RMCAO

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OSSGA

July 8, 2014

Township of Guelph Eramosa

Attention: **Ms. Liz Howson**
MSH Ltd.

RE: Response to Township Regarding CRC Representative Gary Hunter Questions

Dear Liz,

Please find attached a spreadsheet that we have compiled for the Township to assist you as you formulate your planning opinion. We have had our team, primarily Mr. Denhoed of Harden Environmental Services Limited, to respond to the various inquiries of Mr. Hunter. The responses should assist in providing you additional information and, in some cases, clarity where the application was misunderstood by the CRC reviewer.

Please note that while we are responding to these inquiries to facilitate the township in their review of comments submitted by the public, we do not consider the queries of Mr. Hunter to fall within the Peer Review Process of the Township. R.J. Burnside and Associates is the Peer Reviewer in this area and they should be allowed to come to an independent opinion based on their expertise. We do consider these comments relevant in the Planning Process and this response is provided in that context.

Sincerely,
JAMES DICK CONSTRUCTION LIMITED

Greg Sweetnam

Hidden Quarry - Response to Township regarding CRC Hunter Queries July-08-14

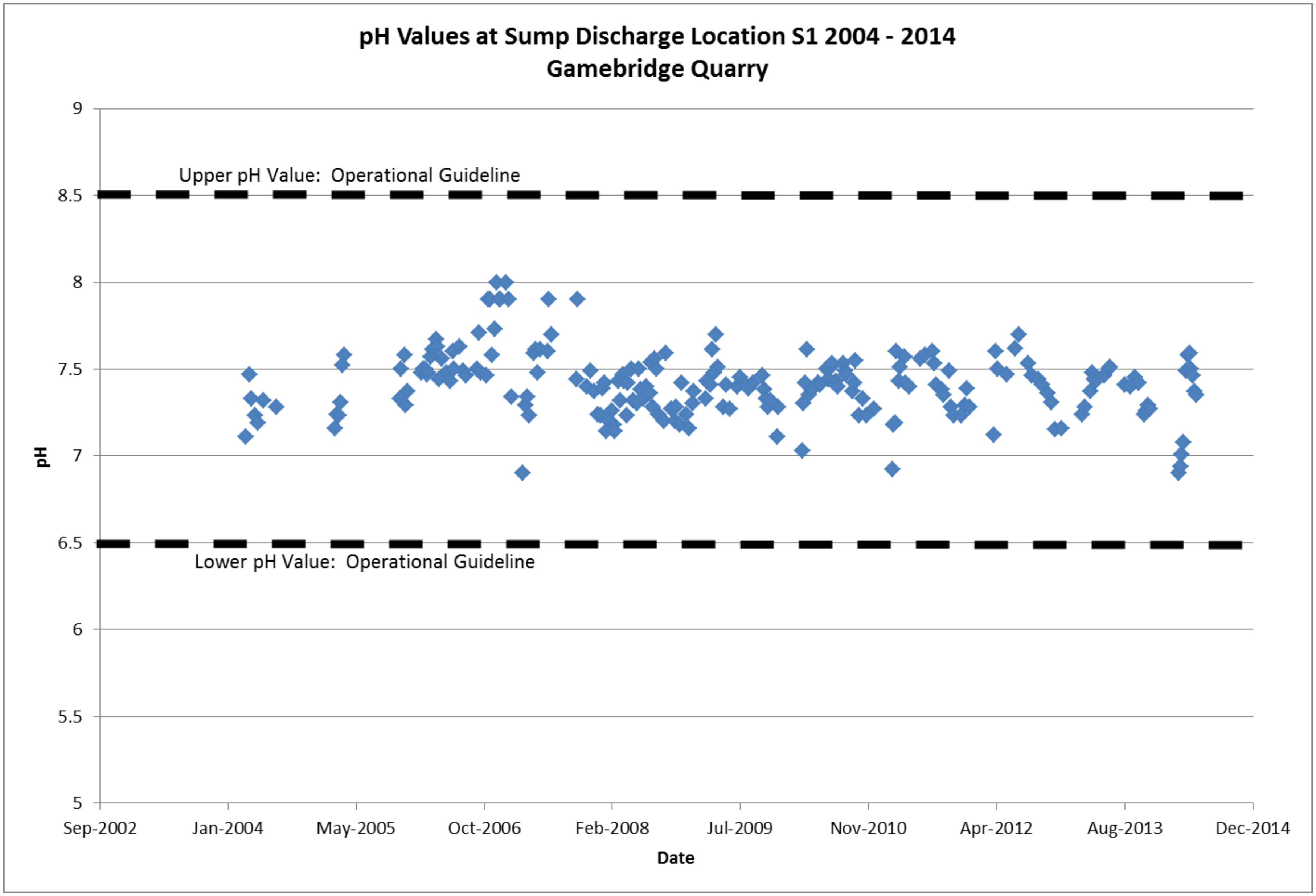
#	Contact	Date	Question	Response	Action Item
1	Gary Hunter	20-May-14	What is the vertical geodetic benchmark used to reference the groundwater monitoring infrastructure and site features?	The groundwater monitors and water wells included in the level survey used a benchmark known as the 1978 Southern Ontario Adjustment available from the Ministry of Transport Ontario. The vertical benchmark is based on the Canadian Geodetic Vertical Datum 1928 (CGVD28). The actual benchmark used was DHO PRECISE BM 700-87 ELEVATION 347.587 m AMSL.	None
2	Gary Hunter	20-May-14	Are all infrastructure features, contour mapping and the Site Plan referenced to this same vertical benchmark network?	The contour mapping is based on the 1 m contour interval available from the GRCA. No vertical benchmark is noted in the meta data for this layer other than being a projection of NAD83/UTM Zone 17N. As shown on Figure 3.5, all purple coloured well locations and yellow colour monitoring well locations were surveyed with a common vertical datum based on the MTO benchmark.	None
3	Gary Hunter	20-May-14	What is the source of the MOE Water Well Record ground elevations in the Harden 2012 Report Appendix F - Table F1? Have any location corrections been applied?	The ground elevations are obtained from the MOE Water Well Information System (WWIS). No elevation or location corrections have been applied in this table.	None
4	Gary Hunter	20-May-14	Have ground elevations been adjusted for the referenced MOE Well Records in Appendix G Table G1?	There are no ground elevations referenced on Table G1. Of the wells listed in Table G1, the following have been level-surveyed relative to the on-site monitors; W1, W3, W4, W8,W10, W12, W13, W14, W17, W18, W19, W25 and W26	None
5	Gary Hunter	20-May-14	In Table G1, what is the source of the well depths and static water levels? Where 'btoc' is referenced, what is the 'stick up' to allow equation with the Water Well record ground elevation depth references?	Well depths and static water levels are field measurements where value is provided. When the homeowner provided an approximate depth this is noted as such. Stick-up measurements were made on the following wells: W1, W2, W3, W4, W8, W12, W13, W14, W16, W25 and W26.	None
6	Gary Hunter	20-May-14	In Table G1 Site W22 (5198 Hwy 7) the well is reported to be in a 'pit' for survey dates of Oct 1995 and Nov 2011. How did the Applicant confirm this is MOE well No. 28-02047 ?	MOE Licenced Well Technicians visited the site on those occasions and found the 4" well to be in a pit. The age of the well based on site interview with the owner and the diameter of the well led us to assign the MOE well number to the well.	None
7	Gary Hunter	20-May-14	Well MOE 67-08195 completed June 10, 1985 contains a sketch dimensioned location at 150 ft north of Hwy 7 and 300 ft east of the 6th Line within the proposed Hidden Quarry property. The stratigraphy, water founds and static levels are consistent with other wells on the property. Is the Applicant aware of this well? I do not see it in monitoring records; please explain.	This well does not exist at this location. It was plotted on Figure 2.6 for completeness and then was removed from consideration in all subsequent discussions and evaluations. The original well record has the well located in Concession 5, Lot 1 and the overburden is approximately 2 metres thick. This does not correlate to any on-site investigations. The well owner given as Joseph Scarola was never an owner of this property.	None
8	Gary Hunter	20-May-14	Correspondence with the owner confirms that MOE Well No. 67-0745 is located at 4943 6th Line (W5), not at 4953 6th Line (W8) as indicated in Table G-1. A well record for W8 has not yet been found. How does this revised well location impact the Applicant's response to Burnside? Please provide a copy of your Table G-1 well survey notes for the W8 site.	We have no knowledge of well No. 67-0745 and do not reference this well anywhere in our documents. Based on our well survey and discussions with Mr. Mike Bonus (the home owner at the time of survey) at 4953 6th Line the previous owner was Mr. Glendenning matching the name on the water well record. The resident at 4943 6th Line has on three occasions refused to particpate in our well survey. If the well record has been incorrectly assigned and should be assigned to 4943 6th Line, there is no change in our intepretation of potential impact to the well yield. The well record shows that water was found at 18.8 m and there is a static water level of 4.57 metres. Pumping at a rate of 15 gallons per minute resulted in a drawdown of 1.52 metres. This confirms that the well is a high volume producing well with low water level change when stressed.	None
9	Gary Hunter	20-May-14	Table G1 reports surveying W31 (4970 7th Line) well on Oct 1995 and Mar 2012. A drilled well is reported located in front of the house. Well depth and static level are reported as unknown. No MOE # has been found. How is the Table G1 survey consistent with the well in use at the property or with the Harden (2012) Sec 3.6.1.1 pg 19 the and No 63 Response in the Hidden Quarry Comment Documentation which each describe a dug well at the property? Please explain and provide your detailed survey inspection field notes and sketches for the well at 4970 7th Line. A survey by an independent MOE licenced well technician may be required to correct the records.	When visited in 1995 the owner indicated that the well was drilled and did not provide access to the well as the concrete well cover was in poor condition. The same answer was provided in 2011. It was not until 2012 that access was permitted to the well by Ms. Degrandis and it was found to be a shallow dug well. A licensed MOE well technician did survey the well on each occasion.	None
10	Gary Hunter	20-May-14	Table G1 is unreliable and to be useful requires a rigorous on site well inspection and update including surveyed ground elevations, well depths and static water level observations at each well by an independent MOE licenced well technician.	A detailed well survey has been agreed to by James Dick Construction Ltd. This will be carried out by a licensed well technician.	None
11	Gary Hunter	20-May-14	Please provide the digital spreadsheet (.xls) for Table B2 and B4 updated to May 2014. Also corresponding updated Hydrographs as available.	Tables submitted show data back to the 1990's. Data collection will occur according to the monitoring program and all data will be presented in the monitoring reports.	None
12	Gary Hunter	20-May-14	Please provide a copy of the Harden (1998) Report as referenced in Sec 2.5 Hydraulic Testing pg 7 (Harden 2012).	Available as a public document from the Township of Guelph Eramosa for East Half of Lot 1, Concession 6, Township of Guelph-Eramosa. Property is owned by Graham and Charlotte Mudge.	None
13	Gary Hunter	20-May-14	Please provide Table C1 with updated monitoring to April 2014 in digital spreadsheet form. Also corresponding Fig C1 Hydrographs as available.	Tables submitted show data back to the 1990's. Data collection will occur according to the monitoring program and all data will be presented in the monitoring reports.	None
14	Gary Hunter	20-May-14	Does the Applicant have any information on the formational dip of the bedrock strata (top of Cabot Head) at the Hidden Quarry site?	The top of shale was encountered at an elevation of 308.52 m AMSL in M15 and 308.81 m AMSL in M2. The regional dip of the bedrock strata is estimated to be 0.2 to 0.3%, dipping towards the south west.	None
15	Gary Hunter	20-May-14	The Applicant has identified Goat Island Formation above 350 m asl in Borehole M15 at Hidden Quarry site. Is Goat Island present in other site boreholes where the bedrock surface is higher than about 350 m asl?	Bedrock was encountered at higher elevations in M2, M12 and TP9. It is possible that the Goat Island formation is present at those locations.	None
16	Gary Hunter	20-May-14	Please provide a copy of the preliminary assignment of the unsubdivided Ambel Formation in borehole M2 into Goat Island, Gasport, Irondequoit, Rockway and Merritton Formations and any comments from Dr Brunton (Harden 2012, Sec 3.5.1, pg 15).	The Harden 2012 report states that there has been no assignment of the core into the new nomenclature suggested by Frank Brunton.	None
17	Gary Hunter	20-May-14	Please provide a copy of the MW-08-T3-06 well log as referenced in Harden 2012, Sec 3.5.1, pg 15).	This is available from the City of Guelph and or the Grand River Conservation Authority. We do not have permission to distribute.	None
18	Gary Hunter	20-May-14	Will the Goat Island Rock be separated from or blended into the commercial crushed rock aggregate produced in the proposed quarry?	The Goat Island, where present in trace amounts, will not be mined in a separate bench and will be blended into the appropriate products.	None
19	Gary Hunter	20-May-14	What preparation of the weathered bedrock surface will be required to provide a staging area for underwater blasting preparation at Hidden Quarry?	No special preparation is required.	None
20	Gary Hunter	20-May-14	The Sept 2012 Site Plan Notes specify maximum extraction depth at 317 m asl (pg 3 of 5) and the figures on pg 4 of 5 specify the floor of the rehabilitated quarry lake at 320 m asl. The Applicant response in the Hidden Quarry comment documentation says the minimum depth will be 320 m asl. What quarry depth has the Applicant's Hydrogeologist recommended?	No recommendation with respect to final depth were made by Harden Environmental Services Ltd. The current mining elevation of 327 MASL is a compromise made by the operator to leave undisturbed rock at depth and is a practical depth of extraction for equipment currenly employed by the operator. Burnside suggested that the quarry depth should be adjusted to avoid the deeper fracture set. The operator has agreed to this.	None

21	Gary Hunter	20-May-14	The Applicant's bedrock flow test for Well M15 (Harden July 15, 2013 Letter Appendix B Sec 3.1 pg 6) indicated that approximately one third of the well yield was obtained from various fractures between elevation 350 m asl to above 324 m asl and two thirds of the well yield was obtained from a single set of fractures at 324 m asl and from a fracture at 318 m asl (one third each).	No comment.	None
22	Gary Hunter	20-May-14	The Applicant also reported poor hydraulic connectivity between the shallow bedrock and deeper fractures at M15. The lower part of the borehole below about 315 m asl including the Cabot Head formation contact at 308.5 m asl was described as not an active part of the flow system. Does the Applicant have any comparative observations of shallow vs deeper aquifer hydraulic heads (vertical gradients) in the proposed Site Plan Extraction Area?	M15 is located within the Site Plan extraction area. Hydrualic potentials for four individual sections of the aquifer are provided in the Harden Environmental response to R. J. Burnside on June 10, 2014	None
23	Gary Hunter	20-May-14	Will the higher yield deeper aquifer from 324 to 318 m asl be the primary control for quarry pond water levels and the upgradient propagation of quarry drawdown impacts?	No. James Dick Construction Ltd. has agreed to limit quarry depth to 327 m AMSL.	None
24	Gary Hunter	20-May-14	Does the Applicant have any observations at all of the hydraulic heads in the 324 to 318 m asl deep aquifer zone? What aquifer zones do the static levels observed in Monitors M2 and M4 actually represent?	Yes. M15 was converted into a multi-level monitoring station with hydraulic heads measured in the fractures identified at 324 and 318m AMSL. This information is provided in Harden , June 10, 2014. The vertical head profile shows very little difference, with both vertically downward and upward gradients observed betwen fractures. The static water levels in M2 and M4 represent average hydraulic potential over the open borehole between the bottom of the well and the bottom of the well seal shown on the borehole records.	None
25	Gary Hunter	20-May-14	Is the 324 to 318 m asl fractured rock aquifer zone in M15 coincident with the aquifer discharge zone on the lower slopes and floor of the Blue Spring Creek Valley to the south?	The elevation of Blue Springs Creek nearest to the site is approximaetly 330 m AMSL and where it crosses beneath 5th Line Nassagaweya has an elevation of approximatley 325 m AMSL. Therefore, these fractures are lower than the ground surface in the Blue Springs Creek valley.	None
26	Gary Hunter	20-May-14	When will the Hidden Quarry Comment Documentation (Mar 13, 2013) be updated to reflect the results from the M15 hydrogeological testing and the extended on site groundwater monitoring?	All testing of M15 has been included in correspondence with R.J. Burnside and Associates.	None
27	Gary Hunter	20-May-14	Would you agree that the vertical interval from 324 to 318 m asl in borehole M-15 is part of Brunton's and Gartner Lee's regional 'Production Zone' Aquifer?	There is no 'production zone aquifer' identified as a separate aquifer within the Gasport Formation. Our review of the Brunton (OFR 6226) confirms that the term 'production zone ' was not used to describe any portion of the Gasport aquifer. A 'production zone' was identifed by Gartner Lee as a higher yielding section of the formerly unsubdivided Amabel aquifer. We agree that the fractures identified at 324 and 318 m AMSL in M15 could fall within the 'production zone' of the Gasport Aquifer.	None
28	Gary Hunter	20-May-14	What would the Applicant estimate the specific yield of M15 and the potential capacity of a production well if located at Hidden Quarry M15?	Similar to the Municipal wells TW3 and TW4.	None
29	Gary Hunter	20-May-14	Please provide copies of the database input files. Please also provide the water and observation well files including static water level observation dates for the area within 1500 m of the proposed quarry site boundaries.	Appendix H describes the input parameters. MOE well data is available for the area.	None
30	Gary Hunter	20-May-14	Is it fair to say that the modelling is based primarily on 'kriged' multi season 'open hole' water well static level data with a general bias towards shallower bedrock water wells?	The statement is inaccurate. The modeling output is not based on any water levels. The groundwater model output is based on the assigned parameters of recharge, hydraulic conductivity and porosity (storage) and the vertical and horizontal constraints assigned within the model (i.e. boundary conditions).	None
31	Gary Hunter	20-May-14	What is the statistical variability of the 'predicted water levels' and 'maximum predicted water level change' estimated in Fig 10 and Fig 11 of the Modelling Report? Is ± 5 m a fair estimate for Fig 10? What about Fig 11?	There is no statistical variability in the outcome of the model. The values presented in Figures H10 and H11 represent unique values based on a certain set of model input values.	None
32	Gary Hunter	20-May-14	Is there sufficient unique regional hydraulic data to model the hydraulic heads of the deep aquifer as identified in the Hidden Quarry site for the elevation interval between 324 and 318 m asl?	It is well accepted that the Gasport Aquifer can be modelled as a continuum. The fractures located between 324 m AMSL and 318 m AMSL will not be intersected by the quarry.	None
33	Gary Hunter	20-May-14	Considering that there will be a water deficit within the quarry pond footprint due to evaporation increases, where will the water come from that raises the Applicant predicted groundwater levels and increases flows on the downgradient side of the quarry?	It is estimated that there will be an additional capture of 3600 m3 of water in microdrainage area D1 and 2500 m3 of water in microdrainage area D2. The estimated increase in evaporation at the site is 18,765 m3 resulting in an overall loss of 12,665 m3 annually. To put this into perspective, the annual precipitation at the site has historically ranged from 243,712 m3 to 482,854 m3. Thus the change in evaporation is insignificant relative to the variability in precipitation. The extraction of the rock creates a space within the aquifer with infinite transmissivity. This results in the same hydraulic potential in the quarry pond despite groundwater potentials decreasing northwest to southeast by several metres in the adjacent aquifer. The magnitude of the hydraulic potential in the pond has been shown via the modeling effort and as observed at several existing gravel pit ponds to be somewhat of an average between the pre-extrction upgradient and downgradient hydraulic potentials in the aquifer. This effect results in a drawdown at the upgradient side of the quarry and a potentiometric surface rise in the downgradient side of the quarry. The "increased" flow downgradient is a very localized effect and results from adjacent aquifer water flowing into the quarry pond in the northern half of the pond needing to flow out of the southern half of the pond.	None
34	Gary Hunter	20-May-14	Will the upgradient groundwater divides move away from the quarry with reduced water level elevation to capture more water from adjacent catchments?	The Eramosa River/Blue Springs Creek groundwater shed divide occurs at a hydrualic potential of approximatley 365 m AMSL or 15 metres greater in hydraulic potential than occurs at the site. The watersheds are very large and any potential disturbance to the groundwater shed divide is small and local to the proposed quarry. Any diversion of water from the Eramosa River to the Blue Springs Creek watershed will not be measureable.	None
35	Gary Hunter	20-May-14	The Sept 21, 2012 Site Plan Notes (pg 4 of 5) predicts the west quarry final lake level at 348.6 m asl and the east quarry lake at 348.4 m asl. However the wetland creation Notes (pg 4 of 5) estimate final quarry pond water tables at ± 346 to 349 m asl.	It appears that Hunter has misunderstood this Site Plan Note. The elevations (+/- 346 to 349 masl) refer to the bottom of the wetlands not the pond water elevation. These elevations are noted as it is desireable to have 0- 2m of water in the wetland areas.	None
36	Gary Hunter	20-May-14	The Harden (2012) Fig 3.17 shows a water level decline across the quarry extraction limits from 354 to 347 m asl (7 m difference). Appendix H Fig 11 shows a drawdown of 1.8 m on the north extraction limit and a rise of about 1.2 m at the south limit. Where did the other 4 m of the pre-quarry vertical gradient go?	As indicated in our report, the maximum water level decline in the quarry is 2.45 m at the northern edge and a rise of 2.81 at the southern edge for a total change of 5.26 metres. The reason that this does not add up to 7 metres is that the final predicted water level determined by the model equalizes inputs to the pond with outputs. For example, only a small portion of the proposed pond perimeter is presently exposed to the lower hydraulic potential of 347 m AMSL and thus has less of an influence on the final water level. If the quarry edges were parallel to the groundwater equipotentials, then the final water level in the pond would be a statistical mean of the pre and post hydruaulic potentials.	None
37	Gary Hunter	20-May-14	Has the Applicant overestimated the final quarry pond levels and underestimated the bedrock aquifer drawdowns upgradient of the quarry?	No. A scientifically sound approach was used to estimate the final quarry pond level and bedrock aquifer water level changes upgradient of the site.	None
38	Gary Hunter	20-May-14	Are the average late summer / early fall water low levels more likely to be in the 346 m asl range consistent with the lower limit shown in the Site Plan Rehabilitation Notes (pg 4 of 5)?	It is not reasonable to expect the final water level in the West Pond to be in the order of 346 m AMSL. The lowest historical water level recorded in M4 at the southern edge of the licensed area is 345.5 m AMSL and the lowest historical water level in M1D located near the upper edge of the proposed quarry is 350.63 m AMSL. The final water level in the West Pond will stabilize somewhat above the mean of these two values (348.6 m AMSL) . Hunter has misread the notes on Page 4 of 5 as they pertain to the floor elevation of the wetland, not the water level of the quarry pond.	None

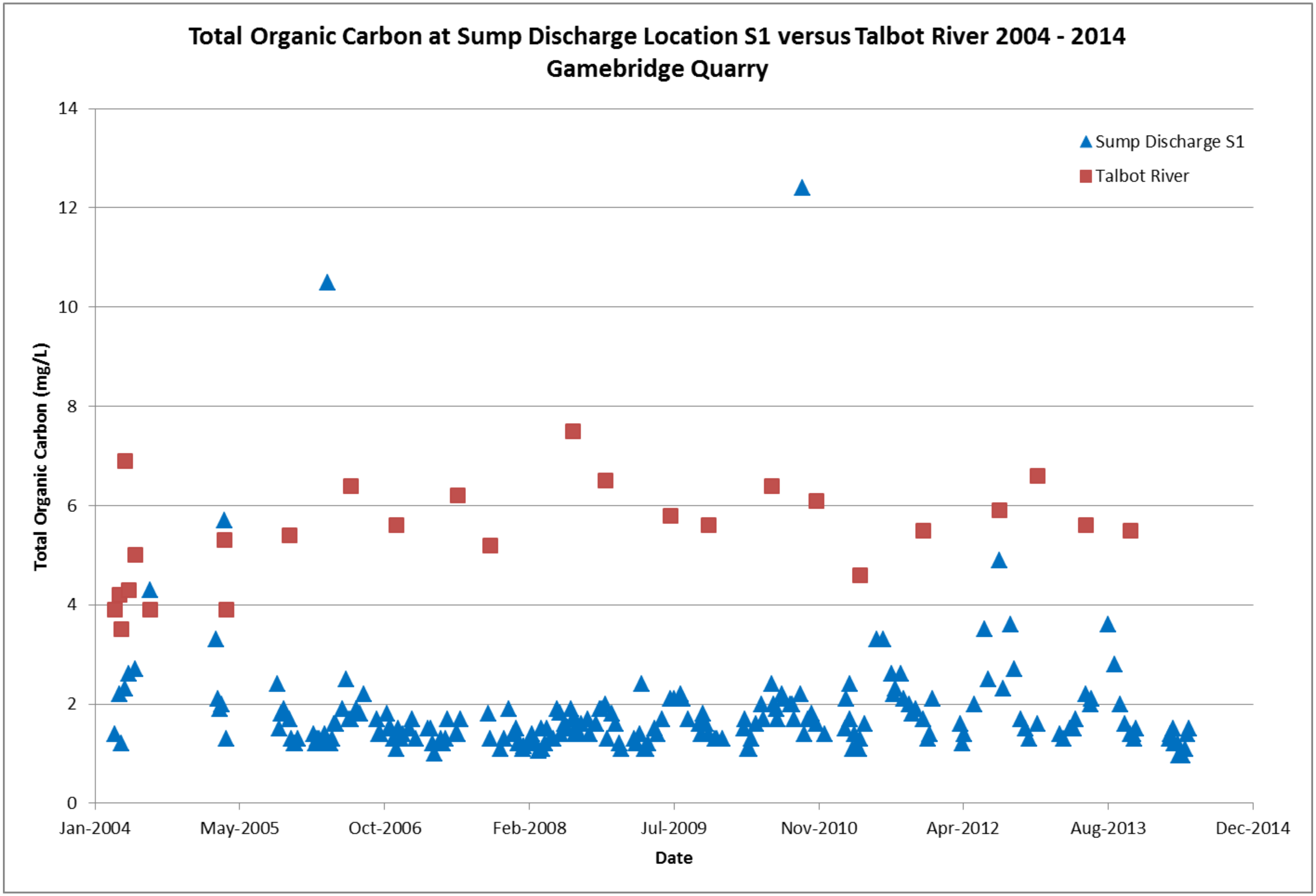
39	Gary Hunter	20-May-14	The Harden (2012) Fig 3.17 plot referenced above is based mainly on spring season (May 31, 2011) high water levels. Please provide a corresponding late summer / early fall plot using 'same date' data.	A substantial quantity of data has been presented including late summer and fall. Please refer to the tables in the report.	None
40	Gary Hunter	20-May-14	Will the actual drawdowns be sufficient during dry season to interfere with bored and shallow bedrock wells and streams (and ponds) fed by bedrock springs up to 1 km or more upgradient of the quarry?	It is our professional opinion, as expressed in our report, that springs, ponds and shallow dug wells upgradient of the site will not be affected by the anticipated change in bedrock water levels. A high degree of monitoring as requested by the Township of Guelph Eramasa and the Ministry of the Environment has been agreed to by James Dick Construction Ltd. to verify this opinion. Phase 1 of the quarry extraction is predicted to have a negligable impact on bedrock water levels upgradient of the site thus providing a significant period of time to obtain additional baseline information to be gathered prior to potential water level changes occuring in the bedrock upgradient.	None
41	Gary Hunter	20-May-14	Based on the Applicant predicted increased quarry water level at 348.6 m asl, will the forested kettle depression located on private property immediately south of MW4 and Highway 7 experience root zone flooding and dieback?	The kettle depression has an estimated minimum elevation of 349 m AMSL according to the one metre contour interveal mapping provided by the GRCA. As shown on Figure 3.17 the potentiometric surface has an elevation of approximately 346 m AMSL. The predicted water level rise beneath the kettle depression, as shown on Figure 4.3 is approximately one metre. Therefore, root zone flooding is not predicted to occur.	None
42	Gary Hunter	20-May-14	How does the Applicant propose to create a dry staging platform for drilling and blasting? Will positive or passive dewatering be required?	The dry platform is either formed by the surface of the bedrock, or where the surface of the bedrock is submerged, by a layer of shot rock. No dewatering will occur. Drilling will occur to a maximum of 327 masl.	None
43	Gary Hunter	20-May-14	Has the Applicant considered progressively mining from the southeast upgradient into the higher northwest water tables of the site?	Various scenarios have been considered and the current phasing as presented is the preferred approach.	None
44	Gary Hunter	20-May-14	Will adaptive management based on southerly site quarrying with a more gradual drawdown of northerly boundary groundwater monitors be more effective than initiating quarrying in the deeper water to the north as proposed on the Sept 2012 Site Plans (pg 2 of 5)?	No. The greatest water level change occurs when mining Phase 3 (southern half of the quarry on the west side of Tributary B). The mining of Phase 1 (northern half of the west side of Tributary B) results in a predicted water level change of less than five centimetres beneath the Allen and De Grandis properties.	None
45	Gary Hunter	20-May-14	Does the Applicant propose to waste the silty till overburden spoil or place imported fill in the quarry excavation?	There is no proposal to import any offsite fill or snow onto the property. Native onsite soils may be used for wetland and habitat creation in the pond.	None
46	Gary Hunter	20-May-14	How does the Applicant propose to maintain clear clean unobstructed groundwater flow to nearby domestic and commercial wells through the life cycle of the quarry excavation ?	The quarry ponds are stillwater features and therefore the majority of deposition of rock fines will occur in the quarry ponds themselves. Groundwater flow occurs very slowly and any turbidity entering the aqufier downgradient of the site will settle out of the water. The mobilization of fine particles in the Gasport Aquifer and was observed during thepumping of M15 and also in other Gasport aquifer wells. This shows that the flow rate in the aquifer is too slow to mobilize fine particles. No obstructions to southerly groundwater flow are being proposed at this quarry (e.g. barrier walls) and therefore groundwater flow will continue to occur as it presently does. Approximately half of the overall bedrock thickness will remain undisturbed and water will continue to flow beneath the quarry as it does today.	None
47	Gary Hunter	20-May-14	Will the quarry walls become clogged with silt turbidity or be barricaded by lower permeability waste spoil ?	Our experience with other quarries is that quarry walls do not become clogged with silty turbidity and we do not anticipate any clogging of fractures at this quarry. Fine-grained material generated by the extraction of the overburden will be used in rehabilitation above-the-water-table, where needed for wetlands within the quarry pond or removed from the site to be used in products produced elsewhere.	None
48	Gary Hunter	20-May-14	Will the Site Plans specify that a Permit to Take Water and an Environmental Compliance Approval to Discharge Wash Water is required?	Any permits required by the MOE are governed by other legislation. The site plan makes note of permits that may be required.	None
49	Gary Hunter	20-May-14	Please provide Warnock Lake supporting technical information - say pre and post extraction hydroperiod monitoring and historical aerial imagery to support this observation.	The attached report "Evaluation of Three Hydraulic Barriers in Southern Ontario" (Harden Environmental, 2001) shows pre and post water level monitoring confirming barrier effectiveness at Warnock Lake and Heritage Lake.	"Evaluation of Three Hydraulic Barriers in Southern Ontario" (Harden Environmental, 2001) attached.
50	Gary Hunter	20-May-14	What will stop groundwater flows around the ends of the proposed northwest wetland hydraulic barrier in the proposed Hidden Quarry?	Groundwater must flow around the ends of the proposed hydraulic barrier. The purpose of the hydraulic barrier is to cause water levels to rise and flow around the barrier. The barrier is positioned parallel to groundwater flow and similar to an obstruction in a stream, will cause the water level to rise and flow around the obstruction. Our observation is that there is significant groundwater flow in the overburden sand and gravel on the upgradient side of the wetland and therefore we have included an overflow structure at 355.8 m AMSL to prevent excessive flooding of this wetland.	None
51	Gary Hunter	20-May-14	The Harden Sept 2012 Appendix E Fig 1 Sampling Location illustrates a rock drill operating from a dry platform. Is this dry platform maintained by dewatering (sump reference in the title of Table 1)? What are the depths of rock drilling? Is this dry drilling platform the top of the 'Gasport' Formation?	The dry platform is either formed by the surface of the bedrock, or where the surface of the bedrock is submerged, by a layer of shot rock. No dewatering will occur. Drilling will occur to a maximum of 327 masl.	None
52	Gary Hunter	20-May-14	Please provide a certified copy of the Laboratory Analytical Report(s) for this Feb 15, 2012 sample.	See attached.	Maxaam Validated Certificate of Analysis attached.
53	Gary Hunter	20-May-14	However this single grab sample (Appendix E Table 1) illustrates Provincial Water Quality Objective criteria exceedances for Cobalt, Lead and Zinc (Note Zinc (revised) as 20 µg/L). Total Ammonia -N concentration is at about 80%, Unionized Ammonia at 25 % and Nitrate at about 12 % of the PWQO. Benzene is reported at a trace amount. Please comment.	Cobalt, lead and zinc naturally occur in the Eramosa Formation being extracted at the Guelph Limestone Quarry. We concur that Total Ammonia - N, un-ionized ammonia and nitrate do not exceed Provincial Water Quality Objectives. The source of benzene in trace amounts could be derived from many sources including the naturally bituminous Eramosa Formation or from traffic on Highways 7 and 6 adjacent to the quarry.	None

54	Gary Hunter	20-May-14	Hardness, Alkalinity, pH, Sulphate, Total Organic Carbon, Organic Nitrogen, Colour, Total Dissolved Solids, Total Suspended Solids, Oil and Grease and Pathogens were not reported in Appendix E Table 1. Many of these parameters are likely to be elevated in an active quarry environment with frequent blasting especially if the underwater quarry is used for washwater silt and overburden disposal.	There is no proposal to emplace any fill, other than for wetland creation, in the pond. Hunter has not provided any data to substantiate his opinion that Hardness, Alkalinity, pH, sulphate, Total Organic Carbon, Organic Nitrogen, Colour, Total Dissolved Solids, Total Suspended Solids, Oil and Grease or Pathogens are likely to be elevated in an active quarry environment. Our reported findings are that in an active quarry environment hardness, alkalinity, pH, sulphate, TOC, Organic Nitrogen, Colour, TDS, TSS, Oil and Grease and pathogens are not elevated as a result of quarry activity. Hardness is naturally elevated in the Gasport Aquifer and is un-related to quarry activities. For example, 100% of the samples tested for Hardness by the City of Guelph in 2013 exceeded the Maximum Acceptable Concentration in the Annual & Summary Report available on-line. The Aesthetic/Operational standard for Alkalinity is 30 to 500 mg/L. As mainly a measure of the concentrations of carbonate and bicarbonate in the water, alkalinity will be naturally elevated in the Gasport Aquifer. The quarry activity will not introduce alkalinity to the water and the natural buffering capacity of the water will regulate the concentrations of carbonate and bicarbonate in the water. A total of 219 samples were obtained from an active limestone quarry near Brechin, Ontario. Blasting is conducted at the quarry. The attached Figure 1 shows the range of pH in the sump water at the quarry. As expected, because of the high buffering capacity of limestone and dolostone, the pH of the discharge water remains within the Ontario Drinking Water Operational Guideline of 6.5 to 8.5 pH units. There is no justification in the suggestion that pH will be elevated in the Hidden Quarry pond water or downgradient in the groundwater. Total Organic Carbon (TOC)is a measure of the dissolved and particulate carbon in the water. Again, a total of 219 samples tested for Total Organic Carbon in quarry sump water in Gamebridge, Ontario, found that the quarry water has lower TOC than the nearby natural waters of the Talbot River (26 samples) (attached Figure 2). There is no source of organic carbon in the quarry environment in comparison to the natural environment where wetlands, lakes and streams will contain elevated TOC. Organic Nitrogen is used to measure the concentration of nitrogen attached to organic molecules. Groundwater samples obtained from the Hidden Quarry site from stations M2, M15-3 and M3 and surface water samples obtained from stations SW4, SW11 and SW3 contained higher concentrations of organic nitrogen than samples obtained from the Guelph Limestone site following a blast. There is no reason to expect that the Colour of the water will be affected by the quarry activities. Unlike natural surface waters which dissolve organic matter, the quarry pond will be relatively sterile and the dissolution of the rock does not affect the colour of the water. Total Dissolved Solds will not necessarily increase. The action of the quarry is to remove dolostone from below-the-water table thereby decreasing the volume of rock interacting with the water. Total Suspended Solids (TSS) may increase in close proximity to the excavating equipment. There is no environmental consequence of having higher TSS in the quarry pond proximal to the excavating equipment. A total of 227 oil and grease samples were obtained at the Gamebridge Quarry. None exceeded the MOE Specified Daily Effluent Limit of 30 mg/L. Of the 227 samples, oil and grease was not detected in 190 samples, and of the 37 samples where oil and grease was detected, the average result was 1.3 mg/L with a maximum value of 7.7 mg/L. This water was discharged to the Talbot River with no consequence. Pathogens were not found in the Guelph Limestone quarry water sample obtained on April 16, 2014. Samples obtained from Tributary A (at RS1) and Tributary B (at SW4) near to the proposed quarry contained E. coli (Appendix C, Harden Response to Burnside Review, June 10 2014).	pH and TOC figures attached.
55	Gary Hunter	20-May-14	The Total Ammonia and Total Kjeldahl Nitrogen at the Dolime Quarry are elevated above the Hidden Quarry pre-development groundwater at M15 at 0.06 mg/L and 0.20 mg/L respectively (Appendix B to Harden July 15, 2013 letter to James Dick Construction Ltd). Total Ammonia-N is reported as Non-Detectible at Harden W1 (MOE 67-05627).	Subsequent samples from Guelph Limestone Quarry as reported to R.J. Burnside and Associates on June 10, 2014 show that ammonia is not present before or after a blast. Ammonia will not persist in the oxygenated quarry pond water and is therefore not an environmental threat. The additional samples from Gueplh Limestone Quarry also show that the quarry water has less TKN than samples obtained from M3, M2 and M15-II. With respect to Total Nitrogen, water samples from M3, M2, M15-III, M15-II, SW4 and SW8 exceed those obtained from the quarry in February 2012.	
56	Gary Hunter	20-May-14	There is a known direct relationship between the ammonia and nitrate levels and the amount of undetonated explosives in the rock through which water flows (Revey 1996). Are the Nitrogen parameters in this Dolime Quarry grab sample elevated due to incomplete detonation or combustion of explosives in a wet environment? Was the blast 'smoke' produced orange or white in colour in the Feb 12, 2012 detonation?	There is no evidence to suggest that nitrogen chemicals are elevated in the Guelph Limestone Quarry samples. A review of several quarry sites is provided in the Harden January 14, 2014 response to R.J. Burnside that shows that nitrogen chemicals are not an issue in quarry water discharge.	None
57	Gary Hunter	20-May-14	The difference between Total Kjeldahl Nitrogen (0.7 mg/L) and Total Ammonia N (0.39 mg/L) in Table 1 indicates that Organic Nitrogen in the grab sample is 0.31 mg/L. This value exceeds by 2x the Ontario Drinking Water Standards (2006) of 0.15 mg/L for Organic Nitrogen.	Organic Nitrogen does not have an Ontario Drinking Water Standard. There is an Operational Guideline of 0.15 mg/L, but this is a guideline, not a standard. None of the present M15 samples pass the guideline. None of the northern wells on-site pass the guideline (one is 10x the guideline) due to off-site contamination of the groundwater. None of the stream samples pass the guideline. Biological activity such as plant growth in the rehabilitated wetlands, will assist in the improvement of water quality presently impaired by farming activities upgradient of the Hidden Quarry site.	None
58	Gary Hunter	20-May-14	What blasting management protocols are employed at Guelph Dolime Quarry to minimize spillage, reduce product leaching and reduce undetonated explosives and incomplete combustion. How deep are the drill holes? What 'sleep' times typically occur? What is the frequency of blasting? What blasting agents are used?	At the Guelph Limestone Quarry, JDCL uses waterproof emulsions, blast tubes and excellent hygiene to minimize spillage, leaching and incomplete combustion. Explosives are used within manufacturers specifications for sleep times. Depths vary but we have seen these techniques up to 35m. The Guelph Limestone Quarry blasts generally once a week during peak operations, but only about 22 times per year. Each event has a duration of about one second.	None
59	Gary Hunter	20-May-14	This single grab sample is not sufficient as an analogue to establish a Water Quality comfort level for underwater blasting and quarrying at the Hidden Quarry.	Additional samples were obtained and reported to R.J. Burnside and Associates in the Harden Environmental June 10, 2014 letter.	None
60	Gary Hunter	20-May-14	I request that the Applicant discloses all Water Quality Compliance Monitoring for the Guelph Dolime Quarry and provides additional immediate post blast water quality sampling and analysis for the parameters in para 7 above and the BTEX suite.	Additional samples were obtained and reported to R.J. Burnside and Associates in the Harden Environmental June 10, 2014 letter.	None
61	Gary Hunter	20-May-14	I request a site inspection, together with other CRC members who may be interested, of the Dolime Quarry at the time of and following an underwater blast event.	The operator takes this request under advisement and will consider this request.	None
62	Gary Hunter	20-May-14	Has the bedrock outcrop / subcrop evidence at the De Grandis farm area been considered in the Applicant Hydrogeological Investigation and reporting?	We visited the De Grandis property on no less than five occasions and potential impacts to the De Grandis dug well and pond were carefully considered in our assessment. We mention the De Grandis property on twenty-eight occasions in our report and dedicate Section 5.3.2 to potential impacts to the De Grandis property. The geological conditions observed at the De Grandis property were given a significant amount of consideration. Similar boulder conditions occur on the Hidden Quarry site as shown on the cover page of the report. These are not bedrock/subcrop conditions as the overburden is approximately ten metres thick. These are glacial remnants and similar large boulders are found elsewhere at the height of the Paris Moraine. For example, on the Nassagaweya-Puslinch Townline between the 25th Sideroad and the 20th Sideroad there are numerous very large boulders found at the height of the Paris Moraine and between 30 and 40 metres above the bedrock.	None

63	Gary Hunter	20-May-14	What evidence does the Applicant have to support its hypothesis apparently based on extrapolated data from the Hidden Quarry site that the De Grandis ponds, the source of Tributary B, are perched above the basal silty till and fed by upper overburden granular aquifers? This condition likely exists on the W½ Lot 3 of the De Grandis Farm where the topographically high Paris Moraine deposits are prominent but not on the E½ of Lot 2 and adjacent Lot 3.	None of our opinions in regards to the De Grandis well and pond are based on extrapolated data from the Hidden Quarry site. There are several lines of evidence that form our opinion in regards to overburden source of water for the Degrandis Ponds. 1) The geological mapping provided by the Ontario Geological Survey as shown on our Figure 3.6 identifies the surficial quaternary geology as Kames and Eskers. These geological deposits are widely accepted as being relatively permeable with relatively high infiltration. Additional work conducted by Abigail Burt (2011) as shown on our Figure 3.7 also confirms the potential for the Port Stanley till in this area, a till that pre-dates the eskers and kame deposits. 2) Soil samples obtained from the Allen property in close proximity to the De Grandis ponds identify a silty glacial till in samples A8, A11 and A12. 3) Ms. De Grandis identified a spring west of her farm house, occuring at higher elevation, at the base of the moraine feature. Hunter agrees that this spring may have a source derived from the moraine sediments 4) Streamflow measurements confirm downward hydraulic gradients between surface water station SW9 and SW4 shown on Figure 2.4. therefore, shortly after discharging from the De Grandis pond, the hydraulic gradients are downward beneath Tributary B. 5) The De Grandis well is a shallow dug well in the overburden and is a high yielding well from an unconfined source. 6) The description of the pond excavation by Ms. Degrandis was that the pond was dry, digging through 'clay'. When the known spring located along the north shore of the pond was excavated, this resulted in a source of water for the pond. 6) On our visit to the De Grandis farm, Ms. De Grandis identifed several springs located in shallow water along the north shore of the pond. 7) The water quality of the De Grandis shallow dug well is indicative of a shallow, unconfined source. Therefore, none of the scientific or anecdotal information supports a bedrock source of water on the De Grandis farm.	None
64	Gary Hunter	20-May-14	How are the groundwater model predicted bedrock water level contours calibrated in the De Grandis Pond area?	The baseline groundwater conditions, used to calibrate the groundwater model before predictions are made, were obtained from regional water well record data, on-site monitoring well data and private water well survey information.	None
65	Gary Hunter	20-May-14	Similarly what geological evidence does the Applicant have that the Allen Spring is not a bedrock spring?	1) The water level of the Allen Spring is approximately six metres above the bedrock water level in the Allen well. The static water level in the Allen well should be flowing artesian if the bedrock water levels were six metres higher. 2) The elevation of the bedrock at the Allen Farm well is approximately 354 m AMSL and at the Harden test site 352 m AMSL (See Figure 3.5) whereas the spring has an elevation of approximatley 361 m AMSL 3) the description in the well record of the 5.5 metres of overburden is clay with gravel and stones 4) Hunter concedes that the spring conditions in the west half of Lot 3 are likely to be from permeable sediments overlying silty till sedimients.	None
66	Gary Hunter	20-May-14	The Applicant predicts bedrock aquifer drawdowns at 80 cm at the Allen Spring vicinity. Is this drawdown likely sufficient to terminate dry season discharge to streamflow at this location?	Historical seasonal water level changes in the Hidden Quarry bedrock water level of up to two metres have been measured and the Allen Spring has never gone dry. Water taking by the mushroom farmer resulting in a drawdown of approximately fifty metres in the bedrock have not affected spring flow from the Allen Spring. It is therefore, our opinion that the predicted 80 cm change in bedrock water levels at the Allen Spring will not affect discharge from the spring.	None
67	Gary Hunter	20-May-14	Is the applicant willing to construct boreholes and sentry observation wells in the vicinity of the Allen Spring and the De Grandis ponds in support of its application?	There is no requirement for offsite monitoring at these locations. SW4 is a surrogate monitoring site that corelates to flow coming from De Grandis pond and RS1 quantifies flow coming from the Allen Spring.	None
68	Gary Hunter	20-May-14	Please provide a digital copy of the UTM geographic coordinate string for the GRCA field staked setback base line and the proposed setback limit.	The setbacks are graphically shown on the updated site plan.	None
69	Gary Hunter	20-May-14	Please verify the last paragraph statements on pg 57 (Sec 6.0) related to total aggregate tonnage resources and that only 20% of the aggregate resource occurring below the water table.	This is a typo. It will be corrected in Final GWS Report referenced on the site plan.	None
70	Gary Hunter	20-May-14	If site boreholes confirm the evidence of a bedrock platform and bedrock springs at the De Grandis ponds and at the Allen Springs, how would this change the Sec 7.1 (pg 58) statements attributed to Harden Environmental (2012) .	See responses 62 and 63 above.	None
71	Gary Hunter	20-May-14	How would this loss of bedrock spring flow influence the sustainability of the Provincially Significant Allen Wetland and Tributary A and B - Brydson Creek?	Based on the evidence available including our observations and measurements in the Provincially Significant Wetland indicate that a cessation of flow from the De Grandis pond would not have an effect on the sustainability of the wetland. The basis for this opinion is 1) The berm separating the open water in the De Grandis ponds and the PSW has been breached, allowing for a relatively free flow of water. It appears that when intact, the berm would have retained a significant volume of water resulting in a premature cessation of stream flow to the PSW, there is no obvious effect of this loss of flow to the wetland, 2) Cessation of flow from the De Grandis ponds is an annual occurance and the wetland is conditioned for this occurence 3) The soil beneath the PSW is a sandy silt till and there are drainage ditches dug through the wetland as evidence of attempts to remove water from the wetland (i.e. the wetland retains stormwater and direct precipitation). Therefore, direct precipitation and runoff are significant contributers to the PSW.	None
72	Gary Hunter	20-May-14	Please provide us with a complete set of up-to-date digital AutoCAD .dwg or equivalent high resolution Site Plan files or legible hard copy for formal comment.	June 6, 2014 site plans available on Township Website. http://www.get.on.ca/uploads/userfiles/files/planning/hidden-quarry-site-plans-2014-06-06.pdf	June 6 2014 Site Plan PDF available on Township website



Harden Environmental Services Ltd.	**Project No:** 9506	Hydrogeologic Impact Assessment Proposed Aggregate Extraction	**Figure 1: pH Values at Sump Discharge Gamebridge Quarry**
	Date: Jul 2014	Part of Lot 1, Concession 6 Township of Guelph/Eramosa, County of Wellington	
	Drawn By: AR		



Harden Environmental Services Ltd.	**Project No:** 9506	Hydrogeologic Impact Assessment Proposed Aggregate Extraction	**Figure 2: Total Organic Carbon** **Gamebridge Quarry**
	Date: Jul 2014	Part of Lot 1, Concession 6 Township of Guelph/Eramosa, County of Wellington	
	Drawn By: AR		

Attention: Aaron Warkentin
Harden Environmental
4622 Nassagaweya-Puslinch Twnl
Moffat, ON
L0P 1J0

Report Date: 2012/02/24

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B222699
Received: 2012/02/16, 08:46

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Methylnaphthalene Sum	1	2012/02/16	2012/02/22	CAM SOP - 00301	EPA 8270
Perchlorate in water	1	2012/02/17	2012/02/21	CAM SOP-00451	EPA 331.0/6850 (mod)
Petroleum Hydro. CCME F1 & BTEX in Water	1	N/A	2012/02/22	CAM SOP-00315	CCME CWS
Petroleum Hydrocarbons F2-F4 in Water	1	2012/02/21	2012/02/21	CAM SOP-00316	CCME Hydrocarbons
Total Metals Analysis by ICPMS	1	N/A	2012/02/22	CAM SOP-00447	EPA 6020
Total Ammonia-N	1	N/A	2012/02/22	CAM SOP-00441	US GS I-2522-90
Nitrate (NO3) and Nitrite (NO2) in Water (1)	1	N/A	2012/02/23	CAM SOP-00440	SM 4500 NO3I/NO2B
PAH Compounds in Water by GC/MS (SIM)	1	2012/02/17	2012/02/21	CAM SOP-00318	EPA 8270
Total Kjeldahl Nitrogen in Water	1	2012/02/22	2012/02/23	CAM SOP-00454	EPA 351.2 Rev 2
Volatile Organic Compounds in Water	1	N/A	2012/02/21	CAM SOP-00226	EPA 8260 modified

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. Reporting results to two significant figures at the RDL is to permit statistical evaluation and is not intended to be an indication of analytical precision.

The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following the 'Alberta Environment Draft Addenda to the CWS-PHC, Appendix 6, Validation of Alternate Methods'. Documentation is available upon request. Maxxam has made the following improvements to the CWS-PHC reference benchmark method: (i) Headspace for F1; and, (ii) Mechanical extraction for F2-F4. Note: F4G cannot be added to the C6 to C50 hydrocarbons. The extraction date for samples field preserved with methanol for F1 and Volatile Organic Compounds is considered to be the date sampled.

Maxxam Analytics is accredited by SCC (Lab ID 97) for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other

Attention: Aaron Warkentin
Harden Environmental
4622 Nassagaweya-Puslinch Twnl
Moffat, ON
L0P 1J0

Report Date: 2012/02/24

CERTIFICATE OF ANALYSIS

-2-

warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) Values for calculated parameters may not appear to add up due to rounding of raw data and significant figures.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

ANDREW TURNER, Project Manager
Email: ATurner@maxxam.ca
Phone# (800) 268-7396 Ext:233

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Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 2

Harden Environmental

Maxxam Job #: B222699
Report Date: 2012/02/24

RESULTS OF ANALYSES OF WATER

Maxxam ID		MN9623		
Sampling Date		2012/02/15 16:00		
	Units	**SUMP**	**RDL**	**QC Batch**
Inorganics				
Total Ammonia-N	mg/L	0.39	0.05	2768497
Total Kjeldahl Nitrogen (TKN)	mg/L	0.7	0.1	2770291
Nitrite (N)	mg/L	0.05	0.01	2768472
Nitrate (N)	mg/L	1.2	0.1	2768472
Nitrate + Nitrite	mg/L	1.2	0.1	2768472
Miscellaneous Parameters				
Perchlorate (CLO4)	ug/L	ND	0.05	2767145

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam

Harden Environmental

Maxxam Job #: B222699
Report Date: 2012/02/24

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID			MN9623		
Sampling Date			2012/02/15 16:00		
	Units	**Criteria**	**SUMP**	**RDL**	**QC Batch**
Metals					
Total Aluminum (Al)	mg/L	**-**	0.016	0.0050	2770314
Total Antimony (Sb)	mg/L	**0.02**	0.00090	0.00050	2770314
Total Arsenic (As)	mg/L	**0.1**	0.0016	0.0010	2770314
Total Barium (Ba)	mg/L	**-**	0.051	0.0020	2770314
Total Beryllium (Be)	mg/L	**0.011**	ND	0.00050	2770314
Total Bismuth (Bi)	mg/L	**-**	ND	0.0010	2770314
Total Boron (B)	mg/L	**0.2**	0.056	0.010	2770314
Total Cadmium (Cd)	mg/L	**0.0002**	ND	0.00010	2770314
Total Calcium (Ca)	mg/L	**-**	120	0.20	2770314
Total Chromium (Cr)	mg/L	**-**	ND	0.0050	2770314
Total Cobalt (Co)	mg/L	**0.0009**	**0.0013**	0.00050	2770314
Total Copper (Cu)	mg/L	**0.005**	0.0019	0.0010	2770314
Total Iron (Fe)	mg/L	**0.3**	ND	0.10	2770314
Total Lead (Pb)	mg/L	**0.005**	**0.0055**	0.00050	2770314
Total Lithium (Li)	mg/L	**-**	ND	0.0050	2770314
Total Magnesium (Mg)	mg/L	**-**	32	0.050	2770314
Total Manganese (Mn)	mg/L	**-**	0.026	0.0020	2770314
Total Molybdenum (Mo)	mg/L	**0.04**	0.0069	0.00050	2770314
Total Nickel (Ni)	mg/L	**0.025**	0.014	0.0010	2770314
Total Potassium (K)	mg/L	**-**	3.5	0.20	2770314
Total Silicon (Si)	mg/L	**-**	3.6	0.050	2770314
Total Selenium (Se)	mg/L	**0.1**	ND	0.0020	2770314
Total Silver (Ag)	mg/L	**0.0001**	ND	0.00010	2770314
Total Sodium (Na)	mg/L	**-**	80	0.10	2770314
Total Strontium (Sr)	mg/L	**-**	1.1	0.0010	2770314
Total Tellurium (Te)	mg/L	**-**	ND	0.0010	2770314
Total Thallium (Tl)	mg/L	**0.0003**	0.000056	0.000050	2770314
Total Tin (Sn)	mg/L	**-**	ND	0.0010	2770314
Total Titanium (Ti)	mg/L	**-**	ND	0.0050	2770314
Total Tungsten (W)	mg/L	**0.030**	ND	0.0010	2770314

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: ONTARIO PROVINCIAL WATER QUALITY OBJECTIVES
Ref. to MOEE Water Management document dated Feb.1999

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID			MN9623		
Sampling Date			2012/02/15 16:00		
	Units	**Criteria**	**SUMP**	**RDL**	**QC Batch**
Total Uranium (U)	mg/L	**0.005**	0.0020	0.00010	2770314
Total Vanadium (V)	mg/L	**0.006**	ND	0.00050	2770314
Total Zinc (Zn)	mg/L	**0.03**	**0.057**	0.0050	2770314
Total Zirconium (Zr)	mg/L	**0.004**	ND	0.0010	2770314

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: ONTARIO PROVINCIAL WATER QUALITY OBJECTIVES
Ref. to MOEE Water Management document dated Feb.1999

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID			MN9623		
Sampling Date			2012/02/15 16:00		
	Units	**Criteria**	**SUMP**	**RDL**	**QC Batch**
Calculated Parameters					
Methylnaphthalene, 2-(1-)	ug/L	**-**	ND	0.071	2766069
Polyaromatic Hydrocarbons					
Biphenyl	ug/L	**0.2**	ND	0.050	2768173
Acenaphthene	ug/L	**-**	ND	0.050	2768173
Acenaphthylene	ug/L	**-**	ND	0.050	2768173
Anthracene	ug/L	**0.0008**	ND	0.050	2768173
Benzo(a)anthracene	ug/L	**0.0004**	ND	0.050	2768173
Benzo(a)pyrene	ug/L	**-**	ND	0.010	2768173
Benzo(b/j)fluoranthene	ug/L	**-**	ND	0.050	2768173
Benzo(g,h,i)perylene	ug/L	**0.00002**	ND	0.050	2768173
Benzo(k)fluoranthene	ug/L	**0.0002**	ND	0.050	2768173
Chrysene	ug/L	**0.0001**	ND	0.050	2768173
Dibenz(a,h)anthracene	ug/L	**0.002**	ND	0.050	2768173
Fluoranthene	ug/L	**0.0008**	ND	0.050	2768173
Fluorene	ug/L	**0.2**	ND	0.050	2768173
Indeno(1,2,3-cd)pyrene	ug/L	**-**	ND	0.050	2768173
1-Methylnaphthalene	ug/L	**2**	ND	0.050	2768173
2-Methylnaphthalene	ug/L	**2**	ND	0.050	2768173
Naphthalene	ug/L	**7**	ND	0.050	2768173
Phenanthrene	ug/L	**0.03**	ND	0.030	2768173
Pyrene	ug/L	**-**	ND	0.050	2768173
Surrogate Recovery (%)					
D10-Anthracene	%	-	89		2768173
D14-Terphenyl (FS)	%	-	96		2768173
D8-Acenaphthylene	%	-	86		2768173

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: ONTARIO PROVINCIAL WATER QUALITY OBJECTIVES
Ref. to MOEE Water Management document dated Feb.1999

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID			MN9623		
Sampling Date			2012/02/15 16:00		
	Units	**Criteria**	**SUMP**	**RDL**	**QC Batch**
Volatile Organics					
Acetone (2-Propanone)	ug/L	**-**	ND	10	2767160
Benzene	ug/L	**100**	0.11	0.10	2767160
Bromodichloromethane	ug/L	**200**	ND	0.10	2767160
Bromoform	ug/L	**60**	ND	0.20	2767160
Bromomethane	ug/L	**0.9**	ND	0.50	2767160
Carbon Tetrachloride	ug/L	**-**	ND	0.10	2767160
Chlorobenzene	ug/L	**15**	ND	0.10	2767160
Chloroform	ug/L	**-**	ND	0.10	2767160
Dibromochloromethane	ug/L	**40**	ND	0.20	2767160
1,2-Dichlorobenzene	ug/L	**2.5**	ND	0.20	2767160
1,3-Dichlorobenzene	ug/L	**2.5**	ND	0.20	2767160
1,4-Dichlorobenzene	ug/L	**4**	ND	0.20	2767160
Dichlorodifluoromethane (FREON 12)	ug/L	**-**	ND	0.50	2767160
1,1-Dichloroethane	ug/L	**200**	ND	0.10	2767160
1,2-Dichloroethane	ug/L	**100**	ND	0.20	2767160
1,1-Dichloroethylene	ug/L	**40**	ND	0.10	2767160
cis-1,2-Dichloroethylene	ug/L	**200**	ND	0.10	2767160
trans-1,2-Dichloroethylene	ug/L	**200**	ND	0.10	2767160
1,2-Dichloropropane	ug/L	**0.7**	ND	0.10	2767160
cis-1,3-Dichloropropene	ug/L	**-**	ND	0.20	2767160
trans-1,3-Dichloropropene	ug/L	**7**	ND	0.20	2767160
Ethylbenzene	ug/L	**8**	ND	0.10	2767160
Ethylene Dibromide	ug/L	**5**	ND	0.20	2767160
Hexane	ug/L	**-**	ND	0.50	2767160
Methylene Chloride(Dichloromethane)	ug/L	**100**	ND	0.50	2767160
Methyl Isobutyl Ketone	ug/L	**-**	ND	5.0	2767160
Methyl Ethyl Ketone (2-Butanone)	ug/L	**400**	ND	5.0	2767160
Methyl t-butyl ether (MTBE)	ug/L	**200**	ND	0.20	2767160
Styrene	ug/L	**4**	ND	0.20	2767160
1,1,1,2-Tetrachloroethane	ug/L	**20**	ND	0.10	2767160

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: ONTARIO PROVINCIAL WATER QUALITY OBJECTIVES
Ref. to MOEE Water Management document dated Feb.1999

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VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID			MN9623		
Sampling Date			2012/02/15 16:00		
	Units	**Criteria**	**SUMP**	**RDL**	**QC Batch**
1,1,2,2-Tetrachloroethane	ug/L	**70**	ND	0.20	2767160
Tetrachloroethylene	ug/L	**50**	ND	0.10	2767160
Toluene	ug/L	**0.8**	ND	0.20	2767160
1,1,1-Trichloroethane	ug/L	**10**	ND	0.10	2767160
1,1,2-Trichloroethane	ug/L	**800**	ND	0.20	2767160
Trichloroethylene	ug/L	**20**	ND	0.10	2767160
Vinyl Chloride	ug/L	**600**	ND	0.20	2767160
p+m-Xylene	ug/L	**-**	ND	0.10	2767160
o-Xylene	ug/L	**40**	ND	0.10	2767160
Xylene (Total)	ug/L	**-**	ND	0.10	2767160
Trichlorofluoromethane (FREON 11)	ug/L	**-**	ND	0.20	2767160
Surrogate Recovery (%)					
4-Bromofluorobenzene	%	-	94		2767160
D4-1,2-Dichloroethane	%	-	106		2767160
D8-Toluene	%	-	103		2767160

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria: ONTARIO PROVINCIAL WATER QUALITY OBJECTIVES
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PETROLEUM HYDROCARBONS (CCME)

Maxxam ID		MN9623		
Sampling Date		2012/02/15 16:00		
	Units	**SUMP**	**RDL**	**QC Batch**
BTEX & F1 Hydrocarbons				
F1 (C6-C10)	ug/L	ND	25	2770026
F1 (C6-C10) - BTEX	ug/L	ND	25	2770026
F2-F4 Hydrocarbons				
F2 (C10-C16 Hydrocarbons)	ug/L	ND	100	2768808
F3 (C16-C34 Hydrocarbons)	ug/L	ND	100	2768808
F4 (C34-C50 Hydrocarbons)	ug/L	ND	100	2768808
Reached Baseline at C50	ug/L	Yes		2768808
Surrogate Recovery (%)				
1,4-Difluorobenzene	%	99		2770026
4-Bromofluorobenzene	%	100		2770026
D10-Ethylbenzene	%	105		2770026
D4-1,2-Dichloroethane	%	103		2770026
o-Terphenyl	%	107		2768808

ND = Not detected
RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Test Summary

Maxxam ID MN9623
Sample ID SUMP
Matrix Water

Collected 2012/02/15
Shipped
Received 2012/02/16

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Methylnaphthalene Sum	CALC	2766069	2012/02/22	2012/02/22	AUTOMATED STATCHK
Perchlorate in water	LCMS	2767145	2012/02/17	2012/02/21	JANET DALISAY
Petroleum Hydro. CCME F1 & BTEX in Wat	HSGC/MSFD	2770026	N/A	2012/02/22	SUNG HO KIM
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	2768808	2012/02/21	2012/02/21	JOLANTA KAWZOWICZ
Total Metals Analysis by ICPMS	ICP/MS	2770314	N/A	2012/02/22	AREFA DABHAD
Total Ammonia-N	LACH/NH4	2768497	N/A	2012/02/22	ALINA DOBREANU
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	2768472	N/A	2012/02/23	BAVANI KAILAYA
PAH Compounds in Water by GC/MS (SIM)	GC/MS	2768173	2012/02/17	2012/02/21	YUAN ZHOU
Total Kjeldahl Nitrogen in Water	AC	2770291	2012/02/22	2012/02/23	CHANDRA NANDLAL
Volatile Organic Compounds in Water	P&T/MS	2767160	N/A	2012/02/21	VIVEK AKOLKAR

Maxxam ID MN9623 Dup
Sample ID SUMP
Matrix Water

Collected 2012/02/15
Shipped
Received 2012/02/16

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Perchlorate in water	LCMS	2767145	2012/02/17	2012/02/21	JANET DALISAY
Petroleum Hydrocarbons F2-F4 in Water	GC/FID	2768808	2012/02/21	2012/02/21	JOLANTA KAWZOWICZ
Nitrate (NO3) and Nitrite (NO2) in Water	LACH	2768472	N/A	2012/02/23	BAVANI KAILAYA
Total Kjeldahl Nitrogen in Water	AC	2770291	2012/02/22	2012/02/23	CHANDRA NANDLAL

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GENERAL COMMENTS

Results relate only to the items tested.

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Quality Assurance Report

Maxxam Job Number: WB222699

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
2767145 JDA	Matrix Spike						
	[MN9623-01]	Perchlorate (CLO4)	2012/02/21		101	%	75 - 115
	Spiked Blank	Perchlorate (CLO4)	2012/02/21		100	%	75 - 115
	Method Blank	Perchlorate (CLO4)	2012/02/21	ND, RDL=0.05		ug/L	
	RPD [MN9623-01]	Perchlorate (CLO4)	2012/02/21	NC		%	20
2767160 VAK	Matrix Spike	4-Bromofluorobenzene	2012/02/21		102	%	70 - 130
		D4-1,2-Dichloroethane	2012/02/21		107	%	70 - 130
		D8-Toluene	2012/02/21		100	%	70 - 130
		Acetone (2-Propanone)	2012/02/21		112	%	60 - 140
		Benzene	2012/02/21		96	%	70 - 130
		Bromodichloromethane	2012/02/21		95	%	70 - 130
		Bromoform	2012/02/21		97	%	70 - 130
		Bromomethane	2012/02/21		96	%	60 - 140
		Carbon Tetrachloride	2012/02/21		91	%	70 - 130
		Chlorobenzene	2012/02/21		92	%	70 - 130
		Chloroform	2012/02/21		97	%	70 - 130
		Dibromochloromethane	2012/02/21		95	%	70 - 130
		1,2-Dichlorobenzene	2012/02/21		91	%	70 - 130
		1,3-Dichlorobenzene	2012/02/21		92	%	70 - 130
		1,4-Dichlorobenzene	2012/02/21		92	%	70 - 130
		Dichlorodifluoromethane (FREON 12)	2012/02/21		96	%	60 - 140
		1,1-Dichloroethane	2012/02/21		94	%	70 - 130
		1,2-Dichloroethane	2012/02/21		99	%	70 - 130
		1,1-Dichloroethylene	2012/02/21		99	%	70 - 130
		cis-1,2-Dichloroethylene	2012/02/21		94	%	70 - 130
		trans-1,2-Dichloroethylene	2012/02/21		91	%	70 - 130
		1,2-Dichloropropane	2012/02/21		101	%	70 - 130
		cis-1,3-Dichloropropene	2012/02/21		108	%	70 - 130
		trans-1,3-Dichloropropene	2012/02/21		105	%	70 - 130
		Ethylbenzene	2012/02/21		104	%	70 - 130
		Ethylene Dibromide	2012/02/21		98	%	70 - 130
		Hexane	2012/02/21		109	%	70 - 130
		Methylene Chloride(Dichloromethane)	2012/02/21		96	%	70 - 130
		Methyl Isobutyl Ketone	2012/02/21		118	%	70 - 130
		Methyl Ethyl Ketone (2-Butanone)	2012/02/21		109	%	60 - 140
		Methyl t-butyl ether (MTBE)	2012/02/21		115	%	70 - 130
		Styrene	2012/02/21		87	%	70 - 130
		1,1,1,2-Tetrachloroethane	2012/02/21		91	%	70 - 130
		1,1,2,2-Tetrachloroethane	2012/02/21		97	%	70 - 130
		Tetrachloroethylene	2012/02/21		85	%	70 - 130
		Toluene	2012/02/21		91	%	70 - 130
		1,1,1-Trichloroethane	2012/02/21		88	%	70 - 130
		1,1,2-Trichloroethane	2012/02/21		95	%	70 - 130
		Trichloroethylene	2012/02/21		86	%	70 - 130
		Vinyl Chloride	2012/02/21		90	%	70 - 130
		p+m-Xylene	2012/02/21		99	%	70 - 130
		o-Xylene	2012/02/21		101	%	70 - 130
		Trichlorofluoromethane (FREON 11)	2012/02/21		87	%	70 - 130
	Spiked Blank	4-Bromofluorobenzene	2012/02/21		101	%	70 - 130
		D4-1,2-Dichloroethane	2012/02/21		101	%	70 - 130
		D8-Toluene	2012/02/21		102	%	70 - 130
		Acetone (2-Propanone)	2012/02/21		120	%	60 - 140
		Benzene	2012/02/21		98	%	70 - 130
		Bromodichloromethane	2012/02/21		94	%	70 - 130
		Bromoform	2012/02/21		97	%	70 - 130

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Quality Assurance Report (Continued)

Maxxam Job Number: WB222699

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
2767160 VAK	Spiked Blank	Bromomethane	2012/02/21		102	%	60 - 140
		Carbon Tetrachloride	2012/02/21		97	%	70 - 130
		Chlorobenzene	2012/02/21		95	%	70 - 130
		Chloroform	2012/02/21		100	%	70 - 130
		Dibromochloromethane	2012/02/21		95	%	70 - 130
		1,2-Dichlorobenzene	2012/02/21		94	%	70 - 130
		1,3-Dichlorobenzene	2012/02/21		96	%	70 - 130
		1,4-Dichlorobenzene	2012/02/21		97	%	70 - 130
		Dichlorodifluoromethane (FREON 12)	2012/02/21		105	%	60 - 140
		1,1-Dichloroethane	2012/02/21		97	%	70 - 130
		1,2-Dichloroethane	2012/02/21		98	%	70 - 130
		1,1-Dichloroethylene	2012/02/21		105	%	70 - 130
		cis-1,2-Dichloroethylene	2012/02/21		96	%	70 - 130
		trans-1,2-Dichloroethylene	2012/02/21		95	%	70 - 130
		1,2-Dichloropropane	2012/02/21		101	%	70 - 130
		cis-1,3-Dichloropropene	2012/02/21		107	%	70 - 130
		trans-1,3-Dichloropropene	2012/02/21		104	%	70 - 130
		Ethylbenzene	2012/02/21		99	%	70 - 130
		Ethylene Dibromide	2012/02/21		96	%	70 - 130
		Hexane	2012/02/21		122	%	70 - 130
		Methylene Chloride(Dichloromethane)	2012/02/21		95	%	70 - 130
		Methyl Isobutyl Ketone	2012/02/21		107	%	70 - 130
		Methyl Ethyl Ketone (2-Butanone)	2012/02/21		112	%	60 - 140
		Methyl t-butyl ether (MTBE)	2012/02/21		106	%	70 - 130
		Styrene	2012/02/21		88	%	70 - 130
		1,1,1,2-Tetrachloroethane	2012/02/21		93	%	70 - 130
		1,1,2,2-Tetrachloroethane	2012/02/21		94	%	70 - 130
		Tetrachloroethylene	2012/02/21		94	%	70 - 130
		Toluene	2012/02/21		95	%	70 - 130
		1,1,1-Trichloroethane	2012/02/21		93	%	70 - 130
		1,1,2-Trichloroethane	2012/02/21		94	%	70 - 130
		Trichloroethylene	2012/02/21		91	%	70 - 130
		Vinyl Chloride	2012/02/21		96	%	70 - 130
		p+m-Xylene	2012/02/21		100	%	70 - 130
		o-Xylene	2012/02/21		102	%	70 - 130
		Trichlorofluoromethane (FREON 11)	2012/02/21		92	%	70 - 130
	Method Blank	4-Bromofluorobenzene	2012/02/21		90	%	70 - 130
		D4-1,2-Dichloroethane	2012/02/21		101	%	70 - 130
		D8-Toluene	2012/02/21		104	%	70 - 130
		Acetone (2-Propanone)	2012/02/21	ND, RDL=10		ug/L	
		Benzene	2012/02/21	ND, RDL=0.10		ug/L	
		Bromodichloromethane	2012/02/21	ND, RDL=0.10		ug/L	
		Bromoform	2012/02/21	ND, RDL=0.20		ug/L	
		Bromomethane	2012/02/21	ND, RDL=0.50		ug/L	
		Carbon Tetrachloride	2012/02/21	ND, RDL=0.10		ug/L	
		Chlorobenzene	2012/02/21	ND, RDL=0.10		ug/L	
		Chloroform	2012/02/21	ND, RDL=0.10		ug/L	
		Dibromochloromethane	2012/02/21	ND, RDL=0.20		ug/L	
		1,2-Dichlorobenzene	2012/02/21	ND, RDL=0.20		ug/L	
		1,3-Dichlorobenzene	2012/02/21	ND, RDL=0.20		ug/L	
		1,4-Dichlorobenzene	2012/02/21	ND, RDL=0.20		ug/L	
		Dichlorodifluoromethane (FREON 12)	2012/02/21	ND, RDL=0.50		ug/L	
		1,1-Dichloroethane	2012/02/21	ND, RDL=0.10		ug/L	
		1,2-Dichloroethane	2012/02/21	ND, RDL=0.20		ug/L	
		1,1-Dichloroethylene	2012/02/21	ND, RDL=0.10		ug/L	

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Quality Assurance Report (Continued)

Maxxam Job Number: WB222699

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
2767160 VAK	Method Blank	cis-1,2-Dichloroethylene	2012/02/21	ND, RDL=0.10		ug/L	
		trans-1,2-Dichloroethylene	2012/02/21	ND, RDL=0.10		ug/L	
		1,2-Dichloropropane	2012/02/21	ND, RDL=0.10		ug/L	
		cis-1,3-Dichloropropene	2012/02/21	ND, RDL=0.20		ug/L	
		trans-1,3-Dichloropropene	2012/02/21	ND, RDL=0.20		ug/L	
		Ethylbenzene	2012/02/21	ND, RDL=0.10		ug/L	
		Ethylene Dibromide	2012/02/21	ND, RDL=0.20		ug/L	
		Hexane	2012/02/21	ND, RDL=0.50		ug/L	
		Methylene Chloride(Dichloromethane)	2012/02/21	ND, RDL=0.50		ug/L	
		Methyl Isobutyl Ketone	2012/02/21	ND, RDL=5.0		ug/L	
		Methyl Ethyl Ketone (2-Butanone)	2012/02/21	ND, RDL=5.0		ug/L	
		Methyl t-butyl ether (MTBE)	2012/02/21	ND, RDL=0.20		ug/L	
		Styrene	2012/02/21	ND, RDL=0.20		ug/L	
		1,1,1,2-Tetrachloroethane	2012/02/21	ND, RDL=0.10		ug/L	
		1,1,2,2-Tetrachloroethane	2012/02/21	ND, RDL=0.20		ug/L	
		Tetrachloroethylene	2012/02/21	ND, RDL=0.10		ug/L	
		Toluene	2012/02/21	ND, RDL=0.20		ug/L	
		1,1,1-Trichloroethane	2012/02/21	ND, RDL=0.10		ug/L	
		1,1,2-Trichloroethane	2012/02/21	ND, RDL=0.20		ug/L	
		Trichloroethylene	2012/02/21	ND, RDL=0.10		ug/L	
		Vinyl Chloride	2012/02/21	ND, RDL=0.20		ug/L	
		p+m-Xylene	2012/02/21	ND, RDL=0.10		ug/L	
		o-Xylene	2012/02/21	ND, RDL=0.10		ug/L	
		Xylene (Total)	2012/02/21	ND, RDL=0.10		ug/L	
		Trichlorofluoromethane (FREON 11)	2012/02/21	ND, RDL=0.20		ug/L	
	RPD	Acetone (2-Propanone)	2012/02/21	NC		%	30
		Benzene	2012/02/21	10.4		%	30
		Bromodichloromethane	2012/02/21	NC		%	30
		Bromoform	2012/02/21	NC		%	30
		Bromomethane	2012/02/21	NC		%	30
		Carbon Tetrachloride	2012/02/21	NC		%	30
		Chlorobenzene	2012/02/21	NC		%	30
		Chloroform	2012/02/21	NC		%	30
		Dibromochloromethane	2012/02/21	NC		%	30
		1,2-Dichlorobenzene	2012/02/21	NC		%	30
		1,3-Dichlorobenzene	2012/02/21	NC		%	30
		1,4-Dichlorobenzene	2012/02/21	NC		%	30
		1,1-Dichloroethane	2012/02/21	NC		%	30
		1,2-Dichloroethane	2012/02/21	NC		%	30
		1,1-Dichloroethylene	2012/02/21	NC		%	30
		cis-1,2-Dichloroethylene	2012/02/21	NC		%	30
		trans-1,2-Dichloroethylene	2012/02/21	NC		%	30
		1,2-Dichloropropane	2012/02/21	NC		%	30
		cis-1,3-Dichloropropene	2012/02/21	NC		%	30
		trans-1,3-Dichloropropene	2012/02/21	NC		%	30
		Ethylbenzene	2012/02/21	11.6		%	30
		Ethylene Dibromide	2012/02/21	NC		%	30
		Methylene Chloride(Dichloromethane)	2012/02/21	NC		%	30
		Methyl Isobutyl Ketone	2012/02/21	NC		%	30
		Methyl Ethyl Ketone (2-Butanone)	2012/02/21	NC		%	30
		Methyl t-butyl ether (MTBE)	2012/02/21	NC		%	30
		Styrene	2012/02/21	NC		%	30
		1,1,1,2-Tetrachloroethane	2012/02/21	NC		%	30
		1,1,2,2-Tetrachloroethane	2012/02/21	NC		%	30
		Tetrachloroethylene	2012/02/21	NC		%	30

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Quality Assurance Report (Continued)

Maxxam Job Number: WB222699

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
2767160 VAK	RPD	Toluene	2012/02/21	NC		%	30
		1,1,1-Trichloroethane	2012/02/21	NC		%	30
		1,1,2-Trichloroethane	2012/02/21	NC		%	30
		Trichloroethylene	2012/02/21	NC		%	30
		Vinyl Chloride	2012/02/21	NC		%	30
		p+m-Xylene	2012/02/21	12.5		%	30
		o-Xylene	2012/02/21	NC		%	30
		Xylene (Total)	2012/02/21	12.5		%	30
2768173 YZ	Matrix Spike	D10-Anthracene	2012/02/21		92	%	50 - 130
		D14-Terphenyl (FS)	2012/02/21		61	%	50 - 130
		D8-Acenaphthylene	2012/02/21		87	%	50 - 130
		Biphenyl	2012/02/21		80	%	50 - 130
		Acenaphthene	2012/02/21		91	%	50 - 130
		Acenaphthylene	2012/02/21		89	%	50 - 130
		Anthracene	2012/02/21		94	%	50 - 130
		Benzo(a)anthracene	2012/02/21		91	%	50 - 130
		Benzo(a)pyrene	2012/02/21		75	%	50 - 130
		Benzo(b/j)fluoranthene	2012/02/21		70	%	50 - 130
		Benzo(g,h,i)perylene	2012/02/21		74	%	50 - 130
		Benzo(k)fluoranthene	2012/02/21		74	%	50 - 130
		Chrysene	2012/02/21		86	%	50 - 130
		Dibenz(a,h)anthracene	2012/02/21		80	%	50 - 130
		Fluoranthene	2012/02/21		95	%	50 - 130
		Fluorene	2012/02/21		91	%	50 - 130
		Indeno(1,2,3-cd)pyrene	2012/02/21		76	%	50 - 130
		1-Methylnaphthalene	2012/02/21		72	%	50 - 130
		2-Methylnaphthalene	2012/02/21		72	%	50 - 130
		Naphthalene	2012/02/21		79	%	50 - 130
		Phenanthrene	2012/02/21		92	%	50 - 130
		Pyrene	2012/02/21		97	%	50 - 130
	Spiked Blank	D10-Anthracene	2012/02/21		102	%	50 - 130
		D14-Terphenyl (FS)	2012/02/21		98	%	50 - 130
		D8-Acenaphthylene	2012/02/21		91	%	50 - 130
		Biphenyl	2012/02/21		93	%	50 - 130
		Acenaphthene	2012/02/21		99	%	50 - 130
		Acenaphthylene	2012/02/21		93	%	50 - 130
		Anthracene	2012/02/21		98	%	50 - 130
		Benzo(a)anthracene	2012/02/21		97	%	50 - 130
		Benzo(a)pyrene	2012/02/21		91	%	50 - 130
		Benzo(b/j)fluoranthene	2012/02/21		83	%	50 - 130
		Benzo(g,h,i)perylene	2012/02/21		87	%	50 - 130
		Benzo(k)fluoranthene	2012/02/21		87	%	50 - 130
		Chrysene	2012/02/21		81	%	50 - 130
		Dibenz(a,h)anthracene	2012/02/21		97	%	50 - 130
		Fluoranthene	2012/02/21		105	%	50 - 130
		Fluorene	2012/02/21		96	%	50 - 130
		Indeno(1,2,3-cd)pyrene	2012/02/21		90	%	50 - 130
		1-Methylnaphthalene	2012/02/21		87	%	50 - 130
		2-Methylnaphthalene	2012/02/21		89	%	50 - 130
		Naphthalene	2012/02/21		94	%	50 - 130
		Phenanthrene	2012/02/21		101	%	50 - 130
		Pyrene	2012/02/21		108	%	50 - 130
	Method Blank	D10-Anthracene	2012/02/21		97	%	50 - 130
		D14-Terphenyl (FS)	2012/02/21		101	%	50 - 130
		D8-Acenaphthylene	2012/02/21		87	%	50 - 130

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2768173 YZ	Method Blank	Biphenyl	2012/02/21	ND, RDL=0.050		ug/L	
		Acenaphthene	2012/02/21	ND, RDL=0.050		ug/L	
		Acenaphthylene	2012/02/21	ND, RDL=0.050		ug/L	
		Anthracene	2012/02/21	ND, RDL=0.050		ug/L	
		Benzo(a)anthracene	2012/02/21	ND, RDL=0.050		ug/L	
		Benzo(a)pyrene	2012/02/21	ND, RDL=0.010		ug/L	
		Benzo(b/j)fluoranthene	2012/02/21	ND, RDL=0.050		ug/L	
		Benzo(g,h,i)perylene	2012/02/21	ND, RDL=0.050		ug/L	
		Benzo(k)fluoranthene	2012/02/21	ND, RDL=0.050		ug/L	
		Chrysene	2012/02/21	ND, RDL=0.050		ug/L	
		Dibenz(a,h)anthracene	2012/02/21	ND, RDL=0.050		ug/L	
		Fluoranthene	2012/02/21	ND, RDL=0.050		ug/L	
		Fluorene	2012/02/21	ND, RDL=0.050		ug/L	
		Indeno(1,2,3-cd)pyrene	2012/02/21	ND, RDL=0.050		ug/L	
		1-Methylnaphthalene	2012/02/21	ND, RDL=0.050		ug/L	
		2-Methylnaphthalene	2012/02/21	ND, RDL=0.050		ug/L	
		Naphthalene	2012/02/21	ND, RDL=0.050		ug/L	
		Phenanthrene	2012/02/21	ND, RDL=0.030		ug/L	
		Pyrene	2012/02/21	ND, RDL=0.050		ug/L	
	RPD	Acenaphthene	2012/02/21	NC		%	30
		Acenaphthylene	2012/02/21	NC		%	30
		Anthracene	2012/02/21	NC		%	30
		Benzo(a)anthracene	2012/02/21	NC		%	30
		Benzo(a)pyrene	2012/02/21	NC		%	30
		Benzo(b/j)fluoranthene	2012/02/21	NC		%	30
		Benzo(g,h,i)perylene	2012/02/21	NC		%	30
		Benzo(k)fluoranthene	2012/02/21	NC		%	30
		Chrysene	2012/02/21	NC		%	30
		Dibenz(a,h)anthracene	2012/02/21	NC		%	30
		Fluoranthene	2012/02/21	NC		%	30
		Fluorene	2012/02/21	NC		%	30
		Indeno(1,2,3-cd)pyrene	2012/02/21	NC		%	30
		1-Methylnaphthalene	2012/02/21	21.4		%	30
		2-Methylnaphthalene	2012/02/21	20.3		%	30
		Naphthalene	2012/02/21	28.0		%	30
		Phenanthrene	2012/02/21	NC		%	30
		Pyrene	2012/02/21	NC		%	30
2768472 BAV	Matrix Spike [MN9623-01]	Nitrite (N)	2012/02/23		96	%	80 - 120
		Nitrate (N)	2012/02/23		87	%	80 - 120
	Spiked Blank	Nitrite (N)	2012/02/23		93	%	85 - 115
		Nitrate (N)	2012/02/23		94	%	85 - 115
	Method Blank	Nitrite (N)	2012/02/23	ND, RDL=0.01		mg/L	
		Nitrate (N)	2012/02/23	ND, RDL=0.1		mg/L	
	RPD [MN9623-01]	Nitrite (N)	2012/02/23	NC		%	25
		Nitrate (N)	2012/02/23	2.9		%	25
2768497 ADB	Matrix Spike	Total Ammonia-N	2012/02/22		99	%	80 - 120
	Spiked Blank	Total Ammonia-N	2012/02/22		102	%	85 - 115
	Method Blank	Total Ammonia-N	2012/02/22	ND, RDL=0.05		mg/L	
	RPD	Total Ammonia-N	2012/02/22	NC		%	20
2768808 JKA	Matrix Spike	o-Terphenyl	2012/02/21		107	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/02/21		98	%	50 - 130
		F3 (C16-C34 Hydrocarbons)	2012/02/21		98	%	50 - 130
		F4 (C34-C50 Hydrocarbons)	2012/02/21		91	%	50 - 130
	Spiked Blank	o-Terphenyl	2012/02/21		107	%	50 - 130

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2768808 JKA	Spiked Blank	F2 (C10-C16 Hydrocarbons)	2012/02/21		83	%	70 - 130
		F3 (C16-C34 Hydrocarbons)	2012/02/21		96	%	70 - 130
		F4 (C34-C50 Hydrocarbons)	2012/02/21		87	%	70 - 130
	Method Blank	o-Terphenyl	2012/02/21		105	%	50 - 130
		F2 (C10-C16 Hydrocarbons)	2012/02/21	ND, RDL=100		ug/L	
		F3 (C16-C34 Hydrocarbons)	2012/02/21	ND, RDL=100		ug/L	
		F4 (C34-C50 Hydrocarbons)	2012/02/21	ND, RDL=100		ug/L	
	RPD [MN9623-04]	F2 (C10-C16 Hydrocarbons)	2012/02/21	NC		%	30
		F3 (C16-C34 Hydrocarbons)	2012/02/21	NC		%	30
		F4 (C34-C50 Hydrocarbons)	2012/02/21	NC		%	30
2770026 SHK	Matrix Spike	1,4-Difluorobenzene	2012/02/23		100	%	70 - 130
		4-Bromofluorobenzene	2012/02/23		102	%	70 - 130
		D10-Ethylbenzene	2012/02/23		110	%	70 - 130
		D4-1,2-Dichloroethane	2012/02/23		103	%	70 - 130
		F1 (C6-C10)	2012/02/23		81	%	70 - 130
	Spiked Blank	1,4-Difluorobenzene	2012/02/22		101	%	70 - 130
		4-Bromofluorobenzene	2012/02/22		100	%	70 - 130
		D10-Ethylbenzene	2012/02/22		106	%	70 - 130
		D4-1,2-Dichloroethane	2012/02/22		103	%	70 - 130
		F1 (C6-C10)	2012/02/22		108	%	70 - 130
	Method Blank	1,4-Difluorobenzene	2012/02/22		98	%	70 - 130
		4-Bromofluorobenzene	2012/02/22		99	%	70 - 130
		D10-Ethylbenzene	2012/02/22		103	%	70 - 130
		D4-1,2-Dichloroethane	2012/02/22		103	%	70 - 130
		F1 (C6-C10)	2012/02/22	ND, RDL=25		ug/L	
		F1 (C6-C10) - BTEX	2012/02/22	ND, RDL=25		ug/L	
	RPD	F1 (C6-C10)	2012/02/22	NC		%	30
		F1 (C6-C10) - BTEX	2012/02/22	NC		%	30
2770291 C_N	Matrix Spike [MN9623-03]	Total Kjeldahl Nitrogen (TKN)	2012/02/23		96	%	80 - 120
	QC Standard	Total Kjeldahl Nitrogen (TKN)	2012/02/23		99	%	85 - 115
	Spiked Blank	Total Kjeldahl Nitrogen (TKN)	2012/02/23		94	%	85 - 115
	Method Blank	Total Kjeldahl Nitrogen (TKN)	2012/02/23	ND, RDL=0.1		mg/L	
	RPD [MN9623-03]	Total Kjeldahl Nitrogen (TKN)	2012/02/23	3.1		%	20
2770314 ADA	Matrix Spike	Total Aluminum (Al)	2012/02/22		103	%	80 - 120
		Total Antimony (Sb)	2012/02/22		104	%	80 - 120
		Total Arsenic (As)	2012/02/22		103	%	80 - 120
		Total Barium (Ba)	2012/02/22		102	%	80 - 120
		Total Beryllium (Be)	2012/02/22		102	%	80 - 120
		Total Bismuth (Bi)	2012/02/22		103	%	80 - 120
		Total Boron (B)	2012/02/22		99	%	80 - 120
		Total Cadmium (Cd)	2012/02/22		102	%	80 - 120
		Total Calcium (Ca)	2012/02/22		NC	%	80 - 120
		Total Chromium (Cr)	2012/02/22		102	%	80 - 120
		Total Cobalt (Co)	2012/02/22		101	%	80 - 120
		Total Copper (Cu)	2012/02/22		NC	%	80 - 120
		Total Iron (Fe)	2012/02/22		106	%	80 - 120
		Total Lead (Pb)	2012/02/22		102	%	80 - 120
		Total Lithium (Li)	2012/02/22		103	%	80 - 120
		Total Magnesium (Mg)	2012/02/22		NC	%	80 - 120
		Total Manganese (Mn)	2012/02/22		101	%	80 - 120
		Total Molybdenum (Mo)	2012/02/22		107	%	80 - 120
		Total Nickel (Ni)	2012/02/22		101	%	80 - 120
		Total Potassium (K)	2012/02/22		104	%	80 - 120
		Total Silicon (Si)	2012/02/22		101	%	80 - 120

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2770314 ADA	Matrix Spike	Total Selenium (Se)	2012/02/22		101	%	80 - 120
		Total Silver (Ag)	2012/02/22		101	%	80 - 120
		Total Sodium (Na)	2012/02/22		101	%	80 - 120
		Total Strontium (Sr)	2012/02/22		NC	%	80 - 120
		Total Tellurium (Te)	2012/02/22		101	%	80 - 120
		Total Thallium (Tl)	2012/02/22		102	%	80 - 120
		Total Tin (Sn)	2012/02/22		104	%	80 - 120
		Total Titanium (Ti)	2012/02/22		110	%	80 - 120
		Total Tungsten (W)	2012/02/22		108	%	80 - 120
		Total Uranium (U)	2012/02/22		104	%	80 - 120
		Total Vanadium (V)	2012/02/22		105	%	80 - 120
		Total Zinc (Zn)	2012/02/22		102	%	80 - 120
		Total Zirconium (Zr)	2012/02/22		108	%	80 - 120
	Spiked Blank	Total Aluminum (Al)	2012/02/22		105	%	80 - 120
		Total Antimony (Sb)	2012/02/22		107	%	80 - 120
		Total Arsenic (As)	2012/02/22		103	%	80 - 120
		Total Barium (Ba)	2012/02/22		105	%	80 - 120
		Total Beryllium (Be)	2012/02/22		105	%	80 - 120
		Total Bismuth (Bi)	2012/02/22		104	%	80 - 120
		Total Boron (B)	2012/02/22		101	%	80 - 120
		Total Cadmium (Cd)	2012/02/22		105	%	80 - 120
		Total Calcium (Ca)	2012/02/22		103	%	80 - 120
		Total Chromium (Cr)	2012/02/22		104	%	80 - 120
		Total Cobalt (Co)	2012/02/22		103	%	80 - 120
		Total Copper (Cu)	2012/02/22		104	%	80 - 120
		Total Iron (Fe)	2012/02/22		108	%	80 - 120
		Total Lead (Pb)	2012/02/22		104	%	80 - 120
		Total Lithium (Li)	2012/02/22		104	%	80 - 120
		Total Magnesium (Mg)	2012/02/22		106	%	80 - 120
		Total Manganese (Mn)	2012/02/22		104	%	80 - 120
		Total Molybdenum (Mo)	2012/02/22		105	%	80 - 120
		Total Nickel (Ni)	2012/02/22		103	%	80 - 120
		Total Potassium (K)	2012/02/22		103	%	80 - 120
		Total Silicon (Si)	2012/02/22		104	%	80 - 120
		Total Selenium (Se)	2012/02/22		103	%	80 - 120
		Total Silver (Ag)	2012/02/22		102	%	80 - 120
		Total Sodium (Na)	2012/02/22		103	%	80 - 120
		Total Strontium (Sr)	2012/02/22		103	%	80 - 120
		Total Tellurium (Te)	2012/02/22		105	%	80 - 120
		Total Thallium (Tl)	2012/02/22		101	%	80 - 120
		Total Tin (Sn)	2012/02/22		107	%	80 - 120
		Total Titanium (Ti)	2012/02/22		108	%	80 - 120
		Total Tungsten (W)	2012/02/22		107	%	80 - 120
		Total Uranium (U)	2012/02/22		105	%	80 - 120
		Total Vanadium (V)	2012/02/22		105	%	80 - 120
		Total Zinc (Zn)	2012/02/22		105	%	80 - 120
		Total Zirconium (Zr)	2012/02/22		108	%	80 - 120
	Method Blank	Total Aluminum (Al)	2012/02/22	0.0085, RDL=0.0050		mg/L	
		Total Antimony (Sb)	2012/02/22	ND, RDL=0.00050		mg/L	
		Total Arsenic (As)	2012/02/22	ND, RDL=0.0010		mg/L	
		Total Barium (Ba)	2012/02/22	ND, RDL=0.0020		mg/L	
		Total Beryllium (Be)	2012/02/22	ND, RDL=0.00050		mg/L	
		Total Bismuth (Bi)	2012/02/22	ND, RDL=0.0010		mg/L	
		Total Boron (B)	2012/02/22	ND, RDL=0.010		mg/L	
		Total Cadmium (Cd)	2012/02/22	ND, RDL=0.00010		mg/L	

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2770314	ADA	Method Blank	Total Calcium (Ca)	2012/02/22	ND, RDL=0.20		mg/L	
			Total Chromium (Cr)	2012/02/22	ND, RDL=0.0050		mg/L	
			Total Cobalt (Co)	2012/02/22	ND, RDL=0.00050		mg/L	
			Total Copper (Cu)	2012/02/22	ND, RDL=0.0010		mg/L	
			Total Iron (Fe)	2012/02/22	ND, RDL=0.10		mg/L	
			Total Lead (Pb)	2012/02/22	ND, RDL=0.00050		mg/L	
			Total Lithium (Li)	2012/02/22	ND, RDL=0.0050		mg/L	
			Total Magnesium (Mg)	2012/02/22	ND, RDL=0.050		mg/L	
			Total Manganese (Mn)	2012/02/22	ND, RDL=0.0020		mg/L	
			Total Molybdenum (Mo)	2012/02/22	ND, RDL=0.00050		mg/L	
			Total Nickel (Ni)	2012/02/22	ND, RDL=0.0010		mg/L	
			Total Potassium (K)	2012/02/22	ND, RDL=0.20		mg/L	
			Total Silicon (Si)	2012/02/22	ND, RDL=0.050		mg/L	
			Total Selenium (Se)	2012/02/22	ND, RDL=0.0020		mg/L	
			Total Silver (Ag)	2012/02/22	ND, RDL=0.00010		mg/L	
			Total Sodium (Na)	2012/02/22	ND, RDL=0.10		mg/L	
			Total Strontium (Sr)	2012/02/22	ND, RDL=0.0010		mg/L	
			Total Tellurium (Te)	2012/02/22	ND, RDL=0.0010		mg/L	
			Total Thallium (Tl)	2012/02/22	ND, RDL=0.000050		mg/L	
			Total Tin (Sn)	2012/02/22	ND, RDL=0.0010		mg/L	
			Total Titanium (Ti)	2012/02/22	ND, RDL=0.0050		mg/L	
			Total Tungsten (W)	2012/02/22	ND, RDL=0.0010		mg/L	
			Total Uranium (U)	2012/02/22	ND, RDL=0.00010		mg/L	
			Total Vanadium (V)	2012/02/22	ND, RDL=0.00050		mg/L	
			Total Zinc (Zn)	2012/02/22	ND, RDL=0.0050		mg/L	
			Total Zirconium (Zr)	2012/02/22	ND, RDL=0.0010		mg/L	
		RPD	Total Aluminum (Al)	2012/02/22	NC		%	20
			Total Antimony (Sb)	2012/02/22	NC		%	20
			Total Arsenic (As)	2012/02/22	NC		%	20
			Total Barium (Ba)	2012/02/22	4.4		%	20
			Total Beryllium (Be)	2012/02/22	NC		%	20
			Total Bismuth (Bi)	2012/02/22	NC		%	20
			Total Boron (B)	2012/02/22	0.2		%	20
			Total Cadmium (Cd)	2012/02/22	NC		%	20
			Total Calcium (Ca)	2012/02/22	5.1		%	20
			Total Chromium (Cr)	2012/02/22	NC		%	20
			Total Cobalt (Co)	2012/02/22	NC		%	20
			Total Copper (Cu)	2012/02/22	4.1		%	20
			Total Iron (Fe)	2012/02/22	NC		%	20
			Total Lead (Pb)	2012/02/22	NC		%	20
			Total Lithium (Li)	2012/02/22	NC		%	20
			Total Magnesium (Mg)	2012/02/22	3.4		%	20
			Total Manganese (Mn)	2012/02/22	NC		%	20
			Total Molybdenum (Mo)	2012/02/22	NC		%	20
			Total Nickel (Ni)	2012/02/22	5.3		%	20
			Total Potassium (K)	2012/02/22	3.4		%	20
			Total Silicon (Si)	2012/02/22	3.4		%	20
			Total Selenium (Se)	2012/02/22	NC		%	20
			Total Silver (Ag)	2012/02/22	NC		%	20
			Total Sodium (Na)	2012/02/22	4.2		%	20
			Total Strontium (Sr)	2012/02/22	1.6		%	20
			Total Tellurium (Te)	2012/02/22	NC		%	20
			Total Thallium (Tl)	2012/02/22	NC		%	20
			Total Tin (Sn)	2012/02/22	NC		%	20
			Total Titanium (Ti)	2012/02/22	NC		%	20

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2770314	ADA	RPD	Total Tungsten (W)	2012/02/22	NC		%	20
			Total Uranium (U)	2012/02/22	5.4		%	20
			Total Vanadium (V)	2012/02/22	NC		%	20
			Total Zinc (Zn)	2012/02/22	NC		%	20
			Total Zirconium (Zr)	2012/02/22	NC		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
QC Standard: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Spiked Blank: A blank matrix to which a known amount of the analyte has been added. Used to evaluate analyte recovery.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was not sufficiently significant to permit a reliable recovery calculation.
NC (RPD): The RPD was not calculated. The level of analyte detected in the parent sample and its duplicate was not sufficiently significant to permit a reliable calculation.

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The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

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Evaluation of Three Hydraulic Barriers in Southern Ontario

Prepared for: James Dick Construction Ltd.
February, 2001
File: 9603

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Our File: 9603

March 8, 2001

James Dick Construction Ltd.
Box 470
Bolton, Ontario
L7E 5T4

Attention: Mr. Gregory Sweetnam
Property Manager

Dear Mr. Sweetnam,

Re: Barrier Performance Report

We are pleased to present our evaluation of groundwater barriers installed at two sand and gravel pits in Southern Ontario. The barriers are effective in protecting adjacent surface water features.

Sincerely,

Stan Denhoed, M.Sc., P.Eng.

Introduction

Hydraulic barriers are becoming common features on site plans for aggregate extraction operations. Barriers are features designed to protect groundwater sensitive areas such as wetlands or fisheries. A hydraulic barrier is typically constructed by removing natural geologic material (e.g. sand and gravel) that has a relatively high hydraulic conductivity, and replacing it with geologic materials (e.g. silt or clay) that has a relatively low hydraulic conductivity.

This barrier performance report is an evaluation of the effectiveness of three such hydraulic barriers in southern Ontario. The purpose of the barriers installed at Heritage Lake Pit is to protect Mill Creek and MacCrimmon Creek from hydrogeological impact due to pit operations (Figure 1). The barrier installed at Caledon Sand and Gravel Pit is intended to maintain pre-extraction groundwater levels around Warnock Lake (Figure 2).

Site Descriptions

Heritage Lake Pit

Located in Puslinch Township the site occupies approximately 33 hectare. The site is licensed for a maximum extraction of 500,000 tonnes/year. When removed from below the water table, this volume of material translates into an equivalent water displacement of 6 L/s (98 gal/min). The predominant overburden material is an outwash gravel deposit with a hydraulic conductivity of approximately 10^{-3} m/s. Beneath the sand and gravel deposits lies Wentworth Till, a sandy, stony, silt till. The Wentworth Till overlies the porous, fine-grained dolostone bedrock of the Guelph Formation. Although the till is an effective aquitard, it is not continuous over the entire site. The barriers are necessary during active extraction to minimize impacts to Mill Creek and MacCrimmon Creek the located at distances of 120 m and 650 m, respectively. Post extraction, the influence of the barriers on groundwater flow will be evaluated and the barrier configuration altered if necessary.

Caledon Sand and Gravel Pit

Caledon Sand and Gravel extracts material from the Caledon Meltwater Channel and from the Paris Moraine. Sand and gravel are the dominant materials ranging in hydraulic conductivities from 10^{-2} to 10^{-4} m/s. Relatively continuous lenses of till underlie the sand and gravel. Regionally, the thickness of the overburden ranges from 20 to 75 m overtop of dolostone bedrock of the Manitoulin Formation. The barrier is required post-extraction to address the potential of causing additional water loss from Warnock Lake.

Barrier Construction

Heritage Lake Pit

Construction of the barrier walls was carried out in the period of 24 August to 26 September 1998. The barriers are located between the extractive operations and both Mill Creek and MacCrimmon Creek. The barriers, constructed of a mixture of bentonite, on-site granular material and silt pond fines, were installed to a depth ranging from 2 m to 14 m, concluding 0.5 m into a low permeability soil stratum. During construction, samples of the barrier were taken and testing indicated a hydraulic conductivity of 1.8×10^{-8} cm/s. The barrier locations are shown in Figure 1. The East-West barrier is approximately 750 m long and the North-South barrier is approximately 400 m long.

Caledon Sand and Gravel

Construction of the barrier wall commenced in the Spring of and was 95% completed by October 2000. The barrier is situated between pit operations and Warnock Lake. The core of the barrier is constructed with silt and granular material from on site washing operations. The base of the barrier is 11 m wide, and terminates in natural till. The hydraulic conductivity of the barrier is estimated to be 10^{-8} cm/s. The barrier location is shown on Figure 2. The barrier is approximately 750 m long. A cross-section of the barrier is illustrated in Figure 3.

Barrier Performance Evaluation

The performance of the barrier walls is based on their ability to maintain a greater hydraulic head gradient across the barrier compared to pre-barrier conditions.

Heritage Lake Pit

The hydraulic head distribution across the North-South Barrier on April 24, July 31 and October 11, 2000, is shown in Figure 4. The hydraulic gradient across the barrier is greater than occurred in the natural sand and gravel and water level fluctuations on the MacCrimmon Creek side of the barrier are small relative to the extraction side. A comparison of seasonal water levels before and after barrier installation suggests that groundwater levels continue to fluctuate within pre-barrier limits on the MacCrimmon Creek side of the barrier. The hydraulic head values for the East-West Barrier on September 29 and October 11, 2000, are shown in Figure 5. Water levels on the Mill Creek side of the barrier appear unaffected, despite a lowering of the water levels in the extraction area.

Caledon Sand and Gravel

The hydraulic head distribution across the barrier on May 19, June 28, and November 29, 2000 is illustrated in Figure 6. The dashed lines in this figure show the hydraulic gradient before the barrier was installed, on May 23, 1996 and August 20, 1997. Before the barrier was installed a small hydraulic gradient was present from 98-2 to 94-2. The available data shows that the seasonal changes in Warnock Lake water levels occur, and remain comparable to historical levels.

Conclusions

The hydraulic barriers installed at Heritage Lake Pit and Caledon Sand and Gravel are effective in maintaining hydraulic separation between pit operations and the groundwater system outside of the barriers. It is found that properly designed and constructed hydraulic barriers are providing adequate protection to the streams and wetlands at the Heritage Lake Pit and the Caledon Sand and Gravel sites.

Stan Denhoed, P.Eng, M.Sc.
Principal

Dru Heagle, M.Sc.
Hydrogeologist

References

Alston Associates Inc., 1998. Geotechnical Design and Construction Inspection, Barrier Walls Proposed Heritage Lake Development, Puslinch Township, Ontario. Reference No. 98-076.

Blackport Hydrogeology Inc., 2000. Threshold Discussion, Heritage Lake Pit, Puslinch Township, Ontario. Reference No. 001031.

England Naylor Engineering Ltd., 1994. Hydrological Investigation Proposed Heritage Lake Residential Subdivision Part of Lots 23, 24, 25, Concession 2, Puslinch Township. Reference No. 0402G1.R01.

Harden Environmental Services Ltd., 2000. Caledon Sand and Gravel 1998/1999 Monitoring Report. File 9401.

MacNaughton, Hermsen, Britton, Clarkson Planning Ltd., 1996. Caledon Sand and Gravel Site Plan, 1996.

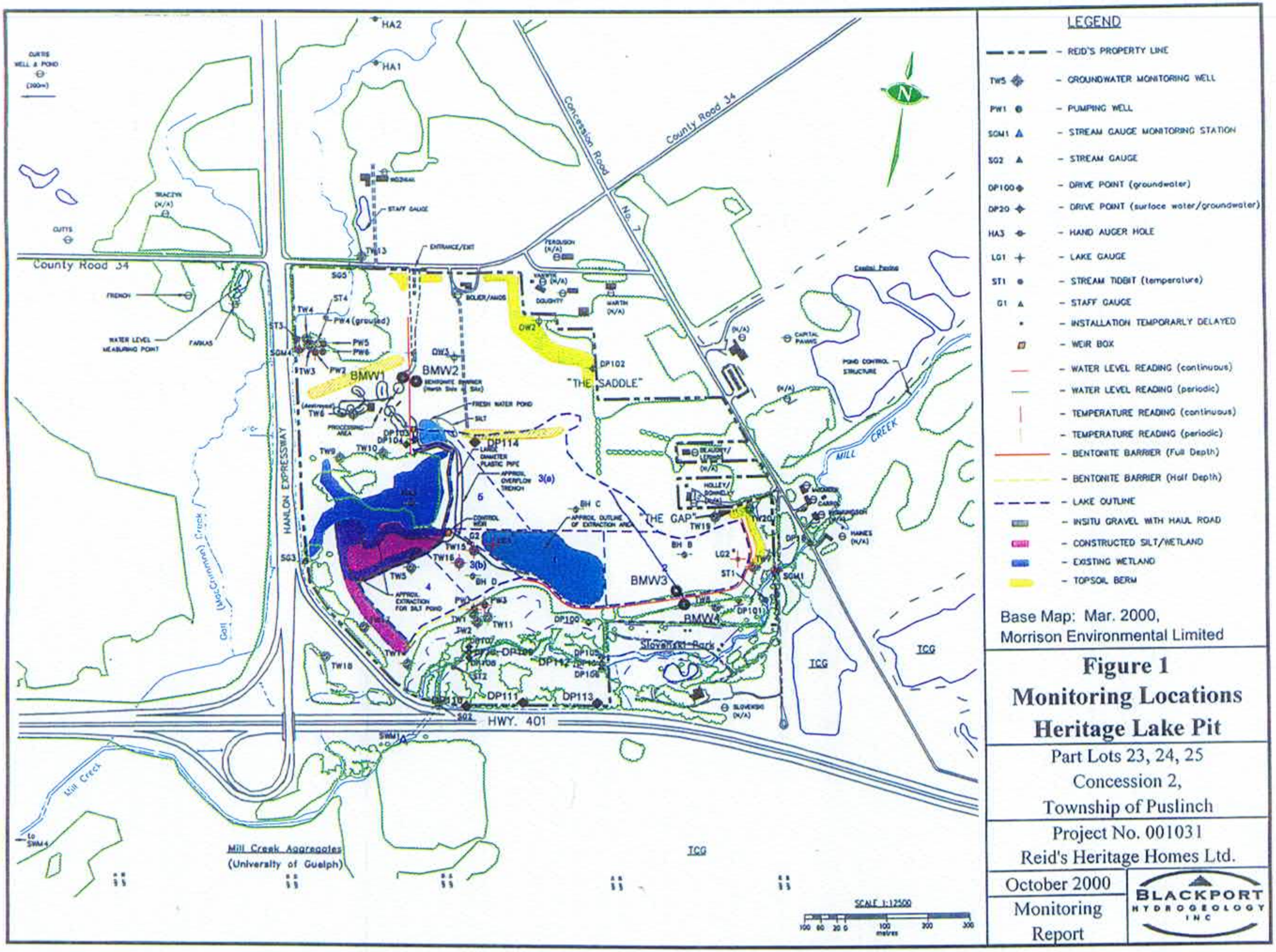


Figure 1. Barrier and Monitoring Well Locations, Heritage Lake Pit. Source: Blackport Hydrogeology Inc., 2000.

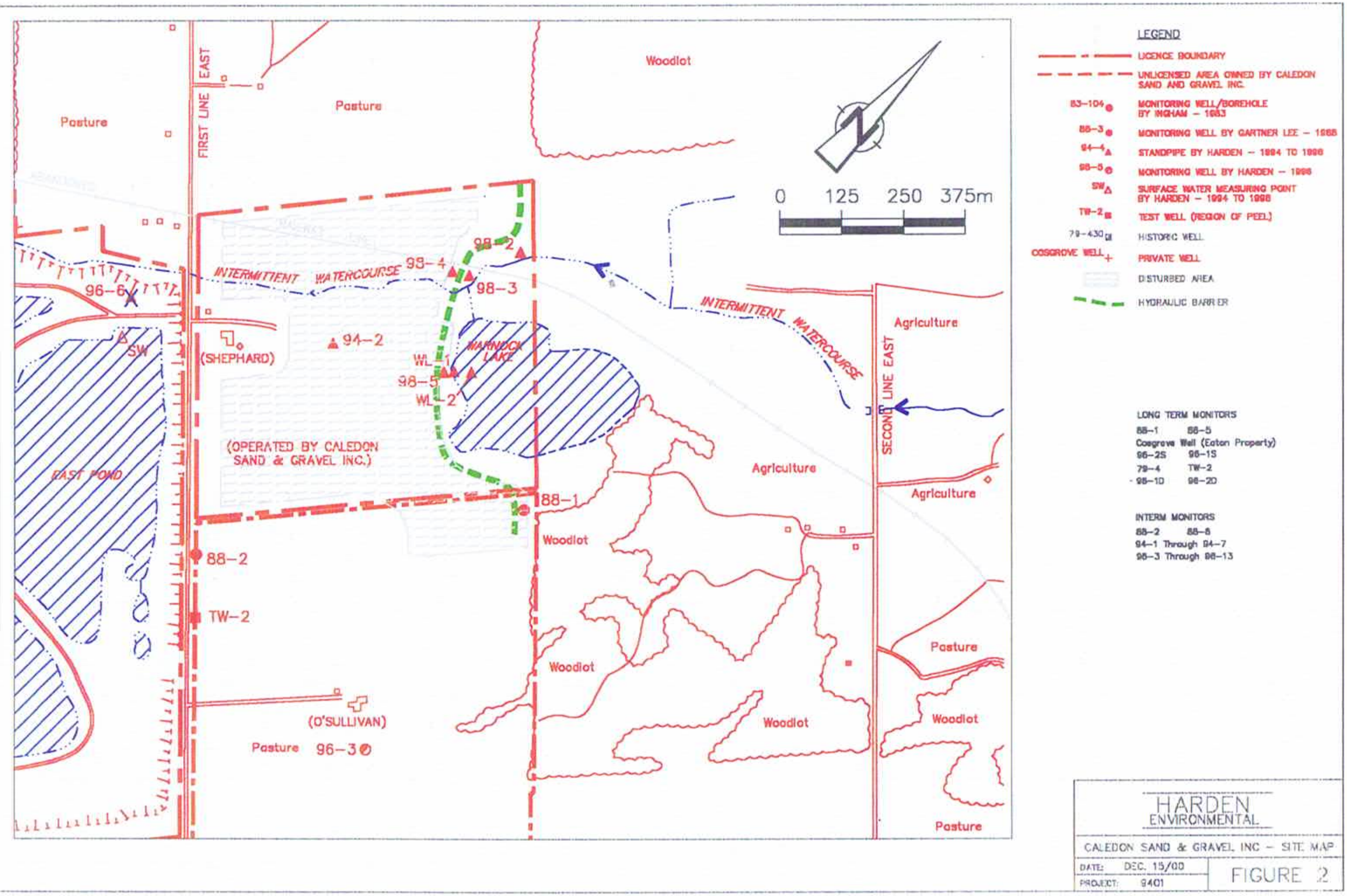
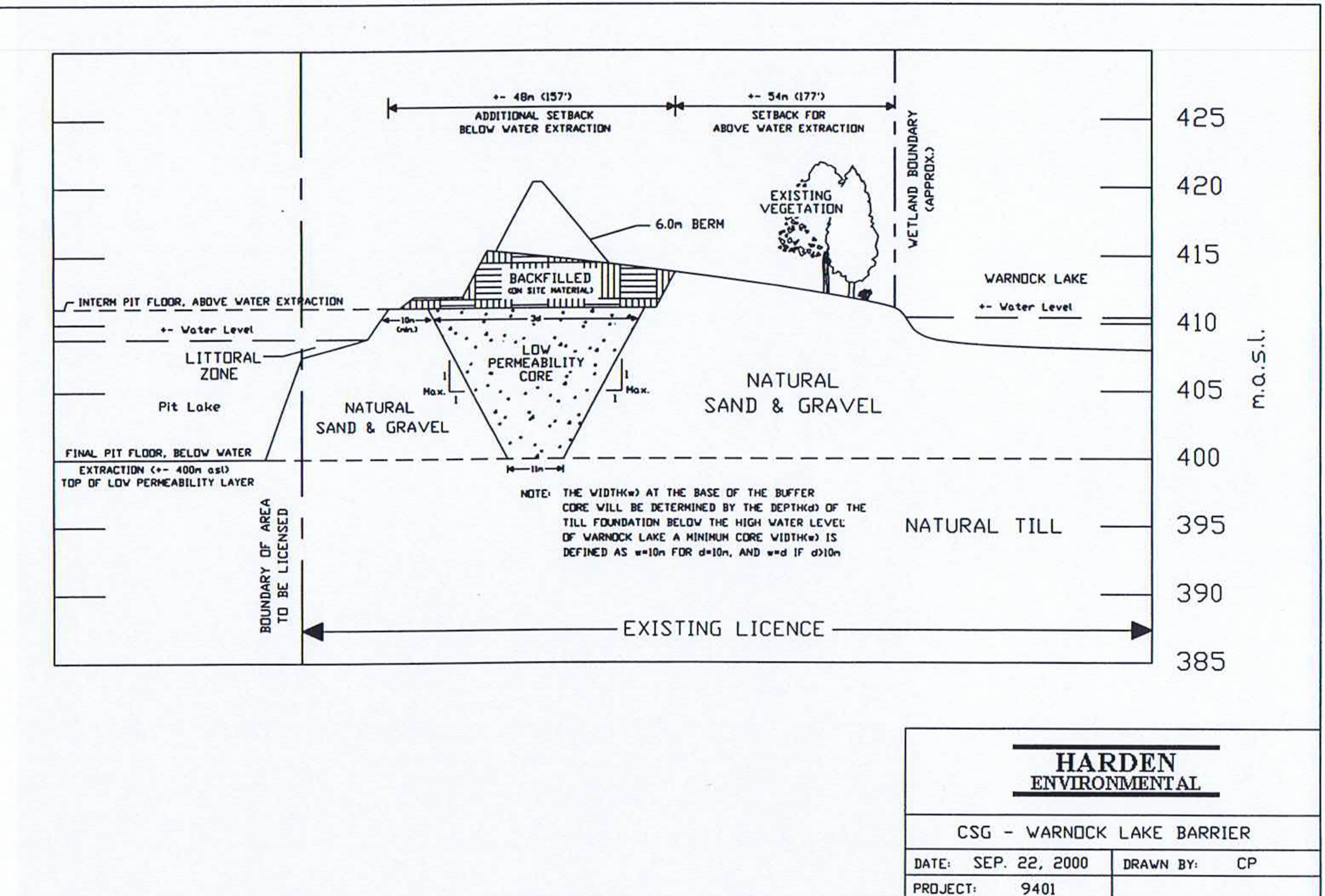


Figure 2. Barrier and Monitroing Well Locations, Caledon Sand & Gravel



gure 3. Warnock Lake Hydraulic Barrier Cross-Section

Source: MacNaughton, Hermsen, Britton, Clarkson Planning Ltd., 1996.

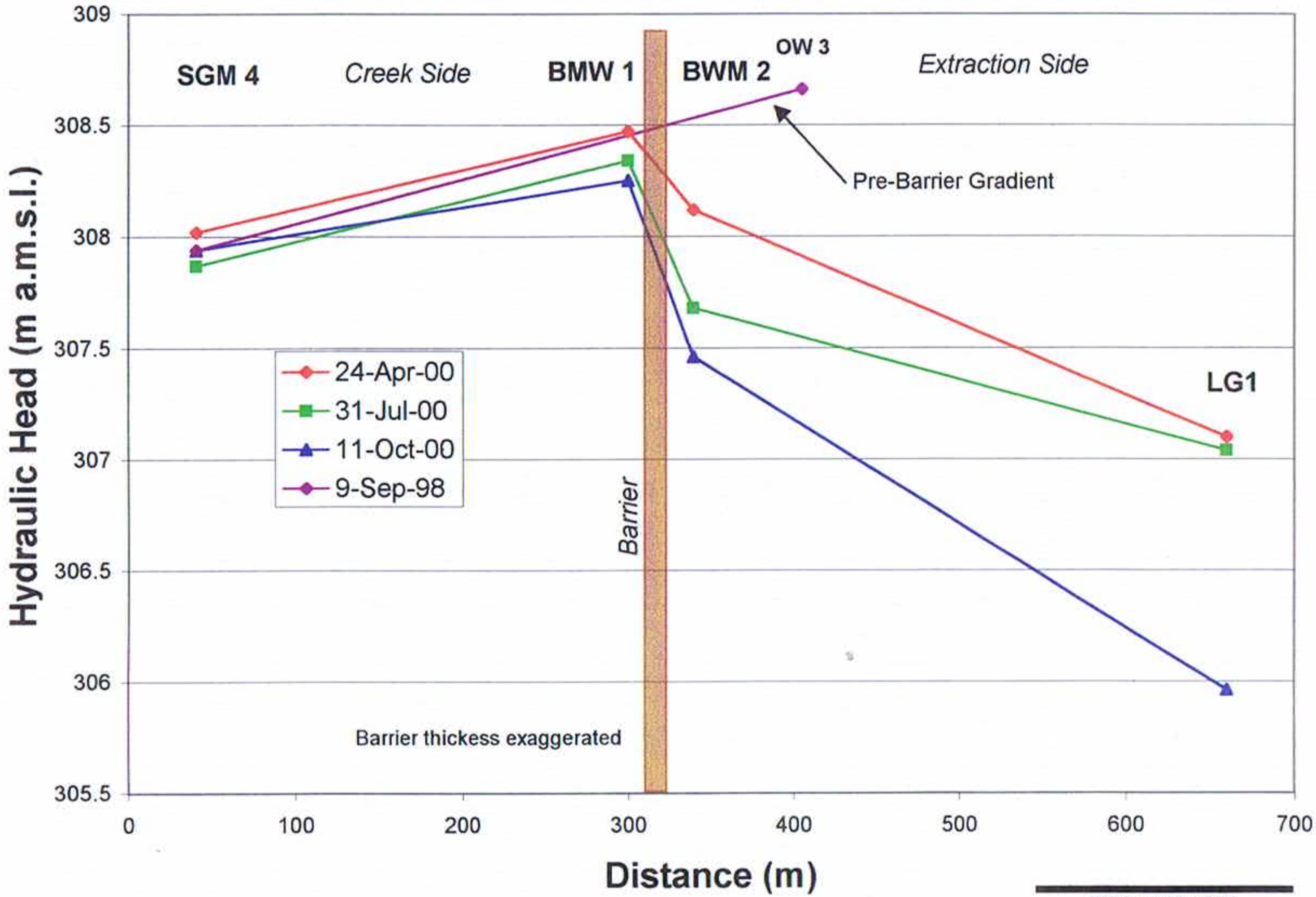


Figure 4. Hydraulic Head Values Across North-South Barrier Heritage Lake Pit

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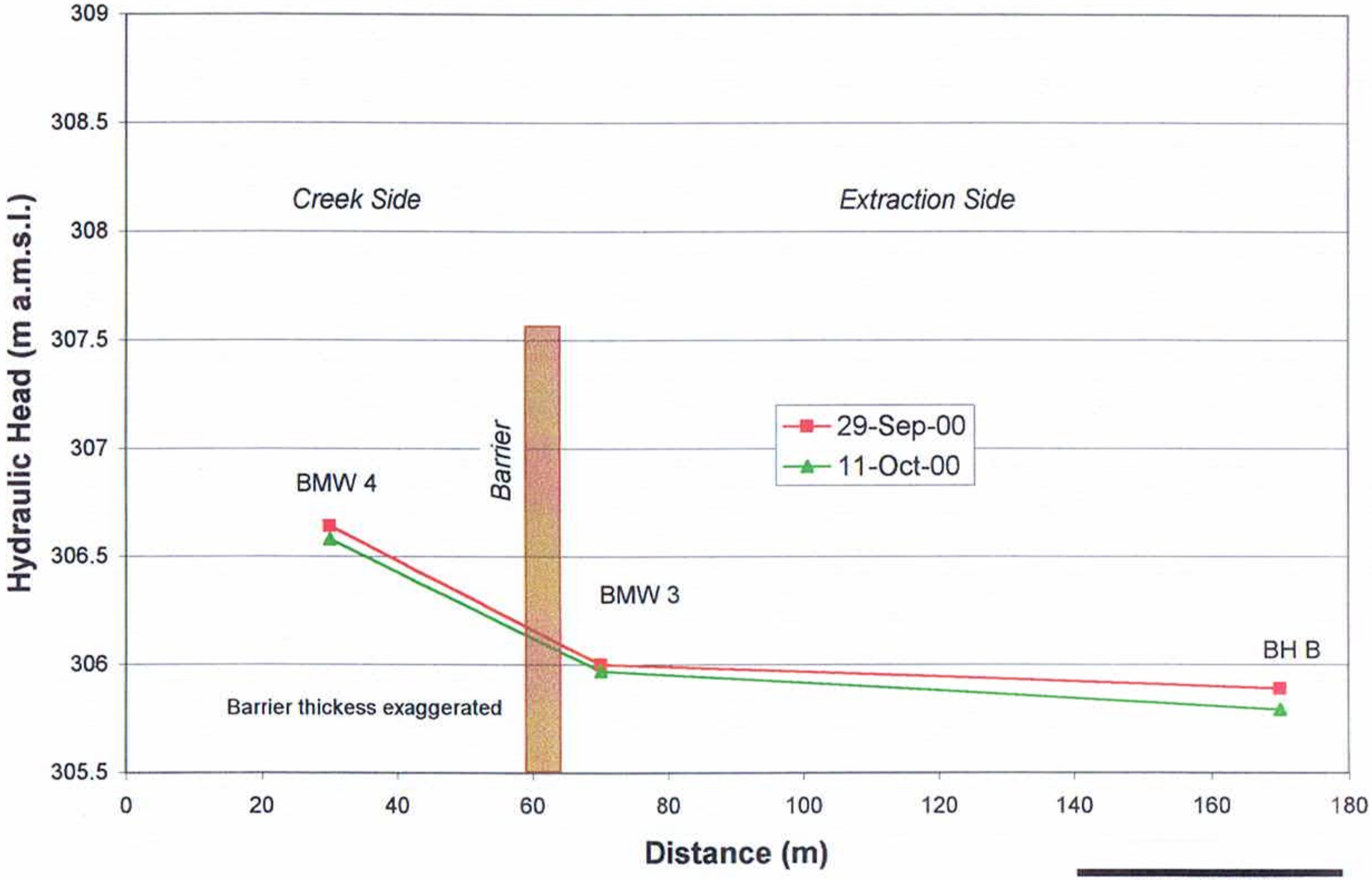

Figure 5. Hydraulic Head Values Across East-West Barrier Heritage Lake Pit

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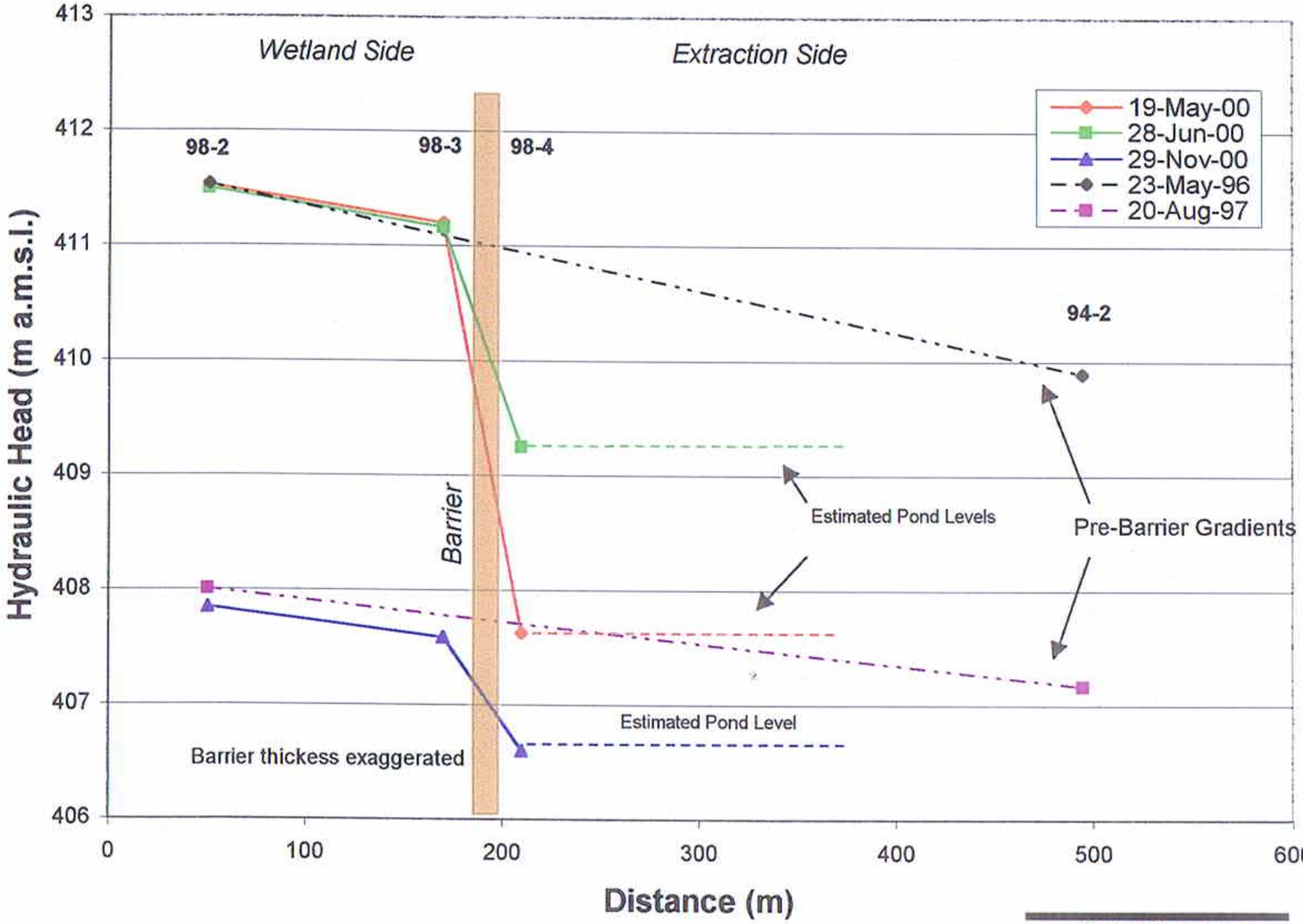

Figure 6. Hydraulic Gradients Across Warnock Lake Barrier Caledon Sand and Gravel

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