0.2	0.2	<0.01	
Total Kjeldahl Nitrogen	mg/L	0.29	0.2	0.15	0.15	0.17	0.17	0.53	0.73	<0.10	
Ion Balance	Unitless	1.06	1.06	0.99	0.94	0.96	1	0.94	0.9	1.02	
Calcium	mg/L	37	39	50	45	22	23	50	47	54	
Magnesium	mg/L	27	28	26	24	16	17	30	28	29	
Potassium	mg/L	5	4	5	4	4	4	6	5	5	

Table 8: Summary of the General Chemistry Parameters for the combined Oxford Formation and March Formation Water Supply Aquifers as defined by TW2, TW4, TW5, and TW8

Combined Oxford/March/Nepean Formations

Table 9 and Table 10, presented in this section, summarize the overall laboratory groundwater geochemistry of the raw water resulting from the mixing of the upper Oxford Formation, the March Formation and the lower Nepean Formation water supply aquifers. The water quality of this aquifer is presented based on the analysis of raw water recovered from TW3 and TW9.

SUMMARY OF HEALTH AND AESTHETIC/	OPERATIONAL PARAMETI	ERS FOR THE COMBI	INED OXFORD FORM TW3 and 1	MATION, MARCH FOF	RMATION, AND NEP	EAN FORMATION WA	TER SUPPLY AQUIFE	RS AS DEFINED BY	
		τv	V3		TW9		OD	ODWS*	
Parameter	Units	3 Hour	6 Hour	3 Hour	6 Hour	6 Hour Repump	Type	Limit	
Microbiological Parameters**									
Escherichia Coli	ct/100 mL	0	0	0	0	0	MAC	0	
Faecal Coliforms	ct/100 mL	0	0	0	0	0	-	-	
Faecal Strep.	ct/100 mL	0	0	0	0	0	-	-	
HPC	ct/1 mL	0	0	107	46	6	-	-	
Total Coliforms	ct/100 mL	0	0	89	68	0	MAC	0	
Chemical Parameters (Health Related)								-	
Fluoride	mg/L	0.3	0.3	0.37	0.37	0.36	MAC	2.4	
Nitrite	mg/L	<0.10	< 0.10	<0.10	< 0.10	0	MAC	1	
Nitrate	mg/L	<0.10	< 0.10	< 0.10	< 0.10	0	MAC	10	
Chemical Parameters with Aesthetic Object	ives/ Operational Guideline	es						•	
Alkalinity	mg/L	212	212	201	204	202	OG	500	
Chloride	mg/L	44	44	56	50	59	AO	250	
Colour	TCU	2	<2	<2	<2	2	AO	5	
DOC	mg/L	1.6	1.5	1.5	1.7	1.4	AO	5	
Hydrogen Sulfide	mg/L	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	AO	0.05	
pH		7.97	8	8.04	8.12	8.02	AO	6.5-8.5	
Sulphate	mg/L	48	48	54	50	48	AO	500	
Hardness	mg/L	252	261	231	229	227	OG	100	
Sodium	mg/L	32	32	34	34	35	AO	20(200)	
Iron	mg/L	0.25	0.26	0.47	0.13	0.16	AO	0.3	
Manganese	mg/L	0.02	0.02	0.03	0.02	0.02	AO	0.05	
TDS	mg/L	401	402	430	427	417	AO	500	
Turbidity (laboratory)	NTU	2.3	1.9	13.1	2.5	1.2	AO/MAC	5/1	
Turbidity (field)	NTU	0.7	0.3	5.1	0	0	AO/MAC	5/1	

Table 9: Summary of the Health and Aesthetic / operational Parameters for the combined Oxford Formation, March Formation and Nepean Formation Water Supply Aquifers as defined by TW3 and TW9.



SUMMARY OF GENERAL CHEMISTRY PARAMETERS FOR THE COMBINED OXFORD FORMATION, MARCH FORMATION, AND NEPEAN FORMATION WATER SUPPLY AQUIFERS AS DEFINED BY TW3 and TW9

Deremeter	Unite	TV	V3	TW9				
Parameter	Units	3 Hour	6 Hour	3 Hour	6 Hour			
General Parameters								
Conductivity	uS/cm	527	527	477	476			
N-NH3 (Ammonia)	mg/L	0.1	0.09	0.15	0.15			
Phenols	mg/L	< 0.001	< 0.001	< 0.001	< 0.001			
Tannin & Lignin	mg/L	0.2	0.2	0.2	0.2			
Total Kjeldahl Nitrogen	mg/L	0.15	0.15	n/a	n/a			
Ion Balance	Unitless	0.99	0.94	0.9	0.95			
Calcium	mg/L	50	45	46	47			
Magnesium	mg/L	26	24	26	27			
Potassium	mg/L	5	4	3	3			

Table 10: Summary of the General Chemistry Parameters for the combined Oxford Formation, March Formation and Nepean Formation Water Supply Aquifers as defined by TW3 and TW9.

SUMMARY OF HEA	ALTH AND AESTHETIC	OPERATIONAL PAR	AMETERS FOR TW7	FOR BOTH UNSLEE	ED AND SLEEVED W	ELL CONSTRUCTION	CONDITIONS		
Parameter	Units	TW7 (NO SLEEVE)		TW7 (SLEEVED)			ODWS*		
		3 Hour	6 Hour	3 Hour	6 Hour	24 H Repump	Туре	Limit	
Microbiological Parameters**									
Escherichia Coli	ct/100 mL	0	0	0	0	0	MAC	0	
Faecal Coliforms	ct/100 mL	0	0	0	0	0	-	-	
Faecal Strep.	ct/100 mL	0	0	0	0	0	-	-	
HPC	ct/1 mL	0	0	1	3	5	-	-	
Total Coliforms	ct/100 mL	0	0	0	0	0	MAC	0	
Chemical Parameters (Health Related)									
Fluoride	mg/L	<0.10	<0.10	0.14	0.14	0.22	MAC	2.4	
Nitrite	mg/L	<0.10	<0.10	<0.10	<0.10	<0.10	MAC	1	
Nitrate	mg/L	<0.10	< 0.10	<0.10	<0.10	< 0.10	MAC	10	
Chemical Parameters with Aesthetic Objectives,	Chemical Parameters with Aesthetic Objectives/ Operational Guidelines								
Alkalinity	mg/L	398	399	382	384	337	OG	500	
Chloride	mg/L	20	20	16	16	15	AO	250	
Colour	TCU	26	26	19	21	18	AO	5	
DOC	mg/L	14.8	13.2	10.8	12.4	7.8	AO	5	
Hydrogen Sulfide	mg/L	0.01	0.01	< 0.01	< 0.01	< 0.01	AO	0.05	
pH		7.95	7.95	7.96	7.97	7.85	AO	6.5-8.5	
Sulphate	mg/L	202	200	122	130	112	AO	500	
Hardness	mg/L	635	649	482	484	372	OG	100	
Sodium	mg/L	13	13	14	15	27	AO	20(200)	
Iron	mg/L	4.78	4.73	3.39	3.33	1.7	AO	0.3	
Manganese	mg/L	0.3	0.3	0.2	0.2	0.1	AO	0.05	
TDS	mg/L	708	708	610	612	534	AO	500	
Turbidity (laboratory)	NTU	26.5	25.6	21	19	7	AO/MAC	5/1	
Turbidity (field)	NTU	N/A	5.2	3.33	1.49	0	AO/MAC	5/1	
* Ontario Drinking Water Standards identifies th ** Free Chlorine residuals verified to be non-det	ne following types of p tectable prior to collec	arameters: MAC - M tion of water sample	aximum Allowable (es	oncentration; AO - A	Aesthetic Objective; C	IG - Operational Guid	eline		

Table 11: Summary of Health and Aesthetic / Operational Parameters for TW7 for both Unsleeved and Sleeved Well Construction Conditions

SUMMARY OF GENERAL CHEMISTRY PARAMETERS FOR TW7 FOR BOTH UNSLEEVED AND SLEEVED WELL CONSTRUCTION CONDITIONS								
Parameter	Units	TW7 (NC) SLEEVE)	TW7 (SLEEVED)				
		3 Hour	6 Hour	3 Hour	6 Hour	24 H Repump		
General Parameters								
Conductivity	uS/cm	1090	1090	938	941	821		
N-NH3 (Ammonia)	mg/L	0.77	0.76	0.65	0.65	0.54		
Phenols	mg/L	< 0.001	<0.001	< 0.001	< 0.001	< 0.001		
Tannin & Lignin	mg/L	1	1.1	0.8	0.8	0.5		
Total Kjeldahl Nitrogen	mg/L	1.29	1.23	0.72	0.64	0.56		
Ion Balance	Unitless	1.05	1.07	0.97	0.96	0.92		
Calcium	mg/L	175	179	127	128	93		
Magnesium	mg/L	48	49	40	40	34		
Potassium	mg/L	2	2	2	2	3		

Table 12: Summary of General Chemistry Parameters for TW7 for both Unsleeved and Sleeved Well Construction Conditions



7.3. 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 within 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 suggests the utilization of the number of bedrooms plus one, to determine the minimum number of people per house. As the proposed development will likely contain four-bedroom single family homes, using the Procedure D-5-5 methodology, the number of persons would be five (5) and the total peak demand rate is calculated to be 18.75 L/min. This estimated total peak demand is well below the well yields demonstrated for the preferred water supply aquifer.

Analysis of Table 4 in Section 7.1, 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 75 % 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. Long term offsite impacts on wells intercepting the March Formation are not anticipated, considering the drawdown experienced in TW8 from the 24 hour pumping test, the spacing of the wells on the site, and the intermittent nature of the water use.

Water Quality

Oxford Formation

A review of the water quality analysis data from Table 5 and Table 6, 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).

The well head water quality monitoring, carried out on each of the two (2) test wells during the constant rate pumping test, indicated that the raw water had generally stabilized within three (3) to four (4) hours following the commencement of pumping.



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

Sodium (Na) concentrations in TW1 were noted to be present above a concentration of 20 mg/L (22 mg/L to 25 mg/L reported). The sodium concentrations do vary between the two (2) test wells, with TW6 reporting lower concentrations (6 mg/L to 7 mg/L). This may be a result of the active use of TW6 as a water supply well for a neighbouring residence and may indicate that the sodium concentrations within this formation may fall with continued well development.

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.

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. TW1 and TW6 had 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 MECP in 1995.

Iron (Fe), an aesthetic water quality parameter, has an aesthetic objective set at 0.30 mg/L. This objective is set by appearance effects. Excessive iron concentrations in drinking water may impart a brownish colour to laundered goods and plumbing fixtures. The colour of the water may also be affected by excessive iron concentrations and the raw water can produce a bitter, astringent taste which may affect beverages.

Combined Oxford and March Formations

Analysis of Table 7 and Table 8, which reflect the general groundwater geochemistry associated with the combined Oxford Formation and March Formation water supply aquifers, reveals that the raw water meets all of the critical health related parameters of the Ontario Drinking Water Quality Standards (ODWS).

With respect to aesthetic water quality parameters, the raw water originating from this combined aquifer system shows similarly elevated concentrations of sodium, hardness and iron as was noted in the water quality summary for the Oxford Formation water supply aquifer, above.



It should be noted that, with respect to TW8, the 24 hour pumping test resulted in significant reductions to the iron and colour concentrations. Due to its proximity to TW7, which allowed overburden water into the combined aquifer system, it was necessary to pump for an additional period of time in order to remove the remaining aesthetic parameter exceedances by stabilizing the pH within the raw water. The stabilized pH, as noted in Table 7, is approaching the range of values summarized in Table 9. Table 9 reflects the water quality from the Oxford, March and Nepean Formations, however most of the influence on the water quality from those wells is believed to be from the March and Nepean Formations.

Turbidity was elevated in TW2 during the original pumping tests. Similarly, iron was also elevated. Additional well development through the pumping of future wells at a low flow rate, intended on drawing water from the formation(s) in a more laminar fashion, will reduce the turbidity to the desired values of less than 5 NTU. This is evidenced by the 2010 pumping tests carried out on TW4, TW8 and TW9.

Combined Oxford, March and Nepean Formation

The summarized raw water quality for TW3 and TW9, the wells which were confirmed to penetrate into the Nepean Formation, appears in Table 9 and Table 10. Analysis of the tabulated data, which reflect the general groundwater geochemistry associated with the combined Oxford Formation, March Formation, and Nepean Formation water supply aquifers, reveals that the raw water meets all of the critical health related parameters of the Ontario Drinking Water Quality Standards (ODWS).

With respect to aesthetic water quality parameters, the raw water originating from this combined aquifer system shows similarly elevated concentrations of sodium, hardness and, to a much lesser extent, iron, as was noted in the water quality summary for the Oxford Formation and Combined Oxford and March Formation aquifer systems, above. The noted iron concentrations, with the exception of the initial three (3) hour concentration measured for TW9, all fell below the 0.30 mg/L threshold. Additional discussions on this phenomenon are discussed in the water conditioning considerations in Section 8.8 of this report.

It should be noted that the initial development of future water wells will likely require a period of well development of a similar duration as the six (6) hour pumping tests carried out on these test wells in order to reduce initial turbidity levels and iron concentrations which will likely be elevated. This is evidenced by all of the pumping tests carried out on the test wells at this site.



8.0 Development Recommendations

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

8.1. Site Development

Based on the results of our study, this site is considered to be suitable for the development of more than 66 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.

8.2. 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. PH0482-7) 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 510 m², assuming a four (4) bedroom, two-storey 300 m² home, and including a garage of 70 m² with a driveway area of 140 m² (7 m wide by 20 m long (on average)). This impervious area is considered to be moderately conservative, but is representative of the larger homes being constructed elsewhere in the Greely area. Each residence 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. PH0482-7) 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.)

8.3. Predictive Impact Assessment

Hydrogeological Sensitivity

In accordance with Section 5.0 of the MECP 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.

Hydrogeological Sensitivity as defined by the City of Ottawa refers to bedrock within 2.0 m of the ground surface. Available drift thickness mapping shows an onsite drift thickness between 5 to 15 m. Bedrock was not encountered onsite in any of the test pits, with the exception of TP 5 which notes a inferred bedrock surface at 1.3 m bgs. As TP12-10 was completed adjacent to TP 5, and extended to 3.2 m bgs, it is inferred that the refusal encountered in TP 5 was refusal on till. Furthermore, the soil description on the soil profile for TP12-10 notes sand with boulders, which is the likely cause of refusal. TW4 was also completed near TP5, and notes an overburden thickness of 4.0 m on the WWR. This is further corroborated by the WWR's for the onsite Test Wells which demonstrate that bedrock was encountered between 3.7 and 17.7 m bgs on the subject site.

As such, the subject site is not considered to be hydrogeologically sensitive based on the overburden thickness being greater than 2.0 m across the subject site.



Isolation of Supply Aquifer

As established in Section 6.0 of this report, the confining pressure and aquifer analyses suggest that the preferred water supply aquifer system, as defined by TW9, exhibits an aquifer response indicative of a confined aquifer present between two (2) aquitards. However, the scope of this Hydrogeological Study did not include a detailed analysis of the preferred aquifer system and focussed on demonstrating hydraulic isolation. As such, the information presented in this section adds a degree of security to the natural protection of the preferred aquifer system and only infers the system is hydraulically isolated, but does not corroborate this.

Predictive Impact Assessment for Nitrate

Nitrate is considered to be a critical parameter of concern when assessing impacts to groundwater quality downgradient of an onsite sewage system. MECP Procedure D-5-4 applies for the proposed development. For the purpose of this guideline, the Ontario Drinking Water Objective of 10 mg/L of nitrate is the maximum allowable concentration detectable in the groundwater prior to the property line.

Guideline D-5-4 indicates that where the average lot size is 1.0 ha or larger, a detailed assessment is typically not required since it is considered be a low-risk development and that adequate surplus water is available in the soils to appropriately dilute the nitrate output on the property. The proposed severed lots have an average size of less than 1.0 ha and, as such, a detailed impact assessment has been completed.

In order to demonstrate that private services would adequately support the proposed residential subdivision, a predictive nitrate impact assessment for the subject site is shown below. The values shown in the Predictive Nitrate Impact Assessment attached to this report are summarized below:

Site area

- 62.6 ha
- Impervious area % 20 % (Although impervious area calculations result in an area of 9% (based on a 300 m2 home, a garage of 70 m2, a driveway area of 140 m2 and a subdivision road length of 22,000 m²) the Stormwater Managements Design Brief completed by JFSA with Project Ref # P584-06 dated May 11, 2022 notes a impervious area of 20%. The impervious area of 20% was used to demonstrate that the NIA calculation would work for the subdivision using a conservative approach.)
- Daily sewage flow66,000 l/day(Based on Ontario Guideline D-5-4)(66 Lots)



Concentration of nitrate in effluent (Value based on typical effluent concentration) 40 mg/L

□ Surplus Water 361 mm/year (The surplus water value was estimated based on Environment Canada Climate Office values with a soil type comprised of clay loam (Urban Lawn/Shallow Rooted Crops) and anthropogenic sources, which can be found attached. Although there is a significant amount of sand across the subject site, the value for clay loam was used in order to be conservative)

Combined infiltration factor based on:	0.45
 Topography infiltration factor 	0.15
 Soil texture infiltration factor 	0.20
Cover infiltration factor	0.10
	 Combined infiltration factor based on: Topography infiltration factor Soil texture infiltration factor Cover infiltration factor

The topography infiltration factor of 0.15 is based upon a average of rolling land with a average slope of 2.8 to 2.8 m/km and hilly land with an average slope of 28 m to 47 m/km for the proposed development.

The soil texture infiltration factor was based on a medium combination of clay and loam with a value of 0.2 which is a reasonable generalization based upon the geotechnical field investigation, available geological mapping and surrounding WWR's. Although there is a significant amount of sand across the subject site, the value for clay loam was used in order to be conservative.

The vegetative cover infiltration factor was calculated as 0.1 based the value for cultivated land (0.1).

Based on Ontario Guideline D-5-4 Individual On-Site Sewage Systems: Water Quality Impact Risk Assessment, the predictive nitrate impact assessment reviewed the potential impacts using a value of 1,000 L/day per lot. The calculation for a standard septic system results in a predicted nitrate concentration of 9.14 mg/L nitrate concentration for the subject sites, using a value of 40 mg/L nitrate concentration within the effluent.

Background nitrate concentrations of 0.16 mg/L from the background nitrogen family results were detected in the overburden groundwater across the subject site, and as such, were included in the Nitrate Impact Assessment Calculation.

Based on the results of the predicted nitrate impact assessment, it is our opinion that the proposed residential subdivision can adequately support the proposed single family dwellings without having an adverse impact on the underlying bedrock aquifer.



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 roadside ditches.

With respect to the utilization of stormwater runoff in the calculations, the drainage at the site is proposed to consist of a series of grassed ditches and subdrains. As such, most of the stormwater runoff can be justified to be utilized for the purposes of the predictive impact assessment as the distance of travel across the individual lots and into the drainage network is sufficiently long. In order to simplify the predictive impact assessment, however, stormwater runoff has not been included in the available dilution water calculations. Attention should be made to the discussion on best management practices for promoting the infiltration of surface water into the shallow overburden and for the reuse of the greywater, etc., to reduce long term demands of the preferred water supply aquifer.

8.4. 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 4 bedroom residence with a finished floor area of 300 m² 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 (PH0482-7) 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. PH0482-7 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. PH0482-7) 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.

With respect to the presence of peat and a perched water table located within the southeastern quadrant of the site, specialized construction will be required. In order to prevent uneven settlement of both the building foundations and sewage systems, the peat and all other organic materials will be required to be excavated within the footprint of the building and within the limits of the distribution piping for the leaching beds proposed in this quadrant. It is also prudent for the peat to be removed from the mantle area(s) also, to minimize overall differential settlement within/near the leaching bed area.

The leaching beds will be fully raised within the southeast quadrant also. As such, it will be required to place imported sand fill into the excavation resulting from the excavation and removal of the peat within the specified limits of the leaching bed areas.

8.5. Long Term Safe Yield Calculation

The twenty-year safe well yield calculation is used to estimate the long-term safe pumping rate for a well and can be calculated using the following equation (Farvolden 1959):

 $Q_{20} = 0.683^{*}T^{*}H_{A}^{*}S_{f}$

Where:

- **Q**₂₀ = 20 year safe pumping rate for the well (m^3/d)
- \Box T = Transmissivity (m²/day)
- $\Box H_A = Available Head (m)$
- $\Box S_{f} = Safety Factor = 0.7 (no units)$



The most conservative transmissivity value from the pumping tests completed on the onsite test wells was used to complete this calculation (i.e T = $2.4 \text{ m}^2/\text{day}$). The safe yield was calculated to be 54.5 m³/day or 37.8 L/min constantly during a day. This value is more than twice the anticipated peak draw of 18.75 L/min that would be expected for 2 hours per day or more than 18 times the average water demand per day (3,000 L/day).

8.6. 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 the 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 essence of the predictive model assimilates a total of 66 individual pumping wells and simulates the drawdown from a single centrally located imaginary pumping well set at a pumping rate of 3,000 L/day/lot (i.e. 198,000 L/day). Figure A4-1, located in Appendix 4, summarizes the prediction of drawdown versus time for a constant pumping rate of 198,000 L/day.

The recovery data was utilized in the Theis & Jacob Recovery analysis which specifies a transmissivity of the order of 13.3 m²/day. The value for storativity (6.8×10^{-4}) was calculated based on the Cooper & Jacob's Time-Drawdown analysis of the observation well data for TW8. The chosen transmissivity value is considered to be conservative in that it reflects a lower transmissivity value for the preferred water supply aquifer. The storativity value is considered to be consistent and representative of a confined limestone aquifer.

It is prudent to note that this model is considered to be very conservative as the governing assumption of a single well pumping at the combined rates of the individuals, does not consider the separation distances of the individual wells. As such, the model will inherently over estimate the drawdown at both the location of pumping, and in the vicinity of the highest density of the proposed development. As the distance from the centre of the development increases, the model should provide a better prediction of offsite well interference.



In the long-term model, the maximum anticipated drawdown predicted at the imaginary pumping well, based on 66 lots continuously pumping for 9,125 days, or approximately 25 years, is of the order of 10.42 m. As the available drawdown in the future well in the site are upwards of 48 m, this corresponds to a reduction in available drawdown of approximately 22 %. Considering the very conservative nature of the model, this predicted loss of available storage in wells near the center of the proposed development is considered to be satisfactory.

Offsite Potential Well Interference

Figure A4-2, in Appendix 4, presents a prediction of drawdown versus time for an imaginary production well pumping at a constant rate of 50,000 L/day. The nearest offsite wells are located approximately 250 m away from the centre of the site, where the imaginary well is located. A conservative radius of impact of 100 m was used to support this assessment. Based on this radial distance, the closest offsite wells would experience a drawdown of 0.48 m at 1 day of pumping and approximately 3.2 m at 9.125 days (25 years) of continuous pumping. As the available drawdown in the offsite wells, located in the immediate vicinity of the site, are of the order of 48 m, based on the published water well records, this corresponds to a loss of available storage of approximately 5% at 365 days (1 year) and 7% after 9,125 days (25 years) of pumping. Based on the available water well records, the Sleepy Cedars Campground, which has a static water level of approximately 5 m below top of casing and a depth of approximately 53 m, the long term pumping would reduce the static water level from 5 to approximately 8 m after 9,125 days (25 years) of continuous pumping. This would leave 45 m of available drawdown in that well. The same analysis can be extended to the other neighbouring wells located to the immediate north and east of the site which intercept and draw water from the combined Oxford, March, and Nepean Formations. The available well records suggest that the houses to the immediate east of the site, as evidenced by TW6 in the aquifer analysis program, are completed in the Upper Oxford Formation and are not expected to exhibit any well interference from the future wells at this site, if constructed in accordance with the recommendations for the well construction presented in Section 8.7 below.

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



8.7. 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 gpm 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 proposed well construction methodology should endeavor to extend the casing hole through the overburden and should be advanced a minimum of 18 to 24 m bgs or at least 6 m into competent bedrock. Based on a casing length of 24 m bgs, this should result in a casing penetration of sufficient depth to ensure the casings are set into sound bedrock.

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.

With respect to the presence of peat in the southeast quadrant and it's impact on well construction, the thickness of the peat, as determined by the field investigation suggests the maximum thickness of the peat to be less than 3 m. As such, it is recommended that the peat be removed within a minimum of 3 m radius around the proposed location of the well, prior to constructing the well at the site. The peat can be replaced with uncontaminated imported fill, or select, site excavated, non-organic material.

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 chlorine should then be left for 24 hours and purged out of the well until it can be determined that a free chlorine residual of 0 mg/L is present.



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 form the casing.

With respect to the existing test wells, all of the wells completed on the site, with the exception of TW7 which was previously abandoned, are considered to be acceptable for reuse as future wells as they meet the intent of the well construction specifications presented above. The use of the existing wells for the future servicing of proposed lots, is subject to the finalized lot fabric and road alignment. Should any of the wells be ultimately located in a location which they will not be utilized for private servicing, they must be abandoned in strict conformity with Ontario regulation 903.

8.8. 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 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.

Additional well development should be undertaken upon completion of the construction of future water wells at this site. The wells should be subjected to a period of well development of at least six (6) hours at a rate of approximately 23 L/min (5 gpm) in order to stabilize the raw water within the aquifer system in the immediate vicinity of the constructed well. Water samples, for verification of raw water quality in anticipation of water conditioning, should not be collected until the pH measured at the wellhead does not vary by more than 20% during a 30-minute interval during pumping.



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.

8.9. Implementation of Best Management Practices

The surficial soils present throughout most of the site are conducive to the implementation of rainwater infiltration and retention technologies, including, but not limited, to infiltration trenches and shallow rear yard swales complete with subdrains.

Backwash water from water softeners is suitable for discharge into infiltration galleries located a minimum of 5 m from the leaching bed area and should be set on sufficient in situ or imported sand fill to be incorporated into proposed lot drainage patterns. Backwash water from a water softener, based on the anticipated regeneration cycle, can be directed to the sewage system, provided the sewage system components are sized and designed accordingly. As a minimum, the backwash cycle should be assumed to be once per day at a volume of upwards of 150 L. The septic tank, if conventional sewage treatment technologies are employed, should be fitted with a high quality plate/tube style effluent filter in order to minimize suspended solids migration. With respect to the proposed lots, it will be advantageous to consider the selection of advanced wastewater treatment systems in place of the more traditional fill based Class 4 sewage systems. The reduction in height and area will have a beneficial impact on preserving existing forested areas.

With respect to residential water use, it is recommended that individual homeowners utilize water conserving plumbing fixtures and follow lawn irrigation strategies created by the City of Ottawa. Irrigation systems for lawn irrigation are discouraged from use in this development.

8.10. Subdivision Phasing Plan

The City of Ottawa's Official Plan related to phased subdivision development requires the submission and acceptance of a Servicing Review Study for each phase of rural development. The intent of this study is to review the sewage system



and well construction being carried out in the first/previous phase(s) in order to evaluate if, and how, the subsequent phases should proceed.

The lot fabric of the proposed subdivision consists of a total of 40 lots in Phase 1, and the balance of the lots (26) reserved for Phase 2. The proposed layout for lots in Phase 1 is such that most of the lots are situated along the upgradient end of the southerly flow of overburden groundwater beneath the site. As such, the following methodology should be employed to complete the Servicing Review Study.

- □ The existing test wells in both Phase 1 and Phase 2 should be purged and sampled for a comprehensive suite of groundwater parameters consistent with the original Hydrogeological Study report. This update water quality should be compared against the original baseline data to determine the presence/extent of surficial impacts, if any, and to confirm the baseline water quality as it related to recommendations for water conditioning, etc.
- The water well records for the constructed wells should be reviewed in order to confirm that the wells are intercepting the preferred water supply aquifer, if the wells are intercepting the preferred water supply aquifer the sampling regime should focus on the health-related parameters within the newly constructed homes with a representative cross section of the wells being sampled for the comprehensive suite of groundwater parameters carried out for the test wells. If the wells constructed in Phase 1 do not intercept the preferred water supply aquifer, these wells should be sampled for the comprehensive suite of groundwater parameters included in the original baseline water quality plan for the Hydrogeological Study.
- Collect representative samples of the overburden groundwater located downgradient of the sewage system installations at the upgradient limits of Phase1/Phase 2 development line, and at the downgradient property limits beyond Phase 2. The water samples should be analysed for the full nitrogen species, sodium, chloride, total coliforms, faecal coliforms, and E.coli.
- The sewage system design, construction and operation should be reviewed for each of the systems installed and approved with the Ottawa Septic System Office.

It has been generally accepted by the City of Ottawa, historically, that the Servicing Review study should be initiated when a minimum of 20% of the lots in each phase (i.e 8 lots of 40 possible lots) have been occupied for a minimum of three (3) seasons. This condition, in our opinion, should be considered to be the minimum trigger point to initiate the Servicing Review Study. Notwithstanding the above, the City of Ottawa, in March 2011, approved a series of standard draft conditions for the subdivision development. In this approved conditions, the City of Ottawa has provided clear direction regarding the trigger point at which a Servicing Review

Study should be initiated for a subdivision utilizing private services. Specifically, the draft conditions read as follows:

"The registration of this subdivision shall be phased. Each phase of registration is to contain not more than 40 lots. Prior to the registration of each phase other than the first phase, the Owner shall submit a performance review of the operation of wells and private sewage disposal systems in the previous phase(s) of the development. Such review shall demonstrate that the previous phase(s) are operating satisfactorily. A Professional Engineer, with experience in hydrogeology, or a professional geoscientist shall prepare the performance review. The final number of lots required for analysis must be supported in the performance review, but in any case the performance review shall only be prepared and submitted for review when a minimum of 50% of the lots in the previous phase have been built and occupied for not less than three seasons, and, when requesting the registration of any phase beyond the second phase, a representative number of lots, to the satisfaction of the General Manger, Planning and growth Management, in the older phases must also be analysed. Further, the Owner agrees that prior to the registration of each phase, lots in that phase or any subsequent phase will not be offered for sale."

Given that this above noted draft condition is endorsed by City Council, it appears prudent to start the Phase 1 review at the stage where 20 lots have been built in Phase 1 and occupied for a minimum of three (3) seasons. It remains that the recommended minimum number of lots that should be used in the analysis be set at no less than eight (8), however, the location of the lots used in the study should be reflective of site conditions and their logical downgradient impacts on Phase 2 development. Obviously, in the even that impacts are measured, or discrepancies noted, for the cross section of lots used in the study, the scope of the study should be increased to provide the necessary information.



9.0 Conclusions

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

- 1. The subject property is situated in an area noted to be generally flat with good to poor surficial drainage patterns. The site can be divided into two (2) distinct drainage areas resulting from a topographical high point located along the southwestern quadrant and extending several hundred metres northward.
- 2. The surficial soils coverage on the subject property are conducive to the subsurface dispersion of sewage system effluent and are not considered to be hydrogeologically sensitive.
- 3. Surrounding land uses are consistent with the intended residential use for this property. Offsite impacts on the subject property have been assessed and are considered to be negligible.
- 4. The surficial geology of the subject property generally consists of a mixture of silty clayey sand to sandy till deposits overlying bedrock, at depth, across the subject area. The soils types and areal delineation are consistent with available soils mapping with some noted exceptions.
- 5. The bedrock geology directly beneath the site consists of limestone of the Oxford Formation. The Oxford Formation is underlain by the March Formation, followed by the Nepean Formation. The preferred water supply aquifers are located within the Oxford and March Formations, creating a combined aquifer system for future water wells.
- 6. The construction of the test wells on the subject property appear to have intercepted at least two (2) individual water supply aquifers of suitable quantity: the Oxford Formation and the March Formation. The quality of the March Formation water supply aquifer is such that it is the preferred aquifer for future wells. An additional water supply aquifer is located within the shallowest portion of the Nepean Formation.
- 7. The most consistent zones of aquifer intercept within the combined Oxford and March Formation aquifer system as reported in the test wells and neighbouring wells is between 28 m and 56 m bgs.
- 8. 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 and free flowing artesian conditions are not anticipated.
- 9. Water quality of the Oxford, March and Nepean Formations is considered to be sufficient for domestic use. Domestic water conditioning equipment may be utilized to reduce hardness and iron levels for aesthetic requirements only.



- 10. 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.
- 11. Sewage systems, containing fully raised leaching beds, are easily accommodated on each of the proposed lots. The proposed development may be serviced using sewage systems which are either in-ground or partially raised. Site specific soil morphology analysis, carried out by a qualified geotechnical engineer, should be completed for each individual sewage system design.
- 12. The subject property is suitable for development as a residential subdivision at the proposed density. Impacts to the neighbouring low density residential development area are expected to be minimal.

10.0 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. The raw water found in the preferred water supply aquifer system is considered to be hard to very hard and may contain iron levels which may result in the visible iron staining to plumbing fixtures and clothing. A residential grade water softener is recommended where these aesthetic parameters are deemed unsuitable to the future homeowner. If the use of water softeners are considered by the future homeowner, 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. In all cases, the raw water should be sampled and submitted for comprehensive chemical analysis for the same parameters tested in this study only after the well and distribution system have been properly flushed and the well has been in use for an extended period.
- 3. It is recommended, in keeping with the intent of the Osgoode Bylaw, that the casing hole extend a minimum of 6 m into the underlying bedrock to ensure the casing extends into sound bedrock. Given the test well construction methodology employed on the site, a casing length of between 18 m and 24 m will be required in order to achieve the necessary bedrock penetration. 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 28 m to 56 m measured below the ground surface. Wells should be constructed with a rotary air drilling rig.
- 5. The recommended minimum range of well yields is set at 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 or Professional Geoscientist of Ontario. Furthermore, it is recommended that a qualified Professional Engineer or Professional Geoscientist 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 wells should be subjected to a period of well development of at least six (6) hours at a rate of approximately 23 L/min (5 gpm) in order to stabilize the raw water within the aquifer system in the immediate vicinity of the constructed well. Water samples, for verification of raw water quality in anticipation of water conditioning, should not be collected until the pH measured at the wellhead does not vary by more than 20% during a 30 minute interval during pumping.
- 8. All future water wells should be completed such that the top of well casing is a minimum of 400 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. It is recommended that the homeowner consult the comprehensive reference document entitled, "Water Supply Wells Requirements and Best Management Practices (December 2009)", prepared by the Ontario Ministry of the Environment and familiarize themselves on their legal obligations to maintain and protect their well.
- 9. Individual future well owner(s) should carry out semi annual verification of potability of the raw water supply. Moreover, the well owner should ensure that they maintain the wellhead and immediate area in accordance with the requirements of Ontario Regulation 903.
- 10. Irrigation systems for cosmetic watering which utilize water from the preferred water supply aquifer are not recommended for use at this site.



11. The Servicing Review Study Report, required to be completed and approved prior to releasing Phase 2 of the development, cannot be initiated until at least 20 homes are built and occupied for three (3) seasons. The minimum number of lots used in the analysis for the Study should be set at eight (8).

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.

We trust that the current submission satisfies your immediate requirements.

Best Regards,

Paterson Group Inc.

Erik Ardley, P.Geo





Michael S. Killam, P.Eng

Ottawa Head Office 9 Auriga Drive Ottawa – Ontario Ottawa Laboratory 28 Concourse Gate Ottawa – Ontario List of Services Geotechnical Engineering & Environmental Engineering & Hydrogeology Materials Testing & Retaining Wall Design & Rural Development





APPENDIX 1

Soil Profile and Test Data Sheets

Symbols and Terms

Ottawa Head Office 9 Auriga Drive Ottawa – Ontario Ottawa Laboratory 28 Concourse Gate Ottawa – Ontario List of Services Geotechnical Engineering & Environmental Engineering & Hydrogeology Materials Testing & Retaining Wall Design & Rural Development



patersongroup	Consulting Engineers
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SOIL PROFILE & TEST DATA

FILE NO.

PH0482

Geotechnical Investigation 1934 Stagecoach Road Ottawa, Ontario

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

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Geotechnical Investigation 1934 Stagecoach Road Ottawa, Ontario

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

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Geotechnical Investigation 1934 Stagecoach Road Ottawa, Ontario

DATUM

SOIL DESCRIPTION EVAMPLE DEPTH IM EVAMPLE IM DEPTH IM EVAMPLE IM Pen. Resist. Blows/0.3m ISO mm Dia. Cone Pen. Resist. Blows/0.3m ISO mm Dia. Cone GROUND SURFACE 0.20 IV IV	BORINGS BY Backhoe		TP11										
End of Test Pit 1.50 (Water infiltration @ 0.5m	SOIL DESCRIPTION	PLOT		SAN	/IPLE	1	DEPTH	ELEV.	Pen. Re	esist. 50 mn	Blows/ n Dia. C	0.3m one	eter ction
GROUND SURFACE 0.20<		STRATA	ТҮРЕ	NUMBER	× ECOVERY	N VALUE	(111)	(111)	0 V	Vater	Conten	t %	Piezome
Grey coarse SAND Grey coarse SAND End of Test Pit (Water infiltration @ 0.5m depth) 20 40 60 80 100							0-	-	20	40	60 = = = = =	80	
	GROUND SURFACE TOPSOIL 0.20 Grey coarse SAND End of Test Pit (Water infiltration @ 0.5m depth)		G	13			- 0-			40	60	80	
Snear Strengtn (KPa)									20 Shea	40 r Stre	60 ngth (kl	80 1 Pa)	00

SOIL PROFILE & TEST DATA

FILE NO.

Geotechnical Investigation 1934 Stagecoach Road Ottawa, Ontario

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

DATUM

DEMARKO											PH048	32
REMARKS							~~		HOL	E NO.	TP12	
BORINGS BY BACKNOE				C	DATE	29 AUG	06				11 12	1
SOIL DESCRIPTION	PLOT		SAN		I	DEPTH (m)	ELEV.	Pen. Re 5	sist. 0 mn	Blov n Dia	vs/0.3m . Cone	neter Iction
	TRATA	ТҮРЕ	UMBER	cover,	VALUE			0 V	/ater	Cont	tent %	Piezom Constru
GROUND SURFACE	S.		Ž	RE	zō	0		20	40	60	80	
FILL: Silty sand and gravel with cobbles and topsoil, some asphalt and cement pieces		G	14			- 0- 1- 2-						······································
Grey coarse SAND												
End of Test Pit	0											-
(Water infiltration @ 2.3m depth)								20 Shea	40 S 5 fr	60 ength	80 (kPa)	100
								Shea	r Stre urbed	ength □ F	(KPa) Remoulded	

SOIL PROFILE & TEST DATA

▲ Undisturbed △ Remoulded

Geotechnical Investigation 1934 Stagecoach Road

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

28 Concourse Gate, Unit 1, Uttawa, UN	I KZE	/ / /			01	ttawa, Č	Ontario				
DATUM									FILE NO.	PH048	2
REMARKS									HOLE NO.	711040	· 6
BORINGS BY Backhoe		······	*****	D	ATE	29 AUG	06	1		1913	•
SOIL DESCRIPTION	PLOT		SAN	/IPLE	r	DEPTH	ELEV.	Pen. Re 5	sist. Blov 0 mm Dia	vs/0.3m . Cone	eter ction
	TRATA	ТҮРЕ	UMBER	× COVERY	VALUE ROD	£***7	(,	• V	Vater Cont	ent %	Piezom Constru
GROUND SURFACE	0		Z	RE	ZŌ			20	40 60	80	
FILL: Silty sand with gravel, cobbles and topsoil, some wood pieces						0-					
Grey coarse SAND						2					Į
End of Test Pit (Water infiltration @ 1.3m depth)						2-					
								20 Shea	40 60 r Strength	80 1 (kPa)	4 00

SOIL PROFILE & TEST DATA

FILE NO.

HOLE NO.

PH0482

Geotechnical Investigation 1934 Stagecoach Road Ottawa, Ontario

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

DATUM

REMARKS

BORINGS BY Hand Auger		DATE 26 SEP 06											Ю.	A	H	1	
SOIL DESCRIPTION	PLOT		SAMPLE			DEPTH (m)	ELEV. (m)	P	en. Ø	Re 5	sist 0 n	t. B nm I	lov Dia	vs/0 . Co).3m one	ו	leter Iction
	STRATA	ТҮРЕ	NUMBER	× ECOVER	NALUE				a	N	late	er C	ont	ent	%		Piezorr Constru
GROUND SURFACE				<u><u></u></u>	ZŬ	0-	-	L.,	20	0	40)	60	3	30 		
).20																
Brown SILTY SAND).40																
Stiff, grey SILTY CLAY to CLAYEY SLIT																	Ā
		-															
1	.35																
gravel	60																
End of Auger Hole								<u></u>					-				
Refusal on inferred glacial till @ 1.60m depth								*****									
(Water infiltration at 0.90m depth)									20	0	40		60	«	30	10	10
									Sh Ur	neai ndist	r St urbe	reng ed /	<mark>)th</mark> ∆ R	(kP	a) ulded		
	1			1				1	1			4	· · ·				

SOIL PROFILE & TEST DATA

Geotechnical Investigation 1934 Stagecoach Road Ottawa, Ontario

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

DATUM

REMARKS

FILE	NO.	

PH0482

HOLE NO. **AH 2** BORINGS BY Hand Auger DATE 26 SEP 06 SAMPLE PLOT Pen. Resist. Blows/0.3m Piezometer Construction DEPTH ELEV. SOIL DESCRIPTION • 50 mm Dia. Cone (m) (m) × RECOVERY N VALUE or ROD STRATA NUMBER ТҮРЕ O Water Content % **GROUND SURFACE** 20 40 60 80 0 TOPSOIL 0.60 ____ G 2 Stiff, grey-brown SANDY CLAY 1.00 1 Grey CLAYEY SILT, trace G 3 fine sand 1.25 _ _ _ _ _ _ Grey SILTY CLAY to **CLAYEY SILT**, trace fine sand Ā AH terminated in soft silty clay @ 1.60m doct clay @ 1.60m depth 20 40 60 80 100 Shear Strength (kPa) ▲ Undisturbed △ Remoulded

SOIL PROFILE & TEST DATA

100

20

40

Shear Strength (kPa) ▲ Undisturbed △ Remoulded

60

80

Geotechnical Investigation 1934 Stagecoach Road Ottawa, Ontario

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

DATUM

BORINGS	6 BY	Hand	Auge
			THE REAL PROPERTY OF THE PARTY

DATUM										FIL	ENC).	рнс	48	32
REMARKS												ю.		~	
BORINGS BY Hand Auger		T		<u> </u>	DATE	26 SEP (06	1					AH	3	T
SOIL DESCRIPTION	PLOT		SAN			DEPTH (m)	ELEV.	Pen	.Re	sist 0 m	:. Bl nm E	lows Dia. I	;/0.3r Cone	n	eter ction
	ATA	Ы	BER	VER	Rap		,		~ 14	1-4-			- 4 0/		szom
	STR	1	MNN	SECO.	ک م ا				2 VI 20		er Co	onte	nt %)	Co Bi
GROUND SURFACE				bits		0-	_		1	40		1			
TOPSOIL															
0.4	D							*******							

SANDY SILT to SANDY CLAY (medium density)															
1.00															
						1-	-								
Grey SILTY CLAY															
															5
1.8															≚
AH terminated in silty clay @ 1.80m depth															
(Water infiltration at 1.60m depth)															

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

FILE NO.

HOLE NO.

PH0482

Geotechnical Investigation 1934 Stagecoach Road Ottawa, Ontario

DATUM

BORINGS BY Hand Auger		1		[LE NO	' A	H 4				
SOIL DESCRIPTION	PLOT		SAN	/IPLE →		DEPTH (m)	ELEV. (m)	Pen. Re • 5	sist. 0 m	Blo m Di	ws/0 a. Co	.3m ne	neter iction
GROUND SUBFACE	STRATA	ТҮРЕ	NUMBER	XECOVER'	N VALUE			○ V 20	Vate 40	r Cor	ntent	%	Piezom Constru
TOPSOIL						0-							
Brown SILTY SAND													
SAND, some gravel													
						1 -	_						
Refusal on inferred Glacial Till													
								20 Shear ▲ Undist	40 Stre	ength ∆ I	א א ו (kPa Remou) 1) Ided	0

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

FILE NO.

PH0482

Geotechnical Investigation 1934 Stagecoach Road Ottawa, Ontario

DATUM

BORINGS BY Hand Auger				D	ATE	26 SEP (06		HOL	E NO.	A	H 5	
SOIL DESCRIPTION	PLOT		SAN	APLE ►		DEPTH (m)	ELEV. (m)	Pen. Re ● 5	sist. 0 mr	Blo [.] n Dia	ws/0 a. Co).3m one	neter uction
	IRATA	ГҮРЕ	JMBER	2 SOVER	VALUE			• •	/ater	Con	itent	%	biezon onstru
GROUND SURFACE	S		ž	RE	z p	0-	_	20	40	60) 8	30	40
TOPSOIL	0					Ŭ							
Grey SILTY CLAY													
SANDY SILT, trace clay (medium density)										· · · · · · · · · · · · · · · · · · ·			
1.0	0					1-	-						
РЕАТ 1.2	<u>معد</u> عدد معد 0												
Soft to stiff, grey SILTY CLAY													•
1.6Soft to stiff, grey SILTYCLAY to SANDY CLAY,trace fine sand1 8	0												Ţ
End of Auger Hole													
Auger hole terminated in silty clay to sand clay at 1.80m depth													
(Water infiltration at 1.60m depth)													
								20 Shear ▲ Undist	40 Stre	60 ength ∆ F	8 (kP a Remou	0 1 a) Ilded	100

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

SOIL PROFILE & TEST DATA

Geotechnical Investigation 1934 Stagecoach Road Ottawa, Ontario

DATUM

REMARKS

BORINGS BY Hand Auger				[DATE	26 SEP (06		НОЦ	E NO.	AH	6 ו	
SOIL DESCRIPTION	PLOT		SAN	MPLE		DEPTH	ELEV.	Pen. Re ● 5	sist. 0 mn	Blov n Dia	vs/0.3 . Con	}m e	eter ction
GROUND SURFACE	STRATA	ТҮРЕ	NUMBER	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	N VALUE	(,	(***)	○ V 20	Vater	Con	tent 9	%	Piezom
TOPSOIL 0.15				Euler		- 0-	aa						
Brown SILTY SAND													
DIOWIT DIETT DAND													
1.10						1-	-						
Stiff SILTY CLAY to CLAYEY SILT													
AH terminated in stiff silty clay to clayey silt @ 1.50m depth													
								20 Shear ▲ Undist	40 Strei urbed	60 ngth ∆ Re	80 (kPa) emoulde	 10 ed	ю

FILE NO. PH0482

HOLE NO.

SOIL PROFILE & TEST DATA

FILE NO.

HOLE NO.

PH0482

Geotechnical Investigation 1934 Stagecoach Road Ottawa, Ontario

28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7

DATUM

BORINGS	BY	Hanc	I Auger

BORINGS BY Hand Auger						DATE	26 SEP (06						: NO	· /	ΥH	7	
SOIL DESCRIPTION		PLOT		SAN	/IPLE		DEPTH (m)	ELEV. (m)	P	en (. R	esis 50 i	st. mm	Blo 1 Di	ws/ a. C	0.3n one	n	leter ction
		STRATA	ТҮРЕ	NUMBER	2 XECOVER	N VALUE or ROD				(Nat	ter	Cor	nten	t %	1	Piezom Constru
GROUND SURFACE							0-	-				-4						
TOPSOIL	0.10																	
CLAYEY SAND, trace silt																		Ţ
	0.30	///																
	-																	
Grey SILTY SAND																		
				-														
		· · · · ·					1											
							1-	-										
	1 00	·																
AH terminated in silty sand	. 1.20	411.																
@ 1.20 m depth																		
(Water infiltration at 0.20m depth)																		
									<u> </u>	: :	20	: 4	0		<u>i</u>)	80	10	0
										S	hea	nr S	tre	ngt	h (kl	Pa)		
	[1			14	ΔU	nais	curb	ed	Δ	кетс	uideo	a –	

28 Concourse Gate, Unit 1, Ottawa	, ON K2E	717			19 Ot	34 Stage tawa, Or	coach R ntario					
DATUM Ground surface elevati	ons interp	olated	from	i topo	surve	y plan.			FILE	E NO.	PH	1048:
REMARKS				_			2040		ноі	LE NO		21/N
BORINGS BY Backhoe				<u>D</u>		S August	2010	Der D				
SOIL DESCRIPTION	LOII	SAMPLE				DEPTH (m)	ELEV. (m)	Pen. R • 5	 50 mm Dia. Cone 			
	RATA	ЧЪЕ	MBER	% OVER	ROD			0 V	 Vater	r Con	itent	%
GROUND SURFACE	ST	H	DINI.	REC	N) - D-	_	20	40	6(t	0 8	80 - :-: -
TOPSOIL				ļ								
	<u>0.30</u>											
						ł						
						1-	-					
SAND with mari		G	1			•						
				ł								
	2.00	ļ										
						2						
SILTY CLAY		G	2									
End of Test Pit	2.50	1										
(GWL @ 0.7m depth)												
					ļ							
					İ							
	1									<u></u>		

natoreonar		in	Cons	ulting		SOIL	. PRO	FILE A	ND TEST DATA	1
Palei Juit 1 Ottawa Ol	Pr 19	Proposed Residential Subdivision 1934 Stagecoach Road								
28 Concourse Gate, ont 1, ottawa, or	interp	olated	l from	topo s	UTVe	tawa, Or y plan.	itario		FILE NO. DUID 482	<u> </u>
REMARKS	•									
BORINGS BY Backhoe		-		DA		6 August 2	2010		TP 2-10	D
	ЪТ	SAMPLE				DEDTU	EL EV	Pen. R	ar on	
SOIL DESCRIPTION	A PL		~	R	۲o	(m)	(m)	• 5	tructi	
	TRATA	ГҮРЕ	UMBER	COVER	VALU E RQI			• •	Piezo	
GROUND SURFACE	Š		N	RE	z °	0-	_	20	40 60 80	
TOPSOIL	_					Ŭ				
0.2		-								
				ĺ						
										₽
				ĺ		1-	-			1
SAND with gravel		G	2							1
			3						· · · · · · · · · · · · · · · · · · ·	
									\$. .	
									\$.{	
						2-	-			
2.4		-								
SILTY CLAY		G	4							
		-								-
							1			
(GWL @ 0.7 m depm)										
							1			
	ļ									
								20	40 60 80	100
								She ▲ Undi	sturbed △ Remoulded	

natoreana	ro	10	Cons	ultino	1	SOIL	. PRO	FILE A		ST DATA	۱	
palersony	Proposed Residential Subdivision 1934 Stagecoach Road Ottawa Ontario											
DATUM Ground surface elevati	ons inter	poiate	d from	topo s		y plan.	itario	<u> </u>	FILE NO.			
REMARKS				•						PH0482		
BORINGS BY Backhoe				DA	ATE 6	6 August 2	2010		HOLE NO		V2-1	
	ы		SAM	PLE				Pen. R	Pen. Resist. Blows/0.3m			
SOIL DESCRIPTION	DIA	ы				DEPTH (m)	ELEV. (m)	• •	● 50 mm Dia. Cone			
	ATA	Ed	BER	VER	ROD		1	O Water Content %			iezo! onstr	
	STR							20	20 40 60 80			
GROUND SURFACE						0-	-					
	0.27	_										
	🕅											
FILL: Silty sand with cobbles		G	5									
		8 -										
	0.96	8				1-	-					
		:									Ţ	
Coarse SAND												
		G	6									
						2-	-					
							ļ					
	2.60	-										
	3.00	2				3	1					
End of Test Pit												
(GWL @ 1.5m depth)						1						
				1								
			ł									
					1							
					ļ							
											100	
						20 40 60 80 Shear Strength (kPa						
								▲ Und	listurbed 2	A Remoulded		
natoroonar	\sim	10	Con	sultin	a	SOIL	PRO	FILE A	ND TEST DAT	4		
--	--------	-------------------	------------	--------	---------------	-----------------------	--------------------	-------------------	--	----------		
28 Concourse Gate. Unit 1. Ottawa. ON		4 P 717	Engi	ineers	Pr 19	oposed R 34 Staged	esident coach R	ial Subdiv oad	vision			
DATUM Ground surface elevations	interp	olatec	from	topos	surve	y plan.			FILE NO. DHO492			
	•											
Romings By Backhoe				D/	ATE (6 August 2	2010		TP 4-1	0		
BORINGS BT BROKINGO			SAN	PLE			_	Pen. R	esist. Blows/0.3m			
SOIL DESCRIPTION	DIO		۰, ۱۳ س	 	<u></u> Во	DEPTH (m)	ELEV. (m)	• 5	50 mm Dia. Cone	omete		
	TRAT?	TYPE	UMBET	COVEI	VALU F ROI			0 v	Nater Content %	Piez		
GROUND SURFACE	S		z	RE	z °	0-		20	40 60 80	 		
Coarse SAND Coarse SAND 2.30 SILTY CLAY End of Test Pit (GWL @ 0.4m depth)		G	7			1-						
								20 She	40 60 80 ear Strength (kPa) isturbed △ Remoulded	100		

natoreonar	^ 1	in	Con	sultino	1	SOIL	- PRO	FILE A	ND TES	T DATA	٩
28 Concourse Gate, Unit 1, Ottawa, OF		4 P 717	Engi	ineers	Pr 19	oposed F 34 Stage ttawa. O	Resident coach R ntario	ial Subdi oad	vision		
DATUM Ground surface elevations	interp	olated	i from	topo s	surve	y plan.			FILE NO.	PH0482	
REMARKS									HOLE NO.		<u> </u>
BORINGS BY Backhoe	<i></i> ,				TE (6 August	2010	r 		IP 5-10	J
	ET O		SAN	IPLE [.]		ПЕРТН	FI EV.	Pen. R	esist. Blow	/s/0.3m	on
SOIL DESCRIPTION	PL D		~	2	<u>۲</u>	(m)	(m)	• 5	60 mm Dia. (Cone	truct
	RAT	YPE.	MBE	%	VALU RQJ			0	Vater Conte	ent %	Piez
	L'S	F	R	Ma N	N O	0		20	40 60	80	
TOPSOIL 0.1	8					- 0-					
FILL: Sandy silt with gravel and cobbles		G	9			1-					
SANDY SILT with marl	0	G	10			2.					
SILTY CLAY	0	G	11								
End of Test Pit											
(TP dry upon completion)								20 She	40 60 Par Strengti sturbed △ F	80 a (kPa) Remoulded	100

natoreonar		in	Con	sultin	a	SOIL	. PRO	FILE A	ND TES	ST DATA	۱
Patersong		4 P 717	Engi	ineers	Pr 19	oposed F 34 Stage	Resident coach R	ial Subdiv oad	vision		
Ground surface elevations	interp	olated	d from	topos	l Ot surve	tawa, Or y plan.	itario		FILE NO.	DU0492	
REMARKS				-						PH0402	
BORINGS BY Backhoe				D	ATE (3 August 2	2010		HOLE NO.	TP6/MV	V4-1(
	E		SAM	PLE				Pen. R	esist. Blo	ws/0.3m	노또
SOIL DESCRIPTION	A PLO		~	N	В о	DEPTH (m)	ELEV. (m)	• 5	i0 mm Dia.	Cone	omete
	TRAT	TYPE	UMBEI	COVE	VALU F RQI			0 v	Vater Cont	ent %	Piez
GROUND SURFACE	ŝ		¥.	RE	×٥	0	_	20	40 60	80	<u> </u>
TOPSOIL0.15						Ŭ					, ₽
SAND with marl		G	12			1-	- 				
SILTY SAND with boulders		G	13			2- 3-					
End of Test Pit (GWL @ 0.1m depth)								20 She ▲ Undis	40 60 ar Strengt) 80 h (kPa) Remoulded	

natoreonar		In	Con	sultina		SOIL	PRO	FILE A		ſES	T D	ΑΤΑ	
28 Concourse Gate Unit 1 Offawa C	UL N K2F	лЧ 717	Engi	ineers	Pr 19	oposed F 34 Stage	Resident coach R	ial Subdiv oad	vision				
28 Concourse Gale, only 1 Standy C	s interr	nolated	l from	topo s		v plan.			FILEI	NO.			··· ···· ··
DATUM GIOUNU SUNACE Elevation	5 (110)	5014(0)		topo o		, h					PHO	482	<u>.</u>
REMARKS					6		2010		HOLE	NO.	TP	7/MV	V3-1
BORINGS BY Backhoe		Τ				August	2010	Dam D		Bla			
SOIL DESCRIPTION	PLOT		SAM	PLE 거		DEPTH (m)	ELEV. (m)	• 5	esist. 0 mm	Dia.	Cone	,	meter
	IRATA	IYPE	OMBER	\$ COVER	VALU ROD			- o v	later (Cont	ent %	ò	Piezo Const
GROUND SURFACE	ία Γ		IN	RE	z °	0	_	20	40	60	80		
TOPSOIL0.1	4					U							: ⊻
SILTY SAND		G	14										
- with clay by 0.4m depth		-											
		G	15										
		•											
1.1	0	•				1-	-						
SAND with marl		G	16										
1	501	l G	10										
		1											
			ľ										
			ł										
SILTY CLAY		1				2-							
		G	17								•••••		
											•••••		目
		2											
		1											[]目
										Ī			間
End of Test Pit		1-				3-	1						<u>↓</u>
(G)M @ 0.1m denth)													ļ
						1							
							1						
		1	ļ										

20 40 60 80 Shear Strength (kPa)

▲ Undisturbed △ Remoulded

100

Patci SUIGUUP Engineers Proposed Residential Subdivision 28 Concourse Gate, Unit 1, Ottawa, ON K2E 7T7 Proposed Residential Subdivision 1934 Stagecoach Road Ottawa, Ontario	
DATUM Ground surface elevations interpolated from topo survey plan. PH0482	
REMARKS HOLE NO. TO 9 4	
BORINGS BY Backhoe DATE 6 August 2010	U
SAMPLE Pen. Resist. Blows/0.3m	ter
SOIL DESCRIPTION A M M (m) (m) (m)	ome
S S S S S S S S S S S S S S S S S S S	Piez
GROUND SURFACE	
TOPSOIL 0.20	
SAND G 18	
SILT	
	-
- with boulders by 3.1m depth	
End of Test Pit	
(TP dry upon completion)	
20 40 60 80 Shoo Strength (JBD)	100
Silical Strength (KFA) ▲ Undisturbed △ Remoulded	

natoreona	roi	In	Con	sultino		SOIL	PRO	FILE A	ND TEST DATA	1
28 Concourse Gate, Unit 1, Ottawa.		лр 717	Engi	ineers	Pr 19	oposed F 34 Stage	Resident coach R	ial Subdiv oad	vision	_
DATUM Ground surface elevation	ons inter	polated	d from	topo s	urve	y plan.			FILE NO. PH0482	
REMARKS									HOLE NO.	
BORINGS BY Backhoe		1		DA	TE (6 August :	2010		IP 9-10	U
	ц		SAN	IPLE		DEPTH	ELEV.	Pen. R	esist. Blows/0.3m	ion
SOIL DESCRIPTION	A PL		~	RX	۳o	(m)	(m)	• 5	o mm Dia, Cone	omet
	TRAT	TPE	DMBE	° 0 VE	VALU RQ			0 V	Nater Content %	Piez
GROUND SURFACE	ι. Σ		NI	REC	z ö		_	20	40 60 80	
TOPSOIL	1 22									
	.23		i							
		G	20							
SAND										
	<u>, ov</u>									
						1-	<u>-</u>			1
						ļ				
SILT		ļ								-
						2.	+			4
		G	21							
										-
										•
										-
						3	Ļ			-
	<u>3.50 </u>	Ц					ļ			1
(TP dry upon completion)										
								20	40 60 80	_} 100
						1		She	ear Strength (kPa) isturbed \triangle Remoulded	

notorcona	ro		Consi	ultina		SOIL	PRO	FILE A	ND TE	ST DATA	۸
28 Concourse Gate. Unit 1. Ottawa			Engin	eers	Pro 193	posed R 34 Stage	esident coach R	ial Subdi oad	vision		
DATUM Ground surface elevat	ions inter	polated	d from to	opo su	JIVØY	r plan.			FILE NO.	PH0482	
REMARKS									HOLE NO		
BORINGS BY Backhoe				DAT	<u>TE 6</u>	August 2	2010	·		TP10/N	1005-
SOIL DESCRIPTION	LOT		SAMP	LE			ELEV.	Pen. R	Resist. Blo 50 mm Dia	ows/0.3m . Cone	leter ction
	RATA I	XPE	MBER	S OVERY	ALUE ROD	(111)	(111)	01	Water Con	itent %	Piezom Constru
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SYMBOLS AND TERMS

SOIL DESCRIPTION

Behavioural properties, such as structure and strength, take precedence over particle gradation in describing soils. Terminology describing soil structure are as follows:

Desiccated	-	having visible signs of weathering by oxidation of clay minerals, shrinkage cracks, etc.
Fissured	-	having cracks, and hence a blocky structure.
Varved	-	composed of regular alternating layers of silt and clay.
Stratified	-	composed of alternating layers of different soil types, e.g. silt and sand or silt and clay.
Well-Graded	-	Having wide range in grain sizes and substantial amounts of all intermediate particle sizes (see Grain Size Distribution).
Uniformly-Graded	-	Predominantly of one grain size (see Grain Size Distribution).

The standard terminology to describe the strength of cohesionless soils is the relative density, usually inferred from the results of the Standard Penetration Test (SPT) 'N' value. The SPT N value is the number of blows of a 63.5 kg hammer, falling 760 mm, required to drive a 51 mm O.D. split spoon sampler 300 mm into the soil after an initial penetration of 150 mm.

Relative Density	'N' Value	Relative Density %
Very Loose	<4	<15
Loose	4-10	15-35
Compact	10-30	35-65
Dense	30-50	65-85
Very Dense	>50	>85

The standard terminology to describe the strength of cohesive soils is the consistency, which is based on the undisturbed undrained shear strength as measured by the in situ or laboratory vane tests, penetrometer tests, unconfined compression tests, or occasionally by Standard Penetration Tests.

Consistency	Undrained Shear Strength (kPa)	'N' Value
Very Soft	<12	<2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very Stiff	100-200	15-30
Hard	>200	>30

SYMBOLS AND TERMS (continued)

SOIL DESCRIPTION (continued)

Cohesive soils can also be classified according to their "sensitivity". The sensitivity is the ratio between the undisturbed undrained shear strength and the remoulded undrained shear strength of the soil.

Terminology used for describing soil strata based upon texture, or the proportion of individual particle sizes present is provided on the Textural Soil Classification Chart at the end of this information package.

ROCK DESCRIPTION

The structural description of the bedrock mass is based on the Rock Quality Designation (RQD).

The RQD classification is based on a modified core recovery percentage in which all pieces of sound core over 100 mm long are counted as recovery. The smaller pieces are considered to be a result of closely-spaced discontinuities (resulting from shearing, jointing, faulting, or weathering) in the rock mass and are not counted. RQD is ideally determined from NXL size core. However, it can be used on smaller core sizes, such as BX, if the bulk of the fractures caused by drilling stresses (called "mechanical breaks") are easily distinguishable from the normal in situ fractures.

RQD % ROCK QUALITY

90-100	Excellent, intact, very sound
75-90	Good, massive, moderately jointed or sound
50-75	Fair, blocky and seamy, fractured
25-50	Poor, shattered and very seamy or blocky, severely fractured
0-25	Very poor, crushed, very severely fractured

SAMPLE TYPES

SS	-	Split spoon sample (obtained in conjunction with the performing of the Standard
		Penetration Test (SPT))

- TW Thin wall tube or Shelby tube
- PS Piston sample
- AU Auger sample or bulk sample
- WS Wash sample
- RC Rock core sample (Core bit size AXT, BXL, etc.). Rock core samples are obtained with the use of standard diamond drilling bits.

SYMBOLS AND TERMS (continued)

GRAIN SIZE DISTRIBUTION

MC%	-	Natural moisture content or water content of sample, %
LL	-	Liquid Limit, % (water content above which soil behaves as a liquid)
PL	-	Plastic limit, % (water content above which soil behaves plastically)
PI	-	Plasticity index, % (difference between LL and PL)
Dxx	-	Grain size which xx% of the soil, by weight, is of finer grain sizes These grain size descriptions are not used below 0.075 mm grain size
D10	-	Grain size at which 10% of the soil is finer (effective grain size)
D60	-	Grain size at which 60% of the soil is finer
Сс	-	Concavity coefficient = $(D30)^2 / (D10 \times D60)$
Cu	-	Uniformity coefficient = D60 / D10
Cc and (Cu are i	used to assess the grading of sands and gravels:

Well-graded gravels have: 1 < Cc < 3 and Cu > 4Well-graded sands have: 1 < Cc < 3 and Cu > 4Well-graded sands have: 1 < Cc < 3 and Cu > 6Sands and gravels not meeting the above requirements are poorly-graded or uniformly-graded. Cc and Cu are not applicable for the description of soils with more than 10% silt and clay (more than 10% finer than 0.075 mm or the #200 sieve)

CONSOLIDATION TEST

p'o	-	Present effective overburden pressure at sample depth
p'c	-	Preconsolidation pressure of (maximum past pressure on) sample
Ccr	-	Recompression index (in effect at pressures below p'c)
Сс	-	Compression index (in effect at pressures above p'c)
OC Ratio		Overconsolidaton ratio = p'c / p'o
Void Ratio	D	Initial sample void ratio = volume of voids / volume of solids
Wo	-	Initial water content (at start of consolidation test)

PERMEABILITY TEST

k - Coefficient of permeability or hydraulic conductivity is a measure of the ability of water to flow through the sample. The value of k is measured at a specified unit weight for (remoulded) cohesionless soil samples, because its value will vary with the unit weight or density of the sample during the test.

SYMBOLS AND TERMS (continued) STRATA PLOT Topsoil Asphalt Peat Sand Silty Sand Fill ∇ Sandy Silt Clay Silty Clay Clayey Silty Sand Glacial Till Shale Bedrock

MONITORING WELL AND PIEZOMETER CONSTRUCTION



PIEZOMETER CONSTRUCTION





APPENDIX 2

Published MECP Well Data for Test Wells

Local Well Records (Regional Hydrogeology)

MECP Provincial Offences order - Sleepy Cedars

Ottawa Head Office 9 Auriga Drive Ottawa – Ontario Ottawa Laboratory 28 Concourse Gate Ottawa – Ontario List of Services Geotechnical Engineering \diamond Environmental Engineering \diamond Hydrogeology Materials Testing \diamond Retaining Wall Design \diamond Rural Development



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A105360 Well Record Τω۹ Below Well Regulation 903 Ontario Water Resources Act Ministry of Ontario the Environ Page \cap 🖸 Metric Impenal leasurements recorded in: Weil Constructed Well Owner's Information E-mail Address by Well Owner Cenan 2000 Erst Nai <u>₽</u>~v No. (nc. area codo) 4A Province Postal Co 5Hg imber/(taim sp ≮ eod Well Location :Lot iship Address of Wall Location (Street Number/Name) OSGOCOD ۸ Province Staccocht Cored Cay Postal Code #1934 į . Ontario rstrictionreipality ree • Other Musicip 5008205 ហា<u>រា ជី</u> 54 40 rack Materials/Abandorument Scaling Record (are associate on the back of this form) NAD . 8:3. Depth (m()) General Description Overburden and Bed Other Matemals Most Common Material General Colour 0' 19')a 12' 20' O (Si nan 201128 ers Jel 28.92 $(\Box \mathcal{D}$ ine store 92' 234' ned Sond Store ings :-·--54 Results of Well Yield Testing After test of well weld, water west the all the state of Recovery Annular Space Draw Down Volume placed Time WaterLevel Time Worst Level Type of Scalant Used Depth Set at (TTA) (m îi) (Material and Type) (01:) (min) (നഹ) ï٥ From 13.6 3'3" 1.8 Slate evental AL V 38' 28' NG 13.6 <u>]</u>]3.'3'' 21 -Toniste Slenig 1 1 by-Nee 46 2 2 36 $\partial o'$ 3 з e (Vinin GPM) Well Use 4 b 4 Method of Construction 🗋 Not used ion of p Compercial Publo [] Oiamund hrs + O_ min Cable Tool 5 5 Domestic Liverstock C Ocwaterna ⊡ Jettori 1 Botary (Conventional) [] Monitoring Test Hole ner level and of pump Prived [] 10 Rocary (Reverse) 10 📋 Cooling & Air Conditioning 🗋 Krigátión 316 (10:9509 Borang Dir percession Industrial 15 15 give rate (Vm 🗋 Other, specify Other, specify 20 Status of Well 20 Construction Record - Casing mended pump depth (/071) Whater Supply Open Hole DR Matenal (Galvonzed Entregiaus, Thickness) Concrete, Pluste, Steel) (em/n) Depth (m/ti) 25 25 Replacement Viol ٢ 105306 \sim To Dearmetel (cm/m) From [] Test Hole remended pump rate 30 30 $+\partial'$ Recharge Well 188' -67 38 $\partial \mathfrak{O}$ Cewstering Vicil 40 40 production (Vimin (GPM)) \sim Caservation and/or Montaining Hole 734 35 50 (æ: 50 6 Alteration O.molacted? (Construction) 60 60 X2 ⊡ No Abandoned, Insutional Supply Map of Well Location Abendoned, Poor Please provide a map below following instructions on the back. Construction Record - Screen Water Quality Depth (m/l) Outude Material Sto: N (TS*) (Plastic, Calvaczed Steul). From Diamete (crrvin) 6KM WODER, SPECARY Hole Diameter the eccar Water Betails Damet Depth (nvit) and at Depth Kind of Water Fresh Duttested Ťu (cn'a)Fram When and at Dopin, Kind of Water ______Fresh ______ 234 -(lanewow) Gas _Other, specify ______ (m/fi) [[Gas. Other specify____ Well Contractor and Well Technician information Well Conscions Location N Multicipality of Well Contractor A Nome i NGC \mathcal{D}^{+} KICHMOND ₩~ Postal Code Bus ้องระก Ministry Use Only Package Delavered Well owner lų No stiomhabert z110756 00000 BRAHAM KLAST package eel.vered 38382 70 Yes No Contractor Date Submitted 0083 Technician al າສ**ເ**ບ¢€ Ulmustry's Copy

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(print in block letters)	Address / 2 3	13 ve	11,011	au/a
Casing and Screen Record		Pumpi	ng Test	
Inside diameter of casing	Static level .		31	
Total length of casing	Test-pumping ra	ite	15	G,I
Type of screen none	Pumping level	· · · · · · · · · · · · · · · · · · ·	81	
Length of screen .	Duration of test g	oumping	1.40	••••••••••••••••
Depth to top of screen	Water clear or cl	oudy at end c	l test C/e	917
Diameter of finished hole 6 14 "	Recommended p	oumping rate	15-	G.I
	with pump settin	g of . , 🦪	• feet belo	ow ground sur
Well Log			Wate	r Record
Overburden and Bedrock Record	From ft.	To ft.	Depth(s) at which water(s) found	Kind of was (fresh, sali sulphur)
Sand	0	48		
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For what purpose(s) is the water to be used?				
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Is well on unland in valley or on billside? UD/0/10/	road and	lot line. In	dicate north by	arrow.
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Name of Driller or Borer H. Sallv		_a_M	10	<u> </u>
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(Signature of Licensed Drilling or Boring Contractor)			±7	
Form 7 15M-60-4138		····γ κα	-1	Ð ⁽
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The Ontario Water Resources	Act
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Capital	Water Supply Ltd.	1558		58 JUL 18 2001
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The Ontario Water Resources Act WATER WELL RECORD

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21 ⁶⁴) Fresh 3 C Sulphur 21		Please Please			77-30	31 ***	Ö' Gro	uted ·	Benton	ite ((
	Jeany € C Gaas JErranda 3 C Sulphur ≫ 40		Galvanized Concrete				18-21	22-25		Cement	; (1)
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£-05	¹³ 1 ⊡ Freeh 3 ⊡ Subphur 34 2 ⊡ Sahy 4 ⊡ Minamaba 2 ⊡ Sahy 4 ⊡ Gaas	**	3 D Concreta 4 D Open hole 5 D Pinate					74-77 XXXX	*				

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INSPECTION ID#: 869

COMPANY/MUNICIPALITY: Sleepy Cedars Family Camping

MAILING ADDRESS: 1893 Manotick Station Road, Ottawa, ON K4P 1H2

INSPECTION SITE ADDRESS: Sleepy Cedars Family Camping 1893 Manotick Station Road, Ottawa, ON K4P 1H2

> City of Ottawa (former Osgoode Township) K4P 1H2

> > TITLE: owner

FAX: none

CONTACT NAME: Jim Lefebvre

CONTACT TELEPHONE: 613-821-0756

INSPECTION DATE: 2001/06/12

DATE OF LAST INSPECTION:

WATER WORKS NUMBER: Not Applicable

OPERATING AUTHORITY: Sleepy Cedars Family Camping (878854 Ontario Inc.)

OP. AUTHORITY ADDRESS: 1893 Manotick Station Road, Ottawa, ON K4P 1H2

OP. AUTHORITY TOWN/CITY: City of Ottawa (former Osgoode Township)

OP. AUTHORITY POSTAL CODE: K4P 1H2

OP. AUTHORITY CONTACT NAME:Jim LefebvreTITLE:OP. AUTHORITY TELEPHONE:FAX:

1.0 INTRODUCTION

The Sleepy Cedars Campground was inspected in order to determine applicability of the water works pertaining to the Ontario Water Resources Act (OWRA) s.52 and Ontario Regulation 459/00 (O.R. 459/00). The ground water facility was inspected to assess compliance with the Ministry of the Environment's requirements concerning treatment process, process management, monitoring, record keeping and reporting.

An Occurrence Report (oris no. 990037645) was generated for this site concerning an adverse water quality event on May 29, 2001. Tracy Zakordonski of the Ottawa Public Health Laboratory advised the Spills Action Centre of a total coliform count of 1. Subsequent re-sampling of the well produced a total coliform count of 0 coliforms.

Certificate of Approval List:

V7.0 (March 28,2001)

Not Applicable

2.0 INSPECTION OBSERVATIONS

2.1 SYSTEM DESCRIPTION

Drinking water at this site is supplied from a 6 inch diameter drilled well completed to a reported depth of 165 feet and constructed in 1979 (as reported by previous owner - Art Albert). Water is distributed to 100 individual campsites without the benefit of disinfection or filtration. Typical residency of the campground is 35 - 40 percent. There is currently only one full time resident at the park.

The eight inch diameter well head extends 25 centimetres above grade and is secured with a steel expansion cap attached to the top of the casing. The discharge line and electrical connections enter the well through the top of the cap. The well and associated plumbing is housed in a padlocked garden shed, located 25 metres north of the park office. The land is graded away from the well head and is separated from the nearest sanitary weeping bed by a height of land and a distance exceeding 50 metres. A totalizing flow meter was installed in the discharge line at the well head, on April 30, 2001. No other visible sources of contamination were identified.

PERMIT NUMBERS	SOURCE	RENEWAL DATES	PERMITTED AMOUNT OF TAKING	UNITS
NA	Drilled Well			
			- <u> </u>	
		<u> </u>	· · · · · · · · · · · · · · · · · · ·	
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2.2 PERMIT TO TAKE WATER ASSESSMENT

V7.0 (March 28,2001)

INSPECTION STATUS: FINAL

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2.3 CAPACITY ASSESSMENT

ITEM	1998	1999	2000
Avg. Day Flow m ³ /day			
Max. Day Flow m ³ /day		<u> </u>	
Rated capacity m ³ /day			
% (Maximum Day/Rated Capacity)			

A capacity assessment was not completed upon this well. A flow meter installed April 30, 2001 indicates that the average daily discharge is less than 9000 litres during the operating season.

2.4 PLANT TREATMENT REQUIREMENTS

A) SURFACE WATER SOURCE(S)

Does the plant comply with the requirements of Ontario Regulation 459/00 regarding treatment requirements for surface water?

N/A

Does the plant provide the following:

Chemically-assisted filtration: N/A Disinfection: N/A

If the plant does not provide minimum level of treatment for surface water as per Ontario Regulation 459/00 s.5(2), has the owner delivered a written notice to the Director by October 31, 2000 in accordance with Ontario Regulation s.5(5)(b), describing a timetable of actions required to achieve compliance?

N/A

Do records show that water entering the water distribution system has been treated with chlorination (or another treatment that, in the Director's opinion, is as effective as chlorination to achieve disinfection that persists into the distribution system) in accordance with Ontario Regulation 459/00 s.5(3) and any applicable instrument or authorizing document (i.e. Order, Certificate of Approval)? N/A

V7.0 (March 28,2001)

INSPECTION STATUS: FINAL

B) GROUND WATER SOURCE(S)

Does the plant comply with the requirements of Ontario Regulation 459/00 regarding treatment requirements for ground water (i.e. Disinfection)? NO

Chlorination or any other approved disinfection process is not practised upon this ground water supply.

Do records show that water entering the water distribution system has been treated with chlorination (or another treatment that, in the Director's opinion, is as effective as chlorination to achieve disinfection that persists into the distribution system) in accordance with Ontario Regulation 459/00 s.5(3) and any applicable instrument or authorizing document (i.e. Order, Certificate of Approval)? NO

If the plant does not provide minimum level of treatment of ground water as per Ontario Regulation 459/00 s.5(1), has the owner:

 (i) delivered a written notice to the Director by October 31, 2000 in accordance with Ontario Regulation s.5(5)(b), describing a timetable of actions required to achieve compliance or their intention to seek a variance in their Certificate of Approval in accordance with Ontario Regulation 459/00 s.6(2)(b), or

(ii) obtained a variance in their Certificate of Approval in accordance with Ontario Regulation 459/00 s.6(2)(b)?

NO

2.5 SAMPLING AND ANALYSIS REQUIREMENTS

Does the plant comply with all sampling and analysis requirements in accordance with Ontario Regulation 459/00 s.7 and any applicable Order and Certificate of Approval?

NO

The only sampling completed upon the water supply consists of bacteriologic submissions to the Public Health Unit, every two weeks during the operating season of the campground as well as regular Health Unit inspection and sampling of the swimming pool water.

2.6 WATER QUALITY ASSESSMENT

Specifically with regard to health-related water quality parameters only, is the plant meeting the water quality requirements of its Certificate of Approval, Ontario Drinking Water Standards, or an Order or direction?

NO

2.7 MINISTRY SAMPLE RESULTS

Were Ministry samples collected during the inspection? YES

Do sample results show compliance with Ontario Drinking Water Standards and any applicable instrument or authorizing document (i.e. Order, Certificate of Approval) for those parameters which were required to be analysed? YES

Comment:

The Ministry sample results indicated that the turbidity analysis of 1.37 NTU was in exceedance of the MAC value of 1.0 NTU for treated water leaving the plant. This MAC value was established to ensure efficiency of the disinfection process and disinfection is not currently practiced at this facility.

2.8 REPORTING REQUIREMENTS

Is the owner complying with reporting requirements of Ontario Regulation 459/00 s.12 (quarterly reports), section 13 (engineer's reports), section 8 (adverse water quality notification), and those of any applicable instrument or authorizing document (i.e. Order, Certificate of Approval)?

NO

2.9 PLANT AND OPERATOR CERTIFICATION

- a) Plant Certification
 - i) Facility Level: Not Applicable
 - ii) Certificate Number: Not Applicable
 - iii) Date of Issue:

b) Do the plant operators have the appropriate level of certificate for this plant? NO

Jim Lefebvre, owner of Sleepy Cedars Family Camping, is resposible for the operations, maintenance and sampling of the water works.

2.10 PROCESS WASTEWATER

Is the process waste water treated prior to discharge? N/A

No process waste water is generated at this water works.

Does the discharge meet the requirements outlined in: a) its Certificate of Approval N/A b) Ministry policy? N/A

3.0 REVIEW OF PREVIOUS NON-COMPLIANCE ISSUES

There are no previous non-compliance issues associated with this facility.

4.0 SUMMARY OF INSPECTION FINDINGS (HEALTH/ENVIRONMENTAL IMPACT)

Was there any indication of a known or anticipated human health impact during the inspection and/or review of relevant material, related to this Ministry's mandate ?

YES

The level of treatment provided fails to conform with that identified in O.R.459/00.

Specifics:

The operating authority fails to provide disinfection which is identified as the minimum level of treatment for ground water sources of drinking water (O.R. 459/00 s.4).

Was there any indication of a known or anticipated environmental impact during the inspection and/or review of relevant material ?

NO

a) If the CofA contains conditions dictating monitoring and/or effluent quality for process wastewater treatment, is the facility operating in compliance with those conditions?

b) If the water works has no process wastewater treatment provisions in place, is there evidence that untreated discharges have adversely impacted the environment or have a significant potential to adversely impact sensitive receivers?

Specifics:

Was there any indication of a known or suspected violation of a legal requirement during the inspection and/or review of relevant material which could cause a human health impact or environmental impairment? YES

a) Do the maximum water takings comply with those prescribed in applicable Permits To Take Water?

b) Has the water works complied with sampling and analysis provisions contained in O.R. 459/00, or all MACrelated monitoring provisions contained in a CofA and Orders? Sampling and analysis is currently provided for bacteriologic parameters, only.

c) Are all operators licensed as required under O. R. 435/93?

Specifics:

Mr. Lefebvre is not a licensed operator. Operations presently consist solely of maintenance and repairs to the pump and distribution system as well as bi-monthly bacteriologic sampling.

Was there any indication of a potential for environmental impairment during the inspection and/or the review of relevant material?

NO

Specifics:

5.0 ACTION(S) REQUIRED

A Provincial Officers Order was issued to for the owner to attain the services of a qualified consultant to assess the water works with respect to the applicability of the Ontario Water Resources Act and Ontario Regulation 459/00.

ACTIONS TAKEN

ACTION	ORDER ISSUED	COMPLIANCE DATE	COMPLIED WITH
Assessment of water works	YES	2001/09/30	PENDING
			······································

Provincial Officers Order # P805-010712-01

6.0 OTHER INSPECTION FINDINGS

Casing stick-up is slightly less than the requirements of Ontario Regulation 903 s. 13(3). Casing should be extended to correct height or granular backfill material removed to ensure a minimum extension of 30 centimetres above ground surface.

The operator of the water works does not possess the appropriate certification for this facility as required under O.R. 435/93.

Minimum level of treatment for a groundwater supply water works (ie. disinfection) is not provided as indicated by O.R. 459/00 section 5.(1).

Containers of paint and other non-essential materials should be removed from the structure enclosing the well head.

A system of record keeping should be established to document analytical results and flow volumes.

7.0 OCCURRENCE REPORT # :

9940008744

A Provincial Officers Order was issued August 20, 2001 to Jim Lefebvre (owner) to attain the services of a qualified consultant to undertake an assessment of the water works to determine the applicability of Section 52 of the Ontario Water Resources Act and Ontario Regulation 459/00 and to provide a written report of this assessment to the Provincial Officer.

PREPARED BY ENVIRONMENTAL OFFICER:

Timothy O'Brien	Sim Brien	Oltawa	2001/08/20
(Print)	(Signature)	(District Office)	(Date)

ENDORSED BY DISTRICT SUPERVISOR:

Paul Kchoe	Paul Kilber	Ottawa	Cury 22/01
(Print)	(Signature)	(District Office)	(Date)

REPORT MAILED OUT ON: LAB RESULTS MAILED OUT ON:

STATUS: FINAL

NOTE: "This inspection does not in any way suggest that there is or has been compliance with applicable legislation and regulations as they apply or may apply to this facility. It is, and remains, the responsibility of the owner and/or the operating authority to ensure compliance with all applicable legislative and regulatory requirements."

CHEMICAL/PHYSICAL OBJECTIVES HEALTH RELATED

(Sleepy Cedars July 12/01)

PARAMETER (mg/L unless specified)	Sample Results	MAC	IMAC ²	AO3
Alachior	NA		0.005	
Aldicarh	NA	0.009		
Aldrin + Dieldrin	NA	0.0007		
Arsenic	0.0		0.025	
Atrazine + - dealkylated metabolites	NA		0.005	
Azinphos-methyl	NA	0.02		
Barium	0.0805	1		
Bendiocarb	NA	0.04		
Benzene	0.0	0.005	·	
Benzo(a)pyrene	NA	0.00001	·	
Boron	0.121		5	
Bromoxyail	NA		0.005	
Cadmium	0.0	0.005		
Carbaryl (Sevin)	NA	0.09		
Carbofiran	NA	0.09		
Carbon Tetrachloride	0.0	0.005		
Chlordane ⁴	NA	0.007		
Chloramines	NA	3.0		
Chlorpyrifos (Dursban)	NA	0.09		
Chromium	0.0026	0.05		
Cyanazine (Bladex)	NA		0.01	······································
Diazinon	NA	0.02		
Dicamba	NA	0.12		
1,2-Dichlorobenzene	0.0	0.2		0.003
1,4-Dichlombenzene	0.0	0.005		0.001
DDT + metabolites ⁵	NA	0.03	-	
1,2-Dichloroethane	0.0		0.005	
1,1-Dichloroethylene (vinylidene chloride)	NA	0.014		
Dichloromethane	0.0	0.05		
2,4-Dichlorophenol	NA	0.9		0.0003
2,4-Dichlorophenoxy acetic acid (2,4-D)	NA		0.1	
Diclotop-methyl	NA	0.009		
Dimethoate	NA		0,02	
Diquat	NA	0.07		
Diuron	NA	0.15		
Fluoride	0.41	b	· · · · · · · · · · · · · · · · · · ·	
Heptachlor + Heptachlor Epoxide	NA	0.003		
Lead	0.00017	0.01 c		

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-10-										
(Hexachlorocyclohexane (Lindane)	NA	0.004								
Malathion	NA	0.19								
Mercury	0.0	0.001								
Methoxychlor (DMDT)	NA	0.9	· · · · · · · · · · · · · · · · · · ·							
Metolachlor	NA		0.05							
Metribuzin (Sencor)	NA	0.08								
Monochlarobenzene	NA	0.08	····	0.03						
Nitrate (as Nitrogen)	0.013	10.0 d								
Nitrite (as Nitrogen)	0.003	1.0 d	<u> </u> ''────							
Nitrate + Nitrite	0.016	10.0 d								
Nitrotiacedic Acid (NTA)	NA	0.4	<u>i i</u>							
Nitrosodimethylamine (NDMA)	NA		0.000009							
Paraquat	NA		0.01	· · · ·						
Parathion	NA	0.05	·							
Pentachlorophenol	NA	0.06		0.03						
Phorate (Thinet)	NA		0.002							
Pichloram	NA		0.19							
Polychlorinated Biphenyls (PCB)	NA		0.003							
Prometryne	NA		0.001							
Selenium	0.001	0.01								
Sinazine	NA		0.01							
Temephos	NA	· · · · · · · · · · · · · · · · · · ·	0.28							
Terbufos	NA		0.001							
Tetrachloroethylene (perchloroethylene)	NA	0.03								
2,3,4,6-Tetrachlorophenol	NA	0.1		0.001						
Triallate	NA	0.23								
Trichloroethylene	NA	0.05								
2,4,6-Trichlorophenol	NA	0.005		0.002						
2,4,5-Trichlorophenoxy acetic acid (2,4,5-T)	NA	0.28		0.02						
Trifhuralin	NA		0.045							
Tribalomethanes	0.00	0.1 e								
Turbidity (NTU)	1.37	f		f						
Uranium	0.00012	0.1	1 1							
Vinyi Chloride (chlorocthylene)	NA	0.002								

Shortforms:

-T>	 A measurable trace amount; interpret with caut 	ion
-----	--	-----

<W - No measurable response (2010)

- Not detected ND
- No appropriate procedure available
 Result not available !NP

NA

Footnotes:

- 1 Maximum Acceptable Concentration (MAC)
- 2 Interim Maximum Acceptable Concentration (IMAC)
- Aesthetic Objective (AO) 3
- 4 Includes O-Chlordane, O-Chlordane and Oxychlordane
- Includes p,p'-DDE, o,p'-DDT, p,p'-DDD and p,p'DDT 5

- Not sampled NS
- Nephelometric Turbidity Unit
 Nanograms per litre NTU ng/L
- Φg/L mg/L Micrograms per litre
 Milligrams per litre

Total toxic equivalents when compared with 2,3,7,8-TCDD (tetrachlorodibenzo-p-dioxin) a)

 b) Where fluoridation of drinking water is practised, it is recommended that the concentration be adjusted to 1.0 (+/- 0.2) mg/L, the optimum level for control of dental caries. Communities in Northern Ontario, where the annual mean daily maximum temperature is less than 10 °C may wish to consider adjusting the fluoride concentration to 1.2 (+/- 0.2) mg/L. Adverse effects of fluoride in drinking water above 1.5 mg/L and below 2.4 mg/L are cosmetic in nature (dental mottling in a small portion of the population). Levels above 1.5 mg/L should be reported to the local medical officer of health.

This objective applies to water at the point of consumption. Since lead is a component in some plumbing systems, first flush water c) may contain higher concentrations of lead than water that has been flushed for five minutes. Faucets, therefore, should be thoroughly flushed before water is taken for consumption.

d)

Where nitrate and nitrite are present, the total of the two should not exceed 10 mg/L. The interim maximum acceptable concentration (IMAC) for total trihalomethanes (THMs) in drinking water is 0.1 mg/L (100 ug/L), e) expressed as a running annual average of quarterly samples. This IMAC is based on the risk associated with chloroform, the THM most often present and generally found in the greatest concentrations in drinking water, The guideline is designated as interim until such time as the risks from other disinfection byproducts are ascertained.

A MAC for turbidity of 1 NTU in drinking water leaving the treatment plant was established to ensure the efficiency of the Ð disinfection process. Treatment processes can result in increased turbidity in the distribution system. To ensure that the aesthetic objective for turbidity at the free flowing outlet of the ultimate consumer has been set at 5 NTU.

MICROBIOLOGICAL OBJECTIVES HEALTH RELATED (Sleepy Cedars July 12/01)

PARAMETER SAMPLE MAXIMUM ACCEPTABLE (organisms/100 mL) RESULTS CONCENTRATION Total Coliforns 0 0.0 E. Coli 0.0 Ö 200** NA Background Standard Plate Count NA 500**

Footnotes:

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Escherichia coli is a more definitive indicator of fecal contamination than other fecal coliforms or total coliforms.

At elevated levels, the general bacterial population may interfere with the detection of coliforms. This general population can be estimated from either background colony counts on the total coliform membrane filters or heterotrophic plate counts (HPC). If the membrane filter contains more than 200 background colonies on a total coliform medium per 100 mL or if the HPC exceeds 500 colonies per mL, the site should be resampled. If there is a recurrence of unacceptable background or heterotrophic plate counts, an inspection of the site should be undertaken to determine the cause.

CHEMICAL/PHYSICAL OBJECTIVES NON-HEALTH RELATED (Sleepy Cedars July 12/01)

PARAMETERS (mg/L-uniters specified)	Sample Results	Objective	Type of Objective
Aluminum	0.0182	0.1	0G
Copper	0.0031	1	AO
Ethylhenzene	0.0	0.0024	AO
Iron	0.115	0.3	AO
Manganese	0.0117	0.05	AO
Toluene	0.0	0.024	AO
Total Dissolved Solids	NA	500	AO
Xylenes	0.0	0.3	AO
Zinc	0.0064	5	AO

Shortforms:

<T - A measurable trace amount, interpret with caution

- Result not available NA

ND - Not detected

Φg/L OĞ

- micrograms per litre - Operational Guideline

<₩ - No measurable response (zero) - Not sampled NS mg/L

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- nulligrams per litre
- Aesthetic Objective
- True Colour Units

AŎ TCU

WATER W		DATA	SYSTEM	Oct 29			PAGE	- : 10:)6 CO	UNTY :	OTTA	 RA-CA	RLETO		·			GROUND WATER BULLETIN REPORT	
MUNICIPA CONCESS: ETC	ALIT: ION	Y LOT	WELL NO	UTM EASTING NORTHING	elev Feet	DATE	DRILLER	CSG DIA INS	KIND OP WATER	WATER Found Peet	STAT LVL FEET	Pump LVL Feet	test Rate GPM	Test Time Hr:MN	WATER USE	sci Depth Peet	reen Length Feet	OWNER DEPTHS IN FEET TO WHICH FORMATIONS EXTEND	
CONTINU	ING.	os	GOODE '	TOWNSHIP															
CON	03	009	15- 30072	9999999 9999999		1998/0	155 6	06	UX	0210	16	125	10	1:0	DO			T. PRINCIOTTA CONST. BRWN SAND DRY 0003 GREY SAND WBRG 0009 GR. STKY 0020 GREY SAND GRVL PCKD 0035 GREY LM: 0112 WHIT SNDS HARD 0220	ey Clay Sn hard
CON	03	009	15- 30076	9999999 99999999		1996/0	6 1558	06	UK	0190	27	245	6	1:0	DO			T. PRINCICTTA CONST. BRWN LOAM BLOR PCXD 0007 GREY LMSN HARD 01- SNDS HARD 0250	43 WHIT
CON	03	009	15-	452530	340	1963/1	1 3113	04	FR	0068	15	15	7	1 :0	ST DO	0		PIPER G Red MSND 0030 Grey LMSN 0058	
CON	63	009	15-	452448	3,20	1973/0	94 3644	05	FR	0081	4	40	15	1:0	DÔ			BROADFOOT N GREY SAND 0028 GREY LMSN 0081	
CON	¢Э	010	13297	9999999		1992/3	11 3749	06	FR	0194	46	145	21	1 :0	ST			RICKOL CONST. BRWN FILL STNS LOOS 0005 GREY LMSN MGRD HAJ	RD 0205
CON	03	010	26997 15- 27989	99999999 9999999 99999999		1994/0	D5 1558	06	UK	0217	14	25	6	1 :0	DO			RAINA, JAM2S DRWN SAND BLDR PCKD 0010 BRWN SAND STNS WB GREY SAND GRVL WBRG 0040 GREY LMSN MGRD HA	RG 0050 RD 0160
CON	03	010	15-	452533	320	1974/0	08 1558	06	FR	0040	5	20	25	1 :0	DO			GREY SNUS 0223 BANNER CONSTRUCTION BENN SAND DOLD GRUL BLOR DO4D BLCK LMSN DO	41
CON	03	010	14287 15- 30103	5007883 9999999 99999999		1996/(06 4006	06	UK	0094	23	47	5	1 :0	סם			HUTT, PAUL BRWN SAND STNS 0006 BRWN HPAN GRVL SAND 00 LMSN FCRD 0041 GREY LMSN MGRD 0066 GREY LM	35 GREY SN HARD
CON	03	010	15- 13545	454210 5008896	320	1973/0	09 1558	06	FR	0046	12	30	15	1 :0	DO			0100 NEUEND CONSTR LTD BRWN SAND BLDR 0025 GREY HPAN BLDR 0036 BL	CK LMSN
CON	03	011	15-	999999		1995/0	06 1119	06	σx	0100	12	90	13	1 :0	DO			DUAB PHILLIPPEE, MARCEL Sand Side Od49 Grey LMSN 0107	
CON	03	011	28582 15-	99999999 454444	315	1974/3	11 1558	06	su	0045	4	20	50	1 :0	DO			JAR BARLOW EXCAV CO GREY SAND 0010 GRVL BLCR D041 BLCK LMSN 00.	46
CON	03	011	14452 15-	5008631 454440	312	1974/	09 2557	06	FR	0170	22	70	12	1 :30	ST D	0		O'BRIEN JOHN SAND GRVL 0036 GREY LMEN 0170	
CON	03	011	14306 15-	452700	320	1962/	03 1603	02	FR	0089	13	25	9	3 :O	st d	0		ADAME S BLDR MSND GRVL 0051 GREY LMSN 0089	
CON	03	011	07187 15- 11310	454510 5008330	308	1971/	07 3504	06	FR	0110	1	1	20	1 :30	9 0			MAI J SAND SILT 0015 CSND 0040 GRVL BLDR 0048 HP. LMSN 0115	AN 0055
CON	03	011	15- 13548	454466 5008430	313	1973/	09 1558	06	FR	0102	1	30	30	1:0	DO			MAI G BRWN GRVL STNS 0005 GREY SAND STNS 0035 GR SAND BLDR 0058 GREY LMSN 0102	EY GRVL
CON	03	012	15- 30322	9999999 99999999		1998/	06 1119	96	FR	0074	15	60	20	1 :	DO			GORD WIENA CONST Sand Grvl 0048 Grey LMSN 0080	
CON	03	012	15- 22201	9999999 7 99999999		1907/	11 1558	06	FR	0050	Э	20	15	1 :0	DO			C V CONST. LTD. BRWN SAND 0003 BRWN CLAY 0006 GREY CLAY SN 0030 GREY SAND GRVL BLDR 0042 GREY LMSN 00:	DY BLDR 55
CON	03	012	15- 1681:	454440 3 5008000	315	1978/	11 3644	06	FR	0058	15	50	8	1:0	ĐO			POWERS M GREY HEAN GRVL 0037 GREY LMSN D064	
CON	03	012	15- 1676:	452780 5007180	305	197B/	07 3644	06	FR	0160	25	120	12 1	1;0	PS			ALBERT A GREY SAND STNS 0040 GREY LMSN 0120 WHIT SN 0165	ds lmsn
												inpol	n Ne	40,er	iv Lld	lay.			
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JOHN D. PATERSON AND ASSOCIATES LIMITED



Consulting Engineers

November 26, 2001 File No. G8399.LET.01

Ministry of the Environment 2435 Holly Lane Ottawa, Ontario K1V7P2

Attention: Mr. Tim O'Brien

Subject: Assessment of Existing Water Works Sleepy Cedars Family Campground 1893 Manotick Station Road Ottawa (Manotick Station), Ontario

Dear Sir.

Pursuant to the Provincial Officer Order, P805-010712-01, the owners of the Sleepy Cedars Family Campground have engaged the services of John D. Paterson & Associates Limited to carry out an assessment of the existing water works to determine the applicability of Ontario Regulation 459/00.

Sleepy Cedars Family Campground is a privately owned seasonal operation with approximately 100 campsites. The park is in operation for approximately 6 months of the year between the months of May and October. The potable water supply park is serviced by single drilled well. Based on the information obtained from the water well data system, the well was drilled in 1978 to a depth of 50.3 metres.

The well is equipped with a submersible well pump, which feeds two pressure storage tanks. The well water is pumped to each site through a shallow 25 mm diameter piping distribution network. The well and distribution piping network is contained completely on the subject property. No water treatment or disinfection system is in place. A water meter was installed on the well head in April, 2000 and the peak daily flow recorded in the summer, when the park was near full occupancy, was approximately 10, 000 litres. It is our understanding that no Certificate of Approval exists for the subject water works. Mr. Tim O'Brien Page 2 File: G8399.LET.01 November 26, 2001



A constant discharge pump test was carried out, by this firm, on October 22, 2001. The main purpose of the pump test was to determine the capability of the existing water works. In addition, an analysis of the water bearing aquifer has been carried out to determine its characteristics. The existing well pump and existing water line in the well was used for this test. The existing water distribution line was disconnected from the pressure tanks and rerouted to the nearby field. The submersible pump consists of a one-half horsepower Gould pump Model 5GS05. The flow range for this pump according to the manufacturer's specifications is 6.8 L/min to 34.0 L/min (1.5 igpm to 7.5 igpm).

The existing well was pumped for a total of 250 minutes. Water meter readings were recorded throughout the pump test and based on these readings, the total volume of water pumped over duration of the test was 7.995 m³. As such, the average pump rate for the test duration was calculated to be 31.98 L/ min (7.03 igpm). In addition, the pump rate of the existing water works was measured at random times during the pump test using a fixed volume container. Using this method the average pumping rate was calculated to be 34 L/min (7.5 igpm).

Using the pump test data, the aquifer was evaluated using the Cooper & Jacob Time-Drawdown method, the results of which have been attached to this submission. At a pumping rate of 34 L/min, the water level in the well was lowered 4.285 m. The rate of recovery was rapid with the water level returning to approximately 96% of the static level in approximately 33 minutes. A transmissivity of $4.40 \times 10^{-3} \text{ m}^2/\text{min}$ was calculated from the test data. A transmissivity of this magnitude is considered to be moderately acceptable.

Based on our findings, it is our opinion that the aquifer at this site is capable of supplying water in excess of 50,000 L/day. However, the existing water works is only capable of supplying water at a maximum rate of 34 L/min or 48,960 L/day. As such, since the existing water works is not capable of supplying water at a rate greater than 50,000 litres per day, it is our interpretation of the regulations that no Certificate of Approval is required according to Section 52 of the OWRA. Since no Certificate of Approval is required, the water works is also exempt from Regulation 459/00, which mandates a minimum level of treatment (i.e. disinfection).

Although, the existing water works is, in our opinion, exempt from Regulation 459/00, the owner of the facility is encouraged to continue weekly bacteriological testing when the facility is in operation. Also, regular maintenance of the pump and distribution system of the water works, is recommended.

Mr. Tim O'Brien Page 3 File: G8399.LET.01 November 26, 2001



We trust that this submission satisfy your requirements. Should you have any questions please do not hesitate to contact us.

Yours truly

JOHN D. PATERSON & ASSOCIATES LTD.

Albert Van Schie, C.E.T.

Andrew J. Tovell, P.Eng.

cc. Sleepy Cedars Family Campground





Transmissivity [m²/min]: 4.40 x 10⁻³

John	D. Paterson & Associates Ltd.	Pumping test analysis	5	Date: 21.11.2001	Page 2				
1-28 C Nepean	JONCOURSE GALE	Time-Drawdown-meil COOPER & JACOB	nod after	Project: Sleepy Cedars Family Camping					
K2E 7T	7	Confined aquifer		Evaluated by: SJW					
Pumpi	ing Test No. 1		Test conducted or	on: 02,11,2001					
Existin	ng Well		Existing Well	· · · · · · · · · · · · · · · · · · ·					
Discha	arge 0.57 l/s		Distance from the	tance from the pumping well 0.150 m					
Static	water level: 5.180 m below datum								
	Pumping test duration	Water level	Draw	down	·				
	(min)	[m]	1						
. 1	1.00	5.850		0.670					
2	2.00	6.650		1.470					
4	3.00	7.200		2.020					
5	7.00	7.840		2.660					
6	10.00	8.430		3.250	····				
8	20.00	8.830		3.520					
9	30.00	9.000		3.820					
10	40.00	9.100		3.920					
12	70.00	9.210		4.030					
13	232.00	9.460		4.280					
14	235.00	9.460		4.280					
15	240.00	9.475		4.295					
				4.200					
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APPENDIX 3

Soil Laboratory Test Results

Water Laboratory Test Results

Ottawa Head Office 9 Auriga Drive Ottawa – Ontario Ottawa Laboratory 28 Concourse Gate Ottawa – Ontario List of Services Geotechnical Engineering & Environmental Engineering & Hydrogeology Materials Testing & Retaining Wall Design & Rural Development





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REPORT OF ANALYSIS

Client: Paterson Group							Report Num	bar:	2703126	
28 Concourse Gate, Unit 1							Date:		2007-02-19	
Nepean, ON							Date Submit	ted:	2/07-02-14	
K2E 7T7										
Attention: Mr. Robert Passmore							Project:		PH0482	
INVDICE: Paterson Group Inc.							P.O. Number	r:	5391	
Chain of Custody Number: 49792							Matrix:		Waler	
	L	AB ID:	524516	524517					GUIDELINE	
	Sample	a Date: 🗌	2007-02-14	2007-02-14						
	Samj	ple ID:	TW1 WS1	TW1 WS2					ODWSOG	
PARAMETER	UNITS	MDL			l		1	TYPE	LIMIT	UNITS
Tatal Coliforms	cl/100mL		0	O	1	1		MAC	0	cl/100mL
Escherichia Coli	ct/100mL		0	Q		1		MAC	0	ct/100mL
Heterotrophic Plate Count	ct/1mL	1	0	-0						
Faecal Coliforms	cl/100mL		0	Ū						

MDL = Method Detection Limit INC = Incomplete AO = Acstholic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment.

APPROVAL Tern Krista Quantnit Microbiology Analyst

+ John D

Paterson 2001/001

REPORT OF ANALYSIS

Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2E 7T7 Attention: Mr. Robert Pacemore							Report Numi Dato: Date Submitt Project:	ber: led:	2703139 2007-02-16 2007-02-14 PH0482	
INVOICE: Paterson Group Inc.							P.O. Number	:	5391	
Chain of Custody Number: 49792			1	r—	T		Matrix:		Waler	
	_	LAB ID:	524535	ł					GUIDELINE	
	Sam	pie Data:	2007-02-14		╆┈┈╾╴━		<u> </u>	_		
	Sa	mple ID:	1 1991 9952	1					ODWSOG	1
				ĺ						
PARAMETER	UNITS	MDL	<u> </u>		[<u> </u>		TYPE	LIMIT	UNITS
Alkalinity as CaCO3	ma/L	5	243		{			OG	500	ma/L
Chloride	ma/L	1	8				1	AO	250	mg/L
Calqua	ТСО	z	<2	ļ		1		AO	5	TCU
Conductivity	uS/cm	5	527			1				
Dissolved Organic Carbon	mg/L	0.5	1.5					AO	5	πα/L
Fluande	Jun	0.10	0.39					MAC	1.5	mg/L
Hydrogen Sulphide	mg/L	0.01	<0.01		1			AO	0.05	mg/L
N-NH3 (Ammonia)	mg/L	0.02	0.09]	1	
N-NO2 (Nitrite)	mg/L	0.10	<0.10]			1	MAC	1.0	mg/L
N-NO3 (Nitrate)	mg/L	0.10	<0.10		1			MAC	10.0	_ mg/L
pH	-		8.13					AO	6.5-8.5	
Phenois	mg/L	0.001	<0.001					ļ	1	1
Sulphale	mg/L	1	33		[[AO	500	ոց/Լ
Tannin & Lignin	rng/L	0.1	0.2			[í i	1	J j
TDS (COND - CALC)	rng/L	5	343			}		AO	500	mg/L
Tolal Kieldahi Nitrogen	mg/L	0.05	0.15					f .	1	!
Turbidity	NTU	0.1	4.6		1		l '	AC	1.0	ΝΤΟ
Hardness as CaCO3	mg/L	1	211					06	100	mg/L
Ion Balance		0.01	0.94						1	
Calcium	l mg/L	1	45					í		1
Magnesium	mg/L	1	24							
Potassium	mg/L	1	4							
Sedium	ու	2	25					AO	20	mg/L
Iron	l mg/L	0.03	0.47 🛹		1	-		AO	0.3	mg/L
Manganese	mg/L	0.01	0.02				1	AO	0.05	тgЛ
-		4								
								,		
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MDL = Mathed Detection Limit INC = Incomplete AD = Aestholic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAL laar Supervisor

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REPORT OF ANALYSIS

Client: Paterson Group 28 Concourse Gate, Unit 1							Report Numi Date:	bor:	2703138 2007-02-19	
Nepean, ON							Date Submit	tøď:	2007-02-14	
K2E 717							·			
Atlention: Mr. Robert Pasamore							Project:		PH0482	
INVO/CE: Palerson Group Inc.							P.O. Number	:	5391	
Chain of Custody Number: 49792							Matrix:		Water	
		LAB ID:	524534						GUIDELIN	E
	Sam	ple Date:	2007-02-14							
	Sa	mpia ID:	TW1 WS1	1				1	ODWSOG	
PARAMETER	UNITS	MDL	<u> </u>		+		+	Түре	LIMIT	
Alkalinity as CaCO3	mg/L	5	242		1	1	1	06	500	mail
Chloride	mg/L	1	7	1		1		AO	250	ma/L
Colour	TCU	2	2					AO	5	TCU
Conductivity	uS/em	5	527				1 I			1
Dissolved Organic Carbon	mg/L	0.5	1.7					AO	5	rma/l
Fluoride	mg/L	0.10	0.36	í	1			MAG	1.5	maΔ
Hydrogen Sulphide	mp/L	0.01	0.01	1		1		AO	0.05	កាល
N-NH3 (Ammonia)	mg/L	0.02	0.10	4						
N-NO2 (Ninite)	mg/L	0.10	<0.10		1		1	MAC	1 10	mod
N-NO3 (Nitrate)	mg/L	0.10	<0.10			1	i i	MAC	10.0	molt
pH	_		8,10			1	1	AC	65-85	
Phenois	mg/L	0.001	<0.001		1	1		1		
Sulphale	mg/L	1	34				[AG	500	
Tannin & Lignin	rng/L	D.1	0.2						1	
TDS (COND - CALC)	mg.A_	5	343		1		1	AO	500	mo/L i
Total Kjeldahl Nitrogen	mg/L	0.05	0.15				[
Turbidity	NTU	0,1	12.0					AO	1.0	NTU
Hardness as CaCO3	mg/L	1	232			}		OG	100	mo/L
Ion Balance		0,01	0.99			J				
Calcium	mg/L	1	50			Į				1
Magnesium	mg/L	1	26	l				ſ		
Polassium	നൃ/L	٢	5		1		1			
Sodium	mg/L	2	22		1			AC I	20	me/i
iran	mart	0.03	0.65					AO	0.3	mo/t
Manganese	ma/L	0.01	0.62		1			AO	0.05	mo/f
		2								

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAL Ewilo Me Inorganje Cab Supervisor

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REPORT OF ANALYSIS

Client: Paterson Group							Report Numb	jet:	2704804	
28 Concourse Gale, Unit 1							Date:		2007-03-15	
Nepean, ON							Date Submitt	ed:	2007-03-12	
K2E 717										
Attontion: Mr. Robert Passmore							Project:		PH0482	
NVOICE: Paterson Group Inc.							P.O. Number:	:	4247	
Chain of Custody Number: 51925							Matrix:		Water	
		AB ID;	529574	529575					GUIDELINE	
	Sampl	e Dale:	2007-03-12	2007-03-12						
	Sam	ipte ID:	TW2 WS1	TW2 WS2					ODWSOG	
PARAMETER	UNITS	MDL						TYPE		UNITS
Total Coliforms	ct/100mL		0	0)		MAC	0	cl/100mL
Escherichia Coli	ct/100mL		0	0		1		MAC	0	cl/100ml
Heterotrophic Plate Count	ct/1mL		>500	185				1		1
Feecal Coliforns	ct/100mL		0	Ď	[1			
Faecal Streptococcus	ct/100mL		0	0	[1			
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MDL = Matted Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operationed Guideline MAC = Maximum Allowable Concentration IMAC = Interim Meximum Allowable Concentration Comment:

APPROVAL true Krista Quantrill Microbiology Analyst

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REPORT OF ANALYSIS

Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2E 7T7						Report Numi Date: Date Submit	ber: led:	2704803 2007-03-15 2007-03-12		
Attention: Mr. Robert Passmore							Project:		PH0482	
INVOICE: Paterson Group Inc.							P.O. Number	:	4247	
Chain of Custody Number: 51925			1				Matrix:		Water	
	_	LAB D:	529572	529573				-∥	GUIDELINI	
	Samp	ale Date:	2007-03-12	2007-03-12		· · ·		4		
	Şa	mple ID:	1002 0051	19972 99 52]		ODWSOG	
PARAMETER	UNITS	MDL					<u> </u>	TYPE		
Alkalinity as CaCO3	mg/L	5	193	199		1		06	500	ла/L
Chloride	mp/L	1	6	6	1		1	E AO	250	ma/L
Colour	TCU	2	<2	<2		ļ		AO	5	TCU
Canductivity	uS/cm	5	414	419				1		
Dissolved Organic Carbon	mg/L	0.5	2.8	2.4				AO	5	
Fluaride	mg/L	0.10	0.43	0.42				MAC	1.5	ma/L
Hydrogen Sulphide	mg/L	0.01	0.02	0.02	ļ			AO	0.05	ma/L
N-NH3 (Ammonia)	mg/L	0.02	0.23	0.23	1			_		
N-NO2 (Nitrite)	mg/L	0.10	<0.10	<0.10				MAC	1.0	ma/L
N-NO3 (Nitrale)	mg/L	0.10	<0.10	<0.10	1	í	ļ	MAC	10.0	ma/L
ρH	-		8.29	8.33	1		1	AO	6.5-8.5	
Phenots	mg/L	0.001	<0.001	<0.001		!	ſ			I
Sulphate	mg/L	1	20	20		[500	mar
Tanala & Lignin	mg/L	0.1	0.2	0.1					1	
TDS (COND - CALC)	mg/L	5	269	272]	AO	500	mg/L
Total Kjeldahi Nilrogen	mg/L	0.05	0.29	0.20						
Turbidity	NTU	0.1	23.4	15,6 🚈				AO	1.0	NTU
Hardness as CaCO3	mg/L	1	204	213	ſ		-	OG	100	mark
Ion Balance	_	0.01	1.06	1.06			1	[
Calcium	mg/L	1	37	39						
Magnesium	mg/L	1	27	28						
Potassium	mg/L	1	5	4						
Sodium	mg/L	2	12	11				AO	20	ma/L
Iron	mg/L	D,03	1.47	0.33				AO	0.3	നവി
Manganese	mg/L	0.01	0.03	0.02				AD	0.05	mo/L
	-									

MDL = Method Detection Limit INC = Incomplete AO = Aesthebic Objective OG = Operational Guideline MAC = Maximum Alcowoble Concentration IMAC = Interim Maximum Alcowoble Concentration Comment:

529572: Holding time for furbidity analysis was exceeded

529573: Holding time for turbidity analysis was exceeded.

APPROVAL: Ewar lugginic Lab Supervisor

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REPORT OF ANALYSIS

Client: Paterson Group 28 Concourse Gate, Unit 1 Nepeen, ON K2E 717							Report Num Oste: Date Submit	ber: ted:	2704187 2007-03-08 2007-03-02	I
Attention: Mr. Robert Passmore							Project:		PHO482	
INVOICE, Palerson Group Inc.							P.O. Number	r:	4251	
Chain of Custody Number: 55862			· · · · · · · · · · · · · · · · · · ·				Matrix:		Water	
	_	LAB ID:	527607	527608	<u></u>			_ 	GVID ELIN	5
	Sam	ple Date:	2007-03-01	2007-03-01		<u> </u>				
	Sa	impla !D:	1003 0051	TW3 WS2	Í			ľ	ODWSOG	
PARAMETER	UNITS	MDL			<u> </u>	<u> </u>	÷	TYPE	LIMIT	UNITS
Alkalinity as CaCO3	mg/L	5	212	212	<u> </u>			OG	500	mg/L
Chloride	ing/L	1	44	44	1	l]	AD	250	ጠባ/ኒ
Colour	עסד	2	2	<2	1			AO	5	TCU
Conductivity	uS/cm	5	617	619				1		
Dissolved Organic Carbon	rng/L	0.5	1.6	1.5			1	AO	5	mari
Fluoride	mg/L	0.10	0.30	0.30				MAC	1.5	ma/L
Hydrogen Sulphide	mg/L	0.01	<0.01	<0.01				AO	0.05	ma/L
N-NH3 (Ammonia)	rng/L	0.02	0.08	<0.02	Į					
N-NO2 (Nrtile)	; mg/L	0.10	<0.10	<0.10	1		i	MAC	1.0	mo/L
N-NO3 (Nitrate)	mg/L	0.10	<0.10	<0.10		1		MAC	19.0	mo/L
ρH			7.97	8.00				AO	6.5-8.5	'*-
Phenois	mg/L	0.001	<0.001	<0.001	1		1		_	
Sulphale	[mg/L	1	40	48		í		AO	500	man
Teania & Lignia	mg/L	0.1	<0.1	<0.1			(}	
TDS (COND - CALC)	mg/L	5	401	402		f	1	AO	500	mat
Total Kjeldahi Nitrogen	mg/L	0.05	0.11	0.0 9		1		H		
Turbidity	NTU	0.1	2.3	1.9			ĺ	AO	1.0	NTU 1
Hardness as CaCO3	mg/L	1	252	261		{	[OG	100	ma/L
Ion Balance		0.01	1.01	1.03		1		ļ		
Calcium	mg/L	1	-58	60						1 1
Magnesium	mgriL	1	26	27						
Potassium	mg/L	1	4	4		l				
Sodium	mg/L	2	32	32			l 1	AO	20	mar
Iron	mg/L	0.03	0 25	0.26			•	AO .	0.3	ma/L
Manganese	"Ngm	0,01	0.02	0.02				AO	0.05	mg/L

MDL = Method Detection Limit INC = Incomplete AO = Assthutic Objective OG = Operational Guideline MAC = Maximum Alcowable Concentration IMAC = Interim Maximum Alcowable Concentration Comment:

APPROVAL ı Şapervisor

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REPORT OF ANALYSIS

						Report Numi Date: Date Submitt Project: P.O. Number	per: keđ:	2704188 2007-03-05 2007-03-02 PH0482	
						Matrix:	-	Waler	
	LAB ID:	527614	527615		1	1	1	GUIDELINE	
Samp	le Date:	2007-03-01	2007-03-01				F		
San	npłe iD:	TW3 WS1	TW3 WS2				Ĩ	odwsog	
UNITS	MDL			· · · · ·			TYPE	LIMIT	UNITS
cl/100mL		0	Q		1		MAC	0	c#100mL
ct/100mL		0	0		1	1	MAC	Ó	ct/100mL
ct/1mL		0	0						
cl/100mL		0	a		1				
ct/100mL		0	C						
	Samp Sam CV100mL CV100mL CV100mL CV100mL CV100mL	LAB ID: Sample Date: Sample ID: UNITS MDL cl/100mL cl/100mL cl/100mL cl/100mL	LAB ID: 527614 Sample Date: 2007-03-01 Sample ID: TW3 WS1 UNITS MDL 0 cU100mL 0 cU100mL 0 cU100mL 0 cU100mL 0 cU100mL 0 cU100mL 0 cU100mL 0	LAB ID: 527614 527615 Sample ID: 2007-03-01 2007-03-01 Sample ID: TW3 WS1 TW3 WS2 UNITS MDL 0 0 cl/100mL 0 0 0 cl/100mL 0 0 0 cl/100mL 0 0 0 cl/100mL 0 0 0 cl/100mL 0 0 0 cl/100mL 0 0 0 cl/100mL 0 0 0	LAB ID: 527614 527615 Sample Date: 2007-03-01 2007-03-01 Sample ID: TW3 WS1 TW3 WS2 UNITS MDL 0 0 cV100mL 0 0 0 cV100mL 0 0 0 cV100mL 0 0 0 cV100mL 0 0 0 cV100mL 0 0 0 cV100mL 0 0 0 cV100mL 0 0 0	LAB ID: 527614 527615 Sample Date: 2007-03-01 2007-03-01 Sample ID: TW3 WS1 TW3 WS2 UNITS MDL 0 0 cV100mL 0 0 0 cV100mL 0 0 0 cV100mL 0 0 0 cV100mL 0 0 0 cV100mL 0 0 0 cV100mL 0 0 0 cV100mL 0 0 0 cV100mL 0 0 0 cV100mL 0 0 0	Image: Number Date: Date Submit Date: Date Submit Date: Date Submit Date: Date Submit Date: Project: P.O. Number Matrix: P.O. Nu	LAB ID: 527614 527615 Project: Sample Date: 2007-03-01 2007-03-01 Project: Sample Date: 2007-03-01 2007-03-01 Project: Sample Date: 2007-03-01 2007-03-01 Project: Sample Date: Sample Date: 2007-03-01 Project: Project: VMTS MDL Project: Project: Project: UNITS MDL Project: Project:	Report Number: 27/W188 2007-03-02 Date: 2007-03-02 Project: PH0482 Project: Valer Project: Valer Sample Date: 2007-03-02 Project: Valer Sample Date: 2007-03-02 Project: Valer Sample Date: 2007-03-01 ODWSCG Subscription Subscription VMNTS MOL TW3 WS1 TW3 WS2 ODWSCG ODWSCG VMNTS MOL 0 0 MAC 0 c#100mL 0 0 MAC 0 0 c#100mL 0 0 MAC 0 0 c#100mL 0 0 O MAC 0 c#100mL 0 0 O MAC 0 c#100mL 0 0 O Image: State St

MDL = Method Detection Limit INC = Incomplete AC = Aesthetic Objective IDC = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment.

APPROVA Krista Quantrill Microbiology Analysi

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REPORT OF ANALYSIS

Client: Paterson Group 28 Concourse Gale, Unit 1 Nepesn, ON K2E 7T7							Report Num Dato: Date Submit	iber: Ited:	2704215 2007-03-12 2007-03-02	2
Attention: Mr. Robert Passmore							Project:		PH0482	
INVOICE: Paterson Group Inc.							P.O. Numbe	r:	4251	
Chain of Custody Number: 55863							Matrix:		Water	
		LAB ID:	527650	527651					GUIDELIN	E
	Sam	ple Date:	2007-03-02	2007-03-02						
	Sa	smpte ID:	TW4 WS1	TW4 WS2					ODWSOG	•
PARAMETER	UNITS	MDL	·	·	<u> </u>			TYPE	11001	LINITS
Alkalinity as CaCO3	որն	5	240	242	1			00	500	
Chloride	mg/L	1	5	2	1			AO	250	mo/l
Colour	t TCU	2	<2	<2	1	ł		AO	5	TCU
Conductivity	uS/om	5	525	525		•				
Dissolved Organic Carbon	mg/L	0.5	1.2	1.3	1			40		
Fluoride	ma/L	0.10	0.12	0.12			1	MAC	1.5	ang/L
Hydrogen Sulphide	me/L	0.01	<0.01	NZA		1		A.0	1.2	mg/L
N-NH3 (Ammonia)	ma/L	0.02	0.03	<0.02		ļ			0.00	, ing/L
N-NO2 (Nitrite)	ma/L	0.10	<0.10	<0.10				MARC	1	
N-NO3 (Nitrate)	ma/L	0.10	<0.10	<0.10		1		MAC	10.0	enger_
рН	Ū		7.94	7.90				100	5596	ing/L
Phenois	mo/L	0.001	<0.001	<0.001					0.5-0.5	1
Sulphale	mo/L	1	43	44		1			¥00	
Tannin & Lignin	mgit	0.1	<0.1	<0.1					500	mg/L
TDS (COND - CALC)	mg/L	5	341	341]		40	600	
Total Kjeldehl Nitrogen	mo/L	0.05	<0.05	<0.05					300	I IIG*L
Turbidily	עדא	0,1	10.B	64.9			i i	1 AD		1 100
Hardness as CaCO3	mg/L	1	268	291					1.00	med
ton Balance		0.01	1.04	1.05		ì			100	ing/L
Calcium	mg/L	1	71	72		1				
Magnesium	mg/L	1	27	27		1			:	
Potassium	mg/L	1	1	1						
Sođium	movL	2	6	6				40	20	mail
Irón	ma/L	0.03	0.26	0.69		ſ			20	ng/L
Manganese	ma/L	0.01	0.04	0.06			1		0.05	mgµ∟ ma/
									0.00	1181.6
		1				1				

MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration INAC = Interim Maximum Allowable Concentration Comment:

527651: H2S analysis is not available due to cloudy sample. N/A = Not Available.

APPROVAL inonanic Lab Supervisor

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REPORT OF ANALYSIS

Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON							Report Numb Date: Date Submitt	ber: Re d:	2704213 2007-03-05 2007-03-02	
Attention: Mr. Robert Passmore							Project:		PH0482	
INVOICE: Palenson Group fric							P.O. Number, Mateixe	;	4251	
Chain of Custody Number: 55883			617648	527640	_·	· · · · · · · · · · · · · · · · · · ·	MAURI	-	CUDELINE	
	5	LAG ID; In Data:	2007-03-02	2007-03-02		-			GOIDECINE	
	a annp Sar	nnie ID:	TW4 WS1	TW4 WS2	<u> </u>	<u> </u>	1	-		
	U .								ODWSOG	
PARAMETER	UNITS	MDL						TYPE	LIMIT	UNITS
Total Coliforms	cV100mL		Û	0	1			MAC	0	ct/100mL
Escherichia Coll	cV100mL		Ð	0				MAC	0	al/100mL
Heterotrophic Plate Count	ct/tmL		Û	0	Į			Π		
Faecal Coliforms	ct/100mL		0	0	1		1	1		
Faecal Streptococcus	c1/100mL		0	0				ſ	1	
					Ì			1		
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MDL = Method Detection Limit SNC = Incomplete AC = Aesthetic Objective DG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAU Krista Quantrill Microbiology Analyst

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REPORT OF ANALYSIS



Cilent: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2E 7T7 Attention: Mr. Robert Passmore INVOICE: Paterson Group Inc. Chain of Custody Number: 124240						Report Numb Date: Date Submitt Project: P.O. Number Matrix:	9er: Xed: :	1025567 2010-10-25 2010-10-18 PH0482	
		LAB ID:	837627		<u></u>			GVIDELINE	
	ple Date: ample ID:	2010-10-18 TW4 WS10/ 18							
PARAMETER	UNITS	MRL				-	TYPE	LIMIT	UNITS
Total Coliforms	CFU/100mL		Õ]					
Escherichia Coll	CFU/100mL		0	1	1			ļ	
Heterotrophic Plate Count	CFU/1mL		0		1				
Faecal Coliforms	CFU/100mL		0				f.		
			U						

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAL: Jennifer Mitchell Microbiology/Lab Supervisor

Methods references and/or additional QA/QC information available on request.

REPORT OF ANALYSIS



Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2E 7T7 Attention: Mr. Robert Passmore INVOICE: Paterson Group Inc.				Report Num Date: Date Submit Project: P.O. Number	ber: led: :	1022331 2010-09-20 2010-09-15 PH0482 7892			
Callant of Callody Mumper: 129081					 .	Matrix:		Water	
	D	LAB ID:	828613	828614	·	<u> </u>			
	ងណា	pie Date:	2010-09-14	2010-09-14	 		-		
	36	impie iu:	14/09/10	14/09/10				ODWSOG	
PARAMETER	UNITS	MRL					TYPE	LIMIT	
Total Collforms	CFU/100mL		OG	OG	1		MAC	0	CFU/100mL
Escherichia Coli	CFU/100mL	i	0	0	1		MAC	Ō	CFU/100mL
Helerotrophic Plete Count	CFU/1mL		82	58	1		1	-	
Faecal Collforms	CFU/100mL		0	0		1			

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment: 828613: OG = Overgrown.

828614: OG = Overgrown.

APPROVAL Jennifer Mitchell Microbiology Lab Supervisor Results relate only to the parameters tested on the samples submitted.

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REPORT OF ANALYSIS



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Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2E 7T7							Report Numi Date: Date Submit	ber: ted:	1022296 2010-09-21 2010-09-14	
Attention: Mr. Robert Passmore							Project:		PH0482	
INVOICE: Paterson Group Inc.							P.O. Number	-:		
Chain of Custody Number: 129681							Matrix:		Water	
		LAB 1D:	828519	828520					GUIDELIN	
	San	nple Date:	2010-09-14	2010-09-14					· · ·	
	5	ample ID;	WS1-TW4-	WS2-TW4-					DDWSOG	
			14/05/10	14/09/10						
PARAMETER	UNITS	MRL				1		TYPE	1 IMIT	UNITS
Alkalinity as CaCO3	mg/L	5	195	195		· -		00	500	
Chloride	mg/L	1	45	44				AO	250	mail
Colour	TCU	2	<2	2				AO	5	
Conductivity	uS/cm	5	579	577					, v	100
Dissolved Organic Carbon	ma/L	0.5	1.4	1.5				1 40	-	
Fluoride	ma/L	0.1	0.34	0.33				1 MAG	1 5	mg/L
Hydrogen Sulphide	ma/L	0.01	<0.01	<0.01			1		0.05	mg/L
N-NH3 (Ammonia)	ma/L	0.02	0.03	0.03					0.05	mg/L
N-NO2 (Nivile)	ma/L	01	<0.00	<0.00					1.0	
N-NO3 (Nitrate)	mod	01	<0.10	<0.10	1	ſ		MAC		mg/∟
pH	, ingre	0.,	8 18	9.21				MAC	10.0	mg/L
, Phenois	t ma/l	0.001	<0.001	<0.001				l I	0.5-8.5	
Sulphate	mo/	1	37	~0.001			1	1		
Tannin & Lionin	mg/L		-01	-01				AU	500	mg/L
Total Dissolved Solids (COND - CALC)	mo/	5.1	376	-0.1						
Total Kieldahl Nitrogen	mg/C	0.1	-010	375				AO	500	mg/L
Turbidity	NTU	0.1	\$0.10	<0.10			i			
Hardness as CaCO3		0.1	0.0	0.4				MAC	1.0	NTU
In Balance	mg/L	1	21/	215				OG	100	mg/L
Celclum		0.01	1.01	0.99						
Manasium	mg/L		49	48				li		
Polescium	mg/L		23	23						
Sodium	mg/∟	1	4	4					·	
kan la statistica de la statistica de la statistica de la statistica de la statistica de la statistica de la st	mg/L	2	36	34				AO	200	mg/L
Mon	mg/L	0.03	0.12	0.11				AO	0.3	mg/L
indi iĝa la 26.	mg/L	0.01	0.02	0.02				AO	0.05	mg/L
							,			

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Meximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAC Ewan McBobbie Ingrganic Lab Supervisor

REPORT OF ANALYSIS

Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2E 7T7							Report Num Date: Date Submi	iber: Ited:	2704935 2707-03-19 2007-03-14	l
Attention: Mr. Robert Passmore							Project:		PH0482	
INVOICE. Paterson Group Inc. Chain of Custody Number: 51926							P.O. Numbe Matrix;	F.	4247 Weler	
		LAB ID:	529993	529994					GUIDELIN	£
	Samp	lo Date:	2007-03-13	2007-03-13						
	Sar	npie (D;	TW5 WS1	TW5 WS2					DDWSOG	
PARAMETER	UNITS	MDL			Ţ			TYPE		UNITS
Total Coliforms	ci/100mL		3	۵		1	1	MAC	1 0	CI/100m1
Escherichia Coli	ct/100mL	;	0	ð				MAC	a	cl/100ml
Heterotrophic Plate Count	cl/1mL		17	21					_	
Faecal Coliforns	ct/160mL		0	0						
Faecal Streptocaccus	ct/100mL		0	0		1			ĺ	
		i								
	l l									
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MDL = Mothod Detection Limit INC = Incomplete AO = Aesthetic Objective QG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Internet Maximum Allowable Concentration Comment

APPROVAL Krista Quantrill Microbiology Analyst

REPORT OF ANALYSIS

Client: Paterson Group						nber:	er: 2704924		
28 Concourse Gale. Unit 1						Date:		2007-03-19	
Nanean ON						Date Submi	itted:	2007-03-14	
K2F 717									
Attention: Mr. Robert Passmore						Project:		PH0482	
						E O. Numbe	۱۳ [.]	6247	
INVOICE: Paterson Group Inc.						Latrix.	24 1	Weler	
Chain of Custody Number: 51926		1.80.10.	620077	526078	1 1	BIRNING		GUIDECINE	
	£	LAD ID:	2007 09 13	2007-03-13		··· · · · ·		0010100110	·
	-3414 Co	mole iD:	TW5 WS1	TW5 W52	÷				
	38	nihte to:						ODWSOG	
PARAMETER	UNITS	MDL					TYPE		
Alkalinity as CaCO3	ma/L	5	178	178			0G	500	mg/L
Chloride	ma/L		4	4	1		AO	250	mg/L
Colour	TGU	2	<2	3			AO	5	TCU
Conductarity	uStorn	5	376	376					
Discrimenty Discriment Organic Cathon	ma/L	0.5	1.7	1.7			AD	5	mg/L
Elioride	itto/L	0.10	0.71	0.71			MAC	1.5	mg/L
Hydrogen Sulphide	mo/L	0.01	<0.01	<0.01			AO	0.05	ma/L
N_NH3 (Ammonio)	mnA.	0.02	0.14	0.14	1		1 -	-	
N. N.(72 /Nikvite)	ma/L	0.10	<0.10	<0.10			MAC	i .0	mail
	mo/i	0.10	<0.10	<0.10			NIAC	10.0	maiL
			8,19	8.20			AO	6.5-8.5	~ u - ,
ph Phonois	me/L	0.001	<0.001	<0.001					1
Sulahota	ma/l	1	15	15		Į	AO	500	mg/L
Tannin & Lignin	ma/l	0.1	0.1	0,1				1	
TOS (COND - CALC)	ma/l	5	244	244			AO	500	, ma/∟
Tatal Kieldahi Nitrogen	ma/L	0.05	0.17	0.17	Ì			ļ	
Turkirlihr	NTU	0.1	0.3	0.6			DA I	4.0	NTU
Hardoess as CaCO3	ma/L	1	121	127			i og	100	mg/L
		9.01	0,96	1.00				ļ	
Calcium	ma/L	1	22	23			l		
Maonesium	ma/L	1	16	17					
Potaesium	mo/L			4					1 1
Sodam	rw/L	2	31	31			AO	20	ma/L
Iran	mo/	0.03	0.05	0.05			AQ	0.3	ma/L
Manganese	mont	0.01	<0.01	<0.01			AO	0.05	ma/L
Inter (Rei I care	1440 -								
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MDL = Method Detection Limit INC = Incomplete AO = Aesthetic Objective OC = Operational Guideline MAC = Maximum Alowable Concentration IMAC = Interim Maximum Alowable Concentration Comment;

APPROVAL inorg Supervisor

8-146 Culomade Road, Ottawa, ON, K2E 7Y1 608 Nonis Court, Kingston, ON, K7P 2R8

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A COLITEST LABORATORIES LTD			. <u> </u>			<u></u>	ORIC	H ANA	11313
ACCUTEST LABORATION ALO TIP						Report Humber:	:	2705468	
lient: Paterson Group						Date:		2007-03-20	
28 Concourse Gate, Unit 1						Ozta Submitted	•	2001-00-22	
Nepean, ON						19 I		PH0482	
K2E 717						Project			
tiention: Mr. Robert Passmore						D.O. Number			
						Matrix:		Water	
VOICE: Paterson Group Inc.								GUIDELINE	
hain of Custody Number. 5215-		LAB IO:	531325	531326					
	Samp	a Date:	2007-03-21	2007-03-21				പാരടവദ	
	Sar	npte ID:	TWGWST	1 140 41 22				051130G	
									T
				┞─────┤			TYPE		
PARAMETER		MDL		0			MAC	0	
	ct/100mL			0			MAC	0	CV100m
scherichia Coli	ct/100miL			- 1					1
Heterotrophic Plate Count	ci/1mL		Ň	a	ļ				
Faecal Coliforns				G					
Faecal Strendodoccus	CI/100ML			-					
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MOL = Method Detection Linit INC = Incomptete AO = Asstratic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration MAC = Interim Maximum Allowable Concentration

Comment:

There APPROVAL: Ksista Quantrilt Microlaiology Analyst

2001/003

ACCUTEST LABORATORIES LTD				,	·	RE	PORT	OF ANA	LYSIS
Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON						Report Num Date: Oate Submit	ber: led:	2705474 2007-03-26 2007-03-22	
K2E 7T7						Project:		PH0482	
INVOICE: Paterson Group Inc. Chain of Castody Number: 52194					<u></u>	F.O. Number Matrix:		Water	
		LAB D:	531353	531354				GUIDELINE	<u>.</u>
	Sam.	ple D <i>a</i> te:	2007-03-21	2007-03-21					
	Sa	mpie ID:	TW6 WS1	TW6 W 52				ODWSOG	
PARAUFTER		MOL		<u> </u>	╆───┼╌		TYPE	LIMIT	UNITS
Alkalinity as CaCO3	mg/L	5	227	226			OG	500	mg/L
Chiadre	mg/L	1	7	7			AO	250	mg/L
Colour	TCU	2	3	3		1	AO	5	TCU
Conductivity	US/cm	5	477	475				l	
Dissolved Omanic Carboo	mp/L	0.5	2.0	2.1			AO	5	mg/L
Euoride	mg/L	0.10	0.32	0.32	t i		MAC	1.5	mg/L
Hydrogen Sulphide	ma/L	0.01	0.01	<0.01			AO	0.05	mg/L
N-NH3 (Ammonia)	mg/L	0.02	0.15	0.15	4 1				
	mg/L	0,10	<0.10	<0.10			MAC	1.0	mg/L
N-NO3 (Nitrate)	mg/L	0.10	<0.10	<0.10	1		MAC	10.0	mg/L
nH			8.11	8.14			AO	6.5-B.5	
Phenols	mg/L	0.001	<0.001	<0.001	{				
Sulphate	mg/L	1	24	24	£		AO	500	mg/L
Tanoin & Lignin	mg/L	0.1	0.2	0.2	I		1		1
TOS (COND - CALC)	mo/L	5	310	309	1		AO	500	mg/i.
Total Kjeldahl Nitrogen	mg/L	0.05		-					
Turbidity	NTU	0.1	1.0	1.0			AO	1.0	NITU
Hardness as CaCO3	mg/L	1	222	229			00	100	mg#L

28/03 2007 16:10 FAX 813 727 5222

APPROVAL:

AO

AO

AO

Ewan McRobbie Inorganic Lab Supervisor

20

0.3

0.05

mg/L

mg/L

mg/L

·____

Ion Batance

Magnesium

Potassium

Manganese

Comment:

Sodium

Iron

Calcium

0.95

47

27

3

7

0.18

0.01

0.01

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1

2

0.03

0.01

MDL = Mathod Detection Limit INC = Incomplete AO = Acothetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

mg/L

mg/L

rng/L

mg/L

mg/L

mg/L

D.91

46

26

3

6

0.17

0.01

REPORT OF ANALYSIS

Client: Paterson Group 28 Concourse Gate, Unil 1 Nepean, ON K2E 7T7 Attention: Mr. Robert Passmore INVOICE: Paterson Group Inc. Chain of Custody Number: 74467	LAB ID: Ne Dete: mple ID:	600527 2008-01-24 7445 WS1 71-7	600528 2008-01-24 TW5 WS2 Tw-7			Report Num Date: Date Submit Project: P.O. Number Matrix:	ber: ted: :	2801811 2008-01-28 2008-01-25 PH0482 5758 Water GUIDELINE		
PARAMETER	UNITS	MRL	<u> </u>	<u> </u>		· ·		TYPE	1 10017	l hereit
Total Coliforns	ct/100mL		0	0		<u> </u>	·	MAC		UNITS
Escherichia Coli	ct/100mL		0	ō				MAC		ct/100mL
Relerotrophic Plate Count	ct/1mL		D	D						
Faecai Coliforms	ct/100mL		D	0		[
	ct/100mL		C	Ð						
					;					
				-						
MRL = Nethod Department (mit, INC = Incomplete, AD = A patients Objective		10.11.0						Lj		

MRL = Method Reporting Limit INC = Incomplete AD = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAL: Tim McCooeye QC Manager

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REPORT OF ANALYSIS

Client: Paterson Group 28 Concourse Gale, Unit 1 Nepean, ON K2E 777	Report Number: Date: Date Submitted:	2801841 2008-01-30 2008-01-25
Attention: Mr. Robert Passmore	Project:	PH0482
INVOICE: Paterson Group Inc.	P.O. Number:	5758

Chain of Custody Number: 74457	·	Matri					rix: Water			
		LAB ID:	600605	600606					GUIDELINE	
	Sam	ple Date:	2008-01-24	2008-01-24						
	Sa	mpia 10:	TW5WS1 TW7	T₩5 ₩S2 T∾ 1					ODWSOG	
PARAMETER	UNITS	MRL						TYPE		UNITS
Alkalinity as CaCO3	mg/L	5	398	399,	1			00	500	ma/L
Chloride	mg/L	1	20	20	£			AO	250	ma/L
Colour	TCU	2	26	26	1			AO	5	TCU
Conductivity	uS/cm	5	1090	1090	1				_	
Dissolved Organic Carbon	mg/L	0.5	14.8	13.2				AO	5	mo/l
Fluoride	mg/L	0.10	<0.10	<0.10			ľ	MAC	t.s	mo/L
Hydrogen Sulphide	mg/L	0.01	0.01	0.01				AO	0.05	ma/L
N-NH3 (Ammonie)	mg/L	0.02	0.77	0.76	1	·				
N-NO2 (Nitrite)	mg/L	0.10	<0.10	<0.10	-			MAC	1.0	mail
N-NO3 (Nitrate)	ጠይ/L	0.10	<0.10	<0.10	!			MAC	10.0	mail
рH			7.95	7.95	1		1	AD	6.5-8,5	
Phenois	mg/L	0.001	<0.001	<0.001			1			
Sulphate	mg/L	1	202	200				AO	500	mg/L
Tannín & Lignin	mg/L	0.1	1.0	1.1						
TDS (COND - CALC)	mg/L	5	708	`708]	1		AO	500	mg/L
Total Kjeldahl Nitrogen	mg/L	0.10	1.29	1.23	4			N .		_
Turbidily	NTU	0,1	26.5	27.6	4	·		AO	1.0	NTU
Haroness as CaCO3	mg/L	1	635	649	1		{	OG	100	ma/L
Ion Balance		0.01	1.05	1.07	1					5
Calcium	tng/L	1	175	179	i			1		•
Magnesium	mg/L	1	48	49	1			i i		
Potassium	mg/L	1	2	2	í .			ľ		
Sodium	mg/L	2	13	13	i i			AO	20	mg/L
Iron	mg/L	0.03	4.78	4.73	i i			AO	0.3	mg/L
Manganese	mg/L	0.01	0.30	0.30			[AO	0.05	mg/L

MRL = Method Reporting Limit INC = Incomplete AQ = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAL: obbie Ewate ic Lab Supervisor Inor

8-146 Colonnade Roled, Ohawa, ON, K2E 7Y1 608 Norris Court, Kingston, ON, K7P 2R9

EAUVA AUCUTESI

REFURT OF ANAL (SIS



Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2E 7T7 Attention: Mr. Robert Passmore INVOICE: Paterson Group Inc.							Report Numbo Date: Date Submitte Project: P.O. Number:	er: ed:	2929266 2009-11-30 2009-11-27 PH04B2 8378	
Chain of Custody Number: 105053		1.4.0.10	700544	709545	· · · ·			11		
	-	LAB ID:	763514	/63515			ļ		GUIDELINE	
	Sam	pie Date:	2008-11-27	2009-11-27			-			
	Sa	amplé ID:	1 1 4 1 - 4 4 9 1 - 0 9	1441-4422-09				[ODWSOG	
						-				·
PARAMETER	UNITS	MRL	<u>_</u>]	[]	TYPE		UNITS
Total Coliforms	CFU/100mL		a	D			4	MAG		GFU/100mL
Escherichia Coli	CFU/100mL		0	0			1	MAC	U U	CFU/100mL
Heterotrophic Plate Count	CFU/1mL			3		,				
Faecal Coliforms	CFU/100mL			U				i		
Faecal Streptococcus	CFU/100mL		0	0						

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAL:

Dragana Dzeletovic Microbiology Analyst LAOVA ACCULSE

RE- URT UN ANALYSIU



Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2E 7T7 Attention: Mr. Robert Passmore							Report Numb Date: Date Submitte Project:	er: 9 d:	2929267 2009-12-03 2009-11-27 PH04B2	
INVOICE: Paterson Group Inc. Chain of Custody Number: 105053							P.O. Number: Matrix:	E1	8378 Water	
	-	LAB ID:	763516	763517			<u> </u>		GUIDELINE	
	San	nple Date:	2009-11-27	2009-11-27	<u>}</u>	1				
	5	ample ID:	1001-0021-09	1007-0052-09					ODWSOG	
PARAMETER	UNITS	MRL					1	TYPE	LIMIT	UNITS
Alkalinity as CaCO3	mg/L	5	382	384				OG	500	mg/L
Chloride	mg/⊾	1	16	16				AO	250	mg/L
Colour	тси	2	19	21				AO .	5	TCU
Conductivity	uS/cm	5	938	941						
Dissolved Organic Carbon	mg/L	0,5	10.8	12.4				AO	5	mg/L
Fluoride	mg/L	0.1	0.14	0.14				MAC	1.5	mg/L
Hydrogen Sulphide	mg/L	0.01	<0.01	<0.01				AO	0.05	mg/L
N-NH3 (Ammonia)	mg/L	0.02	0.65	0.65						
N-NO2 (Nitrite)	mg/L	0,1	<0.10	<0.10				MAC	1.0	mg/L
N-NO3 (Nitrate)	mg/L	0.1	<0.10	<0.10				MAC	10.0	mg/L
pH			7,96	7.97			}		6.5-8.5	l f
Phenois	mg/L	0.001	<0.001	<0.001						
Sulphate	mg/L	1	122	130				AO	500	mg/L
Tannin & Lignin	mg/L	0.1	0.8	0.8				ļ.		!
Total Dissolved Solids (COND - CALC)	mg/L	5	610	612				AO	500	mg/L
Total Kjeldahl Nitrogen	mg/L	0.1	0.72	0,64]	
Turbidity	NTU	0.1	21.0	19.0				MAC	1.0	ΝΤυ
Hardness as CaCO3	mg/L	1	482	484				OG	100	mg/L
Ion Balance		0,01	C.97	0.96						ľ
Calcium	mg/L	j 1	127	128						
Magneslum	mg/L	1 1	40	40						
Polassium	mg/L	1	2	2						
Sodium	mg/L	2	14	15				AO	200	mg/L
Iron	mg/L	0.03	3,39	3.33			l í	AO	0.3	mg/L
Manganese	mg/L	0.01	0.20	0.20		ĺ		AO	0.05	mg/L

MRL = Mathod Reporting Limit INC = Incomplete AO = Aeathetic Objective DG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAL:

Ewan McRobbie Inorganic Lab Supervisor

REPORT OF ANALYSIS

Client: Paterson Group 28 Concourse Gale, Unit 1 Nepean, ON K2E 7T7 Attantion: Mr. Robert Becomerce							Report Numi Date: Date Submit	ber: ted:	1000576 2010-01-14 2010-01-12	,
Attention, INI, Robert Fassingre							Project:		PR0452	
INVOICE: Palerson Group Inc.							P.O. Number	•		
Chain of Cuslody Number: 106392			770704	r	·		Matrix:		Water	
	Sam	LAD ID:	2010 01 12					-⊮	GUIDELINE	<u> </u>
	Şalı Şa	ample ID:	WS Jan 12/10						ODWSOG	
PARAMETER		MRL			<u> </u>	<u> </u>		TYPE	LIMIT	
Total Coliforms	CFU/100mL		0			ļ		MAC	0	CFU/100mL
Escherichia Coli	CFU/100mL		0					MAC	0	CFU/100mL
Heterotrophic Plate Count	CFU/1mL		5				ł	1	}	
Faecal Coliforms	CFU/100mL		0					ł		
Faecal Streptococcus	CFU/100mL		0		1					
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MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROV/ Kaleui Krista Quantrill Drinking Water Coordinator

REPORT OF ANALYSIS

Cilent: Paterson Group 28 Concourse Gate, Unil 1 Nepean, ON K2E 7T7							Report Numi Date: Date Submitt	ed:	1000596 2010-01-20 2010-01-12	
Attention: Mr. Robert Passmore							Project:		PH0482	
INVOICE: Paterson Group Inc. Chain of Custody Number: 106392							P.O. Number Matrix:	ī	W/ater	
		LAB ID:	770726		T			T	GUIDELINE	
	San	nple Date:	2010-01-12							
	S	ample (D:	WS JAN			Γ -		71		
			12/10						ODWSOG	
PARAMETER	UNITS	MRL			· · · · · ·			TYPE	LIMIT	UNITS
Alkalinity as CaCO3	mg/L	5	337		[·				500	
Chioride	mg/L	1	15		Í			AO	250	mg/L
Colour	TCU	2	18			ł		AO	5	TCU
Conductivity	u\$/cm	5	821						1	
Dissolved Organic Carbon	mg/L	0.5	7.8]			AO	5	ma/L
Fluoride	mg/L	0.1	0.22		1	ł	1	MAC	1.5	mo/L
Hydrogen Sulphide	mg/L	0.01	<0.01]		AO	0.05	ma/L
N-NH3 (Ammonia)	mg/L	0.02	0.54					ļ		
N-NO2 (Nitrite)	mg/L	0.1	<0.10					MAC	1.0	mo/L
N-NO3 (Nitrate)	mg/L	0.1	<0.10			í		MAC	10.0	ma/L
рН	-		7.85						6.5-8.5	
Phenois	mg/L	0.001	<0.001					1		
Sulphate	mg/L	1	112					AO	500	mg/L
Tannin & Lignin	mg/L	0.1	0.5				1		1	Ŭ
Total Dissolved Solids (COND - CALC)	mg/L	5	534					AO	500	mg/L
Total Kjeldahl Nitrogen	mg/L	0.1	0.56							
Turbidity	UTN	0.1	7.0					MAC	1.0	NTU
Hardness as CaCO3	mg/L	1	372					OG	100	mg/L
ion Balance		0.01	0.92							-
Calcium	mg/L	1	93	i						
Magnesium	mg/L	1	34				J I			
Potassium	mg/L	1	3							' ļ
Sodium	mg/L	2	27					AO	200	mg/L
Iron	mg/L	0.03	1.70					AO	0.3	mg/L
Manganese	mg/L	0.01	0,10					AO	0.05	mg/L
										_

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAL Ewan McRobble Inorganic Lab Supervisor Results relate only to the parameters tested on the samples submitted.

REPORT OF ANALYSIS

ent: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2E 717 ention: Mr. Robert Passmore						Report Number: Date: Date Submitted: Project:		1001869 2010-02-01 2010-01-29 PH0482			
INVOICE: Paterson Group Inc. Chain of Custody Number: 106397			774805				P.O. Number Matrix:	:	7886 Water		
LAB ID: Sample Date: Sample ID:			774085 2010-01-29 W\$1-29-10 2					-			
PARAMETER	UNITS	MRL		[+	TYPE	LIMIT	UNITS	
Colour	TCU	2	7				1	AO	5	TCU	
Turbidity	NTU	0.1	3.4					MAC	1.0	UTN	
Iron	mg/L	0.03	0.87				ſ	AO	0.3	mg/L	
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MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAL Ewan/McRobbie Inorganio Lab Supervisor Results relate only to the narame

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REPORT OF ANALYSIS



Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2E 7T7 Attention: Mr. Robert Passmore INVOICE: Paterson Group Inc. Chain of Custody Number: 129684 LAB ID: Sample Date:			829312 2010-09-17				Report Number: Date: Date Submitted: Project: P.O. Number: Matrix:		1022585 2010-09-20 2010-09-17 PH0482 7892 <u>Water</u> GUIDELINE	
	58	ample ID:	TW8-WS2					i		
PARAMETER	UNITS	MRL						TYPE	LIMIT	UNITS
Total Collforms	CFU/100mL		1					MAC	0	CFU/100mL
Escherichia Coli	CFU/100mL		0			1		MAC	0	CFU/100mL
Heterotrophic Plate Count	CFU/1mL		88							
Faecal Collforms	CFU/100mL		0							}

MRL = Method Reporting Limit INC = Incomplete AQ = Aesthetic Objective QG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAL: Jennillec Microfil Microbiology Lab-Supervisor

REPORT OF ANALYSIS



Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2E 7T7							Report Numl Date: Date Submitt	ber: ted:	1022567 2010-09-21 2010-09-17	
Attention: Mr. Robert Passmore							Project:		PH0482	
INVOICE: Paterson Group Inc.							P.O. Number	:	7892	
Chain of Custody Number: 106399							<u>Matrix:</u>		Water	
		LAB ID:	829275						GUIDELINE	
	San	ple Date:	2010-09-16					4		
	S	ample ID:	1W8-WS1				}		ODWSOG	
				1			ĺ			
PARAMETER	UNITS	MRL		•	<u> </u>				1 MIT	
Alkelinity as CeCO3	mg/L	5	294			<u> </u>		OG	500	mg/l
Chloride	mg/L	1	13					AO	250	mo/l
Colour	TCU	2	13					AO	5	TCU
Conductivity	uS/cm	5	711						-	
Dissolved Organic Caroon	mg/L	0.5	5.0					AO	5	ma/L
Fluoride	mg/L	0.1	0.41					MAC	1.5	ma/L
Hydrogen Sulphide	mg/L	0.01	<0.01				}	AO	0.05	mg/L
N-NH3 (Ammonia)	mg/L	0.02	0.21					1		1 × 1
N-NO2 (Nitrite)	mg/L	0.1	<0.10					MAC	1.0	mg/L
N-NO3 (Nitrate)	mg/L	0.1	<0.10					MAC	10.0	mg/L
pH			8.16				ł		6.5-8.5	
Phenois	mg/L	0.001	<0.001					1		
Sulphate	mg/L	1	76			1		AO	500	mg/L
Tannin & Lignin		0.1	0.2						ļ	-
Total Dissolved Solids (COND - CALC)	mg/L	5	462					AO	500	mg/L
Total Kjeldahi Nitrogen	mg/L	0.1	0.53		1			!		-
Turbidity	NTU	0.1	0.9				1	MAC	1.0	NTU
Herdness as CaCO3	mg/L	1	248					06	100	mg/L
Ion Balance		0.01	0.94							
Calcium	mg/L	1	50							
Megnesium	mg/L	1	30							. Í
Potassium	mg/L	1	6							
Sodium	mg/L	2	51	1				AO .	200	mg/L
iron .	mg/∟	0.03	0.44					AO	0.3	mg/L
Manganese ·	mg/L	0.01	0.03					AO	0.05	mg/L
			,							}

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVA Ewan McRobbie Inorganic Lab Supervisor Results relate only to the parameters tested on the samples submitted

REPORT OF ANALYSIS



Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2E 7T7					Report Number: Date: Date Submitted:		1022614 2010-09-21 2010-09-17		
Attention: Mr. Robert Passmore						Project:		PH0482	
INVOICE: Paterson Group Inc.						P.O. Number:	:	7892	
Chain of Custody Number: 129684						Matrix:		Water	
		LAB ID:	829452					GUIDELIN	
	San	nple Date:	2010-09-17						
	Sample ID:		TW8-WS2			ODWSOG			
PARAMETER	UNITS	MRL		┥───┦──		<u> </u>	TYPE		IIMITS
Alkalinity as CeCO3	mg/L	5	286	···	<u> </u>		06	500	
Chloride	ma/L	1	13				40	260	mg/L
Colour	TCU	2	12	[5	
Conductivity	uS/cm	5	693					ľ	1
Dissolved Organic Carbon	ma/L	0.5	49			1	40		mail
Fluoride	mo/L	0.1	0.41	1			MAC	1 1 5	ing/L
Hydrogen Sulphide	ma/L	0.01	<0.01					0.05	nigiL
N-NH3 (Ammonia)	mg/L	0.02	0.21			1		0.05	mg/L
N-NO2 (Nitrite)	mo/L	0.1	<0.10				MAC	1 10	
N-NO3 (Nilrate)	ma/L	0.1	<0.10				MAC	10.0	ng/L
pH			8.18			1	MAC	6696	mg/L
Phenois	ma/L	0.001	<0.001					0.5-0.5	
Sulphate	mo/L	1	70				40	500	mat
Tannin & Lignin	mo/L	0.1	0.2					000	nig/L
Total Dissolved Solids (COND - CALC)	mo/L	5	450					500	matt
Total Kjeldahl Nilrogen	ma/L	0.1	0.73				\sim	500	mg/L
Turbidity	NTU	0.1	0.7				MAC	10	NTU
Hardness as CaCO3	mo/L	1	233				06	1.0	
ion Balance	···· e r –	0.01	0.90					100	mg/L
Calcium	ma/L	1	47						
Magnesium	ma/L		28						
Potássium	ma/L	1	5] []			
Sodium	ma/L	2	46				*0	200	
Aluminum	ma/L	0.01	<0.01					200	rng/L mail
Antimony	ma/L	0.0005	<0.0005				MAC	0.000	mg/L
Arsenic	ma/L	0.001	<0.001			! .	IMAC	0.000	mg/L
Barlum	ma/L	0.01	0.34				MAC	0.020	mg/L /
Bery 4lium	ma/L	0.001	<0.001				MAC	1.0	mg/L
Boron	ma/L	0.01	0.16				BAAC	E 0.	
Cadmium	mg/L	0.0001	<0.0001				MAC	0.005	mg/L

MRL = Method Reporting Limit INC = Incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVA Ewan McRobbie Inorganic Lab Supervisor

Results relate only to the parameters tested on the samples submitted.
EXOVA ACCUTEST

REPORT OF ANALYSIS



Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2F 77							Report Numi Date: Date Submit	ber: Ted:	1022614 2010-09-21 2010-09-17	
Attention: Mr. Robert Passmore							Project:		PH0482	
INVOICE: Paterson Group Inc.							P.O. Number	:	7892	
Chain of Custody Number: 129684							Matrix:		Water	
		LAS ID:	829452	_	·				GUIDELINE	
	San	ple Date:	2010-09-17			<u> </u>		4		
	S	ample ID:	TW8-WS2		1	1			ODWSOG	
							ļ	1		
PARAMETER	UNITS	MRI				+	4	TYDE	1 MAIT	
Chromium	ma/L	0.001	0.002					MAC	0.05	ma/l
Cobali	ma/L	0.0002	<0.0002							
Соррег	mg/L	0.001	<0.001					AO	1.0	mp/l.
Iron	mg/L	0.03	0.41				1	AO	0.3	mo/L
Lead	mg/L	0.001	<0.001					MAC	0.010	mo/L
Manganese	mg/L	0.01	0.03					AQ.	0.05	ma/L
Mercury	mg/L	0.0001	<0.0001					MAC	0.001	mg/L
Molybdenum	mg/L	0.005	<0.005							
Nickel	mg/L	0.005	<0.005							i i
Selenium	mg/L	0.001	<0.001			}		MAC	0.01	ma/L
Sillcon	mg/L	0.1	6.7							
Silver	mg/L	0.0001	<0.0001					j		
Strontium	mg/L	0.001	1.76							ļ
Thallium	mg/L	0.0001	<0.0001					-		
Titanlum	mg/L	0.01	<0.01					í.		
Vanadium	mg/L	0.001	0.002							
Zine	mg/L	0.01	<0.01					AO	5.0	mg/L
					1				ľ	-
					1					
						}				
					ļ					
							1			
	I									

MRL = Method Reporting Limit INC = Incomplete AO = Aesthelic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAL: Ewan McRobbi Inorganic Lab Supervisor Require relate only to the heremotors thered on the ear

EXOVA ACCUTEST

REPORT OF ANALYSIS



Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2F 777							Report Num Date: Date Submit	ber: ted:	1022614 2010-09-21 2010-09-17	
Attention: Mr. Robert Passmore							Project:		PH0482	
INVOICE: Paterson Group Inc. Chain of Custody Number: 129884							P.O. Number Matrix:		7892 Waler	
		LAB ID:	829452						GUIDELINE	
	San	nple Date:	2010-09-17							
	9	lample 1D:	TW8-WS2						ODWSOG	
PARAMETER	UNITS	MRL						TYPE	LIMIT	
TRIAZINE & RELATED HERBICIDES			-		1	1	1		1	1
Atrazine	ug/L	0.2	<0.2					1		
De-ethylated atrazine	ug/L	0.5	<0.5							
Cyanazine	ug/L	1	<1		!			IMAC	10	ua/L
Metalachior	ug/L	0.5	<0.5		1			IMAC	50	ua/L
Prometryne	ug/L	0.25	<0.25	ļ				IMAC	1	ua/L
Simazine	ug/L	1	<1	;	1	}		IMAC	10	

MRL = Method Reporting Limit INC = Incomplete AQ = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAL Charlie Qu

Organic Lab Team Leader

						Report Numi Date: Date Submit	ber: ted:	1022429 2010-09-2 2010-09-1	D 5
						Project:		PH0482	
	_					P.O. Number Matrix:	:	7892 Water	
	LAB ID:	828874	828675					GUIDELIN	E
Sam	ple Date:	2010-09-15	2010-09-15			-			
3:	ample ID:	WS1-TW9	W\$2-TW9					ODWSOC	•
UNITS	MRL						TYPE	LIMIT	UNITS
CFU/100mL		89	68				MAC	0	CFU/100ml
CFU/100mL		Q	0				MAC	0	CFU/100ml
CFU/1mL	ĺ	107	46				-		
CFU/100mL		0	0						
	Sam Sr CFU/100mL CFU/100mL CFU/100mL CFU/100mL	LAB ID: Sample Date: Sample ID: UNITS MRL CFU/100mL CFU/100mL CFU/100mL CFU/100mL CFU/100mL	LAB ID: 828874 Sample Date: 2010-09-15 Semple ID: WS1-TW9 UNITS MRL CFU/100mL 89 CFU/100mL 0 CFU/100mL 0 CFU/100mL 0 CFU/100mL 0	LAB ID: 828874 823875 Sample Date: 2010-09-15 2010-09-15 Semple ID: WS1-TW9 WS2-TW9 UNITS MRL 0 CFU/100mL 89 68 CFU/100mL 0 0 CFU/100mL 0 0	LAB ID: 828874 828875 Sample Date: 2010-09-15 2010-09-15 Sample ID: WS1-TW9 WS2-TW9 UNITS MRL 0 CFU/100mL 0 0 GFU/100mL 0 0 UNITS III 0 III 0 0	LAB ID: 828874 828876	Kaport Num Bate: Date Submit Date Submit Project: P.O. Number Matrix: P.O. Number Matrix: Sample Date: 2010-09-15 Sample ID: WS1-TW9 WS2-TW9	Report Number: Date: Date Submitted: Project: P.O. Number: Matrix: LAB ID: 228874 828875 Sample Date: 2010-09-15 2010-09-15 Sample ID: WS1-TW8 WS2-TW9 UNIT8 MRL CFU/100mL 89 68 CFU/100mL 0 0 CFU/100mL 0	LAB ID: 228274 328275 OUtbox OUtbox 7892 Matrix: Water 2010-09-13 OUtbox 392 Sample Date: 2010-09-15 OUtbox OUtbox 000/SOC Sample Date: 2010-09-15 OUVDELIN OUVDELIN Sample Date: 2010-09-15 OUVDELIN OUVDELIN VINITS MRL 0 OVXSOC OUVSOC CFU/100mL 89 68 MAC 0 CFU/100mL 0 0 MAC 0 CFU/100mL 0 0 0 MAC 0 CFU/100mL 0 0 0 Image: Cell of the second

MRL = Method Reporting Limit INC = incomplete AO = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APEROVAL Jennifer Mitchel A Microbiology Lab/Supervisor Results relate only to the parameters tasted on the samples submitted.

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EXOVA ACCUTEST

REPORT OF ANALYSIS



Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2E 7T7							Report Numl Date: Date Submitt	ber: ed:	1022441 2010-09-21 2010-09-15	
Attention: Mr. Robert Passmore							Project:		PH0452	
INVOICE: Paterson Group Inc.							P.O. Number	:	7892	
Chain of Custody Number: 129682							Matrix:	14	Water	
	•	LAB ID:	828919	828920				╢	GUIDELIN	
	Şan	ipie Date:	2010-09-15	2010-09-15				4		
	3	ampie iv:	4421-1443	W52-1W9					ODWSOG	
DADAMETED	UNITE	-							1	
Alkalinity as CaCO3		MIKL 5	201	204	·				LIMIT	UNIT6
Chieride	mg/⊑	1	56	204				UG	000	mg/L
Coloric	TOU	2	- 2					AO	250	mg/L
Canductivity	100	5	662	857					5	100
Dissolved Ornanic Carbon	mo/l	0.5	15	17			Í			
Fluoride	ma/l	0.0	0.37	0.37					5	mg/L m=4
Hydrogen Sulphide	mg/L	0.1	<0.1	<0.07				MAC .	6.1	mg/L
N-NH3 (Ammonia)	mail	0.07	0.05	0.04]		10	0.05	mg/L
N-NO2 (Nitrite)	ma/i	0.01	<0.00	<0.10		1		li Mac	10	
N-NO3 (Nitrate)	mg/L	01	<0.10	<0.10]		MAC	10.0	mg/L mg/L
pH	(light	0.1	8.04	812					65.85	mg/L
Phenols	ma/l	0.001	<0.001	<0.001					0.0-0.0	
Suphate	ma/L	1	54	50			1	AO	500	mail
Tannín & Lignin	ma/L	0.1	<0.1	<0.1			1			, night
Total Dissolved Solids (COND - CALC)	ma/L	5	430	427			1	AO	500	mail
Total Kieldahl Nitrogen	ma/L	0.1	0.21	0.32		1			000	
Turbidity	NTU	0.1	13.1	2.5		1		MAC	10	
Herdness as CaCO3	ma/L	1	231	229				20	100	mat
Ion Balance	···· 3 -	0.01	0.92	0.92					100	ingre
Calcium	ma/L	1	48	47		1				
Magnesium	mg/L	1	27	27						
Polessium	ma/L	1	5	5						
Sodium	ma/L	2	34	34			i i	AO	200	mail
Iron	mg/L	0.03	0.47	0.13				AO	0.3	mg/L
Manganese	mg/L	0.01	0.03	0.02				AO	0.05	mo/l
							}			

MRL = Method Reporting Limit INC = Incomplete AD = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration

Comment:

628919: H2S MRL elevated due to sample turbidity.

APPROVAL Ewan McRobbie Inorganic Lab Supervisor Results relate only to the parameters tested on the samples submitted.

EXOVA ACCUTEST

REPORT OF ANALYSIS



Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2E 7T7 Attention: Mr. Robert Passmore							Report Nun Date: Date Submi Project:	nber: tted:	1023312 2010-09-2 2010-09-2 PH0482	7 1
INVOICE: Paterson Group Inc.										
Chain of Custody Number: 129698							P.Q. Numbe	r:		
		LAS ID;	831312	Γ	- I		matrix:		Water	
	Samp	ole Date:	2010-09-23				+	━╢━───	GUIDELIN	Ë
	Sa	mple ID:	TW9-WS3 23- 09-10		-				ODWSOG	i
PARAMETER		MDI				<u> </u>				
Total Coliforms	CEU/100mL	MILL		<u> </u>		<u> </u>		TYPE		UNITS
Escherichia Coll	CFU/100mt		0					MAC	0	CFU/100mL
Helerotrophic Plate Count	CFU/1m/		6					MAC	0	CFU/100mL
Faecal Coliforms	CFU/100mt		ň		ł					
Faecal Streptococcus	CFU/100mL		ň	1				1		

MRL = Method Reporting Limit INC = Incomplete AO = Aesthelic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAL: Jennifer Mile Microbiology Kab Supervisor

Methods references and/or additional QA/QC information available on request.

EXOVA ACCUTEST

REPORT OF ANALYSIS



Δ.

Client: Paterson Group 28 Concourse Gate, Unit 1 Nepean, ON K2E 7T7							Report Num Date: Date Submi	iber: tted:	1023306 2010-09-34 2010-09-24) ‡	
Attention: Mr. Robert Pasamore							Project:		PH0462		
INVOICE: Paterson Group Inc. Chain of Custody Number: 129698							P.O. Númbe Matrix:	r:	Water		
	Sar S	LAB ID; nple Date: Sample ID;	831305 2010-09-23 TW9-WS3- 23/09/10						<u>GUIDELIN</u> ODWSOG	E	_
PARAMETER	UNITS	MRL				+	<u> </u>		Liber	100070	4
Alkalinity as CaCO3	mg/L	5	202		+		+		500		┥
Chloride	mg/L	1	59	ļ	1	1	1	ĂÕ	250	mg/L	ł
Calour	TCU	2	2						200	TCU	
Conductivity	uS/cm	5	642						, v	1 100	
Dissolved Organic Carbon	/mg/L	0.5	1.4		}		ļ		5		ſ
Fluoride	mg/L	0,1	0.36	ļ				MAC	1.5	mg/L	
Hydrogen Sulphide	mg/L	0.01	< 0.01					40	0.05		1
N-NH3 (Ammonia)	mg/L	0.02	0.09]			0.00	I mg/L	
N-NO2 (Nitrite)	mg/L	0.1	<0.10				1	MAC	10		
N-NO3 (Nitrate)	mg/L	0.1	<0.10					MAC	10.0	mg/L	Í
pH			8.02						8595	mg/L	
Phenois	mg/L	0.001	<0.001		1	í	ĺ	íl –	0.5-6.5		
Sulphate	mg/Ľ	1	48						500		
Tannin & Lignin	mg/L	0.1	<0.1	ſ					500	mg/L	1
Total Dissolved Selids (COND - CALC)	mg/L	5	417			ļ	}	1 10	500	}	
Total Kjeldahi Nitrogen	mg/L	0.1	<0.10		Í				500	_ mg/∟	
Turbidity	NTU	0.1	1.2								
Hardness as CeCO3	/ mg/L	1	227]	MAC	1.0	NIU	
ion Belance		0.01	0.92		1	1			100	mg/L	
Calcium	ma/L	1	48		1					1	
Magnesium	ma/L	1	26					J			ł
Potassium	ma/L	1	5							ł	
Sodium	ma/L	2	35		ļ					l	
iron	ma/L	0.03	0.16					AO AO	200	mg/L	
Manganèse	ma/L	0.01	0.02				ļ	AU	0.3	mg/L	L
								AU	0.05	mg/L	
											ĺ

MRL = Method Reporting Limit INC = Incomplete AC = Aesthetic Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAL Ewan McRobble Inorganic Lab Supervisor

Methods references and/or additional QA/QC information available on request.

EXOVA ACCUTEST

REPORT OF ANALYSIS

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EXOVA Accutest

Client: Patarson Group 28 Concourse Gale, Unit 1 Nepean, ON K2E 717	ent: Paterson Group 28 Concourse Gale, Unit 1 Nepean, ON K2E 7T7 Iention: Mr. Robert Passmore								1027490 2010-11-10 2010-11-09	
							Project:		PH0482	
INVOICE: Paterson Group Inc. Chain of Custody Number: 127854							P.O. Numbe Matrix:	171	10041 Water	
		LAB ID:	843639	843640	843641		T		GUIDELINI	
	Sam	ple Date:	2010-11-08	2010-11-08	2010-11-08					
	34	ample ID:	MW1-10	MW2-10	MW8-10					
PARAMETER	UNITS	MRL	<u> </u>	1	··	<u> </u>		TYDE		
N-NO2 (Nitrile)	mg/L	0,1	<0.10	<0.10	<0.10			-	LIMI1 -	UNITS
N-NO3 (Nibale)	mg/L	0.1	D.16	0.16	0.15	1				
	(ng)L	0.1	0.16	0.16	0.16					
					-					

MRL = Method Reporting Limk INC = Incomplete AO = Aesthelia Objective OG = Operational Guideline MAC = Maximum Allowable Concentration IMAC = Interim Maximum Allowable Concentration Comment:

APPROVAL Evan McRobbio Inorganic Lab Supervisor

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Methods references and/or additional QA/QC Information available on request.

Results relate only to the parameters tested on the samples submitted.



APPENDIX 4

Aquifer Analysis Data

Graphical Summary of Field Water Quality Data for Test wells

Figure - A4 – 1 - Potential Well Interference Model 1 (Cumulative Drawdown)

Figure - A4 – 2 - Potential Well Interference Model 2 (Individual Drawdown)

Detailed Nitrate Impact Assessment Data

Ottawa Head Office 9 Auriga Drive Ottawa – Ontario Ottawa Laboratory 28 Concourse Gate Ottawa – Ontario List of Services Geotechnical Engineering & Environmental Engineering & Hydrogeology Materials Testing & Retaining Wall Design & Rural Development





Pater 1-28 (son Group Ltd.	Pumping test analysis		Date: 25.04.2007	none, Page 2	
Nepear	n, ON K2E 717	time-Drawdown plot		Project: PH0482		
				Evaluated by: RAP)	
Pump	ing Test No. 1		Test conducted on: F			
TW1			TW1			
Discha	arge 0.40 l/s		Distance from the pu			
Static	water level: 3 930 m bolovi dotum			mping well 0.150 m		
	Rumping test duration	187-11				
	r unping test duration	vvaler level	Drawdov	vn		
	[min]	[m]	(m)			
1	0.00	3.930		0.000		
2	1.00	5.490		1.560		
4	2.50	5.560		1.630		
5	3.00	5.940	<u> </u>	1.850		
6	3.50	6.210		2.010		
7	4.00	6.360		2.430		
- 8	4.50	6,490		2.560		
9	6.00	6.760		2.830		
11		6.950		3.020		
12	9,00	7.070		3.140		
13	10.00	7.290		3.360		
14	12.00	7.470		3.540		
15	14.00	7.590		3.660		
10	16.00	7.700		3.770		
18	20.00	7.780		3.850		
19	25.00	8.305		4 375		
20	30.00	8.150		4.220		
21	35.00	8.225		4.295		
22	40.00	8.290		4.360		
23	50.00	8.380		4.450		
25	55.00	8.465	_	4.470		
26	60.00	8.505		4.575		
27	70.00	8.600		4.670		
28	80.00	8.700		4.770		
30	90.00	8.700		4.770		
31	120.00	8.950		<u> </u>		
32	140.00	8.990		5.060		
33	160.00	9.050		5.120		
34	180.00	9.070		5.140		
30 36	210.00	9.095		5.165		
37	270.00	9.100		5.230	· · · · · · · · · · · · · · · · · · ·	
38	300.00	9.180		5.250		
39	330.00	9,190		5.260		
40	360.00	9.210		5.280		
41	361.00	7.250		3.320		
43	363.00	6.020		2.690		
44	364.00	6.080		2,150		
45	365.00	5.900		1.970		
46	366.00	5.730		1.800	·····	
47	367.00	5.580		1.650		
40	369.00	5.4/0		1.540		
50	370.00	5.300		1.370		

Paterson Group Ltd. 1-28 Concourse Gate		Pumping test analysis		Date: 25.04.2007	поле, Page 3
Nepean, ON K2E	59 Gale 5717	Time-Drawdown plot		Project: PH0482	· · · · · · · · · · · · · · · · · · ·
				Evaluated by: RAP	· · · · · · · ·
Pumping Tes	1 No. 1		Test conducted on: I	eb. 14/07	·····
TW1			TW1		
Discharge 0.4	40 l/s		Distance from the pu	mping well 0, 150 m	
Static water l	evel: 3.930 m below datum				
- Pu	nping test duration	Water level	Drawdoy		
51	[min]	[m]	[m]		
52	374.00	5.170		1.240	
53	376.00	4 990		1.140	·
54	378.00	4.940		1.010	
55	380.00	4.880		0.950	· · · · · · · · · · · · · · · · · · ·
56	385.00	4.790		0.860	
57	390.00	4.710		0.780	
58	395.00	4.640		0.710	
60	405.00	4.615	· · · · · · · · · · · · · · · · · · ·	0.685	
61	410.00	4.570		0.640	······
62	415.00	4.510		0.580	
63	420.00	4,490		0.560	
64	430.00	4.440		0.510	
65	440.00	4.410		0.480	
66	450.00	4.389		0.459	
67	460.00	4.350		0.420	
80	470.00	4.330	<u> </u>	0.400	
	400.00	4.310		0.380	
		······································			
	<u> </u>				
		·		· ·	
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Storativity: 2.82 x 10⁻²

Pater	Paterson Group Ltd. Pumping te 1-28 Concourse Gate Theis analy	Pumping test analysis		Date: 25.04.2007	none, Page 2
1-28 C Nepean	, ON K2E 7T7	Theis analysis metho Confined aquifer	a	Project: PH0482	
				Evaluated by: RAP	2
Pumpi	ing Test No. 1		Test conducted on: I	Feb. 14/07	
TW1			TW1		
Discha	arge 0.40 l/s		Distance from the pu	mping well 0.150 m	
Static	water level: 3.930 m below datum				
	Pumping test duration	Waler level	Drawdou	wp	
	·		Diamoo		
	(min)	[m]	[m]		
2	1.00	5 490		1.560	
3	1.50	5.560		1.630	
4	2.50	5.780		1.850	
5	3.00	5.940		2.010	·····
6	3.50	6.210		2.280	
7	4.00	6.360		2.430	
ŏ o	<u>4.50</u>	6,490		2.560	·
	7.00	6.700		3.020	,
11	8.00	7.070		3.140	
12	9.00	7.200		3.270	· · · · · · · · · · · · · · · · · · ·
13	10.00	7.290		3.360	
14	12.00	7.470		3.540	
<u>15</u>	14.00	7.590		3.660	
10	18.00	7.700		3.770	······································
18	20.00	7.880		3.950	
19	25.00	8.305	·	4.375	
20	30.00	8.150		4.220	
21	35.00	8.225		4.295	
22	40.00	8.290	<u> </u>	4.360	
23	45.00			4.450	<u></u>
25	55.00	8.465		4.535	·
26	60.00	8.505		4.575	
27	70.00	8.600		4.670	
28	80.00	8.700		4.770	
29	90.00	8.700		4.770	
30	120.00	8.810		<u>4.000</u> <u>5.020</u>	<u></u>
32	140.00	8.990		5.060	
33	160.00	9.050	· · · · · · · · · · · · · · · · · · ·	5.120	
34	180.00	9.070		5.140	
35	210.00	9.095		5.165	
36	240.00	9,160	<u>- </u>	5.230	
31	300.00	9.170 Q 180	<u></u>	5,250	
39	330.00	9.190		5.260	
40	360.00	9.210	-	5.280	<u> </u>
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Storativity: 2.74 x 10⁻²

Pater	Paterson Group Ltd. Pumping test 1-28 Concourse Gate Time Drawdow	Pumping test analysis	5	Date: 25.04.2007	none, Page 2				
1-28 C Nepean	oncourse Gate . ON K2E 717	I Ime-Drawdown-met COOPER & JACOB	nod atter	Project: PH0482	<u> </u>				
		Confined aquifer		Evaluated by: RAP	,				
Pumpi	ing Test No. 1		Test conducted on: Feb. 14/07						
TW1	,,,,,,,,,,		TW1		<u> </u>				
Discha	arge 0.40 l/s		Distance from the r	umping well 0.150 m					
Statio	water level: 3 930 m below datum								
	Pumping test duration	Water lovel	Draud	DWD					
		FEALCH IG YOL	D.19MQ	DIAMOAN					
	[min]	[m]	(m)	1	·				
- 7	1.00	5 400		1.560					
3	1.50	5.560		1.630	· · · · · · · · · · · · · · · · · · ·				
4	2.50	5.780		1.850					
5	3.00	5.940		2.010					
6	3.50	6.210		2.280					
7	4.00	6.360		2.430					
8	4.50	6.490		2.560					
9	6.00	6.760		2.830					
	7.00	<u> </u>	· · · · · · · · · · · · · · · · · · ·	3.020					
12	0.00 0.00	7.000		3 270					
13	10 00	7 200	· · · · · · · · · · · · · · · · · · ·	3.360	<u></u>				
14	12.00	7 470		3.540					
15	14.00	7.590		3.660					
16	16.00	7.700		3.770					
17	18.00	7.780)	3.850					
18	20.00	7.880		3.950					
19	25.00	8.305	»	4.375					
20	30.00	8.150	· · · · · · · · · · · · · · · · · · ·	4.220					
21	35.00	8.225	<u>, , , , , , , , , , , , , , , , , , , </u>	4.295					
22	40.00	0.29L	,)	4 450					
23	50.00			4.470					
24	55.00	8.465	5	4.535	<u> </u>				
26	60.00	8.505	5	4.575					
27	70.00	8.600)	4.670					
28	80.00	8.700		4.770					
29	90.00	8.700)	4.770					
30	100.00	8.810	<u>}</u>	4.880					
31	120.00	8.950	<u>-</u>	5.020					
32	140.00	B.991	<u>-</u>	5.000	••••••••••••••••••••••••••••••••••••••				
33		Q 071	5-1	5.140					
<u>२म</u> २म	210 00	9.09	5	5.165					
36	240.00	9.16	o	5.230					
37	270.00	9.17	D	5.240					
38	300.00	9.18	õ	5.250					
39	330.00	9.19	0	5.260					
40	360.00	9.21	0	5.280					
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Transmissivity [m²/min]: 3.03×10^{-3}

	Paterso	on Group Ltd.	Pumping test analysi	s	Date: 25.04.2007	none Page 2
	1-28 Cor Nepean, O	ncourse Gate N K2E 7T7	Recovery method aft	ter Project: PH0482		
			Confined aquifer		Evaluated by: RAF	
	Pumping	Test No. 1		Test conducted on:	Feb 14/07	
· •	TW1			TW1		
	Discharg	e 0.40 l/s		Distance from the -		
	Static wa	ter level: 3.930 m below datum		Bumping heat down		
		Time from	Water level	Pumping test durati	on: 360.00 min	
		end of pumping		drawdo	vai	
		[ກາກ]	[m]	[m]		
	2	1.00	7.250		3.320	
	3	3.00	6.330		2.690	
	4	4.00	6.080		2.150	
	5	5.00	5.900		1.970	
	7		5.730		1.800	
	8	8.00	5.470	_ 	1.540	
	9	9.00	5.380		1.450	
			5.300		1.370	
	12	14.00	5.070		1.240	
	13	16.00	4.990		1.060	
	14		4.940		1.010	
	16	25.00	4.880	···	0.950	
	17	30.00	4.710		0.780	
	18	35.00	4,640		0.710	
	20	40.00	4.615		0.685	
	21	50.00	4.540		0.610	
	22	55.00	4.510		0.580	
	23	60.00	4.490		0.560	
	25	80.00	4.410		0.510	
	26	90.00	4.389		0.459	
	27	100.00	4.350		0.420	
	29	120.00	4.310	_ 	0.400	
	 					
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Paterson Group Ltd.		Pumping test analysis		e: 25.04.2007	none, Page 2
T-28 Col Nepean, C	ncourse Gate N K2E 717	Time-Drawdown plot	Pro	ject: PH0482	
			Eva	luated by: RAF	. <u> </u>
Pumping	Test No. 2	Те	st conducted on: Mar.	12/07	•••
TW2		TV	/2		
Discharg	ge 0.60 l/s	Dis	stance from the pumpir	ig well 0.150 m	
Static w	ater level: 1.670 m below datum				
	Pumping test duration	Water level	Drawdown		
	[min]	[m]	լայ		
1	0.00	1.670		000	
2	0.50	2.110		0,440	
3	1.00	2.130	· · · · · · · · · · · · · · · · · · ·	0.460	•
4	1.50	4.190		2.520	
5	2.00	5.230		3.560	
6	3.00	6.900		5.230	
7	4.00	8.440		6.770	
8	5.00	8.970		7.300	
9	7.00	10.620	•	8.950	
10	8.00	10.750		9.080	
11	9.00	10.400		8.730	
12	11.50	9.650		7.980	
13	15.00	9.600		7.930	
14	20.00	9.960		8.290	
15	25.00	10.240		8.570	
16	30.00	10.310		8.640	· · · · · · · · · · · · · · · · · · ·
17	45.00	10.930		9.260	
18	60.00	11.210		9.540	
19	90.00	11.380		9.710	
20	120.00	11.570		9.900	······
	150.00	11.700		0.030	·
22	160.00	11.630		10.100	
23	210.00	11.800		10.180	
24	240.00	11 940	· · · · · · · · · · · · ·	0.270	
25	270.00	11.940		0 290	
20	330.00	12 100		10.430	
27	360.00	12.130		10.460	
	360.50	11.480	· · · · · · · · · · · · · · · · · · ·	9.810	
- 20	361.00	10.580	<u> </u>	8.910	
31	361.50	9.630	· · · · · · · · · · · · · · · · · · ·	8.160	
32	362.00	9.220		7.550	
33	363.00	8.100		6.430	
34	364.00	7.020		5.350	
35 1	365.00	6.040		4.370	
36	366.00	5.230		3.560	
37	367.00	4.490		2.820	
38	368.00	3.840		2.170	
39	369.00	3.370		1.700	
40	370.00	2,970		1.300	
41	372.00	2.400		0.730	
42	375.00	2.000		0.330	
43	380.00	1.900	÷	0.230	
44	384.00	1.900		0.230	
45	390.00	1.880			·
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Paterson Group Ltd. Pumping test ana		Pumping test analysis	Date: 25.0	Date: 25.04.2007 none, Page 2		
I-28 Con Vepean. Of	course Gate	Theis analysis method Confined aquifer	Project: Pl	Project: PH0482		
, smil 41			Evaluated by: RAP			
oumping	Test No. 2	···	Test conducted on: Mar. 12/07		_	
TW2			TW2			
Discharge 0.60 1/s			Distance from the pumping well	0.150 m		
 Static wa	ter level: 1.670 m below datum					
	Pumping test duration	Water level	Drawdown			
	[min]	[m]	[m]	_		
2	0.50	2.110	0.440			
3	1.00	2.130	0.460	_		
4	1.50	4.190	2.520			
-5	2.00	5.230	3.560			
7	4.00	8.440	6.770		······································	
8	5.00	8.970	7.300	_ <u>_</u>		
9	7.00	10.620	8.950			
10	8.00	10.750	9.080			
11	9.00	10.400	8.730			
12	11.50	9.650	7.930	· · · · · · · · · · · · · · · · · · ·		
14	20.00	9.960	8.290			
15	25.00	10.240	8.570			
16	30.00	10.310	8.640			
17	45.00	10.930	9.260		<u> </u>	
18	60.00	11.210	9.540			
20	120.00	11.570	9,900			
21	150.00	11.700	10.030			
22	180.00	11.830	10.160			
23	210.00	11.860	10.190			
	240.00	11.910	10.240			
- 25	300.00	11.940	10.290		<u> </u>	
-20 -	330.00	12.100	10.430			
28	360.00	12.130	10.460			
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Transmissivity [m²/min]: 1.92×10^{-3} Storativity: 2.27 x 10^{-2}

Paters	son Group Ltd.	Ip Ltd. Pumping test analysis Gate Time-Drawdown-method after COOPER & JACOB Confined aquifer		Date: 25.04.200	17 none, Page 2	
Nepean,	ON K2E 7T7			Project: PH0482 Evaluated by: RAP		
<u> </u>						
Pumpir	ng Test No. 2		Test conducted on: Mar. 12/07			
TW2			TW2	·		
Discha	rge 0.60 l/s		Distance from the p	umping well 0.150	m	
Static v	water level: 1.670 m below datum					
	Pumping test duration	Water level	Drawdo	own		
	[min]	(m)	(m)			
2	0.50	2.110		0.440		
3	1.00	2.130		0.460		
4	1.50	4.190		2.520		
с 8	2.00	5.230	_	3.560		
7	<u> </u>	0.900		5.230		
8	5.00	8 970		7 300		
9	7.00	10.620		8.950		
10	8.00	10.750		9.080	·····	
11	9.00	10.400		8.730		
12	11.60	9.650		7.980		
		9.600		7.930		
15	20.00	9.960		<u> </u>		
16	30.00	10.310		8.570		
17	45.00	10.930	·	9,260	······································	
18	60.00	11.210		9.540		
19	90.00	11.380		9.710		
20	120.00			9.900		
22	150.00	11.700		10.030		
23	210.00	11.850		10.160		
24	240.00	11.910		10.240		
25	270.00	11.940		10.270		
26	300.00	11.960		10.290		
27	330.00	12.100		10.430		
				10.460		
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Transmissivity [m²/min]: 9.61 x 10-4

Paterson Group Ltd. Pumping test :		Pumping test analysis		Date: 25.04.200	7 none, Page 2	
1-28 Col	ncourse Gate	Recovery method afte	r	Project: PH0482		
Nepean, C	N K2E 717	Confined aquifer		Evaluated by: R	AP	
	Test No. 2	L	Test conducted or			
TW2			TW2		······	
Discharg	je 0.60 l/s		Distance from the	pumping well 0.150	'm	
Static w	ater level: 1.670 m below datum		Pumping test dura	ation: 360.00 min		
	Time from	Water level	Resi	dual		
	end of pumping		drawo	nwot		
	[min]	[m]	<u>(n</u>			
1	0.50	11.480		9.810	····	
2	1.00	9.830		8.160		
- 4	2.00	9.220		7.550		
5	3.00	8.100		6.430		
6	4.00	7.020		5.350		
7	5.00	6.040		4.370		
- ×	7 00	4.490		2.820		
- 10	8.00	3.840		2.170		
11	9.00	3.370		1.700		
12	10.00	2.970		1.300		
13	12.00	2.400		0.330		
14	20.00			0.230		
10	24.00	1.900		0.230		
17	30.00	1.880		0.210		
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Paterson Group Ltd.		Pumping test analysis		Date: 25.04.2007	none, Page 2		
1-28 C Nepean	oncourse Gate ON K2E 7T7	Time-Drawdown plot		Project: PH0482			
,				Evaluated by: RAP			
Pumpi	ng Test No. 1		Test conducted on: Mar. 1/07				
TW3			TW3				
Discha	rge 1.90 l/s		Distance from the pu	Imping well 0.150 m			
Statics	water level: 6 610 m bolow datum						
	Rumping test duration	Water level	Drawdov				
	Pumping test duration	AAGIEL IEAEL	Diawoo	1			
	[min]	[m]	[m]				
1	0.00	6.610		0.000			
- 2	1.00	6.850		0.240			
4	1.50	6.900		0.290	·····		
5	2.00	6.900		0.290			
6	3.00	6.910		0.300			
7	4.00	6.910		0.300			
8	5.00	6.910		0.300			
9	10.00	6.910		0.300			
- 11	30.00	6.910		0.300			
12	45.00	6.910		0.300			
13	60.00	6.920		0.310			
14	90.00	6.920		0.310			
15	120.00	6.930	· · · · · · · · · · · · · · · · · · ·	0.320			
16	150.00	<u> </u>		0.340	·		
18	210.00	6 950	· · · · · · · · · · · · · · · · · · ·	0.340			
	240.00	6.940	· · · · · · · · · · · · · · · · · · ·	0.330			
20	270.00	6.950		0.340			
21	300.00	6.960		0.350			
22	330.00	6.950) 	0.340			
23	360.50	6.690	<u></u>	0.060			
24	361.50	6.660	/ · ·	0.050			
26	362.00	6.650)	0.040			
27	362.50	6.650		0.040			
28	363.00	6.640)	0.030			
29	364.00	6.630	<u>}</u>	0.020			
30	365.00	6.63	<u></u>	0.020			
		0.020					
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Storativity: 2.75 x 10⁻³

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Paterson Group Ltd.		oup Ltd. Pumping test analysis		Date: 25.04.2007	none, Page 2	
1-28 C Nepean	Concourse Gate , ON K2E 7T7	ICOURSE Gate Theis analysis method		Project: PH0482		
		· · · · · · · · · · · · · · · · · · ·				
Pumpi	ing Test No. 1		Test conducted on: Mar. 1/07			
тwз			T W3		···	
Discha	arge 1.90 l/s		Distance from the pu	Imping well 0.150 m		
Static	water level: 6.610 m below datum	_ 1			<u> </u>	
T	Pumping test duration	Water level	Drawdov	wn		
		[m]	[m]			
2	0.50	6.850		0.240		
3	1.00	6.890		0.280		
5	2.00	6.900		0.290		
- 6	3.00	6.910		0.300		
7	4.00	6.910		0.300		
8	5.00	6.910		0.300	· · · · · · · · · · · · · · · · · · ·	
9	10.00	6.910		0.300		
	20.00	6.910 6.010	· · · · · · · · · · · · · · · · · · ·	0.300		
12	45.00	6.910		0.300		
13	60.00	6.920		0.310		
14	90.00	6.920		0.310	· / /	
15	120,00	6.930		0.320		
16	150.00	6.950	<u> </u>	0.340	······································	
1/	210.00	6.950		0.330		
	240.00	6.940	· · · · · · · · · · · · · · · · · · ·	0.330		
20	270.00	6.950		0.340		
21	300.00	6.960)	0.350		
22	330.00	6.950)	0.340		
	· · · · · · · · · · · · · · · · · · ·				· · · · · · · · · · · ·	
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Transmissivity [m²/min]: 7.18 x 10⁻¹

Storativity: 3.64 x 10⁻⁸

Paterso 1-28 Co	on Group Ltd. ncourse Gate	Pumping test analysis	od after	Date: 25.04.2007	none, Page 2
Nepean, C	DN K2E 717	COOPER & JACOB	יש מונכו	Project: PH0482	
		Contined aquiter		Evaluated by: RAP	,
Pumping	g Test No. 1		Test conducted on: N	far. 1/07	
TW3			Т₩З		
Dischar	ge 1.90 l/s		Distance from the pu	mping well 0.150 m	
Static w	ater level: 6.610 m below datum	· · · · · · · · · · · · · · · · · · ·			
	Pumping test duration	Water level	Drawdov	/n	
	[min]	[m]	(m]		
2	0.50	6.850		0.240	
3	1.00	6.890		0.280	
4	1.50	6.900		0.290	
5	2.00	6.900		0.290	
6	3.00	6.910		. 0.300	
	4.00	6.910		0.300	
- 8	5.00	6.910		0.300	
	10.00	6.910		0.300	
	30.00	6.910		0.300	
12	45.00	6.910		0.300	
13	60.00	6.920		0.310	······
14	90.00	6.920		0.310	
15	120.00	6.930		0.320	
16	150.00	6.950		0.340	
17	180.00	6.960		0.350	
18	210.00	6.950		0.340	
- 19	240.00	6.940		0.330	
	300.00	6.960		0.340	· · · · · · · · · · · · · · · · · · ·
22	330.00	6.950		0.340	
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Transmissivity [m²/min]: 3.26 x 10⁻¹

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Pate	rson Group Ltd.	Pumping test analysis Recovery method after THEIS & JACOB		Dale: 25.04.2007	none, Page 2	
Nepea	n, ON K2E 717			Project: PH0482		
ļ		Confined aquifer		Evaluated by: RAP		
Pump	ping Test No. 1		Test conducted on: Mar. 1/07			
TW3						
Disch	arge 1.90 l/s		Distance from the nu			
Statio	Water loval: 6 610 m balaw datum			mping well 0.150 m		
	Time from	144.4	Pumping test duratio	n: 360.00 min		
	end of pumping	Water level	Residua	ul l		
	[min]	កោរ	drawdow	'n		
1	0.50	6.690	(m]	0.080		
2	1.00	6.670		0.060		
3	1.50	6.660		0.050		
	2.00	6.650		0.040		
6	3.00	6,640		0.040		
7	4.00	6.630		0.020		
8	5.00	6.630		0.020		
9	6.00	6.620		0.010		
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Pate	son Group Ltd.	Pumping test analysis Time-Drawdown plot		Date: 25.04.2007	none, Page 2		
Nepear	Joncourse Gate n. ON K2E 7T7			Project: PH0482			
				Evaluated by: RAP			
Pump	ing Test No. 1		Test conducted on: Mar. 2/07				
TW4							
Disch	aroe 1.90 l/s		Distance for a file				
Statio			Distance from the pl	imping well 0.150 m			
	Rumaine test duration						
	Pumping test duration	Water level	Drawdoy	vn			
	[min]	[m]	[m]				
1	0.00	1.640		0.000			
2	0.50	3.240		1.600			
3	1.00	4.060		2.420			
- 4	2.00	4.550		2.910			
6	3.00	4.870		3.230			
7	4.00	5.540		3.900			
8	5.00	5.660		4.020			
9	8.00	5.860		4.220			
10	10.00	5.940		4.300			
	15.00	6.060		4.420			
13		6.170		4.530			
14	45.00	6.450		4.690			
15	60.00	6.540		4 900	······································		
16	90.00	6.710		5.070			
17	120.00	6.840		5.200			
18	150.00	6.840		5.200			
19	180.00	6.820		5.180			
20	210.00	6.920		5.280			
22	270.00	6.880		5.220			
23	300.00	6.870		5.230			
24	330.00	6.890		5.250			
25	360.00	6.850		5.210			
26		6.620		4.980	<u> </u>		
21	361,50	4.190		2.550			
29	363.00	2.080		0.440			
30	364.00	1.980		0.340			
31	365.00	1.950		0.310			
32	367.50	1.900		0.260			
33	370.00	1.880	·	0.240			
34	376.00	1.850	<u> </u>	0.210			
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Transmissivity [m²/min]: 1.97 x 10⁻²

Storativity: 3.48 x 10⁻³

ŋ
Paterson Group Ltd. 1-28 Concourse Gate Nepean, ON K2E 7T7		Pumping test analysis		Date: 25.04.2007	none, Page 2
		Theis analysis metho Confined aquifer	d .	Project: PH0482	
•				Evaluated by: RAP	
Pumping T	est No. 1	Test conducted		Mar. 2/07	<u> </u>
TW4			TW4		
Discharge	1.90 Vs		Distance from the pu	Imping well 0.150 r	m ·
Static wate	r level: 1.640 m below datum		• • •		
۶	Pumping test duration	Water level	Drawdo	wn	<u></u> .
		[m]	(m)		
2	0.50	3.240		1.600	
3	1.00	4.060		2.420	
5	2.00	4.550		3 230	
6	3.00	5.280		3.640	
7	4.00	5.540		3.900	
8	5.00	5.660		4.020	
	8.00	5.860		4.220	
10	10.00	5.940		4.300	
12	20.00	6 170	· · · · · · · · · · · · · · · · · · ·	4.420	
13	30.00	6.330	· · · · · · · · · · · · · · · · · · ·	4.690	
14	45.00	6.450		4.810	
15	60.00	6.540		4.900	
16	90.00	6.710		5.070	
- 18	150.00	6.040	· · · · · · · · · · · · · · · · · · ·	5.200	
19	180.00	6.820	· · · · · · · · · · · · · · · · · · ·	5.180	
20	210.00	6.920		5.280	
21	240.00	6.860)	5.220	
22	270.00	6.880	<u> </u>	5.240	_ _ .
23	330.00		/	5.230	
25	360.00	6.850	, , ,	5.210	
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Transmissivity [m²/min]: 1.87 x 10⁻²

Storativity: 5.62 x 10-3

Pate 1-28 (rson Group Ltd.	Pumping test analysis Time-Drawdown-method after COOPER & JACOB		Date: 25.04.2007	none, Page 2
Nepear	n, ON K2E 7T7			Project: PH0482	
		Confined aquifer	Evaluated by: RAP		
Pump	ing Test No. 1		Test conducted on: Mar. 2/07		
TW4			TW4		
Disch	arge 1.90 l/s		Distance from the ou	moing well 0 150 m	
	water level: 1.640 m below datum				
	Pumping test duration	Water level	Drawdow		
			Diavidov		
	(min]	[m]	[m]		
2	0.50		<u> </u>	1 600	
3	1.00	4.060		2.420	
4	1.50	4.550		2.910	
6	3.00	4.870		3.230	
7	4.00	5.540		3.900	
8	5.00	5.660		4.020	
10	10.00	5.860	· · · · · · · · · · · · · · · · · · ·	4.220	
11	15.00	6.060		4.420	
12	20.00	6.170		4.530	
	45.00	6.450	· · · · · · · · · · · · · · · · · · ·	4.690	
15	60.00	6.540	·····	4.900	·
16	90.00	6.710		5.070	
18	150.00	6.840		5.200	
19	180.00	6.820		5.180	
20	210.00	6.920		5.280	
22	270.00	6.880	,	5.220	
23	300.00	6.870		5.230	····
24	330.00	6.890		5.250	
- 25		0.050		5.210	
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Transmissivity [m²/min]: 5.84 x 10-3

Paterson Group Ltd. 1-28 Concourse Gate Nepean, ON K2E 7T7		Pumping test analysis		Date: 25.04.2007	none, Page 2
		THEIS & JACOB	[Project: PH0482	
				Evaluated by: RAP	
Pumping T	est No. 1	Tes	st conducted an: N	lar. 2/07	
FW4		TΛ	/4		
Discharge	1. 9 0 l/s	Dis	stance from the pu	mping well 0.150 m	
Static wate	er level: 1.640 m below datum	Pu	mping test duration	1: 360.00 min	
	Time from	Water level	Residua	l [
	end of pumping		drawdow	m l	
-	[min]	[m]	(m)		
-2	1.50	6.620		4.980	·
3	2 00	4.190		2.550	
4	3.00	2 080		0.440	
5	4.00	1.980		0.340	
6	5.00	1.950		0.310	
7	7.50	1.900		0.260	
8	10.00	1.880		0.240	
9	16.00	1.850		0.210	
					
					
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Pater	Paterson Group Ltd. Pumpin		imping test analysis		none, Page 2		
Nepear	Nepean, ON K2E 717		rawdown plot		Project: PH0482		
			Evaluated by: RAP				
Pump	ing Test No. 1		Test conducted on: March 13/07				
TW5			TW5				
Disch	arge 0.70 l/s		Distance from the nu	mping well 0 150 m			
Static	water level: 5.730 m below datum						
	Pumping test duration	Water level	Draudou				
!		AAGTEL IEAGI		vn			
	[min]	[m]	[m]				
1	0.00	5.730		0.000			
	100	5.930		0.200			
4	1.00	6.100		0.370			
5	2.00	6.160		0.430	· · · · · · · · · · · · · · · · · · ·		
6	3.00	6.170		0.440			
	4.00	6.180		0.450			
	5.00	6.190		0.460			
- 9 10	20.00	6.200		0.470			
11	30.00	6.240	_	0.500			
12	45.00	6.240		0.510			
13	60.00	6.240		0.510			
14	90.00	6.240		0.510			
15	120.00	6.240		0.510	· · · · · · · · · · · · · · · · · · ·		
10	150,00	6.250		0.520			
18	210.00	6.230		0.500			
19	240.00	6.220		0.490			
20	270.00	6.220		0.490			
21	300.00	6.210		0.480			
22	330.00	6.210		0.480			
23	360.50	5.860		0.490			
25	361.00	5.810		0.080			
26	361.50	5.780		0.050			
27	362.00	5.760		0.030			
28	362.50	5.750		0.020			
$\frac{23}{30}$	364.00	5.740		0.010	••••••••••••••••••••••••••••••••••••••		
31	365.00	5.740		0.010			
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Transmissivity [m²/min]: 9.46 x 10-2

Storativity: 6.05 x 10-4

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1-28 Concourse Gate Theis analysis method Nepean, ON K2E 7T7 Confined aquifer Evaluated by: RAP				
Evaluated by RAP				
Evendated by, the	Evaluated by: RAP			
Pumping Test No. 1 Test conducted on: March 13/07	Test conducted on: March 13/07			
TW5 TW5	TW5			
Discharge 0.70 Vs Distance from the pumping well 0.150 m	· · · · · · · · · · · · · · · · · · ·			
Static water level: 5.730 m below datum				
Pumping test duration Water level Drawdown				
[min] [m] [m]				
2 0.50 5,930 0.200				
3 1.00 6.100 0.370				
4 1.50 6.140 0.410				
5 <u>2.00</u> <u>6.160</u> <u>0.430</u>				
0 3.00 0.170 0.440 7 4.00 6.180 0.450	_, <u>_</u>			
8 5.00 6.190 0.460				
9 10.00 6.200 0.470				
10 20.00 6.230 0.500				
11 <u>30.00</u> <u>6.240</u> <u>0.510</u>				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$				
14 90.00 6.240 0.510				
15 120.00 6.240 0.510				
16 150.00 6.250 0.520				
17 180.00 6.250 0.520				
18 210.00 6.230 0.300 10 240.00 6.220 0.490				
20 270.00 6.220 0.490				
21 300.00 6.210 0.480				
22 330.00 6.210 0.480				
23 360.00 6.220 0.490				

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Transmissivity [m²/min]: 1.01×10^{-1} Storativity: 1.97×10^{-4}

Paterson Group Ltd. Pumping test analys		S	Date: 25.04.2007 none, Page 2		
1-28 C Nepear	Joncourse Gate h, ON K2E 7T7	thod after Project: PH0482			
		Confined aquifer	Evaluated by: RAP		
Pump	ing Test No. 1	Test conducted on: March 13/07			
TW5	······································		TW5		
Disch	arge () 7() //s		Distance from the n	imping well 0 150 n	
Chatie				Imping weit 0, 150 m	
Static	water level: 5.730 m below datum				<u> </u>
	Pumping test duration	vvater level	Drawdov	WD	
	[min]	[m]	[m]		
	0.50	<u></u>		0.000	
2	1.00	<u> </u>	· · · · · · · · · · · · · · · · · · ·	0.200	
4	1.50	6.140		0.410	
5	2.00	6.160		0.430	
7	4.00	<u> </u>	· · · · · · · · · · · · · · · · · · ·	0.450	
8	5.00	6.190)	0.460	
9	10.00	6.200		0.470	
10	20.00	6.230 6.240		0.500	
12	45.00	6.240		0.510	
13	60.00	6.240)	0.510	
14	90.00	6.240)	0.510	
16	120.00	6.250	<u>,</u>	0.520	
- 17	180.00	6.250		0.520	
18	210.00	6.230)	0.500	
19 20	240.00	6.220	, ,	0.490	
21	300.00	6.210		0.480	
22	330.00	6.21	2	0.460	
23	360.00	0.220	∕ <u>-</u>	0.430	_ <u>, </u>
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Transmissivity [m²/min]: 5.98 x 10-2

Pater	son Group Ltd.	S	Date: 25.04.2007	none, Page 2		
Nepean	, ON K2E 717	Recovery method aft THEIS & JACOB	er Project: PHO		· · · · · · · · · · · · · · · · · · ·	
<u> </u>		Confined aquifer	Evaluated by: RAP			
Pump	ing Test No. 1		Test conducted on:	March 13/07		
TW5			TW5		······································	
Disch	arge 0.70 l/s		Distance from the p	umping well 0.150 m		
Static	water level: 5.730 m below datum		Pumping test duration	on: 360.00 min		
	Time from	Water level	Residu	al		
	end of pumping	[m]	drawdor	wn		
1	0.50	5.860	[11]	0.130		
2	1.00	5.810		0.080		
	2.00	5.760		0.030		
5	2.50	5.750		0.020		
<u>6</u> 7	3.00	5.750	I	0.020		
8	5.00	5.740		0.010	·	
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Paterson Group Ltd.		Time Dresudence allalysis	Pumping test analysis		none, rage z	
u~∠o CO Nepean, (ON K2E 717	ume-prawdown plot	lime-brawdown plot		Project: PH0482	
				Evaluated by: RAP		
Pumping Test No. 1			Test conducted on: M	lar 21/07		
TW6			TW6			
Dischar	ge 0.73 l/s		Distance from the pu	mping well 0.150 m		
Static w	vater level: 2.320 m below datum					
	Pumping test duration	Water level	Drawdow	'n		
	[min]	[m]	[m]			
1	0.00	2.320		0.000		
2	0.50	2.840		0.520		
3	1.00	2.890		0.570		
	3.00	3.100		0.780		
-6	4.00	3.080	<u> </u>	0.760		
7	5.00	3.100		0.780		
6	10.00	3.120		0.800		
9	20.00	3.140		0.820		
10	30.00	3.180		0.870		
11	45.00	3.190		0.070		
13	90.00	3.220		0.900		
14	120.00	3.240		0.920		
15	150.00	3.270		0.950		
16	180.00	3.290		0.970		
17	210.00	3.300		0.980		
18	240.00	3.310		0.990		
	300.00	3 320		1.000		
20	330.00	3.330		1.010		
22	360.00	3.330		1.010		
23	361.00	2.580		0.260		
24	361.50	2.400		0.080		
25	362.00	2.380		0.000		
26	370.00	2.330		0.010	·	
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Transmissivity [m²/min]: 5.33×10^{-2}

Storativity: 3.41 x 10⁻⁴

Pater	Paterson Group Ltd. Pumping		Imping test analysis		none, Page 2	
1-28 (Nepear	Juncourse Gate	Theis analysis metho Confined aquifer	Theis analysis method Confined aquifer		L	
			Evaluated by: RAP			
Pump	ing Test No. 1		Test conducted on: N	lar 21/07		
TW6			TW6			
Disch	arge 0.73 l/s		Distance from the pu	mping well 0.150 m		
Static	water level: 2.320 m below datum	· · · ·		•••••		
	Pumping test duration	Water level	Drawdov	Drawdown		
	[min]					
	[min]	[m]	[m]	· · · · · · · · · · · · · · · · · · ·		
2	0.50	2.840		0.520		
- 3	1.00	2.890		0.570		
	3.00	3.020		0.700		
6	4.00	3.080		0.760		
7	5.00	3.100		0.780		
8	10.00	3.120	· · · · · · · · · · · · · · · · · · ·	0.800		
9 10	30.00	3.140		0.820		
11	45.00	3.190		0.870		
12	60.00	3.200	· · · · · ·	0.880		
13	90.00	3.220		0.900		
14	120.00	3.240	· · · · · · · · · · · · · · · · · · ·	0.920		
15	180.00	3.270		0.950		
17	210.00	3.300		0.980	- -	
18	240.00	3.310		0.990		
19	270.00	3.320		1.000		
20	300.00		<u></u>	1.000	· · · · · ·	
22	360.00	3.330	,	1.010		
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Transmissivity [m²/min]: 5.22 x 10⁻²

Storativity: 4.32 x 10⁻⁴

Paterson Group Ltd. 1-28 Concourse Gate Nepean, ON K2E 7T7		Pumping test analysis	3	Date: 25.04.20	007 none, Page 2
		COOPER & JACOB	nod after	Project: PH04	32
		Confined aquifer		Evaluated by: RAP	
Pumping Tes	t No. 1		Test conducted o	n: Mar 21/07	
TW6			TW6		
Discharge 0.	73 l/s		Distance from the	pumping well 0.15	i0 m
Static water I	evel: 2.320 m below datum				
Pui	nping test duration	Water level	Draw	down	
	(
		(m]	(n	n]	
2	0.50	2.840		0.520	
3	1.00	2.890		0.570	
4	2.00	3.020		0.700	
	4.00	3.100		0.780	
7	5.00	3.100		0.780	······
8	10.00	3.120		0.800	
9	20.00	3.140		0.820	
10	30.00	3.180		0.860	
12	60.00	3 200		0.870	
13	90.00	3.220		0.900	
14	120.00	3,240		0.920	
	150.00	3.270		0.950	
16	180.00	3.290		0.970	
18	240.00	3.310		0.990	
19	270.00	3.320		1.000	
20	300.00	3.320		1.000	· · · · · · · · · · · · · · · · · · ·
21	330.00	3.330		1.010	
		3.330	<u> </u>	1.010	
					·*
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Transmissivily [m²/min]: 3.23 x 10⁻²

Paterson Group Ltd.		Pumping test analysi	Pumping test analysis		none, Page 2
Nepean,	ON K2E 7T7	Recovery method after THEIS & JACOB		Project: PH0482	
		Confined aquifer	Evaluated by: RAP		
Pumpin	ng Test No. 1		Test conducted on: I	Mar 21/07	
TW6			TW6	-	
Dischar	rge 0.73 l/s		Distance from the m	Impino well 0 150 m	
Static w	vater level: 2.320 m below datum		Pumping tost duratie	amping wen 0, 150 ht	
	Time from	Water level	Pumping test duration		
	end of pumping		drawdov	vn	
1	[min] 1.00	[m]	[m]		
2	1.50	2.580		0.260	
3	2.00	2.380		0.060	,
4	<u>5.00</u>	2.350		0.030	
	10.00	2.330		0.010	
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Transmissivity [m²/min]: 5.48 x 10⁻⁴



Transmissivity [m²/min]: 1.93 x 10⁻⁴

Storativity: 4.23 x 10⁻³



Transmissivity [m²/min]: 6.56 x 10⁻³

-		<u></u>	·····	· · · · · · · · · · · · · · · · · · ·		
1-28	rson Group Ltd.	Pumping test analysis Recovery method after THEIS & MCOR		Date:	none, Page 2	
Nepea	n ON K2E 717			Project: PH0482		
	Confi		onfined aquifer		Fortunt of how Dates	
D		Evaluated by: RAP				
Pump		Test conducted on:	January 24, 2008			
TW7			TW7 Pumping Test	···· <u>— </u>		
Disch	arge 0.76 l/s		Distance from the pu	mping well 0.150 r	า	
Static	v.ater level: 2.350 m below datum		Pumping test duration	n: 360.00 min		
	Time from	Water level	Residua	al		
	end of pumping		drawdov	vn		
	[min]	[m]	[m]			
1	0.50	5.700		3.350		
2	1.00	5.240		2.890		
3	1.50	5.150		2.800		
4	2.00	5.070		2.720		
6	4.00	4.900		2.550		
7	5.00	4.750	· } · · · · ·	2.400		
8	7.00	4.470		2.120		
9	10.00	4.300		1.950		
10	15.00	4.100		1.750	<u> </u>	
11	20.00	3.940		1.590	· · · · · · · · · · · · · · · · · · ·	
12	30.00	3.700		1.350		
13	45.00	3.450		1.100		
15	75.00	3.310		0.960		
16	105.00	2.960		0.610		
17	120.00	2.850		0.500	·	
51	540.00	2.350		0.000		
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Transmissivity (m²/min): 6.88 x 10⁻³

Storativity: 4.76 x 10⁻²

	Paterso	n Group Ltd.	Pumping test analysis Theis analysis method Confined aquifer		Date:	none, Page 2	
	Nepean, Qf	N K2E 717			Project: PH048	2	
	ļ				Evaluated by: f	RAP	
	Pumping	Test No.		Test conducted of	on: January 24, 2008		
	TW7		TW7 Pumping Test				
	Discharg	e 0.76 l/s	Distance from th		he pumping well 0.150 m		
	Static wa	ter level: 2.350 m below datum					
		Pumping test duration	Water level		vdown		
		[min]	[m]	[1	m]		
	- 2	0.50	3 42	· · · · · · · · · · · · · · · · · · ·	1.070		
	3	1.00	3.77	<u>, </u>	1.420		
	4	1.50	3.95(0	1.600		
	5	2.00	4.10	0	1.750		
	6	2.50	4.220	<u>p</u>	1.870		
		3.00	4.330	<u> </u>	1.980		
	9	5.00	4.470 <u>4.470</u>	<u> </u>	2,720		
	10	7.00	4.79		2.290		
1	11		4.990	0	2.640		
	12	20.00	5.370	0	3.020		
	13	30.00	5.550	0	3.200		
	14	60.00	5.99		3.640		
	16	120.00	6.17	<u></u>	3.820		
	17	150.00	6.44	<u> </u>	4,090		
	18	180.00	6.51	0	4.160		
	19	210.00	6.59	o	4.240		
	20	240.00	6.63	0	4.280		
	21	270.00	6.65	0	4.300		
	22	330.00	6,67		4.320	·	
	24	360.00	6.72	0	4.370		
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	Paterson Group Ltd. 1-28 Concourse Gate		Pumping test analysi Time-Drawdown plot	is	Date:	none, Page 2		
	Nepean, ON	K2E 7T7			Project: PH0482			
	Pumping 1				Evaluated by: F	RAP		
				lest conducted on: January 24, 2008				
· 1				TW7 Pumping Test				
		U./6 //s		Distance from the	Distance from the pumping well 0.150 m			
-	Static water level: 2.350 m below datum							
		Pumping test duration	Water level	Draw	down			
		(min)	[m]	ĺn	1			
	1	0.00	2.350		0.000			
	3	1.00			1.070	· · · · · · · · · · · · · · · · · · ·		
,	4	1.50	3.770		1.420			
	5	2.00	4.100		1.600			
	- 6	2.50	4.220		1.870			
		3.00	4.330		1.980			
1	9		4.470		2.120			
	10	7.00	4.840		2.290			
	11	10.00	4.990		2.440			
	12	20.00	5.370		3.020			
		30.00	5.550		3.200			
	15	90.00	5.990		3.640			
	16	120.00	6.170		3.820			
	17	150.00	6.440		4.090			
1	18	180.00	6.510		4 160			
1	20	210.00	6.590		4.240			
	21	270.00	6 650		4.280			
i	22	300.00	6.670		4.300			
i.	23	330.00	6.730		4.380			
	24	360.00	6.720		4.370			
	26	360.50	5.700		3.350			
	27	361.50	5.240	<u> </u>	2.890			
	28	362.00	5.070		2.600			
	29	363.00	4.900		2.550			
	30	364.00	4.750		2.400			
	32	365.00	4.650		2.300			
	33	370.00	4.470		2.120			
	34	375.00	4.100		1.750			
	35	380.00	3.940		1.590			
	36	390.00	3.700	·	1.350			
	38	405.00	3.450	+	1.100			
	39	435.00	3.070	· · · · · · · · · · · · · · · · · · · 	0.960			
	40	465.00	2.960		0.610			
	41	480.00	2.850		0.500			
	42	900.00	2.350	·	0.000			
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Transmissivity [m²/min]: 9.26 x 10-3

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Wate	erloo Hydrogeologic	Pumping test analysis	S	Date:	none, Page 2		
Waterie	volumula 131, VV. 20,Ontario,Canada	Time-Drawdown plot		Project: PH0482			
ph.(519	9)746-1798		Evaluated by:				
Pump	ing Test No. 24 hour		Test conducted on:				
TW8			TW8				
Disch	arge 0.76 l/s						
Static	water level: 4 830 m below datum						
	Pumping test duration	Drouvla					
				wn			
	[min]	[m]	[m]				
	0.00	4.830		0.000			
$\frac{2}{3}$	2 00	5.860		2.030			
4	3.00	7 740		2.560			
5	4.00	7,990		3.160			
6	5.00	8.170		3.340			
7	6.00	8.320		3.490			
8	7.00	8.410		3.580			
- 10	8.00	<u> </u>	·	3.640			
11	9,00	8.560		3.730			
12	15.00	8.600		3.770			
13	20.00	8.850		4.020			
14	25.00	8.900		4.070			
15	30.00	8.950		4.120			
16	40.00	9.010		4.180			
17	50.00	9.040		4.210			
18	60.00	9.080		4.250	· 		
20	100.00	9.120		4.290			
21	120.00	9,160		4.330			
22	150.00	9.170		4.340			
23	180.00	9.050		4.220	••••••••••••••••••••••••••••••••••••••		
24	210.00	9.080		4.250			
25	240.00	9.140		4.310			
20	300.00	9.110		4,280			
28	420.00	9.130		4.300			
29	480.00	9.070	- - -	4.240	· · · · · · · · · · · · · · · · · · ·		
30	540.00	9.100		4.270			
31	600.00	9.080		4.250			
32	660.00	9.070		4.240			
33	720.00	9.070		4.240			
34	1080.00	9.050		4.220	·		
36	1440.00	9.050		4.220			
37	1443.00	6.250		1.420			
38	1444.00	6.100		1.270			
39	1445.00	5.970		1.140			
40	1446.00	5.870		1.040			
	1447.00	5.790		0.960			
42	1448.00 1448.00	5.730		0.900			
40	1449.00	5.670		0.790			
45	1455.00	5.470	·	0.640			
46	1460.00	5.370		0.540			
47	1465.00	5.300		0.470			
48	1470.00	5.250		0.420			
49	1480.00	5.170		0.340			
50	1490.00	5.150		0.320			

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Waterl	oo Hydrogeologic	Pumping test analysis		Date:	none, Page 3		
Waterloo,	Ontario,Canada	nime-Drawdown plot		Project: PH0482	,		
ph.(519)7	46-1798		Evaluated by:				
Pumping	g Test No. 24 hour		Test conducted on:				
TW8			TW8		· · · · · · · · · · · · · · · · · · ·		
Dischar	ge 0.76 l/s						
Static w	ater level: 4.830 m below datum	·····					
	Pumping test duration	Water level	Drawdov	vn			
	imini	[m]	[m]				
51	1500.00	5.100		0.270			
52	1520.00	5.040		0.210			
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Water	loo Hydrogeologia	Pumping test and i		Data		
180 Co	lumbia St. W.	Time-Drawdown plot			none, Page 4	
Waterloo ph (519)7	Ontario.Canada 746.1798			Project: PH0482		
		<u></u>	Evaluated by:			
Pumpin	ig Test No. 24 hour		Test conducted on;			
TW8			TW1			
Dischar	rge 0.76 l/s		Distance from the pu	mping well 353.00)0 m	
Static v	vater level: 2.230 m below datum		······			
Pumping test duration		Water level	Drawdown			
	[min]	[m]	<u>(m)</u>		 , 	
2	60.00	2.230		0.000		
3	100.00	2.230		0.000		
4	150.00	2.230		0.000		
5	180.00	2.200		-0.030		
7	300.00	2.190		-0.040		
8	360.00	2.190		-0.040		
9	363.00	2.200		-0.030		
10	420.00	2.190		-0.040		
11	540.00	2.190		-0.040		
13	660.00	2.190		-0.040		
14	720.00	2.160		-0.070		
15	1080.00	2.160		-0.070		
	1440.00	2.150		-0.080		
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Wate	erloo Hydrogeologic	Pumping test analysi	S	Date:	none, Page 5	
Waterio	xx, Ontario, Canada	Ime-Urawdown plot		Project: PH0482		
ph.(519	9)746-1798		Evaluated by:			
Pump	ing Test No. 24 hour		Test conducted on:			
TW8			TW7			
Disch	arge 0.76 l/s		Distance from the pu	mping well 72.000	 m	
Static	water level: 6.890 m below datum					
	Pumping test duration	Water level	Drawdov	Drawdown		
1	[min]	[m]	[m]	0.000		
2	60.00	6.890		0.000		
3	100.00	6.950		0.060		
4	150.00	7.040		0.150		
5	180.00	7.010		0.120		
6	240.00	7.100		0.210		
7	300.00	7.130		0.240		
<u>о</u>	360.00	7.140		0.250		
10	420.00	7.140		0.250		
11	540.00	7.130		0.240		
12	600.00	7.050		0.160		
13	660.00	7.140		0.250		
14	720.00	7.140		0.250		
15	1080.00	7.140		0.250		
10	1440.00	7.140		0.250		
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Waterloo Hydrogeologic Pumping test :		Pumping test analysi	s	Date:	none, Page 6		
180 C Waterk	columbia St. W.	Time-Drawdown plot		Project: PH0482			
ph.(519	0)746-1798		Evaluated by:				
Pump	ing Test No. 24 hour		Test conducted on:				
TW8			TW5				
 Disch	arge 0.76 l/s		Distance from the sur				
	water level 5 000 as he level at the	<u> </u>		mping well 134.0	00 m		
Static	Bumping test duration						
	Pumping test ouration	Water level	Drawdown				
	[min]	(m)	[m]				
1	0.00	5.880		0.000			
2	60.00	5.880		0.000			
3	100.00	5.910		0.030			
	240.00	5.880		0.000			
6	300.00	5.970		0.030			
7	360.00	5.910		0.030			
8	363.00	5.880		0.000	·····		
9	420.00	5.880		0.000			
10	480.00	5.880		0.000	····		
	540.00	5.860		-0.020			
13	660.00	5.850	<u> </u>	-0.030			
14	720.00	5.850		-0.030			
15	1080.00	5.850		-0.030			
16	1440.00	5.850		-0.030			
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Wate	erloo Hydrogeologic	Pumping test analysis Time-Drawdown plot		Date:	none, Page 7
Waterk	columbia St. VV. 20,Ontario,Canada			Project: PH0482	
ph.(519	9)746-1796			Evaluated by:	
Pump	ing Test No. 24 hour		Test conducted on:	I	
TW8	·		TW2		
Disch	Discharge 0.76 l/s Distance from the pumping well 167,000 m				
Static	water level: 4 420 m below datum				
	Pumping test duration	Water level	Drouvday		
	i amping toor carbion	AAGICI ICACI		WIL .	
	[min]	[m]	[m]		·
1	0.00	4.420		0.000	
	100.00	4.420		0.000	·
4	150.00	4.430		0.010	
5	180.00	4.450		0.030	
6	240.00	4.430		0.010	
7	300.00	4.420		0.000	
8	360.00	4.420		0.000	·
10	<u>303.00</u> <u>420.00</u>	4.450		0.030	
11	480.00	4.430		0.010	
12	540.00	4.450		0.030	
13	600.00	4.450		0.030	
14	660.00	4.450		0.030	
15	720.00	4.450		0.030	
15	1080.00	4.450		0.030	
				0.050	
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Water	Waterloo Hydrogeologic Pumping test an		5	Date:	none, Page 8	
Waterloo	o,Onterio,Canada	Time-Drawdown plot		Project: PH0482		
ph.(619))746-1798			Evaluated by:		
Pumpi	ing Test No. 24 hour		Test conducted on:	· · · · · · · · · · · · · · · · · · ·		
TW8			TW9			
Discha	arge 0.76 l/s		Distance from the ou	Imping well 304.00	00 m	
Static	water level: 2.930 m below datum					
	Pumping test duration	Water level	Drawdov	wn		
┞──╷┤	[min]	[m]	[m]	0.000	<u> </u>	
2	60.00	2.930	·	0.000		
3	100.00	2.960		0.030		
4	150.00	2.960		0.030		
5	180.00	2.960		0.030		
6	240.00	2.960		0.030		
7	300.00	2.960		0.030		
0	420.00	2.960		0.030		
10	480.00	2.960		0.030		
11	540.00	2.960		0.030		
12	600.00	2.940		0.010		
13	660.00	2.960		0.030		
14	1080.00	2.960	· · · · · · · · · · · · · · · · · · ·	0.030		
10	1440.00	2.900		0.030		
	1770.00	2.300				
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Waterloo Hydrogeologic		ologic Pumping test analysis		Date:	none, Page 2	
Waterlo	olumbia St. VV. Io,Ontario,Canada	Uistance-Time-Drawdown-method after COOPER & JACOB		Project: PH0482		
ph.(519))746-179B	Confined aquifer	_	Evaluated by:		
Pumpi	ing Test No. 24 hour	T	Test conducted on:			
TW8			T W8			
Disch	arge 0.76 l/s					
Statio	water level: 1 830 m hotour dat		· · · · · · · · · · · · · · · · · · ·			
5000	Rupping test duration	181-4		<u> </u>		
l	e onlying test outation	vvater level	Drawdo	wn		
	[min]	[m]	[m]			
2	1.00	6.860		2.030		
- 4	3.00	7.740		2.980		
5	4.00	7.990		3.160		
6	5.00	8.170		3.340		
7	6.00	8.320		3.490		
- 8	7.00	8.410		3.580		
9 10	0.00 0.00	8.470		3.540		
	10.00	0.000 8 600		3.770		
12	15.00	8.760		3.930	-	
13	20.00	8.850		4.020		
14	25.00	8.900		4.070		
15	30.00	8.950	_	4.120		
<u>16</u> <u>17</u>	40.00	9.010		4.180		
18	60.00 60.00	9.040 9.040	-	4.210		
19	80.00	9.120		4.290	· · · · · · · · · · · · · · · · · · ·	
20	100.00	9.150		4.320		
21	120.00	9.160		4.330	·····	
22	150.00	9.170		4.340		
- <u>-23</u> - <u>-</u> 24	210.00	9.050		4.220	<u> </u>	
	240.00	9.140		4.310		
26	300.00	9.110		4.280		
27	360.00	9.130		4.300		
28	420.00	9.010		4.180		
29	480.00	9.070		4.240	· · · · · · · · · · · · · · · · · · ·	
30	601.00	9.100		4,250		
32	660.00	9.070		4.240	 	
33	720.00	9.070		4.240		
34	1080.00	9.050		4.220		
35	1440.00	9.050		4.220		
36	1442,00	<u>Б.450</u> 6 350		1 420		
	1444.00	6.100		1.270		
39	1445.00	5.970		1.140		
40	1446.00	5.870		1.040		
41	1447.00	5.790		0.960		
42	1448.00	5.730		0.900		
43 44	1450.00	5.620		0.790		
45	1455.00	5.470		0.640		
46	1460.00	5.370		0.540		
47	1465.00	5.300		0.470		
48	1470.00	5.250		0.420		
49 50	1480.00	5.170	·	0.320		
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Waterloo Hydrogeologic 180 Columbia Sl. W. Waterloo,Ontario,Canada		Do Hydrogeologic Pumping test analysis umbia St. W. Distance-Time-Drawdown-method Datario,Canada after COOPER & JACOB		Date:	none, Page 3		
				Project: PH0482			
ph (519)74	16-1798	Confined aquifer		Evaluated by:	Evaluated by:		
Pumping	g Test No. 24 hour		Test conducted or	n:			
TW8			TW8				
Discharç	ge 0.76 l/s						
Static wa	ater level: 4.830 m below datum	·······					
	Pumping test duration	Water level	Draw	down			
	[min]	[m]	[n	n)			
51	1500.00	5.100		0.270			
52	1520.00	5.040		0.210			
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Waterloo Hydrogeologic Pumping test analy 180 Columbia St. W. Distance-Time-Drav Waterloo Ontario Canada after COOPER & U		 S	Date:	none, Page 4	
		Distance-Time-Draw	down-method	Project: PH048	<u></u>
ph.(519	2)746-1798	Confined aquifer		Evaluated by:	-
Pump	ving Test No. 24 hour		Test conducted of		
TW8	····		TW/1		
Disch	arge 0.76]/s				
Static	water level: 2 220 m below deturn			e pumping weil 353.0	
	Pumping test duration			- <u>-</u>	
	r umping test duration	vvaler level	Drav	vdown	
-	[min]	<u>[m]</u>	I	m]	
2	60.00	2 230		0.000	
3	100.00	2.230		0.000	
4	150.00	2.230		0.000	,,,,
5	180.00	2.200		-0.030	
6 7	240.00	2.190		-0.040	
- ' R	300.00	2.190		-0.040	
9	363.00	2.190		-0.040	
10	420.00	2.190		-0.030	
11	540.00	2.190		-0.040	
12	600.00	2.190		-0.040	·
13	660.00	2.190		-0.040	
14	720.00	2.160		-0.070	
10	1080.00	2.160		-0.070	<u> </u>
	1440.00	2.150		-0.080	· · · · · · · · · · · · · · · · · · ·
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180 C	180 Columbia SI W		\$ 	Date:	none, Page 5
Waterto	oo,Ontario,Canada	after COOPER & JA(after COOPER & JACOB		2
ph.(519	J)746-1798	Confined aquifer		Evaluated by:	
Pump	Pumping Test No. 24 hour Test			t n:	······
TW8					<u></u>
Disch	arge 0.76 l/s		Distance from the		
Static	water level: 6 800 m below datum			pumping wen 72.00	
	Pumping test duration				
	a onping test duration	vvater level	Draw	down	
	[min]	(m)	ſ'n	1	
2	<u> </u>	6.890		0.000	
4	150.00	7 040		0.060	<u> </u>
5	180.00	7,010		0.130	
6	240.00	7.100		0.210	
7	300.00	7.130		0.240	
8	360.00	7.140		0.250	
9	363.00	7.140		0.250	
10	420.00	7.160		0.270	
12	600.00	7.130		0.240	
13	660.00	7.140		0.100	······································
14	720.00	7.140		0.250	
15	1080.00	7.140		0.250	
16	1440.00	7.140		0.250	
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Wate	Waterloo Hydrogeologic Pumping test analys 180 Columbia St. W. Distance-Time-Draw		5	Dale:	none, Page 6
180 C			listance-Time-Drawdown-method		
Wateric ph.(519	00,0ntario,Canada))746-1798	atter COOPER & JA(Confined aquifer	COB		
Pump	ing Test No. 24 hour		Test conducted		
T14/9					
			GVVI		
Disch.	arge 0.76 l/s		Distance from the p	oumping well 134.00	0 m
Static	water level: 5.880 m below datum				
	Pumping test duration	Water level	Drawdo	own	
	[min]	r1	-		
	[0:03]	[m]	[m]		
2	60.D0	5.880		0.000	
3	100.00	5.910		0.030	
4	240.00	5.880		0.000	
6	300.00	5.910	· · · · · · · · · · · · · · · · · · ·	0.030	
7	360.00	5.910		0.030	
8	363.00	5.880		0.000	
9	420.00	5.880		0.000	
10	480.00	5.880		0.000	
12	540.00	5.860		-0.020	
	660.00	5 850		-0.030	
14	720.00	5.850		-0.030	
15	1080,00	5.850		-0.030	
16	1440.00	5.850		-0.030	
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Waterloo Hydrogeologic 180 Columbia St. W. Waterloo, Ontario, Canada		o Hydrogeologic Pumping test analysis		Date:	none, Page 7		
		Distance-Time-Draw after COOPER & JA	after COOPER & JACOB		2		
ph.(519)746-1798 Contined aquifer				Evaluated by:			
Pumping Test No. 24 hour			Test conducted o	n:			
TW8			TW2				
Discha	arge 0.76 l/s		Distance from the	pumping well 167.0	100 m		
Static	water level: 4.420 m below datum						
	Pumping test duration	Water level	Draw	down			
	[min]	[m]	(r	n]			
2	60.00	4.420	,	0.000			
3	100.00	4.430		0.010			
- 4	150.00	4.420	·	0.000			
- 5	180.00	4.450		0.030	<u> </u>		
- 0	240.00	4.430	· · · · · · · · · · · · · · · · · · ·	0.010			
- 8	360.00	4.420	· · · · · · · · · · · · · · · · · · ·				
- 9	363.00	4,450		0.030			
10	420.00	4,420)	0.000			
11	480.00	4.430)	0.010			
12	540.00	4.450)	0.030			
13	600.00	4.450		0.030			
14	660.00	4.450)	0.030			
15	720.00	4.450)	0.030			
16	1080.00	4.450)	0.030			
	1440.00	4.450)	0.030			
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Wate 180 C	erioo Hydrogeologic Pumping test analysis Dale:		none, Page 8			
Waterlo	o,Ontario,Canada	after COOPER & JACOB		Project: PH0482		
ph.(519))746-1798	Confined aquifer		Evaluated by:		
Pumpi	ing Test No. 24 hour		Test conducted on:			
TW8			TW9			
Discha	arge 0.76 l/s		Distance from the	pumping well 304 0	00 m	
Static	water level: 2.930 m below datum					
	Pumping test duration	Water level	Draw	down		
	[min]	[m]	n]	ן [ו		
2	60.00	2 960	·	0.030	· · · · · · · · · · · · · · · · · · ·	
3	100.00	2.960		0.030		
4	150.00	2.960		0.030		
5	180.00	2.960		0.030		
6	240.00	2.960		0.030		
/ 8	300.00	2.960		0.030		
9	420.00	2.960		0.030	······	
10	480.00	2.960		0.020		
11	540.00	2.960		0.030		
12	600.00	2.940		0.010		
13	660.00	2.960		0.030		
14	720.00	2.960		0.030		
15	1080.00	2.960		0.030		
10	1440.00			<u>D.030</u>		
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Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada		Pumping test analysis Theis analysis method Confined aquifer		Dale:	none, Page 2		
				Project: PH0482			
ph (519)746-1798			Evaluated by:				
Pumpi	ng Test No. 24 hour		Test conducted or		·		
TW8			TW8	· · · · · · · · · · · · · · · · · · ·			
Discha	arge 0.76 l/s			· · ·	·····		
Static	waler level: 4.830 m below datum			· · · · · · · · · · · · · · · · · · ·			
	Pumping test duration	Waler level	Drawo				
	(min)	[m]	m][m	1			
2	1.00	6.860		2.030			
3	2.00	7.410		2.580			
4	3.00	7.740		2.910	. <u></u>		
6	5.00	7.990		3.160			
7	6.00	8.320		3.490			
8	7.00	8.410		3.580			
9	8.00	8.470		3.640			
10	9.00	8.560		3.730			
11	10,00	8.600		3.770			
13	20.00			4 020			
14	25.00	8,900		4.070			
15	30.00	8.950		4.120			
16	40.00	9.010		4.180	· · · · · · · · · · · · · · · · · · ·		
17				4.210			
18	80.00	9.080		4.250			
20	100.00	9.150		4.320			
21	120.00	9,160		4.330			
22	150.00	9.170		4.340			
23	180.00	9.050		4.220			
24	210.00	9.080		4.250			
25	300.00	9,110		4.260			
27	360.00	9.130		4.300			
28	420.00	9.010		4.180			
29	480.00	9.070		4.240			
30	540.00	9.100		4.270			
31	660.00	9.080		4.230			
33	720.00	9.070		4.240			
34	1080.00	9.050		4.220			
35	1440.00	9.050		4.220			
36	1442.00	6.450		1.620			
- 37	1443.00	6.250		1 270			
39	1445.00	5.970		1.140	······································		
40	1446.00	5.870		1.040			
41	1447.00	5,790		0.960			
42	1448.00	5.730		0.900			
43	1449.00	5.670		<u>0.840</u>	 -		
44	1455.00	5.470		0.640			
46	1460.00	5.370		0.540			
47	1465.00	5.300		0.470			
48	1470.00	5.250		0.420			
49	1480.00	5.170		0.340			
90	1490.00	0.150		0.020			

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Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada		Pumping test analys	Pumping test analysis		none, Page 3		
		Theis analysis meth Confined aquifer	od	Project: PH0482			
ph.(519)746-1	798			Evaluated by:	Evaluated by:		
Pumping To	est No. 24 hour		Test conducted on				
TW8			TW8				
Discharge (0.76 l/s						
Static water	r level: 4.830 m below datum		<u> </u>	<u> </u>			
P	umping test duration	Water level	Drawd	lown			
	()	<i>с</i> ,					
51	<u></u>	[m] 5 100	[m	0.270			
52	1520.00	5.040	<u>, </u>	0.210	· · · · · · · · · · · · · · · · · · ·		
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Wate	rloo Hydrogeologic	Pumping test analysis Theis analysis method Confined aquifer		Date:	none, Page 4	
Waterlo	olumora St. VV. po,Ontario,Canada			Project: PH0482		
ph.(519	9)746-1798		Evaluated by:			
Pump	ing Test No. 24 hour		Test conducted on:	·		
TW8			TW1			
Disch	arge 0.76 l/s		Distance from the pu	mping well 353.000	ń۱	
Static	water level: 2.230 m below datum					
· · · · · · · · · · · · · · · · · · ·	Pumping lest duration	Water level	Drawdov			
	[min]	[m]	()			
	[//mij	[///]	[m]			
2	60.00	2,230		0.000		
4	150.00	2.230		0.000		
5	180.00	2,200		-0.030		
6	240.00	2.190		-0.040		
8	360.00	2.190		-0.040		
9	363.00	2.200		-0.030		
10	420.00	2.190		-0.040		
12	600.00	2.190		-0.040		
13	660.00	2.190		-0.040		
14	720.00	2.160		-0.070		
15		2.160		-0.070		
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180 Columbus BL W. Westookunk, conside pl: \$189726-1748 Theis analysis method Confined aquifer Project: PMO482 Pumping Test No. 24 hour Test conducted on: Test conducted on: TW8 Distance from the pumping well 72.000 m Static water level: 6.890 m bolow datum Distance from the pumping well 72.000 m Static water level: 6.890 m bolow datum Test conducted on: 2 60.00 6.890 0.000 3 100.00 6.890 0.000 4 150.00 7.040 0.520 5 180.00 7.040 0.520 6 240.00 7.160 0.220 7 300.00 7.150 0.220 8 380.00 7.140 0.250 9 253.00 7.140 0.250 10 460.00 7.150 0.220 11 660.00 7.150 0.220 12 680.00 7.140 0.250 13 660.00 7.140 0.250 14 720.00 7.140 0	Waterloo Hydrogeologic 180 Columbia St. W. Waterloo Ontario Canada		geologic Pumping test analysis V. Theis analysis method		Date:	none, Page 5
pt :51374-1799 Evaluated by: Pumping Test No. 24 hour Test conducted on: TW8 TW7 Dischargo 0.76 Us Distance from the pumping well 72.000 m Stlut weller (next) 6.890 m below deturt Dischargo 0.76 Us Image: the stlut well of the s					Project: PH0482	
Pumping Test No. 24 hour Test conducted on: TW8 TW7 Discharge 0.76 Vs Discharge from the pumping well 72.000 m Static water level: 6.880 m below datum Urewdown [min] [m] 2 60.00 4 150.00 5 160.00 6 240.00 7 30.00 6 240.00 7 30.00 7 30.00 7 30.00 8 360.00 9 35.00 10 47.00 12 660.00 7 30.00 14 560.00 15 1060.00 12 660.00 13 660.00 14 720.00 15 108.00 14 1720.00 15 108.00 14 1720.00 15 108.00 16 1440.00 16 1440.00 </th <th>ph.(519)</th> <th>)746-1798</th> <th></th> <th></th> <th colspan="2">Evaluated by:</th>	ph.(519))746-1798			Evaluated by:	
TW8 TW7 Discharge 0.76 bs Distance from the pumping well 72 000 m Static water level: 6.890 m bolow datum Drawdown Imin] [min] 2 00.00 6.890 3 100.00 6.590 4 150.00 7.040 5 180.00 7.040 7 300.00 7.130 8 350.00 7.140 9 363.60 7.140 10 400.00 7.160 11 544.00 7.140 12 600.00 7.160 13 680.00 7.140 14 720.00 7.140 15 1080.00 7.140 16 144.00 7.140 16 144.00 7.140 16 144.00 7.140 16 144.00 7.140 16 144.00 7.140 16 144.00 7.140 16 144.00 7.140	Pumpi	ng Test No. 24 hour	·	Test conducted or	- .	_,
Discharge 0.76 Vs Distance from the pumping well 72 000 m Static water level 6.890 m below datum Drawdown [min] [m] 2 00.00 3 100.00 4 150.00 5 180.00 7 300.00 7 300.00 7 300.00 7 300.00 7 300.00 7 300.00 7 300.00 7 300.00 7 300.00 7 300.00 7 10 8 308.00 9 363.00 10 427.00 11 540.00 12 600.00 13 660.00 14 720.00 15 1080.00 16 1440.00 17.140 0.2560 16 1440.00 17.140 0.2560 18 1440.00	TW8			TW7		<u> </u>
Static water level Drawdown [min] [m] 2 60.00 3 100.00 4 156.00 5 160.00 6 240.00 7 300.00 8 360.00 7 300.00 7 300.00 7 300.00 7 300.00 7 300.00 7 300.00 7 300.00 7 300.00 10 420.00 7 300.00 7 100 9 35.00 11 540.00 12 600.00 7 140 0.250 15 1080.00 7 140 0.250 15 1080.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 16 1	Discha	arge 0.76 l/s		Distance from the	numping well 72 00	0 m
Purpling lest duration Water level Drawdown [min] [m] [m] 2 60.00 6.890 0.000 3 100.00 6.890 0.060 4 150.00 7.040 0.150 5 180.00 7.040 0.150 6 2.40.00 7.100 0.210 7 300.00 7.130 0.240 8 359.60 7.140 0.250 9 333.300 7.140 0.250 9 333.00 7.140 0.250 10 420.00 7.130 0.240 12 600.00 7.130 0.240 13 660.00 7.140 0.250 14 4770.00 7.140 0.250 15 1080.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 140 140	Static	water level: 6 890 m below datum				
Propendies consister Value Even Drawdown (min) (m) (m) 2 60.00 6.890 0.000 3 100.00 6.890 0.000 4 159.00 7.040 0.123 5 180.00 7.100 0.210 6 240.00 7.100 0.240 7 3300.00 7.140 0.2250 9 363.00 7.140 0.250 10 420.00 7.130 0.240 11 540.00 7.140 0.250 12 660.00 7.140 0.250 12 660.00 7.140 0.250 13 660.00 7.140 0.250 14 720.00 7.140 0.250 15 1080.00 7.140 0.250 14 720.00 7.140 0.250 15 1080.00 7.140 0.250 16 1440.00 7.140 0.250	Statte	Rumping test duration	Motor loval		·····	•
[min] [m] [m] 2 60.00 6.890 0.000 3 100.00 6.890 0.060 4 150.00 7.040 0.150 5 180.00 7.040 0.150 6 240.00 7.130 0.240 7 380.00 7.140 0.250 9 363.00 7.140 0.250 10 420.00 7.160 0.270 11 540.00 7.130 0.240 12 660.00 7.140 0.250 13 560.00 7.140 0.250 14 770.00 7.140 0.250 15 1080.00 7.140 0.250 16 1440.00 7.140 0.260 16 1440.00 7.140 0.260 16 1440.00 7.140 0.260 16 1440.00 1.140 1.140 16 1440.00 1.140 1.140		Fumping test duration	vvaler (eve)	Ulawo		
2 60.00 6.890 0.000 3 100.00 6.950 0.060 4 150.00 7.040 0.160 5 180.00 7.010 0.120 6 240.00 7.100 0.210 7 300.00 7.130 0.244 8 350.00 7.140 0.250 9 33.30 7.140 0.250 10 420.00 7.130 0.244 8 350.00 7.140 0.250 11 540.00 7.130 0.240 12 600.00 7.160 0.250 13 660.00 7.140 0.250 14 720.00 7.140 0.250 15 1080.00 7.140 0.250 16 1440.05 7.140 0.260 16 1440.05 7.140 0.260 16 1440.05 1.440.05 1.440.05 17 19 19 19		[min]	[m]	n]	1]	
1 0.000 0.000 3 100.00 6.850 0.060 4 150.00 7.040 0.150 5 180.00 7.100 0.210 6 240.00 7.100 0.240 7 300.00 7.130 0.240 8 360.00 7.140 0.250 9 363.00 7.140 0.250 10 470.00 7.166 0.270 11 540.00 7.300 0.240 12 60.00 7.560 0.160 13 660.00 7.140 0.250 14 720.00 7.140 0.250 15 1000.00 7.140 0.250 15 1000.00 7.140 0.260 16 1440.00 7.140 0.260 16 1440.00 7.140 0.260 16 1440.00 1 1 1 17 140 0.260 1 <td>2</td> <td>60.00</td> <td>6 890</td> <td></td> <td>0.000</td> <td>· · · · · · · · · · · · · · · · · · ·</td>	2	60.00	6 890		0.000	· · · · · · · · · · · · · · · · · · ·
4 150.00 7.040 0.150 5 180.00 7.010 0.120 6 240.00 7.100 0.210 7 300.00 7.130 0.240 8 360.00 7.140 0.250 9 363.00 7.140 0.250 10 420.00 7.160 0.270 11 540.00 7.130 0.240 12 660.00 7.140 0.250 13 660.00 7.140 0.250 14 700.00 7.140 0.250 15 1080.60 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 17 140 0.250 1.140 18 1980.00 7.140 0.250 19 19 19 19 19 19 19 19 19	3	100.00	6.950		0.060	
5 180.00 7.010 0.120 6 24000 7.130 0.240 7 360.00 7.130 0.240 8 360.00 7.140 0.250 9 363.00 7.140 0.250 10 420.00 7.160 0.270 11 540.00 7.130 0.240 12 600.00 7.130 0.240 13 660.00 7.130 0.240 14 72.000 7.140 0.250 15 1080.00 7.140 0.250 16 144.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 1.140 0.140 17 140 0.250 1.140 18 1440.00 1.140 1.140	4	150.00	7.040		0.150	
6 240.00 7.100 0.210 7 360.00 7.130 0.240 8 360.00 7.140 0.250 9 363.00 7.140 0.250 9 363.00 7.140 0.250 10 420.00 7.160 0.270 11 540.00 7.130 0.240 12 660.00 7.160 0.250 13 660.00 7.140 0.250 15 1080.00 7.140 0.250 15 1080.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 17 140 0.250 14 18 1080.00 7.140 0.250 19 140.00 7.140 0.250 10 140.00 7.140 0.250 10 140.00 1.140 0.250 10 140.00 1.140 1.140 11 140.00 1.140 1.140 1	5	180.00	7.010		0.120	
7 300.00 7.130 0.240 8 360.00 7.140 0.250 9 363.00 7.140 0.250 10 420.00 7.160 0.270 11 540.00 7.130 0.240 12 660.00 7.140 0.250 13 660.00 7.140 0.250 14 720.00 7.140 0.250 15 1080.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 17 140 0.250 140 18 1440.00 7.140 0.250 19 140.00 140.00 140.00 19 140.00 140.00 140.00 19 140.00 140.00 140.00	6	240.00	7.100		0.210	······································
8 360.00 7.140 0.250 9 363.00 7.140 0.250 10 420.00 7.160 0.270 11 540.00 7.130 0.240 12 660.00 7.160 0.250 13 660.00 7.140 0.250 14 720.00 7.140 0.250 15 1080.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250 17 140 0.250 1.00 18 1440.00 7.140 0.250 19 1440.00 7.140 0.250 10 1440.00 7.140 0.250 10 1440.00 140.00 140.00 10 140.00 140.00 140.00 10 140.00 140.00 140.00 10 140.00 140.00 140.00 10 140.00 140.00 140.00 14	7	300.00	7.130		0.240	
9 363.00 7.140 0.250 10 420.00 7.150 0.270 11 540.00 7.130 0.240 12 600.00 7.050 0.160 13 666.00 7.140 0.250 14 770.00 7.140 0.250 15 1080.00 7.140 0.250 16 1440.00 7.140 0.260 16 1440.00 7.140 0.260 16 1440.00 7.140 0.260 16 1440.00 7.140 0.260 16 1440.00 7.140 0.260 16 1440.00 7.140 0.260 17 140 0.260 1.00 18 1440.00 7.140 0.260 19 19 19 19 19 19 19 19 19 19 19 19 19 19 19 19 19 19 19 19 19 19 19 <td>8</td> <td>360.00</td> <td>7.140</td> <td></td> <td>0.250</td> <td></td>	8	360.00	7.140		0.250	
10 420.00 7.160 0.270 11 540.00 7.130 0.240 12 600.00 7.140 0.250 13 660.00 7.140 0.250 14 770.00 7.140 0.250 15 1980.00 7.140 0.250 16 1440.00 7.140 0.250 16 1440.00 7.140 0.250	9	363.00	7.140		0.250	
11	10	420.00	7.160		0.270	
12 00000 7.140 0.160 13 660.00 7.140 0.250 14 720.00 7.140 0.250 15 1080.00 7.140 0.250 16 1440.00 7.140 0.250	11	540.00	7.130	,, <u>,</u> , <u>,</u>	0.240	
	12	660.00	7.050	· · · · · · · · · · · · · · · · · · ·	0.160	
	14	720.00	7.140	· · · · · · · · · · · · · · · · · · ·	0.250	
	15	1080.00	7,140	,, _,, _	0.250	
Image: Section of the section of th	16	1440.00	7.140)	0.250	
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Wate	erloo Hydrogeologic	Pumping test analysis Theis analysis method Confined aquifer		Date:	лопе, Page 6
Waterio	co, Ontario, Canada			Project: PH0482	
ph.(519	9)746-1798			Evaluated by:	
Pump	ing Test No. 24 hour		Test conducted on:	· · · · · · · · · · · · · · · · · · ·	
TW8			TW5		
Disch	arge 0.76 l/s		Distance from the pu	Imping well 134.000	
Static	water level: 5.880 m below datum				
	Pumping test duration	Water level	Drawdoy		
	[min]	[m]	[m]		
2	60.00	5.880	<u> </u>	0.000	
3	100.00	5.910		0.030	
4	180.00	5.880		0.000	
6	300.00	<u> </u>		0.030	
7	360.00	5.910		0.030	
8	363.00	5.880		0.000	
9	420.00	5.880		0.000	
10	480.00	5.880		0.000	
12	600.00	5.850		-0.020	
13	660.00	5.850		-0.030	
14	720.00	5.850		-0.030	
15	1080.00	5.850		-0.030	
10	1440.00	5.850		-0.030	_ • <u>_</u>
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Wate	rloo Hydrogeologic	Pumping test analysi	s	Date:	none, Page 7
180 C Waterlo	olumbia St. W. o Oplario Canada	Theis analysis metho Confined aquifer	Theis analysis method Confined aquifer		
ph.(519)746-1790			Evaluated by:	
Pump	ing Test No. 24 hour	,,	Test conducted on:	<u> </u>	
TW8					
Disch			Distance from the		
			Distance from the pi	umping well 167.00	0 m
Static	water level: 4.420 m below datum				
	Pumping test duration	Water level	Drawdo	wn	
	ſmin]	Iml	[10]		
		[]			
2	60.00	4.420		0.000	
3	100.00	4.430		0.010	
<u>4</u> 5	180.00	4.420	r.	0.000	
6	240.00	4.430	·	0.010	
7	300.00	4.420		0.000	
8	360.00	4.420	-	0.000	
9	363.00	4.450		0.030	
10	420.00	4.420	<u> </u>	0.000	
12	480.00	4.430		0.030	<u></u>
13	600.00	4.450		0.030	
14	660.00	4.450		0.030	
15	720.00	4,450		0.030	
16	1080.00	4.450		0.030	u u
17	1440.00	4.450		0.030	
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Waterloo Hydrogeologic 180 Columbia SI. W. Waterloo,Ontario,Canada		Pumping test analysi	umping test analysis		none, Page 8
		Theis analysis metho Confined aguifer	bd	Project: PH0482	
ph.(519)7	746-1798	,	Evaluated b		
Pumpin	ng Test No. 24 hour	····	Test conducted on:	-1. ·	
TW8	·		TW9		<u> </u>
Discha	rge 0.76 l/s		Distance from the p	umping well 304.0	00 m
Static v	water level: 2.930 m below datum	<u>. </u>	· · · ·		
	Pumping test duration	Water level	Drawdo	own	• • • • • •
	,				
	[min]	[m]	[m]		
2	60.00	2.960)	0.030	
3	100.00	2.960	}	0.030	·····
4	150.00	2.960)	0.030	
5	180.00	2.960)	0.030	
6	240.00	2.960)	0.030	
	300.00	2.960) 	0.030	
8	360.00	2.960		0.030	
9	420.00	2.950)	0.020	
11	540.00	2.900	<u> </u>	0.030	
12	600.00	2.94()	0.010	
13	660.00	2.960		0.030	<u> </u>
14	720.00	2.960	<u> </u>	0.030	
15	1080.00	2.960		0.030	
16	1440.00	2.960)	0.030	
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Waterloo Hydrogeologic Pu 180 Columbia St. W. Th Waterloo,Ontario,Canada Columbia St.		Pumping test analysis	Pumping test analysis Thels analysis method Confined aquifer		none, Page 2
		Theis analysis methor Confined aquifer			 2
ph.(519)746-1798	}	Evaluated by:		
Pump	ing Test No. 24 hour		Test conducted on		
TW8			114/8	·	
Disch					
					<u> </u>
Static	water level: 4.830 m below datum				
	Pumping test duration	Water level	Drawd	own	
	[min]	լայ	ſm	1	
				<u>ا</u>	
2	1.00	6.860		2.030	
3 4	2.00	7.410		2.580	
		7.740		2.910	I r
6	5.00	8.170		3.160	
7	6.00	8.320		3.490	
8	7.00	8.410		3.580	
9	8.00	8.470		3.640	
10	9.00	8.550		3.730	·
12	15.00	8.000	<u> </u>	3.770	
13	20.00	8.850		4.020	
14	25.00	B.900		4.070	
15	30.00	8.950		4.120	
16	40.00	9.010		4.180	
- 18	<u></u>	9.040		4.210	
19	80.00	9,120		4.290	
20	100.00	9.150		4.320	
21	120.00	9.160		4.330	
22	150.00	9.170		4.340	
23	210.00	9.050		4.220	
25	240.00	9.140		4.310	<u> </u>
26	300.00	9.110		4.280	
27	360.00	9.130		4.300	
28	420.00	9.010		4.180	
- 29	480.00	9.070		4.240	
31	600.00	9.080		4.250	
32	660.00	9.070		4.240	·
33	720.00	9.070		4.240	
34	1080.00	9.050		4.220	
35	1440.00	9.050		4.220	
37	1443.00	6.250		1.420	
38	1444.00	6.100	_ 	1.270	
39	1445.00	5.970		1.140	
40	1446.00	5.870		1.040	
41	1447.00	5,790		0.960	
43	1449.00	5 670		0.840	
44	1450.00	5.620		0.790	
45	1455.00	5.470		0.640	······································
46	1460.00	5.370		0.540	
4/	1465.00	5.300		0.470	
49	1480.00	5 170		0.340	
50	1490.00	5.150		0.320	

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Waterloo Hydrogeologic 180 Columbia St. W. Waterloo Ontatio Canada		Pumping test analys	Pumping test analysis		none, Page 3
		Theis analysis method Confined aguifer		Project: PH0482	
ph.(519)7	46-1798	•		Evaluated by:	
Pumpin	g Test No. 24 hour		Test conducted on:		
TW8			TW8		
Dischar	ae 0.76 l/s				
Statio u	vater level: 4.830 m below datum	·	L		
Stallo W	Pumping test duration	Water level	Drawd	own	
		11461 10101			
	[min]	[m]	[m]	0.070	
51	1500.00	5.100)	0.210	
	1020.00				
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Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada		Pumping test analysis Theis analysis method Confined aquifer		Date:	none, Page 4	
				Project: PH0482		
ph.(519)	746-1798		E		Evaluated by:	
Pumping Test No. 24 hour Test co				producted on:		
TW8			TW1			
Discha	arge 0.76 l/s		Distance from the pr	umping well 353.0	00 m	
Static	water level: 2.230 m below datum		· · · · · · · · · · · · · · · · · · ·			
	Pumping test duration	Water level	Drawdo	wn		
	[min]	[m]	[m]			
2	<u></u>	2 230	· · · · · · · · · · · · · · · · · · ·	0.000		
3	100.00	2.230	/	0.000		
4	150.00	2.230		0.000		
5	180.00	2.200		-0.030	······	
6	240.00	2.190		-0.040		
7	300.00	2,190		-0.040		
8	360.00	2.190	<u> </u>	-0.040		
10	363.00	2.200		-0.030		
11	420.00	2.190	· · · · · · · · · · · · · · · · · · ·	-0.040		
12	600.00	2.190		-0.040		
13	660.00	2.190	,	-0.040		
14	720.00	2.160)	-0.070		
15	1080.00	2.160)	-0.070	•	
16	1440.00	2.150)	-0.080		
						
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Wate	erioo Hydrogeologic	Pumping test analysis		Date:	none, Page 5		
Waterlo	polumpia St. VV. po,Onlario,Canada	Theis analysis metho Confined aguifer	bd	Project: PH0482	<u></u>		
ph.(519	9)746-1798				Evaluated by:		
Pump	ing Test No. 24 hour		Test conducted on:				
TW8			TW7				
Disch	arge 0.76 l/s		Distance from the pu				
Statio					n		
	Rumping test duration						
	Fumping test duration	vvater level	Drawdor	wn			
	[min]	[m]	[m]				
	<u> </u>	0.000					
- 2	60.00	6.890		0.000			
4	150.00	7 040		0.060	/		
5	180.00	7.010		0.120			
6	240.00	7.100		0.210			
7	300.00	7.130		0.240			
8	360.00	7.140		0.250			
	363.00	7.140		0.250			
11	420.00	7.160		0.270			
12	600.00	7.130		0.240			
13	660,00	7.140	· · · · · ·	0.250			
14	720.00	7.140		0.250	· · · · · · · · · · · · · · · · · · ·		
15	1080.00	7.140		0.250			
16	1440.00	7.140		0.250			
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Waterloo Hydrogeologic 180 Columbia St. W. Waterloo,Ontario,Canada		Pumping test analysi	Pumping test analysis		none, Page 6	
		Theis analysis method Confined aquifer		Project: PH0482		
ph (519)7	46-1798		· · · · · · · · · · · · · · · · · · ·		Evaluated by:	
Pumpin	g Test No. 24 hour	· · · · · · · · · · · · · · · · · · ·	Test conducted or			
TW8			TW5			
Dischar	ge 0.76 Vs		Distance from the	pumping well 134.0	00 m	
Static w	ater level: 5.880 m below datum	, <u>, , , , , , , , , , , , , , , , </u>				
	Pumping test duration	Water level	Drawo	jown		
	[min]	[m]	l In	a 1		
		[m]	<u></u>	<u>' </u> -		
2	60.00	5.880		0.000		
3	100.00	5.910		0.030		
4	240.00	5.880		0.000		
- 5	300.00	5.970		0.090		
7	360.00	5.910		0.030		
B	363.00	5.880	<u></u>	0.000		
9	420.00	5.880		0.000		
10	480.00	5.880		0.000	·····	
11	540.00	5.860		-0.020		
12	600.00	5.850	·	-0.030		
13	660.00	5.850		-0.030		
<u>- 14 i</u>	720.00	5.850		-0.030		
15	1080.00	5.850))	-0.030		
- 16			· · · · · · · · · · · · · · · · · · ·	-0.030	······································	
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Waterloo HydrogeologicPumpin180 Columbia St. W.Theis arWaterloo, Ontario, CanadaConfineph.(519)746-1798Confine		Pumping test analysis		Date:	none, Page 7	
		Confined aquifer	bd	Project: PH048	2	
			Evaluated			
Pumpir	ng Test No. 24 hour		Test conducted on:			
T W8			TW2	·	· · · · · · · · · · · · · · · · · · ·	
Discha	rge 0.76 l/s		Distance from the p	umping well 167.0	000 m	
Static v	vater level: 4.420 m below datum		L			
	Pumping test duration	Water level	Drawdo			
	r:-1					
	[min]	[m <u>ş</u>	[m]			
2	60.00	4.420		0.000		
3	100.00	4.430)	0.010		
4	150.00	4.420	· · · · · · · · · · · · · · · · · · ·	0.000	·	
2	240.00	4,450	· · · · · · · · · · · · · · · · · · ·	0.030		
7	300.00	4.430		0.010		
8	360.00	4,420	,	0.000	·······	
9	363.00	4.450	, ,	0.030	· · · · · · · · · · · · · · · · · · ·	
10	420.00	4.420		0.000		
11	480.00	4.430		0.010		
12	540.00	4.450		0.030		
13	600.00	4.450)``	0.030		
14	660.00	4.450)	0.030	· · · · · · · · · · · · · · · · · · ·	
15	720.00	4.450	<u> </u>	0.030		
10	1080.00	4.450	,	0.030		
	110.00		· · · · · · · · · · · · · · · · · · ·			
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Waterloo Hydrogeologic 180 Columbia St. W. Waterloo, Ontario, Canada		Pumping test analys	Pumping test analysis Theis analysis method Confined aquifer		none, Page 8
		Theis analysis metho Confined aguifer			
ph.(619	ph. (619)746-1798			Evaluated by:	
Pump	ing Test No. 24 hour	•	Test conducted or	<u>ו</u> ז:	
TW8	· · · ·		TW9		· · · · · · · ·
Disch	arge 0.76 l/s		Distance from the	pumping well 304.04	00 m
Static	water level: 2.930 m below datum	- · - · -			
	Pumping test duration	Water level	Draw		
			Didw		
	[min]	[m]	n]	ו]	
2	60.00	2 960	<u> </u>	0.030	
3	100.00	2.960	>	0.030	
4	150.00	2.960)	0.030	
5	180.00	2.960)	0.030	
6	240.00	2.960)	0.030	
7	300.00	2.960	2	0.030	
8	360.00	2.960	<u>, </u>	0.030	
9	420,00	2.950	<u></u>	0.020	
10	480.00	2.90	<u></u>	0.030	
12	\$40.00 600.00	2.900	>	0.010	
12	660.00	2.96		0.030	······································
14	720.00	2.96	D	0.030	
15	1080.00	2.96	0	0.030	
16	1440.00	2.96	0	0.030	
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Waterloo Hydrogeologic 180 Columbia St. W. Waterloo Ontario Canada		Pumping test analysis	Date:	: none, Page 2		
		Theis analysis method Confined aquifer	Proje	ect: PH0482		
ph.(519)746-17	98	an addition	Evalu	Evaluated by:		
Pumping Tes	st No. 24 hour	Te	Test conducted on:			
TW8	<u></u>	- <u></u>	TW8			
 Discharge 0	76 l/s			·		
				· · · · · · · · · · · · · · · · · · ·		
Static water	level: 4.830 m below datum					
Pu	mping test duration	Water level	Drawdown			
	fmint	(m)	[m]			
2	1.00	6.860	2.0	030		
3	2.00	7.410	2.	580		
	3.00	7./40	2.	160		
6	5.00	8.170	3.	340		
7	6.00	8.320	3.4	490		
8	7.00	8.410	3.	580		
9	8.00	8.470	3.	640		
10	9.00	8.560	3.	730		
17	10.00	8.600	3.	<u>.//U</u>		
13	20.00	8 850	3	<u></u>		
14	25.00	8.900	4.	.070		
15	30.00	8.950	4.	.120	- ,	
16	40.00	9.010	4.	.180		
17	50.00	9.040	4.	.210		
18	60.00	9.080	4.	.250		
19	80.00	9.120	4.	320		
20	120.00	9.100	<u>4.</u>	330		
22	150.00	9.170	4.	.340		
23	180.00	9.050	4.	.220		
24	210.00	9.080	4.	.250		
25	240.00	9.140	4	.310		
26	300.00	9.110	4	.280		
27	360.00	9.130	4.	.500		
20	420.00	9.010	4	.240		
30	540.00	9.100	4	.270	A	
31	600.00	9.080	4	.250		
32	660.00	9.070	4	.240		
33	720.00	9.070	4	.240		
34	1080.00	9.050	4	.220		
35	1440.00	9.050	4	620	_	
37	1442.00	6.450		1.420		
38	1444.00	6.100	<u> </u>	1.270		
39	1445.00	5.970	1	1.140		
40	1446.00	5.870	<u>1</u>	1.040		
41	1447.00	5.790	- <u>-</u>	2.960		
42	1448.00	5.730		1.900	-	
-43	1449.00	5.620		0.790		
- 44 - <u>4</u> 5	1450.00	<u> </u>		0.640		
46	1460.00	5.370		0.540		
47	1465.00	5.300	(0.470		
48	1470.00	5.250		0.420		
49	1480.00	5.170	<u></u>	D.340		
50	1490.00	5.150		0.320		

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Waterloc	D Hydrogeologic	Pumping test analysi	is Na	Date:	none, Page 3
Nalerico,Ont	tario,Canada	Confined aquifer	Theis analysis method Confined aquifer		
oh.(519)746-	1798				Evaluated by:
Pumping T	fest No. 24 hour		Test conducted o	, n:	
TW8			TW8		· · · · · · · · · · · · · · · · · · ·
Discharge					
	Q. 10 //S			· · · · · · · · · · · · · · · · · · ·	
Static wate	er level: 4.830 m below datum	·			
1	Pumping test duration	Water level	Draw	/down	
;	fminl	[m]	t.	m1	
51	1500.00	5.100	U	0.270	
52	1520.00	5.040	ļ	0.210	
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Wate	Waterioo HydrogeologicPumping test analys180 Columbia St, W.Theis analysis methodWaterioo, Ontario, CanadaConfined aquifer		s _,	Date:	none, Page 4	
Waterlo			od Project: PH0/			
ph (519	9)746-1798		Evaluated by:			
Pump	ing Test No. 24 hour		Test conducted on:			
TW8			TW1			
Disch	arge 0.76 l/s		Distance from the pu	Imping well 353.00	00 m	
Static	Static water level: 2.230 m below datum					
	Pumping test duration Water le		Drawdov	wn		
	(min)	[m]	ſml			
		[;;;]	[11]			
$\frac{2}{3}$	60.00	2.230		0.000		
4	150.00	2.230		0.000		
5	180.00	2.200		-0.030	<u></u> <u></u>	
6	240.00	2.190		-0.040		
7	300.00	2.190		-0.040		
8	360.00	2.190		-0.040		
10	420.00	2.200	<u> </u>	-0.030		
11	540.00	2.190		-0.040		
12	600.00	2.190		-0.040		
13	660.00	2.190		-0.040	· · · · · · · · · · · · · · · · · · ·	
14	720.00	2.160		-0.070		
15	1080.00	2,160		-0.070		
- 16	1440.00	2.150		-0.080		
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Wate	rloo Hydrogeologic	Pumping test analysis Theis analysis method Confined aquifer		Date:	none, Page 5
180 C Waterlo	olumbia St. VV. IojOntario,Canada			Project: PH0482	2
ph.(519)746-1798		Evaluated by:		
Pump	ing Test No. 24 hour	·	Test conducted on:		
TW8			T\ 07	· .	
Diech					
Disch	Discharge 0.76 l/s			pumping well 72.00	
Static	water level: 6.890 m below datum				
	Pumping test duration	Water level	Drawo	lown	
	[min]	[m]	ព	1 I	
			· · · · · · · · · · · · · · · · · · ·		
2	60.00	6.890		0.000	
3 4	150.00	7.040		0.060	· · · · · · · · · · · · · · · · · · ·
5	180.00	7.010		0.120	
6	240.00	7.100		0.210	
7	300.00	7.130		0.240	
ß	360.00	7.140		0.250	
- 9	363.00	7.140		0.250	
11	540.00	7 130		0.210	
12	600.00	7.050	· · · · · · · · · · · · · · · · · · ·	0.160	
13	660,00	7.140		0.250	
14	720.00	7.140		0.250	
15	1060.00	7.140	·	0.250	
10	1440.00	7.140	·		
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Waterloo Hydrogeologic F 180 Columbia St. W. T Waterloo,Ontario,Canada C		Pumping test analysis	umping test analysis		none, Page 6
		Confined aquifer	a	Project: PH048	2
ph.(519)746-1798					
Pumping Test	No. 24 hour		Test conducted o	n:	
FW8			TW5		
Discharge 0.76	δ l/s		Distance from the	pumping well 134.0	
Static water le	vel: 5.880 m below datum				
Pum	ping test duration	Water level	Draw	down	
				1	
	[min]	[m]	[n]	
2	60.00	5.880		0.000	
3	100.00	5.910		0.030	
	180.00	5.880	· · · · · · · · · · · · · · · · · · ·	0.000	,
	300.00	5.910		0.030	
7	360.00	5.910		0.030	
8	363.00	5.880		0.000	
9	420.00	5.880		0.000	
. 10	480.00	5.880		0.000	
11	540.00 600.00	5.860		-0.020	
13	660.00	5.650		-0.030	
14	720.00	5.850		-0.030	
15	1080.00	5.850		-0.030	
16	1440.00	5.850		-0.030	
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Waterloo Hydrogeologic Pumping test and 180 Columbia St. W. Theis analysis m Waterloo, Ontario, Canada Confined aquifer		Pumping test analysi	s	Date:	none, Page 7
		 Theis analysis method Confined aquifer 	d	Project: PH0482	
ph.(519)	746-1798		Evaluated by:		
Pumpi	ng Test No. 24 hour		Test conducted on:		
TW8			TW2		
Discha	arge 0.76 l/s	Distance from the p	oumping well 167.0	000 m	
Static	water level: 4.420 m below datum				
	Pumping test duration	Water level	Drawd	own	
	[min]	(m)	[m]	<u> </u>	
2	60.00	4.420		0.000	
3	100.00	4.430		0.010	
4	150.00	4.420	· · · · · · · · · · · · · · · · · · ·	0.000	······································
ح اغ	240.00	4.450		- 0.030	· · · · · · · · · · · · · · · · · · ·
- 7	300.00	4.420	· · · · · · · · · · · · · · · · · · ·	0.000	
8	360.00	4.420	· · [· · · · · · · · · · · · · · · · ·	0.000	· · · · · · · · · · · · · · · · · · ·
9	363.00	4.450		0.030	
10	420.00	4.420		0.000	
11	480.00	4.430	<u> </u>	0.010	
12	540.00 600.00	4,450	J =	0.030	<u>.</u>
13	660.00	4.450	· · · · · · · · · · · · · · · · · · ·	0.030	
15	720.00	4.450)	0.030	
16	1080.00	4.450)	0.030	
17	1440.00	4.450)	0.030	
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Waterloo Hydrogeologic Pumping		Pumping test analysi	ŝ	Date:	none, Page 8	
180 C Waterfo	olumbia St. W. 10,0ntario,Canada	Theis analysis metho Confined aquifer	Theis analysis method Confined anuifer		2	
ph.(519)746-1798		Evaluated by:			
Pump	ing Test No. 24 hour	· · · · · · · · · · · · · · · · · · ·	Test conducted on:			
TW8	TW8			TW9		
Disch	arge 0.76 l/s	Distance from the	pumping well 304.0	000 m		
Static	water level: 2.930 m below datum	·····			·	
	Pumping test duration	Water level	Draw	down		
	[min]	[m]	[n	<u>1]</u>		
2	60.00	2.960		0.030		
3	100.00	2.960		0.030		
4	150.00	2.960		0.030		
5	240.00	2.960		0.030	······································	
7	300.00	2.960	· · · · · · · · · · · · · · · · · · ·	0.030		
8	360.00	2.960		0.030		
9	420.00	2.950		0.020		
10	480.00	2.960	l	0.030		
11	540.00	2.960	·	0.030		
12	660.00	2.940	·	0.010		
14	720.00	2.960	<u> </u>	0.030		
15	1080.00	2.960)	0.030		
16	1440.00	2.960)	0.030		
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Transmissivity [m³/min]: 4.19 x 10⁻¹

Storativity: 4.07 x 10⁻⁴

Wate	Waterloo Hydrogeologic Pumping test ana 180 Columbia St. W		s	Date:	none, Page 2		
Wateric	orumula ol. VV. po,Ontario,Canada	COOPER & JACOB	hod after	Project: PH0482			
ph.(519	9)746-1798	Confined aquifer	Evaluated by:				
Pump	ing Test No. 1		Test conducted on:				
TW9		TW9					
Disch	arge 1.26 l/s						
Static	water level: 2.930 m below datum						
	Pumping test duration	Water level	Drawdo	wn	·····		
	[min]	[m]	[m]				
2	1.00	3.010		0.080			
3	2.00	3.030		0.100	<u> </u>		
4	3.00	3.030		0.100			
6	<u> </u>	3.030		0.100			
7	6.00	3.030		0.100			
8	7.00	3.030		0.100			
9	8.00	3.030		0.100			
10	9.00	3.030		0.100			
12	10.00	3.030		0.100			
13	20,00	3.030		0.110			
14	25.00	3.040		0.110			
15	30.00	3.040		0.110			
16	40.00	3.040		0.110			
1/	<u> </u>	3.040		0.110			
19	80.00	3.050		0.120			
20	120.00	3.050		0.120			
21	150.00	3.060		0.130			
22	180.00	3.060		0.130			
23	240.00	3.000		D 140			
25	300.00	3.070		0.140			
26	360.00	3.070		0.140			
27	361.00	2.990		0.060			
28	362.00	2.980	· · · · · · · · · · · · · · · · · · ·	0.050			
30	364.00	2.970		0.040			
31	365.00	2.970		0.040			
32	366.00	2.970		0.040			
33	367.00	2.960	· · · · · · · · · · · · · · · · · · ·	0.030			
35	369.00	2.900	·	0.030			
36	370.00	2.960	, <u> </u>	0.030			
37	375.00	2.950		0.020			
38	380.00	2.940		0.010			
39	385.00	2.930	·	D.000			
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Waterloo Hydrogeologic Pumping test analysi 180 Columbia St. W. Time-Drawdown-met Waterloo, Ontario, Canada COOPER & JACOB		ís	Date:	none, Page 3	
		COOPER & JACOB	thod after	Project: PH0482	
ph.(519	9)746-1798	Confined aquifer	Evaluated by:		
Pump	ing Test No. 1		Test conducted on:		
TW9			TW2		
Disch	arge 1.26 l/s		Distance from the p	umping well 277.000) m
Static	water level: 4.390 m below datum				
	Pumping test duration	Water level	Drawdo	wn	
	ໄດ້ເກັກ	[m]	[m]		
3	150.00	4.400		0.010	
4	245.00	4.420	,	0.030	
5	330.00	4.420		0.030	
	300.00	4.420	<u> </u>	0.030	
					
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400 0		Pumping test analysis	3	Date:	none, Page
Vaterico Ontario Conorda		Time-Drawdown-method after		Project: PH048	
ph (519)7	46-1798	Confined aquifer		Eveluated hu	·
Pumpine				Evaluated by:	
			Test conducted	d on:	
1009			TW8		
Dischar	je 1.26 l/s		Distance from	the pumping well 304.	 m 000
Static w	ater level: 4.880 m below datum				
	Pumping test duration	Water level		ourdouro	
			L/I	awuown	
	[min]	(m)		[m]	
- 2 - 3 -	150.00	4.880	<u> </u>	0.000	
4	245.00	4.990		0.010	
5	330.00	4.880	_	0.000	
6	360.00	4.880		0.000	
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	lumbia St. W	Pumping test analys	is	Date:	noné, Page 5		
Waterloo,	,Ontario,Canada	COOPER & JACOB	thod after	Project: PH04			
ph.(519)7	46-1798	Confined aquifer		Evaluated by:			
Pumpin	g Test No. 1		Test conducted	on:			
TW9			TW7				
Dischar	ge 1.26 l/s		Distance from th	ne pumping well 344	.000 m		
Static w	vater level: 5.230 m below datum						
	Pumping test duration	Water level	Dra	wdown			
	[min]						
	[min]	[m]	· · · · · · · · · · · · · · · · · · ·	[m]			
2	80.00	5.240	,	0.010			
3	150.00	5.260	, , ,	0.030			
4	245.00	5.260)	0.030	· · · · · · · · · · · · · · · · · · ·		
5	330.00	5.240		0.010			
- 6	360.00	5.240		0.010			
			 				
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Transmissivity [m²/min]: 5.65 x 10⁻¹

Storativity: 4.38 x 10⁻⁴

Watertoo Hydrogeologic 180 Columbia St. W. Watertoo,Ontario,Canada		Pumping test analysis Theis analysis method Confined aguifer		Date:	none, Page 2	
				Project: PH0482		
ph.(519)746-1798			Evaluated by:		
Pump	ing Test No. 1		Test conducted on:			
TW9			TW9			
Disch	arge 1.26 l/s					
Static	water level: 2 930 m below datum					
	Pumping test duration	Mater level	Drouvdo			
	i umping rest duration	AAQ(C) IGAGI	Drawdo	WALI		
	[min]	[m]	[m]			
	1.00					
3	2.00	3.030		0.080	<u> </u>	
4	3.00	3.030		0.100		
5	4.00	3.030		0.100		
6	5.00	3.030	· · · · · · · · · · · · · · · · · · ·	0.100		
7	6.00	3.030		0.100		
8	7.00	3.030		0.100		
9	8.00	3.030		0.100		
10	9.00	3.030		0.100		
11	10.00	3.030		0.100		
12	20.00	3.030	/	0.100		
14	25.00	3.040	·	0.110		
15	30.00	3.040	; · · · · · · · · · · · · · · · · · · ·	0.110		
16	40.00	3.040)	0.110	••••••••••••••••••••••••••••••••••••••	
17	50.00	3.040	, , , , , , , , , , , , , , , , , , , ,	0.110		
18	60.00	3.040		0.110		
19	80.00	3.050)"	0.120	······································	
20	120.00	3.050)	0.120		
21	150.00	3.000	J	0.130		
22	210.00	3.000	, , , , , , , , , , , , , , , , , , ,	0.130		
24	240.00	3.070	<u>,</u>	0.140		
25	300.00	3.070)	0.140	······································	
26	360.00	3.070) 	0.140		
27	361.00	2.990		0.060		
28	362.00	2.980)	0.050		
29	363.00	2.970)	0.040	······································	
30	364.00	2.970		0.040		
		2.970	<u>,</u>			
33	367.00	2.960	·	0.030		
34	368.00	2.960)	0.030		
35	369.00	2.960	>	0.030	· · · · · · · · · · · · · · · · · · ·	
36	370.00	2.960		0.030		
37	375.00	2.950)	0.020		
38	380.00	2.940)	0.010		
39	385.00	2.930	, <u> </u>	0.000	·	
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180 Col	umbia St. W	Their analysis	i	Date.	none, Page 3
Waterloo, Ontario, Canada		l heis analysis method Confined aquifer		Project: PH0482	
ph (519)745-1798				Evaluated by:	
Pumping Test No. 1			Test conducted on:	L	
TW9			TW2		
Dischar	ge 1.26 l/s		Distance from the m		
Static w	ater level: 4 300 m below datum			mping weil 277.	
	Pumping test duration	Mater level			
		TATEL ISASI	Diawooi	wn	
	[min]	[m]	[m]		
2	80.00	4 400	<u> </u>	0.010	
3	150.00	4.420		0.030	
4	245.00	4.420		0.030	
0 	330.00	4.420		0.030	
		4.420		0.030	
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Wateri 180 Cel	oo Hydrogeologic	Pumping test analys	is	Date:	none, Page 4
Waterloo,	umpia St. VV. Ontario,Canada	Confined aquifer	od	Project: PH0482	
ph.(519)7	46-1798	Evaluated by:			
Pumping	g Test No. 1		Test conducted on:		
TW9			TW8		· ·
Dischar	ge 1.26 l/s		Distance from the p	umping well 304.000) m
Static w	ater level: 4.880 m below datum				<u> </u>
-	Pumping test duration	Water level	Drawdo	own	
	[min]	[m]	[m]		
2	80.00	4.680	· · · · · · · · · · · · · · · · · · ·	0.000	
3	150.00	4.890	· · · · · · · · · · · · · · · · · · ·	0.010	
- 4	330.00	4.910	<u></u>	0.030	
	360.00	4.000 <u>4</u> RRA	·	0.000	
			· · · · · · · · · · · · · · · · · · ·	0.000	
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Waterlo	o Hydrogeologic	Pumping test analysi	S	Date:	none, Page
180 Colur Waterlag Or	nbia St. W.	Theis analysis metho	d	Project: PH0482	
ph.(519)746	-1798	Commed additer		Evaluated by:	
Pumpina	 Test No. 1	<u> </u>	Test conducted or	n'	
	· · · · · · · · · · · · · · · · · · ·				
1442			1 VV/		
Discharge	2 1.26 l/s		Distance from the	pumping well 344	.000 m
Static wat	er level: 5.230 m below datum				
· · · · · · · · · · · · · · · · · · ·	Pumping test duration	Water level	Draw	down	
ł		• •			
	[min]	[m]	[n	<u>n]</u>	
2	80.00	5.240		0.010	
3	150.00	5.260		0.030	
4	245.00	5.260		0.030	
6	360.00	5.240		0.010	
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Transmissivity (m²/min]: 3.37 x 10⁻¹

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180 Columbia St. W. Recovery method after Project: P Waterloo,Ontario,Canada THEIS & JACOB Evaluated ph (619)746-1798 Confined aquifer Evaluated Pumping Test No. 1 Test conducted on: TW9 TW9 TW9 Static water level: 2.930 m below datum Pumping test duration: 360.00 m	H0482 I by: nin
Ph (619)746-1798 Confined aquifer Evaluated Pumping Test No. 1 Test conducted on: TW9 TW9 Discharge 1.26 l/s Pumping test duration: 360.00 m	I by:
Pumping Test No. 1 Test conducted on: TW9 TW9 Discharge 1.26 l/s Static water level: 2.930 m below datum Pumping test duration: 360.00 m	nin
TW9 TW9 Discharge 1.26 l/s Static water level: 2.930 m below datum Pumping test duration: 360.00 m	nin
Discharge 1.26 I/s Static water level: 2.930 m below datum Pumping test duration: 360.00 m	nin
Static water level: 2.930 m below datum Pumping test duration: 360.00 n	nin
r unping rest duration, 500,00 j.	
Time from Water level Residual	
end of pumping drawdown	
[min] [m] (m)	
1 1.00 2.990 0.060	
2 2.00 2.980 0.050 3 3.00 2.970 0.040	
4 4.00 2.970 0.040	
5 5.00 2.970 0.040	
6 <u>6.00</u> <u>2.970</u> <u>0.040</u>	
7 7.00 2.960 0.030 8 8.00 2.960 0.030	
9 9.00 2.960 0.030	
10 10.00 2.960 0.030	
<u>11</u> <u>15.00</u> <u>2.950</u> <u>0.020</u>	
12 20.00 2,940 0.010 13 25 00 2,940 0.010	
	
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Wate	rloo Hydrogeologic	Pumping test analysis	<u>-</u> 6	Date:	none, Page 2
Waterk	olumpia St. VV.	Time-Drawdown plot		Project: PH0482	
ph (519	9)746-1798		i	Evaluated by:	
Pump	ing Test No. 1		Test conducted on:		
-					•
			TVV9		
Disch	arge 1.26 l/s			_	
Static	water level: 2.930 m below datum				
	Pumping test duration	Water level	Drawdov	у л	
1	[min]	[m]	(m]		
2	1.00	2.930		0.000	<u> </u>
3	2.00	3.030		0.000	
4	3.00	3.030		0.100	
5	4.00	3.030		0.100	
6	5.00	3.030		0.100	
8	7.00	3.030		0.100	
9	8.00	3.030		0.100	
10	9.00	3.030		0.100	
11	10.00	3.030		0.100	
12	15.00	3.030		0.100	
13	20.00	3.040		0.110	
15	30.00	3.040		0.110	•••• <u> </u>
16	40.00	3.040		0.110	
17	50.00	3.040		0.110	
18	60.00	3.040	_ _	0.110	· · · · · · · · · · · · · · · · · · ·
20	120.00	3.050		0.120	
21	150.00	3.060		0.130	
22	180.00	3.060		0.130	
23	210.00	3.060		0.130	
24	240.00	3.070		0.140	
25	300.00	3.070		0.140	
27	361.00	2.990		0.060	
28	362.00	2.980	· • • ·	0.050	· · ··································
29	363.00	2.970		0.040	
30	364.00	2.970		0.040	
31	365.00	2.970		0.040	<u> </u>
33	367.00	2.960		0.040	· · · · · · · · · · · · · · · · · · ·
34	368.00	2.960		0.030	
35	369.00	2.960		0.030	
36	370.00	2.960		0.030	
37	375.00	2.950		0.020	
39	385.00	2.930		0.000	
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Wate	rioo Hydrogeologic	Pumping test analysis	5	Date:	none, Page 3	
Wateric	olumbia St. VV. xx,Ontario,Canada	Time-Drawdown plot		Project: PH0482		
ph.(519)746-1798		Evaluated by:			
Pump	ing Test No. 1		Test conducted on:	<u> </u>		
TW9			TW2			
Disch	arge 1.26 l/s		Distance from the p	umping well 277.00	20 m	
Static	water level: 4.390 m below datum					
	Pumping test duration	Water level	Drawdo	wn		
	[min]	[m]	[m]			
1	0.00	4,390	[]	0.000	·	
2	80.00	4.400		0.010		
3	150.00	4.420		0.030	· · · · · · · · · · · · · · · · · · ·	
4 5	330.00	4.420		0.030		
6	360.00	4.420		0.030		
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Inter-Drawdown plot Project: PH0492 Pumping Test No. 1 Test conducted on: TW9 TW8 Discharge 1.26 Vs Distance from the pumping well 304 000 m Static water level: 4.880 m below datum Drawdown 1 0.00 4.880 2 80.00 4.880 3 150.00 4.880 4 245.00 4.800 5 330.00 4.880 6 389.00 4.880 0 0.000 - 1 0.00 4.880 2 80.00 4.880 0 0.000 - 3 150.00 4.880 0 0.000 - 1 0.00 4.880 0 - - 1 0.00 4.880 0 - - 1 0.000 - 1 0.000 - 1 0.000 - 1	Water	loo Hydrogeologic	Pumping test analysi	s	Date:	none, Page 4	
PA(519)746-1728 Evaluated by: Pumping Test No. 1 Test conducted on: TWB TWB Discharge 1.26 I/s Distance from the pumping well 304.000 m Static water level: 4.880 m below datum Drawdown [min] (m) 1 0.00 2 80.00 3 150.00 4 245.00 5 330.00 4 245.00 6 360.00 6 360.00 7 4.880 7 0.000 6 360.00 4.880 0.000 6 360.00 4.880 0.000 - - - - - - - - - - - - - - - - - - - - - - -	Teo Golumpia St. W. Time Waterloo, Ontario, Canada		I Ime-Drawdown plot	Time-Drawdown plot			
Pumping Test No. 1 Test conducted on: TW8 TW8 Discharge 1.26 Vs Distance from the pumping well 304.000 m Static water level: 4.880 m below datum Drawdown [min] [m] 1 0.00 2 80.00 3 150.00 4 245.00 4 245.00 6 360.00 6 360.00 4.880 0.000 6 360.00 4.880 0.000 6 360.00 4.880 0.000 6 360.00 4.880 0.000 - - - - - - - - - - - - - - - - - - - - - - - - - - <td>ph.(519)7</td> <td>746-1798</td> <td> </td> <td colspan="4">Evaluated by:</td>	ph.(519)7	746-1798		Evaluated by:			
TWB TWB Discharge 1.26 I/s Distance from the pumping weil 304.000 m Static water level: 4.880 m below datum Drawdown [min] [m] 1 0.00 4.880 2 80.00 4.880 0.000 3 150.00 4.880 0.000 4 245.00 4.910 0.030 5 330.00 4.880 0.000 6 380.00 4.880 0.000 6 380.00 4.880 0.000 6 380.00 4.880 0.000 7 7 7 7 7 7 7 7 8 30.00 4.880 0.000 7 7 7 7 7 7 7 7 7 7 7 7 8 7 7 7 8 7 7 7 8 7 7 7	Pumpin	ng Test No. 1		Test conducted on:			
Discharge 1.26 //s Distance from the pumping well 304.000 m Static water level: 4.880 m below datum	TW9			TW8			
Pumping test duration Water level Drawdown [min] [m] [m] 1 0.00 4.880 0.000 2 80.00 4.890 0.000 3 150.00 4.890 0.000 4 245.00 4.910 0.030 5 330.00 4.880 0.000 6 360.00 4.880 0.000 6 360.00 4.880 0.000 6 360.00 4.880 0.000 1	Discha	rge 1.26 l/s		Distance from the pa	Imping well 304.00	0 m	
Pumping test duration Water level Drawdown [min] [m] [m] 1 0.00 4.880 0.000 2 80.00 4.890 0.000 3 150.00 4.890 0.000 4 245.00 4.910 0.030 5 330.00 4.880 0.000 6 360.00 4.880 0.000 6 360.00 4.880 0.000 6 360.00 4.880 0.000 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	Static v	vater level: 4.880 m below datum	, <u> </u>				
[min] [m] [m] 1 0.00 4.880 0.000 2 80.00 4.880 0.000 3 150.00 4.890 0.010 4 245.00 4.910 0.030 5 330.00 4.880 0.000 6 380.00 4.880 0.000 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -<		Pumping test duration	Water level	Drawdo	wn		
1 0.00 4.880 0.000 2 80.00 4.880 0.000 3 150.00 4.890 0.010 4 245.00 4.910 0.030 5 330.00 4.880 0.000 6 380.00 4.880 0.000 6 380.00 4.880 0.000 6 380.00 4.880 0.000 6 380.00 4.880 0.000 6 380.00 4.880 0.000 6 380.00 4.880 0.000 6 380.00 4.880 0.000 6 380.00 4.880 0.000 6 380.00 4.880 0.000 6 380.00 4.880 0.000 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	{	[min]	ſm	(m)			
2 80.00 4.880 0.000 3 150.00 4.890 0.010 4 245.00 4.910 0.030 5 330.00 4.880 0.000 6 360.00 4.880 0.000 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - </td <td>1</td> <td>0.00</td> <td>4.880</td> <td> [n]</td> <td>0.000</td> <td></td>	1	0.00	4.880	[n]	0.000		
3 160.00 4.890 0.010 4 245.00 4.910 0.030 5 330.00 4.880 0.000 6 380.00 4.860 0.000 - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -	2	80.00	4.880		0.000		
	3	150.00	4.890		0.010		
		330,00	4.880		0.000		
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Waterloo Hydrogeologic Pumping test analys 180 Columbia St W		S	Date:	none, Page 5		
Waterlo	o,Ontario,Canada	Time-Urawdown plot		Project: PH0482		
ph.(\$19)746-1798			Evaluated by:	/:	
Pump	ng Test No. 1	Test conducted on:	······································			
TW9			TW7			
Discha	arge 1.26 l/s		Distance from the pu	mping well 344.000	m	
Static	water level: 5.230 m below datum					
	Pumping test duration	Water level	Drawdov	vn		
	Imin1	[m]	fmal			
1	0.00	5.230	<u>1</u> 11]	0.000		
2	80.00	5.240		0.010		
4	245.00	5.260		0.030		
5	330.00	5.240		0.010		
		5.240		0.010		
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Model No. 1: Determination of Potential Well Interference- 20 Year Cumulative Impact

Pumping Rate (Q) m3/day Transmissivity (T) m2/day Average Well Spacing (m) r Coefficient of Storage S	3 13.3 100 0.00068			Average anticipated well depth: % drawdown under worst case scenario	D:	48 22%	m
Notes:	Analysis Assumes Continuous	Pumping of 61 to 70 Wells					
Time (days)	1st Well Grouping u W	2nd Well Gi (u) u	rouping W(u)	3rd Well Grouping u W(u)	4th Well Gr u	ouping W(u)	Drawdown
5 10 25 50 100 365 1100 3650 9125	1.3E-02 3.7 6.4E-03 4.4 2.6E-03 5.3 1.3E-03 6.0 6.4E-04 6.7 1.8E-04 8.0 5.8E-05 9.1 1.8E-05 10. 7.0E-06 11.	785 3.8E-02 806 1.9E-02 776 7.7E-03 695 3.8E-03 775 1.9E-03 455 5.3E-04 779 1.7E-04 3479 5.3E-05 2924 2.1E-05	2.7306 3.4050 4.2970 4.9993 5.6906 6.6959 8.1027 9.2681 10.1938	6.4E-022.23463.2E-022.89651.3E-023.77856.4E-034.48063.2E-035.17068.8E-046.45922.9E-047.56878.8E-058.76103.5E-059.6830	8.9E-02 4.5E-02 1.8E-02 8.9E-03 4.5E-03 1.2E-03 4.1E-04 1.2E-04 4.9E-05	1.9290 2.5684 3.4581 4.1534 4.8310 6.1494 7.2240 8.4509 9.3465	2.41 3.12 4.07 4.83 5.56 6.93 8.15 9.44 10.42
12.00 <u> <u> </u> <u> </u> <u> </u> <u> </u> 10.00 <u> </u> </u>		Figure A4-1	: Graph	of Drawdown vs. Time			-
00.8 Drawdown							

0.00

Time (days)



Ottawa	Intl A		WATE	R BUDG	IET ME	ANS FOR	R THE F	PERIOD	1939-2	019	DC20492
LAT LON	45.32 G 75.67	WA LO	TER HO WER ZO	DLDING	CAPAC	ETY1	100 MM 60 MM	HE A.	AT IND	EX	36.68 1.079
DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	-10.7	62	11	14	0	0	0	24	84	98	295
28- 2	-9.0	56	11	16	1	1	0	26	113	98	350
31- 3	-2.9	65	31	77	5	5	0	101	70	100	416
30- 4	5.7	73	68	75	31	31	0	112	0	100	490
31- 5	13.1	76	76	0	80	80	0	14	0	81	566
30- 6	18.3	85	85	0	116	112	-4	5	0	49	651
31- 7	20.9	88	88	0	136	114	-22	3	0	20	739
31- 8	19.6	84	84	0	118	87	-31	1	0	16	823
30- 9	14.8	82	82	0	75	65	-10	3	0	30	905
31-10	8.3	77	77	0	37	36	-1	9	0	63	77
30-11	1.2	76	59	8	10	10	0	31	9	89	154
31-12	-6.9	79	26	14	1	1	0	32	48	97	233
AVE	6.0 TTL	904	698	204	610	542	-68	361			

Ottawa	Intl A		STAN	DARD	DEVIATIO	ONS FO	OR THE	PERIOD	1939-	2019	DC20492
DATE	TEMP (C)	PCPN	RAIN	MELT	PE	AE	DEF	SURP	SNOW	SOIL	ACC P
31- 1	2.9	25	15	18	1	1	0	28	44	8	59
28- 2	2.6	27	14	26	1	1	0	35	59	7	63
31- 3	2.6	28	22	49	5	5	0	55	87	0	71
30-4	1.8	32	33	88	9	9	0	89	3	2	80
31- 5	1.8	34	34	3	12	12	0	25	0	22	94
30- 6	1.2	38	38	0	8	12	10	16	0	36	105
31- 7	1.1	45	45	0	8	28	29	17	0	30	118
31- 8	1.3	37	37	0	8	28	30	4	0	29	127
30- 9	1.5	39	39	0	8	16	16	13	0	35	133
31-10	1.5	37	37	1	7	7	2	19	0	35	37
30-11	1.8	27	27	8	4	4	0	32	13	20	45
31-12	3.0	30	22	14	1	1	0	30	34	9	55

patersongroup

1934 Stagecoach Road, Ottawa

PREDICTIVE NITRATE IMPA	ACT ASSESSE	EMENT
Infiltration Factors		
Topography	0.15	
Soil	0.20	
Cover	0.10	
Total	0.45	
Site Characteristics		
Area of Site :	625720	m²
Total of roof areas:	24420	m²
Total area of paved driveway areas:	31101	m²
Roof + paved driveway areas	55521	m ²
Impervious Area	55521	m²
Percent Impervious Area =	9	%
Impervious Area according to SWMDB completed by JFSA	125144	m²
Percent Impervious Area according to SWMDB completed by JFSA	20%	%
Infiltration Area =	500576	m²
Septic Effluent		
Concentration of Effluent (Cs) =	40	mg/L
Daily Sewage Flow (Qs)=	66	m ³
See Notes below.		
Infiltration Calculation		
Nitrate concentration in precipitation $(C_i) =$	0	mg/L
Surplus Water (Environment Canada)	361	mm/yr
Factored Water Surplus =	162	mm/yr
Infiltration % due to stormwater management measures	-	%
Infiltration rate from stormwater management measures =	0	mm/yr
Infiltration Flow Entering the System (Q _i) =	223	m³/day
Mass Balance Model (MOEE, 1995)	lativo Nitrato Concentration	
$O_{T} = (Q_{b}O_{b}+Q_{e}O_{e}+Q_{i}O_{i})/(Q_{b}+Q_{e}+Q_{i}) = CullularO_{a}$ flow entering the system screep the upgradient, erec		3/-1
Q_b = now entering the system across the upgradient area	0	m²/day
C_b = background minate concentration	0.16	mg/L
$Q_e =$ now entering the system from the centre offluent	66	m°/day
C_e = concentration of initiates in the septic endent	40	ing/∟
$Q_i = 1000$ entening the system norm initiation $Q_i = Concentration of nitrates in the infiltrate$	223	m²/day
	. 914	mg/L
C _T =	- J.14 66	ing/∟
	00	IUIS

Notes: Although impervious area calculations result in an area of 9% (based on a 300 m2 home, including a garage of 70 m2, a driveway area of 140 m2 and a subdivision road length of 22,000 m2) the Stormwater Managements Design Brief completed by JFSA with Project Ref # P584-06 dated May 11, 2022 notes a impervious area of 20%. The impervious area of 20% was used to demonstrate that the NIA calculation would work for the subdivision using a conservative approach



APPENDIX 5

PH4734 – 1 – Site Plan

PH4734 – 2 - MECP Water Well Location Plan

PH4734 - 3 - Surficial Geology Plan

PH4734 – 4 - Bedrock Geology Plan

PH4734 – 5 - Bedrock Aquifer Plan

PH0482 – 4 – Generalized Hydrogeological Cross Section

PH0482 – 7 – Lot Development Plan

Ottawa Head Office 9 Auriga Drive Ottawa – Ontario Ottawa Laboratory 28 Concourse Gate Ottawa – Ontario List of Services Geotechnical Engineering ♦ Environmental Engineering ♦ Hydrogeology Materials Testing ♦ Retaining Wall Design ♦ Rural Development





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DO M BUF SUBJECT S			SITE	
LEGEND: SITE BOUNDARY MECP WELL LOCATIONS SCALE: 1:10,002 0 10 20 30 40 50m 75 0 10 20 30 40 50m 75 PATERSON PATERSON CALEGA DAY		OTTAWA, Title:	TTT3226 CANADA WATER BUDGET ASS PROPOSED RESIDENTIAL 1934 STAGECOAC	INC. ESSMENT SUBDIVISION H ROAD
TEL: (613) 226-7381 NO	. REVISIONS DATE		F WAIER WELL LU	



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	Scale:		Date:
		1:7500	04/2023
	Drawn by:		Report No.:
		YA	PH4734-REP.01
ONTARIO	Checked by:		Dwg. No.:
		OB	PH4734-3
	Approved by:		
		ML	Revision No.:





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APPROXIMATE TEST PIT LOCATION APPROXIMATE TEST WELL LOCATION GROUND SURFACE ELEVATION (m) DATE OF TEST WELL CONSTRUCTION

04/06/2024	Updated Phasing Areas	1
dd/mm/yyyy	Description	Rev.
Client:		

7773226 CANADA INC.

9 AURIGA DRIVE OTTAWA, ON K2E 7T9 TEL: (613) 226-7381

PROPOSED RESIDENTIAL DEVELOPMENT

1934 STAGECOACH ROAD OTTAWA (OSGOODE), ONTARIO

LOT DEVELOPMENT

Date:		
06/2023		
Drawn by:	File:	
YA	PH0482	
Checked by:	Scale:	
EA	1:5000	
Approved by:	Date:	
MK	06/2023	
Drawing No.:		
F	PH0482-7	