Functional Servicing and Preliminary Stormwater Management Report

1898 Whistle Bare Road
Township of North Dumfries

GMBP File: 416130

December 2019

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330 TRILLIUM DRIVE, UNIT D , KITCHENER ON N2E 3J2 P: 519-748-1440
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TABLE OF CONTENTS

APPENDICES

FUNCTIONAL SERVICING AND STORMWATER MANAGEMENT REPORT

1898 WHISLTE BARE ROAD

TOWNSHIP OF NORTH DUMFRIES

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1. INTRODUCTION

In support of the Zone Change and Site Plan Applications for the proposed development at 1898 Whistle Bare Road in the Township of North Dumfries, this Functional Servicing and Stormwater Management Report has been prepared to document the site servicing and stormwater management design requirements for the proposed development.

The Owner is required to have a Professional Engineer design a stormwater management system and have said Engineer supervise and certify that the stormwater management system was installed in accordance with the approvals given under Section 41 of the Planning Act.

The site layout was prepared by GSP Group Inc., dated April 2, 2019. A topographic survey was completed by ACI Survey Consultants Inc., dated November 3, 2017.

2. SITE INFORMATION

The 38.6-hectare site is located within the Township of North Dumfries. The site is bound by existing wetland to the north, Whistle Bare Golf Course to the east, Whistle Bare Road to the south and existing agricultural area to the west.

The intent of the Owner at this time is to develop 383 seasonal camping sites, recreational facilities, water wells and sewage treatment facility, along with the associated driving, parking and landscaped areas. Access to the site will via Whistle Bare Road.

2.1 Existing Site Conditions

2.1.1 Natural Features

A geotechnical investigation or the site was completed as part of the Sewage Systems Assessment Report (LVM, October 2014). Soils on site were found to range from peat to sand and sand and gravel deposits, however areas of silt, and silt till were also identified on site. Groundwater was found to range from 0.2m below ground surface to 1.3 m below ground surface in the north (rear) portion of the site, and 2.5 m below ground surface in the area of the existing water supply well. A copy of the Sewage Systems Assessment Report (LVM, October 2014) has been included in Appendix A. A Hydrogeological Assessment (Chung and Vander Doelen Engineering, dated November 2019) has been recently completed, which provides further details related to the soil and groundwater conditions on the site.

The site is regulated by the Grand River Conservation Authority due to the presence of a cold-water tributary of Blair Creek and associated flood plain. The Regulatory floodplain elevation across the south of the site is 298.0m.

The Environmentally Sensitive Policy Area (ESPA) limit has been identified by Natural Resource Solutions Inc. and has been illustrated on the preliminary drawings.

2.1.2 Topographic Conditions

The site slopes in a south to north direction, with a portion of the site sloping towards the south east wetland complex and a second portion of the site sloping towards Blair Creek.

The existing centreline elevation of Whistle Bare Road ranges from 311.55 m to 312.09m across the frontage of the site. Across the site, the existing ground elevation ranges from 312.75m to a low of approximately 297.13m.

2.1.3 Existing Development

Under existing conditions, the site includes two (2) residential dwellings, an 80-site seasonal campground, swimming pond, recreational facility, pavilion and restrooms.

2.2 Proposed Development

2.2.1 Site Grading

The site layout and the internal roads are shown on the Preliminary Site Grading Plan (GM BluePlan Engineering Limited Drawing No. 2). The elevation of the internal road network is controlled by the elevation of the centerline road elevations of Whistle Bare Road, elevations of existing internal roads on site, and existing elevations along the south property line and along the existing natural features.

The site has been graded to match the existing elevations along the property limits and along the boundary of the existing natural features.

2.2.2 Roadways

Existing gravel roadways will be maintained as much as is feasible. All proposed internal gravel roadways will be constructed with minimum and maximum slopes of 0.5% and 6.0% respectively. The internal gravel roadways, with a width of 3.0 to 6.0 metres (measured from edge to edge of gravel), will be constructed with roadside ditches to convey stormwater runoff.

3. SITE SERVICING

3.1 Water Supply

Water supply for the existing campground is provided by the existing private well (Tag #A070624).

The on-site private drilled well (A070624) is estimated at 6.7m below ground surface. There is a second existing private well (A219397) which is not currently used by the development. Based on the Hydrogeological Investigation completed by Chung and Vander Doelen Engineering Inc. (dated November 2019), this well was recently drilled to a depth of 30m and tested at a rate of 363 L/min with excellent recovery.

The following table depicts the available well data:

Table No. 1: Well Record Information

Well Tag No.	Depth	Recommended Pump Rate	Water Level
A070624	6 m	100 L/min	2.7 m below ground surface
A219397	30 m	363 L/min	15 m below ground surface

Based on the available data and the LVM Sewage Systems Assessment Report (2014), the campground started to record water usage rates in 2014. Typical usage from this data ranged from 3,800 L/day (0.044 L/sec) on weekdays to 8,000 L/day (0.093 L/s) on weekends for the existing 80-site layout.

The proposed seasonal campground will increase the number of campsites from 80 to 361. To provide a conservative estimate of the anticipated peak flows, we have included 400 campsites in our preliminary calculations. The anticipated water demand was calculated as follows, based on 250 L/c/day and 2.5 residents per unit:

Average Day Domestic Demand	*250 L/p/d x 2.5 p/site x 400 sites = 2.89 L/sec*
Peak Day Demand	*2.89 L/s x 1.28 = 248 L/min = 3.70 L/sec*
Peak Hour Demand	*2.89 L/sec x 4.5 = 780 L/min = 13.00 L/sec*

*** Peaking Factors utilized are from the Region of Waterloo Water Supply Master Plan (2015)*

The average day demand calculated above (2.89 L/s) is significantly higher than what would be extrapolated from the 2014 water usage data. As part of the detailed design, domestic water usage rates and demands will be further reviewed and refined.

As part of the proposed development, Well #A070624 is planned to be decommissioned and that Well #A219397 will be utilized to provide water supply for the expanded campground. As part of the detailed design, the capacity of Well #A219397 will be confirmed to identify whether the peak hourly demand can be met with one supply well, or if a secondary well will be required. In addition, the detailed design will include a review of the existing pumping equipment and recommendations for upgrades to better service the proposed development.

In general, based on the pumping test performed and the details included in the Hydrogeological Investigation Report (November 2019), the aquifer has capacity to meet the water servicing needs of this development.

Fire demand for permanent structures will be calculated during the detailed design phase of the development site. Permanent structures proposed in the north (rear) portion of the site will be protected using a stand pipe connection to the existing swimming pond. Permanent structures at the south (front) of the site will be protected through fire reservoir storage as required.

A preliminary water servicing plan (GM BluePlan Engineering Limited Drawing No. 4) has been developed to illustrate the approximate servicing alignments. Water service sizes will be confirmed as part of the detailed design.

3.2 Sanitary Servicing

Sanitary servicing for the existing 80-site campground, including existing restrooms, are provided via individual septic systems. The existing residences are also serviced via individual septic systems. Additional information regarding the current septic system servicing is provided in the Sewage Systems Assessment Report (LVM, dated October 23, 2014). A copy of the Sewage Systems Assessment Report (LVM, October 2014) has been included in Appendix A.

Sanitary servicing for the proposed seasonal campground will be provided by gravity collection and pumping via forcemain to a centralized sewage treatment facility. A portion of the proposed development, approximately 20%, is proposed to flow via gravity to the proposed on-site wastewater treatment facility. The remainder of the site is proposed to flow via gravity to three (3) individual sewage pumping stations where it will be pumped via forcemain to the proposed on-site sewage treatment facility. The preliminary sanitary servicing design, including preliminary catchments for each sewage pump station, is shown on GM BluePlan Engineering Limited Drawing No. 3. Sanitary sewer and forcemain sizes will be confirmed as part of the detailed design.

To provide a conservative estimate of the anticipated sanitary flows, we have included 400 campsites in our preliminary design. The anticipated sanitary flows for the site were calculated as follows, based on an estimated flow of 450L/site/d (FlowSpec Engineering 2019), and 2.5 persons/site (1000 person total occupancy), as well as infiltration and inflow based on 0.25 L/s/ha.

Total Average Flow		*450 L/site/day x 400 sites = 2.08 L/sec*
Harmon Peak Factor	$1+\frac{14}{4+\sqrt{P}}$	$1+\left(14/4+\sqrt{1000/1000}\right)$= *3.80*
Total Peak Flow		*2.08 L/sec x 3.80 = 7.90 L/sec*
Total Infiltration and Inflow		*0.25 L/sec/ha x 38.6 ha = 9.65 L/sec*
Peak Wet Weather Flow		7.90 L/sec + *9.65 L/sec = 17.55 L/sec*

The on-site sanitary pump stations will be equipped with storage volume for emergencies and will be equipped with multiple pumps in series to effectively pump flows to the on-site wastewater treatment facility. Further details will be provided during detailed design.

The centralized sewage treatment facility design is being completed by FlowSpec Engineering. The wastewater servicing assessment completed by Flowspec Engineering has been included in Appendix B and outlines the functional servicing of the proposed treatment facility.

3.3 Storm Servicing

Storm servicing for the proposed campground will be provided via roadside ditch drainage, which will be conveyed to the appropriate outlets. See details on the Preliminary Grading Plan (Drawing No. 2).

4. PRELIMINARY STORMWATER MANAGEMENT

4.1 Stormwater Management Criteria

The stormwater management criteria for this site are as follows:

1. Post-development flows are to be attenuated to pre-development levels.
2. Major storm flows are to be routed overland to an appropriate outlet.
3. Quality control is to be provided.

The City of Cambridge design storm parameters were used to provide the mass rainfall data routing. The 2, 5 and 100-year design storm events were analyzed to determine the impact on this site. The 2, 5 and 100-year design storm event results are appended.

The Chicago Rainfall Distribution parameters and the total depth of rainfall used for the 2, 5 and 100-year analysis are as follows:

Table No. 2: City of Cambridge Chicago Rainfall Distribution Parameters

	2-Year	5-Year	100-Year
a =	573.10	1219.80	3015.10
b =	5.00	10.50	21.00
c =	0.761	0.823	0.870
r =	0.400	0.400	0.400
Duration (minutes) =	180	180	180
Rainfall Depth (mm) =	32.356	48.647	89.669

The hydrologic model MIDUSS was used to create runoff hydrographs and to route the flows through the storage structures. The Horton infiltration method was used in the runoff calculations. The parameters used in MIDUSS are as follows:

Table No. 3: Horton Infiltration Parameters

	Impervious Areas	Pervious Areas
Maximum Infiltration	0.0 mm/hr	75.0 mm/hr
Minimum Infiltration	0.0 mm/hr	12.5 mm/hr
Lag Constant	0.0 hr	0.25 hr
Depression Storage	1.5 mm	5.0 mm

Based on the Hydrogeological Report prepared by Chung and Vander Doelen Engineering (dated November 2019), the on-site soils range from coarse sands to silty clay. In the north portion of the site, the soils are estimated to have an infiltration rate of 25mm/hr. The soils from the south portion of the site are estimated to have an infiltration rate of 100mm/hr.

4.2 Existing Condition

Under existing conditions, the 38.6-hectare site was modelled as two (2) catchments (see Figure No. 1). The existing condition MIDUSS modelling files are included in Appendix C.

Catchment 10 (38.6-hectares, 10% impervious) represents the existing condition of the site less the existing natural areas, including existing recreational facilities, residences, campsite, gravel road, and landscaped areas. Runoff generated from Catchment 10 sheetflows overland, ultimately discharging to the existing wetland complex and to Blair Creek.

Catchment 20 (10-hectares, 0% impervious) represents the existing natural areas, including the wetland complex and environmentally sensitive areas on site. Runoff generated from Catchment 20 sheetflows overland, ultimately discharging to the existing wetland complex and to Blair Creek.

4.2.1 Existing Condition Flow Rates

The existing conditions flow rates were calculated using MIDUSS software to route the hydrographs.

In summary, the existing condition flow rates for the 2-year, 5-year, and 100-year design storm events are as follows:

Table No. 4: Existing Condition Flow Rates

	2-Year	5-Year	100-Year
Catchment 10	0.820 m^3/s	1.248 m^3/s	3.171 m^3/s
Catchment 20	0.073 m^3/s	0.262 m^3/s	1.075 m^3/s
Total Off-Site	0.829 m^3/s	1.296 m^3/s	4.321 m^3/s

4.3 Allowable Release Rates

The Township of North Dumfries requires post-development flow rates to be attenuated to existing levels. Therefore, the allowable release rates from the site under post-development conditions are as follows:

Table No. 5: Allowable Release Rates

	2-Year	5-Year	100-Year
Allowable Release Rate	0.829 m^3/s	1.296 m^3/s	4.321 m^3/s

4.4 Post-Development Condition

Under post-development conditions, the site was modelled as three (3) catchments (see Figure No. 2). The post-development condition MIDUSS modelling files are included in Appendix C.

Catchment 100 (7.6-hectares, 40% impervious) represents a portion of the proposed gravel drive aisles, camp sites, and landscaped areas located at the north end of the site. Runoff generated from Catchment 100 is directed to roadside ditches, ultimately discharging to the existing wetland complex and to Blair Creek.

Catchment 101 (12.6-hectares, 30% impervious) represents the existing hydro corridor, and a portion of the proposed gravel drive aisles, camp sites, and landscaped areas located at the south end of the site. Runoff generated from Catchment 101 is directed to roadside ditches, ultimately discharging to the existing wetland complex and to Blair Creek.

The subsurface soils for Catchment 101 were identified to be more suitable for infiltration than soils in the Catchment 100 area, due to the increased depth to groundwater. As such, there will be a greater emphasis on infiltration in Catchment 101 as part of the detailed design works.

Catchment 102 (8.4-hectares, 75% impervious) represents the proposed site storage area, wastewater treatment facility, overnight area, existing residences and proposed recreational hall at the south side of the site. Runoff generated from Catchment 102 is directed to the proposed gravel road and roadside ditches, ultimately discharging to the existing wetland complex and to Blair Creek.

Catchment 200 (10.0-hectares, 0% impervious) represents the existing natural areas, including the wetland complex and environmentally sensitive areas on site. Runoff generated from Catchment 20 sheetflows overland, ultimately discharging to the existing wetland complex and to Blair Creek.

Quality control for Catchments 100, 101, and 102 will be provided through directing runoff over grassed areas and ditches, where filtration and sedimentation of suspended particles may occur. Quality control in higher traffic areas such as parking lots and storage areas maybe provided by oil grit separator units prior to discharge. This will be confirmed as part of the detailed design.

The following table summarizes the unattenuated post-development flow rates from the site.

Table No. 6: Post-Development Condition Flow Rates

	2-Year	5-Year	100-Year
Catchment 100	0.571 m^3/s	0.824 m^3/s	1.342 m^3/s
Catchment 101	0.712 m^3/s	1.040 m^3/s	1.774 m^3/s
Catchment 102	1.177 m^3/s	1.672 m^3/s	2.538 m^3/s
Catchment 200	0.073 m^3/s	0.262 m^3/s	1.075 m^3/s
Total Flow Rate	**2.469 m^3/s**	**3.584 m^3/s**	**5.987 m^3/s**

In order to attenuate post-development flows to the existing conditions levels, approximately 4,500 m^3 of volume is required to be stored on site. Of this volume, approximately 1,500 m^3 will be used to balance the post-development water budget, as described in Section 5.

The proposed concept plan includes a significant length of gravel roadways for access to the individual camp sites. In order to provide sufficient drainage of these roadways, drainage ditches will be provided. Drainage ditches will incorporate infiltration features as required to achieve the water budget criteria and will also be used to provide the required runoff storage volumes. Should additional storage be required during the detailed design stage, surface ponding may also be recommended in areas of least anticipated use. The site will be configured as to limit the amount of surface ponding during the 2-year design storm even, to 0.10m (+/-). Details of the preliminary grading are shown in GM BluePlan Engineering Limited Drawing No.2.

The required infiltration volume was calculated using an annual water balance approach as described in the following section.

5. WATER BUDGET

The average annual precipitation for the area in which the study site is located is estimated to be about 916 mm. Based on the available data from the Grand River Conservation Authority Mapping, the annual recharge and runoff rates were identified as 347 mm/year and 39 mm/year, respectively. Therefore, the estimated evapotranspiration rate is as follows:

916mm (precipitation) – 347mm (recharge) - 39mm (runoff) = 530mm (evapotranspiration)

For impervious surfaces within the development, the annual evapotranspiration is estimated to be 125mm, resulting in approximately 791mm available for recharge and runoff.

Under existing conditions, the average natural groundwater recharge volume and runoff volume for the 38.6-hectare site is estimated to be 119,056 m^3/year and 47,315 m^3/year respectively. Under the proposed post development conditions, the average annual natural groundwater recharge volume for the 38.6-hectare site is estimated to be 87,513 m^3/year, leaving a recharge deficit of approximately 31,543 m^3/year to maintain the existing conditions.

A statistical analysis of the Waterloo-Wellington A rainfall station data (1991 – 2001) was completed to identify the probability of exceedance for the historical rainfall event depths. In any given year, based on this data, the probability that a rainfall event exceeds the 2-year storm depth of 32mm (City of Cambridge design storm parameters at 3-hour duration) is 2%. Therefore, rainfall events less than 32mm have a probability of 98% occurrence.

In order to be conservative in our estimate, we have assumed that 95% of the annual runoff from a given catchment is representative of storms less than or equal to the 2-year design storm event (32mm total depth).

In order to provide the required volume of recharge each year, the runoff generated from Catchment 101 during the 2-year storm events (and less) will be infiltrated. Catchment 101 produces approximately 33,340 m^3/year of runoff, 95% of which is 31,673 m^3, which will be infiltrated annually through the use of ditch infiltration structures as previously indicated. This additional infiltration volume satisfies the recharge deficit.

It is anticipated that Catchment 101 will produce 1,500 m^3 of runoff during the 2-year design storm event. This volume will be infiltrated under all design storm events, up to and including the 100-year design storm event.

Based on the Hydrogeological Report prepared by Chung and Vander Doelen Engineering (dated November 2019), the on-site soils range from coarse sands to silty clay. In the north portion of the site, the soils are estimated to have an infiltration rate of 25mm/hr. The soils from the south portion of the site are estimated to have an infiltration rate of 100mm/hr. Given the high infiltration rate of the native soils on the south side of the site, we do not foresee difficulties meeting the water balance requirements. Additional infiltration details will be provided through the detailed design phase.

As the site and internal gravel roads are to be used seasonally, there is little risk of chloride impacts from winter maintenance practices, therefore infiltration along roadside ditches should not significantly impact the existing groundwater chemistry. The bottom of the proposed infiltration structures will at least 1m above the seasonally high groundwater table and/or bedrock.

The preliminary water budget is summarized in Appendix C. As part of the detailed design, the infiltration ditches will be modelled and a detailed water balance will be provided.

6. SEDIMENT AND EROSION CONTROL PLAN

A silt fence will be installed along the property boundary in all locations where runoff will discharge from the site to adjacent lands. The silt fence will serve to minimize the opportunity for water borne sediments to be washed on to the adjacent properties.

Inspection and maintenance of all silt fencing will start after installation is complete. The fence will be inspected on a weekly basis during active construction or after a rainfall event of 13 mm or greater. Maintenance will be carried out, within 48 hours, on any part of the facility found to need repair.

Once construction and landscaping has been substantially completed, the silt fence will be removed, any accumulated sediment will be removed and the landscaping will be completed.

After construction of the complete development, erosion and sediment transport will be minimal.

7. MAINTENANCE PLAN

Maintenance plans for the proposed stormwater management measures will be provided during the detailed design phase.

8. CONCLUSIONS

In summary, the features of the functional servicing and preliminary stormwater management for the proposed development at 1898 Whistle Bare Road in the Township of North Dumfries are as follows:

1. Water supply will be provided by the existing private domestic supply well #A219397 and additional private drilled wells as required.
2. Sanitary service will be provided by the collection and pumping of sewage to the on-site wastewater treatment facility.
3. Storm service will be provided with roadside ditch drainage to appropriate outlets.
4. Major storm runoff generated from the site will continue to sheetflow overland to the existing wetland complex and to Blair Creek.
5. Post-development flows will be attenuated to the existing conditions levels via infiltration and ponding in roadside ditches and areas of least anticipated use.
6. Quality control will be provided through directing storm flows over grassed areas and through ditches to provide filtration and settling of suspended particles. Quality control for higher traffic areas such as parking lots and storage areas will be provided by oil grit separators prior to discharge.
7. Infiltration structures are proposed along roadside ditches to assist in meeting the recharge requirements for the post-development water balance.
8. Prior to construction, a silt fence will be installed along the property boundary in all locations where runoff will discharge from the site to adjacent lands. This will minimize the transport of sediment off-site during the construction period.

All of which is respectfully submitted.

GM BLUEPLAN ENGINEERING LIMITED

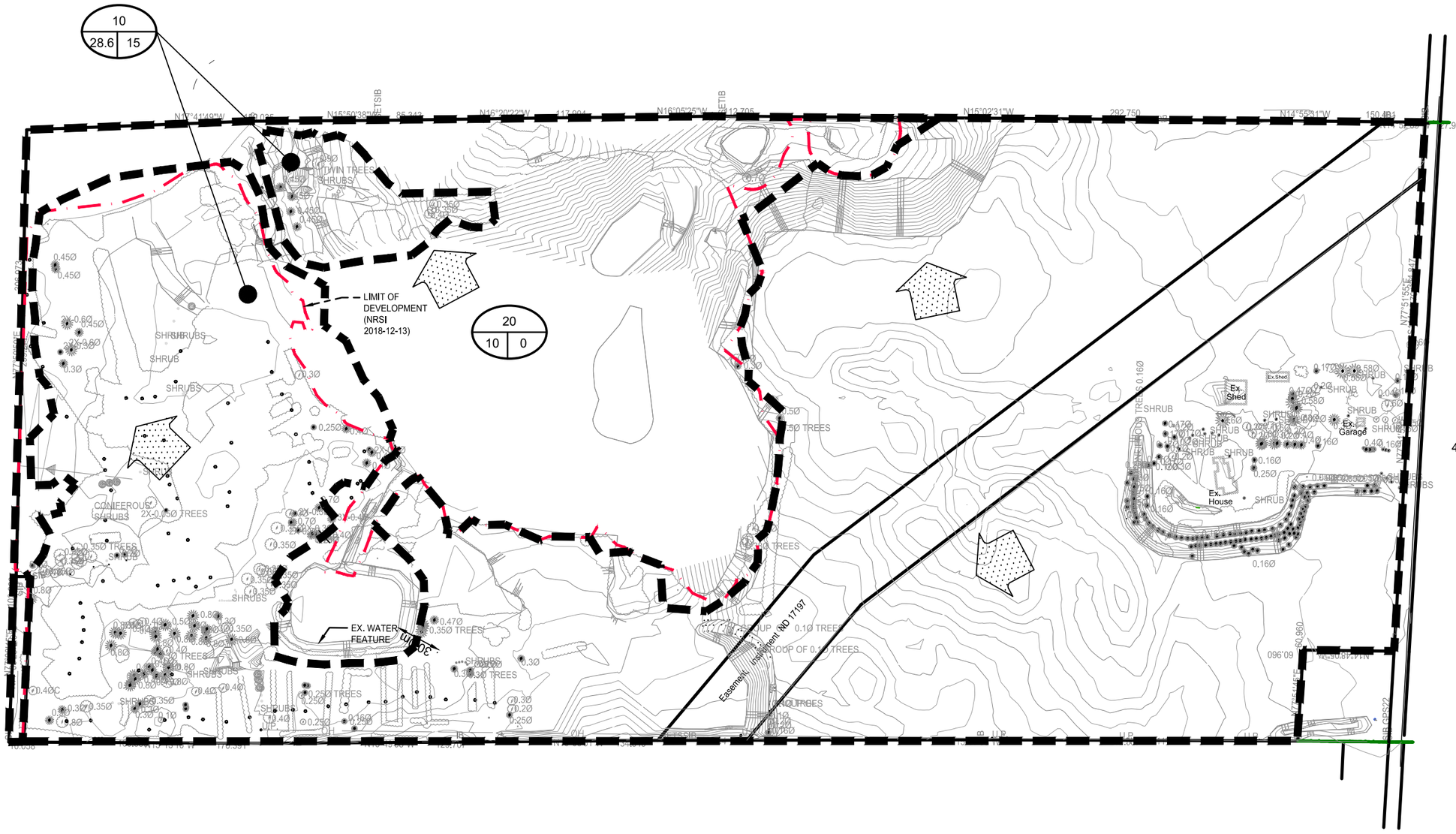
Per:

Sarah Primmer, P. Eng.
SP/rdj

\\gamsby.local\GMProjects\Kitchener\416-2016\416130 Whistle Bare Road Campground\5 Work in Progress\Reports, Manuals, Contracts\Design Report\416130 Functional Servicing and SWM Report_2019-12-17.docx

WHISTLE BARE ROAD CAMPGROUNDS

THE TOWNSHIP OF NORTH DUMFRIES



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LEGEND

- PROP. STORM SEWER
- DRAINAGE AREA BOUNDARY
- 201 / 0.11 | 80 — CATCHMENT NUMBER; % IMPERVIOUS; CATCHMENT AREA IN HECTARES
- MAJOR OVERLAND FLOW PATH

40 20 0 50 100 150

1:3000(m)

PRE-DEVELOPMENT DRAINAGE FIGURE

Figure No. 1

BluePlan ENGINEERING

416130
OCTOBER 2019
Scale: 1:3000 | NAD 1983 UTM Zone 17N

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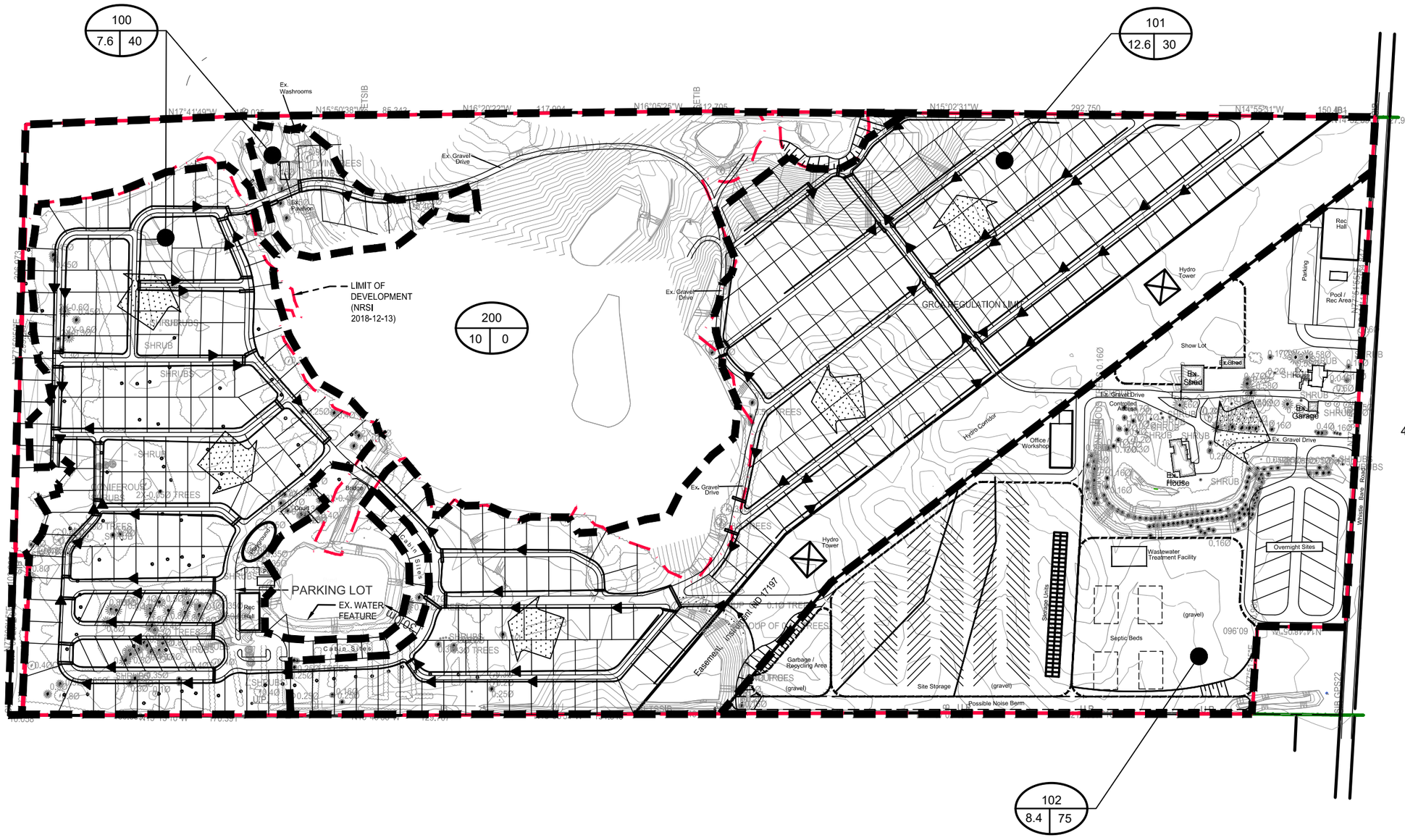
WHISTLE BARE ROAD CAMPGROUNDS

THE TOWNSHIP OF NORTH DUMFRIES



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LEGEND

- PROP. STORM SEWER
- DRAINAGE AREA BOUNDARY
- 201 / 0.11 | 80 — CATCHMENT NUMBER; % IMPERVIOUS; CATCHMENT AREA IN HECTARES
- MAJOR OVERLAND FLOW PATH

40 20 0 50 100 150

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POST-DEVELOPMENT DRAINAGE FIGURE

Figure No. 2

BluePlan ENGINEERING

416130
OCTOBER 2019
Scale: 1:3000 | NAD 1983 UTM Zone 17N

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APPENDIX A:
Sewage Systems Assessment Report

Englobe Corp. (LVM), October 23, 2014

LVM

Soil and Materials Engineering
Environmental Engineering
Building Science
Supply Chain Quality

Sage Campground Inc.

Sage Campground
1912/1898 Whistle Bare Road
Township of North Dumfries, Ontario

Sewage Systems Assessment Report

Date: October 23, 2014
Ref. N°: 160-P-0000145-0-00-0400-TU-R-0001-00

LVM, a division of EnGlobe Corp.

LVM

Sage Campground Inc.

Sage Campground
1912/1898 Whistle Bare Road
Township of North Dumfries, Ontario

Sewage Systems Assessment Report | 160-P-0000145-0-00-400

Prepared by:

Chris Helmer, B.Sc., P.Geo.
Hydrogeologist

Prepared by:

Brad Schildroth
Project Manager

Reviewed by:

Vanessa Marshall, P.Eng., M.Eng.
Team Leader, Engineering Group

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

Tables

Appendices

Property and Confidentiality

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Test results mentioned herein are only valid for the sample(s) stated in this report.

LVM's subcontractors who may have accomplished work either on site or in laboratory are duly qualified as stated in our Quality Manual's procurement procedure. Should you require any further information, please contact your Project Manager."

Sage Campground Inc.
1912 Whistle Bare Road
Cambridge, Ontario N1R 5S3
Attention: Ron and Terrie Sage

REVISION AND PUBLICATION REGISTER		
Revision N°	Date	Modification And/Or Publication Details
0A	2014-08-19	Draft Report Issued
0B	2014-08-29	Revised Draft Report Issued
00	2014-10-23	Final Report Issued

DISTRIBUTION	
2 copy	Ron and Terrie Sage, Sage Campground Inc.
1 copy	Mr. Husein Awad, Ministry of the Environment – West Central Region
1 copy	File

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INTRODUCTION

LVM, a division of EnGlobe Corp.(LVM) is pleased to present this report that provides a functional and environmental assessment of the private on-site sewage systems that service the Sage Campground property. The location of the property is shown on Drawing 1 in Appendix 5. The property covers approximately 38.6 hectares, and is bounded by Whistle Bare Road to the south, and agricultural and forested land to the north, east, and west.

The south (front) half of the property consists of agricultural land, and contains two single-family residences. The north (rear) half of the property consists of mixed forested and cleared land, and contains a seasonal campground. A forested wetland is situated within a depression in the centre of the campground, from which emerges a creek that flows from the property in an easterly direction and eventually outflows into Blair Creek approximately 100 m to the east. A number of ponds have been excavated on the north half of the property, which outflow to the on-site creek via small tributaries. The general property layout is shown on the appended Drawing 2.

The campground consists of eighty seasonal trailer sites, a main washroom building with no showers or laundry facilities, and a picnic pavilion with two associated washrooms. Water is supplied to the campground by an on-site drilled well located as shown on the appended Drawing 2. Sanitary sewage servicing is provided to the trailer sites and the Campground Pavilion washroom by individual Class 4 (leaching bed) sewage systems, and to the Picnic Pavilion washroom by an individual Class 5 (holding tank) sewage system. The systems are described in further detail in sections contained within this report.

The single-family residences at front of the property are serviced by on-site water supply and sewage systems located nearby. The main residence sewage system has been previously approved; therefore, only the secondary residence at 1898 Whistle Bare Road (the Farmhouse) and the campground are included in the impact assessment portion of this report.

Mr. Kevin Noll, Senior Environmental Officer with the Ontario Ministry of the Environment (MOE) Guelph District Office conducted an inspection of the campground on September 26, 2011, and subsequently issued Onsite Sewage Disposal Site Inspection Report No. 0605-8MRJAP to Sage Campgrounds Inc. Section 5 of the MOE report mandated that Sage Campgrounds Inc. must retain the services of a qualified person to obtain a Certificate of Approval (recently rebranded by the MOE as an Environmental Compliance Approval (ECA)) that acknowledges all of the currently unapproved sewage systems in the campground on the property.

In support of the ECA, the qualified person would be required to conduct an engineering assessment of each sewage system in the campground, and an assessment of impact on both local groundwater and surface water. Further, should any of the sewage systems require upgrading, as a result of the engineering and impact assessments, the design details for said upgrades would need to be included in the ECA application.

The purpose of this report is to outline the procedures of the sewage systems assessment; summarize conditions of the local geology and hydrogeology; describe the components and condition of each sewage system; assess the functionality of each sewage system, and assess the impact on both local groundwater and surface water; and, make recommendations pertaining to system upgrades, if necessary, as a result of the assessment.

1 PRE-APPLICATION CONSULTATION

Pre-application consultation for this project was undertaken by LVM via an on-site meeting and email correspondence with Mr. Noll, Ms. Nadia Marenco, Hydrogeologist with the MOE West Central Region Technical Support Section, and Mr. Paul Odom, Surface Water Team Leader with the MOE West Central Region Technical Support Section, in order to discuss the proposed scope of work, within the context of the above-described inspection report.
The consultation yielded the following broad requirements:

- A functional assessment would be required for a representative sample set of Class 4 sewage systems. The attendees of the meeting agreed to eight systems for assessment. Further, since the systems are located near a wetland and tributary of Blair Creek, an assessment of impact to groundwater and surface water would also be required.
- A functional assessment would be required for all of the Class 5 sewage systems. Given there is no discharge to the on-site environment from these systems, an assessment of impact to groundwater and surface water would not be required.
- The groundwater and surface water impact assessment must comply with the requirements of the following MOE documents where applicable;
  - Design Guidelines for Sewage Works, 2008 (DGSW);
  - Guideline B-7: Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities; and;
  - Guideline B-1: Water Management – Policies, Guidelines, Provincial Water Quality Objectives of the Ministry of the Environment, 1994 (PWQO)
- The surface water impact assessment must apply to the on-site tributary of Blair Creek toward which shallow groundwater is presumed to flow from the Class 4 sewage systems.
- The surface water impact assessment must apply a mass balance approach, based on shallow groundwater flow and chemistry test results gathered by LVM, and flow and chemistry test results from the selected surface water body.

2 ASSESSMENT PROCEDURE

The methodology for the assessment included the following tasks:

- review topographic, geological, and hydrogeological mapping and reports for the area, including previous reports by LVM;
- install eight monitoring wells for groundwater level measurement and chemistry testing;
- install four mini-piezometers for groundwater level measurement adjacent to surface water bodies;
- measure shallow groundwater elevations in the monitoring wells and mini-piezometers, in order to delineate horizontal shallow groundwater flow direction and determine groundwater recharge/discharge conditions;
- collect shallow groundwater samples from the monitoring wells for chemical analysis of nutrient and bacterial parameters;
- collect water supply well samples for chemical analysis of nutrient and bacterial parameters;
- measure the flow rate of the Blair Creek tributary at its exit from the subject property (east property boundary);
- collect surface water samples from the Blair Creek tributary at its exit from the subject property (east property boundary) for chemical analysis of nutrient and bacterial parameters;
- physically analyze, via exploratory excavation, one class 4 sewage system that services the secondary residence, one Class 4 sewage system that services the Campground Pavilion washroom building, one Class 5 sewage systems that services the Picnic Pavilion washroom building and eight representative Class 4 sewage systems that service the trailer sites;
- assess the functionality and environmental integrity of the Class 4 sewage systems based on the representative analyses, and provide recommendations, as necessary; and,
- assess the functionality of the Class 5 sewage system, and provide recommendations, as necessary.

2.1 FIELD PROGRAM

The field program involved the advancement of eight boreholes to depths ranging from 3.8 to 5.8 m on April 24 and 25, 2012, and four mini piezometers were installed in proximity to ponds and creeks on April 26, 2012. Additionally, the excavation of eleven test pits throughout the sewage system evaluation areas were conducted on April 30, 2013. The boreholes were advanced by Geo-Environmental Drilling Inc. under the full-time observation of a technician from LVM using a CME-75 track-mounted drillrig equipped with continuous flight hollow stem augers to identify the subsurface soil and groundwater conditions. The mini-piezometers were installed by an LVM field technician and the test pits were completed using a small tractor backhoe under the full-time observation of a technician from LVM to identify subsurface soil and groundwater conditions and provide assessment of the current sewage system components. The current borehole, mini piezometer, and test pit locations, are shown on the appended Drawing 2.

Soil samples were recovered from the boreholes at regular 0.75 and 1.50 m depth intervals using a 50 mm diameter split-spoon sampler in accordance with the Standard Penetration Test (SPT) procedure (ASTM D1586). Soil samples obtained from the boreholes were submitted for moisture content analysis, with selected samples submitted for particle size distribution analysis. The laboratory results for moisture content are presented on the borehole logs in Appendix 4, and the particle size distribution analyses are shown on Figure 1 in Appendix 3.

The borehole and mini-piezometer locations and ground surface elevations were surveyed by LVM with geodetic references provided by ACI Survey Consultants Inc. The monitoring wells were located relative to existing site features, and the ground surface elevations are referred to the following temporary benchmark:

TBM: Cut cross in concrete near southwest corner of washroom building

Elevation: 344.37 m (geodetic) .

2.2 MONITORING WELL AND MINI-PIEZOMETER INSTALLATIONS

2.2.1 Monitoring Well Installation

During the borehole drilling program, monitoring wells were installed in the boreholes for measurement of groundwater levels.

The 50 mm diameter monitoring wells were constructed by inserting slotted, Schedule 40 PVC well screen and riser pipe into the open auger holes. Sand was added in order to place a filter pack around the screen, until the level of the sand was approximately 300 mm above the top of the screen. Bentonite seals were then placed above the sand pack/pre-packed screens to prevent the infiltration of surface water. The tops of all the well riser pipes were vented to allow accurate measurement of stabilized groundwater levels, and protective steel casings with lockable covers were concreted in place to house each of the monitoring wells. Details of the monitoring well installations and soil and groundwater conditions encountered are provided on the borehole logs included in Appendix 4.

In Boreholes BH-3-12 and BH-8-12 upper (-U) and lower (-L) monitoring wells were installed in separate stratigraphic units, with the shallower monitoring well constructed using 19 mm PVC tubing with fabricated screens and vented riser pipe to allow accurate water level measurement.

All of the monitoring wells were constructed in accordance with Ontario Regulation 903 (amended by O.Reg. 468/10) as administered by the Ontario Ministry of the Environment (MOE). A well record was submitted to the MOE based on the cluster system whereby one well record can be submitted on behalf of an entire property. Provincial Site Cluster Tag Identification Number A115242 was placed on the monitoring well at Borehole BH-8-12.

Borehole logs are included in Appendix 4 for reference

2.2.2 Mini Piezometer Installation

A total of four mini-piezometers were installed adjacent to on-site ponds and tributary creeks, using a hand auger to advance each hole to between 0.91 and 4.88 m. The mini-piezometers were constructed using 19 mm diameter PVC pipe with fabricated screens 0.61 to 1.52 m in length.

Mini piezometer logs are included in Appendix 4 for reference.

2.2.3 Test Pit Excavation

A series of test pits were excavated on the property in the vicinity of the existing building areas (secondary residence, campground and picnic pavilion washrooms, and the campground residential area) which are serviced by existing sewage systems. Eleven representative test pit locations were selected to identify local soil conditions and evaluate and assess the sewage system components and related capacity. The test pits were backfilled immediately after completion of sampling and observation.

2.3 LABORATORY SOIL TESTING

All soil samples secured during this investigation were returned to the LVM laboratory for moisture content testing, the results of which are plotted on the appended borehole logs. Some samples were collected and submitted for particle size distribution analysis.

2.4 GROUNDWATER CHEMISTRY TESTING

Between April and August 2012 water chemistry samples were obtained from on-site monitoring wells and the campground supply well and analyzed for a variety of general chemistry parameters. A summary of the groundwater chemistry analysis results is included in the appended Table 102, and the laboratory Certificates of Analysis are included in Appendix 6 for reference. Additionally, between April and September 2012 water chemistry samples were obtained from the tributary creek at the downstream property boundary and analyzed for general chemistry parameters. A summary of the groundwater chemistry analysis results is included in the appended Table 103, and the laboratory Certificates of Analysis are included in Appendix 6 for reference.

The park owners have collected water chemistry samples from the pumphouse and distribution sites between April 2012 and July 2013 and submitted them for analysis of selected parameters. A summary of the drinking water supply chemistry analysis results is included in the appended Table 104, and the laboratory Certificates of Analysis are included in Appendix 6 for reference.

3 SUMMARIZED CONDITIONS

3.1 PHYSIOGRAPHY AND AREA GEOLOGY

The site is located within the Guelph Drumlin Field Physiographic Region, and within a Spillways Physiographic Landform (Chapman and Putnam, 1984). According to the Ministry of Northern Development and Mines Quaternary Geology map of the Cambridge Area (Karrow, 1987), the southern portion of the site is located within an area of outwash gravel deposits, while the northern portion of the site is located within an area of lacustrine and outwash sand deposits. An illustration showing the Quaternary Geology of the site is provided on Drawing 3, in Appendix 5.

Underlying glacial deposits in the area is the massive and thick bedded Guelph Formation dolostone.

3.2 LOCAL SUBSURFACE CONDITIONS

We refer to the appended borehole, mini piezometer and test pit logs for soil descriptions and stratigraphies, results of SPT testing, moisture content profiles, pocket penetrometer test results, details of monitoring well construction, and groundwater measurements and observations

The borehole, mini piezometer and test pit logs show that the subsurface soil stratigraphy generally consists of organic (peat/topsoil) deposits of varying thickness overlying sand and/or sand and gravel deposits. Borehole BH-08-12, located on the east side of the tributary creek, encountered deposits of silt, silt till, and silt/sand to its termination depth.

3.3 LOCAL GROUNDWATER AND SURFACE WATER CONDITIONS

Groundwater levels were measured in the on-site monitoring wells on April 27, July 3, and August 8, 2012 with measurements summarized in the appended Table 101.

Groundwater beneath the site occurs in the extensive near surface sandy/granular deposits; and as shown on the appended Drawing 2, groundwater flows generally northeastwards towards Blair Creek with localized influence along the tributary creek and pond outlet.

The numerous ponds on site are groundwater fed (ponds are supported by groundwater discharge, and generally represent the shallow groundwater table), and outlet to the tributary creek which flows to Blair Creek.

3.4 WATER CHEMISTRY SAMPLING AND ANALYSIS

The following subsections discuss water chemistry sampling results from the various locations on the property. All Laboratory Certificates of Analysis are included in Appendix 6 for reference.

3.4.1 Groundwater Chemistry

Groundwater samples were obtained from the eight monitoring wells on site on April 27, July 3, and August 8, 2012 and submitted to ALS Environmental in Waterloo, Ontario for analysis of a variety of parameters. As shown on the appended Table 102, the measured concentrations of Nitrate varied widely across the property but did not exceed the Ontario Drinking Water Standards (ODWS) criteria limits. The measured Nitrate concentration exhibited a slight increasing trend at all monitoring wells apart from Borehole BH-5-12 and BH-6-12.

No E. coli was detected in any of the groundwater chemistry samples; however, the measured concentrations of Total Coliforms exceeded the ODWS criteria limit at all monitoring wells on each sample date.

3.4.1.1 *Measured Nitrate Concentrations*

Boreholes BH-1-12 and BH-2-12 are located upgradient of all sewage leaching beds within the campground; however, measured Nitrate concentrations increased at both locations between April and August, 2012. Furthermore, Borehole BH-02-12 (located at the western property boundary and upgradient of all leaching beds) exhibits the highest measured Nitrate concentrations for each of the three monitoring events.

In contrast, Boreholes BH-3-12 and BH-4-12 are located downgradient of leaching beds; however, measured nitrate concentrations at both locations were consistently lower than the measured Nitrate concentration at BH-2-12.

Boreholes BH-6-12 and BH-7-12 (located at the northern/northeastern edge of the property) are at the downgradient ends of the campground; however, measured Nitrate concentrations at these locations are generally the lowest measured concentrations on site.

3.4.1.2 *Measured Total Coliforms Concentrations*

Concentrations of Total Coliforms exhibit similar trends to measured Nitrate concentrations, with upgradient monitoring wells (Boreholes BH-1-12 and BH-2-12) exhibiting the highest concentrations of Total Coliforms, and downgradient Boreholes BH-3-12 and BH-4-12 exhibiting the lowest measured concentrations.

3.4.1.3 *Groundwater Chemistry Interpretation*

The groundwater chemistry data collected during the dry summer of 2012 helps to highlight the chemistry trends across the property, as dilution via precipitation was minimal.

It is apparent that concentrations of sensitive parameters such as Nitrate and Total Coliforms are not increasing downgradient of the campground leaching beds, but are in fact generally decreasing from the upgradient end of the property to the downgradient end. This suggests external (upgradient) influences on groundwater chemistry that are not exacerbated by the on-site leaching beds. Furthermore, the decreasing concentrations suggest that natural attenuation processes are in effect in the subsurface soils and groundwater.

An alternate source of nutrients and Total Coliforms in groundwater could be the numerous agricultural fields to the west and south of the campground property. Regular application of chemical fertilizer and manure would be expected on active agricultural fields, and as the groundwater flow direction is generally northwards/westwards on the campground property, the fields are interpreted to be generally upgradient.

3.4.2 Surface Water Chemistry

Surface water samples were obtained from the tributary creek at the downstream property boundary (as shown on the appended Drawing 2) on April 27, June 3, and September 5, 2012 and submitted to ALS Environmental in Waterloo, Ontario for analysis of a variety of parameters. As shown on the appended Table 103, the measured concentration Total Coliforms exhibited an increasing trend during the year, while the concentrations of Nitrate, Total Suspended Solids, and E. coli peaked in August and declined slightly in September.

The measured concentration of E. coli exceeded the Provincial Water Quality Objectives (PWQO) criteria limit in July, August, and September.

3.4.2.1 *Surface Water Chemistry Interpretation*

The presence of Total Coliforms in surface water, and the increase in concentration during the year, is not unusual given the large ponds and wetland areas in proximity to the tributary creek. The relatively low measured temperature in the creek during a low precipitation summer reinforces the conclusion that groundwater discharge is the primary contributor to creek flow.

The groundwater contour map on the appended Drawing 2 indicates localized convergence of shallow groundwater flow towards the tributary creek; however, the majority of the campground site where leaching beds are located is more than 50 m from the creek, and beyond the influence of the creek as a discharge location. Additionally, it is noted that no groundwater chemistry samples has measured concentrations of E. coli. Therefore, the presence of Nitrate, Total Coliforms, and E. coli in surface water do not appear to be directly related to the leaching beds on the Sage Campground property.

As discussed previously in Section 3.4.1.3, the agricultural fields to the south and west of the campground may be influencing groundwater chemistry. Impacted groundwater discharging to the two ponds at the southern end of the campground property, and contribution of nutrients and bacteria from the wetland through which the tributary creek flows, are interpreted to be more significant sources of surface water contamination.

3.4.3 Drinking Water Supply System Chemistry

Water samples were obtained from the drinking water supply pumphouse (upstream of any treatment systems) by LVM employees on April 27, July 3, and August 28, 2012 and submitted to ALS Environmental in Waterloo, Ontario for analysis of a variety of parameters. Additionally, on April 29, May 27, and July 5, 2013 water chemistry samples from selected distribution locations and the supply pumphouse were obtained by Sage Campground employees and submitted to ALS Environmental in Waterloo, Ontario for analysis of a variety of parameters. As shown on the appended Table 104, measured Nitrate concentrations were elevated in 2012 but remained below the ODWS criteria limit. The sample from May, 2013 had a lower Nitrate concentration than the three samples from 2012.

In April, 2012 and May, 2013 the presence of Total Coliforms was measured in the raw water (pre-treatment); however, these occurrences appear to be isolated in nature.

As shown on the appended Drawing 2, the campground water supply well is at the southwestern edge of the campground property, and is upgradient of the campground itself. Therefore, the water quality issues noted above are not interpreted to be a result of the leaching beds located within the campground.

3.4.4 Sewage Effluent Chemistry

Sewage sampling was not conducted on this property and specific sewage chemistry results were not obtained. Alternatively, it was considered reasonable that the chemistry of raw sewage that discharges to the sewage systems is presumed to be consistent with typical domestic sewage with respect to oil and grease, BOD_5, TSS, and total nitrogen, due to the nature of the property occupancy without the use of park laundry facilities or restaurant kitchen operations.

Typical raw domestic sewage exhibits the following relevant chemistry:

Table 1: Typical Raw Domestic Sanitary Sewage Chemistry

PARAMETER	CONCENTRATION
Total Suspended Solids (TSS)	220 mg/L
Biochemical Oxygen Demand, 5-day, 20 degrees C (BOD_5)	200 to 250 mg/L
Total Nitrogen	40 mg/L
pH	6.0 to 8.0

3.5 ON-SITE WATER SUPPLY WELLS

The well at 1898 Whistle Bare Road is approximately 0.9 m in diameter with a steel case. The well is approximately 6 m deep, and was installed in the early 1900's to supply the original farmhouse. This well is not currently used, as the farmhouse is not currently occupied; however, the house has previously been used as a rental property and may be rented in the future.

The well at 1912 Whistle Bare (MOE Well Tag #A003434) is a 0.16 m diameter steel-cased well drilled to 18.6 mBGS. The well supplies the residential dwelling on the property.

The Campground Well (A070624) is a 0.16 m diameter steel-cased well drilled to 6.7 mBGS. The well supplies the eighty campground sites on the property via a private water distribution system.

3.6 SEWAGE SYSTEMS PHYSICAL ANALYSIS

A representative sample of sewage systems underwent physical analysis, including selective pumping of tanks, exploratory excavation of selected leaching beds, test hole advancement, and soil particle size distribution analysis at the LVM laboratory, in order to ascertain the following information:

- sequence, size, material, and layout of all tanks and leaching beds;
- functional condition of each of the components;
- subsurface soil and groundwater conditions in the vicinity of the leaching beds; and,
- percolation times of the predominant soils underlying the leaching beds.

LVM staff were present for monitoring of the exploratory excavation of the leaching beds, and test pit excavation, in order to record measurements and observations. The test pit locations are shown on the appended Drawing 2, and the test pit logs are provided in Appendix 4 for reference.

3.7 SEWAGE SYSTEMS

The following subsections set forth descriptions of the eleven sewage systems including the secondary single family residence, the campground pavilion washroom, the picnic pavilion washroom and eight campground trailer sites under current use that underwent physical analysis. The main residence/campground office sewage system is already described in the current C of A and not included as part of this assessment. The following includes summaries of the sequence, size, material, configuration, and condition of all encountered components plus the local soil and groundwater conditions. The physical analysis was conducted on April 30 and May 1, 2013. Photographs taken during the physical analysis are provided in Appendix 8.

3.7.1 Secondary Residence (1898 Whistle Bare Road)

The single-family residence is located at the south end on the upper section of the property directly adjacent to Whistle Bare Road. The residence is serviced by a sewage system that consists of a septic tank and in-ground absorption trench leaching bed. The leaching bed is situated within a grassed yard area.

The septic tank is approximately a 1,000 L round single-chambered concrete tank containing heavy wooden boards forming a dividing partition wall within the interior compartment and is equipped with the original concrete inlet and outlet baffles. No effluent filter was observed in the septic tank. The edge of the tank is located 0.4 m from the foundation of the residence and the top of the tank is buried to a depth of approximately 0.2 m and equipped with a single 1.1 m diameter concrete lid that is accessible at grade. The tank was observed to be in reasonably good condition at the time of the analysis.

A 100 mm diameter sewer (reportedly black asbestos type) extends from the septic tank to a common header that provides effluent distribution to the leaching bed.

The leaching bed consists of four runs of 75 mm diameter clay distribution tile spaced at either 2.44 m or 3.66 m, on centre, ranging in length from 11.0 to 11.5 m (estimated total length of 45 m). The clay tiles were buried to an approximate depth of 0.3 m to the top of the pipe and the distribution runs were constructed in a thin layer of gravel surrounding the tiles. No filter cloth was observed over the gravel/tile trench. At the time of the analysis, the stone layer in the exposed trenches was moderately contaminated with soil and dry biomat accumulation was minimal to moderate. No effluent was observed flowing inside or outside the pipe at the time of the analysis. The exposed distribution tiles were observed to be in good to fair condition (both interior and exterior) at the time of the analysis, with dry sludge accumulation ranging from half to partially full (50 to 75 % capacity). No effluent emission to the ground surface was evident at any time during the physical analysis.

3.7.1.1 *Local Subsurface and Groundwater Conditions*

Please refer to the appended log of the test pit (Test Pit TP-11-13) situated in the vicinity of the secondary single-family residence sewage system for soil descriptions and stratigraphies, and groundwater observations. The subsurface stratigraphy contacted in the area of the sewage system comprises surficial topsoil overlying an extensive deposit of sand and gravel.

A sample of sand and gravel recovered during the subsurface investigation was submitted to the LVM laboratory for particle size distribution analysis. The results of the analysis are shown on Figure 1 presented in Appendix 3, and indicate that the sand and gravel sample contains 37% gravel, 58% sand, and 5% silt.

At the time of the analysis, no shallow groundwater was encountered in Test Pit TP-11-13 within the sand and gravel deposit, and only damp to moist moisture conditions were observed within the soils.

3.7.1.2 *Raw Sewage Chemistry*

The chemistry of raw sewage that discharges to the sewage system is presumed to be consistent with typical domestic sewage with respect to oil and grease, BOD_5, TSS, and total nitrogen, as described in Section 3.4.4.

3.7.2 Campground Pavilion Washroom

The washroom building is located in the lower section on the northwest side of the property along an access road servicing the park and situated near the most northern pond on the property. The washroom building is serviced by a sewage system that consists of a septic tank and an inground absorption trench leaching bed. The leaching bed is situated within a grassed recreational area.

The septic tank is an approximately 1,893 L (Infiltrator model, 500 Series), single-chambered plastic tank installed near the entrance of the building. The tank was observed to be in excellent condition at the time of the analysis given the tank is relatively new and is less than five years old. The tank is equipped with a sealed single lid that is accessible at grade and buried just below the ground surface with a 0.1 m layer of soil coverage above. The inlet and outlet baffles were not inspected at the time of the inspection.

A solid 100 mm diameter PVC sewer extends 0.3 m from the plastic tank and splits into two runs that provide effluent distribution to the leaching bed via 100 mm diameter PVC perforated pipes. The distribution pipes are each 3.05 m in length with an estimated total length of 6.0 m and spaced at approximately 0.4 m on centre. The exposed distribution pipes are bedded on a layer of coarse stone and concrete debris stone with a thickness of approximately 0.3 to 0.5 m. The pipe was buried to an approximate depth of 0.4 m to the top of the pipe and the distribution runs were not capped but covered with filter fabric to prevent soil intrusion. The exposed distribution pipes were observed to be in excellent condition (both interior and exterior) at the time of the analysis, with no effluent or sludge accumulation observed.

3.7.2.1 *Local Subsurface and Groundwater Conditions*

Please refer to the appended log of Test Pit TP-4-13 situated in the vicinity of the campground washroom sewage system for soil descriptions and stratigraphies, and groundwater observations. In general, the subsurface stratigraphy contacted in the area of the sewage system comprises a surficial layer of topsoil, overlying a layer of silt/sand and underlain by an extensive deposit of sand, some gravel.

A sample of sand, some gravel recovered during the subsurface investigation was submitted to the LVM laboratory for particle size distribution analysis. The results of the analysis are shown on Figure 1 presented in Appendix 3, and indicate that the sand, some sample contains 12% gravel, 86% sand, and 2% silt.

At the time of the analysis, shallow groundwater was encountered in Test Pit TP-4-13 within the sand deposit at a depth of 1.2 m.

The groundwater contours depicted on the appended Drawing 2 indicate a northwards flow direction in the vicinity of the campground washroom.

3.7.2.2 *Raw Sewage Chemistry*

The chemistry of raw sewage that discharges to the sewage system is presumed to be consistent with typical domestic sewage with respect to oil and grease, BOD_5, TSS, and total nitrogen, as described in Section 3.4.4.

3.7.3 Picnic Pavilion Washroom

The washroom building is located in the lower section on the northeast side of the property along a maintenance road servicing the park and situated near the north trailer storage area on the property. The washrooms at the picnic pavilion are serviced by a holding tank sewage system which does not contain a constructed leaching bed. A 1,893 L (Infiltrator model, 500 series) single-chambered plastic tank is installed behind the washroom building. The tank was observed to be in excellent condition at the time of the analysis given the tank is relatively new and is less than five years old. The tank is equipped with a sealed single lid that is accessible at grade and buried just below the ground surface with a 0.2 m layer of soil coverage above. The inlet and outlet baffles were not inspected at the time of the inspection.

3.7.3.1 *Local Subsurface and Groundwater Conditions*

Please refer to the appended log of the test pit (Test Pit TP-10-13) situated in the vicinity of the picnic pavilion washroom sewage system for soil descriptions and stratigraphies, and groundwater observations. The subsurface stratigraphy contacted in the area of the sewage system comprises surficial topsoil, overlying silt/sand and underlain by an extensive deposit of sand.

A sample of sand, some gravel recovered during the subsurface investigation was submitted to the LVM laboratory for particle size distribution analysis. The results of the analysis are shown on Figure 1 presented in Appendix 3, and indicate that the sand, some gravel sample contains 10% gravel, 89% sand, and 1% silt.

At the time of the analysis, no shallow groundwater was encountered in Test Pit TP-10-13 in the sand deposit, and only damp to moist moisture conditions were observed within the soils.

The groundwater contours on the appended Drawing 2 indicate flow in a north-eastwards direction, following the tributary creek.

3.7.3.2 *Raw Sewage Chemistry*

The chemistry of raw sewage that discharges to the sewage system is presumed to be consistent with typical domestic sewage with respect to oil and grease, BOD_5, TSS, and total nitrogen, as described in Section 3.4.4.

3.7.4 Campground Trailer Sites

The residential campground area is located on the lower section of the property occupying the northwest corner of the site. The park contains a total of 80 trailer sites which are accessible by multiple access roads similar to that of a subdivision. A typical trailer site comprises a small parcel of land suitable for a semi-permanent dwelling, parking for a vehicle in the driveway and some trees adjacent to the limits of the space. Each site contains a private water service and independent sewage system.

A representative sample of campground trailer sites were assessed across the property and evaluated. The sewage systems typically fall into three categories based on construction methods used for installation of the systems. Those groups of systems have been categorized by age and are referred to as "1st Generation", "2nd Generation", and "3rd Generation" sewage systems which are described in detail below.

3.7.4.1 *1st Generation Sewage Systems; Site #15, #44, #53 and #61*

The following is a summary of the generalized conditions of the sewage systems found at the above noted sites.

The septic tank configuration at these sites consist of two single-chambered plastic barrels/drums which have a volume of approximately 200 L each, which are connected in series to each other at a point 0.4 m approximately below grade allowing effluent to flow from one tank to another. The tank contains a 100 mm PVC fitting inserted on the top of the first tank and located above the ground surface which acts as the inlet and connection point to the trailer sewer. On two sites, an additional 100 mm PVC fitting, similar to the inlet is located on the secondary tank compartment and is used for pump outs and monitoring the capacity of the system. The tanks are buried to a depth of approximately 0.2 m and are not equipped with inlet or outlet baffles, or outlet effluent filters. The tanks also do not have the capability of attaching risers or functional lids that would be accessible at grade. The tanks were observed to be in good condition with no deterioration of the material or signs of collapsing at the time of the analysis; however, it was noted that that the tanks were positioned slightly off-axis, which may be attributed to the backfilling procedures.

A single 0.3 m to 1.2 m length of 100 mm diameter plastic corrugated and perforated "big O" pipe was observed to exit the secondary compartment of the septic tank configuration. The section of pipe was approximately 0.6 below grade which permitted storage in the tank to allow sewage and solids to settle and remain in the tank while effluent could escape. The purpose of the section of pipe was to distribute the effluent to the surrounding soils after the tanks reached their capacity. The pipe was constructed over area approximately 0.9 wide by 0.9 m long by 0.6 m deep, that had been excavated and loosely backfilled with concrete debris, bricks and, and large stones to provide a soak away zone. The section of pipe did not appear to exhibit significant sludge accumulation at the time of the analysis.

3.7.4.2 *2nd Generation Sewage System; Site #26*

The following is a summary of the generalized conditions of the sewage systems found at the above noted site.

The septic tank configuration at this site consists of two single-chambered plastic barrels/drums which have a volume of approximately 200 L each, which are connected in series to each other at a point 0.4 m approximately below grade allowing effluent to flow from one tank to another. The tank contains a 100 mm PVC fitting inserted on the top of the first tank and located above the ground surface which acts as the inlet and connection point to the trailer sewer. An additional 100 mm PVC fitting, similar to the inlet located on the secondary tank compartment and is used for pump outs and monitoring the capacity of the system was not constructed. The tanks are buried to a depth of approximately 0.2 m and are not equipped with inlet or outlet baffles, or outlet effluent filters. The tanks also do not have the capability of attaching risers or functional lids that would be accessible at grade. The tanks were observed to be in good condition with no deterioration of the material or signs of collapsing at the time of the analysis, however, it was noted that that the tanks were positioned slightly off-axis, which may be attributed to the backfilling procedures.

The leaching bed comprises a single 0.9 m length of 75 mm diameter perforated ABS pipe and was observed to exit the secondary compartment of the septic tank configuration. The section of pipe was approximately 0.4 below grade which permitted storage in the tank to allow sewage and solids to settle and remain in the tank while effluent could escape. The purpose of the section of pipe was to distribute the effluent to the surrounding soils after the tanks reached their capacity. The pipe was constructed over area approximately 0.6 wide by 1.5 m long by 0.9 m deep, that had been excavated and loosely backfilled with concrete debris, bricks and, and large stones to provide a soak away zone. The infiltration area containing the section of pipe was covered with a similar size piece of discarded tin roof sheeting to prevent soil intrusion. The section of pipe did not appear to exhibit significant sludge accumulation at the time of the analysis.

3.7.4.3 *3rd Generation Sewage System; Site #1, #19, and #57*

The following is a summary of the generalized conditions of the sewage systems found at the above noted sites.

The septic tank configuration at these sites consist of three single-chambered plastic barrels/drums which have an volume of approximately 200 L each, which are connected in series to each other at a point 0.4 to 0.6 m approximately below grade allowing effluent to flow from one tank to another. The tank contains two 100 mm PVC fittings inserted on the top of the first tank and located above the ground surface which acts as a separate inlet for connection to the trailer sewer as well as a port for convenient pump outs.

An additional single 100 mm PVC fitting, similar to the inlet is located on the second and third tank compartments and are used for pump outs and monitoring the capacity of the system. The tanks are buried to a depth of approximately 0.2 m and are not equipped with inlet or outlet baffles, or outlet effluent filters. The tanks also do not have the capability of attaching risers or functional lids that would be accessible at grade. The tanks were observed to be in good condition with no deterioration of the material or signs of collapsing at the time of the analysis, however, it was noted that that the tanks were positioned slightly off-axis, which may be attributed to the backfilling procedures.

The leaching bed comprised two, 2.44 m (Sites 1 and 19) or two, 3.05 m (Site 57) lengths of 100 mm diameter perforated PVC pipe that were observed to exit the third tank compartment of the septic tank configuration. The pipes were situated 0.6 m apart on centre and they were approximately 0.6 below grade which permitted storage in the tanks to allow sewage and solids to settle and remain in the tank while effluent could escape. The purpose of the sections of pipe was to distribute the effluent to the surrounding soils after the tanks reached their capacity. The pipes were constructed over area approximately 0.6 wide by 3.0 m long by 0.9 m deep, that had been excavated and loosely backfilled with concrete debris, bricks and large stones. A layer of 0.1 m of 50 to 100 mm river stone was overlain to provide protection to the pipe and a piece of filter fabric was installed directly over the stone and pipe to prevent soil infiltration in the underlying infiltration area. The section of pipe did not appear to exhibit significant sludge accumulation at the time of the analysis.

3.7.4.4 *Local Subsurface and Groundwater Conditions*

Please refer to the appended test pit logs for soil descriptions and stratigraphies, moisture content profiles, and groundwater measurements and observations of locations situated in the vicinity of independent sewage systems servicing the campground trailer sites. In general, the subsurface stratigraphy contacted in the area of the campground trailer sites sewage systems comprises a surficial layer of topsoil or fill, overlying a layer of silt/sand and underlain by extensive deposits of sand, with varying amounts of silt and gravel.

Samples of sand recovered in those areas during the subsurface investigation were submitted to the LVM laboratory for particle size distribution analysis. The results of the analysis are shown on Figures 2 and 3 presented in Appendix 3, and indicate that the samples contain 1 to 10% gravel, 89 to 95% sand, and 2 to 10% silt.

Shallow groundwater exists in the vicinity of the trailer site sewage systems and generally occurs within the sand deposit. The varying depths to shallow groundwater at the nearby test pit locations are between 0.9 and 1.4 m below grade with the exception of Test Pit TP-8-13 where groundwater was found to occur at 1.7 m below grade and at Test Pit TP-9-13, where no groundwater was encountered during excavation.

3.7.4.5 *Raw Sewage Chemistry*

The chemistry of raw sewage that discharges to the sewage system is presumed to be consistent with typical domestic sewage, with respect to oil and grease, BOD_5, TSS, and total nitrogen, as described in Section 3.4.4.

4 SEWAGE SYSTEMS ASSESSMENT

4.1 FUNCTIONAL ASSESSMENT

This subsection provides a functional assessment of the sewage system types under current use, based upon the following parameters:

- percolation time of the predominant soil(s) underlying each sewage system leaching bed;
- daily design (peak) sanitary sewage flow for each sewage system; and,
- physical condition of each sewage system (described in Subsection 3.3).

4.1.1 Secondary Residence (1898 Whistle Bare Road)

4.1.1.1 *Percolation Time*

The subsurface soil stratigraphy in the vicinity of the secondary single-family residence sewage system consists of topsoil overlying sand and gravel to a depth of 1.8 m. The leaching bed absorption trenches are founded within the sand and gravel deposit, therefore, for the purpose of the functional assessment, a percolation time was assessed using the sand and gravel deposit.

The percolation time of the sand and gravel was assessed based on physical characteristics encountered during the subsurface investigation (i.e. structure, density, organics, etc.); and, soil type as described by the Unified Soil Classification System in Supplementary Standard SB-6 of the OBC, "Percolation Time and Soil Descriptions", and determined by the laboratory test results (Figure 1). The sand and gravel is classified as "GW - SW", for which the OBC specifies a percolation time in the range of <1 (less than 1) to 12 min/cm. A percolation time of T = 2 min/cm was selected for the functional assessment.

4.1.1.2 *Daily Design Sanitary Sewage Flow*

The theoretical peak daily sanitary sewage flow for the residence was calculated, as follows, from Table 8.2.1.3.A. of the OBC, based on occupancy information supplied to LVM by the property owner:

Table 2: Peak Daily Sanitary Sewage Flow from the OBC (Single-Family Residence)

	DESCRIPTION	DESIGN FLOW
A	3 bedrooms (up to 5)	1,600 L/day
B	0 bedrooms (over 5)	0 L/day
C	130 m^2 approximate total finished area (excluding the basement)	0 L/day
D	17 plumbing fixture units from Table 7.4.9.3. of the OBC	0 L/day
	Total = A + (greater of B, C, and D)	1,600 L/day

Therefore, a theoretical peak daily sanitary sewage flow of 1,600 L/day was used for the functional assessment.

4.1.1.3 *Assessment*

The single-family residence is serviced by a sewage system that consists of a septic tank and in-ground absorption trench leaching bed. The septic tank effective volume is 1,000 L (single-chambered tank with no effluent filter), and the total distribution pipe length is estimated to be 44 m.

The current OBC stipulates that a sewage system with a septic tank and in-ground absorption trench leaching bed must meet the following minimum requirements, with respect to capacity, based both on the percolation time of the predominant underlying soil deposit and the theoretical peak daily sanitary sewage flow of the single-family residence:

- 3,600 L dual-chambered septic tank equipped with an effluent filter as specified in the OBC stipulating a minimum of two days of storage at the peak daily flow and a tank size not less than a 3,600 L.
- In-ground absorption trench leaching bed with a total distribution pipe length of 40 m as specified in the OBC as the minimum total length, and calculated as follows:

$$L = \frac{Q \times T}{200}$$

where:

Q = 1,600 L/day (refer to Subsection 4.1.3.2)

T = 2 min/cm (refer to Subsection 4.1.3.1)

The above calculations indicate that the septic tank does not meet the current minimum OBC capacity requirements; however, the leaching bed capacity does comply with the current capacity standard stipulated by the OBC. Further deficiencies of the sewage system are summarized as follows:

- The septic tank is a single compartment tank and may not properly separate solids and liquids.
- The septic tank contains a wooden divider which may not be properly functional as a partition it does not extend to the bottom of the tank.
- The septic tank does not contain an effluent filter.
- The septic tank is located 0.4 m from the building foundation.
- The septic tank is located within the 15 m OBC setback distance to the existing dug well servicing the dwelling.
- The exposed absorption trenches exhibit only a trace amount of stone encompassing the distribution tiles, and the stone used within the trench is significantly contaminated with soil.
- The absorption trenches were not covered with filter fabric.
- The exposed distribution tiles exhibit a moderate amount of dry sludge/biomaterial accumulation.
- The distance from the closest absorption trench to the existing dug well servicing the dwelling is approximately 8 m.

Despite the above-referenced deficiencies, the sewage system appears to function adequately, with no visual or reported evidence of effluent emission to the ground surface. The adequate functionality of the system is likely aided by the relatively low occupancy of the residence and the percolation rate of the sand and gravel soils in the area. Although the system does not meet the minimum horizontal distances set forth in the OBC to items such as structures and water supply wells, the leaching bed is vertically separated by greater than the OBC minimum of 900 mm to the high groundwater table.

4.1.2 Campground Washroom

4.1.2.1 *Percolation Time*

The subsurface soil stratigraphy in the vicinity of the campground washroom sewage system consists of topsoil overlying silt/sand and underlain by sand, some gravel. The leaching bed absorption trenches are founded within the sand deposit, therefore, for the purpose of the functional assessment, a percolation time was assessed using the sand soils.

The percolation time of the sand was assessed based on physical characteristics encountered during the subsurface investigation (i.e. structure, density, organics, etc.); and, soil type as described by the Unified Soil Classification System in Supplementary Standard SB-6 of the OBC, "Percolation Time and Soil Descriptions", and determined by the laboratory test results shown on the appended Figure 1. The sand is classified as "SP", for which the OBC specifies a percolation time of 2 to 8 min/cm. A percolation time of T = 5 min/cm was selected for the functional assessment.

4.1.2.2 *Daily Design Sanitary Sewage Flow*

The peak daily sanitary sewage flow used for the functional assessment of the campground washroom sewage system was derived from interviews with the client and estimated published values from the OBC. Although metered water use readings are collected throughout the operating season, the water use is not broken down between washrooms, drinking water, irrigation, showers, laundry, vehicle washing, etc.; therefore, the readings are not considered useful for peak daily flow calculations.

The washrooms are open seasonally and available to the entire campground (eighty trailer sites plus guests), however use of the washroom building is intended to be utilized primarily during social functions (i.e. bingo, card games) occurring at the pavilion or as a convenient alternative for a park residents while they are away from a private dwelling unit. Residents are advised by staff that the use of this facility was to be a secondary option when possible. Water use in the washroom building was reported to be minor given that most campground occupants abided by this guideline and used their private dwelling predominately. It is reported that the tank is pumped out as required, but generally only requires an annual pump out at the end of the season. Of note, laundry and showers facilities are not available in this building or publicly at the campground.

Campground site use is reported to peak on summer weekends with lower usage during the week. The theoretical peak daily flow for the campground washroom was calculated from Table 8.2.1.3.B. of the OBC. The calculation is based on an “Assembly Hall” occupancy, with no food service provided. The theoretical peak daily flow is thus calculated in the following table:

Table 3 : Peak Daily Sanitary Sewage Flow from the OBC (Campground Pavilion Washroom)

DESCRIPTION	PEAK DAILY FLOW CALCULATION	PEAK DAILY FLOW
Assembly Hall (no food service provided)	50 seats x 8 L/day/seat	400 L/day
	Total	400 L/day

Therefore, a theoretical peak daily sanitary sewage flow of 400 L/day was used for the functional assessment.

4.1.2.3 *Assessment*

The washroom is serviced by a sewage system that consists of a septic tank and in-ground absorption trench leaching bed. The park staff currently manages this system as a holding tank with an outlet overflow whereby they reportedly monitor the effluent levels and arrange for a pump out when the tank reaches its capacity, therefore preventing effluent overflow into the leaching bed system. The septic tank has an effective volume of 1,893 L (single-chambered plastic tank with no effluent filter), and the total distribution pipe length is estimated to be 6 m.

The current OBC and MOE stipulate that a sewage system with a septic tank and in-ground absorption trench leaching bed must meet the following minimum requirements, with respect to capacity, based both on the percolation time of the predominant underlying soil deposits and the theoretical peak daily sanitary sewage flow of the washrooms servicing the campground:

- 3,600 L dual-chambered septic tank equipped with an effluent filter as specified in the OBC stipulating a minimum of three days of storage at the peak daily flow and a tank size not less than a 3,600 L, and,
- In-ground absorption trench leaching bed with a total distribution pipe length of 40 m as specified in the OBC as the minimum total length, and calculated as follows:

$$L = \frac{Q \times T}{200}$$

where:

L = minimum required length of distribution pipe (m)

Q = peak daily sanitary sewage flow (L/day)

T = combined percolation time of predominant soils underlying the leaching bed (min/cm)

Each of the above parameters are detailed, as follows:

Q = 400 L/day (refer to Subsection 4.1.2.2)

T = 5 min/cm (refer to Subsection 4.1.2.1)

The above calculations indicate that the septic tank and leaching bed capacity do not comply with the **current** capacity standards stipulated by the OBC. Further deficiencies of the sewage system are summarized as follows:

- The septic tank is single-chambered tank (not dual-chambered), which does not have an internal partition divider to separate and contain solids.
- The septic tank does not contain an inlet baffle.
- The septic tank does not contain an outlet effluent filter.

- The distribution pipes are not covered or protected with any crushed stone and are susceptible to damage.
- The ends of the exposed distribution tiles are not capped.
- The minimum OBC setback distances between the washroom building and the septic tank, or the distribution pipes of the leaching bed do not comply.

Despite the above-referenced deficiencies, the sewage system appears to function adequately with no visual or reported evidence of effluent emission to the ground surface. The adequate functionality of the system is likely aided by the limited nature of its use due the reported low volume of sewage generated during the week and also the percolation rate of the sand soils in the area. As well, the system meets the minimum horizontal distances set forth in the OBC to property boundaries, water supply wells, and surface water bodies.

Of notable concern, the vertical separation from the leaching bed to the high groundwater table is less than 900 mm; however, the nearest drinking water supply well to the system is approximately 200 m upgradient of the sewage system leaching bed with respect to shallow groundwater flow, and the system is situated at least 50 m away from the nearest surface water body.

4.1.3 Picnic Pavilion Washroom

4.1.3.1 *Percolation Time*

The subsurface soil stratigraphy in the vicinity of the picnic pavilion washroom sewage system consists of topsoil overlying silt/sand and underlain by sand. For the purpose of the functional assessment, a percolation time was assessed using the sand deposit, however, it is reported that a septic tank/holding tank is the only sewage system component located in this area. A leaching bed comprising distribution pipes has not been constructed in this area and does not exist, reportedly.

The percolation time of the sand was assessed based on physical characteristics encountered during the subsurface investigation (i.e. structure, density, organics, etc.); and, soil type as described by the Unified Soil Classification System in Supplementary Standard SB-6 of the OBC, "Percolation Time and Soil Descriptions", and determined by the laboratory test results shown on the appended Figure 1. The sand is classified as "SP", for which the OBC specifies a percolation time of 2 to 8 min/cm. A percolation time of T = 5 min/cm was selected for the functional assessment.

4.1.3.2 *Daily Design Sanitary Sewage Flow*

The peak daily sanitary sewage flow used for the functional assessment of the picnic pavilion washroom sewage system was derived from interviews with the client and published values from the OBC. Although metered water use readings are collected throughout the operating season, the water use is not broken down between washrooms, drinking water, irrigation, showers, laundry, vehicle washing, etc.; therefore, the readings are not considered useful for peak daily flow calculations.

The picnic pavilion provides a dedicated shelter and grassed area for authorized groups and is used occasionally for private functions. Events are held infrequently on average of two per month, seasonally; and the reported number of visitors attending an event would be approximately fifty (50). Functions held at the pavilion are most commonly throughout the day and often involve a meal prepared using a BBQ and consists of mostly pre-packaged foods thus involving no kitchen preparation workspace.

The washrooms adjacent to the area are accessible and limited to persons attending a scheduled event held at the picnic pavilion. The washrooms doors are locked and inaccessible to campers at all other times since the use of the picnic washroom building is intended to be utilized only during these functions (i.e. family picnic or company demonstration). Water use in the picnic pavilion washroom building is reported to be minor given the limited use during the season. It is reported that the septic holding tank is pumped out as required, and reportedly, the property owner would typically only need to conduct an annual pump out at the end of the season.

The theoretical peak daily flow for the picnic pavilion was calculated from Table 8.2.1.3.B. of the OBC. The calculation is based on an “Assembly Hall” occupancy, with no food service provided. The theoretical peak daily flow is thus calculated in the following table:

Table 4 : Peak Daily Sanitary Sewage Flow from the OBC (Picnic Pavilion Washroom)

DESCRIPTION	PEAK DAILY FLOW CALCULATION	PEAK DAILY FLOW
Assembly Hall (no food service provided)	50 seats x 8 L/day/seat	400 L/day
	Total	400 L/day

Therefore, a theoretical peak daily sanitary sewage flow of 400 L/day was used for the functional assessment.

4.1.3.3 *Assessment*

The Picnic Pavilion is serviced by a sewage system that consists of only a septic holding tank. The total septic holding tank effective volume is 1,893 L (single-compartment plastic tank with no outlet).

The current OBC stipulates that a sewage system with a Class 5 septic holding tank must meet the following minimum requirements, with respect to capacity, based on the theoretical peak daily sanitary sewage flow of the Picnic Pavilion:

- a 9,000 L single compartment holding tank equipped with an alarm, venting system and a pump-out contract based on the minimum requirement of seven (7) days of storage at the peak daily flow and not less than the value noted above as specified in the OBC;

In the event that the sewage system was deemed as a Class 4 system with no apparent leaching bed instead of a Class 5 holding tank, the current OBC stipulates that a sewage system with a septic tank and in-ground absorption trench leaching bed must meet the following minimum requirements, with respect to capacity, based both on the percolation time of the predominant underlying soil deposit and theoretical peak daily sanitary sewage flow of the Picnic Pavilion:

- 3,600 L minimum dual-compartment septic tank equipped with an effluent filter, based on the minimum requirement of three days of storage at the peak daily flow but not less than the value noted above as specified in the OBC; and,
- In-ground absorption trench leaching bed with a total distribution pipe length of 40 m as specified in the OBC as the minimum total length, and calculated as follows:

$$L = \frac{Q \times T}{200}$$

where:

Q = 400 L/day (refer to Subsection 4.1.3.2)

T = 5 min/cm (refer to Subsection 4.1.3.1)

The above calculations indicate that the septic holding tank does not meet the current minimum OBC capacity requirement as either a Class 5 holding tank or a Class 4 septic tank sewage system. The system, if classified as a Class 5, holding tank is not vented and does not contain a high level float and an audible or visual alarm. If classified as a Class 4 sewage system, the septic tank is not constructed with two compartments and the absence of a sewage system leaching bed in the form of an in-ground absorption trenches, provides no comparison of size for the capacity of the sewage system. Further deficiencies of the sewage system are summarized as follows:

- The septic/holding tank does not contain an inlet or outlet baffle or an effluent filter.
- The septic tank is located 0.6 m from the building foundation

Despite the above-referenced deficiencies, the sewage system appears to function adequately, with no visual or reported evidence of effluent emission to the ground surface. The adequate functionality of the system is likely aided by the infrequency of its use and because no apparent leaching bed exists that would disperse effluent to the surrounding soil.

4.1.4 Campground Trailer Sites

4.1.4.1 *Percolation Time*

The subsurface soil stratigraphy in the vicinity of the sewage systems servicing the campground trailer sites generally consists of a surficial layer of topsoil overlying a layer of silt/sand and underlain by either a deposit of sand, some gravel or a deposit of sand and gravel, both becoming saturated with depth. The leaching bed absorption trenches and infiltration configurations are founded primarily within the sand deposit, therefore, for the purpose of the functional assessment, the percolation time was assessed using the more conservative and predominant sand deposit.

The percolation time of the sand was assessed based on physical characteristics encountered during the subsurface investigation (i.e. structure, density, organics, etc.); and, soil type as described by the Unified Soil Classification System in Supplementary Standard SB-6 of the OBC, "Percolation Time and Soil Descriptions", and determined by the laboratory test results shown on the appended Figures 2 and 3. The sand is classified as "SP", for which the OBC specifies a percolation time of 2 to 8 min/cm. A percolation time of T = 8 min/cm was selected for the functional assessment.

4.1.4.2 *Daily Design Sanitary Sewage Flow*

The campground is available to a maximum of eighty (80) trailer sites, each containing a water service and a site sewer hook-up connected to a private Class 4 sewage system, and open seasonally between April and October. Trailer site use is reported to peak on summer weekends with lower usage throughout the week. The peak daily sanitary sewage flow used for the functional assessment of the campground area sewage systems was derived from published values from the OBC and MOE. The theoretical peak daily flow for the campground sites were calculated from Table 8.2.1.3.B. of the OBC. The calculation is based on a “Campground Park” occupancy, with water and sewer hook-up provided, with the current number of available sites stated as the capacity of the park. The theoretical peak daily flow is thus calculated in the following table:

Table 5 : Peak Daily Sanitary Sewage Flow from the OBC (Campground Area)

DESCRIPTION	PEAK DAILY FLOW CALCULATION	PEAK DAILY FLOW
Campground Trailer Sites (water and sewer hook-up)	80 sites x 425 L/day/site	34,000 L/day
	Total	34,000 L/day

It is important to note that as of the 2014 Operating Season, Sage Campground has started to record daily park water usage rates. Typical usage is approximately 3,800 L/day on weekdays, and 8,000 L/day on weekends. As the daily sanitary sewage flow would be close to the water usage values, it is clear that the actual peak daily sanitary sewage flow is significantly lower than the theoretical calculation presented above.

4.1.4.3 *Assessment*

Each campground site is serviced by a Class 4 sewage system that consists of septic tank(s) and an in-ground absorption trench type leaching bed. The sewage systems operate such that effluent flows through multiple tanks before overflowing into one of three leaching bed variations as described previously as 1st, 2nd and 3rd generation sewage systems. Each site contains multiple single-chambered plastic barrels as an alternative to a two-chambered traditional precast tank, contain no baffles or effluent filters and are each approximately 200 L in volume. The total septic tank volumes calculated for each site are dependent on the quantity of barrels/tanks installed but can be estimated to be approximately 400 L or 600 L (two tank and three tank configurations respectively). The variations of leaching beds that service each site contain between 0.3 and 6 m (total) of distribution pipe constructed as predominately an in-ground type leaching bed.

The current OBC and MOE stipulate that a sewage system with a septic tank and in-ground absorption trench leaching bed must meet the following minimum requirements, with respect to capacity, based both on the percolation time of the predominant underlying soil deposits and the theoretical peak daily sanitary sewage flow; based on an individual campground trailer site as described below:

- 3,600 L minimum dual-compartment septic tank servicing an individual site equipped with an effluent filter, based on the minimum requirement of three days of storage at the peak daily flow but not less than the value noted above as specified in the OBC; and an,
- in-ground absorption trench leaching bed servicing an individual site with a total distribution pipe length of 40 m as specified in the OBC as the minimum total length, and calculated as follows; or

  based on a combined group trailer configuration which is centrally serviced as described below;
- 68,000 L (34,000 x 2 times the daily flow) minimum dual-compartment septic tank servicing all campsites equipped with an effluent filter, based on the minimum requirement of two days of storage at the peak daily flow as specified in the OBC; and an
- in-ground absorption trench leaching bed servicing all campsites with a total distribution pipe length of 1,360 m as specified in the OBC as the minimum total length, and calculated as follows;

$$L = \frac{Q \times T}{}$$

$$\frac{}{200}$$

where:

L = minimum required length of distribution pipe (m)

Q = peak daily sanitary sewage flow (L/day)

T = combined percolation time of predominant soils underlying the leaching bed (min/cm)

Each of the above parameters are detailed, as follows:

Q = 425 or 34,000 L/day, respectively (refer to Subsection 4.1.4.2)

T = 8 min/cm (refer to Subsection 4.1.4.1)

The above calculations indicate that the septic tank and leaching bed capacities for either an individual or group configuration do not comply with the current capacity standards stipulated by the OBC and MOE. Further deficiencies of the sewage systems are summarized as follows:

- The septic tanks are single-chambered tanks (not dual-chambered).
- The septic tanks do not contain inlet baffles.
- The septic tanks do not contain outlet effluent filters.
- The distribution piping and leaching beds are not constructed using standard construction methods or typical installation procedures
- Construction materials (some) used in the installation/construction of the absorption trench distribution system do not conform to Canadian Standards Association (CSA) and are not suitable for use.
- The distribution pipes are not covered or protected with any crushed stone and are susceptible to damage.
- The ends of the exposed distribution tiles are not capped and were found to be open.
- The minimum OBC distance setback distances between the trailer dwellings and the sewage systems (septic tanks, or the distribution pipes of the leaching beds) do not generally conform.

Despite the above-referenced deficiencies, the sewage systems appear to function, with no visual or reported evidence of effluent emission to the ground surface. The functionality of the systems are likely aided by the highly permeable soils, the seasonal nature of their use and relatively low volume of sewage generated by residents; both of which provide an opportunity for hydraulic and organic recovery from peak loads during non-use or non-peak periods. Further, the systems meet the minimum horizontal distances set forth in the OBC to permanent structures, property boundaries, water supply wells, and surface water bodies, however, as listed above, the vertical separation from a leaching bed to the high groundwater table is less than 900 mm in some instances, yet the nearest drilled well water supply well to an active independent sewage system (closest trailer site) is approximately 30 m away, and is upgradient, with respect to shallow groundwater flow.

As noted in Section 4.1.4.2, it is important to consider that the empirical water use data being collected in 2014 shows that the actual peak daily sanitary sewage flow is significantly lower than the theoretically calculated 34,000 L/day.

4.2 ENVIRONMENTAL ASSESSMENT

This subsection provides a collective environmental assessment of the public (campground washroom and picnic pavilion) and private (individual leaching bed) sewage systems, with respect to groundwater and surface water impact. This assessment will focus on the sewage systems within the campground itself, but does not include assessment of the main/secondary residences.

Considering the seasonal operation of the campground and for the purpose of assessment re-evaluation, a previously calculated combined theoretical peak daily sanitary sewage flow of 34,000 L/day in the report, however, this value is considered excessive, given the park is operated on a seasonal basis and experiences limited resident usage during the week. Therefore, an estimated and more reasonable theoretical peak daily sanitary sewage flow of 17,000 L/day was used for the environmental assessment herein.

4.2.1 Groundwater Impact

As described previously in Section 3.4.1, groundwater chemistry data from across the site indicates that concentrations of sensitive parameters such as Nitrate and Total Coliforms are generally decreasing from the upgradient end of the property to the downgradient end. It is concluded that that natural attenuation processes in the subsurface soils and groundwater are effectively reducing the concentration of nitrate in shallow groundwater, and that external (upgradient) impacts such as agricultural processes are having a greater influence on shallow groundwater chemistry than the site itself.

As described in Section 3.3, shallow groundwater discharges to the surface water features (ponds and tributary creek) on the property. As a result, it is concluded that a surface water impact assessment is most appropriate for this site. Nonetheless, a groundwater impact assessment has been prepared for investigative purposes.

In accordance with Section 22.5, "Assessment of Impact on Water Resources", of the MOE document, Design Guidelines for Sewage Works, 2008 (DGSW), and MOE Guideline B-7, Incorporation of the Reasonable Use Concept into MOEE Groundwater Management Activities, a theoretical assessment of the potential impact of the sewage system on local off-site groundwater was conducted.

The DGSW stipulates that the critical contaminant to be used for the groundwater impact assessment is nitrate-nitrogen. The assessment involves theoretically predicting nitrate-nitrogen attenuation between the sewage system location(s) and the downgradient performance boundary, with respect to shallow groundwater flow. The purpose of the prediction is to derive the maximum effluent nitrate-nitrogen concentration objective for future sewage system design purposes. The methodology set forth in the DGSW uses a mass-balance formula to calculate attenuation.

The only permitted mode of attenuation in the formula is dilution via infiltrated precipitation of the subsurface sewage effluent plume. The DGSW and MOE Guideline B-7 stipulate a nitrate-nitrogen concentration limit in shallow groundwater at the downgradient performance boundary of 2.5 mg/L.

Based on this concentration limit and dilution via infiltrated precipitation, the maximum effluent nitrate-nitrogen concentration objective was calculated, as follows:

$$C_{PB} = \frac{C_S \times V_S}{V_S + A_D \times k \times 1{,}000}$$

where:

C_{PB} = shallow groundwater nitrate-nitrogen concentration limit at downgradient performance boundary (mg/L as N)

C_S = maximum effluent nitrate-nitrogen concentration objective (mg/L as N)

V_S = annual effluent flow based on average daily design sanitary sewage flow (L/yr)

Although the property at 1898 Whistle Bare Road is currently not in use, the calculated effluent flow has been added to this calculation as a conservative measure in the event the property becomes occupied in the future.

A_D = dilution area calculated as the product of the leaching bed width transverse to shallow groundwater horizontal flow direction and the distance from the upgradient edge of the leaching bed(s) to the downgradient performance boundary (m^2)

As shallow groundwater flows northwards and eastwards, generally parallel to the tributary creek, and the leaching beds for the Campground Washroom, Picnic Pavilion Washroom, and eighty individual trailers are distributed across the site, calculation of a sewage effluent plume area (for the purposes of assessing the volume of infiltrating precipitation that would act to dilute sewage effluent) is not feasible. Therefore, for the purposes of this assessment it is assumed that the full site area occupied by the eighty trailers (and bounded by the property boundary and the forested land abutting the tributary creek) constitutes the effluent plume area.

k = annual dilution (infiltrated precipitation – m)

Each of the above parameters are detailed as follows:

$\mathbf{C_{PB}}$ = 2.5 mg/L

$\mathbf{V_S}$ = 4,744,270 L/yr

The annual effluent flow was estimated by summing the peak design flows provided in Section 4.1 (1,600 L/day for 1898 Whistle Bare Road; 400 L/day for the Campground Washroom; 400 L/day for the Picnic Pavilion Washroom; and 17,000 L/day for the eighty trailer sites) and applying a factor of 0.67 to convert the total peak flow to an average daily design flow, based on experience with other similar projects.

$\mathbf{A_D}$ = 93,296 m^2

k = 0.25 m (constant stipulated in the DGSW)

The stipulated recharge value of 0.25 m/yr is higher than would normally be expected for the typically sandy soils underlying the site; however, the DGSW constant is stipulated for use in this application, and is understood to have been derived by the MOE to account for direct infiltration of precipitation as well as additional dilution effects, such as groundwater underflow and lateral plume dispersion.

The above mass balance formula yielded a maximum effluent nitrate-nitrogen effluent concentration objective of 14.8 mg/L. While domestic effluent would not be expected to have a nitrate concentration this low, it is clear that the theoretical calculation does not correlate with the empirical data from the site (discussed in Section 3.4.1) which shows no exceedances of the ODWS for nitrate (10 mg/L) in groundwater despite the significantly higher effluent concentration of nitrate in the leaching beds.

It is therefore concluded that the theoretical calculation is not supported by empirical data, and that no groundwater impacts are occurring as a result of the campground operations.

4.2.2 Surface Water Impact

Please see the Surface Water Impact Assessment memo included in Appendix 7.

5 RECOMMENDATIONS

5.1 SECONDARY RESIDENCE SEWAGE SYSTEM

The functional assessment of the sewage system that services the secondary single-family residence indicate that, despite its deficiencies, the system appears to function in an adequate manner, and there was no visual or reported evidence of effluent emission to the ground surface.

It is reasonable and worthwhile to consider the ongoing and continued use of the sewage system until such time that a partial or complete malfunction occurs, but given the age of the sewage system, it is advisable to consider upgrading to a new sewage system altogether at some point in time rather than replacing/upgrading individual components as they fail. Partial modifications may involve the replacement of the septic tank in the sewage system as it is an undersized, single compartment tank and located within the minimum O.B.C. setback regulations to the existing dug well servicing the residence. The existing leaching bed, although suitably sized, is also located within the water well setback, yet modifications to the leaching bed would not be practical as it would involve relocating the system. Given this information, it may be more conceivable to upgrade to a new drilled water well and decommission the dug well entirely, providing the life expectancy of the existing sewage system is taken into consideration. The property owner should consider the future use of the dug water well and decide if water could be supplied from the drilled water well located near the main residence or alternatively from a new well drilled elsewhere on the property. In the event that decommissioning of the current dug well is performed, it would be suitable to upgrade or replace the septic tank or the leaching bed; however, until the current water well situation is determined, the well will play an integral role in the construction of an upgraded sewage system.

Replacement of the entire sewage system in the future should be considered by the property owner based on the findings contained within this report, however, replacement of this system is not critical at this time, as the property has operated in this manner for years in the current location and has maintained these components successfully.

The following recommendations are made in order to improve the current system performance and extend the service life of the system, in the event that a new system is not required or installed.

- An outlet effluent filter should be installed on the septic tank and the filter should be cleaned regularly to ensure free flow of effluent from the septic tank to the leaching bed.
- Sludge accumulation in the septic tank should be monitored closely and it should be pumped once accumulation reaches one-third of the effective volume.
- The leaching bed header and distribution pipes should be “jet-cleaned” internally, in order to remove accumulated sludge and soil.

5.2 PICNIC PAVILION AND CAMPGROUND PAVILION SEWAGE SYSTEMS

The functional assessment of the washroom/campground pavilion sewage systems indicated that, despite their deficiencies, the systems appear to function in an adequate manner, in that there was no visual or reported evidence of effluent emission to the ground surface.

Based on the premise that the installed sewage systems are being utilized primarily as holding tank systems and are emptied as needed, no excessive amount of sewage effluent is anticipated to be discharged to the environment, that could cause a public health concern, although, it is recommend that proper controls be put in place to ensure that this does not occur. Such controls should include an alarm with audible and visual warning, an open aired vent to the tanks, plus the establishment of a service contract with a registered sewage system hauler operator.

To verify concentrations of Ammonia-N and Nitrate-N, it is recommended that one round of effluent chemistry sampling be undertaken from each system, with the samples submitted to an accredited laboratory for analysis of Ammonia-N, Nitrate-N, Nitrite-N, and Total Kjeldahl Nitrogen (TKN) parameters.

5.3 CAMPGROUND TRAILER SITES SEWAGE SYSTEMS

The functional assessment of a sample of sewage systems located randomly throughout the park indicate that despite the deficiencies noted, no visual or reported evidence of effluent emission to the ground surface exists; however, the observed building standards noted and construction practises used during the installation of the sewage systems do not conform to the OBC. Issuance of an ECA acknowledging the existing systems will need to reflect the existing system designs, and any replacement, upgrade, or expansion of the systems would need to meet all applicable OBC standards.

5.4 SURFACE WATER FEATURES

To assess the long term impacts of the property on adjacent surface water features, water chemistry sampling of the recreational pond upstream of the Blair Creek tributary and head pond discharge to the Blair Creek tributary, as well as locations BH3-12, BH4-12, and the downstream tributary sampling location, should be undertaken on a semi-annual basis (once in the spring upon opening of the campground, and once in the fall just prior to closing) with analysis of general chemistry parameters, to confirm that water quality parameter concentrations are not increasing over time. This semi-annual chemistry sampling should continue for a period of four years, after which time the results should be submitted to the MOE for review and assessment. If no increasing trends in nutrient parameters (Nitrate and derivatives, Phosphate and derivatives, and E.coli) are observed, the requirement for surface water chemistry sampling could be terminated.

5.5 ENVIRONMENTAL COMPLIANCE APPROVAL AND FUTURE RECOMMENDATIONS

Continued park operation will require admendment of the existing C of A into a new ECA that includes the existing approval for the main residence/office sewage system, and recognition of all existing systems on the property that have been described in this report, subject to the monitoring requirements outlined in Sections 5.1, 5.2, and 5.4.

Continued park operation under an ECA should include groundwater chemistry monitoring at selected upgradient and downgradient monitoring wells and the secondary residence water supply well on a semi-annual basis (coinciding with surface water chemistry monitoring) for a period of four years with analysis of general chemistry parameters, after which time the results should be submitted to the MOE for review and assessment. If no increasing trends in nutrient parameters (Nitrate and derivatives, Phosphate and derivatives, and E.coli) are observed, the requirement for surface water chemistry sampling could be terminated.

Additionally, water usage should be recorded on a daily basis in order to empirically assess the water usage for the same four year period.

As noted in Section 5.3, any replacement, upgrade of expansion of the trailer systems would need to meet all applicable OBC standards.

Please be advised that this sewage systems assessment is based only on limited observation of the above-described systems and should not be taken as a complete evaluation of construction. It is important to note that the extent of exploratory excavation into the sewage systems was balanced between the need to obtain sufficient information for the assessment, and the need to prevent irreparable damage and maintain the functional integrity of the systems. Finally, the assessment does not provide a warranty or projection of longevity for the sewage systems.

In the event that any of the sewage systems reaches the end of its service life, or occupancy of any of the facilities that are serviced by the sewage systems is increased, new/replacement systems must be designed by a professional engineer to comply with the OBC and DGSW, and an application must be made for amendment of the ECA prior to construction of the system.

STATEMENT OF LIMITATIONS

It is the sole responsibility of the owner to maintain and repair the existing sewage systems, and to provide additional sewage disposal capacity or replace the systems in the future (per OBC standards), if necessary. A reference list of recommended general sewage system operation and maintenance practices are presented in Appendix 1.

The subsurface investigations completed in support of this sewage systems assessment involved a limited sampling of the site gathered at specific test hole locations, and a limited observation of the existing sewage systems through exploratory investigation. The conclusions and recommendations in this report are based on this information gathered. The subsurface conditions between and beyond the test holes will differ from those encountered at the test holes.

Further, the conditions of the existing sewage systems may differ between the exploratory excavations. Should sewage system design services be required in the future, additional test holes may be required to further delineate subsurface conditions for design purposes.

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Appendix 1 General Sewage System Operation and Maintenance

GENERAL SEWAGE SYSTEM OPERATION AND MAINTENANCE

Proper operation and regular servicing and maintenance of private on-site sewage systems are fundamental for long-term performance. It is the responsibility of the owner to ensure that the sewage system is operated within the parameters for which it was designed, and to maintain the system in accordance with Section 8.9 of the Ontario Building Code, 2012 (OBC), "Operation and Maintenance". The following recommendations are also made, with respect to operation and maintenance of the proposed sewage system:

1. Private on-site sewage systems function primarily to treat and remove organic materials from domestic wastewater through both biological and physical processes. The addition of various chemicals such as fuels, grease, paints, pesticides, etc; or, solids such as cigarette butts, condoms, paper towels, diapers, sanitary napkins, etc. into the wastewater can greatly impede the performance of these processes, and must not be discharged to the system. Chemicals such as household drain solvents, cleaners, disinfectants, and bleach may be used in moderation.

2. One of the functions of the septic tank is to accommodate settlement of solid materials suspended in the wastewater before it is discharged to the leaching bed. Suspended solids that discharge to the leaching bed can clog pores within the soil structure and lead to operational difficulties. The baffles located at the inlet and outlet of the tank promote settlement by reducing agitation of the waste materials. The use and regular maintenance of the specified effluent filter will reduce the amount of suspended solids passing into the leaching bed, potentially prolonging the life of the system. Further, the septic tank must be pumped out when sludge/scum levels occupy one-third of its working capacity (approximately every three to five years).

3. All sewage systems have a limited liquid capacity. It is important for satisfactory long-term operation of the system to minimize extraneous sources of water being discharged to the leaching bed. Some common sources of extraneous water to be considered and methods of eliminating or minimizing their effects on the sewage system are described as follows:

    - Backwash water from water treatment systems, particularly water softeners can have an adverse affect on the operation of the system and also can cause premature rotting of concrete tanks. This water should be discharged elsewhere.
    - Wastewater from a kitchen equipped with a garbage grinder increases solids accumulation in the septic tank and therefore should not be used with an on-site sewage system.
    - Sump pump discharge and roof leader lines must drain into swales away from the leaching bed area and must not discharge into the sewage system.
    - Lot drainage must be completed such that properly graded swales direct surface water runoff around and away from the leaching bed.
    - The entire leaching bed area must be provided with good grass growth to help minimize infiltration and maximize evapotranspiration. Trees or shrubs should not be planted over the leaching bed area to encourage evaporation and prevent root intrusion into the distribution pipes.
    - Sprinkler systems should not be installed over the leaching bed area.

GENERAL SEWAGE SYSTEM OPERATION AND MAINTENANCE

(continued)

- The owner should use reasonable water consumption practices and not overload the system with high sustained flows or excessive peak flows.
- Water from pools or whirlpools can overload the system and impede biological processes in the system due to a relatively high concentration of chlorine. This water should be discharged elsewhere.

4. For sewage systems with a tertiary treatment unit, the owner must enter into an ongoing servicing and maintenance agreement with the unit manufacturer/distributor or authorized representative.

5. For a shallow buried trench leaching bed, effluent testing must be carried out annually in accordance with Article 8.9.2.4. of the OBC, and the effluent pump dosage should be monitored and adjusted periodically to reflect actual daily dosage.

For a sand area leaching bed, effluent testing must be carried out in accordance with the associated Building Materials Evaluation Commission Authorization Report (annual effluent testing recommended), and the pump dosage should be monitored and adjusted periodically to reflect daily dosage (if applicable).

Appendix 2 Tables

TABLE 101

GROUNDWATER MEASUREMENTS

Sage Campground - Sewage Systems Assessment
1912 Whistle Bare Road, Township of North Dumfries, Ontario

Borehole Number	Ground Surface Elevation (mASL)	Top of Pipe Elevation (mASL)	Pipe Diameter (mm)	April 27, 2012		July 3, 2012		August 8, 2012	
				Groundwater Elevation (mbTOP)	Groundwater Elevation (mASL)	Groundwater Elevation (mbTOP)	Groundwater Elevation (mASL)	Groundwater Elevation (mbTOP)	Groundwater Elevation (mASL)
1-12	300.48	301.27	50	1.76	298.72	1.94	298.54	2.04	298.44
2-12	301.19	301.92	50	2.46	298.73	2.66	298.53	2.78	298.41
3-12	299.68	300.54	50	1.19	298.49	1.36	298.32	1.47	298.21
3-12 (upper)	299.68	300.56	19	1.19	298.49	1.33	298.35	1.34	298.34
3-12 (lower)	299.68	300.52	19	1.25	298.43	1.25	298.43	1.49	298.19
4-12	298.95	299.70	50	0.61	298.34	0.78	298.17	0.86	298.09
5-12	298.98	299.71	50	1.34	297.64	1.49	297.49	1.57	297.41
6-12	298.48	299.16	50	0.98	297.50	1.15	297.33	1.23	297.25
7-12	297.96	298.73	50	1.11	296.85	1.27	296.69	1.33	296.63
8-12 (upper)	301.24	302.14	19	dry	dry	dry	dry	dry	dry
8-12 (lower)	301.24	302.06	50	3.14	298.10	3.37	297.87	3.48	297.76
MP-1	298.81	300.46	19	0.51	298.30	0.68	298.13	0.76	298.05
SW-1	--	--	--	--	298.51	--	298.34	--	298.22
MP-2	296.67	298.21	19	0.35	296.32	0.44	296.23	0.46	296.21
SW-2	--	--	--	--	296.26	--	296.22	--	296.19
MP-3	298.21	299.11	19	0.56	297.65	0.26	297.95	0.24	297.97
SW-3	--	--	--	--	297.90	--	297.88	--	297.89
MP-4	297.88	298.85	19	0.46	297.42	0.34	297.54	0.33	297.55
SW-4	--	--	--	--	297.51	--	297.44	--	297.43

Notes:

1. MP = mini-piezometer

2. SW = surface water adjacent the mini-piezometer

TABLE 102

GROUNDWATER CHEMISTRY

Sage Campground - Sewage Systems Assessment
1912 Whistle Bare Road, Township of North Dumfries, Ontario

Parameter	ODWS	Type of Objective	April 27, 2012								
			BH 1-12	BH 2-12	BH 3-12	BH 4-12	BH 5-12	BH 6-12	BH 7-12	BH 8-12	Supply Well
Total Ammonia as N (mg/L)	--	--	<0.050	0.115	0.109	0.068	0.096	0.232	0.164	0.130	<0.050
Nitrate as N (mg/L)	10[a]	MAC	0.69	6.74	3.28	5.87	5.88	<0.10	1.28	1.61	7.36
Nitrite as N (mg/L)	10[a]	MAC	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.50
Total Kjeldahl Nitrogen (mg/L)	--	--	<0.15	<0.15	0.17	0.31	0.16	0.81	0.32	0.22	--
Total Phosphorous (mg/L)	--	--	0.532	1.14	1.09	1.13	0.332	1.16	1.52	0.179	<0.050
E. Coli (CFU/100 mL)	N/D	MAC	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Coliforms (CFU/100 mL)	N/D	MAC	**210**	<10	<10	<10	**20**	**10**	**20**	**30**	**13**
pH	6.5-8.5	OG	7.70	7.76	7.91	7.72	7.64	7.63	7.64	7.82	7.89
Temperature (degrees C)	15	AO	app. 7.9	app. 7.9	app. 7.9	7.9	app. 7.9	7.5	8.8	app. 7.9	--

Parameter	ODWS	Type of Objective	July 3, 2012								
			BH 1-12	BH 2-12	BH 3-12	BH 4-12	BH 5-12	BH 6-12	BH 7-12	BH 8-12	Supply Well
Total Ammonia as N (mg/L)	--	--	<0.050	0.061	<0.050	<0.050	<0.050	0.455	0.072	<0.050	<0.050
Nitrate as N (mg/L)	10[a]	MAC	1.01	7.37	4.92	5.52	0.78	<0.10	2.14	3.58	8.49
Nitrite as N (mg/L)	10[a]	MAC	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Kjeldahl Nitrogen (mg/L)	--	--	0.20	0.40	0.18	0.46	0.16	1.37	0.45	0.25	--
Total Phosphorous (mg/L)	--	--	0.035	0.040	0.059	0.596	0.063	0.513	0.070	0.074	<0.050
E. Coli (CFU/100 mL)	N/D	MAC	0	0	0	0	0	0	0	0	0
Total Coliforms (CFU/100 mL)	N/D	MAC	**240**	**90**	**30**	**10**	**7**	**50**	**20**	**20**	0
pH	6.5-8.5	OG	7.37	7.55	7.46	7.41	7.28	6.70	7.41	7.57	7.98
Temperature (degrees C)	15	AO	11.1	10.7	10.0	11.4	12.8	12.0	13.1	10.4	--

Parameter	ODWS	Type of Objective	August 8, 2012								
			BH 1-12	BH 2-12	BH 3-12	BH 4-12	BH 5-12	BH 6-12	BH 7-12	BH 8-12	Supply Well
Total Ammonia as N (mg/L)	--	--	<0.050	<0.050	<0.050	<0.050	<0.050	0.392	<0.050	<0.050	<0.050
Nitrate as N (mg/L)	10[a]	MAC	1.12	8.68	5.72	6.61	1.00	<0.10	2.91	4.23	9.40
Nitrite as N (mg/L)	10[a]	MAC	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Kjeldahl Nitrogen (mg/L)	--	--	0.16	0.28	0.29	0.61	0.26	1.54	0.38	<0.15	--
Total Phosphorous (mg/L)	--	--	0.046	0.687	2.23	0.032	2.12	0.438	0.487	0.094	<0.050
E. Coli (CFU/100 mL)	N/D	MAC	0	0	0	0	0	0	0	0	0
Total Coliforms (CFU/100 mL)	N/D	MAC	**70**	**640**	**1**	**1**	**1**	**10**	**10**	**3**	0
pH	6.5-8.5	OG	6.95	7.34	7.48	7.49	7.36	6.78	7.26	7.56	7.96
Temperature (degrees C)	15	AO	12.3	13.7	13.0	11.0	14.9	13.6	14.6	11.2	--

Notes:
1. *Criteria from Ontario Drinking Water Standards (MOE, 2006)*
2. *Testing carried out at ALS Laboratories, Waterloo, Ontario*
3. *All highlighted / bold values exceed the Ontario Drinking Water Standard*
4. *MAC - Maximum Acceptable Concentration (health-related); AO - Aesthetic Objective (non-health-related); OG - Operational Guideline (non-health-related)*

a. *Where both nitrate and nitrite are present, the total of the two should not exceed 10 mg/L (as nitrogen)*

TABLE 103
SURFACE WATER CHEMISTRY
Sage Campground - Sewage Systems Assessment
1912 Whistle Bare Road, Township of North Dumfries, Ontario

Parameter	PWQO	April 27, 2012	July 3, 2012	August 8, 2012	September 5, 2012
Total Ammonia as N (mg/L)	--	0.109	<0.050	<0.050	<0.05
Nitrate as N (mg/L)	--	5.80	6.92	7.58	7.1
Nitrite as N (mg/L)	--	<0.10	<0.10	<0.10	<0.10
Total Kjeldahl Nitrogen (mg/L)	--	0.52	0.25	0.25	0.39
Total Phosphorous (mg/L)	0.030	<0.030	<0.030	<0.030	0.0044
E. Coli (CFU/100 mL)	100 CFU/100 mL	78	**260**	**330**	**220**
Total Coliforms (CFU/100 mL)	--	85	2700	5100	9700
Biochemical Oxygen Demand (BOD_5) (mg/L)	--	2.5	<2.0	<2.0	<2.0
Total Suspended Solids (mg/L)	--	6.0	9.6	48.0	15.2
pH	6.5 - 8.5	7.86	8.23	7.91	7.87
Temperature (degrees C)	--	approx. 8	11.0	12.2	11.2
Un-ionized Ammonia as N (mg/L)	0.020	approx. 0.002	<0.001	<0.001	<0.001

Notes:
1. *Criteria from Provincial Water Quality Objectives (MOE, 1994)*
2. *Testing carried out at ALS Laboratories, Waterloo, Ontario*
3. *All highlighted / bold values exceed the Provincial Water Quality Objective*

TABLE 104
WATER SUPPLY SYSTEM CHEMISTRY ANALYSIS
Sage Campground - Sewage Systems Assessment
1912 Whistle Bare Road, Township of North Dumfries, Ontario

Parameter	ODWS	Type of Objective	27-Apr-12	3-Jul-12	8-Aug-12
			Raw - Pumphouse		
Total Ammonia as N (mg/L)	--	--	<0.050	<0.050	<0.050
Nitrate as N (mg/L)	10[a]	MAC	7.36	8.49	9.40
Nitrite as N (mg/L)	10[a]	MAC	<0.50	<0.10	<0.10
Total Kjeldahl Nitrogen (mg/L)	--	--	--	--	--
Total Phosphorous (mg/L)	--	--	<0.050	<0.050	<0.050
E. Coli (CFU/100 mL)	N/D	MAC	<10	0	0
Total Coliforms (CFU/100 mL)	N/D	MAC	**13**	0	0
pH	6.5-8.5	OG	7.89	7.98	7.96
Temperature (degrees C)	15	AO	--	--	--

Parameter	ODWS	Type of Objective	29-Apr-13		27-May-13		05-Jul-13	
			Distribution - Site 46	Raw - Pumphouse	Distribution - Site 47	Raw - Pumphouse	Distribution - Site 80	Raw - Pumphouse
Total Coliforms (CFU/100 mL)	0	MAC	0	0	0	**1**	0	0
E. Coli (CFU/100 mL)	0	MAC	0	0	0	0	0	0
Chlorine - Free	--	--	--	--	2.3	--	1.38	--
Lead	10	MAC	--	--	<1.0	--	--	--
Nitrate as N (mg/L)	10	MAC	--	--	--	4.45	--	--
Nitrite as N (mg/L)	1	MAC	--	--	--	<0.10	--	--

TABLE 105
SURFACE WATER CHEMISTRY ANALYSIS - July 11, 2014
Sage Campground - Sewage Systems Assessment
1912 Whistle Bare Road, Township of North Dumfries, Ontario

PARAMETER	PWQO	SP2 Upgradient	SP1 (MP2-12) Downgradient
Color, Apparent	--	10	9
Conductivity	--	408	613
Hardness (as CaCO3)	--	189	273
pH	6.5 - 8.5	**8.55**	8.13
Total Dissolved Solids	--	241	339
Turbidity	--	1	2
Alkalinity, Total (as CaCO3)	--	153	215
Ammonia, Total (as N)	--	<0.050	<0.050
Chloride	--	36	41
Fluoride	--	<0.10	<0.10
Nitrate-N	--	1	5
Nitrite-N	--	<0.10	<0.10
Total Kjeldahl Nitrogen	--	1	0
Phosphate-P (ortho)	--	<0.0030	<0.0030
Total Phosphorus	10 - 30 mg/L	0	0
Sulphate	--	23	26
E. Coli	100 CFU / 100mL	**150**	**300**
Total Coliforms	--	600	800
Aluminum (Al)-Total	0.0015 mg/L	<0.010	**0.027**
Antimony (Sb)-Total	0.02 mg/L	<0.0050	<0.0050
Arsenic (As)-Total	0.005 mg/L	<0.0010	<0.0010
Barium (Ba)-Total	--	0	0
Beryllium (Be)-Total	0.011 mg/L	<0.0010	<0.0010
Bismuth (Bi)-Total	--	<0.0010	<0.0010
Boron (B)-Total	0.2 mg/L	<0.050	<0.050
Cadmium (Cd)-Total	0.0001 mg/L	<0.000090	<0.000090
Calcium (Ca)-Total	--	35	67
Chromium (Cr)-Total	--	<0.00050	<0.00050
Cobalt (Co)-Total	0.0009 mg/L	<0.00050	<0.00050
Copper (Cu)-Total	0.001 mg/L	<0.0010	<0.0010
Iron (Fe)-Total	0.3 mg/L	<0.050	<0.050
Lead (Pb)-Total	0.001 mg/L	<0.0010	<0.0010
Magnesium (Mg)-Total	--	25	26
Manganese (Mn)-Total	--	0	0
Molybdenum (Mo)-Total	0.04 mg/L	<0.0010	<0.0010
Nickel (Ni)-Total	0.025 mg/L	<0.0020	<0.0020
Potassium (K)-Total	--	1	1
Selenium (Se)-Total	0.1 mg/L	<0.00040	<0.00040
Silicon (Si)-Total	--	4	5
Silver (Ag)-Total	0.0001 mg/L	<0.00010	<0.00010
Sodium (Na)-Total	--	16	20
Strontium (Sr)-Total	--	0	0
Thallium (Tl)-Total	0.0003 mg/L	<0.00030	<0.00030
Tin (Sn)-Total	--	<0.0010	<0.0010
Titanium (Ti)-Total	--	<0.0020	<0.0020
Tungsten (W)-Total	0.03 mg/L	<0.010	<0.010
Uranium (U)-Total	0.005 mg/L	<0.0050	<0.0050
Vanadium (V)-Total	0.006 mg/L	<0.0010	<0.0010
Zinc (Zn)-Total	0.02 mg/L	<0.0030	<0.0030
Zirconium (Zr)-Total	0.004 mg/L	<0.0040	<0.0040
BOD Carbonaceous	--	<2.0	<2.0

Notes:

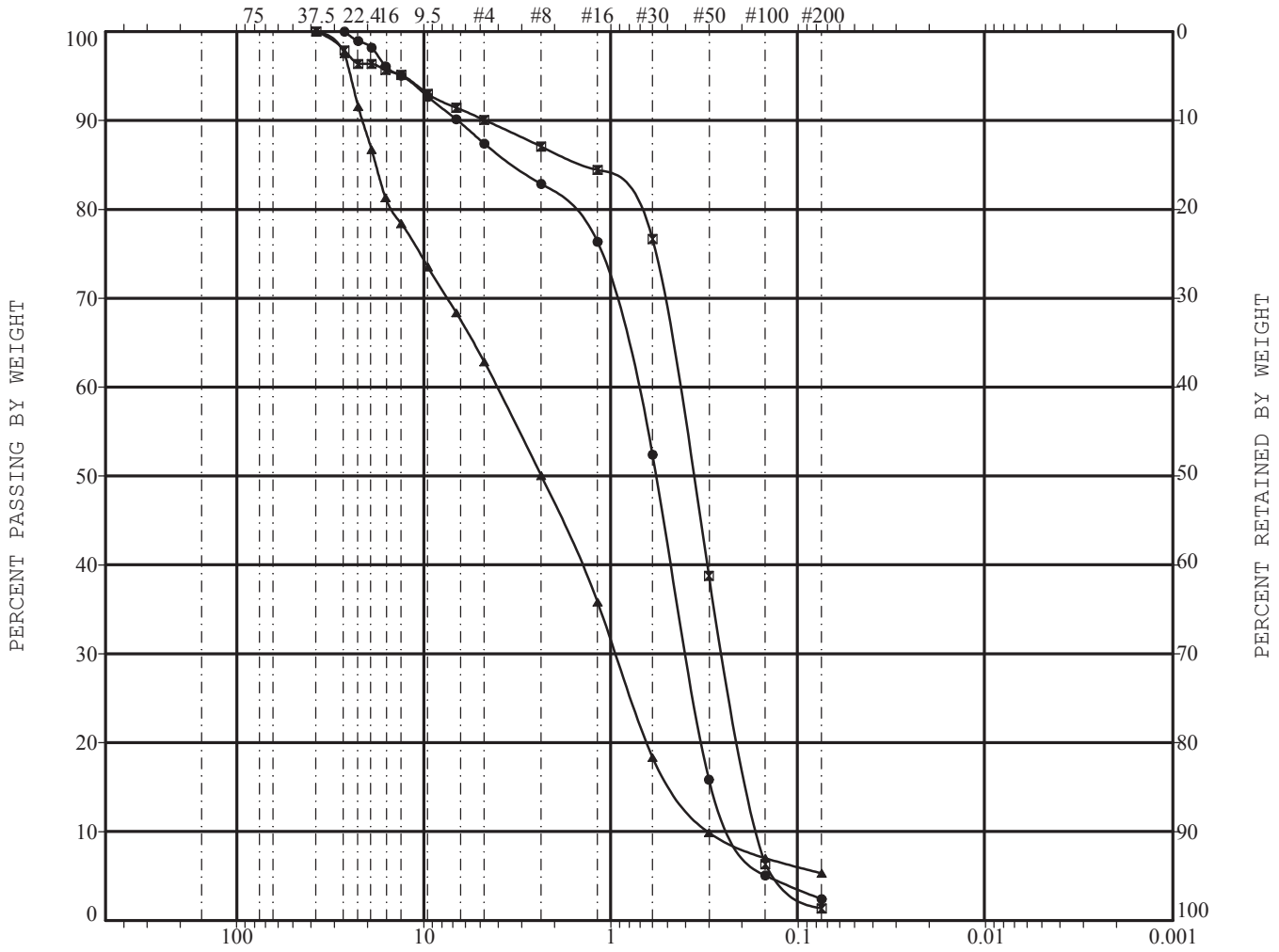
1. *Criteria from Provincial Water Quality Objectives (MOE, 1994)*
2. *Testing carried out at ALS Laboratories, Waterloo, Ontario*
3. *All highlighted / bold values exceed the Provincial Water Quality Objective*

Appendix 3 Figures

Figures 1, 2 and 3: Particle Size Distribution Analyses

UNIFIED SOIL CLASSIFICATION

COBBLES	*GRAVEL*		*SAND*			*SILT OR CLAY*
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN MILLIMETRES			U.S. STANDARD SIEVE No.			HYDROMETER



PROJECT Sage Campground - Sewage System Assessment

LOCATION 1912 Whistle Bare Road, Township of North Dumfries, ON JOB NO. P-0000145-400

CURVE ID	BOREHOLE/ TEST PIT	SAMPLE NO.	DEPTH (m)	SOIL DESCRIPTION
●	TP4-13	1	0.8 - 1.1	SAND, some Gravel, trace Silt
⊠	TP10-13	1	1.1 - 1.4	SAND, some Gravel, trace Silt
▲	TP11-13	1	0.6 - 0.9	SAND and GRAVEL, trace Silt

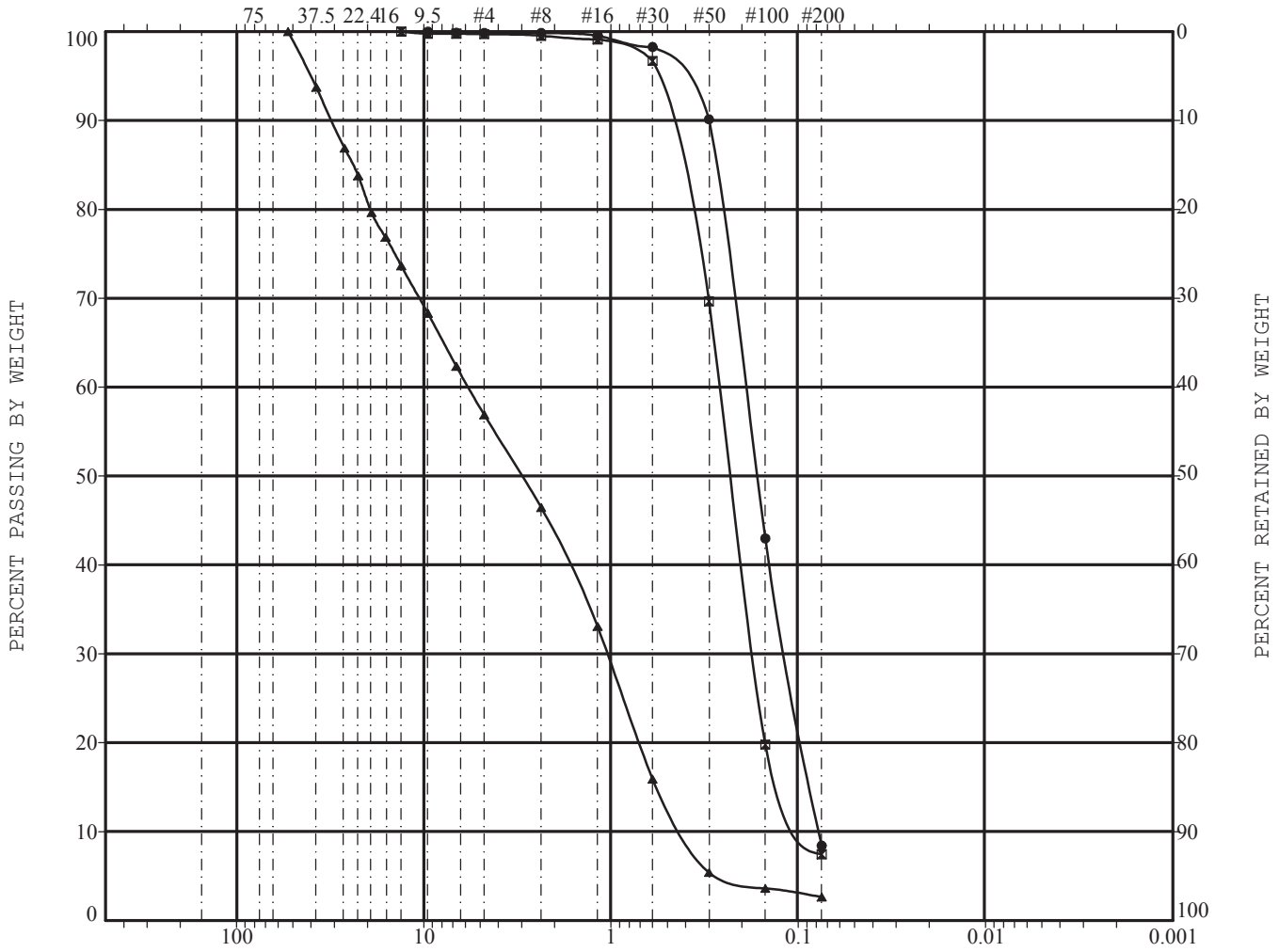
REMARKS

LVM

Figure No. 1

UNIFIED SOIL CLASSIFICATION

COBBLES	*GRAVEL*		*SAND*			*SILT OR CLAY*
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN MILLIMETRES			U.S. STANDARD SIEVE No.			HYDROMETER



PROJECT Sage Campground - Sewage System Assessment

LOCATION 1912 Whistle Bare Road, Township of North Dumfries, ON JOB NO. P-0000145-400

CURVE ID	BOREHOLE/ TEST PIT	SAMPLE NO.	DEPTH (m)	SOIL DESCRIPTION
●	TP3-13	1	1.5 - 1.8	SAND, trace Silt
⊠	TP6-13	1	1.2 - 1.5	SAND, trace Silt
▲	TP9-13	1	1.1 - 1.4	SAND and GRAVEL, trace Silt

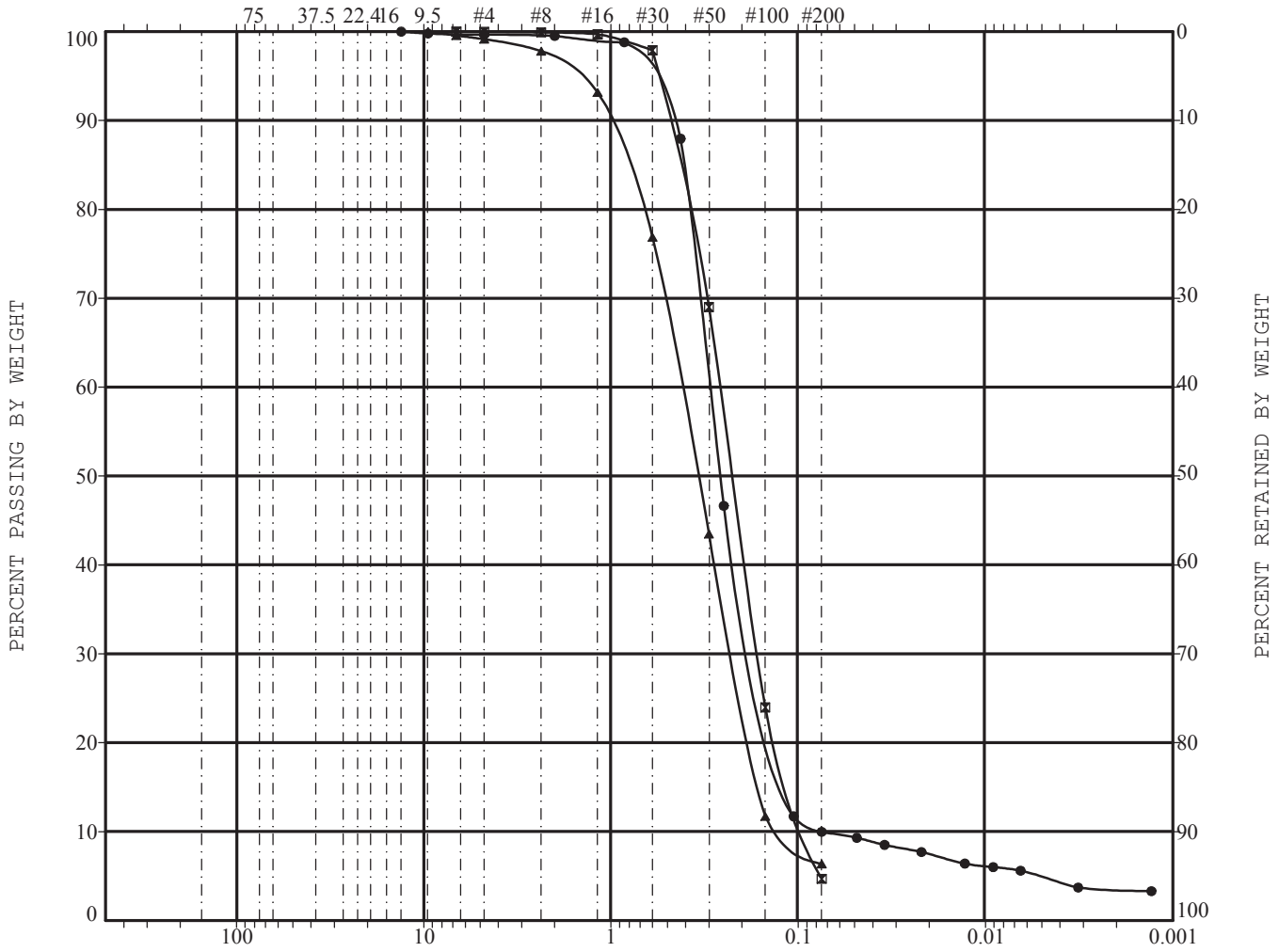
REMARKS

LVM

Figure No. 2

UNIFIED SOIL CLASSIFICATION

COBBLES	*GRAVEL*		*SAND*			*SILT OR CLAY*
	COARSE	FINE	COARSE	MEDIUM	FINE	
U.S. SIEVE SIZE IN MILLIMETRES			U.S. STANDARD SIEVE No.			HYDROMETER



PROJECT Sage Campground - Sewage System Assessment

LOCATION 1912 Whistle Bare Road, Township of North Dumfries, ON JOB NO. P-0000145-400

CURVE ID	BOREHOLE/ TEST PIT	SAMPLE NO.	DEPTH (m)	SOIL DESCRIPTION
●	TP1-13	1	1.5 - 1.8	SAND, trace Silt
⊠	TP2-13	1	0.3 - 0.6	SAND, trace Silt
▲	TP5-13	1	0.9 - 1.2	SAND, trace Silt and Gravel

REMARKS

LVM

Figure No. 3

Appendix 4 Borehole, Test Pit, and Mini Piezometer Logs

List of Abbreviations

Boreholes BH-01-12 to BH-08-12

Test Pits TP-1-13 to TP-11-13

Mini Piezometers MP-01-12 to MP-04-12

LIST OF ABBREVIATIONS

The abbreviations commonly employed on the borehole logs, on the figures, and in the text of the report, are as follows:

Sample Types		Soil Tests and Properties	
AS	Auger Sample	SPT	Standard Penetration Test
CS	Core Sample	UC	Unconfined Compression
RC	Rock Core	FV	Field Vane Test
SS	Split Spoon	ø	Angle of internal friction
TW	Thinwall, Open	γ	Unit weight
WS	Wash Sample	w_p	Plastic limit
BS	Bulk Sample	w	Water content
GS	Grab Sample	w_L	Liquid limit
WC	Water Content Sample	I_L	Liquidity index
TP	Thinwall, Piston	I_p	Plasticity index
		PP	Pocket penetrometer

Penetration Resistances	
Dynamic Penetration Resistance	The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) diameter 60º cone a distance 300 mm (12 in.). The cone is attached to 'A' size drill rods and casing is not used.
Standard Penetration Resistance, N (ASTM D1586)	The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a standard split spoon sampler 300 mm (12 in.)
WH	sampler advanced by static weight of hammer
PH	sampler advanced by hydraulic pressure
PM	sampler advanced by manual pressure

Soil Description			
Cohesionless Soils		**SPT N-Value**	**Relative Density (D_r)**
Compactness Condition		(blows per 0.3 m)	(%)
Very Loose		0 to 4	0 to 20
Loose		4 to 10	20 to 40
Compact		10 to 30	40 to 60
Dense		30 to 50	60 to 80
Very Dense		over 50	80 to 100
Cohesive Soils		**Undrained Shear Strength (C_u)**	
Consistency		**kPa**	**psf**
Very Soft		less than 12	less than 250
Soft		12 to 25	250 to 500
Firm		25 to 50	500 to 1000
Stiff		50 to 100	1000 to 2000
Very Stiff		100 to 200	2000 to 4000
Hard		over 200	over 4000
DTPL	Drier than plastic limit	Low Plasticity, W_L <30	
APL	About plastic limit	Medium Plasticity, 30 < W_L < 50	
WTPL	Wetter than plastic limit	High Plasticity, W_L > 50	

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Ground Elevation: *300.48 m*

Borehole Number: **BH-1-12**

Job N°: *P-0000145-0-00-400*

Drill Date: *2012-04-24*

Project: *Sage Campground - Sewage Systems Assessment*

Field Tech: *R.McMillan*

Location: *1912 Whistle Bare Road, Township of North Dumfries, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		300.48			
	FILL: dark brown sandy silt (topsoil), moist		0.00 / 299.72			
	trace fine gravel		0.76 / 299.57			
1	***TOPSOIL:*** dark brown sandy silt, moist		0.91 / 298.96	SS-1	3-4 4	8
	some black peat layers, WTPL		1.52 / 298.65	SS-2	3-3 4	7
2	***SAND:*** loose to very loose brown fine to coarse sand, some silt, saturated		1.83	SS-3	2-2 2	4
3				SS-4	1-1 2	3
4			295.91			
	compact		4.57	SS-5	5-8 8	16
5	Borehole terminated at 5.03 m		295.45 / 5.03			
6						

Dynamic Cone: 20 40 60 80
Std Penetration: 20 40 60 80
Shear Strength (PP) kPa: 50 100 150 200
Initial
Remold
Shear Strength (FV) kPa: 50 100 150 200
WP WL
Water Content (%): 10 20 30

Groundwater Observations and Standpipe Details

protective cover and concrete
el. 298.72 m 2012-04-27
bentonite seal
sand pack
50 mm pipe
1.52 m slotted screen
native cave

Vertical Scale = 1 : 40.0

Reviewed by: *D.Morlock*

Drafted by: *S.Meteer*

Sheet: *1 of 1*

Notes: *Top of pipe elevation = 301.27 m*

EQ-09-Ge-72 R.1 18.02.2011

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Ground Elevation: *301.19 m*

Borehole Number: **BH-2-12**

Job N°: *P-0000145-0-00-400*

Drill Date: *2012-04-24*

Project: *Sage Campground - Sewage Systems Assessment*

Field Tech: *R.McMillan*

Location: *1912 Whistle Bare Road, Township of North Dumfries, Ontario*

Drill Method: *Hollow Stem Auger*

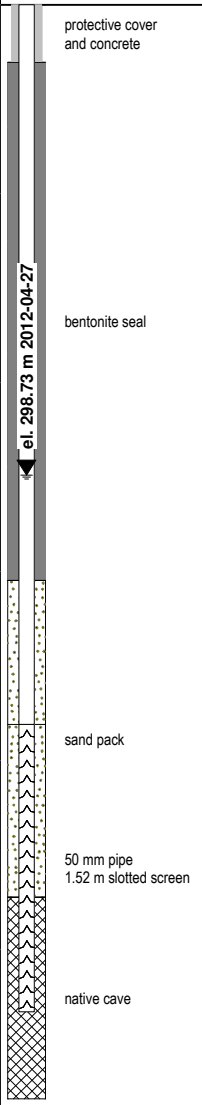
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		301.19			
	FILL: dark brown sandy silt (topsoil), moist		0.00 301.11 0.08			
	SAND AND GRAVEL: compact brown sand and gravel, trace silt, damp			SS-1	3-7 10	17
				SS-2	7-13 14	27
			298.90			
	SAND: compact brown fine to coarse sand, some gravel, damp		2.29 298.75 2.44	SS-3	5-8 8	16
	saturated			SS-4	7-10 9	19
				SS-5	5-5 5	10
				SS-6	6-9 10	19
			295.40			
	Borehole terminated at 5.79 m		5.79			

Dynamic Cone / Std Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200 — Initial / Remold

Water Content (%): WP WL; 10 20 30

Groundwater Observations and Standpipe Details



Vertical Scale = 1 : 40.0

Reviewed by: *D.Morlock*

Drafted by: *S.Meteer*

Sheet: *1 of 1*

Notes: *Top of pipe elevation = 301.92 m*

EQ-09-Ge-72 R.1 18.02.2011

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Ground Elevation: *299.68 m*

Borehole Number: **BH-3-12**

Job N°: *P-0000145-0-00-400*

Drill Date: *2012-04-24*

Project: *Sage Campground - Sewage Systems Assessment*

Field Tech: *R.McMillan*

Location: *1912 Whistle Bare Road, Township of North Dumfries, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		299.68			
	FILL: dark brown sandy silt, moist		0.00 / 299.60 / 0.08			
1	loose brown fine to coarse sand, some silt, damp			SS-1	4-6 3	9
			298.46			
	PEAT: very soft black amorphous peat, WTPL		1.22			
			297.85	SS-2	0-0 1-2	1
2	***MARL:*** very soft grey marl, shells, WTPL		1.83			
			297.39			
	SAND: very loose to loose brown fine to coarse sand, saturated		2.29	SS-3	3-3 3	6
3	some silty sand layers		296.63 / 3.05	SS-4	2-1 1	2
	compact		296.02 / 3.66			
4				SS-5	4-6 8	14
5				SS-6		
			294.35			
	Borehole terminated at 5.33 m		5.33			
6						

Dynamic Cone / Std Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200 — Initial / Remold

Water Content (%): WP WL; 10 20 30

Groundwater Observations and Standpipe Details

el. 298.49 m 2012-04-27
el. 298.49 m 2012-04-27
el. 298.43 m 2012-04-27

protective cover and concrete
bentonite seal
19 mm pipe
0.15 m slotted filter
sand pack
bentonite seal
sand pack
50 mm pipe
1.52 m slotted screen
19 mm pipe
0.15 m slotted filter

Vertical Scale = 1 : 40.0

Reviewed by: *D.Morlock*

Drafted by: *S.Meteer*

Sheet: *1 of 1*

Notes: *Top of pipe elevation = 300.54 m (50 mm), 300.56 m (19 mm upper), 300.52 m (19 mm lower)*

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Ground Elevation: *298.95 m*

Borehole Number: **BH-4-12**

Job N°: *P-0000145-0-00-400*

Drill Date: *2012-04-24*

Project: *Sage Campground - Sewage Systems Assessment*

Field Tech: *R.McMillan*

Location: *1912 Whistle Bare Road, Township of North Dumfries, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		298.95			
	FILL: brown silt, some sand, moist		0.00			
			298.04	SS-1	/WH	
1	***PEAT:*** very soft black amorphous peat, WTPL		0.91			
			297.43	SS-2	/WH	
	MARL: very soft light beige marl, saturated		1.52			
2				SS-3	/WH	
3				SS-4	/WH	
			295.37			
	SAND: loose brown fine to coarse sand, trace silt, saturated		3.58	SS-5	1-5 5	10
4						
				SS-6	3-3 3	6
5			293.92			
	Borehole terminated at 5.03 m		5.03			
6						

Dynamic Cone — Std Penetration: 20 40 60 80

Shear Strength (PP) kPa: 50 100 150 200 — Initial / Remold — Shear Strength (FV) kPa: 50 100 150 200

WP WL — Water Content (%): 10 20 30

Groundwater Observations and Standpipe Details

- protective cover and concrete
- el. 298.34 m 2012-04-27
- bentonite seal
- sand pack
- 50 mm pipe
- 1.52 m slotted screen
- native cave

Reviewed by: *D.Morlock*

Drafted by: *S.Meteer*

Sheet: *1 of 1*

Notes: *Top of pipe elevation = 299.70 m*

Vertical Scale = 1 : 40.0

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Ground Elevation: *298.98 m*

Borehole Number: **BH-5-12**

Job N°: *P-0000145-0-00-400*

Drill Date: *2012-04-24*

Project: *Sage Campground - Sewage Systems Assessment*

Field Tech: *R.McMillan*

Location: *1912 Whistle Bare Road, Township of North Dumfries, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		298.98			
	TOPSOIL: dark brown sandy silt,moist		0.00 / 298.90 / 0.08			
	SAND: compact brown fine to coarse sand, trace silt and fine gravel, damp			SS-1	3-6 7	13
	saturated		297.76 / 1.22			
				SS-2	5-7 8	15
	loose		296.69 / 2.29	SS-3	2-2 4	6
				SS-4	2-4 6	10
	Borehole terminated at 3.81 m		295.17 / 3.81			

Dynamic Cone: 20 40 60 80
Std Penetration: 20 40 60 80
Shear Strength (PP) kPa: 50 100 150 200
Initial / Remold
Shear Strength (FV) kPa: 50 100 150 200
WP WL
Water Content (%): 10 20 30

Groundwater Observations and Standpipe Details

el. 297.64 m 2012-04-27

protective cover and concrete

bentonite seal

native cave
50 mm pipe
1.52 m slotted screen

Vertical Scale = 1 : 40.0

Reviewed by: *D.Morlock*

Drafted by: *S.Meteer*

Sheet: *1 of 1*

Notes: *Top of pipe elevation = 299.71 m*

EQ-09-Ge-72 R.1 18.02.2011

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Ground Elevation: *298.48 m*

Borehole Number: **BH-6-12**

Job N°: *P-0000145-0-00-400*

Drill Date: *2012-04-24*

Project: *Sage Campground - Sewage Systems Assessment*

Field Tech: *R.McMillan*

Location: *1912 Whistle Bare Road, Township of North Dumfries, Ontario*

Drill Method: *Hollow Stem Auger*

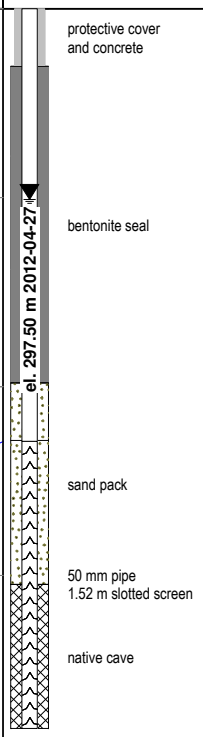
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		298.48			
	FILL: brown sandy silt, some gravel, moist		0.00 / 297.57			
1	***PEAT:*** soft black amorphous peat		0.91 / 296.58	SS-1	1-1 1	2
				SS-2	/WH	
2	***MARL:*** very soft grey marl, WTPL		1.91 / 296.19			
	SAND: loose grey fine to coarse sand, trace silt and fine gravel, saturated		2.29	SS-3	3-2 9	11
3				SS-4	1-4 4	8
				AS-5		
	Borehole terminated at 3.81 m		294.67 / 3.81			
4						
5						
6						

Dynamic Cone — Std Penetration: 20 40 60 80

Shear Strength (PP) kPa: 50 100 150 200 — Initial / Remold — Shear Strength (FV) kPa: 50 100 150 200

WP WL — Water Content (%): 10 20 30

Groundwater Observations and Standpipe Details



Vertical Scale = 1 : 40.0

Reviewed by: *D.Morlock*

Drafted by: *S.Meteer*

Sheet: *1 of 1*

Notes: *Top of pipe elevation = 299.16 m*

EQ-09-Ge-72 R.1 18.02.2011

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Ground Elevation: *297.96 m*

Borehole Number: **BH-7-12**

Job N°: *P-0000145-0-00-400*

Drill Date: *2012-04-25*

Project: *Sage Campground - Sewage Systems Assessment*

Field Tech: *R.McMillan*

Location: *1912 Whistle Bare Road, Township of North Dumfries, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		297.96			
	TOPSOIL: dark brown silt, moist		0.00 / 297.65			
	SAND: compact brown silty fine to medium sand, moist		0.30 / 297.05			
1	saturated		0.91	SS-1	6-8 10	18
				SS-2	6-8 8	16
2				SS-3	4-7 11	18
	compact brown fine to coarse sand, trace silt and fine gravel, saturated		295.37 / 2.59			
3				SS-4	4-8 8	16
	Borehole terminated at 3.81 m		294.15 / 3.81			
4						
5						
6						

Dynamic Cone / Std Penetration: 20 40 60 80

Shear Strength (PP) kPa / Shear Strength (FV) kPa: 50 100 150 200 — Initial / Remold

Water Content (%): WP WL — 10 20 30

Groundwater Observations and Standpipe Details

el. 296.85 m 2012-04-27

protective cover and concrete

bentonite seal

sand pack
50 mm pipe
1.52 m slotted screen

Vertical Scale = 1 : 40.0

Reviewed by: *D.Morlock*

Drafted by: *S.Meteer*

Sheet: *1 of 1*

Notes: *Top of pipe elevation = 298.73 m*

LVM

Ground Elevation: *301.24 m*

Borehole Number: **BH-8-12**

Job N°: *P-0000145-0-00-400*

Drill Date: *2012-04-25*

Project: *Sage Campground - Sewage Systems Assessment*

Field Tech: *R.McMillan*

Location: *1912 Whistle Bare Road, Township of North Dumfries, Ontario*

Drill Method: *Hollow Stem Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		301.24			
	TOPSOIL: dark brown silt, moist		0.00 / 301.04			
	SILT: loose brown silt, some sand, trace clay, roots, moist		0.20 / 300.63			
	stiff brown silt, some clay, DTPL		0.61 / 299.72	SS-1	3-4 5	9
1	compact brown silt, trace fine sand, moist		1.52 / 298.95	SS-2	4-6 6	12
2	***SILT TILL:*** loose brown silt, some sand, trace clay and gravel, moist		2.29 / 298.19	SS-3	5-4 4	8
3	***SILT:*** compact brown silt, saturated, dilatant		3.05 / 297.43	SS-4	5-6 6	12
4	***SILT / SAND:*** loose to compact brown silt / fine sand, saturated, dilatant		3.81 / 295.75	SS-5	3-4 4	8
5				SS-6	5-7 10	17
	SILT TILL: dense brown silt, some sand, moist		5.49 / 295.45	SS-7	9-18 16	34
6	Borehole terminated at 5.79 m		5.79			

Dynamic Cone: 20 40 60 80
Std Penetration: 20 40 60 80
Shear Strength (PP) kPa: 50 100 150 200
Initial
Remold
Shear Strength (FV) kPa: 50 100 150 200
WP WL
Water Content (%): 10 20 30

Groundwater Observations and Standpipe Details

protective cover and concrete
bentonite seal
sand pack
19 mm pipe
0.91 m slotted filter
2012-04-27
upper standpipe dry
el. 298.10 m 2012-04-27
bentonite seal
50 mm pipe
1.52 m slotted screen
sand pack

Reviewed by: *D.Morlock*

Drafted by: *S.Meteer*

Sheet: *1 of 1*

Notes: *MOE Well Tag No. A115242*
Top of pipe elevation = 302.14 m (19 mm upper), 302.06 m (50 mm lower)

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Vertical Scale = 1 : 40.0

EQ-09-Ge-72 R.1 18.02.2011

Test Pit Number: 1-13

Ground Elevation: *n/a*

Project: *Sage Campground - Sewage System Assessment*

Job No.: *P-0000145-400*

Location: *1912 Whistle Bare Road, Township of North Dumfries, ON*

Excavation Date: *April 30th, 2013*

Depth (m)	Description	Symbol	Elevation (m)	Sample Number	Water Content (%) (WP – WL; 10, 20, 30)	Groundwater Observations and Measurements (m)
0.00	Ground Elevation		0.00			
	FILL: dark brown silt (topsoil), moist; rootlets					
	rusty brown sandy silt, moist		-0.50			
	TOPSOIL: layer of brown silt, moist; roots					
1.00	***SILT/SAND:*** light brown silt, trace to some sand, moist		-1.00			
	SAND: grey sand, trace to some silt, wet to saturated		-1.50	1		
	Test pit terminated at 1.9 m.					Upon completion of excacvation, test pit sidewalls stable.
2.00			-2.00			Free groundwater seepage encountered at 1.8 m.
			-2.50			

Reviewed by: *VM*

Drafted by: *BS*

Field Tech: *BS*

Sheet: *1 of 1*

Notes:

Test Pit Number: 10-13

Ground Elevation: *n/a*

Project: *Sage Campground - Sewage System Assessment*

Job No.: *P-0000145-400*

Location: *1912 Whistle Bare Road, Township of North Dumfries, ON*

Excavation Date: *May 1, 2013*

SOIL PROFILE				SAMPLE		
Depth (m)	Description	Symbol	Elevation (m)	Number	Water Content (%) WP / WL / 10 / 20 / 30	Groundwater Observations and Measurements (m)
0.00	Ground Elevation		0.00			
	TOPSOIL: dark brown sandy silt, damp to moist					
	SILT/SAND: rusty brown sand, some silt damp		-0.50			
1.00			-1.00			
	SAND: light brown sand, some gravel, trace silt, damp			1		
			-1.50			
2.00	Test pit terminated at 2.0 m.		-2.00			Upon completion of excacvation, test pit sidewalls stable. No groundwater seepage encountered.
			-2.50			

Reviewed by: *VM*

Drafted by: *BS*

Field Tech: *BS*

Sheet: *1 of 1*

Notes:

Test Pit Number: 11-13

Ground Elevation: *n/a*

Project: *Sage Campground - Sewage System Assessment*

Job No.: *P-0000145-400*

Location: *1912 Whistle Bare Road, Township of North Dumfries, ON*

Excavation Date: *May 1st, 2013*

SOIL PROFILE				SAMPLE		
Depth (m)	Description	Symbol	Elevation (m)	Number	Water Content (%) WP / WL; 10, 20, 30	Groundwater Observations and Measurements (m)
0.00	Ground Elevation		0.00			
	TOPSOIL: dark brown silt, moist; rootlets		-0.50			
	SAND AND GRAVEL: brown coarse sand and gravel, trace silt, damp			1		
1.00			-1.00			
			-1.50			
	Test pit terminated at 1.8 m.					Upon completion of excacvation, test pit sidewalls stable.
2.00			-2.00			No groundwater seepage encountered.
			-2.50			

Reviewed by: *VM*

Drafted by: *BS*

Field Tech: *BS*

Sheet: *1 of 1*

Notes:

Test Pit Number: 2-13

Ground Elevation: *n/a*

Project: *Sage Campground - Sewage System Assessment*

Job No.: *P-0000145-400*

Location: *1912 Whistle Bare Road, Township of North Dumfries, ON*

Excavation Date: *April 30th, 2013*

SOIL PROFILE				SAMPLE		
Depth (m)	Description	Symbol	Elevation (m)	Number	Water Content (%) WP – WL; 10, 20, 30	Groundwater Observations and Measurements (m)
0.00	Ground Elevation		0.00			
	TOPSOIL: dark brown silt, moist; rootlets					
	SILT/SAND: rusty brown silt and sand, moist; rootlets		-0.50	1		
1.00			-1.00			
	SAND: brown sand, trace silt and fine gravel, wet			1		
	saturated		-1.50			
	Test pit terminated at 1.6 m.					Upon completion of excacvation, test pit sidewalls caving. Free groundwater seepage encountered at 1.3 m.
2.00			-2.00			
			-2.50			

Reviewed by: *VM*

Drafted by: *BS*

Field Tech: *BS*

Sheet: *1 of 1*

Notes:

Test Pit Number: 3-13

Ground Elevation: *n/a*

Project: *Sage Campground - Sewage System Assessment*

Job No.: *P-0000145-400*

Location: *1912 Whistle Bare Road, Township of North Dumfries, ON*

Excavation Date: *April 30th, 2013*

SOIL PROFILE				SAMPLE		
Depth (m)	Description	Symbol	Elevation (m)	Number	WP — Water Content (%) — WL (10, 20, 30)	Groundwater Observations and Measurements (m)
0.00	Ground Elevation		0.00			
	TOPSOIL: dark brown silt, damp to moist					
	SILT: rusty brown silt, some sand, moist; rootlets		-0.50			
	SAND: brown sand, trace to some silt, damp					
1.00			-1.00			
	trace silt, very moist		-1.50	1		
	saturated					
2.00			-2.00			
	Test pit terminated at 2.2 m.		-2.50			Upon completion of excacvation, test pit sidewalls stable. Free groundwater seepage encountered at 1.8 m.

Reviewed by: *VM*

Drafted by: *BS*

Field Tech: *BS*

Sheet: *1 of 1*

Notes:

Test Pit Number: 4-13

Ground Elevation: *n/a*

Project: *Sage Campground - Sewage System Assessment*

Job No.: *P-0000145-400*

Location: *1912 Whistle Bare Road, Township of North Dumfries, ON*

Excavation Date: *April 30th, 2013*

SOIL PROFILE				SAMPLE		
Depth (m)	Description	Symbol	Elevation (m)	Number	Water Content (%) WP / WL / 10 / 20 / 30	Groundwater Observations and Measurements (m)
0.00	Ground Elevation		0.00			
	TOPSOIL: dark brown silt, some gravel, damp					
	SILT/SAND: brown to light brown sand and silt, moist		-0.50			
1.00	***SAND:*** brown sand, some gravel, trace silt, very moist		-1.00	1		
	saturated					
	Test pit terminated at 1.4 m.		-1.50			Upon completion of excacvation, test pit sidewalls caving. Free groundwater seepage encountered at 1.2 m.
2.00			-2.00			
			-2.50			

Reviewed by: *VM*

Drafted by: *BS*

Field Tech: *BS*

Sheet: *1 of 1*

Notes:

Test Pit Number: 5-13

Ground Elevation: *n/a*

Project: *Sage Campground - Sewage System Assessment*

Job No.: *P-0000145-400*

Location: *1912 Whistle Bare Road, Township of North Dumfries, ON*

Excavation Date: *April 30th, 2013*

SOIL PROFILE				SAMPLE		
Depth (m)	Description	Symbol	Elevation (m)	Number	Water Content (%) WP / WL / 10 / 20 / 30	Groundwater Observations and Measurements (m)
0.00	Ground Elevation		0.00			
	TOPSOIL: dark brown silt, moist; rootlets					
			-0.50			
	SILT/SAND: rusty brown silt and sand, moist					
	SAND: brown sand, trace silt, very moist					
	saturated					
1.00			-1.00	1		
	Test pit terminated at 1.4 m.		-1.50			Upon completion of excacvation, test pit sidewalls caving. Free groundwater seepage encountered at 0.9 m.
2.00			-2.00			
			-2.50			

Reviewed by: *VM*

Drafted by: *BS*

Field Tech: *BS*

Sheet: *1 of 1*

Notes:

Test Pit Number: 6-13

Ground Elevation: *n/a*

Project: *Sage Campground - Sewage System Assessment*

Job No.: *P-0000145-400*

Location: *1912 Whistle Bare Road, Township of North Dumfries, ON*

Excavation Date: *May 1st, 2013*

SOIL PROFILE				SAMPLE		
Depth (m)	Description	Symbol	Elevation (m)	Number	Water Content (%) WP / WL / 10 / 20 / 30	Groundwater Observations and Measurements (m)
0.00	Ground Elevation		0.00			
	TOPSOIL: dark brown silt, moist; rootlets					
	SILT/SAND: rusty brown silt and sand, moist; rootlets		-0.50			
1.00	***SAND:*** brown sand, trace silt, moist		-1.00			
	saturated			1		
	Test pit terminated at 1.5 m.		-1.50			Upon completion of excacvation, test pit sidewalls caving. Free groundwater seepage encountered at 1.2 m.
2.00			-2.00			
			-2.50			

Reviewed by: *VM*

Drafted by: *BS*

Field Tech: *BS*

Sheet: *1 of 1*

Notes:

Test Pit Number: 7-13

Ground Elevation: *n/a*

Project: *Sage Campground - Sewage System Assessment*

Job No.: *P-0000145-400*

Location: *1912 Whistle Bare Road, Township of North Dumfries, ON*

Excavation Date: *May 1st, 2013*

SOIL PROFILE				SAMPLE		
Depth (m)	Description	Symbol	Elevation (m)	Number	WP — Water Content (%) — WL (10, 20, 30)	Groundwater Observations and Measurements (m)
0.00	Ground Elevation		0.00			
	TOPSOIL: dark brown silt, moist; roots					
	SILT/SAND: rusty brown silt and sand, moist		-0.50			
	SAND: brown sand, trace silt, very moist					
1.00	saturated		-1.00			
	Test pit terminated at 1.3 m.					Upon completion of excacvation, test pit sidewalls caving.
			-1.50			Free groundwater seepage encountered at 1.0 m.
2.00			-2.00			
			-2.50			

Reviewed by: *VM*

Drafted by: *BS*

Field Tech: *BS*

Sheet: *1 of 1*

Notes:

Test Pit Number: 8-13

Ground Elevation: *n/a*

Project: *Sage Campground - Sewage System Assessment*

Job No.: *P-0000145-400*

Location: *1912 Whistle Bare Road, Township of North Dumfries, ON*

Excavation Date: *May 1st, 2013*

SOIL PROFILE				SAMPLE		
Depth (m)	Description	Symbol	Elevation (m)	Number	Water Content (%) WP – WL; 10, 20, 30	Groundwater Observations and Measurements (m)
0.00	Ground Elevation		0.00			
	TOPSOIL: dark brown silt, moist; rootlets					
	SILT/SAND: rusty brown silt and sand, moist		-0.50			
1.00			-1.00			
	SAND: brown sand, trace silt and gravel, moist		-1.50			
	Test pit terminated at 1.8 m.					Upon completion of excacvation, test pit sidewalls stable.
2.00			-2.00			Minor groundwater seepage encountered at 1.7 m.
			-2.50			

Reviewed by: *VM*

Drafted by: *BS*

Field Tech: *BS*

Sheet: *1 of 1*

Notes:

Test Pit Number: 9-13

Ground Elevation: *n/a*

Project: *Sage Campground - Sewage System Assessment*

Job No.: *P-0000145-400*

Location: *1912 Whistle Bare Road, Township of North Dumfries, ON*

Excavation Date: *May 1st, 2013*

SOIL PROFILE				SAMPLE		
Depth (m)	Description	Symbol	Elevation (m)	Number	WP — Water Content (%) — WL (10, 20, 30)	Groundwater Observations and Measurements (m)
0.00	Ground Elevation		0.00			
	TOPSOIL: dark brown silt, moist; rootlets					
	SILT/SAND: rusty brown silt and sand, moist					
	brown		-0.50			
1.00			-1.00			
	SAND AND GRAVEL: brown coarse sand and gravel, trace silt, damp			1		
			-1.50			
2.00	Test pit terminated at 2.0 m.		-2.00			Upon completion of excacvation, test pit sidewalls stable. No groundwater seepage encountered.
			-2.50			

Reviewed by: *VM*

Drafted by: *BS*

Field Tech: *BS*

Sheet: *1 of 1*

Notes:

Ground Elevation: *298.81 m*

Borehole Number: **MP-1-12**

Job N°: *P-0000145-0-00-400*

Drill Date: *2012-04-26*

Project: *Sage Campground - Sewage Systems Assessment*

Field Tech: *D.Souter*

Location: *1912 Whistle Bare Road, Township of North Dumfries, Ontario*

Drill Method: *Hand Auger*

SOIL PROFILE		SAMPLE								
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration (20 40 60 80)	Shear Strength (PP) kPa / Shear Strength (FV) kPa (50 100 150 200); Initial / Remold	Water Content (%) (WP, WL; 10 20 30)	Groundwater Observations and Standpipe Details
	Ground Elevation		298.81							
	SAND AND GRAVEL: brown silty sand and fine gravel, very moist		0.00 / 298.56							
	saturated		0.25 / 297.90							
1	Mini-piezometer terminated at 0.91 m		0.91							native backfill; sand pack; 19 mm pipe; 0.61 m slotted screen; el. 298.30 m 2012-04-26
2										
3										
4										
5										
6										

Reviewed by: *D.Morlock*

Drafted by: *M.Smith*

Sheet: *1 of 1*

Notes: *Top of pipe elevation = 300.46 m*

V:\Style_LVM_Ontario\LogBorehole_Log_LVM_Ontario.sty- Printed : 2013-11-04 11h

Vertical Scale = 1 : 40.0

EQ-09-Ge-72 R.1 18.02.2011

V:\Style_LVM_Ontario\LogBorehole_Log_LVM_Ontario.sty- Printed : 2013-11-04 11h

Ground Elevation: *296.67 m*

Borehole Number: **MP-2-12**

Job N°: *P-0000145-0-00-400*

Drill Date: *2012-04-26*

Project: *Sage Campground - Sewage Systems Assessment*

Field Tech: *D.Souter*

Location: *1912 Whistle Bare Road, Township of North Dumfries, Ontario*

Drill Method: *Hand Auger*

Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value
	Ground Elevation		296.67			
	TOPSOIL: black silt, some organics, wet		0.00 / 296.06			
1	***SAND:*** brown silty sand, some fine gravel, saturated		0.61 / 294.84			
2	Mini-piezometer terminated at 1.83 m		1.83			
3						
4						
5						
6						

Dynamic Cone: 20 40 60 80
Std Penetration: 20 40 60 80
Shear Strength (PP) kPa: 50 100 150 200
Initial / Remold
Shear Strength (FV) kPa: 50 100 150 200
WP WL
Water Content (%): 10 20 30

Groundwater Observations and Standpipe Details

el. 296.32 m 2012-04-26

native backfill

19 mm pipe
0.91 m slotted screen

sand pack

Vertical Scale = 1 : 40.0

Reviewed by: *D.Morlock*

Drafted by: *M.Smith*

Sheet: *1 of 1*

Notes: *Top of pipe elevation = 298.21 m*

EQ-09-Ge-72 R.1 18.02.2011

X:\Style_LVM_Ontario\LogBorehole_Log_LVM_Ontario_NEW.sty- Printed : 2012-10-03 09h

Ground Elevation: *298.21 m*

Borehole Number: **MP-3-12**

Job N°: *P-0000145-0-00-400*

Drill Date: *2012-04-26*

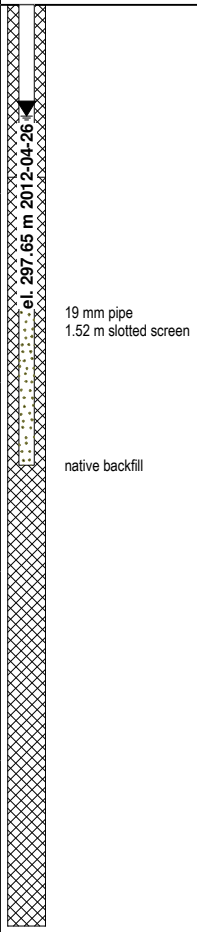
Project: *Sage Campground - Sewage Systems Assessment*

Field Tech: *D.Souter*

Location: *1912 Whistle Bare Road, Township of North Dumfries, Ontario*

Drill Method: *Hand Auger*

SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration (20 40 60 80)	Shear Strength (PP) kPa / Initial / Remold / Shear Strength (FV) kPa (50 100 150 200)	Water Content (%) WP WL (10 20 30)	Groundwater Observations and Standpipe Details
	Ground Elevation		298.21							
	PEAT: dark brown peat, numerous roots, wet		0.00							
			297.75							
	brown organic peat, wet to saturated		0.46							
1										
2										
3										
4										
			293.33							
5	Mini-piezometer terminated at 4.88 m		4.88							
6										



Vertical Scale = 1 : 40.0

Reviewed by: *D.Morlock*

Drafted by: *M.Smith*

Sheet: *1 of 1*

Notes: *Top of pipe elevation = 299.11 m*

EQ-09-Ge-72 R.1 18.02.2011

X:\Style_LVM_Ontario\LogBorehole_Log_LVM_Ontario_NEW.sty- Printed : 2012-10-03 09h

Ground Elevation: *297.88 m*

Borehole Number: **MP-4-12**

Job N°: *P-0000145-0-00-400*

Drill Date: *2012-04-26*

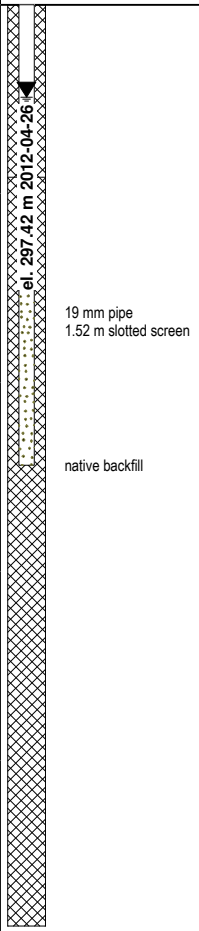
Project: *Sage Campground - Sewage Systems Assessment*

Field Tech: *D.Souter*

Location: *1912 Whistle Bare Road, Township of North Dumfries, Ontario*

Drill Method: *Hand Auger*

SOIL PROFILE		SAMPLE							
Depth (m)	Description	Symbol	Elevation (m) / Depth (m)	Type and Number	"Blows" /150 mm	SPT 'N' Value	Dynamic Cone / Std Penetration (20 40 60 80)	Shear Strength (PP) kPa / Initial / Remold / Shear Strength (FV) kPa (50 100 150 200)	Water Content (%) WP WL (10 20 30)	Groundwater Observations and Standpipe Details
	Ground Elevation		297.88							
	PEAT: dark brown peat, numerous roots, wet		0.00							
			297.42							
	brown organic peat, wet to saturated		0.46							
1										
2										
3										
4										
			293.00							
5	Mini-piezometer terminated at 4.88 m		4.88							
6										



Vertical Scale = 1 : 40.0

Reviewed by: *D.Morlock*

Drafted by: *M.Smith*

Sheet: *1 of 1*

Notes: *Top of pipe elevation = 298.85 m*

Appendix 5 Drawings

Drawing 1: Location Plan
Drawing 2: Site Plan
Drawing 3: Quaternary Geology
Drawing 4: Sewage System Locations

NOTES :
1-REFERENCES: GRAND RIVER CONSERVATION AUTHORITY, 2010 Aerial Photograph (2013).

0 250 500 750 1000 m
SCALE 1:25000

Project

Sage Campground
Sewage Systems Assessment

1912 Whistle Bare Road, Township of North Dumfries, Ontario

Title

LOCATION PLAN

LVM
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	S.Meteer	Discipline	SEWAGE SYSTEMS	Project manager	D.Morlock
Drawn	S.Meteer	Scale	1:25000	Sequence no.	1 of 4
Checked	D.Morlock	Date	2013-11-04		

M. dept.	Project	Disc.	Dwg no.	Rev.
160	P-0000145-0-00-400	TU	1	00

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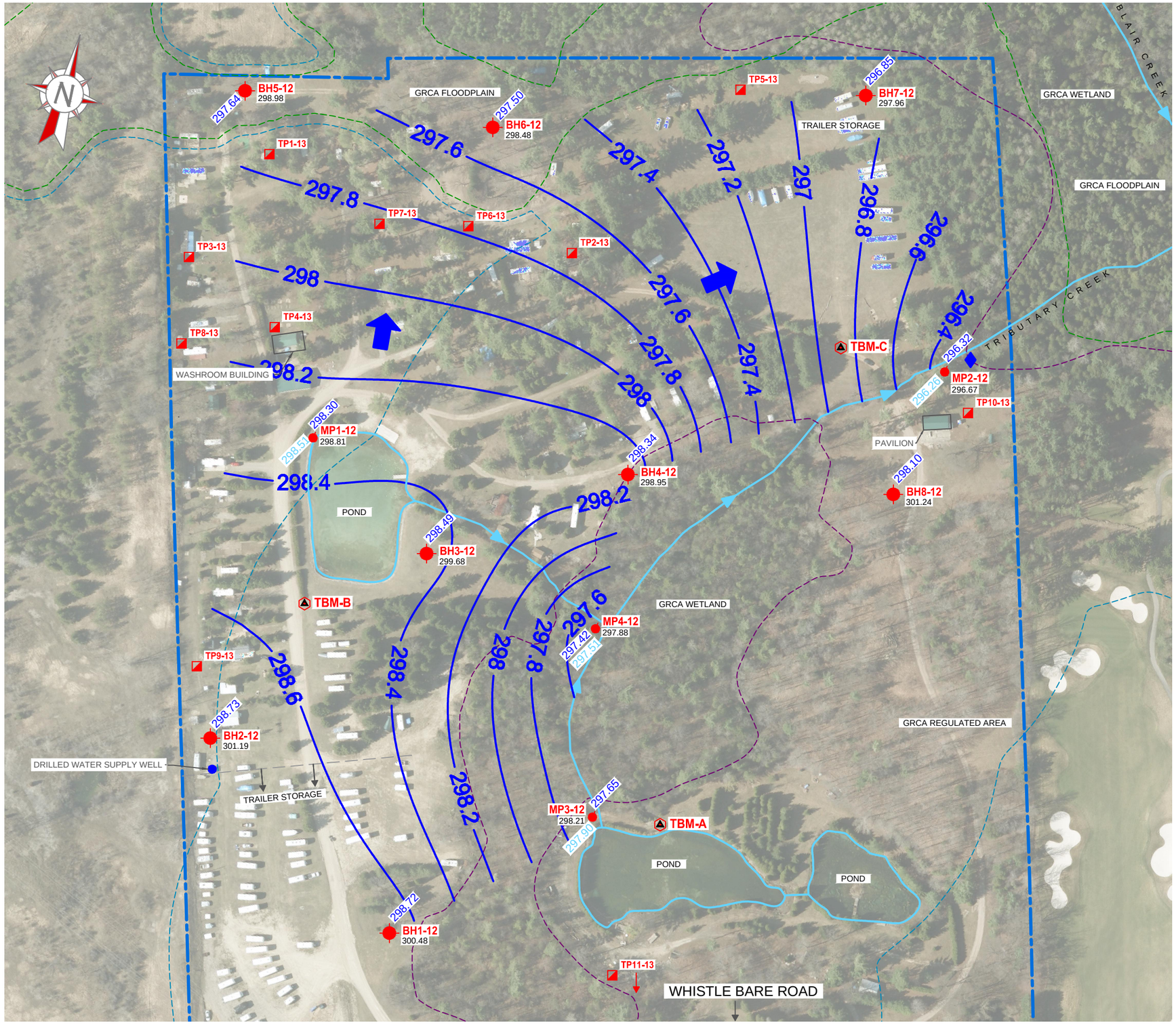

10 cm
0
1
2
3
4
5

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LEGEND :

- TEST PIT LOCATION
- BOREHOLE LOCATION
- MINI-PIEZOMETER LOCATION
- 301.24 GROUND SURFACE ELEVATION (m)
- TEMPORARY BENCHMARK
- SUBJECT PROPERTY BOUNDARY
- GRCA WETLAND LIMIT
- GRCA FLOODPLAIN LIMIT
- GRCA REGULATORY BOUNDARY
- CREEK
- GROUNDWATER FLOW CONTOUR (m) April 27, 2012
- SURFACE WATER SAMPLING LOCATION
- 298.72 GROUNDWATER ELEVATION (m) April 27, 2012
- 297.90 SURFACE WATER ELEVATION - Adjacent Mini-Piezometer (m) April 27, 2012

0 20 40 60 80 100 m

SCALE 1:2000

NOTES :

1-REFERENCES : GRAND RIVER CONSERVATION AUTHORITY (GRCA), 2010 Aerial Photography (2012)

2-BENCHMARKS : Top of steel pin at locations noted on plan. Elevations: TBM-A: 299.040 m; TBM-B: 300.439 m; TBM-C: 298.704.

Project

Sage Campground Sewage Systems Assessment

1912 Whistle Bare Road, Township of North Dumfries, Ontario

Title

SITE PLAN

LVM

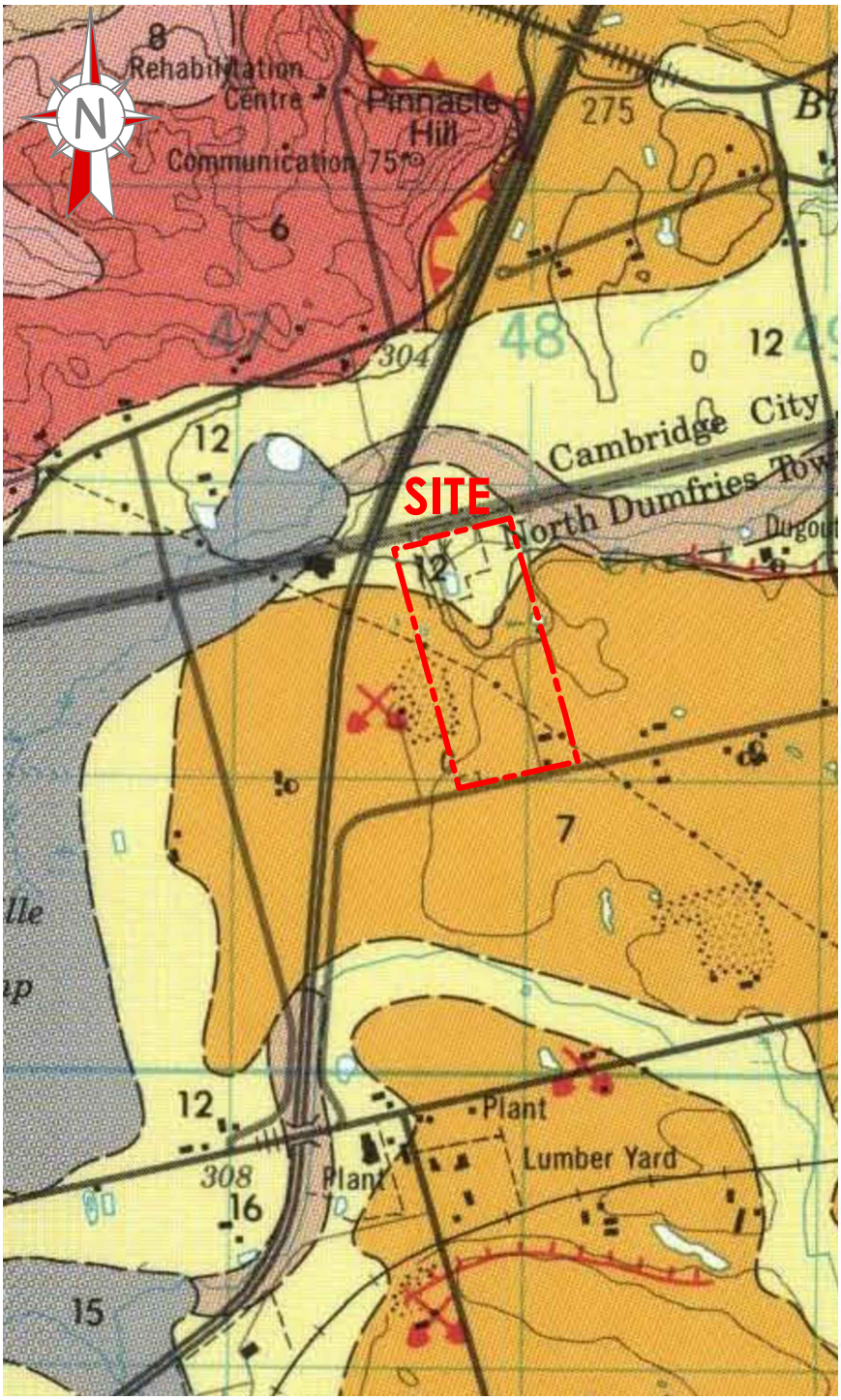
353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	A.Higgins	Discipline	SEWAGE SYSTEMS
Drawn	A.Higgins	Scale	1 : 2000
Checked	D.Morlock	Date	2013-11-04

Project manager: D.Morlock

Sequence no.: 2 of 4

M. dept.	Project	Disc.	Dwg no.	Rev.
160	P-0000145-0-00-400	TU	2	00



LEGEND

PHANEROZOIC

CENOZOIC

QUATERNARY

RECENT

- 17 Lake Ontario deposits: stratified sands, gravel*
- 16 Stream deposits: gravel, sand, silt, and clay
- 15 Peat and muck

PLEISTOCENE

LATE WISCONSINAN

- 14 Alluvial fan gravel*
- 13 Beach gravel
- 12 Lacustrine and outwash sand
- 11 Lake deposits: stratified to varved clay, silt, and fine sand
- 10 Halton Till: clay or silt till
- 9 Outcrop complex: bouldery till and bedrock ridges
- 8 Ice-contact sand: kames and eskers
- 7 Outwash gravel
- 6 Ice-contact gravel: kames and eskers
- 5 Wentworth Till: stony, sandy, silt till
- 4 Port Stanley Till: silt to sandy silt till
- 3 Maryhill Till: clayey silt till
- 2 Catfish Creek Till**: stony, sandy, silt till

PALEOZOIC

ORDOVICIAN AND SILURIAN

- 1 Shale and dolomite

Notes:

*Does not occur on this sheet.

**Exposed only in river banks beneath younger tills.

Deposits on this sheet are mapped only where they reach 1 m or more in thickness. Thinner deposits are not shown.

SYMBOLS

- Drumlin
- Esker
- Outwash fan
- Geological boundary, approximate
- Bedrock pressure-release ridge
- Eroded scarp
- Ice-contact face
- Glacial striae
- Abandoned shoreline feature
- Hummocky topography
- ×88 Sample site
- Sand or gravel pit
- Rock quarry

For other conventional signs refer to 1:50 000 National Topographic System maps.

NOTES :

1-REFERENCES : MINISTRY OF NORTHERN DEVELOPMENT AND MINES, Ontario Geologic Survey Map 2508, Quaternary geology of the Cambridge Area (1987).

0 250 500 750 1000 m

SCALE 1:25000

Project

Sage Campground Sewage Systems Assessment

1912 Whistle Bare Road, Township of North Dumfries, Ontario

Title

QUATERNARY GEOLOGY

LVM

353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	S.Meteer	Discipline	SEWAGE SYSTEMS	Project manager	D.Morlock
Drawn	S.Meteer	Scale	1:25000	Sequence no.	3 of 4
Checked	D.Morlock	Date	2013-11-04		

M. dept.	Project	Disc.	Dwg no.	Rev.
160	P-0000145-0-00-400	TU	3	00

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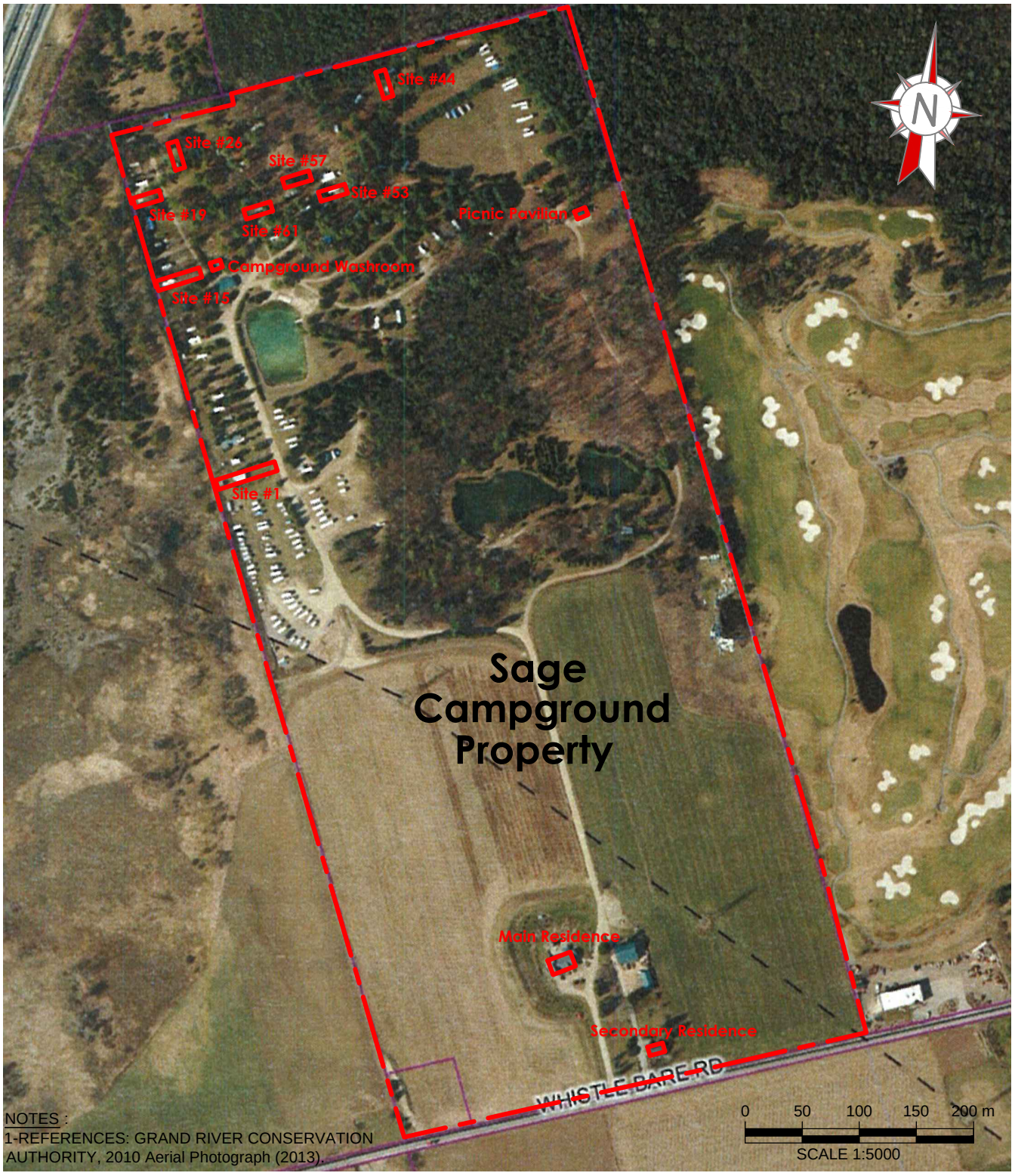

NOTES :
1-REFERENCES: GRAND RIVER CONSERVATION AUTHORITY, 2010 Aerial Photograph (2013).

10 cm
0 1 2 3 4 5

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Project

Sage Campground Sewage Systems Assessment

1912 Whistle Bare Road, Township of North Dumfries, Ontario

Title

SEWAGE SYSTEM LOCATIONS

LVM

353, Bridge Street East
Kitchener (Ontario) N2K 2Y5
Telephone : 519.741.1313
Fax : 519.741.5422

Prepared	B.Schildroth	Discipline	SEWAGE SYSTEMS	Project manager	D. Morlock
Drawn	B.Schildroth	Scale	1:5000	Sequence no.	1 of 4
Checked	D.Morlock	Date	2014-10-24		

M. dept.	Project	Disc.	Dwg no.	Rev.
160	P-0000145-0-00-400	TU	4	00

Appendix 6 Laboratory Certificates of Analysis

LVM INC.
ATTN: DAVE MORLOCK
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5

Date Received: 27-APR-12
Report Date: 04-MAY-12 13:26 (MT)
Version: FINAL

Client Phone: 519-741-1313

Certificate of Analysis

Lab Work Order #: L1140387

Project P.O. #: 205030
Job Reference: 160-P0000145-400
C of C Numbers: 126535
Legal Site Desc:

NANCY SMITH
Account Manager

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1140387-1 BH-01-12 Sampled By: K. THRAMS on 27-APR-12 @ 10:35 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		01-MAY-12	R2358391
Nitrate and Nitrite as N	0.69		0.20	mg/L		03-MAY-12	
Nitrate-N	0.69		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Nitrite-N	<0.10		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Total Kjeldahl Nitrogen	<0.15		0.15	mg/L	30-APR-12	01-MAY-12	R2358414
Phosphorus, Total	0.532		0.030	mg/L	30-APR-12	01-MAY-12	R2358747
Bacteriological Tests							
E. Coli	<10	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357794
Total Coliforms	210	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357788
L1140387-2 BH-02-12 Sampled By: K. THRAMS on 27-APR-12 @ 10:50 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	0.115		0.050	mg/L		01-MAY-12	R2358391
Nitrate and Nitrite as N	6.74		0.20	mg/L		03-MAY-12	
Nitrate-N	6.74		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Nitrite-N	<0.10		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Total Kjeldahl Nitrogen	<0.15		0.15	mg/L	30-APR-12	01-MAY-12	R2358414
Phosphorus, Total	1.14		0.030	mg/L	30-APR-12	01-MAY-12	R2358747
Bacteriological Tests							
E. Coli	<10	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357794
Total Coliforms	<10	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357788
L1140387-3 BH-03-12 Sampled By: K. THRAMS on 27-APR-12 @ 11:20 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	0.109		0.050	mg/L		01-MAY-12	R2358391
Nitrate and Nitrite as N	3.28		0.20	mg/L		03-MAY-12	
Nitrate-N	3.28		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Nitrite-N	<0.10		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Total Kjeldahl Nitrogen	0.17		0.15	mg/L	30-APR-12	01-MAY-12	R2358414
Phosphorus, Total	1.09		0.030	mg/L	30-APR-12	01-MAY-12	R2358747
Bacteriological Tests							
E. Coli	<10	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357794
Total Coliforms	<10	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357788
L1140387-4 BH-04-12 Sampled By: K. THRAMS on 27-APR-12 @ 13:10 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	0.068		0.050	mg/L		01-MAY-12	R2358391
Nitrate and Nitrite as N	5.87		0.20	mg/L		03-MAY-12	
Nitrate-N	5.87		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Nitrite-N	<0.10		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1140387-4 BH-04-12 Sampled By: K. THRAMS on 27-APR-12 @ 13:10 Matrix: WATER							
Anions and Nutrients							
Total Kjeldahl Nitrogen	0.31		0.15	mg/L	30-APR-12	01-MAY-12	R2358414
Phosphorus, Total	1.13		0.030	mg/L	30-APR-12	01-MAY-12	R2358747
Bacteriological Tests							
E. Coli	<10	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357794
Total Coliforms	<10	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357788
L1140387-5 BH-05-12 Sampled By: K. THRAMS on 27-APR-12 @ 11:50 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	0.096		0.050	mg/L		01-MAY-12	R2358391
Nitrate and Nitrite as N	5.88		0.20	mg/L		03-MAY-12	
Nitrate-N	5.88		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Nitrite-N	<0.10		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Total Kjeldahl Nitrogen	0.16		0.15	mg/L	30-APR-12	01-MAY-12	R2358414
Phosphorus, Total	0.332		0.030	mg/L	30-APR-12	01-MAY-12	R2358747
Bacteriological Tests							
E. Coli	<10	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357794
Total Coliforms	20	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357788
L1140387-6 BH-06-12 Sampled By: K. THRAMS on 27-APR-12 @ 12:25 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	0.232		0.050	mg/L		01-MAY-12	R2358391
Nitrate and Nitrite as N	<0.2		0.20	mg/L		03-MAY-12	
Nitrate-N	<0.10		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Nitrite-N	<0.10		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Total Kjeldahl Nitrogen	0.81		0.15	mg/L	30-APR-12	01-MAY-12	R2358414
Phosphorus, Total	1.16		0.030	mg/L	30-APR-12	01-MAY-12	R2358747
Bacteriological Tests							
E. Coli	<10	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357794
Total Coliforms	10	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357788
L1140387-7 BH-07-12 Sampled By: K. THRAMS on 27-APR-12 @ 12:45 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	0.164		0.050	mg/L		01-MAY-12	R2358391
Nitrate and Nitrite as N	1.28		0.20	mg/L		03-MAY-12	
Nitrate-N	1.28		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Nitrite-N	<0.10		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Total Kjeldahl Nitrogen	0.32		0.15	mg/L	30-APR-12	01-MAY-12	R2358414
Phosphorus, Total	1.52		0.030	mg/L	30-APR-12	01-MAY-12	R2358747
Bacteriological Tests							
E. Coli	<10	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357794

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1140387-7 BH-07-12 Sampled By: K. THRAMS on 27-APR-12 @ 12:45 Matrix: WATER							
Bacteriological Tests							
Total Coliforms	20	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357788
L1140387-8 BH-08-12 Sampled By: K. THRAMS on 27-APR-12 @ 10:00 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	0.130		0.050	mg/L		01-MAY-12	R2358391
Nitrate and Nitrite as N	1.61		0.20	mg/L		03-MAY-12	
Nitrate-N	1.61		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Nitrite-N	<0.10		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Total Kjeldahl Nitrogen	0.22		0.15	mg/L	30-APR-12	01-MAY-12	R2358414
Phosphorus, Total	0.179		0.030	mg/L	30-APR-12	01-MAY-12	R2358747
Bacteriological Tests							
E. Coli	<10	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357794
Total Coliforms	30	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357788
L1140387-9 SURFACE WATER Sampled By: K. THRAMS on 27-APR-12 @ 09:25 Matrix: WATER							
Physical Tests							
Total Suspended Solids	6.0		3.0	mg/L	03-MAY-12	04-MAY-12	R2360159
Anions and Nutrients							
Ammonia, Total (as N)	0.109		0.050	mg/L		01-MAY-12	R2358391
Nitrate and Nitrite as N	5.8		0.20	mg/L		03-MAY-12	
Nitrate-N	5.80		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Nitrite-N	<0.10		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Total Kjeldahl Nitrogen	0.52		0.15	mg/L	30-APR-12	01-MAY-12	R2358414
Phosphorus, Total	<0.030		0.030	mg/L	30-APR-12	01-MAY-12	R2358747
Bacteriological Tests							
E. Coli	78		0	CFU/100mL	28-APR-12	29-APR-12	R2357794
Total Coliforms	85		0	CFU/100mL	28-APR-12	29-APR-12	R2357788
Aggregate Organics							
BOD Carbonaceous	2.5		2.0	mg/L	28-APR-12	03-MAY-12	R2359653

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	E. Coli	DLM	L1140387-1, -2, -3, -4, -5, -6, -7, -8, -9
Matrix Spike	Ammonia, Total (as N)	MS-B	L1140387-1, -2, -3, -4, -5, -6, -7, -8, -9

Sample Parameter Qualifier key listed:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD-C-WT	Water	BOD Carbonaceous	APHA 5210 B
Sample is incubated at 20°C– 1 C for 5 days using a nitrification inhibitor.			
EC-MF-WT	Water	E. coli	SM 9222D
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at @44.5–0.2°C for 24–2h. Method ID: WT-TM-1200			
ETL-N2N3-WT	Water	Calculate from NO2 + NO3	APHA 4110 B
NH3-WT	Water	Ammonia as N	EPA 350.1
Sample is measured colorimetrically. When sample is turbid a distillation step is required, sample is distilled into a solution of boric acid and measured colorimetrically.			
NO2-WT	Water	Nitrite-N	EPA 300.0 (IC)
A filtered water sample (drinking waters-unfiltered) is analyzed by ion chromatography.			
NO3-WT	Water	Nitrate-N	EPA 300.0 (IC)
A filtered water sample (drinking waters-unfiltered) is analyzed by ion chromatography.			
P-TOTAL-WT	Water	Total Phosphorus	APHA 4500-P B E
Samples are digested to convert the total phosphorus to orthophosphate. The orthophosphate reacts with ammonium molybdate and potassium antimonyl tartrate to form a antimonyl-phosphomolybdate complex. This complex is measured colorimetrically and reported as phosphorus.			
SOLIDS-TSS-WT	Water	Total Suspended Solids	APHA 2540 D-Gravimetric
A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 105–5°C for a minimum of four hours or until a constant weight is achieved.			
TC-MF-WT	Water	Total Coliforms	SM 9222B
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200			
TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-N
Sample is digested to convert the TKN to ammonium sulphate. The ammonia ions are heated to produce a colour complex. The absorbance measured by the instrument is proportional to the concentration of ammonium sulphate in the sample and is reported as TKN.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

126535

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BOD-C-WT	**Water**							
Batch R2359653								
WG1463764-3 LCS								
BOD Carbonaceous			97.0		%		85-115	03-MAY-12
WG1463764-1 MB								
BOD Carbonaceous			<2.0		mg/L		2	03-MAY-12
EC-MF-WT	**Water**							
Batch R2357794								
WG1463780-1 MB								
E. Coli			0		CFU/100mL		1	29-APR-12
NH3-WT	**Water**							
Batch R2358391								
WG1464660-2 CVS								
Ammonia, Total (as N)			98.7		%		85-115	01-MAY-12
WG1464660-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	01-MAY-12
WG1464660-4 MS		**L1139999-1**						
Ammonia, Total (as N)			87.5		%		75-125	01-MAY-12
WG1464660-6 MS		**L1140294-4**						
Ammonia, Total (as N)			N/A	MS-B	%		-	01-MAY-12
WG1464660-8 MS		**L1140770-2**						
Ammonia, Total (as N)			84.5		%		75-125	01-MAY-12
NO2-WT	**Water**							
Batch R2359735								
WG1465702-6 DUP		**L1140387-5**						
Nitrite-N		<0.10	<0.10	RPD-NA	mg/L	N/A	20	02-MAY-12
WG1465702-3 LCS								
Nitrite-N			92.2		%		85-115	02-MAY-12
WG1465702-4 LCSD		**WG1465702-3**						
Nitrite-N		92.2	92		%	0.0	25	02-MAY-12
WG1465702-1 MB								
Nitrite-N			<0.10		mg/L		0.1	02-MAY-12
NO3-WT	**Water**							
Batch R2359735								
WG1465702-6 DUP		**L1140387-5**						
Nitrate-N		5.88	5.88		mg/L	0.034	20	02-MAY-12
WG1465702-3 LCS								
Nitrate-N			98.6		%		85-115	02-MAY-12
WG1465702-4 LCSD		**WG1465702-3**						

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-WT	**Water**							
Batch R2359735								
WG1465702-4 LCSD		**WG1465702-3**						
Nitrate-N		98.6	99		%	0.041	25	02-MAY-12
WG1465702-1 MB								
Nitrate-N			<0.10		mg/L		0.1	02-MAY-12
P-TOTAL-WT	**Water**							
Batch R2358747								
WG1464796-2 CVS								
Phosphorus, Total			104.0		%		80-120	01-MAY-12
WG1464591-3 DUP		**L1140387-1**						
Phosphorus, Total		0.532	0.538		mg/L	1.1	25	01-MAY-12
WG1464591-4 DUP		**L1140387-8**						
Phosphorus, Total		0.179	0.218		mg/L	20	25	01-MAY-12
WG1464591-2 LCS								
Phosphorus, Total			102		%		80-120	01-MAY-12
WG1464591-1 MB								
Phosphorus, Total			<0.030		mg/L		0.03	01-MAY-12
SOLIDS-TSS-WT	**Water**							
Batch R2360159								
WG1466120-1 LCS								
Total Suspended Solids			100.8		%		80-120	04-MAY-12
WG1466120-2 MB								
Total Suspended Solids			<3.0		mg/L		3	04-MAY-12
TC-MF-WT	**Water**							
Batch R2357788								
WG1463783-1 MB								
Total Coliforms			0		CFU/100mL		1	29-APR-12
TKN-WT	**Water**							
Batch R2358414								
WG1464794-2 CVS								
Total Kjeldahl Nitrogen			97.0		%		75-125	01-MAY-12
WG1464591-3 DUP		**L1140387-1**						
Total Kjeldahl Nitrogen		<0.15	<0.15	RPD-NA	mg/L	N/A	20	01-MAY-12
WG1464591-4 DUP		**L1140387-8**						
Total Kjeldahl Nitrogen		0.22	0.22		mg/L	0.64	20	01-MAY-12
WG1464591-2 LCS								
Total Kjeldahl Nitrogen			94.2		%		80-120	01-MAY-12
WG1464591-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-WT	**Water**							
Batch R2358414								
WG1464591-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	01-MAY-12

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

126535

C of C # 00000

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM

Page ___ of ___

Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.

Specify date required

Service requested		2 day TAT (50%)	
5 day (regular)	X	Next day TAT (100%)	
3-4 day (25%)		Same day TAT (200%)	

COMPANY NAME: LVM
OFFICE: Kitchener
PROJECT MANAGER: Dave Morlock
PROJECT #: 160-P0000#145-400
PHONE: 519. 741. 1313
FAX: 519. 741. 5422
ACCOUNT #:
QUOTATION #:
PO #: 205030

CRITERIA — Criteria on report YES___ NO___

Reg 153/04 ☐ Reg 511/09 ☐
Table 1 2 3 4 5 6 7 8 9

TCLP _____ MISA _____ PWQO _____
ODWS _____ OTHER _____

REPORT FORMAT/DISTRIBUTION

EMAIL X FAX _____ BOTH _____
SELECT: PDF X DIGITAL _____ BOTH _____
EMAIL 1 _____
EMAIL 2 _____

ANALYSIS REQUEST

PLEASE INDICATE FILTERED, PRESERVED OR BOTH <----- (F, P, F/P)

SUBMISSION #: L1140387
ENTERED BY: Austin P
DATE/TIME ENTERED: 27104112 19:16
BIN #: B525

SAMPLING INFORMATION

Date (dd-mm-yy)	Time (24hr) (hh:mm)	TYPE: COMP	TYPE: GRAB	MATRIX: WATER	MATRIX: SOIL	MATRIX: OTHER	SAMPLE DESCRIPTION TO APPEAR ON REPORT	NUMBER OF CONTAINERS	nitrate-nitrogen, nitrite	nitrite-nitrogen	TKN	total ammonia-nitrogen	total phosphorous	E. coli	total coliforms	cBOD s	TSS	COMMENTS	LAB ID
2012-04-27	10:35			X			BH-01-12		✓	✓	✓	✓	✓	✓	✓				-1
	10:50			X			BH-02-12		✓	✓	✓	✓	✓	✓	✓				-2
	11:20			X			BH-03-12		✓	✓	✓	✓	✓	✓	✓				-3
	13:10			X			BH-04-12		✓	✓	✓	✓	✓	✓	✓				-4
	11:50			X			BH-05-12		✓	✓	✓	✓	✓	✓	✓				-5
	12:25			X			BH-06-12		✓	✓	✓	✓	✓	✓	✓				-6
	12:45			X			BH-07-12		✓	✓	✓	✓	✓	✓	✓				-7
	10:00			X			BH-08-12		✓	✓	✓	✓	✓	✓	✓				-8
	9:25			X			surface water		✓	✓	✓	✓	✓	✓	✓	✓	✓		-9

SPECIA

* L 1 1 4 0 3 8 7 - C O F C *

THE QUESTIONS BELOW MUST BE ANSWERED FORWATER SAMPLES (CHECK Yes OR No)

...les taken from a regulated DW System? Yes ☐ No X
If yes, an authorized drinking water COC MUST be used for this submission.
Is the water sampled intended to be potable for human consumption? Yes ☐ No X

SAMPLE CONDITION

FROZEN ☐
COLD X
COOLING INITIATED ☐
AMBIENT ☐
MEAN TEMP 15°C
OBSERVATIONS Yes ☐ No ☐ If yes, add SIF

SAMPLED BY: K. Thrams	DATE & TIME	RECEIVED BY:	DATE & TIME
RELINQUISHED BY: K. Thrams	DATE & TIME	RECEIVED AT LAB BY: AM	DATE & TIME: 04/27/12 17:09

Notes

1. Quote number must be provided to ensure proper pricing
2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.
3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

LVM INC.
ATTN: DAVE MORLOCK
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5

Date Received: 27-APR-12
Report Date: 04-MAY-12 13:26 (MT)
Version: FINAL

Client Phone: 519-741-1313

Certificate of Analysis

Lab Work Order #: L1140393

Project P.O. #: 205030
Job Reference: 160-P0000 145-400
C of C Numbers: 126536
Legal Site Desc:

NANCY SMITH
Account Manager

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1140393-1 WATER SUPPLY WELL- UNTREATED Sampled By: K. THRAMS on 27-APR-12 @ 08:40 Matrix: WATER							
Physical Tests							
Color, Apparent	<1.0		1.0	C.U.	28-APR-12	28-APR-12	R2357536
Conductivity	987		3.0	umhos/cm	30-APR-12	30-APR-12	R2358057
pH	7.89		0.10	pH units	30-APR-12	30-APR-12	R2358054
Redox Potential	136		-1000	mV	30-APR-12	30-APR-12	R2358060
Total Dissolved Solids	590		20	mg/L	01-MAY-12	02-MAY-12	R2359004
Turbidity	<0.10		0.10	NTU	28-APR-12	28-APR-12	R2357499
Anions and Nutrients							
Alkalinity, Bicarbonate (as CaCO3)	236		10	mg/L	02-MAY-12	02-MAY-12	R2359956
Alkalinity, Carbonate (as CaCO3)	<10		10	mg/L	02-MAY-12	02-MAY-12	R2359956
Alkalinity, Hydroxide (as CaCO3)	<10		10	mg/L	02-MAY-12	02-MAY-12	R2359956
Alkalinity, Total (as CaCO3)	237		10	mg/L	02-MAY-12	02-MAY-12	R2359956
Ammonia, Total (as N)	<0.050		0.050	mg/L		01-MAY-12	R2358391
Bromide	<0.50		0.50	mg/L	02-MAY-12	02-MAY-12	R2359735
Chloride	137		2.0	mg/L	02-MAY-12	02-MAY-12	R2359735
Computed Conductivity	853			uS/cm		03-MAY-12	
Conductivity % Difference	-14.6			%		03-MAY-12	
Fluoride	<0.50		0.50	mg/L	02-MAY-12	02-MAY-12	R2359735
Hardness (as CaCO3)	297			mg/L		03-MAY-12	
Ion Balance	105			%		03-MAY-12	
Langelier Index	0.7					03-MAY-12	
Nitrate-N	7.36		0.10	mg/L	02-MAY-12	02-MAY-12	R2359735
Nitrite-N	<0.50		0.50	mg/L	02-MAY-12	02-MAY-12	R2359735
Saturation pH	7.17			pH		03-MAY-12	
Phosphate-P (ortho)	<0.0030		0.0030	mg/L		01-MAY-12	R2358497
TDS (Calculated)	523			mg/L		03-MAY-12	
Sulphate	27.8		2.0	mg/L	02-MAY-12	02-MAY-12	R2359735
Anion Sum	8.89			me/L		03-MAY-12	
Cation Sum	9.32			me/L		03-MAY-12	
Cation - Anion Balance	2.3			%		03-MAY-12	
Inorganic Parameters							
Silica	7.7		2.1	mg/L		02-MAY-12	
Bacteriological Tests							
E. Coli	<10	DLM	10	CFU/100mL	28-APR-12	29-APR-12	R2357794
Total Coliform Background	13		0	CFU/100mL	28-APR-12	29-APR-12	R2357788
Total Coliforms	13		0	CFU/100mL	28-APR-12	29-APR-12	R2357788
Metals							
Sodium Adsorption Ratio	1.94		0.030			03-MAY-12	
Total Metals							
Aluminum (Al)-Total	<0.010		0.010	mg/L	30-APR-12	30-APR-12	R2358222
Antimony (Sb)-Total	<0.0050		0.0050	mg/L	30-APR-12	30-APR-12	R2358222
Arsenic (As)-Total	<0.0010		0.0010	mg/L	30-APR-12	30-APR-12	R2358222
Barium (Ba)-Total	0.078		0.010	mg/L	30-APR-12	30-APR-12	R2358222

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1140393-1 WATER SUPPLY WELL- UNTREATED Sampled By: K. THRAMS on 27-APR-12 @ 08:40 Matrix: WATER							
Total Metals							
Beryllium (Be)-Total	<0.0010		0.0010	mg/L	30-APR-12	01-MAY-12	R2358290
Bismuth (Bi)-Total	<0.0010		0.0010	mg/L	30-APR-12	30-APR-12	R2358222
Boron (B)-Total	<0.050		0.050	mg/L	30-APR-12	30-APR-12	R2358222
Cadmium (Cd)-Total	<0.000090		0.000090	mg/L	30-APR-12	30-APR-12	R2358222
Calcium (Ca)-Total	84.6		0.50	mg/L	30-APR-12	30-APR-12	R2358222
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	30-APR-12	30-APR-12	R2358222
Cobalt (Co)-Total	<0.00050		0.00050	mg/L	30-APR-12	30-APR-12	R2358222
Copper (Cu)-Total	0.0166		0.0010	mg/L	30-APR-12	30-APR-12	R2358222
Iron (Fe)-Total	<0.050		0.050	mg/L	30-APR-12	30-APR-12	R2358222
Lead (Pb)-Total	0.0023		0.0010	mg/L	30-APR-12	30-APR-12	R2358222
Magnesium (Mg)-Total	20.8		0.50	mg/L	30-APR-12	30-APR-12	R2358222
Manganese (Mn)-Total	0.0012		0.0010	mg/L	30-APR-12	30-APR-12	R2358222
Molybdenum (Mo)-Total	<0.0010		0.0010	mg/L	30-APR-12	30-APR-12	R2358222
Nickel (Ni)-Total	<0.0020		0.0020	mg/L	30-APR-12	30-APR-12	R2358222
Phosphorus (P)-Total	<0.050		0.050	mg/L	30-APR-12	30-APR-12	R2358222
Potassium (K)-Total	1.2		1.0	mg/L	30-APR-12	30-APR-12	R2358222
Selenium (Se)-Total	<0.00040		0.00040	mg/L	30-APR-12	30-APR-12	R2358222
Silicon (Si)-Total	3.6		1.0	mg/L	30-APR-12	30-APR-12	R2358222
Silver (Ag)-Total	<0.00010		0.00010	mg/L	30-APR-12	30-APR-12	R2358222
Sodium (Na)-Total	77.0	DLM	5.0	mg/L	30-APR-12	30-APR-12	R2358222
Strontium (Sr)-Total	0.231		0.0010	mg/L	30-APR-12	30-APR-12	R2358222
Thallium (Tl)-Total	<0.00030		0.00030	mg/L	30-APR-12	30-APR-12	R2358222
Tin (Sn)-Total	<0.0010		0.0010	mg/L	30-APR-12	30-APR-12	R2358222
Titanium (Ti)-Total	<0.0020		0.0020	mg/L	30-APR-12	30-APR-12	R2358222
Tungsten (W)-Total	<0.010		0.010	mg/L	30-APR-12	30-APR-12	R2358222
Uranium (U)-Total	<0.0050		0.0050	mg/L	30-APR-12	30-APR-12	R2358222
Vanadium (V)-Total	<0.0010		0.0010	mg/L	30-APR-12	30-APR-12	R2358222
Zinc (Zn)-Total	0.0363		0.0030	mg/L	30-APR-12	30-APR-12	R2358222
Zirconium (Zr)-Total	<0.0040		0.0040	mg/L	30-APR-12	30-APR-12	R2358222

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	E. Coli	DLM	L1140393-1
Duplicate	Sodium (Na)-Total	DLM	L1140393-1
Matrix Spike	Calcium (Ca)-Total	MS-B	L1140393-1
Matrix Spike	Magnesium (Mg)-Total	MS-B	L1140393-1
Matrix Spike	Silicon (Si)-Total	MS-B	L1140393-1
Matrix Spike	Sodium (Na)-Total	MS-B	L1140393-1
Matrix Spike	Strontium (Sr)-Total	MS-B	L1140393-1
Matrix Spike	Ammonia, Total (as N)	MS-B	L1140393-1

Sample Parameter Qualifier key listed:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
ALK-SPEC-WT	Water	Speciated Alkalinity	EPA 310.2
ANIONS-WT	Water	Anion Scan (IC)	EPA 300.0 (IC)
COLOUR-WT	Water	Colour	APHA 2120
Apparent colour is determined by analysis of the decanted sample using the platinum-cobalt colourimetric method.			
EC-MF-WT	Water	E. coli	SM 9222D
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at @44.5–0.2°C for 24–2h. Method ID: WT-TM-1200			
EC-WT	Water	Conductivity	APHA 2510 B
Water samples can be measured directly by immersing the conductivity cell into the sample.			
ETL-SAR-CALC-WT	Water	Sodium Adsorption Ratio	Calculation
ETL-SILICA-CALC-WT	Water	Calculate from SI-TOT-WT	EPA 200.8
IONBALANCE-OP03-WT	Water	Detailed Ion Balance Calculation	APHA 1030E, 2330B, 2510A
MET-TOT-WT	Water	Metal Scan-Total	EPA 200.8
The concentration of metals is determined on an unfiltered aqueous sample. The sample is digested with nitric acid and then analyzed directly by ICP-MS.			
NH3-WT	Water	Ammonia as N	EPA 350.1
Sample is measured colorimetrically. When sample is turbid a distillation step is required, sample is distilled into a solution of boric acid and measured colorimetrically.			
P-ORTHO-LOW-WT	Water	Phosphorus-P (ortho)	APHA 4500-P B E
PH-ALK-WT	Water	pH	APHA 4500 H-Electrode
Water samples are analyzed directly by a calibrated pH meter.			
REDOX-POTENTIAL-WT	Water	Redox Potential	APHA 2580
SOLIDS-TDS-WT	Water	Total Dissolved Solids	APHA 2540C
A well-mixed sample is filtered though glass fibres filter. A known volume of the filtrate is evaporated and dried at 105–5°C overnight and then 180–10°C for 1hr.			
TC-MF-WT	Water	Total Coliforms	SM 9222B
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200			
TCB-MF-WT	Water	REG	SM 9222B
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200.			

Reference Information

TURBIDITY-WT	Water	Turbidity	APHA 2130 B

Sample result is based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. Sample readings are obtained from a Nephelometer.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

126536

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-SPEC-WT	**Water**							
Batch R2359956								
WG1465299-4 CRM		**WT-ALK-CRM**						
Alkalinity, Total (as CaCO3)			100.6		%		80-120	02-MAY-12
WG1465299-2 CVS								
Alkalinity, Total (as CaCO3)			98.5		%		70-130	02-MAY-12
WG1465299-3 DUP		**L1140393-1**						
Alkalinity, Total (as CaCO3)		237	238		mg/L	0.34	20	02-MAY-12
Alkalinity, Bicarbonate (as CaCO3)		236	236		mg/L	0.34	25	02-MAY-12
Alkalinity, Carbonate (as CaCO3)		<10	<10	RPD-NA	mg/L	N/A	25	02-MAY-12
Alkalinity, Hydroxide (as CaCO3)		<10	<10	RPD-NA	mg/L	N/A	25	02-MAY-12
WG1465299-1 MB								
Alkalinity, Total (as CaCO3)			<10		mg/L		10	02-MAY-12
Alkalinity, Bicarbonate (as CaCO3)			<10		mg/L		10	02-MAY-12
Alkalinity, Carbonate (as CaCO3)			<10		mg/L		10	02-MAY-12
Alkalinity, Hydroxide (as CaCO3)			<10		mg/L		10	02-MAY-12
ANIONS-WT	**Water**							
Batch R2359735								
WG1465702-3 LCS								
Chloride			99.0		%		85-115	02-MAY-12
Bromide			105.0		%		85-115	02-MAY-12
Fluoride			98.5		%		85-115	02-MAY-12
Nitrite-N			92.2		%		85-115	02-MAY-12
Nitrate-N			98.6		%		85-115	02-MAY-12
Sulphate			101.1		%		85-115	02-MAY-12
WG1465702-4 LCSD		**WG1465702-3**						
Chloride		99.0	99		%	0.016	25	02-MAY-12
Bromide		105.0	102		%	2.7	25	02-MAY-12
Fluoride		98.5	99		%	0.0	25	02-MAY-12
Nitrite-N		92.2	92		%	0.0	25	02-MAY-12
Nitrate-N		98.6	99		%	0.041	25	02-MAY-12
Sulphate		101.1	101		%	0.16	25	02-MAY-12
WG1465702-1 MB								
Chloride			<2.0		mg/L		2	02-MAY-12
Bromide			<0.10		mg/L		0.1	02-MAY-12
Fluoride			<0.10		mg/L		0.1	02-MAY-12
Nitrite-N			<0.10		mg/L		0.1	02-MAY-12
Nitrate-N			<0.10		mg/L		0.1	02-MAY-12

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ANIONS-WT	**Water**							
Batch R2359735								
WG1465702-1 MB								
Sulphate			<2.0		mg/L		2	02-MAY-12
COLOUR-WT	**Water**							
Batch R2357536								
WG1463784-4 CRM		**WT-COLOUR-CRM**						
Color, Apparent			106.5		%		80-120	28-APR-12
WG1463784-2 CVS								
Color, Apparent			97.6		%		80-120	28-APR-12
WG1463784-3 DUP		**L1140393-1**						
Color, Apparent		<1.0	<1.0	RPD-NA	C.U.	N/A	20	28-APR-12
WG1463784-1 MB								
Color, Apparent			<1.0		C.U.		1	28-APR-12
EC-MF-WT	**Water**							
Batch R2357794								
WG1463780-1 MB								
E. Coli			0		CFU/100mL		1	29-APR-12
EC-WT	**Water**							
Batch R2358057								
WG1464192-1 CVS								
Conductivity			99.4		%		90-110	30-APR-12
WG1464192-4 DUP		**L1140393-1**						
Conductivity		987	986		umhos/cm	0.10	10	30-APR-12
WG1464192-2 MB								
Conductivity			<3.0		umhos/cm		3	30-APR-12
MET-TOT-WT	**Water**							
Batch R2358222								
WG1464072-2 CVS								
Aluminum (Al)-Total			98.9		%		80-120	30-APR-12
Antimony (Sb)-Total			102.1		%		80-120	30-APR-12
Arsenic (As)-Total			99.5		%		80-120	30-APR-12
Barium (Ba)-Total			100.5		%		80-120	30-APR-12
Bismuth (Bi)-Total			96.5		%		80-120	30-APR-12
Boron (B)-Total			109.8		%		70-130	30-APR-12
Cadmium (Cd)-Total			106.4		%		80-120	30-APR-12
Calcium (Ca)-Total			95.3		%		80-120	30-APR-12

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-WT	**Water**							
Batch R2358222								
WG1464072-2 CVS								
Chromium (Cr)-Total			100.9		%		80-120	30-APR-12
Cobalt (Co)-Total			98.4		%		80-120	30-APR-12
Copper (Cu)-Total			100.5		%		80-120	30-APR-12
Iron (Fe)-Total			97.5		%		70-130	30-APR-12
Lead (Pb)-Total			102.2		%		80-120	30-APR-12
Magnesium (Mg)-Total			96.3		%		80-120	30-APR-12
Manganese (Mn)-Total			104.2		%		80-120	30-APR-12
Molybdenum (Mo)-Total			100.9		%		90-110	30-APR-12
Nickel (Ni)-Total			101.0		%		80-120	30-APR-12
Phosphorus (P)-Total			99.1		%		70-130	30-APR-12
Potassium (K)-Total			95.9		%		80-120	30-APR-12
Selenium (Se)-Total			99.2		%		80-120	30-APR-12
Silicon (Si)-Total			103.2		%		70-130	30-APR-12
Silver (Ag)-Total			106.3		%		80-120	30-APR-12
Sodium (Na)-Total			96.0		%		80-120	30-APR-12
Strontium (Sr)-Total			100.9		%		80-120	30-APR-12
Thallium (Tl)-Total			106.9		%		80-120	30-APR-12
Tin (Sn)-Total			100.1		%		70-130	30-APR-12
Titanium (Ti)-Total			103.5		%		80-120	30-APR-12
Tungsten (W)-Total			100.7		%		70-130	30-APR-12
Uranium (U)-Total			101.8		%		80-120	30-APR-12
Vanadium (V)-Total			100.6		%		80-120	30-APR-12
Zinc (Zn)-Total			101.9		%		80-120	30-APR-12
Zirconium (Zr)-Total			100.2		%		80-120	30-APR-12
WG1464023-2 LCS								
Aluminum (Al)-Total			98.1		%		80-120	30-APR-12
Antimony (Sb)-Total			89.8		%		70-130	30-APR-12
Arsenic (As)-Total			98.5		%		70-130	30-APR-12
Barium (Ba)-Total			93.6		%		70-130	30-APR-12
Bismuth (Bi)-Total			101.1		%		70-130	30-APR-12
Boron (B)-Total			104.8		%		70-130	30-APR-12
Cadmium (Cd)-Total			100.3		%		70-130	30-APR-12
Calcium (Ca)-Total			93.4		%		70-130	30-APR-12
Chromium (Cr)-Total			95.5		%		70-130	30-APR-12

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-WT	**Water**							
Batch R2358222								
WG1464023-2 LCS								
Cobalt (Co)-Total			95.9		%		70-130	30-APR-12
Copper (Cu)-Total			96.2		%		70-130	30-APR-12
Iron (Fe)-Total			95.2		%		70-130	30-APR-12
Lead (Pb)-Total			101.7		%		70-130	30-APR-12
Magnesium (Mg)-Total			89.3		%		70-130	30-APR-12
Manganese (Mn)-Total			98.6		%		70-130	30-APR-12
Molybdenum (Mo)-Total			100.4		%		70-130	30-APR-12
Nickel (Ni)-Total			96.3		%		70-130	30-APR-12
Phosphorus (P)-Total			100.6		%		70-130	30-APR-12
Potassium (K)-Total			92.0		%		70-130	30-APR-12
Selenium (Se)-Total			104.2		%		70-130	30-APR-12
Silicon (Si)-Total			98.7		%		70-130	30-APR-12
Silver (Ag)-Total			96.6		%		70-130	30-APR-12
Sodium (Na)-Total			88.0		%		70-130	30-APR-12
Strontium (Sr)-Total			101.9		%		70-130	30-APR-12
Thallium (Tl)-Total			103.4		%		70-130	30-APR-12
Tin (Sn)-Total			95.5		%		70-130	30-APR-12
Titanium (Ti)-Total			99.0		%		70-130	30-APR-12
Tungsten (W)-Total			99.2		%		70-130	30-APR-12
Uranium (U)-Total			100.8		%		70-130	30-APR-12
Vanadium (V)-Total			97.1		%		70-130	30-APR-12
Zinc (Zn)-Total			102.1		%		70-130	30-APR-12
Zirconium (Zr)-Total			96.7		%		70-130	30-APR-12
WG1464023-1 MB								
Aluminum (Al)-Total			<0.010		mg/L		0.01	30-APR-12
Antimony (Sb)-Total			<0.0050		mg/L		0.005	30-APR-12
Arsenic (As)-Total			<0.0010		mg/L		0.001	30-APR-12
Barium (Ba)-Total			<0.010		mg/L		0.01	30-APR-12
Bismuth (Bi)-Total			<0.0010		mg/L		0.001	30-APR-12
Boron (B)-Total			<0.050		mg/L		0.05	30-APR-12
Cadmium (Cd)-Total			<0.000090		mg/L		0.00009	30-APR-12
Calcium (Ca)-Total			<0.50		mg/L		0.5	30-APR-12
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	30-APR-12
Cobalt (Co)-Total			<0.00050		mg/L		0.0005	30-APR-12

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-WT	**Water**							
Batch R2358222								
WG1464023-1 MB								
Copper (Cu)-Total			<0.0010		mg/L		0.001	30-APR-12
Iron (Fe)-Total			<0.050		mg/L		0.05	30-APR-12
Lead (Pb)-Total			<0.0010		mg/L		0.001	30-APR-12
Magnesium (Mg)-Total			<0.50		mg/L		0.5	30-APR-12
Manganese (Mn)-Total			<0.0010		mg/L		0.001	30-APR-12
Molybdenum (Mo)-Total			<0.0010		mg/L		0.001	30-APR-12
Nickel (Ni)-Total			<0.0020		mg/L		0.002	30-APR-12
Phosphorus (P)-Total			<0.050		mg/L		0.05	30-APR-12
Potassium (K)-Total			<1.0		mg/L		1	30-APR-12
Selenium (Se)-Total			<0.00040		mg/L		0.0004	30-APR-12
Silicon (Si)-Total			<1.0		mg/L		1	30-APR-12
Silver (Ag)-Total			<0.00010		mg/L		0.0001	30-APR-12
Sodium (Na)-Total			<0.50		mg/L		0.5	30-APR-12
Strontium (Sr)-Total			<0.0010		mg/L		0.001	30-APR-12
Thallium (Tl)-Total			<0.00030		mg/L		0.0003	30-APR-12
Tin (Sn)-Total			<0.0010		mg/L		0.001	30-APR-12
Titanium (Ti)-Total			<0.0020		mg/L		0.002	30-APR-12
Tungsten (W)-Total			<0.010		mg/L		0.01	30-APR-12
Uranium (U)-Total			<0.0050		mg/L		0.005	30-APR-12
Vanadium (V)-Total			<0.0010		mg/L		0.001	30-APR-12
Zinc (Zn)-Total			<0.0030		mg/L		0.003	30-APR-12
Zirconium (Zr)-Total			<0.0040		mg/L		0.004	30-APR-12
WG1464023-5 MS		**WG1464023-3**						
Aluminum (Al)-Total			101.1		%		70-130	30-APR-12
Antimony (Sb)-Total			93.3		%		70-130	30-APR-12
Arsenic (As)-Total			99.6		%		70-130	30-APR-12
Barium (Ba)-Total			97.7		%		70-130	30-APR-12
Bismuth (Bi)-Total			99.8		%		70-130	30-APR-12
Boron (B)-Total			108.3		%		70-130	30-APR-12
Cadmium (Cd)-Total			100.3		%		70-130	30-APR-12
Calcium (Ca)-Total			N/A	MS-B	%		-	30-APR-12
Chromium (Cr)-Total			98.1		%		70-130	30-APR-12
Cobalt (Co)-Total			94.3		%		70-130	30-APR-12
Copper (Cu)-Total			94.7		%		70-130	30-APR-12

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-WT	**Water**							
Batch R2358222								
WG1464023-5 MS		**WG1464023-3**						
Iron (Fe)-Total			96.7		%		70-130	30-APR-12
Lead (Pb)-Total			98.1		%		70-130	30-APR-12
Magnesium (Mg)-Total			N/A	MS-B	%		-	30-APR-12
Manganese (Mn)-Total			101.4		%		70-130	30-APR-12
Molybdenum (Mo)-Total			96.7		%		70-130	30-APR-12
Nickel (Ni)-Total			94.1		%		70-130	30-APR-12
Phosphorus (P)-Total			102.0		%		70-130	30-APR-12
Potassium (K)-Total			87.8		%		70-130	30-APR-12
Selenium (Se)-Total			98.2		%		70-130	30-APR-12
Silicon (Si)-Total			N/A	MS-B	%		-	30-APR-12
Silver (Ag)-Total			95.8		%		70-130	30-APR-12
Sodium (Na)-Total			N/A	MS-B	%		-	30-APR-12
Strontium (Sr)-Total			N/A	MS-B	%		-	30-APR-12
Thallium (Tl)-Total			99.3		%		70-130	30-APR-12
Tin (Sn)-Total			96.8		%		70-130	30-APR-12
Titanium (Ti)-Total			97.9		%		70-130	30-APR-12
Tungsten (W)-Total			98.6		%		70-130	30-APR-12
Uranium (U)-Total			101.6		%		70-130	30-APR-12
Vanadium (V)-Total			100.7		%		70-130	30-APR-12
Zinc (Zn)-Total			102.1		%		70-130	30-APR-12
Zirconium (Zr)-Total			95.1		%		70-130	30-APR-12
Batch R2358290								
WG1464639-2 CVS								
Beryllium (Be)-Total			107.5		%		80-120	01-MAY-12
WG1464023-2 LCS								
Beryllium (Be)-Total			83.2		%		70-130	01-MAY-12
WG1464023-1 MB								
Beryllium (Be)-Total			<0.0010		mg/L		0.001	01-MAY-12
WG1464023-5 MS		**WG1464023-3**						
Beryllium (Be)-Total			75.2		%		70-130	01-MAY-12
NH3-WT	**Water**							
Batch R2358391								
WG1464660-2 CVS								
Ammonia, Total (as N)			98.7		%		85-115	01-MAY-12
WG1464660-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-WT	**Water**							
Batch R2358391								
WG1464660-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	01-MAY-12
WG1464660-4 MS		**L1139999-1**						
Ammonia, Total (as N)			87.5		%		75-125	01-MAY-12
WG1464660-6 MS		**L1140294-4**						
Ammonia, Total (as N)			N/A	MS-B	%		-	01-MAY-12
WG1464660-8 MS		**L1140770-2**						
Ammonia, Total (as N)			84.5		%		75-125	01-MAY-12
P-ORTHO-LOW-WT	**Water**							
Batch R2358497								
WG1464751-5 DUP		**L1140393-1**						
Phosphate-P (ortho)		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	01-MAY-12
WG1464751-2 LCS								
Phosphate-P (ortho)			94.4		%		80-120	01-MAY-12
WG1464751-1 MB								
Phosphate-P (ortho)			<0.0030		mg/L		0.003	01-MAY-12
WG1464751-4 MS		**L1139954-3**						
Phosphate-P (ortho)			75.0		%		70-130	01-MAY-12
WG1464751-6 MS		**L1140393-1**						
Phosphate-P (ortho)			99.3		%		70-130	01-MAY-12
PH-ALK-WT	**Water**							
Batch R2358054								
WG1464189-3 DUP		**L1140393-1**						
pH		7.89	7.89		pH units	0.0	20	30-APR-12
WG1464189-1 LCS								
pH			7.04		pH units		6.9-7.1	30-APR-12
REDOX-POTENTIAL-WT	**Water**							
Batch R2358060								
WG1464509-1 DUP		**L1140393-1**						
Redox Potential		136	138		mV	1.5	25	30-APR-12
SOLIDS-TDS-WT	**Water**							
Batch R2359004								
WG1464641-2 LCS								
Total Dissolved Solids			88.7		%		70-130	02-MAY-12
WG1464641-1 MB								
Total Dissolved Solids			<20		mg/L		20	02-MAY-12

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TC-MF-WT	**Water**							
Batch R2357788								
WG1463783-1 MB								
Total Coliforms			0		CFU/100mL		1	29-APR-12
TCB-MF-WT	**Water**							
Batch R2357788								
WG1463783-1 MB								
Total Coliform Background			0		CFU/100mL		1	29-APR-12
TURBIDITY-WT	**Water**							
Batch R2357499								
WG1463732-2 CVS								
Turbidity			101.0		%		85-115	28-APR-12
WG1463732-1 MB								
Turbidity			<0.10		NTU		0.1	28-APR-12

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential							
	1	27-APR-12 08:40	30-APR-12 18:02	0.25	81	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM:	Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR:	Exceeded ALS recommended hold time prior to sample receipt.
EHTL:	Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT:	Exceeded ALS recommended hold time prior to analysis.
Rec. HT:	ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1140393 were received on 27-APR-12 17:09.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

126536

C of C # 00000

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM

Page ___ of ___

Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.

Specify date required

Service requested		TAT
5 day (regular)	X	2 day TAT (50%)
3-4 day (25%)		Next day TAT (100%)
		Same day TAT (200%)

COMPANY NAME	LVM
OFFICE	Kitchener
PROJECT MANAGER	Dave Morlock
PROJECT #	160-P0000 145-400
PHONE	519 741 1313
FAX	519-741-5422
ACCOUNT #	
QUOTATION #	
PO #	205030

CRITERIA — Criteria on report YES___ NO___

Reg 153/04 ❑ Reg 511/09 ❑

Table 1 2 3 4 5 6 7 8 9

TCLP _____ MISA _____ PWQO _____

ODWS _____ OTHER _____

REPORT FORMAT/DISTRIBUTION

EMAIL X FAX _____ BOTH _____

SELECT: PDF X DIGITAL _____ BOTH _____

EMAIL 1 dav

EMAIL 2 _____

SAMPLING INFORMATION

Sample Date/Time		TYPE		MATRIX			SAMPLE DESCRIPTION TO APPEAR ON REPORT	NUMBER OF CONTAINERS	ANALYSIS REQUEST: General Analysis Package	COMMENTS	LAB ID
Date (dd-mm-yy)	Time (24hr) (hh:mm)	COMP	GRAB	WATER	SOIL	OTHER					
2012-04-27	8:40			X			Water Supply Well - untreated		X		-1

PLEASE INDICATE FILTERED, PRESERVED OR BOTH <----- (F, P, F/P)

SUBMISSION #: L1140393

ENTERED BY: AustinP

DATE/TIME ENTERED: 27/04/12 19:26

BIN #: B525

SPECIAL INSTRUCTIONS/COMMENTS

THE QUESTIONS BELOW MUST BE ANSWERED FORWATER SAMPLES (CHECK Yes OR No)

Are any samples taken from a regulated DW System? Yes ❑ No X

If yes, an authorized drinking water COC MUST be used for this submission.

Is the water sampled intended to be potable for human consumption? Yes X No ❑

SAMPLE CONDITION

FROZEN	❑	MEAN	
COLD	X	TEMP	1.5
COOLING INITIATED	❑		
AMBIENT	❑		
OBSERVATIONS Yes ❑ No ❑		UNIT	
If yes add SIF			

SAMPLED BY:	K. Thams		
RELINQUISHED BY:	K. Thams	DATE & TIME	
DATE & TIME		RECEIVED BY:	
DATE & TIME		RECEIVED AT LAB BY: ACB	DATE & TIME 27/4/12 14:09

Notes

1. Quote number must be provided to ensure proper pricing

2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.

3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

LVM INC.
ATTN: DAVE MORLOCK
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5

Date Received: 03-JUL-12
Report Date: 09-JUL-12 10:39 (MT)
Version: FINAL

Client Phone: 519-741-1313

Certificate of Analysis

Lab Work Order #: L1171217

Project P.O. #: 205030
Job Reference: 160-P0000145-400
C of C Numbers: 127147
Legal Site Desc:

NANCY SMITH
Account Manager

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

Sample Details/Parameters	Result	Qualifier	D.L.	Units	Criteria Specific Limits STANDARDS		GUIDELINES	Analyzed	Batch
L1171217-1 WATER SUPPLY WELL - BEFORE TREATMENT SYSTEM									
Sampled By: K. THRAMS on 03-JUL-12 @ 07:00									
Matrix: WATER									
General Water Quality Package									
Ammonia, Total (as N)	<0.050		0.050	mg/L				04-JUL-12	R2392246
Anion Scan (IC)									
Chloride	131		2.0	mg/L			250	05-JUL-12	R2394317
Bromide	<0.10		0.10	mg/L				05-JUL-12	R2394317
Fluoride	<0.10		0.10	mg/L	1.5			05-JUL-12	R2394317
Nitrite-N	<0.10		0.10	mg/L	1			05-JUL-12	R2394317
Nitrate-N	8.49		0.10	mg/L	10			05-JUL-12	R2394317
Sulphate	27.1		2.0	mg/L			500	05-JUL-12	R2394317
Silica	8.5		2.1	mg/L				06-JUL-12	
Color, Apparent	1.0		1.0	C.U.			5	04-JUL-12	R2392972
Conductivity	1000		3.0	umhos/cm				03-JUL-12	R2391996
Detailed Ion Balance Calculation									
Ion Balance	117			%				07-JUL-12	
Cation - Anion Balance	7.7			%				07-JUL-12	
Computed Conductivity	876			uS/cm				07-JUL-12	
Conductivity % Difference	-13.4			%				07-JUL-12	
TDS (Calculated)	535			mg/L				07-JUL-12	
Anion Sum	8.71			me/L				07-JUL-12	
Cation Sum	10.2			me/L				07-JUL-12	
Saturation pH	7.15			pH				07-JUL-12	
Langelier Index	0.8			No Unit				07-JUL-12	
Hardness (as CaCO3)	319			mg/L		**	80-100	07-JUL-12	
E. Coli	0		0	CFU/100mL	0			04-JUL-12	R2392405
Metal Scan-Total									
Aluminum (Al)-Total	<0.010		0.010	mg/L			0.1	05-JUL-12	R2393589
Antimony (Sb)-Total	<0.0050		0.0050	mg/L	0.006			05-JUL-12	R2393589
Arsenic (As)-Total	<0.0010		0.0010	mg/L	0.025			05-JUL-12	R2393589
Barium (Ba)-Total	0.084		0.010	mg/L	1			05-JUL-12	R2393589
Beryllium (Be)-Total	<0.0010		0.0010	mg/L				05-JUL-12	R2393589
Bismuth (Bi)-Total	<0.0010		0.0010	mg/L				05-JUL-12	R2393589
Boron (B)-Total	<0.050		0.050	mg/L	5			05-JUL-12	R2393589
Cadmium (Cd)-Total	<0.000090		0.000090	mg/L	0.005			05-JUL-12	R2393589
Calcium (Ca)-Total	89.9		0.50	mg/L				05-JUL-12	R2393589
Chromium (Cr)-Total	0.00050		0.00050	mg/L	0.05			05-JUL-12	R2393589
Cobalt (Co)-Total	<0.00050		0.00050	mg/L				05-JUL-12	R2393589
Copper (Cu)-Total	0.0162		0.0010	mg/L			1	05-JUL-12	R2393589
Iron (Fe)-Total	<0.050		0.050	mg/L			0.3	05-JUL-12	R2393589
Lead (Pb)-Total	0.0035		0.0010	mg/L	0.01			05-JUL-12	R2393589
Magnesium (Mg)-Total	23.0		0.50	mg/L				05-JUL-12	R2393589
Manganese (Mn)-Total	<0.0010		0.0010	mg/L			0.05	05-JUL-12	R2393589
Molybdenum (Mo)-Total	<0.0010		0.0010	mg/L				05-JUL-12	R2393589
Nickel (Ni)-Total	<0.0020		0.0020	mg/L				05-JUL-12	R2393589
Phosphorus (P)-Total	<0.050		0.050	mg/L				05-JUL-12	R2393589
Potassium (K)-Total	1.3		1.0	mg/L				05-JUL-12	R2393589
Selenium (Se)-Total	<0.00040		0.00040	mg/L	0.01			05-JUL-12	R2393589
Silicon (Si)-Total	4.0		1.0	mg/L				05-JUL-12	R2393589

* Detection Limit for result exceeds Criteria Specific Limit. Assessment against Criteria Limit cannot be made.

** Analytical result for this parameter exceeds Criteria Specific Limit listed on this report.

Ontario DW Std O.Reg 169/03 JUNE 2007

Sample Details/Parameters	Result	Qualifier	D.L.	Units	Criteria Specific Limits				Analyzed	Batch
						STANDARDS		GUIDELINES		
L1171217-1 WATER SUPPLY WELL - BEFORE TREATMENT SYSTEM										
Sampled By: K. THRAMS on 03-JUL-12 @ 07:00										
Matrix: WATER										
General Water Quality Package										
Metal Scan-Total										
Silver (Ag)-Total	<0.00010		0.00010	mg/L					05-JUL-12	R2393589
Sodium (Na)-Total	86.0	DLM	5.0	mg/L	**	20		200	05-JUL-12	R2393589
Strontium (Sr)-Total	0.219		0.0010	mg/L					05-JUL-12	R2393589
Thallium (Tl)-Total	<0.00030		0.00030	mg/L					05-JUL-12	R2393589
Tin (Sn)-Total	<0.0010		0.0010	mg/L					05-JUL-12	R2393589
Titanium (Ti)-Total	<0.0020		0.0020	mg/L					05-JUL-12	R2393589
Tungsten (W)-Total	<0.010		0.010	mg/L					05-JUL-12	R2393589
Uranium (U)-Total	<0.0050		0.0050	mg/L		0.02			05-JUL-12	R2393589
Vanadium (V)-Total	<0.0010		0.0010	mg/L					05-JUL-12	R2393589
Zinc (Zn)-Total	0.0372		0.0030	mg/L				5	05-JUL-12	R2393589
Zirconium (Zr)-Total	<0.0040		0.0040	mg/L					05-JUL-12	R2393589
Phosphate-P (ortho)	<0.0030		0.0030	mg/L					06-JUL-12	R2393724
Total Coliform Background	0		0	CFU/100mL					04-JUL-12	R2392404
Redox Potential	199		-1000	mV					03-JUL-12	R2391465
Sodium Adsorption Ratio	2.09		0.030	No Unit					09-JUL-12	
Total Coliforms	0		0	CFU/100mL		0			04-JUL-12	R2392404
Total Dissolved Solids	528		20	mg/L			**	500	07-JUL-12	R2394331
Turbidity	<0.10		0.10	NTU				5	04-JUL-12	R2392482
pH	7.98		0.10	pH units				6.5-8.5	03-JUL-12	R2391994
Individual Analytes										
Speciated Alkalinity										
Alkalinity, Total (as CaCO3)	233		10	mg/L				30-500	06-JUL-12	R2393769
Alkalinity, Bicarbonate (as CaCO3)	230		10	mg/L					06-JUL-12	R2393769
Alkalinity, Carbonate (as CaCO3)	<10		10	mg/L					06-JUL-12	R2393769
Alkalinity, Hydroxide (as CaCO3)	<10		10	mg/L					06-JUL-12	R2393769

* Detection Limit for result exceeds Criteria Specific Limit. Assessment against Criteria Limit cannot be made.

** Analytical result for this parameter exceeds Criteria Specific Limit listed on this report.

Ontario DW Std O.Reg 169/03 JUNE 2007

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
ALK-SPEC-WT	Water	Speciated Alkalinity		EPA 310.2
ANIONS-WT	Water	Anion Scan (IC)		EPA 300.0 (IC)
COLOUR-WT	Water	Colour		APHA 2120
		Apparent colour is determined by analysis of the decanted sample using the platinum-cobalt colourimetric method.		
EC-MF-WT	Water	E. coli		SM 9222D
		A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at @44.5–0.2°C for 24–2h. Method ID: WT-TM-1200		
EC-WT	Water	Conductivity		APHA 2510 B
		Water samples can be measured directly by immersing the conductivity cell into the sample.		
ETL-SAR-CALC-WT	Water	Sodium Adsorption Ratio		Calculation
ETL-SILICA-CALC-WT	Water	Calculate from SI-TOT-WT		EPA 200.8
IONBALANCE-OP03-WT	Water	Detailed Ion Balance Calculation		APHA 1030E, 2330B, 2510A
MET-TOT-WT	Water	Metal Scan-Total		EPA 200.8
		The concentration of metals is determined on an unfiltered aqueous sample. The sample is digested with nitric acid and then analyzed directly by ICP-MS.		
NH3-WT	Water	Ammonia as N		EPA 350.1
		Sample is measured colorimetrically. When sample is turbid a distillation step is required, sample is distilled into a solution of boric acid and measured colorimetrically.		
P-ORTHO-LOW-WT	Water	Phosphorus-P (ortho)		APHA 4500-P B E
PH-ALK-WT	Water	pH		APHA 4500 H-Electrode
		Water samples are analyzed directly by a calibrated pH meter.		
REDOX-POTENTIAL-WT	Water	Redox Potential		APHA 2580
SOLIDS-TDS-WT	Water	Total Dissolved Solids		APHA 2540C
		A well-mixed sample is filtered though glass fibres filter. A known volume of the filtrate is evaporated and dried at 105–5°C overnight and then 180–10°C for 1hr.		
TC-MF-WT	Water	Total Coliforms		SM 9222B
		A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200		
TCB-MF-WT	Water	REG		SM 9222B
		A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200.		
TURBIDITY-WT	Water	Turbidity		APHA 2130 B
		Sample result is based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. Sample readings are obtained from a Nephelometer.		

Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

127147

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA		

Reference Information

160-P0000145-400

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of criteria limits is provided as is without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.

Quality Control Report

Workorder: L1171217 Report Date: 09-JUL-12

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-SPEC-WT	**Water**							
Batch R2393769								
WG1502538-4 CRM		**WT-ALK-CRM**						
Alkalinity, Total (as CaCO3)			91.4		%		80-120	06-JUL-12
WG1502538-2 CVS								
Alkalinity, Total (as CaCO3)			96.1		%		70-130	06-JUL-12
WG1502538-3 DUP		**L1170591-1**						
Alkalinity, Total (as CaCO3)		218	217		mg/L	0.6	20	06-JUL-12
Alkalinity, Bicarbonate (as CaCO3)		216	214		mg/L	0.6	25	06-JUL-12
Alkalinity, Carbonate (as CaCO3)		<10	<10	RPD-NA	mg/L	N/A	25	06-JUL-12
Alkalinity, Hydroxide (as CaCO3)		<10	<10	RPD-NA	mg/L	N/A	25	06-JUL-12
WG1502538-1 MB								
Alkalinity, Total (as CaCO3)			<10		mg/L		10	06-JUL-12
Alkalinity, Bicarbonate (as CaCO3)			<10		mg/L		10	06-JUL-12
Alkalinity, Carbonate (as CaCO3)			<10		mg/L		10	06-JUL-12
Alkalinity, Hydroxide (as CaCO3)			<10		mg/L		10	06-JUL-12
ANIONS-WT	**Water**							
Batch R2394317								
WG1502432-6 DUP		**L1171217-1**						
Chloride		131	130		mg/L	0.3	20	05-JUL-12
Bromide		<0.10	<0.10	RPD-NA	mg/L	N/A	20	05-JUL-12
Fluoride		<0.10	<0.10	RPD-NA	mg/L	N/A	20	05-JUL-12
Nitrite-N		<0.10	<0.10	RPD-NA	mg/L	N/A	20	05-JUL-12
Nitrate-N		8.49	8.47		mg/L	0.2	20	05-JUL-12
Sulphate		27.1	27.0		mg/L	0.3	20	05-JUL-12
WG1502432-3 LCS								
Chloride			95.6		%		85-115	05-JUL-12
Bromide			92.6		%		85-115	05-JUL-12
Fluoride			96.0		%		85-115	05-JUL-12
Nitrite-N			92.4		%		85-115	05-JUL-12
Nitrate-N			93.4		%		85-115	05-JUL-12
Sulphate			96.9		%		85-115	05-JUL-12
WG1502432-4 LCSD		**WG1502432-3**						
Chloride		95.6	95.5		%	0.0	25	05-JUL-12
Bromide		92.6	93.2		%	0.6	25	05-JUL-12
Fluoride		96.0	95.8		%	0.2	25	05-JUL-12
Nitrite-N		92.4	93.2		%	0.9	25	05-JUL-12

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ANIONS-WT	**Water**							
Batch R2394317								
WG1502432-4 LCSD		**WG1502432-3**						
Nitrate-N		93.4	93.6		%	0.1	25	05-JUL-12
Sulphate		96.9	96.8		%	0.0	25	05-JUL-12
WG1502432-1 MB								
Chloride			<2.0		mg/L		2	05-JUL-12
Bromide			<0.10		mg/L		0.1	05-JUL-12
Fluoride			<0.10		mg/L		0.1	05-JUL-12
Nitrite-N			<0.10		mg/L		0.1	05-JUL-12
Nitrate-N			<0.10		mg/L		0.1	05-JUL-12
Sulphate			<2.0		mg/L		2	05-JUL-12
COLOUR-WT	**Water**							
Batch R2392972								
WG1500871-2 CVS								
Color, Apparent			99.8		%		80-120	04-JUL-12
WG1500871-3 DUP		**L1171217-1**						
Color, Apparent		1.0	<1.0	RPD-NA	C.U.	N/A	20	04-JUL-12
WG1500871-1 MB								
Color, Apparent			<1.0		C.U.		1	04-JUL-12
EC-MF-WT	**Water**							
Batch R2392405								
WG1500489-2 DUP		**L1171196-1**						
E. Coli		0	0		CFU/100mL	0.0	50	04-JUL-12
WG1500489-3 DUP		**L1171194-1**						
E. Coli		0	0		CFU/100mL	0.0	50	04-JUL-12
WG1500489-1 MB								
E. Coli			0		CFU/100mL		1	04-JUL-12
WG1500489-4 MB								
E. Coli			0		CFU/100mL		1	04-JUL-12
EC-WT	**Water**							
Batch R2391996								
WG1500150-1 CVS								
Conductivity			99.3		%		90-110	03-JUL-12
WG1500150-3 DUP		**L1171039-1**						
Conductivity		249	248		umhos/cm	0.4	10	03-JUL-12
WG1500150-4 DUP		**L1171039-15**						
Conductivity		63.0	60.0		umhos/cm	4.9	10	03-JUL-12
WG1500150-5 DUP		**L1171205-2**						

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EC-WT	**Water**							
Batch R2391996								
WG1500150-5 DUP		**L1171205-2**						
Conductivity		61.0	61.0		umhos/cm	0.0	10	03-JUL-12
WG1500150-2 MB								
Conductivity			<3.0		umhos/cm		3	03-JUL-12
MET-TOT-WT	**Water**							
Batch R2393589								
WG1501577-2 CVS								
Aluminum (Al)-Total			98.7		%		80-120	05-JUL-12
Antimony (Sb)-Total			99.7		%		80-120	05-JUL-12
Arsenic (As)-Total			96.0		%		80-120	05-JUL-12
Barium (Ba)-Total			98.2		%		80-120	05-JUL-12
Beryllium (Be)-Total			103.8		%		80-120	05-JUL-12
Bismuth (Bi)-Total			89.0		%		80-120	05-JUL-12
Boron (B)-Total			104.6		%		70-130	05-JUL-12
Cadmium (Cd)-Total			103.2		%		80-120	05-JUL-12
Calcium (Ca)-Total			96.6		%		80-120	05-JUL-12
Chromium (Cr)-Total			98.7		%		80-120	05-JUL-12
Cobalt (Co)-Total			96.8		%		80-120	05-JUL-12
Copper (Cu)-Total			97.5		%		80-120	05-JUL-12
Iron (Fe)-Total			95.8		%		70-130	05-JUL-12
Lead (Pb)-Total			102.1		%		80-120	05-JUL-12
Magnesium (Mg)-Total			101.1		%		80-120	05-JUL-12
Manganese (Mn)-Total			99.7		%		80-120	05-JUL-12
Molybdenum (Mo)-Total			95.4		%		90-110	05-JUL-12
Nickel (Ni)-Total			99.4		%		80-120	05-JUL-12
Phosphorus (P)-Total			98.1		%		70-130	05-JUL-12
Potassium (K)-Total			97.0		%		80-120	05-JUL-12
Selenium (Se)-Total			95.2		%		80-120	05-JUL-12
Silicon (Si)-Total			98.6		%		70-130	05-JUL-12
Silver (Ag)-Total			94.6		%		80-120	05-JUL-12
Sodium (Na)-Total			98.3		%		80-120	05-JUL-12
Strontium (Sr)-Total			96.9		%		80-120	05-JUL-12
Thallium (Tl)-Total			103.5		%		80-120	05-JUL-12
Tin (Sn)-Total			99.6		%		70-130	05-JUL-12
Titanium (Ti)-Total			98.5		%		80-120	05-JUL-12

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-WT	**Water**							
Batch R2393589								
WG1501577-2 CVS								
Tungsten (W)-Total			99.4		%		70-130	05-JUL-12
Uranium (U)-Total			99.4		%		80-120	05-JUL-12
Vanadium (V)-Total			97.1		%		80-120	05-JUL-12
Zinc (Zn)-Total			98.5		%		80-120	05-JUL-12
Zirconium (Zr)-Total			95.7		%		80-120	05-JUL-12
WG1500720-4 DUP		**WG1500720-3**						
Aluminum (Al)-Total		<0.10	<0.10	RPD-NA	mg/L	N/A	20	05-JUL-12
Antimony (Sb)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	05-JUL-12
Arsenic (As)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	05-JUL-12
Barium (Ba)-Total		<0.10	<0.10	RPD-NA	mg/L	N/A	20	05-JUL-12
Beryllium (Be)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	05-JUL-12
Bismuth (Bi)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	05-JUL-12
Boron (B)-Total		15.2	16.5		mg/L	8.4	20	05-JUL-12
Cadmium (Cd)-Total		<0.00090	<0.00090	RPD-NA	mg/L	N/A	20	05-JUL-12
Calcium (Ca)-Total		5.0	5.3		mg/L	4.8	20	05-JUL-12
Chromium (Cr)-Total		0.0424	0.0460		mg/L	8.2	20	05-JUL-12
Cobalt (Co)-Total		0.0163	0.0166		mg/L	1.9	20	05-JUL-12
Copper (Cu)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	05-JUL-12
Iron (Fe)-Total		20.7	22.1		mg/L	6.5	20	05-JUL-12
Lead (Pb)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	05-JUL-12
Magnesium (Mg)-Total		<5.0	<5.0	RPD-NA	mg/L	N/A	20	05-JUL-12
Manganese (Mn)-Total		0.209	0.229		mg/L	9.4	20	05-JUL-12
Molybdenum (Mo)-Total		0.138	0.147		mg/L	6.1	20	05-JUL-12
Nickel (Ni)-Total		0.280	0.300		mg/L	6.7	20	05-JUL-12
Phosphorus (P)-Total		9.30	10.0		mg/L	7.3	20	05-JUL-12
Potassium (K)-Total		<10	<10	RPD-NA	mg/L	N/A	20	05-JUL-12
Selenium (Se)-Total		<0.0040	<0.0040	RPD-NA	mg/L	N/A	20	05-JUL-12
Silicon (Si)-Total		<10	<10	RPD-NA	mg/L	N/A	20	05-JUL-12
Silver (Ag)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	05-JUL-12
Sodium (Na)-Total		2400	2430		mg/L	1.0	20	05-JUL-12
Strontium (Sr)-Total		0.021	0.022		mg/L	5.2	20	05-JUL-12
Thallium (Tl)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	05-JUL-12
Tin (Sn)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	05-JUL-12

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-WT	**Water**							
Batch R2393589								
WG1500720-4 DUP		**WG1500720-3**						
Titanium (Ti)-Total		0.020	0.023		mg/L	14	20	05-JUL-12
Tungsten (W)-Total		<0.10	<0.10	RPD-NA	mg/L	N/A	20	05-JUL-12
Uranium (U)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	05-JUL-12
Vanadium (V)-Total		0.089	0.093		mg/L	4.8	20	05-JUL-12
Zinc (Zn)-Total		0.261	0.278		mg/L	6.3	20	05-JUL-12
Zirconium (Zr)-Total		<0.040	<0.040	RPD-NA	mg/L	N/A	20	05-JUL-12
WG1500720-2 LCS								
Aluminum (Al)-Total			108.9		%		80-120	05-JUL-12
Antimony (Sb)-Total			93.9		%		70-130	05-JUL-12
Arsenic (As)-Total			101.1		%		70-130	05-JUL-12
Barium (Ba)-Total			100.1		%		70-130	05-JUL-12
Beryllium (Be)-Total			95.6		%		70-130	05-JUL-12
Bismuth (Bi)-Total			95.0		%		70-130	05-JUL-12
Boron (B)-Total			95.9		%		70-130	05-JUL-12
Cadmium (Cd)-Total			98.4		%		70-130	05-JUL-12
Calcium (Ca)-Total			100.3		%		70-130	05-JUL-12
Chromium (Cr)-Total			100.1		%		70-130	05-JUL-12
Cobalt (Co)-Total			94.4		%		70-130	05-JUL-12
Copper (Cu)-Total			96.2		%		70-130	05-JUL-12
Iron (Fe)-Total			99.5		%		70-130	05-JUL-12
Lead (Pb)-Total			96.8		%		70-130	05-JUL-12
Magnesium (Mg)-Total			107.4		%		70-130	05-JUL-12
Manganese (Mn)-Total			97.7		%		70-130	05-JUL-12
Molybdenum (Mo)-Total			97.8		%		70-130	05-JUL-12
Nickel (Ni)-Total			96.5		%		70-130	05-JUL-12
Phosphorus (P)-Total			111.9		%		70-130	05-JUL-12
Potassium (K)-Total			101.7		%		70-130	05-JUL-12
Selenium (Se)-Total			96.4		%		70-130	05-JUL-12
Silicon (Si)-Total			108.1		%		70-130	05-JUL-12
Silver (Ag)-Total			99.8		%		70-130	05-JUL-12
Sodium (Na)-Total			104.4		%		70-130	05-JUL-12
Strontium (Sr)-Total			95.1		%		70-130	05-JUL-12
Thallium (Tl)-Total			96.8		%		70-130	05-JUL-12

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-WT	**Water**							
Batch R2393589								
WG1500720-2 LCS								
Tin (Sn)-Total			97.1		%		70-130	05-JUL-12
Titanium (Ti)-Total			100.8		%		70-130	05-JUL-12
Tungsten (W)-Total			98.1		%		70-130	05-JUL-12
Uranium (U)-Total			93.3		%		70-130	05-JUL-12
Vanadium (V)-Total			100.3		%		70-130	05-JUL-12
Zinc (Zn)-Total			99.0		%		70-130	05-JUL-12
Zirconium (Zr)-Total			92.4		%		70-130	05-JUL-12
WG1500720-1 MB								
Aluminum (Al)-Total			<0.010		mg/L		0.01	05-JUL-12
Antimony (Sb)-Total			<0.0050		mg/L		0.005	05-JUL-12
Arsenic (As)-Total			<0.0010		mg/L		0.001	05-JUL-12
Barium (Ba)-Total			<0.010		mg/L		0.01	05-JUL-12
Beryllium (Be)-Total			<0.0010		mg/L		0.001	05-JUL-12
Bismuth (Bi)-Total			<0.0010		mg/L		0.001	05-JUL-12
Boron (B)-Total			<0.050		mg/L		0.05	05-JUL-12
Cadmium (Cd)-Total			<0.000090		mg/L		0.00009	05-JUL-12
Calcium (Ca)-Total			<0.50		mg/L		0.5	05-JUL-12
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	05-JUL-12
Cobalt (Co)-Total			<0.00050		mg/L		0.0005	05-JUL-12
Copper (Cu)-Total			<0.0010		mg/L		0.001	05-JUL-12
Iron (Fe)-Total			<0.050		mg/L		0.05	05-JUL-12
Lead (Pb)-Total			<0.0010		mg/L		0.001	05-JUL-12
Magnesium (Mg)-Total			<0.50		mg/L		0.5	05-JUL-12
Manganese (Mn)-Total			<0.0010		mg/L		0.001	05-JUL-12
Molybdenum (Mo)-Total			<0.0010		mg/L		0.001	05-JUL-12
Nickel (Ni)-Total			<0.0020		mg/L		0.002	05-JUL-12
Phosphorus (P)-Total			<0.050		mg/L		0.05	05-JUL-12
Potassium (K)-Total			<1.0		mg/L		1	05-JUL-12
Selenium (Se)-Total			<0.00040		mg/L		0.0004	05-JUL-12
Silicon (Si)-Total			<1.0		mg/L		1	05-JUL-12
Sodium (Na)-Total			<0.50		mg/L		0.5	05-JUL-12
Strontium (Sr)-Total			<0.0010		mg/L		0.001	05-JUL-12
Thallium (Tl)-Total			<0.00030		mg/L		0.0003	05-JUL-12
Tin (Sn)-Total			<0.0010		mg/L		0.001	05-JUL-12

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-WT	**Water**							
Batch R2393589								
WG1500720-1 MB								
Titanium (Ti)-Total			<0.0020		mg/L		0.002	05-JUL-12
Tungsten (W)-Total			<0.010		mg/L		0.01	05-JUL-12
Uranium (U)-Total			<0.0050		mg/L		0.005	05-JUL-12
Vanadium (V)-Total			<0.0010		mg/L		0.001	05-JUL-12
Zinc (Zn)-Total			<0.0030		mg/L		0.003	05-JUL-12
Zirconium (Zr)-Total			<0.0040		mg/L		0.004	05-JUL-12
WG1500720-5 MS		**WG1500720-3**						
Antimony (Sb)-Total			105.5		%		70-130	05-JUL-12
Arsenic (As)-Total			104.7		%		70-130	05-JUL-12
Barium (Ba)-Total			109.7		%		70-130	05-JUL-12
Beryllium (Be)-Total			96.1		%		70-130	05-JUL-12
Bismuth (Bi)-Total			105.0		%		70-130	05-JUL-12
Boron (B)-Total			N/A	MS-B	%		-	05-JUL-12
Cadmium (Cd)-Total			97.8		%		70-130	05-JUL-12
Calcium (Ca)-Total			101.3		%		70-130	05-JUL-12
Chromium (Cr)-Total			102.3		%		70-130	05-JUL-12
Cobalt (Co)-Total			97.0		%		70-130	05-JUL-12
Copper (Cu)-Total			99.6		%		70-130	05-JUL-12
Iron (Fe)-Total			N/A	MS-B	%		-	05-JUL-12
Lead (Pb)-Total			97.2		%		70-130	05-JUL-12
Magnesium (Mg)-Total			113.6		%		70-130	05-JUL-12
Manganese (Mn)-Total			N/A	MS-B	%		-	05-JUL-12
Molybdenum (Mo)-Total			N/A	MS-B	%		-	05-JUL-12
Nickel (Ni)-Total			N/A	MS-B	%		-	05-JUL-12
Phosphorus (P)-Total			N/A	MS-B	%		-	05-JUL-12
Selenium (Se)-Total			95.3		%		70-130	05-JUL-12
Silver (Ag)-Total			91.7		%		70-130	05-JUL-12
Sodium (Na)-Total			N/A	MS-B	%		-	05-JUL-12
Strontium (Sr)-Total			95.7		%		70-130	05-JUL-12
Thallium (Tl)-Total			94.0		%		70-130	05-JUL-12
Tin (Sn)-Total			99.5		%		70-130	05-JUL-12
Titanium (Ti)-Total			101.1		%		70-130	05-JUL-12
Tungsten (W)-Total			99.6		%		70-130	05-JUL-12
Uranium (U)-Total			96.6		%		70-130	05-JUL-12

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-WT	**Water**							
Batch R2393589								
WG1500720-5 MS		**WG1500720-3**						
Vanadium (V)-Total			112.1		%		70-130	05-JUL-12
Zinc (Zn)-Total			N/A	MS-B	%		-	05-JUL-12
Zirconium (Zr)-Total			91.0		%		70-130	05-JUL-12
NH3-WT	**Water**							
Batch R2392246								
WG1500874-2 CVS								
Ammonia, Total (as N)			102.1		%		85-115	04-JUL-12
WG1500874-3 DUP		**L1169690-1**						
Ammonia, Total (as N)		1.93	1.74		mg/L	10	20	04-JUL-12
WG1500874-4 DUP		**L1170394-1**						
Ammonia, Total (as N)		17.5	18.2		mg/L	3.5	20	04-JUL-12
WG1500874-5 DUP		**L1170591-1**						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	04-JUL-12
WG1500874-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	04-JUL-12
WG1500874-6 MS		**L1170591-1**						
Ammonia, Total (as N)			83.2		%		75-125	04-JUL-12
P-ORTHO-LOW-WT	**Water**							
Batch R2393724								
WG1502673-3 DUP		**L1171205-1**						
Phosphate-P (ortho)		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	06-JUL-12
WG1502673-2 LCS								
Phosphate-P (ortho)			96.2		%		80-120	06-JUL-12
WG1502673-1 MB								
Phosphate-P (ortho)			<0.0030		mg/L		0.003	06-JUL-12
WG1502673-4 MS		**L1171205-1**						
Phosphate-P (ortho)			89.5		%		70-130	06-JUL-12
PH-ALK-WT	**Water**							
Batch R2391994								
WG1500146-2 DUP		**L1170591-1**						
pH		8.07	8.12		pH units	0.6	20	03-JUL-12
WG1500146-1 LCS								
pH			6.97		pH units		6.9-7.1	03-JUL-12
REDOX-POTENTIAL-WT	**Water**							

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
REDOX-POTENTIAL-WT	**Water**							
Batch R2391465								
WG1500136-1 DUP		**L1170967-1**						
Redox Potential		190	209		mV	9.5	25	03-JUL-12
SOLIDS-TDS-WT	**Water**							
Batch R2394331								
WG1502699-3 DUP		**L1173858-2**						
Total Dissolved Solids		184	172		mg/L	6.7	20	07-JUL-12
WG1502699-4 DUP		**L1173858-7**						
Total Dissolved Solids		122	122		mg/L	0.0	20	07-JUL-12
WG1502699-5 DUP		**L1173858-9**						
Total Dissolved Solids		24	20		mg/L	18	20	07-JUL-12
WG1502699-2 LCS								
Total Dissolved Solids			91.3		%		85-115	07-JUL-12
WG1502699-1 MB								
Total Dissolved Solids			<20		mg/L		20	07-JUL-12
TC-MF-WT	**Water**							
Batch R2392404								
WG1500486-2 DUP		**L1171196-2**						
Total Coliforms		0	0		CFU/100mL	0.0	50	04-JUL-12
WG1500486-3 DUP		**L1171194-2**						
Total Coliforms		0	0		CFU/100mL	0.0	50	04-JUL-12
WG1500486-1 MB								
Total Coliforms			0		CFU/100mL		1	04-JUL-12
WG1500486-4 MB								
Total Coliforms			0		CFU/100mL		1	04-JUL-12
TCB-MF-WT	**Water**							
Batch R2392404								
WG1500486-2 DUP		**L1171196-2**						
Total Coliform Background		0	0		CFU/100mL	0.0	50	04-JUL-12
WG1500486-3 DUP		**L1171194-2**						
Total Coliform Background		0	0		CFU/100mL	0.0	50	04-JUL-12
WG1500486-1 MB								
Total Coliform Background			0		CFU/100mL		1	04-JUL-12
WG1500486-4 MB								
Total Coliform Background			0		CFU/100mL		1	04-JUL-12
TURBIDITY-WT	**Water**							

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TURBIDITY-WT	**Water**							
Batch R2392482								
WG1501216-2 CVS								
Turbidity			100.0		%		85-115	04-JUL-12
WG1501216-3 DUP		**L1171217-1**						
Turbidity		<0.10	<0.10	RPD-NA	NTU	N/A	20	04-JUL-12
WG1501216-1 MB								
Turbidity			<0.10		NTU		0.1	04-JUL-12

Quality Control Report

Workorder: L1171217 Report Date: 09-JUL-12

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

127147
C of C # 00000

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM Page ___ of ___

Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.

Specify date required	Service requested			
	5 day (regular)	✓	Next day TAT (100%)	
	3-4 day (25%)		Same day TAT (200%)	
			2 day TAT (50%)	

COMPANY NAME	LVM
OFFICE	Kitchener
PROJECT MANAGER	David Morlock
PROJECT #	160-P000145-400
PHONE	519. 741. 1313
FAX	519. 741. 5422
ACCOUNT #	
QUOTATION #	
PO #	205030

CRITERIA — Criteria on report YES___ NO___

Reg 153/04 ❑ Reg 511/09 ❑
Table 1 2 3 4 5 6 7 8 9

TCLP _____ MISA _____ PWQO _____
ODWS _____ OTHER _____

REPORT FORMAT/DISTRIBUTION

EMAIL _X_ FAX _____ BOTH _____
SELECT: PDF _X_ DIGITAL _____ BOTH _____
EMAIL 1 _____
EMAIL 2 _____

ANALYSIS REQUEST

PLEASE INDICATE FILTERED, PRESERVED OR BOTH <----- (F, P, F/P)

SUBMISSION #: L1171217

ENTERED BY: RH

DATE/TIME ENTERED: 3-Jul-12

BIN #: 619

SAMPLING INFORMATION

Date (dd-mm-yy)	Time (24hr) (hh:mm)	TYPE COMP	TYPE GRAB	MATRIX WATER	MATRIX SOIL	MATRIX OTHER	SAMPLE DESCRIPTION TO APPEAR ON REPORT	NUMBER OF CONTAINERS	General Nata Sits Pkg	COMMENTS	LAB ID
2012-07-03	7:00			X			Water Supply Well – before treatment system	5	✓		1
							(Labelled water tap-unheated)				

L1171217-COFC

SPECIAL INSTRUCTIONS/COMMENTS

THE QUESTIONS BELOW MUST BE ANSWERED FORWATER SAMPLES (CHECK Yes OR No)

Are any samples taken from a regulated DW System? Yes ❑ No X
If yes, an authorized drinking water COC MUST be used for this submission.
Is the water sampled intended to be potable for human consumption? Yes X No ❑

SAMPLE CONDITION

FROZEN	❑	MEAN TEMP
COLD	✓	13.7
COOLING INITIATED	❑	
AMBIENT	❑	
OBSERVATIONS Yes ❑ No ❑ If yes add SIF		INIT KS

SAMPLED BY: Karen Thams	DATE & TIME	RECEIVED BY:	DATE & TIME
RELINQUISHED BY: K. Thams	DATE & TIME	RECEIVED AT LAB BY: KSm	DATE & TIME Jul. 3/12 925

Notes

1. Quote number must be provided to ensure proper pricing
2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.
3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

LVM INC.
ATTN: DAVE MORLOCK
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5

Date Received: 03-JUL-12
Report Date: 10-JUL-12 10:23 (MT)
Version: FINAL

Client Phone: 519-741-1313

Certificate of Analysis

Lab Work Order #: L1171212

Project P.O. #: 205030
Job Reference: 160-P0000145-400
C of C Numbers: 127149
Legal Site Desc:

NANCY SMITH
Account Manager

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1171212-1 BH-01-12 Sampled By: K. THRAMS on 03-JUL-12 @ 06:30 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		06-JUL-12	R2393604
Nitrate and Nitrite as N	1.01		0.20	mg/L		07-JUL-12	
Nitrate-N	1.01		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Nitrite-N	<0.10		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Total Kjeldahl Nitrogen	0.20		0.15	mg/L	05-JUL-12	09-JUL-12	R2395239
Phosphorus, Total	0.035		0.030	mg/L	05-JUL-12	10-JUL-12	R2395232
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	03-JUL-12	04-JUL-12	R2392405
Total Coliforms	240	DLA	10	CFU/100mL	03-JUL-12	04-JUL-12	R2392404
L1171212-2 BH-02-12 Sampled By: K. THRAMS on 03-JUL-12 @ 06:45 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	0.061		0.050	mg/L		06-JUL-12	R2393604
Nitrate and Nitrite as N	7.37		0.20	mg/L		07-JUL-12	
Nitrate-N	7.37		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Nitrite-N	<0.10		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Total Kjeldahl Nitrogen	0.40		0.15	mg/L	05-JUL-12	09-JUL-12	R2395239
Phosphorus, Total	0.040		0.030	mg/L	05-JUL-12	10-JUL-12	R2395232
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	03-JUL-12	04-JUL-12	R2392405
Total Coliforms	90	DLA	10	CFU/100mL	03-JUL-12	04-JUL-12	R2392404
L1171212-3 BH-03-12 Sampled By: K. THRAMS on 03-JUL-12 @ 07:10 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		06-JUL-12	R2393604
Nitrate and Nitrite as N	4.92		0.20	mg/L		07-JUL-12	
Nitrate-N	4.92		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Nitrite-N	<0.10		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Total Kjeldahl Nitrogen	0.18		0.15	mg/L	05-JUL-12	09-JUL-12	R2395239
Phosphorus, Total	0.059		0.030	mg/L	05-JUL-12	10-JUL-12	R2395232
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	03-JUL-12	04-JUL-12	R2392405
Total Coliforms	30	DLA	10	CFU/100mL	03-JUL-12	04-JUL-12	R2392404
L1171212-4 BH-04-12 Sampled By: K. THRAMS on 03-JUL-12 @ 07:25 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		06-JUL-12	R2393604
Nitrate and Nitrite as N	5.52		0.20	mg/L		07-JUL-12	
Nitrate-N	5.52		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Nitrite-N	<0.10		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1171212-4 BH-04-12 Sampled By: K. THRAMS on 03-JUL-12 @ 07:25 Matrix: WATER							
Anions and Nutrients							
Total Kjeldahl Nitrogen	0.46		0.15	mg/L	05-JUL-12	09-JUL-12	R2395239
Phosphorus, Total	0.596		0.030	mg/L	05-JUL-12	10-JUL-12	R2395232
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	03-JUL-12	04-JUL-12	R2392405
Total Coliforms	10	DLA	10	CFU/100mL	03-JUL-12	04-JUL-12	R2392404
L1171212-5 BH-05-12 Sampled By: K. THRAMS on 03-JUL-12 @ 07:45 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		06-JUL-12	R2393604
Nitrate and Nitrite as N	0.78		0.20	mg/L		07-JUL-12	
Nitrate-N	0.78		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Nitrite-N	<0.10		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Total Kjeldahl Nitrogen	0.16		0.15	mg/L	05-JUL-12	09-JUL-12	R2395239
Phosphorus, Total	0.063		0.030	mg/L	05-JUL-12	10-JUL-12	R2395232
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	03-JUL-12	04-JUL-12	R2392405
Total Coliforms	7		0	CFU/100mL	03-JUL-12	04-JUL-12	R2392404
L1171212-6 BH-06-12 Sampled By: K. THRAMS on 03-JUL-12 @ 08:00 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	0.455		0.050	mg/L		06-JUL-12	R2393604
Nitrate and Nitrite as N	<0.2		0.20	mg/L		07-JUL-12	
Nitrate-N	<0.10		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Nitrite-N	<0.10		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Total Kjeldahl Nitrogen	1.37		0.15	mg/L	05-JUL-12	09-JUL-12	R2395239
Phosphorus, Total	0.513		0.030	mg/L	05-JUL-12	10-JUL-12	R2395232
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	03-JUL-12	04-JUL-12	R2392405
Total Coliforms	50	DLA	10	CFU/100mL	03-JUL-12	04-JUL-12	R2392404
L1171212-7 BH-07-12 Sampled By: K. THRAMS on 03-JUL-12 @ 08:10 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	0.072		0.050	mg/L		06-JUL-12	R2393604
Nitrate and Nitrite as N	2.14		0.20	mg/L		07-JUL-12	
Nitrate-N	2.14		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Nitrite-N	<0.10		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Total Kjeldahl Nitrogen	0.45		0.15	mg/L	05-JUL-12	09-JUL-12	R2395239
Phosphorus, Total	0.070		0.030	mg/L	05-JUL-12	10-JUL-12	R2395232
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	03-JUL-12	04-JUL-12	R2392405

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1171212-7 BH-07-12 Sampled By: K. THRAMS on 03-JUL-12 @ 08:10 Matrix: WATER							
Bacteriological Tests							
Total Coliforms	20	DLA	10	CFU/100mL	03-JUL-12	04-JUL-12	R2392404
L1171212-8 BH-08-12 Sampled By: K. THRAMS on 03-JUL-12 @ 08:45 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		06-JUL-12	R2393604
Nitrate and Nitrite as N	3.58		0.20	mg/L		07-JUL-12	
Nitrate-N	3.58		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Nitrite-N	<0.10		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Total Kjeldahl Nitrogen	0.25		0.15	mg/L	05-JUL-12	09-JUL-12	R2395239
Phosphorus, Total	0.074		0.030	mg/L	05-JUL-12	10-JUL-12	R2395232
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	03-JUL-12	04-JUL-12	R2392405
Total Coliforms	20	DLA	10	CFU/100mL	03-JUL-12	04-JUL-12	R2392404
L1171212-9 SW - SURFACE WATER Sampled By: K. THRAMS on 03-JUL-12 @ 08:15 Matrix: WATER							
Physical Tests							
Total Suspended Solids	9.6		3.0	mg/L	06-JUL-12	07-JUL-12	R2394250
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		06-JUL-12	R2393604
Nitrate and Nitrite as N	6.92		0.20	mg/L		07-JUL-12	
Nitrate-N	6.92		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Nitrite-N	<0.10		0.10	mg/L	05-JUL-12	05-JUL-12	R2394317
Total Kjeldahl Nitrogen	0.25		0.15	mg/L	05-JUL-12	09-JUL-12	R2395239
Phosphorus, Total	<0.030		0.030	mg/L	05-JUL-12	10-JUL-12	R2395232
Bacteriological Tests							
E. Coli	260	DLM	10	CFU/100mL	03-JUL-12	04-JUL-12	R2392405
Total Coliforms	2700	DLM	100	CFU/100mL	03-JUL-12	04-JUL-12	R2392404
Aggregate Organics							
BOD Carbonaceous	<2.0		2.0	mg/L	04-JUL-12	09-JUL-12	R2394747

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

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
DLA	Detection Limit Adjusted For required dilution
DLM	Detection Limit Adjusted For Sample Matrix Effects

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD-C-WT	Water	BOD Carbonaceous	APHA 5210 B (CBOD)
Sample is incubated at 20°C– 1 C for 5 days using a nitrification inhibitor.			
EC-MF-WT	Water	E. coli	SM 9222D
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at @44.5–0.2°C for 24–2h. Method ID: WT-TM-1200			
ETL-N2N3-WT	Water	Calculate from NO2 + NO3	APHA 4110 B
NH3-WT	Water	Ammonia as N	EPA 350.1
Sample is measured colorimetrically. When sample is turbid a distillation step is required, sample is distilled into a solution of boric acid and measured colorimetrically.			
NO2-WT	Water	Nitrite-N	EPA 300.0 (IC)
A filtered water sample (drinking waters-unfiltered) is analyzed by ion chromatography.			
NO3-WT	Water	Nitrate-N	EPA 300.0 (IC)
A filtered water sample (drinking waters-unfiltered) is analyzed by ion chromatography.			
P-TOTAL-WT	Water	Total Phosphorus	APHA 4500-P B E
Samples are digested to convert the total phosphorus to orthophosphate. The orthophosphate reacts with ammonium molybdate and potassium antimonyl tartrate to form a antimonyl-phosphomolybdate complex. This complex is measured colorimetrically and reported as phosphorus.			
SOLIDS-TSS-WT	Water	Total Suspended Solids	APHA 2540 D-Gravimetric
A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 105–5°C for a minimum of four hours or until a constant weight is achieved.			
TC-MF-WT	Water	Total Coliforms	SM 9222B
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200			
TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-N
Sample is digested to convert the TKN to ammonium sulphate. The ammonia ions are heated to produce a colour complex. The absorbance measured by the instrument is proportional to the concentration of ammonium sulphate in the sample and is reported as TKN.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

127149

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1171212 Report Date: 10-JUL-12

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BOD-C-WT	**Water**							
Batch R2394747								
WG1500917-3 LCS								
BOD Carbonaceous			97.5		%		85-115	09-JUL-12
WG1500917-1 MB								
BOD Carbonaceous			<2.0		mg/L		2	09-JUL-12
EC-MF-WT	**Water**							
Batch R2392405								
WG1500489-1 MB								
E. Coli			0		CFU/100mL		1	04-JUL-12
WG1500489-4 MB								
E. Coli			0		CFU/100mL		1	04-JUL-12
NH3-WT	**Water**							
Batch R2393604								
WG1502415-2 CVS								
Ammonia, Total (as N)			95.2		%		85-115	06-JUL-12
WG1502415-3 DUP		**L1171212-1**						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	06-JUL-12
WG1502415-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	06-JUL-12
WG1502415-10 MS		**L1173169-1**						
Ammonia, Total (as N)			78.6		%		75-125	06-JUL-12
WG1502415-4 MS		**L1171212-1**						
Ammonia, Total (as N)			103.4		%		75-125	06-JUL-12
WG1502415-6 MS		**L1171986-3**						
Ammonia, Total (as N)			92.6		%		75-125	06-JUL-12
WG1502415-8 MS		**L1172986-2**						
Ammonia, Total (as N)			97.5		%		75-125	06-JUL-12
NO2-WT	**Water**							
Batch R2394317								
WG1502432-5 DUP		**L1171212-1**						
Nitrite-N		<0.10	<0.10	RPD-NA	mg/L	N/A	20	05-JUL-12
WG1502432-3 LCS								
Nitrite-N			92.4		%		85-115	05-JUL-12
WG1502432-4 LCSD		**WG1502432-3**						
Nitrite-N		92.4	93		%	0.9	25	05-JUL-12
WG1502432-1 MB								
Nitrite-N			<0.10		mg/L		0.1	05-JUL-12
NO3-WT	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-WT	**Water**							
Batch R2394317								
WG1502432-5 DUP		**L1171212-1**						
Nitrate-N		1.01	1.01		mg/L	0.1	20	05-JUL-12
WG1502432-3 LCS								
Nitrate-N			93.4		%		85-115	05-JUL-12
WG1502432-4 LCSD		**WG1502432-3**						
Nitrate-N		93.4	94		%	0.1	25	05-JUL-12
WG1502432-1 MB								
Nitrate-N			<0.10		mg/L		0.1	05-JUL-12
P-TOTAL-WT	**Water**							
Batch R2395232								
WG1502368-4 CRM		**ERA525**						
Phosphorus, Total			102.6		%		80-120	10-JUL-12
WG1503789-1 CVS								
Phosphorus, Total			99.8		%		80-120	10-JUL-12
WG1502368-3 DUP		**L1171212-1**						
Phosphorus, Total		0.035	0.034		mg/L	2.9	25	10-JUL-12
WG1502368-5 DUP		**L1171212-9**						
Phosphorus, Total		<0.030	<0.030	RPD-NA	mg/L	N/A	25	10-JUL-12
WG1502368-2 LCS								
Phosphorus, Total			103.0		%		80-120	10-JUL-12
WG1502368-1 MB								
Phosphorus, Total			<0.030		mg/L		0.03	10-JUL-12
SOLIDS-TSS-WT	**Water**							
Batch R2394250								
WG1502424-1 LCS								
Total Suspended Solids			99.2		%		80-120	07-JUL-12
WG1502424-2 MB								
Total Suspended Solids			<3.0		mg/L		3	07-JUL-12
TC-MF-WT	**Water**							
Batch R2392404								
WG1500486-1 MB								
Total Coliforms			0		CFU/100mL		1	04-JUL-12
WG1500486-4 MB								
Total Coliforms			0		CFU/100mL		1	04-JUL-12
TKN-WT	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-WT	**Water**							
Batch R2395239								
WG1502368-4 CRM		**ERA525**						
Total Kjeldahl Nitrogen			98.6		%		80-120	09-JUL-12
WG1503788-1 CVS								
Total Kjeldahl Nitrogen			95.7		%		75-125	09-JUL-12
WG1502368-3 DUP		**L1171212-1**						
Total Kjeldahl Nitrogen		0.20	0.16		mg/L	20	20	09-JUL-12
WG1502368-5 DUP		**L1171212-9**						
Total Kjeldahl Nitrogen		0.25	0.28		mg/L	12	20	09-JUL-12
WG1502368-2 LCS								
Total Kjeldahl Nitrogen			94.8		%		80-120	09-JUL-12
WG1502368-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	09-JUL-12

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

127149
C of C # 00000

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM Page ___ of ___

Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.

Specify date required

Service requested
- 2 day TAT (50%)
- 5 day (regular) ✓
- Next day TAT (100%)
- 3-4 day (25%)
- Same day TAT (200%)

COMPANY NAME	! sp
OFFICE	Kitchener
PROJECT MANAGER	David Nicholls
PROJECT #	160-10000145-400
PHONE	519 741 1713
FAX	519 741-5422
ACCOUNT #	
QUOTATION #	
PO #	205030

CRITERIA — Criteria on report YES___ NO___

Reg 153/04 ❑ Reg 511/09 ❑
Table 1 2 3 4 5 6 7 8 9

TCLP _____ MISA _____ PWQO _____
ODWS _____ OTHER _____

REPORT FORMAT/DISTRIBUTION

EMAIL ✓ FAX _____ BOTH _____
SELECT: PDF ✓ DIGITAL _____ BOTH _____
EMAIL 1 _____
EMAIL 2 _____

ANALYSIS REQUEST

PLEASE INDICATE FILTERED, PRESERVED OR BOTH <----- (F, P, F/P)

SUBMISSION #: C11 71212

ENTERED BY: RH

DATE/TIME ENTERED: 3-JUL-12

BIN #: 619

SAMPLING INFORMATION

Date (dd-mm-yy)	Time (24hr) (hh:mm)	TYPE: COMP	TYPE: GRAB	MATRIX: WATER	MATRIX: SOIL	MATRIX: OTHER	SAMPLE DESCRIPTION TO APPEAR ON REPORT	NUMBER OF CONTAINERS	nitrate - nitrogen	nitrite - nitrogen	TKN	total ammonia - nitrogen	total phosphorous	E. coli	total coliforms	CBODs	TSS	COMMENTS	LAB ID
2012-07-03	6:30			✓			BH-01-12	3	✓	✓	✓	✓	✓	✓	✓				1
	6:45			✓			BH-02-12	3	✓	✓	✓	✓	✓	✓	✓				2
	7:10			✓			BH-03-12	3	✓	✓	✓	✓	✓	✓	✓				3
	7:25			✓			BH-04-12	3	✓	✓	✓	✓	✓	✓	✓				4
	7:45			✓			BH-05-12	3	✓	✓	✓	✓	✓	✓	✓				5
	8:00			✓			BH-06-12	3	✓	✓	✓	✓	✓	✓	✓				6
	8:00			✓			BH-07-12	3	✓	✓	✓	✓	✓	✓	✓				7
	8:45			✓			BH-08-12	3	✓	✓	✓	✓	✓	✓	✓				8
	8:15			✓			SW- Surface Water	4	✓	✓	✓	✓	✓	✓	✓	✓	✓		9

* L 1 1 7 1 2 1 2 - C O F C *

SPECIAL INSTRUCTIONS/COMMENTS

THE QUESTIONS BELOW

Are any samples taken from a regulated DW System? Yes ❑ No ❑
If yes, an authorized drinking water COC MUST be used for this submission.
Is the water sampled intended to be potable for human consumption? Yes ❑ No ✓

SAMPLE CONDITION

FROZEN	❑	MEAN TEMP
COLD	✓	13.7
COOLING INITIATED	❑	
AMBIENT	❑	
OBSERVATIONS Yes ❑ No ❑ If yes add SIF		INIT: KS

SAMPLED BY: Karen Thomas	DATE & TIME	RECEIVED BY:	DATE & TIME
RELINQUISHED BY: Karen Thomas	DATE & TIME	RECEIVED AT LAB BY: KSm	DATE & TIME: JUL 3/12 0:25

Notes

1. Quote number must be provided to ensure proper pricing
2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.
3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

LVM INC.
ATTN: DAVE MORLOCK
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5

Date Received: 08-AUG-12
Report Date: 14-AUG-12 15:30 (MT)
Version: FINAL

Client Phone: 519-741-1313

Certificate of Analysis

Lab Work Order #: L1190626

Project P.O. #: 205030
Job Reference: 160-P0000145-0-00-400
C of C Numbers: 128263
Legal Site Desc:

NANCY SMITH
Account Manager

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1190626-1 BH-01-12 Sampled By: K. THRAMS on 08-AUG-12 @ 07:39 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		09-AUG-12	R2413511
Nitrate and Nitrite as N	1.12		0.20	mg/L		10-AUG-12	
Nitrate-N	1.12		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Nitrite-N	<0.10		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Total Kjeldahl Nitrogen	0.16		0.15	mg/L	08-AUG-12	09-AUG-12	R2414021
Phosphorus, Total	0.046		0.030	mg/L	08-AUG-12	09-AUG-12	R2414024
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	09-AUG-12	10-AUG-12	R2414050
Total Coliforms	70	DLM	10	CFU/100mL	09-AUG-12	10-AUG-12	R2414049
L1190626-2 BH-02-12 Sampled By: K. THRAMS on 08-AUG-12 @ 07:50 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		09-AUG-12	R2413511
Nitrate and Nitrite as N	8.68		0.20	mg/L		10-AUG-12	
Nitrate-N	8.68		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Nitrite-N	<0.10		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Total Kjeldahl Nitrogen	0.28		0.15	mg/L	08-AUG-12	09-AUG-12	R2414021
Phosphorus, Total	0.687		0.030	mg/L	08-AUG-12	09-AUG-12	R2414024
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	09-AUG-12	10-AUG-12	R2414050
Total Coliforms	640	DLM	10	CFU/100mL	09-AUG-12	10-AUG-12	R2414049
L1190626-3 BH-03-12 Sampled By: K. THRAMS on 08-AUG-12 @ 08:11 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		09-AUG-12	R2413511
Nitrate and Nitrite as N	5.72		0.20	mg/L		10-AUG-12	
Nitrate-N	5.72		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Nitrite-N	<0.10		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Total Kjeldahl Nitrogen	0.29		0.15	mg/L	08-AUG-12	09-AUG-12	R2414021
Phosphorus, Total	2.23		0.030	mg/L	08-AUG-12	09-AUG-12	R2414024
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	09-AUG-12	10-AUG-12	R2414050
Total Coliforms	1		0	CFU/100mL	09-AUG-12	10-AUG-12	R2414049
L1190626-4 BH-04-12 Sampled By: K. THRAMS on 08-AUG-12 @ 08:42 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		09-AUG-12	R2413511
Nitrate and Nitrite as N	6.61		0.20	mg/L		10-AUG-12	
Nitrate-N	6.61		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Nitrite-N	<0.10		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1190626-4 BH-04-12 Sampled By: K. THRAMS on 08-AUG-12 @ 08:42 Matrix: WATER							
Anions and Nutrients							
Total Kjeldahl Nitrogen	0.61		0.15	mg/L	08-AUG-12	09-AUG-12	R2414021
Phosphorus, Total	0.032		0.030	mg/L	08-AUG-12	09-AUG-12	R2414024
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	09-AUG-12	10-AUG-12	R2414050
Total Coliforms	1		0	CFU/100mL	09-AUG-12	10-AUG-12	R2414049
L1190626-5 BH-05-12 Sampled By: K. THRAMS on 08-AUG-12 @ 08:54 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		09-AUG-12	R2413511
Nitrate and Nitrite as N	1		0.20	mg/L		10-AUG-12	
Nitrate-N	1.00		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Nitrite-N	<0.10		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Total Kjeldahl Nitrogen	0.26		0.15	mg/L	08-AUG-12	09-AUG-12	R2414021
Phosphorus, Total	2.12		0.030	mg/L	08-AUG-12	09-AUG-12	R2414024
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	09-AUG-12	10-AUG-12	R2414050
Total Coliforms	1		0	CFU/100mL	09-AUG-12	10-AUG-12	R2414049
L1190626-6 BH-06-12 Sampled By: K. THRAMS on 08-AUG-12 @ 09:06 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	0.392		0.050	mg/L		09-AUG-12	R2413511
Nitrate and Nitrite as N	<0.2		0.20	mg/L		10-AUG-12	
Nitrate-N	<0.10		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Nitrite-N	<0.10		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Total Kjeldahl Nitrogen	1.54		0.15	mg/L	08-AUG-12	09-AUG-12	R2414021
Phosphorus, Total	0.438		0.030	mg/L	08-AUG-12	09-AUG-12	R2414024
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	09-AUG-12	10-AUG-12	R2414050
Total Coliforms	10	DLM	10	CFU/100mL	09-AUG-12	10-AUG-12	R2414049
L1190626-7 BH-07-12 Sampled By: K. THRAMS on 08-AUG-12 @ 09:17 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		09-AUG-12	R2413511
Nitrate and Nitrite as N	2.91		0.20	mg/L		10-AUG-12	
Nitrate-N	2.91		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Nitrite-N	<0.10		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Total Kjeldahl Nitrogen	0.38		0.15	mg/L	08-AUG-12	09-AUG-12	R2414021
Phosphorus, Total	0.487		0.030	mg/L	08-AUG-12	09-AUG-12	R2414024
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	09-AUG-12	10-AUG-12	R2414050

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1190626-7 BH-07-12 Sampled By: K. THRAMS on 08-AUG-12 @ 09:17 Matrix: WATER							
Bacteriological Tests							
Total Coliforms	10	DLM	10	CFU/100mL	09-AUG-12	10-AUG-12	R2414049
L1190626-8 BH-08-12 Sampled By: K. THRAMS on 08-AUG-12 @ 10:00 Matrix: WATER							
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		09-AUG-12	R2413511
Nitrate and Nitrite as N	4.23		0.20	mg/L		10-AUG-12	
Nitrate-N	4.23		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Nitrite-N	<0.10		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Total Kjeldahl Nitrogen	<0.15		0.15	mg/L	08-AUG-12	09-AUG-12	R2414021
Phosphorus, Total	0.094		0.030	mg/L	08-AUG-12	09-AUG-12	R2414024
Bacteriological Tests							
E. Coli	0		0	CFU/100mL	09-AUG-12	10-AUG-12	R2414050
Total Coliforms	3		0	CFU/100mL	09-AUG-12	10-AUG-12	R2414049
L1190626-9 CREEK - SURFACE WATER Sampled By: K. THRAMS on 08-AUG-12 @ 09:25 Matrix: WATER							
Physical Tests							
Total Suspended Solids	48.0		3.0	mg/L	11-AUG-12	14-AUG-12	R2416079
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		09-AUG-12	R2413511
Nitrate and Nitrite as N	7.58		0.20	mg/L		10-AUG-12	
Nitrate-N	7.58		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Nitrite-N	<0.10		0.10	mg/L	09-AUG-12	09-AUG-12	R2414345
Total Kjeldahl Nitrogen	0.25		0.15	mg/L	08-AUG-12	09-AUG-12	R2414021
Phosphorus, Total	<0.030		0.030	mg/L	08-AUG-12	09-AUG-12	R2414024
Bacteriological Tests							
E. Coli	330	DLM	10	CFU/100mL	09-AUG-12	10-AUG-12	R2414050
Total Coliforms	5100	DLM	100	CFU/100mL	09-AUG-12	10-AUG-12	R2414049
Aggregate Organics							
BOD Carbonaceous	<2.0		2.0	mg/L	08-AUG-12	13-AUG-12	R2415327

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Duplicate	Ammonia, Total (as N)	DLM	L1190626-1, -2, -3, -4, -5, -6, -7, -8, -9

Sample Parameter Qualifier key listed:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD-C-WT	Water	BOD Carbonaceous	APHA 5210 B (CBOD)
Sample is incubated at 20°C– 1 C for 5 days using a nitrification inhibitor.			
EC-MF-WT	Water	E. coli	SM 9222D
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at @44.5–0.2°C for 24–2h. Method ID: WT-TM-1200			
ETL-N2N3-WT	Water	Calculate from NO2 + NO3	APHA 4110 B
NH3-WT	Water	Ammonia as N	EPA 350.1
Sample is measured colorimetrically. When sample is turbid a distillation step is required, sample is distilled into a solution of boric acid and measured colorimetrically.			
NO2-WT	Water	Nitrite-N	EPA 300.0 (IC)
A filtered water sample (drinking waters-unfiltered) is analyzed by ion chromatography.			
NO3-WT	Water	Nitrate-N	EPA 300.0 (IC)
A filtered water sample (drinking waters-unfiltered) is analyzed by ion chromatography.			
P-TOTAL-WT	Water	Total Phosphorus	APHA 4500-P B E
Samples are digested to convert the total phosphorus to orthophosphate. The orthophosphate reacts with ammonium molybdate and potassium antimonyl tartrate to form a antimonyl-phosphomolybdate complex. This complex is measured colorimetrically and reported as phosphorus.			
SOLIDS-TSS-WT	Water	Suspended solids	APHA 2540 D-Gravimetric
A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 105–5°C for a minimum of four hours or until a constant weight is achieved.			
TC-MF-WT	Water	Total Coliforms	SM 9222B
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200			
TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-N
Sample is digested to convert the TKN to ammonium sulphate. The ammonia ions are heated to produce a colour complex. The absorbance measured by the instrument is proportional to the concentration of ammonium sulphate in the sample and is reported as TKN.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

128263

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BOD-C-WT	**Water**							
Batch R2415327								
WG1522593-3 LCS								
BOD Carbonaceous			93.9		%		85-115	13-AUG-12
WG1522593-1 MB								
BOD Carbonaceous			<2.0		mg/L		2	13-AUG-12
EC-MF-WT	**Water**							
Batch R2414050								
WG1523381-1 MB								
E. Coli			0		CFU/100mL		1	10-AUG-12
NH3-WT	**Water**							
Batch R2413511								
WG1523242-2 CVS								
Ammonia, Total (as N)			100.8		%		85-115	09-AUG-12
WG1523242-7 DUP		**L1190626-7**						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	09-AUG-12
WG1523242-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	09-AUG-12
WG1523242-4 MS		**L1190086-1**						
Ammonia, Total (as N)			88.8		%		75-125	09-AUG-12
WG1523242-6 MS		**L1190251-1**						
Ammonia, Total (as N)			80.8		%		75-125	09-AUG-12
WG1523242-8 MS		**L1190626-7**						
Ammonia, Total (as N)			88.7		%		75-125	09-AUG-12
NO2-WT	**Water**							
Batch R2414345								
WG1523764-3 LCS								
Nitrite-N			90.8		%		85-115	09-AUG-12
WG1523764-4 LCSD		**WG1523764-3**						
Nitrite-N		90.8	91		%	0.0	25	09-AUG-12
WG1523764-1 MB								
Nitrite-N			<0.10		mg/L		0.1	09-AUG-12
NO3-WT	**Water**							
Batch R2414345								
WG1523764-3 LCS								
Nitrate-N			96.6		%		85-115	09-AUG-12
WG1523764-4 LCSD		**WG1523764-3**						
Nitrate-N		96.6	97		%	0.2	25	09-AUG-12
WG1523764-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-WT	**Water**							
Batch R2414345								
WG1523764-1 MB								
Nitrate-N			<0.10		mg/L		0.1	09-AUG-12
P-TOTAL-WT	**Water**							
Batch R2414024								
WG1523202-4 CRM		**ERA525**						
Phosphorus, Total			98.0		%		80-120	09-AUG-12
WG1523625-1 CVS								
Phosphorus, Total			97.2		%		80-120	09-AUG-12
WG1523202-3 DUP		**L1190626-1**						
Phosphorus, Total		0.046	0.052		mg/L	12	25	09-AUG-12
WG1523202-5 DUP		**L1190626-9**						
Phosphorus, Total		<0.030	<0.030	RPD-NA	mg/L	N/A	25	09-AUG-12
WG1523202-2 LCS								
Phosphorus, Total			91.3		%		80-120	09-AUG-12
WG1523202-1 MB								
Phosphorus, Total			<0.030		mg/L		0.03	09-AUG-12
SOLIDS-TSS-WT	**Water**							
Batch R2416079								
WG1524947-1 LCS								
Total Suspended Solids			97.2		%		80-120	14-AUG-12
WG1524947-2 MB								
Total Suspended Solids			<3.0		mg/L		3	14-AUG-12
TC-MF-WT	**Water**							
Batch R2414049								
WG1523378-1 MB								
Total Coliforms			0		CFU/100mL		1	10-AUG-12
TKN-WT	**Water**							
Batch R2414021								
WG1523202-4 CRM		**ERA525**						
Total Kjeldahl Nitrogen			100.6		%		80-120	09-AUG-12
WG1523621-1 CVS								
Total Kjeldahl Nitrogen			110.0		%		75-125	09-AUG-12
WG1523202-3 DUP		**L1190626-1**						
Total Kjeldahl Nitrogen		0.16	<0.15	RPD-NA	mg/L	N/A	20	09-AUG-12
WG1523202-5 DUP		**L1190626-9**						
Total Kjeldahl Nitrogen		0.25	0.27		mg/L	5.3	20	09-AUG-12

Quality Control Report

Workorder: L1190626 Report Date: 14-AUG-12

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-WT	**Water**							
Batch R2414021								
WG1523202-2 LCS								
Total Kjeldahl Nitrogen			92.1		%		80-120	09-AUG-12
WG1523202-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	09-AUG-12

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

128263
C of C # 00000

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM

Page ___ of ___

Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.

Specify date required

Service requested: 5 day (regular) ✓ | 3-4 day (25%) | 2 day TAT (50%) | Next day TAT (100%) | Same day TAT (200%)

COMPANY NAME: LVM
OFFICE: Kitchener
PROJECT MANAGER: Dave Murlock
PROJECT #: 160-P000145-0-00-400
PHONE: 519.741.1313 FAX: 519.741.5422
ACCOUNT #:
QUOTATION #: PO # 205030

CRITERIA — Criteria on report YES___ NO___
Reg 153/04 ❑ Reg 511/09 ❑
Table 1 2 3 4 5 6 7 8 9
TCLP _____ MISA _____ PWQO _____
ODWS _____ OTHER _____

REPORT FORMAT/DISTRIBUTION
EMAIL ✓ FAX _____ BOTH _____
SELECT: PDF ✓ DIGITAL _____ BOTH _____
EMAIL 1 _____
EMAIL 2 _____

ANALYSIS REQUEST

PLEASE INDICATE FILTERED, PRESERVED OR BOTH <----- (F, P, F/P)

SUBMISSION #: L1190626
ENTERED BY: RH
DATE/TIME ENTERED: 8AUG12
BIN #: 325

SAMPLING INFORMATION

Date (dd-mm-yy)	Time (24hr) (hh:mm)	TYPE: COMP	TYPE: GRAB	MATRIX: WATER	MATRIX: SOIL	MATRIX: OTHER	SAMPLE DESCRIPTION TO APPEAR ON REPORT	NUMBER OF CONTAINERS	nitrate - nitrogen / nitrite - nitrogen	TKN	total ammonia - nitrogen	total phosphorus	E. coli	total coliforms	CBOD	TSS	COMMENTS	LAB ID
2012-08-08	7:39			✓			BH-01-12	3	✓	✓	✓	✓	✓	✓				1
	7:50			✓			BH-02-12	3	✓	✓	✓	✓	✓	✓				2
	8:11			✓			BH-03-12	3	✓	✓	✓	✓	✓	✓				3
	8:42			✓			BH-04-12	3	✓	✓	✓	✓	✓	✓				4
	8:54			✓			BH-05-12	3	✓	✓	✓	✓	✓	✓				5
	9:06			✓			BH-06-12	3	✓	✓	✓	✓	✓	✓				6
	9:17			✓			BH-07-12	3	✓	✓	✓	✓	✓	✓				7
	10:00			✓			BH-08-12	3	✓	✓	✓	✓	✓	✓				8
	9:25			✓			Creek - surface water	4	✓	✓	✓	✓	✓	✓	✓	✓		9

L1190626-COFC

SPECIAL INSTRUCTIONS/COMM

SAMPLE CONDITION
FROZEN ❑ COLD ✓ COOLING INITIATED ❑ AMBIENT ❑
MEAN TEMP 7.2
OBSERVATIONS Yes ❑ No ❑ If yes add SIF
INIT RH

BELOW MUST BE ANSWERED FORWATER SAMPLES (CHECK Yes OR No)
Regulated DW System? Yes ❑ No ✓
If yes, an authorized drinking water COC MUST be used for this submission.
Is the water sampled intended to be potable for human consumption? Yes ❑ No ✓

SAMPLED BY: Karen Thams
RELINQUISHED BY: Karen Thams
DATE & TIME
RECEIVED BY:
DATE & TIME
RECEIVED AT LAB BY: RH
DATE & TIME: 8-Aug-12 9:20.

Notes
1. Quote number must be provided to ensure proper pricing
2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.
3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

LVM INC.
ATTN: DAVE MORLOCK
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5

Date Received: 08-AUG-12
Report Date: 15-AUG-12 10:55 (MT)
Version: FINAL

Client Phone: 519-741-1313

Certificate of Analysis

Lab Work Order #: L1190638

Project P.O. #: 205030
Job Reference: 160-P0000145-0-00-400
C of C Numbers: 133239
Legal Site Desc:

NANCY SMITH
Account Manager

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

Sample Details/Parameters	Result	Qualifier	D.L.	Units	Criteria Specific Limits STANDARDS		GUIDELINES	Analyzed	Batch
L1190638-1 WATER TAP (BEFORE TREATMENT SYSTEM)									
Sampled By: K. THRAMS on 08-AUG-12 @ 07:54									
Matrix: WATER									
General Water Quality Package									
Ammonia, Total (as N)	<0.050		0.050	mg/L				09-AUG-12	R2413511
Anion Scan (IC)									
Chloride	132		2.0	mg/L			250	09-AUG-12	R2414345
Bromide	<0.10		0.10	mg/L				09-AUG-12	R2414345
Fluoride	<0.10		0.10	mg/L	1.5			09-AUG-12	R2414345
Nitrite-N	<0.10		0.10	mg/L	1			09-AUG-12	R2414345
Nitrate-N	9.40		0.10	mg/L	10			09-AUG-12	R2414345
Sulphate	28.3		2.0	mg/L			500	09-AUG-12	R2414345
Silica	7.7		2.1	mg/L				13-AUG-12	
Color, Apparent	<1.0		1.0	C.U.			5	09-AUG-12	R2413181
Conductivity	998		3.0	umhos/cm				09-AUG-12	R2413970
Detailed Ion Balance Calculation									
Ion Balance	96.3			%				13-AUG-12	
Cation - Anion Balance	-1.9			%				13-AUG-12	
Computed Conductivity	842			uS/cm				13-AUG-12	
Conductivity % Difference	-16.9			%				13-AUG-12	
TDS (Calculated)	529			mg/L				13-AUG-12	
Anion Sum	9.18			me/L				13-AUG-12	
Cation Sum	8.83			me/L				13-AUG-12	
Saturation pH	7.19			pH				13-AUG-12	
Langelier Index	0.8			No Unit				13-AUG-12	
Hardness (as CaCO3)	268			mg/L		**	80-100	13-AUG-12	
E. Coli	0		0	CFU/100mL	0			10-AUG-12	R2414050
Metal Scan-Total									
Aluminum (Al)-Total	<0.010		0.010	mg/L			0.1	10-AUG-12	R2414176
Antimony (Sb)-Total	<0.0050		0.0050	mg/L	0.006			10-AUG-12	R2414176
Arsenic (As)-Total	<0.0010		0.0010	mg/L	0.025			10-AUG-12	R2414176
Barium (Ba)-Total	0.076		0.010	mg/L	1			10-AUG-12	R2414176
Beryllium (Be)-Total	<0.0010		0.0010	mg/L				10-AUG-12	R2414176
Bismuth (Bi)-Total	<0.0010		0.0010	mg/L				10-AUG-12	R2414176
Boron (B)-Total	<0.050		0.050	mg/L	5			10-AUG-12	R2414176
Cadmium (Cd)-Total	<0.000090		0.000090	mg/L	0.005			10-AUG-12	R2414176
Calcium (Ca)-Total	75.2		0.50	mg/L				10-AUG-12	R2414176
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	0.05			10-AUG-12	R2414176
Cobalt (Co)-Total	<0.00050		0.00050	mg/L				10-AUG-12	R2414176
Copper (Cu)-Total	0.0136		0.0010	mg/L			1	10-AUG-12	R2414176
Iron (Fe)-Total	<0.050		0.050	mg/L			0.3	10-AUG-12	R2414176
Lead (Pb)-Total	0.0017		0.0010	mg/L	0.01			10-AUG-12	R2414176
Magnesium (Mg)-Total	19.6		0.50	mg/L				10-AUG-12	R2414176
Manganese (Mn)-Total	<0.0010		0.0010	mg/L			0.05	10-AUG-12	R2414176
Molybdenum (Mo)-Total	<0.0010		0.0010	mg/L				10-AUG-12	R2414176
Nickel (Ni)-Total	<0.0020		0.0020	mg/L				10-AUG-12	R2414176
Phosphorus (P)-Total	<0.050		0.050	mg/L				10-AUG-12	R2414176
Potassium (K)-Total	1.2		1.0	mg/L				10-AUG-12	R2414176
Selenium (Se)-Total	<0.00040		0.00040	mg/L	0.01			10-AUG-12	R2414176
Silicon (Si)-Total	3.6		1.0	mg/L				10-AUG-12	R2414176

* Detection Limit for result exceeds Criteria Specific Limit. Assessment against Criteria Limit cannot be made.

** Analytical result for this parameter exceeds Criteria Specific Limit listed on this report.

Ontario DW Std O.Reg 169/03 JUNE 2007

Sample Details/Parameters	Result	Qualifier	D.L.	Units	Criteria Specific Limits				Analyzed	Batch
						STANDARDS		GUIDELINES		
L1190638-1 WATER TAP (BEFORE TREATMENT SYSTEM)										
Sampled By: K. THRAMS on 08-AUG-12 @ 07:54										
Matrix: WATER										
General Water Quality Package										
Metal Scan-Total										
Silver (Ag)-Total	<0.00010		0.00010	mg/L					10-AUG-12	R2414176
Sodium (Na)-Total	79.0	DLM	5.0	mg/L	**	20		200	10-AUG-12	R2414176
Strontium (Sr)-Total	0.195		0.0010	mg/L					10-AUG-12	R2414176
Thallium (Tl)-Total	<0.00030		0.00030	mg/L					10-AUG-12	R2414176
Tin (Sn)-Total	<0.0010		0.0010	mg/L					10-AUG-12	R2414176
Titanium (Ti)-Total	<0.0020		0.0020	mg/L					10-AUG-12	R2414176
Tungsten (W)-Total	<0.010		0.010	mg/L					10-AUG-12	R2414176
Uranium (U)-Total	<0.0050		0.0050	mg/L		0.02			10-AUG-12	R2414176
Vanadium (V)-Total	<0.0010		0.0010	mg/L					10-AUG-12	R2414176
Zinc (Zn)-Total	0.0313		0.0030	mg/L				5	10-AUG-12	R2414176
Zirconium (Zr)-Total	<0.0040		0.0040	mg/L					10-AUG-12	R2414176
Phosphate-P (ortho)	0.0034		0.0030	mg/L					10-AUG-12	R2414025
Total Coliform Background	5		0	CFU/100mL					10-AUG-12	R2414049
Redox Potential	184		-1000	mV					10-AUG-12	R2414405
Sodium Adsorption Ratio	2.1		0.030	No Unit					15-AUG-12	
Total Coliforms	0		0	CFU/100mL		0			10-AUG-12	R2414049
Total Dissolved Solids	590		20	mg/L			**	500	10-AUG-12	R2414154
Turbidity	0.10		0.10	NTU				5	08-AUG-12	R2414621
pH	7.96		0.10	pH units				6.5-8.5	09-AUG-12	R2413968
Individual Analytes										
Speciated Alkalinity										
Alkalinity, Total (as CaCO3)	254		10	mg/L				30-500	09-AUG-12	R2414044
Alkalinity, Bicarbonate (as CaCO3)	252		10	mg/L					09-AUG-12	R2414044
Alkalinity, Carbonate (as CaCO3)	<10		10	mg/L					09-AUG-12	R2414044
Alkalinity, Hydroxide (as CaCO3)	<10		10	mg/L					09-AUG-12	R2414044

* Detection Limit for result exceeds Criteria Specific Limit. Assessment against Criteria Limit cannot be made.

** Analytical result for this parameter exceeds Criteria Specific Limit listed on this report.

Sample Parameter Qualifier key listed:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
ALK-SPEC-WT	Water	Speciated Alkalinity		EPA 310.2
ANIONS-WT	Water	Anion Scan (IC)		EPA 300.0 (IC)
COLOUR-WT	Water	Colour		APHA 2120

Apparent colour is determined by analysis of the decanted sample using the platinum-cobalt colourimetric method.

EC-MF-WT	Water	E. coli		SM 9222D

A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at @44.5–0.2°C for 24–2h. Method ID: WT-TM-1200

EC-WT	Water	Conductivity		APHA 2510 B

Water samples can be measured directly by immersing the conductivity cell into the sample.

ETL-SAR-CALC-WT	Water	Sodium Adsorption Ratio		Calculation
ETL-SILICA-CALC-WT	Water	Calculate from SI-TOT-WT		EPA 200.8
IONBALANCE-OP03-WT	Water	Detailed Ion Balance Calculation		APHA 1030E, 2330B, 2510A
MET-TOT-WT	Water	Metal Scan-Total		EPA 6020A

The concentration of metals is determined on an unfiltered aqueous sample. The sample is digested with nitric acid and then analyzed directly by ICP-MS.

NH3-WT	Water	Ammonia as N		EPA 350.1

Sample is measured colorimetrically. When sample is turbid a distillation step is required, sample is distilled into a solution of boric acid and measured colorimetrically.

P-ORTHO-LOW-WT	Water	Phosphorus-P (ortho)		APHA 4500-P B E
PH-ALK-WT	Water	pH		APHA 4500 H-Electrode

Water samples are analyzed directly by a calibrated pH meter.

REDOX-POTENTIAL-WT	Water	Redox Potential		APHA 2580
SOLIDS-TDS-WT	Water	Total Dissolved Solids		APHA 2540C

A well-mixed sample is filtered though glass fibres filter. A known volume of the filtrate is evaporated and dried at 105–5°C overnight and then 180–10°C for 1hr.

TC-MF-WT	Water	Total Coliforms		SM 9222B

A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200

TCB-MF-WT	Water	REG		SM 9222B

A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200.

TURBIDITY-WT	Water	Turbidity		APHA 2130 B

Sample result is based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. Sample readings are obtained from a Nephelometer.

Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

133239

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA		

Reference Information

160-P0000145-0-00-400

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of criteria limits is provided as is without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.

Quality Control Report

Workorder: L1190638 Report Date: 15-AUG-12

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-SPEC-WT	**Water**							
Batch R2414044								
WG1523640-4 CRM		**WT-ALK-CRM**						
Alkalinity, Total (as CaCO3)			106.7		%		80-120	09-AUG-12
WG1523640-2 CVS								
Alkalinity, Total (as CaCO3)			99.7		%		70-130	09-AUG-12
WG1523640-3 DUP		**L1190638-1**						
Alkalinity, Total (as CaCO3)		254	257		mg/L	1.1	20	09-AUG-12
Alkalinity, Bicarbonate (as CaCO3)		252	255		mg/L	1.1	25	09-AUG-12
Alkalinity, Carbonate (as CaCO3)		<10	<10	RPD-NA	mg/L	N/A	25	09-AUG-12
Alkalinity, Hydroxide (as CaCO3)		<10	<10	RPD-NA	mg/L	N/A	25	09-AUG-12
WG1523640-1 MB								
Alkalinity, Total (as CaCO3)			<10		mg/L		10	09-AUG-12
Alkalinity, Bicarbonate (as CaCO3)			<10		mg/L		10	09-AUG-12
Alkalinity, Carbonate (as CaCO3)			<10		mg/L		10	09-AUG-12
Alkalinity, Hydroxide (as CaCO3)			<10		mg/L		10	09-AUG-12
ANIONS-WT	**Water**							
Batch R2414345								
WG1523764-5 DUP		**L1190422-5**						
Chloride		21.7	21.5		mg/L	1.0	20	09-AUG-12
Bromide		<1.0	<1.0	RPD-NA	mg/L	N/A	20	09-AUG-12
Fluoride		<0.10	<0.10	RPD-NA	mg/L	N/A	20	09-AUG-12
Nitrite-N		<0.10	<0.10	RPD-NA	mg/L	N/A	20	09-AUG-12
Nitrate-N		<0.10	<0.10	RPD-NA	mg/L	N/A	20	09-AUG-12
Sulphate		1210	1200		mg/L	0.8	20	09-AUG-12
WG1523764-6 DUP		**L1191043-8**						
Chloride		4.4	4.3		mg/L	0.9	20	09-AUG-12
Bromide		<0.10	<0.10	RPD-NA	mg/L	N/A	20	09-AUG-12
Fluoride		<0.10	<0.10	RPD-NA	mg/L	N/A	20	09-AUG-12
Nitrite-N		<0.10	<0.10	RPD-NA	mg/L	N/A	20	09-AUG-12
Nitrate-N		<0.10	<0.10	RPD-NA	mg/L	N/A	20	09-AUG-12
Sulphate		3.5	3.4		mg/L	2.6	20	09-AUG-12
WG1523764-7 DUP		**L1191063-9**						
Chloride		4.7	4.7		mg/L	0.5	20	09-AUG-12
Bromide		<0.10	<0.10	RPD-NA	mg/L	N/A	20	09-AUG-12
Fluoride		<0.10	<0.10	RPD-NA	mg/L	N/A	20	09-AUG-12
Nitrite-N		<0.10	<0.10	RPD-NA	mg/L	N/A	20	09-AUG-12

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ANIONS-WT	**Water**							
Batch R2414345								
WG1523764-7 DUP		**L1191063-9**						
Nitrate-N		<0.10	<0.10	RPD-NA	mg/L	N/A	20	09-AUG-12
Sulphate		4.4	4.4		mg/L	0.2	20	09-AUG-12
WG1523764-3 LCS								
Chloride			98.0		%		85-115	09-AUG-12
Bromide			94.8		%		85-115	09-AUG-12
Fluoride			99.0		%		85-115	09-AUG-12
Nitrite-N			90.8		%		85-115	09-AUG-12
Nitrate-N			96.6		%		85-115	09-AUG-12
Sulphate			99.5		%		85-115	09-AUG-12
WG1523764-4 LCSD		**WG1523764-3**						
Chloride		98.0	98.1		%	0.0	25	09-AUG-12
Bromide		94.8	95.0		%	0.2	25	09-AUG-12
Fluoride		99.0	99.5		%	0.5	25	09-AUG-12
Nitrite-N		90.8	90.8		%	0.0	25	09-AUG-12
Nitrate-N		96.6	96.8		%	0.2	25	09-AUG-12
Sulphate		99.5	99.7		%	0.2	25	09-AUG-12
WG1523764-1 MB								
Chloride			<2.0		mg/L		2	09-AUG-12
Bromide			<0.10		mg/L		0.1	09-AUG-12
Fluoride			<0.10		mg/L		0.1	09-AUG-12
Nitrite-N			<0.10		mg/L		0.1	09-AUG-12
Nitrate-N			<0.10		mg/L		0.1	09-AUG-12
Sulphate			<2.0		mg/L		2	09-AUG-12
COLOUR-WT	**Water**							
Batch R2413181								
WG1523220-4 CRM		**WT-COLOUR-CRM**						
Color, Apparent			96.2		%		80-120	09-AUG-12
WG1523220-2 CVS								
Color, Apparent			99.3		%		80-120	09-AUG-12
WG1523220-3 DUP		**L1190477-4**						
Color, Apparent		20.3	19.6		C.U.	3.4	20	09-AUG-12
WG1523220-1 MB								
Color, Apparent			<1.0		C.U.		1	09-AUG-12
EC-MF-WT	**Water**							

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EC-MF-WT	**Water**							
Batch R2414050								
WG1523381-2 DUP		**L1190477-6**						
E. Coli		0	0		CFU/100mL	0.0	50	10-AUG-12
WG1523381-1 MB								
E. Coli			0		CFU/100mL		1	10-AUG-12
EC-WT	**Water**							
Batch R2413970								
WG1523330-1 CVS								
Conductivity			100.2		%		90-110	09-AUG-12
WG1523330-3 DUP		**L1190638-1**						
Conductivity		998	999		umhos/cm	0.1	10	09-AUG-12
WG1523330-4 DUP		**L1191043-1**						
Conductivity		139	137		umhos/cm	1.4	10	09-AUG-12
WG1523330-5 DUP		**L1191043-13**						
Conductivity		41.3	41.2		umhos/cm	0.2	10	09-AUG-12
WG1523330-6 DUP		**L1191063-16**						
Conductivity		105	105		umhos/cm	0.0	10	09-AUG-12
WG1523330-2 MB								
Conductivity			<3.0		umhos/cm		3	09-AUG-12
MET-TOT-WT	**Water**							
Batch R2414176								
WG1523744-2 CVS								
Aluminum (Al)-Total			103.7		%		80-120	10-AUG-12
Antimony (Sb)-Total			103.2		%		80-120	10-AUG-12
Arsenic (As)-Total			99.6		%		80-120	10-AUG-12
Barium (Ba)-Total			103.6		%		80-120	10-AUG-12
Beryllium (Be)-Total			98.5		%		80-120	10-AUG-12
Bismuth (Bi)-Total			104.3		%		80-120	10-AUG-12
Boron (B)-Total			94.3		%		70-130	10-AUG-12
Cadmium (Cd)-Total			104.6		%		80-120	10-AUG-12
Calcium (Ca)-Total			99.4		%		80-120	10-AUG-12
Chromium (Cr)-Total			99.9		%		80-120	10-AUG-12
Cobalt (Co)-Total			101.3		%		80-120	10-AUG-12
Copper (Cu)-Total			101.4		%		80-120	10-AUG-12
Iron (Fe)-Total			94.4		%		70-130	10-AUG-12
Lead (Pb)-Total			100.9		%		80-120	10-AUG-12
Magnesium (Mg)-Total			97.7		%		80-120	10-AUG-12

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-WT	**Water**							
Batch R2414176								
WG1523744-2 CVS								
Manganese (Mn)-Total			104.2		%		80-120	10-AUG-12
Molybdenum (Mo)-Total			99.5		%		90-110	10-AUG-12
Nickel (Ni)-Total			101.0		%		80-120	10-AUG-12
Phosphorus (P)-Total			102.3		%		70-130	10-AUG-12
Potassium (K)-Total			96.9		%		80-120	10-AUG-12
Selenium (Se)-Total			97.1		%		80-120	10-AUG-12
Silicon (Si)-Total			94.7		%		70-130	10-AUG-12
Silver (Ag)-Total			107.4		%		80-120	10-AUG-12
Sodium (Na)-Total			98.5		%		80-120	10-AUG-12
Strontium (Sr)-Total			101.9		%		80-120	10-AUG-12
Thallium (Tl)-Total			108.1		%		80-120	10-AUG-12
Tin (Sn)-Total			101.7		%		70-130	10-AUG-12
Titanium (Ti)-Total			99.2		%		80-120	10-AUG-12
Tungsten (W)-Total			100.1		%		70-130	10-AUG-12
Uranium (U)-Total			106.9		%		80-120	10-AUG-12
Vanadium (V)-Total			95.7		%		80-120	10-AUG-12
Zinc (Zn)-Total			93.5		%		80-120	10-AUG-12
Zirconium (Zr)-Total			98.4		%		80-120	10-AUG-12
WG1523188-4 DUP		**WG1523188-3**						
Aluminum (Al)-Total		0.076	0.084		mg/L	9.5	20	10-AUG-12
Antimony (Sb)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	10-AUG-12
Arsenic (As)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	10-AUG-12
Barium (Ba)-Total		0.039	0.040		mg/L	1.1	20	10-AUG-12
Beryllium (Be)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	10-AUG-12
Bismuth (Bi)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	10-AUG-12
Boron (B)-Total		<0.050	<0.050	RPD-NA	mg/L	N/A	20	10-AUG-12
Cadmium (Cd)-Total		<0.000090	<0.000090	RPD-NA	mg/L	N/A	20	10-AUG-12
Calcium (Ca)-Total		42.5	42.0		mg/L	1.1	20	10-AUG-12
Chromium (Cr)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	10-AUG-12
Cobalt (Co)-Total		<0.00050	<0.00050	RPD-NA	mg/L	N/A	20	10-AUG-12
Copper (Cu)-Total		<0.0010	0.0014	RPD-NA	mg/L	N/A	20	10-AUG-12
Iron (Fe)-Total		0.356	0.347		mg/L	2.7	20	10-AUG-12
Lead (Pb)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	10-AUG-12

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-WT	**Water**							
Batch R2414176								
WG1523188-4 DUP		**WG1523188-3**						
Magnesium (Mg)-Total		11.3	11.1		mg/L	1.6	20	10-AUG-12
Manganese (Mn)-Total		0.0681	0.0673		mg/L	1.1	20	10-AUG-12
Molybdenum (Mo)-Total		0.0024	0.0023		mg/L	4.3	20	10-AUG-12
Nickel (Ni)-Total		<0.0020	<0.0020	RPD-NA	mg/L	N/A	20	10-AUG-12
Phosphorus (P)-Total		0.997	0.990		mg/L	0.7	20	10-AUG-12
Potassium (K)-Total		4.1	4.1		mg/L	1.2	20	10-AUG-12
Selenium (Se)-Total		<0.00040	<0.00040	RPD-NA	mg/L	N/A	20	10-AUG-12
Silicon (Si)-Total		<1.0	<1.0	RPD-NA	mg/L	N/A	20	10-AUG-12
Silver (Ag)-Total		<0.00010	<0.00010	RPD-NA	mg/L	N/A	20	10-AUG-12
Sodium (Na)-Total		38.5	39.6		mg/L	2.8	20	10-AUG-12
Strontium (Sr)-Total		1.42	1.42		mg/L	0.2	20	10-AUG-12
Thallium (Tl)-Total		<0.00030	<0.00030	RPD-NA	mg/L	N/A	20	10-AUG-12
Tin (Sn)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	10-AUG-12
Titanium (Ti)-Total		0.0043	0.0040		mg/L	9.2	20	10-AUG-12
Tungsten (W)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	10-AUG-12
Uranium (U)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	10-AUG-12
Vanadium (V)-Total		<0.0010	0.0010	RPD-NA	mg/L	N/A	20	10-AUG-12
Zinc (Zn)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	10-AUG-12
Zirconium (Zr)-Total		<0.0040	<0.0040	RPD-NA	mg/L	N/A	20	10-AUG-12
WG1523188-2 LCS								
Aluminum (Al)-Total			104.0		%		80-120	10-AUG-12
Antimony (Sb)-Total			101.6		%		70-130	10-AUG-12
Arsenic (As)-Total			101.0		%		70-130	10-AUG-12
Barium (Ba)-Total			102.6		%		70-130	10-AUG-12
Beryllium (Be)-Total			109.7		%		70-130	10-AUG-12
Bismuth (Bi)-Total			100.3		%		70-130	10-AUG-12
Boron (B)-Total			102.6		%		70-130	10-AUG-12
Cadmium (Cd)-Total			103.4		%		70-130	10-AUG-12
Calcium (Ca)-Total			106.1		%		70-130	10-AUG-12
Chromium (Cr)-Total			99.7		%		70-130	10-AUG-12
Cobalt (Co)-Total			104.7		%		70-130	10-AUG-12
Copper (Cu)-Total			103.3		%		70-130	10-AUG-12
Iron (Fe)-Total			101.8		%		70-130	10-AUG-12

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-WT	**Water**							
Batch R2414176								
WG1523188-2 LCS								
Lead (Pb)-Total			100.6		%		70-130	10-AUG-12
Magnesium (Mg)-Total			99.7		%		70-130	10-AUG-12
Manganese (Mn)-Total			103.3		%		70-130	10-AUG-12
Molybdenum (Mo)-Total			93.4		%		70-130	10-AUG-12
Nickel (Ni)-Total			104.9		%		70-130	10-AUG-12
Phosphorus (P)-Total			113.4		%		70-130	10-AUG-12
Potassium (K)-Total			100.9		%		70-130	10-AUG-12
Selenium (Se)-Total			109.1		%		70-130	10-AUG-12
Silicon (Si)-Total			109.1		%		70-130	10-AUG-12
Silver (Ag)-Total			103.3		%		70-130	10-AUG-12
Sodium (Na)-Total			98.4		%		70-130	10-AUG-12
Strontium (Sr)-Total			96.2		%		70-130	10-AUG-12
Thallium (Tl)-Total			101.4		%		70-130	10-AUG-12
Tin (Sn)-Total			98.9		%		70-130	10-AUG-12
Titanium (Ti)-Total			101.5		%		70-130	10-AUG-12
Tungsten (W)-Total			97.3		%		70-130	10-AUG-12
Uranium (U)-Total			103.1		%		70-130	10-AUG-12
Vanadium (V)-Total			100.8		%		70-130	10-AUG-12
Zinc (Zn)-Total			104.9		%		70-130	10-AUG-12
Zirconium (Zr)-Total			89.0		%		70-130	10-AUG-12
WG1523188-1 MB								
Aluminum (Al)-Total			<0.010		mg/L		0.01	10-AUG-12
Antimony (Sb)-Total			<0.0050		mg/L		0.005	10-AUG-12
Arsenic (As)-Total			<0.0010		mg/L		0.001	10-AUG-12
Barium (Ba)-Total			<0.010		mg/L		0.01	10-AUG-12
Beryllium (Be)-Total			<0.0010		mg/L		0.001	10-AUG-12
Bismuth (Bi)-Total			<0.0010		mg/L		0.001	10-AUG-12
Boron (B)-Total			<0.050		mg/L		0.05	10-AUG-12
Cadmium (Cd)-Total			<0.000090		mg/L		0.00009	10-AUG-12
Calcium (Ca)-Total			<0.50		mg/L		0.5	10-AUG-12
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	10-AUG-12
Cobalt (Co)-Total			<0.00050		mg/L		0.0005	10-AUG-12
Copper (Cu)-Total			<0.0010		mg/L		0.001	10-AUG-12
Iron (Fe)-Total			<0.050		mg/L		0.05	10-AUG-12

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-WT	**Water**							
Batch R2414176								
WG1523188-1 MB								
Lead (Pb)-Total			<0.0010		mg/L		0.001	10-AUG-12
Magnesium (Mg)-Total			<0.50		mg/L		0.5	10-AUG-12
Manganese (Mn)-Total			<0.0010		mg/L		0.001	10-AUG-12
Molybdenum (Mo)-Total			<0.0010		mg/L		0.001	10-AUG-12
Nickel (Ni)-Total			<0.0020		mg/L		0.002	10-AUG-12
Phosphorus (P)-Total			<0.050		mg/L		0.05	10-AUG-12
Potassium (K)-Total			<1.0		mg/L		1	10-AUG-12
Selenium (Se)-Total			<0.00040		mg/L		0.0004	10-AUG-12
Silicon (Si)-Total			<1.0		mg/L		1	10-AUG-12
Silver (Ag)-Total			<0.00010		mg/L		0.0001	10-AUG-12
Sodium (Na)-Total			<0.50		mg/L		0.5	10-AUG-12
Strontium (Sr)-Total			<0.0010		mg/L		0.001	10-AUG-12
Thallium (Tl)-Total			<0.00030		mg/L		0.0003	10-AUG-12
Tin (Sn)-Total			<0.0010		mg/L		0.001	10-AUG-12
Titanium (Ti)-Total			<0.0020		mg/L		0.002	10-AUG-12
Tungsten (W)-Total			<0.010		mg/L		0.01	10-AUG-12
Uranium (U)-Total			<0.0050		mg/L		0.005	10-AUG-12
Vanadium (V)-Total			<0.0010		mg/L		0.001	10-AUG-12
Zinc (Zn)-Total			<0.0030		mg/L		0.003	10-AUG-12
Zirconium (Zr)-Total			<0.0040		mg/L		0.004	10-AUG-12
WG1523188-5 MS		**WG1523188-3**						
Aluminum (Al)-Total			106.8		%		70-130	10-AUG-12
Antimony (Sb)-Total			103.5		%		70-130	10-AUG-12
Arsenic (As)-Total			101.5		%		70-130	10-AUG-12
Barium (Ba)-Total			99.1		%		70-130	10-AUG-12
Beryllium (Be)-Total			108.3		%		70-130	10-AUG-12
Bismuth (Bi)-Total			99.3		%		70-130	10-AUG-12
Boron (B)-Total			105.5		%		70-130	10-AUG-12
Cadmium (Cd)-Total			101.0		%		70-130	10-AUG-12
Calcium (Ca)-Total			N/A	MS-B	%		-	10-AUG-12
Chromium (Cr)-Total			100.4		%		70-130	10-AUG-12
Cobalt (Co)-Total			103.4		%		70-130	10-AUG-12
Copper (Cu)-Total			101.6		%		70-130	10-AUG-12
Iron (Fe)-Total			99.9		%		70-130	10-AUG-12

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-TOT-WT	**Water**							
Batch R2414176								
WG1523188-5 MS		**WG1523188-3**						
Lead (Pb)-Total			98.6		%		70-130	10-AUG-12
Magnesium (Mg)-Total			N/A	MS-B	%		-	10-AUG-12
Manganese (Mn)-Total			102.3		%		70-130	10-AUG-12
Molybdenum (Mo)-Total			95.4		%		70-130	10-AUG-12
Nickel (Ni)-Total			102.7		%		70-130	10-AUG-12
Phosphorus (P)-Total			117.2		%		70-130	10-AUG-12
Potassium (K)-Total			N/A	MS-B	%		-	10-AUG-12
Selenium (Se)-Total			98.2		%		70-130	10-AUG-12
Silicon (Si)-Total			127.1		%		70-130	10-AUG-12
Silver (Ag)-Total			100.0		%		70-130	10-AUG-12
Sodium (Na)-Total			N/A	MS-B	%		-	10-AUG-12
Strontium (Sr)-Total			N/A	MS-B	%		-	10-AUG-12
Thallium (Tl)-Total			100.5		%		70-130	10-AUG-12
Tin (Sn)-Total			97.3		%		70-130	10-AUG-12
Titanium (Ti)-Total			99.8		%		70-130	10-AUG-12
Tungsten (W)-Total			98.7		%		70-130	10-AUG-12
Uranium (U)-Total			104.2		%		70-130	10-AUG-12
Vanadium (V)-Total			103.3		%		70-130	10-AUG-12
Zinc (Zn)-Total			105.4		%		70-130	10-AUG-12
Zirconium (Zr)-Total			87.4		%		70-130	10-AUG-12
NH3-WT	**Water**							
Batch R2413511								
WG1523242-2 CVS								
Ammonia, Total (as N)			100.8		%		85-115	09-AUG-12
WG1523242-3 DUP		**L1190086-1**						
Ammonia, Total (as N)		<0.25	<0.25		mg/L	0.1	20	09-AUG-12
WG1523242-5 DUP		**L1190251-1**						
Ammonia, Total (as N)		0.112	0.111		mg/L	1.0	20	09-AUG-12
WG1523242-7 DUP		**L1190626-7**						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	09-AUG-12
WG1523242-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	09-AUG-12
WG1523242-4 MS		**L1190086-1**						
Ammonia, Total (as N)			88.8		%		75-125	09-AUG-12
WG1523242-6 MS		**L1190251-1**						

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-WT	**Water**							
Batch R2413511								
WG1523242-6 MS		**L1190251-1**						
Ammonia, Total (as N)			80.8		%		75-125	09-AUG-12
WG1523242-8 MS		**L1190626-7**						
Ammonia, Total (as N)			88.7		%		75-125	09-AUG-12
P-ORTHO-LOW-WT	**Water**							
Batch R2414025								
WG1524092-3 DUP		**L1189402-1**						
Phosphate-P (ortho)		0.0617	0.0623		mg/L	1.0	20	10-AUG-12
WG1524092-5 DUP		**L1191043-1**						
Phosphate-P (ortho)		0.0033	0.0034		mg/L	4.8	20	10-AUG-12
WG1524092-7 DUP		**L1191063-7**						
Phosphate-P (ortho)		0.0038	0.0035		mg/L	8.0	20	10-AUG-12
WG1524092-9 DUP		**L1191243-2**						
Phosphate-P (ortho)		0.402	0.405		mg/L	0.7	20	10-AUG-12
WG1524092-2 LCS								
Phosphate-P (ortho)			107.7		%		80-120	10-AUG-12
WG1524092-1 MB								
Phosphate-P (ortho)			<0.0030		mg/L		0.003	10-AUG-12
WG1524092-10 MS		**L1191243-2**						
Phosphate-P (ortho)			N/A	MS-B	%		-	10-AUG-12
WG1524092-4 MS		**L1189402-1**						
Phosphate-P (ortho)			N/A	MS-B	%		-	10-AUG-12
WG1524092-6 MS		**L1191043-1**						
Phosphate-P (ortho)			91.1		%		70-130	10-AUG-12
WG1524092-8 MS		**L1191063-7**						
Phosphate-P (ortho)			93.6		%		70-130	10-AUG-12
PH-ALK-WT	**Water**							
Batch R2413968								
WG1523327-2 DUP		**L1190638-1**						
pH		7.96	7.99		pH units	0.4	20	09-AUG-12
WG1523327-1 LCS								
pH			7.01		pH units		6.9-7.1	09-AUG-12
REDOX-POTENTIAL-WT	**Water**							
Batch R2414405								
WG1524608-1 DUP		**L1189217-43**						
Redox Potential		88.0	92.0		mV	4.4	25	10-AUG-12

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SOLIDS-TDS-WT	**Water**							
Batch R2414154								
WG1523399-3 DUP		**L1190086-2**						
Total Dissolved Solids		290	290		mg/L	0.0	20	10-AUG-12
WG1523399-4 DUP		**L1190086-3**						
Total Dissolved Solids		318	300		mg/L	5.8	20	10-AUG-12
WG1523399-2 LCS								
Total Dissolved Solids			93.3		%		85-115	10-AUG-12
WG1523399-1 MB								
Total Dissolved Solids			<20		mg/L		20	10-AUG-12
TC-MF-WT	**Water**							
Batch R2414049								
WG1523378-2 DUP		**L1190638-1**						
Total Coliforms		0	0		CFU/100mL	0.0	50	10-AUG-12
WG1523378-1 MB								
Total Coliforms			0		CFU/100mL		1	10-AUG-12
TCB-MF-WT	**Water**							
Batch R2414049								
WG1523378-2 DUP		**L1190638-1**						
Total Coliform Background		5	11	G	CFU/100mL	75	50	10-AUG-12
WG1523378-1 MB								
Total Coliform Background			0		CFU/100mL		1	10-AUG-12
TURBIDITY-WT	**Water**							
Batch R2414621								
WG1522965-2 CVS								
Turbidity			102.0		%		85-115	08-AUG-12
WG1522965-3 DUP		**L1190105-1**						
Turbidity		0.11	0.12		NTU	8.7	20	08-AUG-12
WG1522965-1 MB								
Turbidity			<0.10		NTU		0.1	08-AUG-12

Quality Control Report

Workorder: L1190638 Report Date: 15-AUG-12

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects
G	QC result did not meet ALS DQO. Refer to narrative comments for further information.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1190638 Report Date: 15-AUG-12

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: DAVE MORLOCK

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Physical Tests							
Redox Potential							
	1	08-AUG-12 07:54	10-AUG-12 16:09	0.25	56	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1190638 were received on 08-AUG-12 11:20.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

ALS Environmental

133239
C of C # 00000

CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM

Page ___ of ___

Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.

Specify date required

Service requested: 5 day (regular) ✓ | 3-4 day (25%) | 2 day TAT (50%) | Next day TAT (100%) | Same day TAT (200%)

COMPANY NAME: LVM
OFFICE: Kitchener
PROJECT MANAGER: Dave Morlock
PROJECT #: 160-P0000145-0-00-400
PHONE: 519.741.7313 FAX: 519.741.5422
ACCOUNT #:
QUOTATION #: PO # 205030

CRITERIA | Criteria on report YES___ NO___
Reg 153/04 ☐ Reg 511/09 ☐
Table 1 2 3 4 5 6 7 8 9
TCLP _____ MISA _____ PWQO _____
ODWS _____ OTHER _____

REPORT FORMAT/DISTRIBUTION
EMAIL ✓ FAX _____ BOTH _____
SELECT: PDF ✓ DIGITAL _____ BOTH _____
EMAIL 1
EMAIL 2

ANALYSIS REQUEST

PLEASE INDICATE FILTERED, PRESERVED OR BOTH <----- (F, P, F/P)

SUBMISSION #: L1190638
ENTERED BY: RH
DATE/TIME ENTERED: 8-Aug-12
BIN #: 325.

SAMPLING INFORMATION

Sample Date/Time		TYPE		MATRIX			SAMPLE DESCRIPTION TO APPEAR ON REPORT	NUMBER OF CONTAINERS	General Parameters	COMMENTS	LAB ID
Date (dd-mm-yy)	Time (24hr) (hh:mm)	COMP	GRAB	WATER	SOIL	OTHER					
2012-08-08	7:54			✓			water tap (before treatment system)	5	✓		1

L1190638-COFC

SPECIAL INSTRUCTIONS/COMMENTS

THE QUESTIONS BELOW MUST BE ANSWERED FORWATER SAMPLES (CHECK Yes OR No)
Are any samples taken from a regulated DW System? Yes ☐ No ✓
If yes, an authorized drinking water COC MUST be used for this submission.
Is the water sampled intended to be potable for human consumption? Yes ✓ No ☐

SAMPLE CONDITION
FROZEN ☐ COLD ✓ COOLING INITIATED ☐ AMBIENT ☐
MEAN TEMP 7.2
OBSERVATIONS Yes ☐ No ☐ If yes add SIF
INIT RH

SAMPLED BY: Karen Thomas
RELINQUISHED BY: Karen Thomas
DATE & TIME
RECEIVED BY:
DATE & TIME
RECEIVED AT LAB BY: RH
DATE & TIME 8-Aug-12 1120

Notes
1. Quote number must be provided to ensure proper pricing
2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.
3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

LVM INC.
ATTN: DAVE MORLOCK
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5

Date Received: 05-SEP-12
Report Date: 11-SEP-12 12:38 (MT)
Version: FINAL

Client Phone: 519-741-1313

Certificate of Analysis

Lab Work Order #: L1204056

Project P.O. #: 205030
Job Reference: 160-P0000145-0-00-400
C of C Numbers: 133306
Legal Site Desc:

NANCY SMITH
Account Manager

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ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1204056-1 SURFACE WATER @ CREEK Sampled By: KAREN THRAMS on 05-SEP-12 @ 07:30 Matrix: WATER							
Physical Tests							
Total Suspended Solids	15.2		3.0	mg/L	08-SEP-12	11-SEP-12	R2433297
Anions and Nutrients							
Ammonia, Total (as N)	<0.050		0.050	mg/L		06-SEP-12	R2430730
Nitrate and Nitrite as N	7.1		0.20	mg/L		06-SEP-12	
Nitrate-N	7.10		0.10	mg/L	05-SEP-12	05-SEP-12	R2430826
Nitrite-N	<0.10		0.10	mg/L	05-SEP-12	05-SEP-12	R2430826
Total Kjeldahl Nitrogen	0.39		0.15	mg/L	05-SEP-12	06-SEP-12	R2430803
Total Phosphorus	0.0044		0.0030	mg/L		07-SEP-12	R2431519
Bacteriological Tests							
E. Coli	220	DLM	10	CFU/100mL	05-SEP-12	06-SEP-12	R2430527
Total Coliforms	9700	DLM	100	CFU/100mL	05-SEP-12	06-SEP-12	R2430521
Aggregate Organics							
BOD Carbonaceous	<2.0		2.0	mg/L	05-SEP-12	10-SEP-12	R2432703

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

Reference Information

QC Samples with Qualifiers & Comments:

QC Type Description	Parameter	Qualifier	Applies to Sample Number(s)
Matrix Spike	Ammonia, Total (as N)	MS-B	L1204056-1
Matrix Spike	Total Phosphorus	MS-B	L1204056-1
Matrix Spike	Total Phosphorus	MS-B	L1204056-1

Qualifiers for Individual Samples Listed:

Sample Numbe	Client ID	Qualifier	Description
L1204056-1	SURFACE WATER @ CREE	CINT	Cooling initiated. Samples were packaged with ice or ice packs upon receipt.

Sample Parameter Qualifier key listed:

Qualifier	Description
DLM	Detection Limit Adjusted For Sample Matrix Effects
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
BOD-C-WT	Water	BOD Carbonaceous	APHA 5210 B (CBOD)
Sample is incubated at 20°C– 1 C for 5 days using a nitrification inhibitor.			
EC-MF-WT	Water	E. coli	SM 9222D
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at @44.5–0.2°C for 24–2h. Method ID: WT-TM-1200			
ETL-N2N3-WT	Water	Calculate from NO2 + NO3	APHA 4110 B
NH3-WT	Water	Ammonia, Total as N	EPA 350.1
Sample is measured colorimetrically. When sample is turbid a distillation step is required, sample is distilled into a solution of boric acid and measured colorimetrically.			
NO2-WT	Water	Nitrite-N	EPA 300.0 (IC)
A filtered water sample (drinking waters-unfiltered) is analyzed by ion chromatography.			
NO3-WT	Water	Nitrate-N	EPA 300.0 (IC)
A filtered water sample (drinking waters-unfiltered) is analyzed by ion chromatography.			
P-TOTAL-LOW-WT	Water	Phosphorus, Total, Low Level	APHA 4500-P B E
SOLIDS-TSS-WT	Water	Suspended solids	APHA 2540 D-Gravimetric
A well-mixed sample is filtered through a weighed standard glass fibre filter and the residue retained is dried in an oven at 105–5°C for a minimum of four hours or until a constant weight is achieved.			
TC-MF-WT	Water	Total Coliforms	SM 9222B
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200			
TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-N
Sample is digested to convert the TKN to ammonium sulphate. The ammonia ions are heated to produce a colour complex. The absorbance measured by the instrument is proportional to the concentration of ammonium sulphate in the sample and is reported as TKN.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

133306

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L1204056 Report Date: 11-SEP-12

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5

Contact: DAVE MORLOCK

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BOD-C-WT	**Water**							
Batch R2432703								
WG1540067-3 LCS								
BOD Carbonaceous			108.6		%		85-115	10-SEP-12
WG1540067-1 MB								
BOD Carbonaceous			<2.0		mg/L		2	10-SEP-12
EC-MF-WT	**Water**							
Batch R2430527								
WG1539986-1 MB								
E. Coli			0		CFU/100mL		1	06-SEP-12
WG1539986-3 MB								
E. Coli			0		CFU/100mL		1	06-SEP-12
NH3-WT	**Water**							
Batch R2430730								
WG1540788-2 CVS								
Ammonia, Total (as N)			94.1		%		85-115	06-SEP-12
WG1540788-3 DUP		**L1204056-1**						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	06-SEP-12
WG1540788-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	06-SEP-12
WG1540788-10 MS		**L1199787-1**						
Ammonia, Total (as N)			N/A	MS-B	%		-	06-SEP-12
WG1540788-4 MS		**L1204056-1**						
Ammonia, Total (as N)			88.4		%		75-125	06-SEP-12
WG1540788-6 MS		**L1204483-5**						
Ammonia, Total (as N)			91.9		%		75-125	06-SEP-12
WG1540788-8 MS		**L1204774-3**						
Ammonia, Total (as N)			79.3		%		75-125	06-SEP-12
NO2-WT	**Water**							
Batch R2430826								
WG1539880-3 LCS								
Nitrite-N			95.8		%		85-115	05-SEP-12
WG1539880-4 LCSD		**WG1539880-3**						
Nitrite-N		95.8	97		%	0.8	25	05-SEP-12
WG1539880-1 MB								
Nitrite-N			<0.10		mg/L		0.1	05-SEP-12
NO3-WT	**Water**							

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-WT	**Water**							
Batch R2430826								
WG1539880-3 LCS								
Nitrate-N			97.9		%		85-115	05-SEP-12
WG1539880-4 LCSD		**WG1539880-3**						
Nitrate-N		97.9	99		%	1.2	25	05-SEP-12
WG1539880-1 MB								
Nitrate-N			<0.10		mg/L		0.1	05-SEP-12
P-TOTAL-LOW-WT	**Water**							
Batch R2431519								
WG1541018-2 LCS								
Total Phosphorus			93.0		%		80-120	07-SEP-12
WG1541018-1 MB								
Total Phosphorus			<0.0030		mg/L		0.003	07-SEP-12
WG1541018-4 MS		**L1203266-1**						
Total Phosphorus			N/A	MS-B	%		-	07-SEP-12
WG1541018-6 MS		**L1203266-21**						
Total Phosphorus			N/A	MS-B	%		-	07-SEP-12
SOLIDS-TSS-WT	**Water**							
Batch R2433297								
WG1542389-1 LCS								
Total Suspended Solids			97.2		%		80-120	11-SEP-12
WG1542389-2 MB								
Total Suspended Solids			<3.0		mg/L		3	11-SEP-12
TC-MF-WT	**Water**							
Batch R2430521								
WG1539984-1 MB								
Total Coliforms			0		CFU/100mL		1	06-SEP-12
WG1539984-3 MB								
Total Coliforms			0		CFU/100mL		1	06-SEP-12
TKN-WT	**Water**							
Batch R2430803								
WG1540642-4 CRM		**ERA525**						
Total Kjeldahl Nitrogen			90.1		%		80-120	06-SEP-12
WG1541027-1 CVS								
Total Kjeldahl Nitrogen			93.0		%		75-125	06-SEP-12
WG1540642-2 LCS								
Total Kjeldahl Nitrogen			91.0		%		80-120	06-SEP-12
WG1540642-1 MB								

Quality Control Report

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TKN-WT	**Water**							
Batch R2430803								
WG1540642-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	06-SEP-12

Quality Control Report

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

133306
C of C # 00000

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

ALS Environmental

CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM

Page 1 of 1

Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.

Specify date required

Service requested		
5 day (regular)	✓	2 day TAT (50%)
3-4 day (25%)		Next day TAT (100%)
		Same day TAT (200%)

COMPANY NAME: LVM inc
OFFICE: Kitchener
PROJECT MANAGER: David Marlock
PROJECT #: 160-P0000145-0-00-400
PHONE: 519. 741. 1313
FAX: 519. 741. 5422
ACCOUNT #:
QUOTATION #:
PO #: 205030

CRITERIA — Criteria on report YES___ NO___
Reg 153/04 ❑ Reg 511/09 ❑
Table 1 2 3 4 5 6 7 8 9
TCLP _____ MISA _____ PWQO _____
ODWS _____ OTHER _____

REPORT FORMAT/DISTRIBUTION
EMAIL X FAX _____ BOTH _____
SELECT: PDF X DIGITAL _____ BOTH _____
EMAIL 1 dave.marlock@lvm.ca
EMAIL 2 _____

ANALYSIS REQUEST

PLEASE INDICATE FILTERED, PRESERVED OR BOTH <----- (F, P, F/P)

SUBMISSION #: L1204056
ENTERED BY: RH
DATE/TIME ENTERED: 5-Sep-12
BIN #: 735

SAMPLING INFORMATION

Sample Date/Time		TYPE		MATRIX			SAMPLE DESCRIPTION TO APPEAR ON REPORT	NUMBER OF CONTAINERS	nitrate-nitrogen, nitrite-nitrogen	TKN	total ammonia-nitrogen	total phosphorus	E. coli	total coliforms	CBODs	TSS	COMMENTS	LAB ID
Date (dd-mm-yy)	Time (24hr) (hh:mm)	COMP	GRAB	WATER	SOIL	OTHER												
05-09-12	7:30			✓			surface water @ creek	4	✓	✓	✓	✓	✓	✓	✓	✓		1

L1204056-COFC

SPECIAL INSTRUCTIONS/COMMENTS

THE QUESTIONS BELOW MUST BE ANSWERED FORWATER SAMPLES (CHECK Yes OR No)

Are any samples taken from a regulated DW System? Yes ❑ No ❑
If yes, an authorized drinking water COC MUST be used for this submission.
Is the water sampled intended to be potable for human consumption? Yes ❑ No ❑

SAMPLE CONDITION

FROZEN	❑	MEAN TEMP
COLD	✓	
COOLING INITIATED	✓	10.5
AMBIENT	❑	
OBSERVATIONS Yes ❑ No ❑ If yes add SIF		INIT: KS

SAMPLED BY: Karen Thrams

RELINQUISHED BY: Karen Thrams	DATE & TIME	RECEIVED BY:	DATE & TIME
	DATE & TIME	RECEIVED AT LAB BY: KSm	DATE & TIME SEPT 5/12 8:35

Notes

1. Quote number must be provided to ensure proper pricing
2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.
3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

SAGE CAMPGROUNDS
ATTN: RONALD & TERESA SAGE
1912 WHISTLE BARE RD
RR 2
CAMBRIDGE ON N1R 5S2

Date Received: 29-APR-13
Report Date: 30-APR-13 14:47 (MT)
Version: FINAL

Client Phone: 519-623-2463

Certificate of Analysis

Lab Work Order #: L1294711

Project P.O. #: CC PROVIDED
Job Reference: 765001708
C of C Numbers:
Legal Site Desc:

Nellie Gudzak
Account Manager

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Sample Details/Parameters	Result	Qualifier	D.L.	Units	Criteria Specific Limits	Analyzed	Batch
L1294711-1 ~D1 SITE 46							
Sampled By: TERESA SAGE on 29-APR-13 @ 10:55							
Matrix: DISTRIBUTION					STANDARDS / GUIDELINES		
Individual Analytes							
Total Coliforms and e.Coli by DC Agar							
Total Coliforms	0		0	CFU/100mL	0	30-APR-13	R2592749
E. Coli	0		0	CFU/100mL	0	30-APR-13	R2592749
L1294711-2 ~R1 PUMPHOUSE							
Sampled By: TERESA SAGE on 29-APR-13 @ 11:00							
Matrix: RAW					STANDARDS / GUIDELINES		
Total Coliform, e.Coli							
E. Coli	0		0	CFU/100mL	0	30-APR-13	R2592750
Total Coliforms	0		0	CFU/100mL	0	30-APR-13	R2592747

* Detection Limit for result exceeds Criteria Specific Limit. Assessment against Criteria Limit cannot be made.

** Analytical result for this parameter exceeds Criteria Specific Limit listed on this report.

Ontario DW Std O.Reg 169/03 JUNE 2007

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
EC-MF-WT	Water	E. coli		SM 9222D
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at @44.5–0.2°C for 24–2h. Method ID: WT-TM-1200				
TC,EC-DC-WT	Water	Total Coliforms and e.Coli by DC Agar		MOE E3407
A 100mL volume of sample is filtered through a membrane, the membrane is placed on DC Media and incubated at 35–0.5°C for 24–2h.				
TC-MF-WT	Water	Total Coliforms		SM 9222B
A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200				

Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA		

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of criteria limits is provided as is without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.

Quality Control Report

Workorder: L1294711 Report Date: 30-APR-13

Client: SAGE CAMPGROUNDS
1912 WHISTLE BARE RD RR 2
CAMBRIDGE ON N1R 5S2
Contact: RONALD & TERESA SAGE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EC-MF-WT	**Water**							
Batch R2592750								
WG1661868-2 DUP		**L1294909-14**						
E. Coli		0	0		CFU/100mL	0.0	50	30-APR-13
WG1661868-1 MB								
E. Coli			0		CFU/100mL		1	30-APR-13
WG1661868-3 MB								
E. Coli			0		CFU/100mL		1	30-APR-13
TC,EC-DC-WT	**Water**							
Batch R2592749								
WG1661864-2 DUP		**L1294837-1**						
Total Coliforms		0	0		CFU/100mL	0.0	30	30-APR-13
E. Coli		0	0		CFU/100mL	0.0	30	30-APR-13
WG1661864-1 MB								
Total Coliforms			0		CFU/100mL		1	30-APR-13
E. Coli			0		CFU/100mL		1	30-APR-13
WG1661864-3 MB								
Total Coliforms			0		CFU/100mL		1	30-APR-13
E. Coli			0		CFU/100mL		1	30-APR-13
TC-MF-WT	**Water**							
Batch R2592747								
WG1661865-2 DUP		**L1294909-12**						
Total Coliforms		0	0		CFU/100mL	0.0	50	30-APR-13
WG1661865-1 MB								
Total Coliforms			0		CFU/100mL		1	30-APR-13
WG1661865-3 MB								
Total Coliforms			0		CFU/100mL		1	30-APR-13

Quality Control Report

Workorder: L1294711 Report Date: 30-APR-13

Client: SAGE CAMPGROUNDS
1912 WHISTLE BARE RD RR 2
CAMBRIDGE ON N1R 5S2
Contact: RONALD & TERESA SAGE

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

DRINKING WATER CHAIN OF CUSTODY

PLEASE CIRCLE IF SAMPLES ARE SUBJECT TO REGULATION:
Reg 170/03 Reg318/319 C of A Warning Notice Posted Not Regulated

ALS Environmental
ALS Waterloo, 60 Northland Rd. Unit 1, Waterloo, ON N2V 2B8
Ph: 519-886-6910 Fax: 519-886-9047 Toll-Free 1-800-668-9878

Please place regulated and non-regulated samples in SEPARATE SUBMISSIONS

WORKS / CLIENT NAME	WORKS / CLIENT CONTACT
SAGE CAMPGROUND WELL SUPPLY	**RONALD & TERESA SAGE**
WORKS / CLIEN	WORKS / CLIENT PHONE / FAX
1912 WHISTLE BARE RD, CAMBRIDGE	**(519) 623-2463/(519)623-9850**
WORKS NUMBER	HEALTH UNIT
765001708	**Region of Waterloo HU**
WORKS CATEGORY	HEALTH UNIT PHONE / FAX
SDWS	**(519)-883-2008/(519)883-2226**

SAMPLE DESCRIPTION (This description will appear on the report)	Chlorine Residual (mg/L)	Sampling Date/Time: Date (yy/mm/dd)	Sampling Date/Time: Time	Regulated Sample Type (R/T/D)	Sample Type*	NUMBER OF CONTAINERS	D Tot Coliform, E.Coli, HPC	D/R Tot Coliform, E.Coli	D Tot Coliform, E.Coli, Bkg	T Nitrate / Nitrite	D THM (Max. Res. Time)	D Lead (Max Res Time)	T Sched 23 Inorganics	T Sched 24 Organics	T Sodium	T Fluoride	Fecal Coliform	Presence Absence (TC/EC)	LAB ID
SITE 46		13/04/29	10 55	D				X											1
PUMPHOUSE		13/04/29	11 02	R				X											2

L1294711-COFC

PAYMENT OPTIONS

- ☐ Apply against my pre-payment
- ☐ Apply to this Card (please enter Card Info below)
- ☐ Please make prepayment of $_____ by the following means:
  - ☑ Mastercard ☐ Visa ☐ Cheque enclosed

Credit Card #: 5446 1202 1449 0436 Expiry: 07/13

PAID

*** Sample Type Legend : R - Raw Water T - Treated Source D - Distribution Sample**

FOR LAB USE ONLY	
SUBMISSION NO.	L1294711
LOGGED BY	RH
DATE/TIME	29th-APR-13
TEMPERATURE AT RECEIPT [C]	8.4 C

SAMPLED BY (print)	DATE RECEIVED AT LAB:	Other Comments/Cautions (Please identify known or suspected hazards)
TERESA SAGE	APR 29/13 11:30	**EP70022** **TSAGE**
SUBMITTED TO LAB BY: (SIGNATURE)	RECEIVED AT LAB BY:	
Teresa Sage		ronald.sage@sympatico.ca

Original with Submission: Please Photocopy for your Records

SAGE CAMPGROUNDS
ATTN: RONALD & TERESA SAGE
1912 WHISTLE BARE RD
RR 2
CAMBRIDGE ON N1R 5S2

Date Received: 27-MAY-13
Report Date: 29-MAY-13 15:07 (MT)
Version: FINAL

Client Phone: 519-623-2463

Certificate of Analysis

Lab Work Order #: L1306779

Project P.O. #: CC PROVIDED
Job Reference: 765001708
C of C Numbers:
Legal Site Desc:

Nellie Gudzak
Account Manager

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

Sample Details/Parameters	Result	Qualifier	D.L.	Units	Criteria Specific Limits	Analyzed	Batch
L1306779-1 ~D1 SITE 47							
Sampled By: TERESA SAGE on 27-MAY-13 @ 11:40							
Matrix: DISTRIBUTION					STANDARDS / GUIDELINES		
Individual Analytes							
Total Coliforms and e.Coli by DC Agar							
Total Coliforms	0		0	CFU/100mL	0	28-MAY-13	R2619342
E. Coli	0		0	CFU/100mL	0	28-MAY-13	R2619342
L1306779-2 ~R1 PUMPHOUSE							
Sampled By: TERESA SAGE on 27-MAY-13 @ 11:50							
Matrix: RAW					STANDARDS / GUIDELINES		
Total Coliform, e.Coli							
E. Coli	0		0	CFU/100mL	0	28-MAY-13	R2619352
Total Coliforms	1		0	CFU/100mL**	0	28-MAY-13	R2619348
L1306779-3 ~D1 SITE 47							
Sampled By: TERESA SAGE on 27-MAY-13 @ 11:45							
Matrix: DISTRIBUTION					STANDARDS / GUIDELINES		
Individual Analytes							
Chlorine, Free	2.30	PEHR	0.050	mg/L		28-MAY-13	R2620877
L1306779-4 ~D1 SITE 47							
Sampled By: TERESA SAGE on 27-MAY-13 @ 11:47							
Matrix: DISTRIBUTION					STANDARDS / GUIDELINES		
Individual Analytes							
Lead (Pb)	<1.0		1.0	ug/L	10	28-MAY-13	R2619136
L1306779-5 ~E1 PUMPHOUSE							
Sampled By: TERESA SAGE on 27-MAY-13 @ 11:55							
Matrix: TREATED					STANDARDS / GUIDELINES		
NO2-N+NO3-N (O.Reg 170/03)							
Nitrate and Nitrite as N	4.45		0.20	mg/L	10	29-MAY-13	
Nitrate-N (NO3-N)	4.45		0.10	mg/L	10	28-MAY-13	R2620895
Nitrite-N (NO2-N)	<0.10		0.10	mg/L	1	28-MAY-13	R2620895

* Detection Limit for result exceeds Criteria Specific Limit. Assessment against Criteria Limit cannot be made.

** Analytical result for this parameter exceeds Criteria Specific Limit listed on this report.

Reference Information

Qualifiers for Sample Submission Listed:

Qualifier	Description
CINT	Cooling initiated. Samples were packaged with ice or ice packs upon receipt.

Sample Parameter Qualifier key listed:

Qualifier	Description
PEHR	Parameter Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested.

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
CL2-FREE-WT	Water	Free Chlorine		SM 4500-CL G, EPA 330.5
EC-MF-WT	Water	E. coli		SM 9222D
		A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at @44.5–0.2°C for 24–2h. Method ID: WT-TM-1200		
ETL-N2N3-WT	Water	Calculate from NO2 + NO3		APHA 4110 B
NO2-WT	Water	Nitrite-N		EPA 300.0 (IC)
		A filtered water sample (drinking waters-unfiltered) is analyzed by ion chromatography.		
NO3-WT	Water	Nitrate-N		EPA 300.0 (IC)
		A filtered water sample (drinking waters-unfiltered) is analyzed by ion chromatography.		
PB-ONT-DW-WT	Water	Lead (O.Reg 170/03)		EPA 6020A
TC,EC-DC-WT	Water	Total Coliforms and e.Coli by DC Agar		MOE E3407
		A 100mL volume of sample is filtered through a membrane, the membrane is placed on DC Media and incubated at 35–0.5°C for 24–2h.		
TC-MF-WT	Water	Total Coliforms		SM 9222B
		A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200		

Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA		

GLOSSARY OF REPORT TERMS

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mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

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Quality Control Report

Workorder: L1306779 Report Date: 29-MAY-13

Client: SAGE CAMPGROUNDS
1912 WHISTLE BARE RD RR 2
CAMBRIDGE ON N1R 5S2
Contact: RONALD & TERESA SAGE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL2-FREE-WT	**Water**							
Batch R2620877								
WG1677331-2 CVS								
Chlorine, Free			100.0		%		80-120	28-MAY-13
WG1677331-3 DUP		**L1306779-3**						
Chlorine, Free		2.30	2.40		mg/L	4.3	20	28-MAY-13
WG1677331-1 MB								
Chlorine, Free			<0.050		mg/L		0.05	28-MAY-13
EC-MF-WT	**Water**							
Batch R2619352								
WG1676876-3 DUP		**L1306797-2**						
E. Coli		0	0		CFU/100mL	0.0	50	28-MAY-13
WG1676876-1 MB								
E. Coli			0		CFU/100mL		1	28-MAY-13
WG1676876-2 MB								
E. Coli			0		CFU/100mL		1	28-MAY-13
NO2-WT	**Water**							
Batch R2620895								
WG1677549-5 DUP		**L1305633-1**						
Nitrite-N (NO2-N)		<0.10	<0.10	RPD-NA	mg/L	N/A	25	28-MAY-13
WG1677549-6 DUP		**L1305647-3**						
Nitrite-N (NO2-N)		<0.10	<0.10	RPD-NA	mg/L	N/A	25	28-MAY-13
WG1677549-7 DUP		**L1305895-3**						
Nitrite-N (NO2-N)		<0.10	<0.10	RPD-NA	mg/L	N/A	25	28-MAY-13
WG1677549-2 LCS								
Nitrite-N (NO2-N)			94.5		%		70-130	28-MAY-13
WG1677549-3 LCSD		**WG1677549-2**						
Nitrite-N (NO2-N)		94.5	94.5		%	0.1	25	28-MAY-13
WG1677549-1 MB								
Nitrite-N (NO2-N)			<0.10		mg/L		0.1	28-MAY-13
WG1677549-8 MS		**L1305895-3**						
Nitrite-N (NO2-N)			93.1		%		70-130	28-MAY-13
NO3-WT	**Water**							
Batch R2620895								
WG1677549-5 DUP		**L1305633-1**						
Nitrate-N (NO3-N)		4.63	4.63		mg/L	0.0	25	28-MAY-13
WG1677549-7 DUP		**L1305895-3**						
Nitrate-N (NO3-N)		<0.10	<0.10	RPD-NA	mg/L	N/A	25	28-MAY-13
WG1677549-9 DUP		**L1306358-1**						

Quality Control Report

Workorder: L1306779 Report Date: 29-MAY-13

Client: SAGE CAMPGROUNDS
1912 WHISTLE BARE RD RR 2
CAMBRIDGE ON N1R 5S2
Contact: RONALD & TERESA SAGE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NO3-WT	**Water**							
Batch R2620895								
WG1677549-9 DUP		**L1306358-1**						
Nitrate-N (NO3-N)		<0.10	<0.10	RPD-NA	mg/L	N/A	25	28-MAY-13
WG1677549-2 LCS								
Nitrate-N (NO3-N)			100.1		%		70-130	28-MAY-13
WG1677549-3 LCSD		**WG1677549-2**						
Nitrate-N (NO3-N)		100.1	100.2		%	0.0	25	28-MAY-13
WG1677549-1 MB								
Nitrate-N (NO3-N)			<0.10		mg/L		0.1	28-MAY-13
WG1677549-8 MS		**L1305895-3**						
Nitrate-N (NO3-N)			93.7		%		70-130	28-MAY-13
PB-ONT-DW-WT	**Water**							
Batch R2619136								
WG1675733-6 CVS								
Lead (Pb)			100.2		%		80-120	28-MAY-13
WG1675733-4 DUP		**WG1675733-3**						
Lead (Pb)		<1.0	<1.0	RPD-NA	ug/L	N/A	20	28-MAY-13
WG1675733-2 LCS								
Lead (Pb)			103.9		%		70-130	28-MAY-13
WG1675733-1 MB								
Lead (Pb)			<1.0		ug/L		1	28-MAY-13
WG1675733-5 MS		**WG1675733-3**						
Lead (Pb)			95.3		%		70-130	28-MAY-13
TC,EC-DC-WT	**Water**							
Batch R2619342								
WG1676867-2 DUP		**L1306794-2**						
Total Coliforms		0	0		CFU/100mL	0.0	30	28-MAY-13
E. Coli		0	0		CFU/100mL	0.0	30	28-MAY-13
WG1676867-1 MB								
Total Coliforms			0		CFU/100mL		1	28-MAY-13
E. Coli			0		CFU/100mL		1	28-MAY-13
WG1676867-3 MB								
Total Coliforms			0		CFU/100mL		1	28-MAY-13
E. Coli			0		CFU/100mL		1	28-MAY-13
TC-MF-WT	**Water**							

Quality Control Report

Client: SAGE CAMPGROUNDS
1912 WHISTLE BARE RD RR 2
CAMBRIDGE ON N1R 5S2
Contact: RONALD & TERESA SAGE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TC-MF-WT	**Water**							
Batch R2619348								
WG1676872-3 DUP		**L1306779-2**						
Total Coliforms		1	1		CFU/100mL	0.0	50	28-MAY-13
WG1676872-1 MB								
Total Coliforms			0		CFU/100mL		1	28-MAY-13
WG1676872-2 MB								
Total Coliforms			0		CFU/100mL		1	28-MAY-13

Quality Control Report

Workorder: L1306779 Report Date: 29-MAY-13

Client: SAGE CAMPGROUNDS
1912 WHISTLE BARE RD RR 2
CAMBRIDGE ON N1R 5S2
Contact: RONALD & TERESA SAGE

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Quality Control Report

Workorder: L1306779 Report Date: 29-MAY-13

Client: SAGE CAMPGROUNDS
1912 WHISTLE BARE RD RR 2
CAMBRIDGE ON N1R 5S2
Contact: RONALD & TERESA SAGE

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Inorganic Parameters							
Free Chlorine							
	3	27-MAY-13 11:45	28-MAY-13 14:58	0.25	27	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1306779 were received on 27-MAY-13 12:30.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

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Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

DRINKING WATER CHAIN OF CUSTODY

PLEASE CIRCLE IF SAMPLES ARE SUBJECT TO REGULATION:
Reg 170/03 Reg318/319 C of A Warning Notice Posted Not Regulated

ALS Waterloo, 60 Northland Rd. Unit 1, Waterloo, ON N2V 2B8
Ph: 519-886-6910 Fax: 519-886-9047 Toll-Free 1-800-668-9878

Please place regulated and non-regulated samples in SEPARATE SUBMISSIONS

5900

WORKS / CLIENT NAME	WORKS / CLIENT CONTACT
SAGE CAMPGROUND WELL SUPPLY	RONALD & TERESA SAGE
WORKS / CLIEN	WORKS / CLIENT PHONE / FAX
1912 WHISTLE BARE RD, CAMBRIDGE	(519) 623-2463/(519)623-9850
WORKS NUMBER	HEALTH UNIT
765001708	Region of Waterloo HU
WORKS CATEGORY	HEALTH UNIT PHONE / FAX
SDWS	(519)-883-2008/(519)883-2226

SAMPLE DESCRIPTION (This description will appear on the report)	Chlorine Residual (mg/L)	Sampling Date/Time: Date (yy/mm/dd)	Sampling Date/Time: Time	Regulated Sample Type (R/T/D)	NUMBER OF CONTAINERS	Tot Coliform, E.Coli, HPC (D)	Tot Coliform, E.Coli (D/R)	Tot Coliform, E.Coli, Bkg (D)	Nitrate / Nitrite (T)	THM (Max. Res. Time) (D)	Lead (Max Res Time) (D)	Sched 23 Inorganics (T)	Sched 24 Organics (T)	Sodium (T)	~~Fluoride~~ Free Chlorine (T)	Fecal Coliform	Presence Absence (TC/EC)	LAB ID
STEP 7		13/05/27	11:40	D	1		X											1
Pumphouse		13/05/27	11:50	R	1		X											2
SITE 47		13/05/27	11:45	D	1										✓			3
SITE 47		13/05/27	11:47	D	1						X							4

FOR LAB USE ONLY

SUBMISSION NO. L1306779

LOGGED BY RH

DATE/TIME 27 MAY 13

TEMPERATURE AT RECEIPT [C] 10.6 °C

PAYMENT OPTIONS

- ☐ Apply against my pre-payment
- ☐ Apply to this Card (please enter Card Info below)
- ☑ Please make prepayment of $_____ by the following means:
  - ☑ Mastercard ☐ Visa ☐ Cheque enclosed

Credit Card #: 5446 1200 1449 0486 Expiry: 07/13

L1306779-COFC

* **Sample Type Legend : R - Raw Water T - Treated Source D - Distribution Sample**

SAMPLED BY (print):	DATE RECEIVED AT LAB:	Other Comments/Cautions (Please identify known or suspected hazards)
TERESA SAGE		EP70022 TSAGE
SUBMITTED TO LAB BY: (SIGNATURE)	RECEIVED AT LAB BY:	ronald.sage@sympatico.ca
Sage	RH 27 MAY 13 1230	

Original with Submission: Please Photocopy for your Records

DRINKING WATER CHAIN OF CUSTODY

PLEASE CIRCLE IF SAMPLES ARE SUBJECT TO REGULATION:
Reg 170/03 Reg318/319 C of A Warning Notice Posted Not Regulated

ALS Waterloo, 60 Northland Rd. Unit 1, Waterloo, ON N2V 2B8
Ph: 519-886-6910 Fax: 519-886-9047 Toll-Free 1-800-668-9878

Please place regulated and non-regulated samples in SEPARATE SUBMISSIONS

WORKS / CLIENT NAME	WORKS / CLIENT CONTACT
SAGE CAMPGROUND WELL SUPPLY	**RONALD & TERESA SAGE**
WORKS / CLIEN	WORKS / CLIENT PHONE / FAX
1912 WHISTLE BARE RD, CAMBRIDGE	**(519) 623-2463/(519)623-9850**
WORKS NUMBER	HEALTH UNIT
765001708	**Region of Waterloo HU**
WORKS CATEGORY	HEALTH UNIT PHONE / FAX
SDWS	**(519)-883-2008/(519)883-2226**

SAMPLE DESCRIPTION (This description will appear on the report)	Chlorine Residual (mg/L)	Sampling Date/Time: Date (yy/mm/dd)	Sampling Date/Time: Time	Regulated Sample Type (R/T/D)	Sample Type*	NUMBER OF CONTAINERS	D Tot Coliform, E.Coli, HPC	D/R Tot Coliform, E.Coli	D Tot Coliform, E.Coli, Bkg	T Nitrate / Nitrite	D THM (Max. Res. Time)	D Lead (Max Res Time)	T Sched 23 Inorganics	T Sched 24 Organics	T Sodium	T Fluoride	Fecal Coliform	Presence Absence (TC/EC)
PumpHouse		13/05/27	11:55	~~R~~ T				~~X~~		X								

ANALYSES REQUESTED
Please indicate test for each sample by Checkmark in the box below

FOR LAB USE ONLY
SUBMISSION NO. L1306779
LOGGED BY RH
DATE/TIME 27MAY13
TEMPERATURE AT RECEIPT [C] 10.6 °C
LAB ID 5

PAYMENT OPTIONS

- ☐ Apply against my pre-payment
- ☐ Apply to this Card (please enter Card Info below)
- ☑ Please make prepayment of $_____ by the following means:
  - ☑ Mastercard ☐ Visa ☐ Cheque enclosed

Credit Card #: 5446 1200 1449 0426 Expiry: 07/13

L1306779-COFC

*** Sample Type Legend : R - Raw Water T - Treated Source D - Distribution Sample**

SAMPLED BY (print):	DATE RECEIVED AT LAB:	Other Comments/Cautions (Please identify known or suspected hazards)
TERESA SAGE		**EP70022** **TSAGE**
SUBMITTED TO LAB BY: (SIGNATURE)	RECEIVED AT LAB BY: RH 27MAY13 1230	ronald.sage@sympatico.ca

Original with Submission: Please Photocopy for your Records

SAGE CAMPGROUNDS
ATTN: RONALD & TERESA SAGE
1912 WHISTLE BARE RD
RR 2
CAMBRIDGE ON N1R 5S2

Date Received: 05-JUL-13
Report Date: 08-JUL-13 15:03 (MT)
Version: FINAL

Client Phone: 519-623-2463

Certificate of Analysis

Lab Work Order #: L1327776

Project P.O. #: NOT SUBMITTED
Job Reference: 765001708
C of C Numbers:
Legal Site Desc:

Nellie Gudzak
Account Manager

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CRITERIA REPORT

765001708

Sample Details/Parameters	Result	Qualifier	D.L.	Units	Criteria Specific Limits	Analyzed	Batch
L1327776-1 ~D1 SITE 80							
Sampled By: TERESA SAGE on 05-JUL-13 @ 12:55							
Matrix: DISTRIBUTION					STANDARDS / GUIDELINES		
Individual Analytes							
Chlorine, Free	1.38		0.050	mg/L		08-JUL-13	R2644947
Total Coliforms and e.Coli by DC Agar							
Total Coliforms	0		0	CFU/100mL	0	06-JUL-13	R2644459
E. Coli	0		0	CFU/100mL	0	06-JUL-13	R2644459
L1327776-2 ~R1 PUMPHOUSE							
Sampled By: TERESA SAGE on 05-JUL-13 @ 13:10							
Matrix: RAW					STANDARDS / GUIDELINES		
Total Coliform, e.Coli							
E. Coli	0		0	CFU/100mL	0	06-JUL-13	R2644462
Total Coliforms	0		0	CFU/100mL	0	06-JUL-13	R2644461

* Detection Limit for result exceeds Criteria Specific Limit. Assessment against Criteria Limit cannot be made.

** Analytical result for this parameter exceeds Criteria Specific Limit listed on this report.

Ontario DW Std O.Reg 169/03 JUNE 2007

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Preparation Method Reference(Based On)	Analytical Method Reference(Based On)
CL2-FREE-WT	Water	Free Chlorine		SM 4500-CL G, EPA 330.5
EC-MF-WT	Water	E. coli		SM 9222D
	A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at @44.5–0.2°C for 24–2h. Method ID: WT-TM-1200			
TC,EC-DC-WT	Water	Total Coliforms and e.Coli by DC Agar		MOE E3407
	A 100mL volume of sample is filtered through a membrane, the membrane is placed on DC Media and incubated at 35–0.5°C for 24–2h.			
TC-MF-WT	Water	Total Coliforms		SM 9222B
	A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200			

Laboratory Methods employed follow in-house procedures, which are generally based on nationally or internationally accepted methodologies.

Chain of Custody numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA		

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of criteria limits is provided as is without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.

Quality Control Report

Workorder: L1327776 Report Date: 08-JUL-13

Client: SAGE CAMPGROUNDS
1912 WHISTLE BARE RD RR 2
CAMBRIDGE ON N1R 5S2
Contact: RONALD & TERESA SAGE

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL2-FREE-WT	**Water**							
Batch R2644947								
WG1702665-2 CVS								
Chlorine, Free			96.4		%		80-120	08-JUL-13
WG1702665-3 DUP		**L1327776-1**						
Chlorine, Free		1.38	1.41		mg/L	2.2	20	08-JUL-13
WG1702665-1 MB								
Chlorine, Free			<0.050		mg/L		0.05	08-JUL-13
EC-MF-WT	**Water**							
Batch R2644462								
WG1701733-2 DUP		**L1327488-1**						
E. Coli		0	0		CFU/100mL	0.0	50	06-JUL-13
WG1701733-1 MB								
E. Coli			0		CFU/100mL		1	06-JUL-13
WG1701733-3 MB								
E. Coli			0		CFU/100mL		1	06-JUL-13
TC,EC-DC-WT	**Water**							
Batch R2644459								
WG1701729-2 DUP		**L1327412-1**						
Total Coliforms		0	0		CFU/100mL	0.0	30	06-JUL-13
E. Coli		0	0		CFU/100mL	0.0	30	06-JUL-13
WG1701729-1 MB								
Total Coliforms			0		CFU/100mL		1	06-JUL-13
E. Coli			0		CFU/100mL		1	06-JUL-13
WG1701729-3 MB								
Total Coliforms			0		CFU/100mL		1	06-JUL-13
E. Coli			0		CFU/100mL		1	06-JUL-13
TC-MF-WT	**Water**							
Batch R2644461								
WG1701732-2 DUP		**L1327336-1**						
Total Coliforms		0	0		CFU/100mL	0.0	50	06-JUL-13
WG1701732-1 MB								
Total Coliforms			0		CFU/100mL		1	06-JUL-13
WG1701732-3 MB								
Total Coliforms			0		CFU/100mL		1	06-JUL-13

Quality Control Report

Workorder: L1327776 Report Date: 08-JUL-13

Client: SAGE CAMPGROUNDS
1912 WHISTLE BARE RD RR 2
CAMBRIDGE ON N1R 5S2
Contact: RONALD & TERESA SAGE

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Quality Control Report

Workorder: L1327776 Report Date: 08-JUL-13

Client: SAGE CAMPGROUNDS
1912 WHISTLE BARE RD RR 2
CAMBRIDGE ON N1R 5S2
Contact: RONALD & TERESA SAGE

Hold Time Exceedances:

ALS Product Description	Sample ID	Sampling Date	Date Processed	Rec. HT	Actual HT	Units	Qualifier
Inorganic Parameters							
Free Chlorine							
	1	05-JUL-13 12:55	08-JUL-13 12:53	0.25	72	hours	EHTR-FM

Legend & Qualifier Definitions:

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended.
EHTR: Exceeded ALS recommended hold time prior to sample receipt.
EHTL: Exceeded ALS recommended hold time prior to analysis. Sample was received less than 24 hours prior to expiry.
EHT: Exceeded ALS recommended hold time prior to analysis.
Rec. HT: ALS recommended hold time (see units).

Notes*:
Where actual sampling date is not provided to ALS, the date (& time) of receipt is used for calculation purposes.
Where actual sampling time is not provided to ALS, the earlier of 12 noon on the sampling date or the time (& date) of receipt is used for calculation purposes. Samples for L1327776 were received on 05-JUL-13 13:45.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

DRINKING WATER CHAIN OF CUSTODY

ALS Environmental

ALS Waterloo, 60 Northland Rd. Unit 1, Waterloo, ON N2V 2B8
Ph: 519-886-6910 Fax: 519-886-9047 Toll-Free 1-800-668-9878

PLEASE CIRCLE IF SAMPLES ARE SUBJECT TO REGULATION: Reg 170/03 Reg318/319 C of A Warning Notice Posted Not Regulated

Please place regulated and non-regulated samples in SEPARATE SUBMISSIONS

B731

WORKS / CLIENT NAME	WORKS / CLIENT CONTACT
SAGE CAMPGROUND WELL SUPPLY	RONALD & TERESA SAGE
WORKS / CLIEN	WORKS / CLIENT PHONE / FAX
1912 WHISTLE BARE RD, CAMBRIDGE	(519) 623-2463/(519)623-9850
WORKS NUMBER	HEALTH UNIT
765001708	Region of Waterloo HU
WORKS CATEGORY	HEALTH UNIT PHONE / FAX
SDWS	(519)-883-2008/(519)883-2226

SAMPLE DESCRIPTION (This description will appear on the report)	Chlorine Residual (mg/L)	Sampling Date/Time: Date (yy/mm/dd)	Sampling Date/Time: Time	Regulated Sample Type (R/T/D)	NUMBER OF CONTAINERS	Tot Coliform, E.Coli, HPC (D)	Tot Coliform, E.Coli (D/R)	Tot Coliform, E.Coli, Bkg (D)	Nitrate / Nitrite (T)	THM (Max. Res. Time) (D)	Lead (Max Res Time) (D)	Sched 23 Inorganics (T)	Sched 24 Organics (T)	Sodium (FREE CHLORINE) (T)	Fluoride (T)	Fecal Coliform	Presence Absence (TC/EC)	LAB ID
SITE 80		13/07/05	12:55pm	D	1		X											1
PUMPHOUSE		13/07/05	1:10pm	R	1		X											2
SITE 80		13/07/05	12:55pm	D	1									X				1

PAYMENT OPTIONS

- ☐ Apply against my pre-payment
- ☐ Apply to this Card (please enter Card Info below)
- ☑ Please make prepayment of $_____ by the following means:
  - ☐ Mastercard ☑ Visa ☐ Cheque enclosed

Credit Card #: 4520 880 1429 6444 Expiry: 02/14

L1327776-COFC

FOR LAB USE ONLY	
SUBMISSION NO.	L1327776
LOGGED BY	aj
DATE/TIME	5/7/13 14:16
TEMPERATURE AT RECEIPT [C]	9.1

* **Sample Type Legend : R - Raw Water T - Treated Source D - Distribution Sample**

SAMPLED BY (print):	DATE RECEIVED AT LAB:	Other Comments/Cautions (Please identify known or suspected hazards)
TERESA SAGE		EP70022 TSAGE
SUBMITTED TO LAB BY (SIGNATURE)	RECEIVED AT LAB BY:	ronald.sage@sympatico.ca
	5-July-2013 13:45	

Original with Submission Please Photocopy for your Records

Form WR-

LVM INC.
ATTN: CHRIS HELMER
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5

Date Received: 11-JUL-14
Report Date: 16-JUL-14 15:15 (MT)
Version: FINAL

Client Phone: 519-741-1313

Certificate of Analysis

Lab Work Order #: L1485174

Project P.O. #: 213152
Job Reference: P-0000145-0-00-401-05
C of C Numbers: 14-399329
Legal Site Desc:

Nancy Smith
Account Manager

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Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1
L1485174-1 SP1 (MP2-12)						
Sampled By: S. METEER on 11-JUL-14 @ 10:3(						
Matrix: WATER						
Physical Tests						
Color, Apparent	8.8		1.0	C.U.	11-JUL-14	
Conductivity	613		3.0	umhos/cm	14-JUL-14	
Hardness (as CaCO3)	273		10	mg/L	16-JUL-14	
pH	8.13		0.10	pH units	14-JUL-14	6.5-8.5
Total Dissolved Solids	339		20	mg/L	15-JUL-14	
Turbidity	2.10		0.10	NTU	11-JUL-14	
Anions and Nutrients						
Alkalinity, Total (as CaCO3)	215		10	mg/L	11-JUL-14	
Ammonia, Total (as N)	<0.050		0.050	mg/L	15-JUL-14	
Chloride	41.1		2.0	mg/L	15-JUL-14	
Fluoride	<0.10		0.10	mg/L	15-JUL-14	
Nitrate-N	4.53		0.10	mg/L	15-JUL-14	
Nitrite-N	<0.10		0.10	mg/L	15-JUL-14	
Total Kjeldahl Nitrogen	0.21		0.15	mg/L	14-JUL-14	
Phosphate-P (ortho)	<0.0030		0.0030	mg/L	14-JUL-14	
Total Phosphorus	0.0116		0.0030	mg/L	14-JUL-14	
Sulphate	25.8		2.0	mg/L	15-JUL-14	
Bacteriological Tests						
E. Coli	300	DLM	10	CFU/100mL	12-JUL-14	*100
Total Coliforms	800	DLM	100	CFU/100mL	12-JUL-14	
Total Metals						
Aluminum (Al)-Total	0.027		0.010	mg/L	15-JUL-14	*0.015
Antimony (Sb)-Total	<0.0050		0.0050	mg/L	15-JUL-14	0.02
Arsenic (As)-Total	<0.0010		0.0010	mg/L	15-JUL-14	0.005
Barium (Ba)-Total	0.061		0.010	mg/L	15-JUL-14	
Beryllium (Be)-Total	<0.0010		0.0010	mg/L	15-JUL-14	0.011
Bismuth (Bi)-Total	<0.0010		0.0010	mg/L	15-JUL-14	
Boron (B)-Total	<0.050		0.050	mg/L	15-JUL-14	0.2
Cadmium (Cd)-Total	<0.000090		0.000090	mg/L	15-JUL-14	0.0001
Calcium (Ca)-Total	67.4		0.50	mg/L	15-JUL-14	
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	15-JUL-14	
Cobalt (Co)-Total	<0.00050		0.00050	mg/L	15-JUL-14	0.0009
Copper (Cu)-Total	<0.0010		0.0010	mg/L	15-JUL-14	0.001
Iron (Fe)-Total	<0.050		0.050	mg/L	15-JUL-14	0.3
Lead (Pb)-Total	<0.0010		0.0010	mg/L	15-JUL-14	0.001
Magnesium (Mg)-Total	25.5		0.50	mg/L	15-JUL-14	
Manganese (Mn)-Total	0.0094		0.0010	mg/L	15-JUL-14	
Molybdenum (Mo)-Total	<0.0010		0.0010	mg/L	15-JUL-14	0.04
Nickel (Ni)-Total	<0.0020		0.0020	mg/L	15-JUL-14	0.025
Potassium (K)-Total	1.1		1.0	mg/L	15-JUL-14	
Selenium (Se)-Total	<0.00040		0.00040	mg/L	15-JUL-14	0.1
Silicon (Si)-Total	4.5		1.0	mg/L	15-JUL-14	
Silver (Ag)-Total	<0.00010		0.00010	mg/L	15-JUL-14	0.0001
Sodium (Na)-Total	19.9		0.50	mg/L	15-JUL-14	

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Surface Water PWQO

#1: Surface Water PWQO

Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits
L1485174-1 SP1 (MP2-12)						
Sampled By: S. METEER on 11-JUL-14 @ 10:3(						
Matrix: WATER						#1
Total Metals						
Strontium (Sr)-Total	0.230		0.0010	mg/L	15-JUL-14	
Thallium (Tl)-Total	<0.00030		0.00030	mg/L	15-JUL-14	0.0003
Tin (Sn)-Total	<0.0010		0.0010	mg/L	15-JUL-14	
Titanium (Ti)-Total	<0.0020		0.0020	mg/L	15-JUL-14	
Tungsten (W)-Total	<0.010		0.010	mg/L	15-JUL-14	0.03
Uranium (U)-Total	<0.0050		0.0050	mg/L	15-JUL-14	0.005
Vanadium (V)-Total	<0.0010		0.0010	mg/L	15-JUL-14	0.006
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	15-JUL-14	0.02
Zirconium (Zr)-Total	<0.0040		0.0040	mg/L	15-JUL-14	0.004
Aggregate Organics						
BOD Carbonaceous	<2.0		2.0	mg/L	16-JUL-14	
L1485174-2 SP2						
Sampled By: S. METEER on 11-JUL-14 @ 10:4(						
Matrix: WATER						#1
Physical Tests						
Color, Apparent	10.0		1.0	C.U.	11-JUL-14	
Conductivity	408		3.0	umhos/cm	14-JUL-14	
Hardness (as CaCO3)	189		10	mg/L	16-JUL-14	
pH	8.55		0.10	pH units	14-JUL-14	*6.5-8.5
Total Dissolved Solids	241		20	mg/L	15-JUL-14	
Turbidity	1.32		0.10	NTU	11-JUL-14	
Anions and Nutrients						
Alkalinity, Total (as CaCO3)	153		10	mg/L	11-JUL-14	
Ammonia, Total (as N)	<0.050		0.050	mg/L	15-JUL-14	
Chloride	35.7		2.0	mg/L	15-JUL-14	
Fluoride	<0.10		0.10	mg/L	15-JUL-14	
Nitrate-N	1.30		0.10	mg/L	15-JUL-14	
Nitrite-N	<0.10		0.10	mg/L	15-JUL-14	
Total Kjeldahl Nitrogen	0.68		0.15	mg/L	14-JUL-14	
Phosphate-P (ortho)	<0.0030		0.0030	mg/L	14-JUL-14	
Total Phosphorus	0.0103		0.0030	mg/L	14-JUL-14	
Sulphate	23.2		2.0	mg/L	15-JUL-14	
Bacteriological Tests						
E. Coli	150	DLM	10	CFU/100mL	12-JUL-14	*100
Total Coliforms	600	DLM	100	CFU/100mL	12-JUL-14	
Total Metals						
Aluminum (Al)-Total	<0.010		0.010	mg/L	15-JUL-14	0.015
Antimony (Sb)-Total	<0.0050		0.0050	mg/L	15-JUL-14	0.02
Arsenic (As)-Total	<0.0010		0.0010	mg/L	15-JUL-14	0.005
Barium (Ba)-Total	0.030		0.010	mg/L	15-JUL-14	
Beryllium (Be)-Total	<0.0010		0.0010	mg/L	15-JUL-14	0.011
Bismuth (Bi)-Total	<0.0010		0.0010	mg/L	15-JUL-14	
Boron (B)-Total	<0.050		0.050	mg/L	15-JUL-14	0.2

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Surface Water PWQO

#1: Surface Water PWQO

Sample Details Grouping / Analyte	Result	Qualifier	D.L.	Units	Analyzed	Guideline Limits #1
L1485174-2 SP2						
Sampled By: S. METEER on 11-JUL-14 @ 10:4(						
Matrix: WATER						
Total Metals						
Cadmium (Cd)-Total	<0.000090		0.000090	mg/L	15-JUL-14	0.0001
Calcium (Ca)-Total	35.1		0.50	mg/L	15-JUL-14	
Chromium (Cr)-Total	<0.00050		0.00050	mg/L	15-JUL-14	
Cobalt (Co)-Total	<0.00050		0.00050	mg/L	15-JUL-14	0.0009
Copper (Cu)-Total	<0.0010		0.0010	mg/L	15-JUL-14	0.001
Iron (Fe)-Total	<0.050		0.050	mg/L	15-JUL-14	0.3
Lead (Pb)-Total	<0.0010		0.0010	mg/L	15-JUL-14	0.001
Magnesium (Mg)-Total	24.6		0.50	mg/L	15-JUL-14	
Manganese (Mn)-Total	0.0113		0.0010	mg/L	15-JUL-14	
Molybdenum (Mo)-Total	<0.0010		0.0010	mg/L	15-JUL-14	0.04
Nickel (Ni)-Total	<0.0020		0.0020	mg/L	15-JUL-14	0.025
Potassium (K)-Total	1.1		1.0	mg/L	15-JUL-14	
Selenium (Se)-Total	<0.00040		0.00040	mg/L	15-JUL-14	0.1
Silicon (Si)-Total	4.3		1.0	mg/L	15-JUL-14	
Silver (Ag)-Total	<0.00010		0.00010	mg/L	15-JUL-14	0.0001
Sodium (Na)-Total	16.4		0.50	mg/L	15-JUL-14	
Strontium (Sr)-Total	0.151		0.0010	mg/L	15-JUL-14	
Thallium (Tl)-Total	<0.00030		0.00030	mg/L	15-JUL-14	0.0003
Tin (Sn)-Total	<0.0010		0.0010	mg/L	15-JUL-14	
Titanium (Ti)-Total	<0.0020		0.0020	mg/L	15-JUL-14	
Tungsten (W)-Total	<0.010		0.010	mg/L	15-JUL-14	0.03
Uranium (U)-Total	<0.0050		0.0050	mg/L	15-JUL-14	0.005
Vanadium (V)-Total	<0.0010		0.0010	mg/L	15-JUL-14	0.006
Zinc (Zn)-Total	<0.0030		0.0030	mg/L	15-JUL-14	0.02
Zirconium (Zr)-Total	<0.0040		0.0040	mg/L	15-JUL-14	0.004
Aggregate Organics						
BOD Carbonaceous	<2.0		2.0	mg/L	16-JUL-14	

** Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
* Analytical result for this parameter exceeds Guideline Limit listed on this report. Guideline Limits applied:

Surface Water PWQO

#1: Surface Water PWQO

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects.

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference***
ALK-WT	Water	Alkalinity, Total (as CaCO3)	EPA 310.2
ANIONS5-WT	Water	CL,F,NO2,NO3,SO4	EPA 300.0 (IC)
BOD-C-WT	Water	BOD Carbonaceous	APHA 5210 B (CBOD)
		Sample is incubated at 20°C– 1 C for 5 days using a nitrification inhibitor.	
COLOUR-WT	Water	Colour	APHA 2120
		Apparent colour is determined by analysis of the decanted sample using the platinum-cobalt colourimetric method.	
EC-MF-WT	Water	E. coli	SM 9222D
		A 100mL volume of sample is filtered through a membrane, the membrane is placed on mFC-BCIG agar and incubated at @44.5–0.2°C for 24–2h. Method ID: WT-TM-1200	
EC-WT	Water	Conductivity	APHA 2510 B
		Water samples can be measured directly by immersing the conductivity cell into the sample.	
ETL-HARDNESS-CALC-WT	Water	Hardness (as CaCO3)	APHA 2340 B
MET-T-MS-WT	Water	Total Metals in Water by ICPMS	EPA 200.8
		This analysis involves preliminary sample treatment by hotblock acid digestion (APHA 3030E). Instrumental analysis is by inductively coupled plasma - mass spectrometry (EPA Method 6020A).	
NH3-WT	Water	Ammonia, Total as N	EPA 350.1
		Sample is measured colorimetrically. When sample is turbid a distillation step is required, sample is distilled into a solution of boric acid and measured colorimetrically.	
P-ORTHO-LOW-WT	Water	Phosphorus-P (ortho)	APHA 4500-P B E
P-TOTAL-LOW-WT	Water	Phosphorus, Total, Low Level	APHA 4500-P B E
		This analysis is carried by out an discrete colorimetric auto-analyzer using procedures adapted from APHA Method 4500-P "Phosphorus".	
PH-WT	Water	pH	APHA 4500 H-Electrode
		Water samples are analyzed directly by a calibrated pH meter.	
		Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).	
SOLIDS-TDS-WT	Water	Total Dissolved Solids	APHA 2540C
		A well-mixed sample is filtered though glass fibres filter. A known volume of the filtrate is evaporated and dried at 105–5°C overnight and then 180–10°C for 1hr.	
TC-MF-WT	Water	Total Coliforms	SM 9222B
		A 100mL volume of sample is filtered through a membrane, the membrane is placed on mENDO LES agar and incubated at 35–0.5°C for 24–2h. Method ID: WT-TM-1200	
TKN-WT	Water	Total Kjeldahl Nitrogen	APHA 4500-N
		Sample is digested to convert the TKN to ammonium sulphate. The ammonia ions are heated to produce a colour complex. The absorbance measured by the instrument is proportional to the concentration of ammonium sulphate in the sample and is reported as TKN.	
TURBIDITY-WT	Water	Turbidity	APHA 2130 B
		Sample result is based on a comparison of the intensity of the light scattered by the sample under defined conditions with the intensity of light scattered by a standard reference suspension under the same conditions. Sample readings are obtained from a Nephelometer.	

*** ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody numbers:

14-399329

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location	Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA		

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.

Quality Control Report

Workorder: L1485174 Report Date: 16-JUL-14

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: CHRIS HELMER

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
ALK-WT	**Water**							
Batch R2884938								
WG1909534-3 CRM		**WT-ALK-CRM**						
Alkalinity, Total (as CaCO3)			108.3		%		80-120	11-JUL-14
WG1909534-2 CVS								
Alkalinity, Total (as CaCO3)			112.8		%		85-115	11-JUL-14
WG1909534-4 DUP		**L1484984-1**						
Alkalinity, Total (as CaCO3)		37	35		mg/L	5.9	20	11-JUL-14
WG1909534-5 DUP		**L1485465-6**						
Alkalinity, Total (as CaCO3)		57	56		mg/L	1.6	20	11-JUL-14
WG1909534-1 MB								
Alkalinity, Total (as CaCO3)			<10		mg/L		10	11-JUL-14
ANIONS5-WT	**Water**							
Batch R2887821								
WG1911241-2 LCS								
Chloride			102.1		%		85-115	15-JUL-14
Fluoride			102.5		%		85-115	15-JUL-14
Nitrite-N			102.5		%		85-115	15-JUL-14
Nitrate-N			100.5		%		85-115	15-JUL-14
Sulphate			102.1		%		85-115	15-JUL-14
WG1911241-3 LCSD		**WG1911241-2**						
Chloride		102.1	102.7		%	0.5	25	15-JUL-14
Fluoride		102.5	102.1		%	0.4	25	15-JUL-14
Nitrite-N		102.5	103.6		%	1.0	25	15-JUL-14
Nitrate-N		100.5	100.7		%	0.2	25	15-JUL-14
Sulphate		102.1	102.5		%	0.4	25	15-JUL-14
WG1911241-1 MB								
Chloride			<2.0		mg/L		2	15-JUL-14
Fluoride			<0.10		mg/L		0.1	15-JUL-14
Nitrite-N			<0.10		mg/L		0.1	15-JUL-14
Nitrate-N			<0.10		mg/L		0.1	15-JUL-14
Sulphate			<2.0		mg/L		2	15-JUL-14
BOD-C-WT	**Water**							
Batch R2887597								
WG1908934-2 DUP		**L1484901-2**						
BOD Carbonaceous		1710	1690		mg/L	1.7	20	16-JUL-14
WG1908934-4 DUP		**L1485136-1**						
BOD Carbonaceous		172	156		mg/L	9.8	20	16-JUL-14

Quality Control Report

Workorder: L1485174 Report Date: 16-JUL-14

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: CHRIS HELMER

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BOD-C-WT	**Water**							
Batch R2887597								
WG1908934-5 DUP		**L1485150-1**						
BOD Carbonaceous		1930	1920		mg/L	0.4	20	16-JUL-14
WG1908934-3 LCS								
BOD Carbonaceous			99.5		%		85-115	16-JUL-14
WG1908934-1 MB								
BOD Carbonaceous			<2.0		mg/L		2	16-JUL-14
COLOUR-WT	**Water**							
Batch R2884339								
WG1909464-3 CRM		**WT-COLOUR-CRM**						
Color, Apparent			98.0		%		80-120	11-JUL-14
WG1909464-2 CVS								
Color, Apparent			96.9		%		85-115	11-JUL-14
WG1909464-4 DUP		**L1485465-6**						
Color, Apparent		15.5	15.9		C.U.	2.4	20	11-JUL-14
WG1909464-1 MB								
Color, Apparent			<1.0		C.U.		1	11-JUL-14
EC-MF-WT	**Water**							
Batch R2884952								
WG1909341-3 DUP		**L1484905-1**						
E. Coli		0	0		CFU/100mL	0.0	50	12-JUL-14
WG1909341-6 DUP		**L1485465-6**						
E. Coli		5	4		CFU/100mL	22	50	12-JUL-14
WG1909341-7 DUP		**L1485465-4**						
E. Coli		0	0		CFU/100mL	0.0	50	12-JUL-14
WG1909341-1 MB								
E. Coli			0		CFU/100mL		1	12-JUL-14
WG1909341-2 MB								
E. Coli			0		CFU/100mL		1	12-JUL-14
WG1909341-4 MB								
E. Coli			0		CFU/100mL		1	12-JUL-14
WG1909341-5 MB								
E. Coli			0		CFU/100mL		1	12-JUL-14
EC-WT	**Water**							
Batch R2885889								
WG1910396-3 CVS								
Conductivity			100.9		%		90-110	14-JUL-14
WG1910396-5 DUP		**WG1910396-4**						

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: CHRIS HELMER

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EC-WT	**Water**							
Batch R2885889								
WG1910396-5 DUP		**WG1910396-4**						
Conductivity		1190	1190		umhos/cm	0.2	10	14-JUL-14
WG1910396-6 DUP		**L1485544-27**						
Conductivity		1560	1550		umhos/cm	0.3	10	14-JUL-14
WG1910396-1 MB								
Conductivity			<3.0		umhos/cm		3	14-JUL-14
MET-T-MS-WT	**Water**							
Batch R2885820								
WG1910306-1 CVS								
Aluminum (Al)-Total			101.0		%		80-120	14-JUL-14
Antimony (Sb)-Total			100.8		%		80-120	14-JUL-14
Arsenic (As)-Total			99.6		%		80-120	14-JUL-14
Barium (Ba)-Total			96.5		%		80-120	14-JUL-14
Beryllium (Be)-Total			90.9		%		80-120	14-JUL-14
Bismuth (Bi)-Total			99.7		%		80-120	14-JUL-14
Boron (B)-Total			92.5		%		80-120	14-JUL-14
Cadmium (Cd)-Total			100.6		%		80-120	14-JUL-14
Calcium (Ca)-Total			99.2		%		80-120	14-JUL-14
Chromium (Cr)-Total			99.6		%		80-120	14-JUL-14
Cobalt (Co)-Total			100.3		%		80-120	14-JUL-14
Copper (Cu)-Total			101.7		%		80-120	14-JUL-14
Iron (Fe)-Total			102.2		%		80-120	14-JUL-14
Lead (Pb)-Total			102.1		%		80-120	14-JUL-14
Magnesium (Mg)-Total			101.5		%		80-120	14-JUL-14
Manganese (Mn)-Total			100.0		%		80-120	14-JUL-14
Molybdenum (Mo)-Total			92.6		%		80-120	14-JUL-14
Nickel (Ni)-Total			100.1		%		80-120	14-JUL-14
Potassium (K)-Total			97.6		%		80-120	14-JUL-14
Selenium (Se)-Total			99.1		%		80-120	14-JUL-14
Silicon (Si)-Total			96.7		%		80-120	14-JUL-14
Silver (Ag)-Total			102.3		%		80-120	14-JUL-14
Sodium (Na)-Total			99.1		%		80-120	14-JUL-14
Strontium (Sr)-Total			96.3		%		80-120	14-JUL-14
Thallium (Tl)-Total			100.8		%		80-120	14-JUL-14
Tin (Sn)-Total			99.3		%		80-120	14-JUL-14

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: CHRIS HELMER

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-MS-WT	**Water**							
Batch R2885820								
WG1910306-1 CVS								
Titanium (Ti)-Total			99.8		%		80-120	14-JUL-14
Tungsten (W)-Total			96.6		%		80-120	14-JUL-14
Uranium (U)-Total			100.4		%		80-120	14-JUL-14
Vanadium (V)-Total			100.5		%		80-120	14-JUL-14
Zinc (Zn)-Total			94.0		%		80-120	14-JUL-14
Zirconium (Zr)-Total			94.4		%		80-120	14-JUL-14
WG1910306-3 CVS								
Aluminum (Al)-Total			98.2		%		80-120	15-JUL-14
Antimony (Sb)-Total			107.0		%		80-120	15-JUL-14
Arsenic (As)-Total			96.1		%		80-120	15-JUL-14
Barium (Ba)-Total			94.4		%		80-120	15-JUL-14
Beryllium (Be)-Total			97.4		%		80-120	15-JUL-14
Bismuth (Bi)-Total			102.4		%		80-120	15-JUL-14
Boron (B)-Total			99.8		%		80-120	15-JUL-14
Cadmium (Cd)-Total			98.0		%		80-120	15-JUL-14
Calcium (Ca)-Total			100.5		%		80-120	15-JUL-14
Chromium (Cr)-Total			97.9		%		80-120	15-JUL-14
Cobalt (Co)-Total			97.6		%		80-120	15-JUL-14
Copper (Cu)-Total			97.6		%		80-120	15-JUL-14
Iron (Fe)-Total			101.1		%		80-120	15-JUL-14
Lead (Pb)-Total			102.0		%		80-120	15-JUL-14
Magnesium (Mg)-Total			107.7		%		80-120	15-JUL-14
Manganese (Mn)-Total			99.7		%		80-120	15-JUL-14
Molybdenum (Mo)-Total			99.2		%		80-120	15-JUL-14
Nickel (Ni)-Total			98.7		%		80-120	15-JUL-14
Potassium (K)-Total			105.9		%		80-120	15-JUL-14
Selenium (Se)-Total			99.3		%		80-120	15-JUL-14
Silicon (Si)-Total			95.1		%		80-120	15-JUL-14
Silver (Ag)-Total			110.7		%		80-120	15-JUL-14
Sodium (Na)-Total			101.3		%		80-120	15-JUL-14
Strontium (Sr)-Total			97.6		%		80-120	15-JUL-14
Thallium (Tl)-Total			104.4		%		80-120	15-JUL-14
Tin (Sn)-Total			97.5		%		80-120	15-JUL-14
Titanium (Ti)-Total			96.9		%		80-120	15-JUL-14

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: CHRIS HELMER

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-MS-WT	**Water**							
Batch R2885820								
WG1910306-3 CVS								
Tungsten (W)-Total			100.3		%		80-120	15-JUL-14
Uranium (U)-Total			104.0		%		80-120	15-JUL-14
Vanadium (V)-Total			98.4		%		80-120	15-JUL-14
Zinc (Zn)-Total			92.5		%		80-120	15-JUL-14
Zirconium (Zr)-Total			97.1		%		80-120	15-JUL-14
WG1910306-4 CVS								
Aluminum (Al)-Total			98.4		%		80-120	16-JUL-14
Antimony (Sb)-Total			99.9		%		80-120	16-JUL-14
Arsenic (As)-Total			95.1		%		80-120	16-JUL-14
Barium (Ba)-Total			89.3		%		80-120	16-JUL-14
Beryllium (Be)-Total			95.2		%		80-120	16-JUL-14
Bismuth (Bi)-Total			98.4		%		80-120	16-JUL-14
Boron (B)-Total			97.6		%		80-120	16-JUL-14
Cadmium (Cd)-Total			95.3		%		80-120	16-JUL-14
Calcium (Ca)-Total			102.2		%		80-120	16-JUL-14
Chromium (Cr)-Total			95.9		%		80-120	16-JUL-14
Cobalt (Co)-Total			91.7		%		80-120	16-JUL-14
Copper (Cu)-Total			96.2		%		80-120	16-JUL-14
Iron (Fe)-Total			100.2		%		80-120	16-JUL-14
Lead (Pb)-Total			101.4		%		80-120	16-JUL-14
Magnesium (Mg)-Total			101.4		%		80-120	16-JUL-14
Manganese (Mn)-Total			94.1		%		80-120	16-JUL-14
Molybdenum (Mo)-Total			91.4		%		80-120	16-JUL-14
Nickel (Ni)-Total			94.7		%		80-120	16-JUL-14
Potassium (K)-Total			104.7		%		80-120	16-JUL-14
Selenium (Se)-Total			97.5		%		80-120	16-JUL-14
Silicon (Si)-Total			92.7		%		80-120	16-JUL-14
Silver (Ag)-Total			99.8		%		80-120	16-JUL-14
Sodium (Na)-Total			106.0		%		80-120	16-JUL-14
Strontium (Sr)-Total			102.1		%		80-120	16-JUL-14
Thallium (Tl)-Total			99.9		%		80-120	16-JUL-14
Tin (Sn)-Total			94.7		%		80-120	16-JUL-14
Titanium (Ti)-Total			98.9		%		80-120	16-JUL-14
Tungsten (W)-Total			98.8		%		80-120	16-JUL-14

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: CHRIS HELMER

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-MS-WT	**Water**							
Batch R2885820								
WG1910306-4 CVS								
Uranium (U)-Total			100.9		%		80-120	16-JUL-14
Vanadium (V)-Total			101.8		%		80-120	16-JUL-14
Zinc (Zn)-Total			86.2		%		80-120	16-JUL-14
Zirconium (Zr)-Total			99.2		%		80-120	16-JUL-14
WG1910103-4 DUP		**WG1910103-3**						
Aluminum (Al)-Total		<0.10	<0.10	RPD-NA	mg/L	N/A	20	14-JUL-14
Antimony (Sb)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	14-JUL-14
Arsenic (As)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	14-JUL-14
Barium (Ba)-Total		0.104	0.104		mg/L	0.2	20	14-JUL-14
Beryllium (Be)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	14-JUL-14
Bismuth (Bi)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	14-JUL-14
Boron (B)-Total		<0.10	<0.10	RPD-NA	mg/L	N/A	20	14-JUL-14
Cadmium (Cd)-Total		<0.00090	<0.00090	RPD-NA	mg/L	N/A	20	14-JUL-14
Calcium (Ca)-Total		130	128		mg/L	0.9	20	14-JUL-14
Chromium (Cr)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	14-JUL-14
Cobalt (Co)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	14-JUL-14
Copper (Cu)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	14-JUL-14
Iron (Fe)-Total		<0.50	<0.50	RPD-NA	mg/L	N/A	20	14-JUL-14
Lead (Pb)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	14-JUL-14
Magnesium (Mg)-Total		34.6	34.5		mg/L	0.2	20	14-JUL-14
Manganese (Mn)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	14-JUL-14
Molybdenum (Mo)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	14-JUL-14
Nickel (Ni)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	14-JUL-14
Potassium (K)-Total		<10	<10	RPD-NA	mg/L	N/A	20	14-JUL-14
Selenium (Se)-Total		<0.0040	<0.0040	RPD-NA	mg/L	N/A	20	14-JUL-14
Silicon (Si)-Total		<10	<10	RPD-NA	mg/L	N/A	20	14-JUL-14
Silver (Ag)-Total		<0.0010	<0.0010	RPD-NA	mg/L	N/A	20	14-JUL-14
Sodium (Na)-Total		140	138		mg/L	1.3	20	14-JUL-14
Strontium (Sr)-Total		0.873	0.956		mg/L	9.1	20	14-JUL-14
Thallium (Tl)-Total		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	14-JUL-14
Tin (Sn)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	14-JUL-14
Titanium (Ti)-Total		<0.020	<0.020	RPD-NA	mg/L	N/A	20	14-JUL-14
Tungsten (W)-Total		<0.10	<0.10	RPD-NA	mg/L	N/A	20	14-JUL-14

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: CHRIS HELMER

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-MS-WT	**Water**							
Batch R2885820								
WG1910103-4 DUP		**WG1910103-3**						
Uranium (U)-Total		<0.010	<0.010	RPD-NA	mg/L	N/A	20	14-JUL-14
Vanadium (V)-Total		<0.0050	<0.0050	RPD-NA	mg/L	N/A	20	14-JUL-14
Zinc (Zn)-Total		0.101	0.102		mg/L	1.0	20	14-JUL-14
Zirconium (Zr)-Total		<0.040	<0.040	RPD-NA	mg/L	N/A	20	14-JUL-14
WG1910103-2 LCS								
Aluminum (Al)-Total			97.7		%		80-120	14-JUL-14
Antimony (Sb)-Total			93.5		%		80-120	14-JUL-14
Arsenic (As)-Total			96.6		%		80-120	14-JUL-14
Barium (Ba)-Total			96.0		%		80-120	14-JUL-14
Beryllium (Be)-Total			87.7		%		80-120	14-JUL-14
Bismuth (Bi)-Total			94.7		%		80-120	14-JUL-14
Boron (B)-Total			88.8		%		80-120	14-JUL-14
Cadmium (Cd)-Total			95.6		%		80-120	14-JUL-14
Calcium (Ca)-Total			102.9		%		80-120	14-JUL-14
Chromium (Cr)-Total			95.7		%		80-120	14-JUL-14
Cobalt (Co)-Total			96.3		%		80-120	14-JUL-14
Copper (Cu)-Total			96.2		%		80-120	14-JUL-14
Iron (Fe)-Total			98.8		%		80-120	14-JUL-14
Lead (Pb)-Total			93.5		%		80-120	14-JUL-14
Magnesium (Mg)-Total			97.8		%		80-120	14-JUL-14
Manganese (Mn)-Total			96.6		%		80-120	14-JUL-14
Molybdenum (Mo)-Total			93.7		%		80-120	14-JUL-14
Nickel (Ni)-Total			96.2		%		80-120	14-JUL-14
Potassium (K)-Total			99.9		%		80-120	14-JUL-14
Selenium (Se)-Total			95.3		%		80-120	14-JUL-14
Silicon (Si)-Total			94.8		%		80-120	14-JUL-14
Silver (Ag)-Total			99.3		%		80-120	14-JUL-14
Sodium (Na)-Total			99.1		%		80-120	14-JUL-14
Strontium (Sr)-Total			94.6		%		80-120	14-JUL-14
Thallium (Tl)-Total			93.7		%		80-120	14-JUL-14
Tin (Sn)-Total			95.6		%		80-120	14-JUL-14
Titanium (Ti)-Total			95.6		%		80-120	14-JUL-14
Tungsten (W)-Total			91.7		%		80-120	14-JUL-14
Uranium (U)-Total			97.4				80-120	

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: CHRIS HELMER

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-MS-WT	**Water**							
Batch R2885820								
WG1910103-2 LCS								
Uranium (U)-Total			97.4		%		80-120	14-JUL-14
Vanadium (V)-Total			97.1		%		80-120	14-JUL-14
Zinc (Zn)-Total			95.8		%		80-120	14-JUL-14
Zirconium (Zr)-Total			90.4		%		80-120	14-JUL-14
WG1910103-1 MB								
Aluminum (Al)-Total			<0.010		mg/L		0.01	14-JUL-14
Antimony (Sb)-Total			<0.00050		mg/L		0.0005	14-JUL-14
Arsenic (As)-Total			<0.0010		mg/L		0.001	14-JUL-14
Barium (Ba)-Total			<0.0020		mg/L		0.002	14-JUL-14
Beryllium (Be)-Total			<0.00050		mg/L		0.0005	14-JUL-14
Bismuth (Bi)-Total			<0.0010		mg/L		0.001	14-JUL-14
Boron (B)-Total			<0.010		mg/L		0.01	14-JUL-14
Cadmium (Cd)-Total			<0.000090		mg/L		0.00009	14-JUL-14
Calcium (Ca)-Total			<0.50		mg/L		0.5	14-JUL-14
Chromium (Cr)-Total			<0.00050		mg/L		0.0005	14-JUL-14
Cobalt (Co)-Total			<0.00050		mg/L		0.0005	14-JUL-14
Copper (Cu)-Total			<0.0010		mg/L		0.001	14-JUL-14
Iron (Fe)-Total			<0.050		mg/L		0.05	14-JUL-14
Lead (Pb)-Total			<0.00050		mg/L		0.0005	14-JUL-14
Magnesium (Mg)-Total			<0.50		mg/L		0.5	14-JUL-14
Manganese (Mn)-Total			<0.0010		mg/L		0.001	14-JUL-14
Molybdenum (Mo)-Total			<0.00050		mg/L		0.0005	14-JUL-14
Nickel (Ni)-Total			<0.0010		mg/L		0.001	14-JUL-14
Potassium (K)-Total			<1.0		mg/L		1	14-JUL-14
Selenium (Se)-Total			<0.00040		mg/L		0.0004	14-JUL-14
Silicon (Si)-Total			<1.0		mg/L		1	14-JUL-14
Silver (Ag)-Total			<0.00010		mg/L		0.0001	14-JUL-14
Sodium (Na)-Total			<0.50		mg/L		0.5	14-JUL-14
Strontium (Sr)-Total			<0.0010		mg/L		0.001	14-JUL-14
Thallium (Tl)-Total			<0.00030		mg/L		0.0003	14-JUL-14
Tin (Sn)-Total			<0.0010		mg/L		0.001	14-JUL-14
Titanium (Ti)-Total			<0.0020		mg/L		0.002	14-JUL-14
Tungsten (W)-Total			<0.010		mg/L		0.01	14-JUL-14
Uranium (U)-Total			<0.0010		mg/L		0.001	14-JUL-14

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: CHRIS HELMER

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-T-MS-WT	**Water**							
Batch R2885820								
WG1910103-1 MB								
Vanadium (V)-Total			<0.00050		mg/L		0.0005	14-JUL-14
Zinc (Zn)-Total			<0.0030		mg/L		0.003	14-JUL-14
Zirconium (Zr)-Total			<0.0040		mg/L		0.004	14-JUL-14
WG1910103-5 MS		**WG1910103-3**						
Aluminum (Al)-Total			108.6		%		70-130	14-JUL-14
Antimony (Sb)-Total			95.1		%		70-130	14-JUL-14
Arsenic (As)-Total			96.8		%		70-130	14-JUL-14
Barium (Ba)-Total			N/A	MS-B	%		-	14-JUL-14
Beryllium (Be)-Total			91.7		%		70-130	14-JUL-14
Bismuth (Bi)-Total			94.7		%		70-130	14-JUL-14
Boron (B)-Total			107.1		%		70-130	14-JUL-14
Cadmium (Cd)-Total			92.0		%		70-130	14-JUL-14
Calcium (Ca)-Total			N/A	MS-B	%		-	14-JUL-14
Chromium (Cr)-Total			91.5		%		70-130	14-JUL-14
Cobalt (Co)-Total			94.5		%		70-130	14-JUL-14
Copper (Cu)-Total			102.1		%		70-130	14-JUL-14
Iron (Fe)-Total			101.3		%		70-130	14-JUL-14
Lead (Pb)-Total			95.9		%		70-130	14-JUL-14
Magnesium (Mg)-Total			N/A	MS-B	%		-	14-JUL-14
Manganese (Mn)-Total			100.7		%		70-130	14-JUL-14
Molybdenum (Mo)-Total			101.0		%		70-130	14-JUL-14
Nickel (Ni)-Total			98.5		%		70-130	14-JUL-14
Selenium (Se)-Total			92.9		%		70-130	14-JUL-14
Silver (Ag)-Total			98.3		%		70-130	14-JUL-14
Sodium (Na)-Total			N/A	MS-B	%		-	14-JUL-14
Strontium (Sr)-Total			N/A	MS-B	%		-	14-JUL-14
Thallium (Tl)-Total			93.5		%		70-130	14-JUL-14
Tin (Sn)-Total			94.8		%		70-130	14-JUL-14
Titanium (Ti)-Total			96.7		%		70-130	14-JUL-14
Tungsten (W)-Total			93.5		%		70-130	14-JUL-14
Uranium (U)-Total			95.9		%		70-130	14-JUL-14
Vanadium (V)-Total			94.7		%		70-130	14-JUL-14
Zinc (Zn)-Total			N/A	MS-B	%		-	14-JUL-14
Zirconium (Zr)-Total			95.1		%		70-130	14-JUL-14

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: CHRIS HELMER

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
NH3-WT	**Water**							
Batch R2887188								
WG1910980-2 CVS								
Ammonia, Total (as N)			94.9		%		85-115	15-JUL-14
WG1910980-3 DUP		**L1484984-1**						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	15-JUL-14
WG1910980-5 DUP		**L1485174-1**						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	15-JUL-14
WG1910980-7 DUP		**L1485417-1**						
Ammonia, Total (as N)		<0.050	<0.050	RPD-NA	mg/L	N/A	20	15-JUL-14
WG1910980-1 MB								
Ammonia, Total (as N)			<0.050		mg/L		0.05	15-JUL-14
WG1910980-4 MS		**L1484984-1**						
Ammonia, Total (as N)			95.1		%		75-125	15-JUL-14
WG1910980-6 MS		**L1485174-1**						
Ammonia, Total (as N)			98.2		%		75-125	15-JUL-14
WG1910980-8 MS		**L1485417-1**						
Ammonia, Total (as N)			94.2		%		75-125	15-JUL-14
P-ORTHO-LOW-WT	**Water**							
Batch R2885328								
WG1910246-3 DUP		**L1484169-2**						
Phosphate-P (ortho)		0.0699	0.0667		mg/L	4.7	20	14-JUL-14
WG1910246-5 DUP		**L1484973-1**						
Phosphate-P (ortho)		9.10	8.89		mg/L	2.3	20	14-JUL-14
WG1910246-7 DUP		**L1485372-6**						
Phosphate-P (ortho)		<0.0030	<0.0030	RPD-NA	mg/L	N/A	20	14-JUL-14
WG1910246-2 LCS								
Phosphate-P (ortho)			97.9		%		80-120	14-JUL-14
WG1910246-1 MB								
Phosphate-P (ortho)			<0.0030		mg/L		0.003	14-JUL-14
WG1910246-4 MS		**L1484169-2**						
Phosphate-P (ortho)			N/A	MS-B	%		-	14-JUL-14
WG1910246-6 MS		**L1484973-1**						
Phosphate-P (ortho)			N/A	MS-B	%		-	14-JUL-14
WG1910246-8 MS		**L1485372-6**						
Phosphate-P (ortho)			86.9		%		70-130	14-JUL-14
P-TOTAL-LOW-WT	**Water**							

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: CHRIS HELMER

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
P-TOTAL-LOW-WT	**Water**							
Batch R2885306								
WG1910142-3 DUP		**L1485465-4**						
Total Phosphorus		0.161	0.156		mg/L	3.7	20	14-JUL-14
WG1910142-5 DUP		**L1485174-1**						
Total Phosphorus		0.0116	0.0091	J	mg/L	0.0026	0.006	14-JUL-14
WG1910142-2 LCS								
Total Phosphorus			101.9		%		80-120	14-JUL-14
WG1910142-1 MB								
Total Phosphorus			<0.0030		mg/L		0.003	14-JUL-14
WG1910142-4 MS		**L1485465-4**						
Total Phosphorus			N/A	MS-B	%		-	14-JUL-14
WG1910142-6 MS		**L1485174-1**						
Total Phosphorus			101.2		%		70-130	14-JUL-14
PH-WT	**Water**							
Batch R2885830								
WG1910394-3 DUP		**WG1910394-2**						
pH		8.06	8.04	J	pH units	0.02	0.2	14-JUL-14
WG1910394-4 DUP		**L1485544-27**						
pH		7.87	7.87	J	pH units	0.00	0.2	14-JUL-14
WG1910394-1 LCS								
pH			7.01		pH units		6.9-7.1	14-JUL-14
SOLIDS-TDS-WT	**Water**							
Batch R2886244								
WG1910382-3 DUP		**L1485174-1**						
Total Dissolved Solids		339	338		mg/L	0.1	20	15-JUL-14
WG1910382-2 LCS								
Total Dissolved Solids			100.2		%		85-115	15-JUL-14
WG1910382-1 MB								
Total Dissolved Solids			<20		mg/L		20	15-JUL-14
TC-MF-WT	**Water**							
Batch R2884958								
WG1909336-3 DUP		**L1484905-1**						
Total Coliforms		0	0		CFU/100mL	0.0	50	12-JUL-14
WG1909336-1 MB								
Total Coliforms			0		CFU/100mL		1	12-JUL-14
WG1909336-2 MB								
Total Coliforms			0		CFU/100mL		1	12-JUL-14
WG1909336-4 MB								

Quality Control Report

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: CHRIS HELMER

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
TC-MF-WT	**Water**							
Batch R2884958								
WG1909336-4 MB								
Total Coliforms			0		CFU/100mL		1	12-JUL-14
WG1909336-5 MB								
Total Coliforms			0		CFU/100mL		1	12-JUL-14
TKN-WT	**Water**							
Batch R2885473								
WG1910278-1 CVS								
Total Kjeldahl Nitrogen			108.9		%		75-125	14-JUL-14
WG1910119-3 DUP		**L1485035-1**						
Total Kjeldahl Nitrogen		130	122		mg/L	6.5	20	14-JUL-14
WG1910119-4 DUP		**L1484928-8**						
Total Kjeldahl Nitrogen		0.58	0.59		mg/L	1.6	20	14-JUL-14
WG1910119-2 LCS								
Total Kjeldahl Nitrogen			102.1		%		75-125	14-JUL-14
WG1910119-1 MB								
Total Kjeldahl Nitrogen			<0.15		mg/L		0.15	14-JUL-14
TURBIDITY-WT	**Water**							
Batch R2884223								
WG1909160-2 CVS								
Turbidity			100.0		%		85-115	11-JUL-14
WG1909160-4 DUP		**L1484904-1**						
Turbidity		0.56	0.55		NTU	1.8	20	11-JUL-14
WG1909160-1 MB								
Turbidity			<0.10		NTU		0.1	11-JUL-14

Quality Control Report

Workorder: L1485174 Report Date: 16-JUL-14

Client: LVM INC.
353 BRIDGE ST. E.
KITCHENER ON N2K 2Y5
Contact: CHRIS HELMER

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
DLM	Detection Limit Adjusted due to sample matrix effects.
J	Duplicate results and limits are expressed in terms of absolute difference.
MS-B	Matrix Spike recovery could not be accurately calculated due to high analyte background in sample.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1485174-COFC

COC Number: 14 - 399329

Page 1 of 1

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)	
Company:	LVM	Select Report Format:	PDF, EXCEL, EDD (DIGITAL)	R	Regular (Standard TAT if received by 3pm)
Contact:	Susanna Meteer	Quality Control (QC) Report with Report	Yes / No	P	Priority (2-4 business days if received by 3pm)
Address:	Kitchener	Criteria on Report - provide details below if box checked		E	Emergency (1-2 business days if received by 3pm)
Phone:	519 741 1313 x234	Select Distribution:	EMAIL / MAIL / FAX	E2	Same day or weekend emergency if received by 10am – contact ALS for surcharge.
		Email 1 or Fax	Susanna.meteer@lvm.ca	Specify Date Required for E2,E or P:	
		Email 2			

Invoice To		Invoice Distribution	
	Same as Report To: Yes / No	Select Invoice Distribution:	EMAIL / MAIL / FAX
	Copy of Invoice with Report: Yes / No	Email 1 or Fax	chris.helmar@lvm.ca
Company:		Email 2	
Contact:	chris.helmar@lvm.ca		

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:		Approver ID:	Cost Center:
Job #:	P-000145-0-00-401-05	GL Account:	Routing Code:
PO / AFE:	213152	Activity Code:	
LSD:		Location:	

ALS Lab Work Order # (lab use only)	L1485174 B715	ALS Contact:	Sampler: Susanna Meteer

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	General Chem 7	PKN, TP	E-Coli, Total Coliform	CBOD	NO2, NO3	Number of Containers
1	SP1 (MPZ-12)	11-07-14	10:30	H2O	✓	✓	✓	✓	✓	
2	SP2	11-07-14	10:40	H2O	✓	✓	✓	✓	✓	

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? Yes / No	PWQO on report please hold dissolved metals lab filter
Are samples for human drinking water use? Yes / No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen		SIF Observations	Yes / No
Ice packs	Yes / No	Custody seal intact	Yes / No
Cooling Initiated			

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
17.5 C	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
	11-07-14	12:30			12:35pm			

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NA-FM-0326e v08 Front/03 October 2013

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form.**

Appendix 7 Surface Water Impact Assessment

Stantec

Memo

To:	Brad Schildroth LVM	From:	Jim Perrone Stantec Consulting Ltd.
File:	160950758	Date:	July 29, 2014

Reference: Sage Campground Surface Water Impact Assessment

Stantec Consulting was retained by LVM to undertake a Surface Water Impact Assessment as part of the functional and environmental assessment of the private on-site sewage systems that service the Sage Campground property. Components of the Surface Water Impact Assessment included a site visit, watershed delineation of the tributary to Blair Creek, as well as spreadsheet mass balance calculations of sewage parameter releases, and mixing with the surface water receiver.

Total sewage releases from the campground's on-site sewage systems have been estimated by LVM and total approximately 4,744 m^3/year. Although effluent quality testing has not been performed, groundwater sampling of the Sage Campground property was conducted at various locations. Sampling of the tributary to Blair Creek was also undertaken by LVM. As detailed in LVM's Sewage Systems Assessment Report, sampling results suggested elevated groundwater concentrations of nitrate-N at various locations adjacent to the tributary, including drainage likely influenced by the Whistle Bear Golf Club and agricultural lands to the south of the Campground. However, surface water quality parameter concentrations were consistently found below applicable Provincial Water Quality Objectives (PWQOs).

METHODS

The Ministry of Environment's (MOE) protocol for assessing effluent quality requirements includes the calculation of the 7Q20 low flow (7-day low flow that can be expected once in 20 years) for the receiving environment, in this case, the Blair Creek tributary. However, the source of the Sage Campground sewage system effluent discharge to the tributary is via groundwater flux rather than a point source discharge. This precludes application of the 7Q20 condition, since sewage releases have the opportunity to mix with long-term groundwater flux prior to discharge to the surface water receiver. The analysis of potential effluent dilution was therefore undertaken on an average annual basis. The net water surplus for the tributary watershed was calculated using the Thornthwaite-Mather method. It was assumed that all the moisture surplus for the Campground area is available for diluting the sewage system effluent, while drainage from the south would mix with Campground area releases in the tributary.

RESULTS

Figure 1 shows the Blair Creek tributary drainage area as delineated from available topographical data. The total drainage area of the tributary was calculated to be 42.792 ha. Of this total, 12.458 ha are under agriculture, 14.504 ha are occupied by the golf course, 10.886 ha are occupied by the Campground to the west and north of the tributary, with the remainder (4.944 ha) comprised by wetland and GRCA regulated area.

Table 1 shows the 1981-2010 climate normal for Environment Canada's Waterloo-Wellington A station (Climate ID 6149387), which represents the long-term meteorological monitoring station in closest proximity to the Sage Campground property. Total annual precipitation averages 916.3 mm

over the period of record. Using the Thornthwaite-Mather method, an annual average evapotranspiration of 567.1 mm was calculated, indicating an average annual net moisture surplus of 349.2 mm.

Table 1. Waterloo-Wellington A Station Climate Normals 1981-2010

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature:													
Daily Average (°C)	-6.5	-5.5	-1	6.2	13	18	20	19	14.5	8.2	2.5	-3.3	7
Precipitation:													
Rainfall (mm)	28.7	29.7	36.8	68	82	82	98.6	84	87.8	66	75	38	777
Snowfall (cm)	43.7	30.3	26.5	7.3	0.4	0	0	0	0	1.4	13	37.2	160
Precipitation (mm)	65.2	54.9	61.0	74.5	82.3	82.4	98.6	83.9	87.8	67.4	87.1	71.2	916.3

To estimate current surface water quality impacts from the Sage Campground sewage system, a mass balance of water quality parameter loadings was developed. The mass balance for the Blair Creek tributary was divided into three components, namely, the upstream background, golf course, and Campground sewage areas. Groundwater data from BH8-12 were used to represent combined flows and loadings from the golf course and wetland areas. Although no sewage system effluent sampling was performed, groundwater data from BH3-12 and BH4-12 were used to represent combined sewage system and drainage area flows from the Campground. Background flows and loadings, which express themselves in the two headwater ponds to the north of the agricultural lands, were represented by BH1-12.

Table 2 presents results of the mass balance calculations. Flow rates from respective areas were calculated based on the estimated moisture surplus of 349.2 mm/year. The flow rate for the Campground area includes the estimated annual average effluent flow rate of 4,744 m^3/year. To apply a certain level of conservatism, the maximum measured water quality parameter concentration at each borehole location was used to represent the contributing areas.

Table 2. Mass Balance Calculations for Sage Campground Sewage System

	Background	**Golf Course**	**Campground**	**Tributary**
Flow (m^3/day)	119	186	117	422
Ammonia-N (mg/L)	<0.05	0.13	0.109	0.09
Nitrate-N (mg/L)	1.12	4.23	6.61	4.01
E. Coli (CFU/100mL)	240	30	30	89

In reviewing the groundwater quality data for the boreholes, the highly elevated total phosphorus (TP) concentrations measured at various borehole locations (at times greater than 2 mg/L) suggest that groundwater samples were not filtered prior to sampling. All surface water quality sampling of the tributary indicates that TP concentrations are less than the PWQO of 0.03 mg/L. The sandy soils of the tributary watershed likely complex TP to a large extent, rendering TP relatively immobile in the subsurface. Consequently, it was concluded that TP loadings from the sewage system effluent to the tributary are attenuated and a mass balance was therefore not performed for TP.

Reference: Sage Campground Surface Water Impact Assessment

Results for other effluent parameters indicate that ammonia-N, even when assumed to act conservatively, has little potential to impact the tributary, with a calculated in-stream concentration of 0.09 mg/L. assuming a pH of 8 and a temperature of 25 °C in the tributary, this would only translate to an un-ionized ammonia-N concentration of 0.005 mg/L, which is well below the PWQO of 0.0165 mg-N/L. These results are supported by *in situ* sampling of the tributary, which has shown a maximum ammonia-N concentration of 0.109 mg/L in the spring of 2012 (April 27).

Similarly, assuming that *E. Coli* acts conservatively in the subsurface, a tributary concentration of 89 CFU/100 mL is calculated, which is below the PWQO of 100 CFU/100 mL. Although monitoring of the Blair Creek tributary has shown elevated E. Coli concentrations of 220-330 CFU/100 mL, the borehole monitoring data suggest that sewage system effluent is not the source. Other surface sources likely play a role in the elevated *E. Coli* count. This conclusion is supported by sampling of the tributary upstream of the Campground just below the two headponds in July of 2014, which showed *E. Coli* levels of 150 CFU/100 mL.

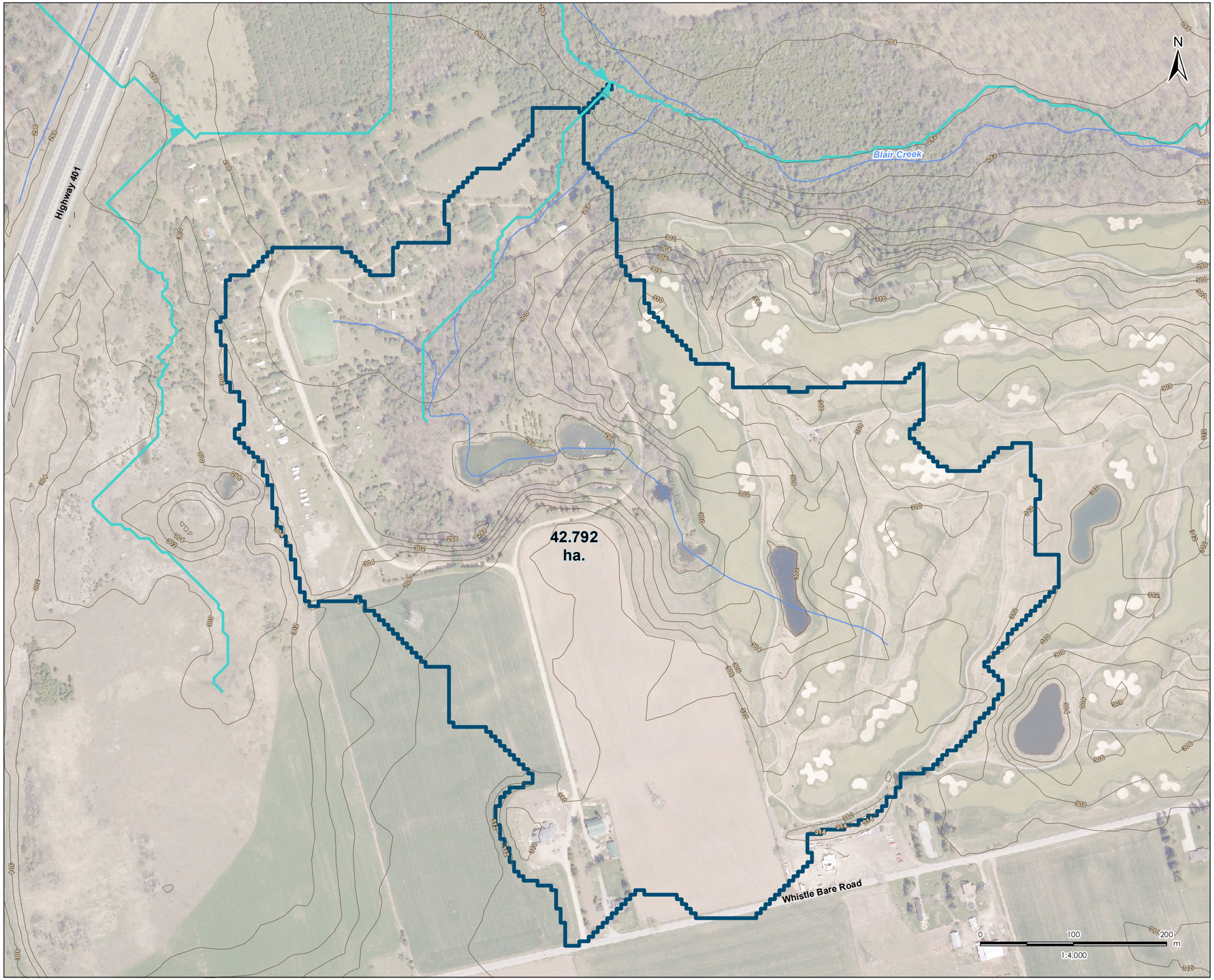
Finally, the mass balance for nitrate-N suggests that nitrate-N concentrations of approximately 4 mg/L may be produced in the tributary. This is below the concentrations of 5.8-7.6 mg/L observed in the tributary in 2012 but is closer to the level of 5 mg/L observed in July 2014. Although there is no PWQO for nitrate-N, a Canadian Water Quality Guideline (CWQG) of 2.93 mg/L has been established . Variability in upstream background loadings, which were set at 1.12 mg/L based on observations at BH1-12 may account for the underestimation of tributary concentrations. However, upstream sampling of the tributary below the two headponds showed a nitrate-N concentration of 1 mg/L, which appears to confirm the relatively low background loadings. Variability in loadings from the golf course and wetland area may also play a role. Based on the estimated annual background watershed inputs, the sewage effluent flow rate of 4,744 m^3/year represents approximately 11% of the Campground area flow rate of 117 m^3/day. The assumed nitrate-N concentration of 6.61 mg/L for this flow suggests total nitrogen loadings of approximately 50 mg/L from the sewage system effluent. This is slightly above but similar to the 40 mg/L concentration generally assumed for such systems. Although Blair Creek tributary nitrate-N levels are above the CWQG of 2.93 mg/L, such concentrations are common in the Grand River watershed and are not anticipated to result in impacts to aquatic life.

STANTEC CONSULTING LTD.

Jim Perrone, P.Eng.
Senior Water Resources Engineer
Phone: 905-415-6344
Fax: 905-474-9889
jim.perrone@stantec.com

Attachment: Figure 1 – Blair Creek Tributary Drainage Area

c. Chris Helmer, LVM



Stantec

Legend

- Watercourse
- Topographic Contours (mAMSL)
- Virtual Stream (DEM)
- Blair Creek Tributary Drainage Area (SWOOP 2010 DEM)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.
3. Orthoimagery © Grand River Conservation Authority, 2006.

July 2014
160950758

Client/Project

LVM, a Division of EnGlobe Corp.
Sage Campground
Surface Water

Figure No.

1

Title

Blair Creek Tributary Drainage Area

V:\01609\Active\160950758\planning\drawing\MXD\Surface_Water\Internal\160950758_Drainage_Area.mxd
Revised: 2014-07-30 By: searles

Appendix 8 Site Photographs

Photo 1: Secondary Residence - Septic tank.

Photo 2: Secondary Residence - Septic tank location.

Photo 3: Secondary Residence - Existing absorption trench.

Photo 4: Campground Pavilion - Septic tank location.

Photo 5: Campground Pavilion - Absorption trench overflow.

Photo 6: Picnic Pavilion - Holding tank location.

G:\160\P0000145\z5_CAD\P-0000145-0-00-400_Photo003-006.dwg
August 15, 2014

Photo 7: Campground Trailer Site - Septic Tank.

Photo 8: Campground Trailer Site - Septic tank system (3rd generation).

Photo 9: Campground Trailer Site - Septic tank system (3rd generation).

G:\160\P0000145\z5_CAD\P-0000145-0-00-400_Photo007-009.dwg
August 15, 2014

Photo 10: Campground Trailer Site - Sewage System (2nd generation).

Photo 11: Campground Trailer Site - Sewage System (2nd generation).

Photo 12: Campground Trailer Site - Sewage System (1st generation).

Photo 13: Campground Trailer Site - Sewage System (1st generation).

Photo 14: Campground Trailer Site - Sewage System (2nd generation).

Photo 15: Campground Trailer Site - Sewage System (3rd generation).

APPENDIX B:
Wastewater Servicing Assessment

FlowSpec Engineering, November 13, 2019

December 17, 2019

Ms. Sarah Primmer, P.Eng.
GM BluePlan Engineering Limited
330 Trillium Drive, Unit D
Kitchener, ON N2E 3J2

Files No.: 00009-2
Document No.: 00009-2.01

Dear Ms. Primmer:

Subject: Wastewater Servicing Assessment
Whistle Bare Campground – Proposed Expansion
1912 Whistle Bare Road
Township of North Dumfries

This report by FlowSpec Engineering ("FlowSpec") presents an assessment of wastewater servicing in support of a proposed expansion of Whistle Bare Campground ("Whistle Bare"), located at 1912 Whistle Bare Road in the Township of North Dumfries.

This assessment is intended to supplement and be conjoined with a broader functional servicing assessment ("FSR") by GM BluePlan Engineering. Onsite wastewater servicing is necessary for Whistle Bare, given the absence of proximal municipal or communal servicing in the area; and on this basis, the FSR addresses wastewater collection/conveyance and this report addresses wastewater treatment/dispersal.

Whistle Bare currently consists of 80 seasonal trailer-sites (each equipped with a dedicated water supply-line and septic system), a public washroom (serviced by a dedicated septic system), a recreation pavilion (no plumbing fixtures), and a picnic pavilion. The campground is situated on the rear (i.e., north) half of the property, while two single-family residences are located at the front of the property.

As it pertains to wastewater servicing, the proposed campground expansion will be comprised of the following: i) realignment of the existing 80 trailer-sites, ii) increase of the total number of sites to 383, including several cabin-sites and overnight-sites, and iii) construction of two recreation hall and pool areas.

In executing the proposed expansion, the existing septic systems that service the campground will be decommissioned and a collection system (i.e., sewers, forcemain, and pump stations) constructed to convey all wastewater to a proposed centralized treatment and subsurface dispersal system or Class 4 wastewater treatment system ("WTS"). Dedicated septic systems will continue to service the two single-family residences. A preliminary site layout and sanitary servicing plan is illustrated on Drawing 3 of the FSR. Drawing 3 also depicts a location at the south corner of the property for the WTS, which has an allotted area of about 10,000 m^2.

The wastewater flows (i.e., theoretical peak flows calculated using fixed formula from the Ontario Building Code ("OBC")) for both the existing and proposed expanded campground exceed 10,000 L/day, such that the property lies within the jurisdiction of the Ontario Ministry of the Environment, Conservation and Parks ("MECP") under Section 53 of the Ontario Water Resources Act; and therefore, construction of the proposed WTS will require procurement of an Environmental Compliance Approval from the MECP.

Based on the foregoing, the primary purpose of this assessment is to derive relevant preliminary design criteria, and evaluate the suitability of the allotted area for the proposed WTS to accommodate wastewater servicing of the proposed expanded campground.

Design Criteria

For the purpose of this assessment, the principal design criteria for a WTS are percolation time (i.e., soil infiltration rate), wastewater flow, and effluent quality. Preliminary derivation of these parameters is provided below.

Percolation Time

A detailed description of the property, as well as general geological and hydrogeological conditions may be found in the associated hydrogeological assessment report prepared by Chung & Vander Doelen Engineering and submitted concurrently with this report.

The subsurface of the proposed WTS location was explored on July 26, 2017 by excavating seven test pits. FlowSpec monitored the excavation, documented soil stratigraphy and groundwater conditions, and collected representative soil samples for visual examination and laboratory-derived particle-size analysis.

The encountered soil stratigraphy and groundwater conditions are described on appended test pit logs. The location of each test pit was surveyed by FlowSpec and is overlain on an appended version of Drawing 3 of the FSR.

Three selected soil samples were submitted to Stantec (Kitchener) for laboratory-derived particle-size analysis, which was completed in accordance with ASTM Method D422-63, "Standard Test Method for Particle-Size Analysis". The resulting particle-size distribution curves are appended.

The soil stratigraphy and groundwater conditions encountered during the subsurface exploration are described on the appended test pit logs. The soil stratigraphy was generally comprised of surficial topsoil, overlying layers of sandy silt and silty sand/gravel to a depth of up to 0.95 m, and underlain by granular deposits of sand and sand/gravel with a trace of silt. The test pits exhibited no observed groundwater seepage or related wet soil conditions.

For contextual purposes, the monitoring well logs contained in the hydrogeological assessment report (monitoring by FlowSpec during installation) indicate that the granular deposits around the proposed WTS location extend to at least the drilling termination depth of 13.7 m, and the groundwater depth is approximately 10 m.

A percolation time was assessed using the following methodology: i) classify each relevant soil encountered during the subsurface exploration using the Unified Soil Classification System, ii) account for characteristics observed during the subsurface exploration (i.e., density and structure), and iii) correlate with a percolation time using OBC Supplementary Standard SB-6, "Percolation Time and Soil Descriptions". The assessment is summarized in the following table:

Soil Description	Unified Soil Classification	Percolation Time (min/cm)
Fine-grained SAND, trace silt (sampled from Test Pit 1)	SP-SM	5
Fine- to medium-grained SAND, trace silt (sampled from Test Pit 2)	SP	2
Fine- to medium-grained SAND AND GRAVEL, trace silt (sampled from Test Pit 3)	SP-SW	2
Medium- to coarse-grained SAND AND GRAVEL, trace silt (Test Pits 4 and 5)	SW	2 (estimated)

A percolation time of 5 min/cm was used for the assessment, based on founding of the proposed leaching bed on the granular deposits described above.

Wastewater Flow

Wastewater flow from seasonal trailer-sites varies with available service connections (i.e., water and wastewater), the type/size of trailer-unit, and plumbing specifics within the trailer-unit (wastewater generated by the recreation halls and pool areas is considered incidental to use of the trailer-sites).

In this case, the sites will be provided with water and wastewater connections. Theoretical peak flow-rates are specified for such sites in the OBC and DGSW, as well as in the MECP documents, "Manual of Policy, Procedure and Guidelines for Onsite Sewage Systems" and "Interim Fact Sheet: MOECC Design Sewage Flow Rates for Seasonal Trailer Parks and Park Model Units", and are summarized in the following table:

Document	Peak Wastewater Flow-Rate (L/day)
Ontario Building Code	425
Design Guidelines for Sewage Works	800
Manual of Policy, Procedure and Guidelines for Onsite Sewage Systems	125 - 425
Interim Fact Sheet: MOECC Design Sewage Flow Rates for Seasonal Trailer Parks and Park Model Units	800

As evidenced by the table above, theoretical flow-rates vary widely; and for this reason, FlowSpec typically approaches design for seasonal campgrounds using a combination of theoretical and empirical flow-rates (empirical rates are calculated from metered water-usage). In the experience of FlowSpec, empirical peak flow-rates are typically in the order of about 200 to 250 L/day/site for travel-trailers and up to about 425 L/day/site for larger park-model-units.

For specific design of the proposed WTS at Whistle Bare, FlowSpec will derive a total peak wastewater flow using a combination of empirical water-use data from the existing 80 trailer-sites and theoretical flow-rates commensurate with the proposed expansion. This figure will be determined once additional information is available concerning the units to be placed on the sites; and therefore, for the purpose of this assessment, the hydraulic capacity of the available area was evaluated to determine its suitability to accommodate a reasonable peak flow for the proposed expanded campground (discussed below).

Effluent Quality

DGSW Section 22.5, "Assessment of Impact on Water Resources", sets forth the environmental impact assessment requirements for "Large Subsurface Sewage Disposal Systems" (i.e., systems with theoretical peak wastewater flows which exceed 10,000 L/day). Specifically, the document speaks to assessing impact on water resources in conformance with MECP contaminant emission guidelines. "Water resources" are typically comprised of the following:

- groundwater which is currently used or could reasonably be used in future as a potable water-supply (typically within 500 m of the proposed leaching bed location); and
- surface water in the form of creeks, rivers, ponds, or wetlands (typically within 300 m of the proposed leaching bed location).

In this case, groundwater is used as a water-supply in the area, and a wetland complex and outflowing tributary to Blair Creek are located on the northerly portion of the property (described in further detail in the hydrogeological assessment report). Therefore, an assessment of impact of water resources will be required to be performed as part of the design process and to the satisfaction of the MECP.

Specifically, DGSW Subsection 22.5.5, "Critical Contaminants", stipulates that nitrate-nitrogen is the critical contaminant normally to be used in the assessment of impact on groundwater; and phosphorous, ammonia-nitrogen, and nitrate-nitrogen are the critical contaminants normally to be used in the assessment of impact on surface water. Since ammonia-nitrogen is presumed to convert completely to nitrate-nitrogen in the subsurface, nitrate-nitrogen and phosphorous would be the critical contaminants used in the impact assessment.

The impact assessment would yield effluent concentration objectives and/or limits for one or both of nitrate-nitrogen or phosphorous, which would then be vetted by the MECP during pre-application consultation; and upon finalization of the criteria, design of the WTS would incorporate treatment infrastructure as required to achieve the criteria.

Assessment

On the basis of the design criteria described above, the proposed WTS will be comprised of the following key components:

- treatment system capable of achieving Level IV (i.e., tertiary) effluent quality, and including treatment infrastructure for reduction of nitrate-nitrogen and/or phosphorous if deemed necessary by the assessment of impact on water resources; and
- Type A dispersal leaching bed for final treatment and dispersal of effluent to the subsurface (consisting of a layer of imported stone containing a series of perforated gravity distribution pipes, and underlain by a layer of imported sand fill with a percolation time of 6 to 10 min/cm).

As described in the introduction, an area of about 10,000 m^2 has been allotted for the proposed WTS, and specifically the leaching bed. The maximum peak wastewater flow that may be accommodated by a Type A dispersal bed occupying the entirety of the allotted area is calculated below, based on OBC Sentence 8.7.7.1.(6). which addresses the minimum required stone area:

$Q = A \times 50\ L/day/m^2$

where:
Q = maximum peak wastewater flow (L/day)
A = available area (m^2)

$Q = 10{,}000\ m^2 \times 50\ L/day/m^2$
$= 500{,}000\ L/day$

Where the percolation time is 15 min/cm or less, the overall area requirement for a Type A dispersal leaching bed is based solely on the minimum required stone area. Given the percolation time is 5 min/cm in the proposed leaching bed area, the maximum peak wastewater flow that may be accommodated in the 10,000 m^2 allotted area is 500,000 L/day.

A groundwater mounding analysis was applied to the maximum peak flow, and yielded a maximum mound-height of about 1 m; and therefore, based on a groundwater depth of about 10 m, groundwater mounding will not affect performance of the leaching bed.

Based on the proposed expanded campground site total of 383, a peak wastewater flow of 500,000 L/day yields a peak flow-rate of approximately 1,300 L/day/site, which is well-above both the theoretical and empirical flow-rates for seasonal trailer-sites described above.

Conclusion

In conclusion, the proposed expanded campground may be serviced by an onsite Class 4 WTS within the 10,000 m^2 area allotted for the proposed leaching bed, provided the following processes are undertaken following the Zoning By-law Amendment Application process: i) an assessment of impact on water resources is to be performed to the satisfaction of the MECP, ii) pre-application consultation is to be completed with the MECP to finalize effluent criteria, and iii) an Environmental Compliance Approval is to be procured from the MECP.

Should you have any questions regarding the above, please do not hesitate to contact the undersigned.

Yours truly,
FlowSpec Engineering Ltd.

David Morlock, P.Eng.
Consulting Engineer

Test Pit 1

Date of Excavation: *July 26, 2017*
Machine: *Mini-Excavator*
Surface Elevation: *--*
Field Technician: *DM*

Depth (m)	Elevation (m)	Soil Description	Sample No.	Sample Depth (m)
0.00	--	*TOPSOIL*: Dark brown sandy silt, some gravel, moist		
0.20	--	*SANDY SILT:* Rusty brown sandy silt, some gravel, moist		
0.40	--	*GRAVELLY SAND*: Loose, brown, gravelly fine to coarse sand, trace silt, damp		
0.80	--	*SAND*: Compact, brown fine sand, trace silt, damp	1	1.0 – 1.2

Comments:

- test pit terminated at 1.9 m
- no groundwater seepage observed
- dry caving observed at 1.7 m

Test Pit 2

Date of Excavation: *July 26, 2017*
Machine: *Mini-Excavator*
Surface Elevation: *--*
Field Technician: *DM*

Depth (m)	Elevation (m)	Soil Description	Sample No.	Sample Depth (m)
0.00	--	*TOPSOIL*: Dark brown silt, moist		
0.25	--	*SILT:* Firm, rusty brown silt, some clay and sand, trace gravel, moist		
0.80	--	*SILTY SAND*: Brown silty sand, moist		
0.95	--	*SAND AND GRAVEL*: Loose, brown medium sand and gravel, trace silt, damp		
1.30	--	*SAND*: Compact, brown fine to medium sand, trace silt, damp	1	1.6 – 1.8

Comments:

- test pit terminated at 2.1 m
- no groundwater seepage observed
- test pit sidewalls stable at completion of excavation

Test Pit 3

Date of Excavation: *July 26, 2017*
Machine: *Mini-Excavator*
Surface Elevation: *--*
Field Technician: *DM*

Depth (m)	Elevation (m)	Soil Description	Sample No.	Sample Depth (m)
0.00	--	*TOPSOIL*: Dark brown sandy silt, moist		
0.30	--	*SANDY SILT:* Rusty brown sandy silt, trace gravel, damp to moist		
0.50	--	*SILTY SAND AND GRAVEL*: Loose, brown, silty sand and gravel, damp		
0.90	--	*SAND AND GRAVEL*: Loose, brown fine to medium sand and gravel, trace silt, frequent cobbles and boulders, damp	1	1.2 – 1.4
1.40	--	*SAND*: Loose, brown medium sand, trace silt, damp		

Comments:

- test pit terminated at 2.0 m
- no groundwater seepage observed
- dry caving observed at 1.4 m

Test Pit 4

Date of Excavation: *July 26, 2017*
Machine: *Mini-Excavator*
Surface Elevation: *--*
Field Technician: *DM*

Depth (m)	Elevation (m)	Soil Description	Sample No.	Sample Depth (m)
0.00	--	*TOPSOIL*: Dark brown sandy silt, damp		
0.20	--	*SAND:* Compact, brown medium sand, some gravel, trace silt, damp		
1.10	--	medium to coarse sand	1	1.2 – 1.4
1.80	--	fine sand		

Comments:

- test pit terminated at 2.0 m
- no groundwater seepage observed
- test pit sidewalls stable at completion of excavation

Test Pit 5

Date of Excavation: *July 26, 2017*
Machine: *Mini-Excavator*
Surface Elevation: *--*
Field Technician: *DM*

Depth (m)	Elevation (m)	Soil Description	Sample No.	Sample Depth (m)
0.00	--	*TOPSOIL*: Dark brown sandy silt, moist		
0.20	--	*SANDY SILT:* Rusty brown sandy silt, moist		
0.35	--	*SILTY SAND AND GRAVEL*: Brown silty sand and gravel, moist		
0.60	--	*SAND AND GRAVEL*: Loose, brown medium to coarse sand and gravel, trace silt, damp		

Comments:

- test pit terminated at 1.7 m
- no groundwater seepage observed
- test pit sidewalls stable at completion of excavation

Test Pit 6

Date of Excavation: *July 26, 2017*
Machine: *Mini-Excavator*
Surface Elevation: *--*
Field Technician: *DM*

Depth (m)	Elevation (m)	Soil Description	Sample No.	Sample Depth (m)
0.00	--	*TOPSOIL*: Dark brown sandy silt, moist		
0.20	--	*SANDY SILT:* Rusty brown sandy silt, moist		
0.35	--	*SILTY SAND AND GRAVEL*: Brown silty sand and gravel, moist		
0.65	--	*SAND AND GRAVEL*: Loose, brown medium to coarse sand and gravel, trace silt, damp; veins of medium to coarse sand, damp		

Comments:

- test pit terminated at 1.8 m
- no groundwater seepage observed
- dry caving observed at 0.8 m

Test Pit 7

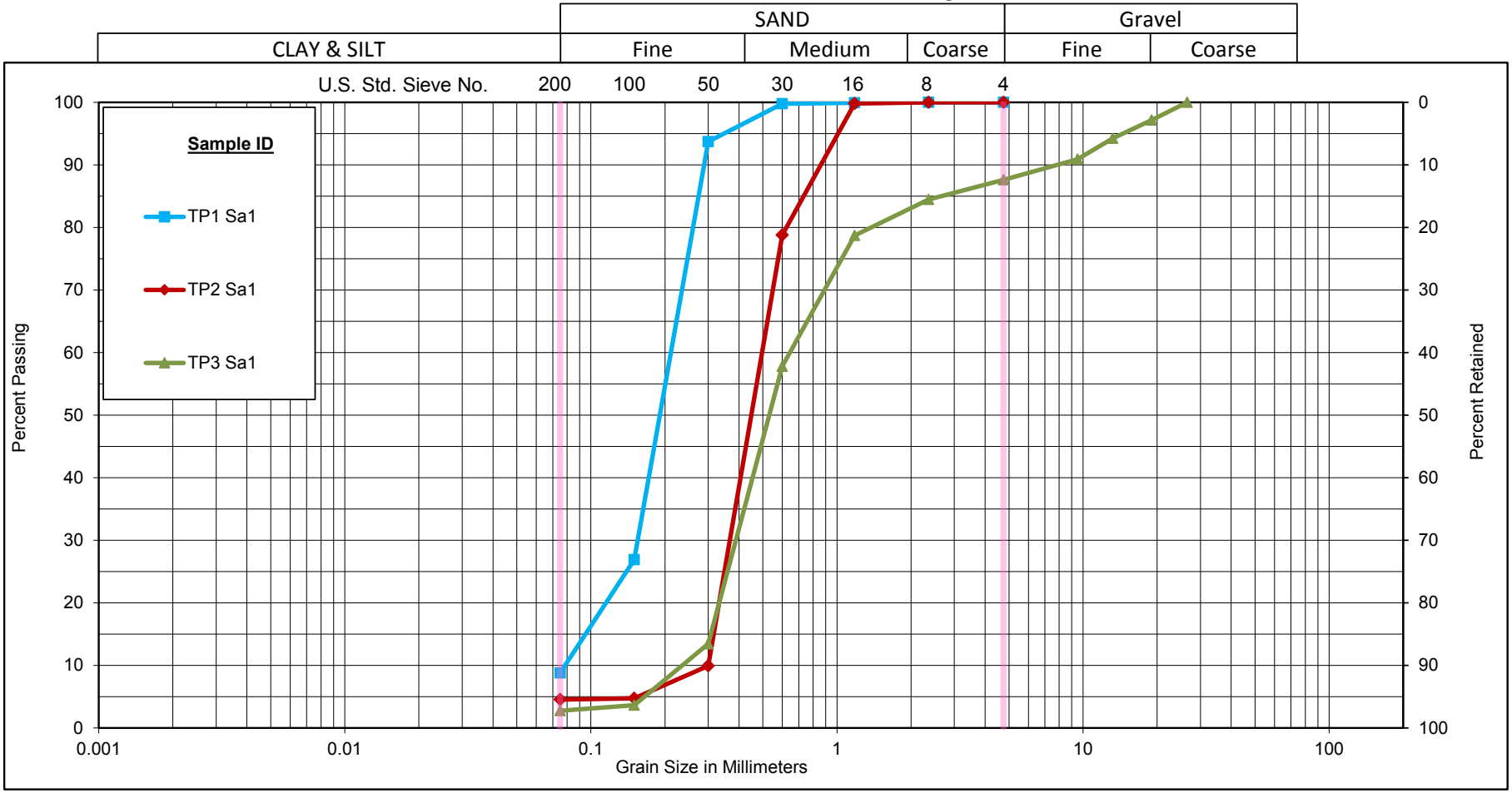
Date of Excavation: *July 26, 2017*
Machine: *Mini-Excavator*
Surface Elevation: *--*
Field Technician: *DM*

Depth (m)	Elevation (m)	Soil Description	Sample No.	Sample Depth (m)
0.00	--	*TOPSOIL*: Dark brown sandy silt, moist		
0.25	--	*SANDY SILT:* Rusty brown sandy silt, moist		
0.45	--	*SILTY SAND AND GRAVEL*: Brown silty sand and gravel, moist		
0.80	--	*SAND AND GRAVEL*: Loose, brown medium sand and gravel, damp		
1.40	--	*SAND*: Compact, brown fine sand, trace silt, damp		

Comments:

- test pit terminated at 2.0 m
- no groundwater seepage observed
- dry caving observed at 1.1 m

Unified Soil Classification System



Sample ID	Depth (m)	% Gravel	% Sand	% Silt & Clay
TP1 Sa1	1.0-1.2	0.0	91.2	8.8
TP2 Sa1	1.6-1.8	0.0	95.5	4.5
TP3 Sa1	1.2-1.4	12.4	84.9	2.7

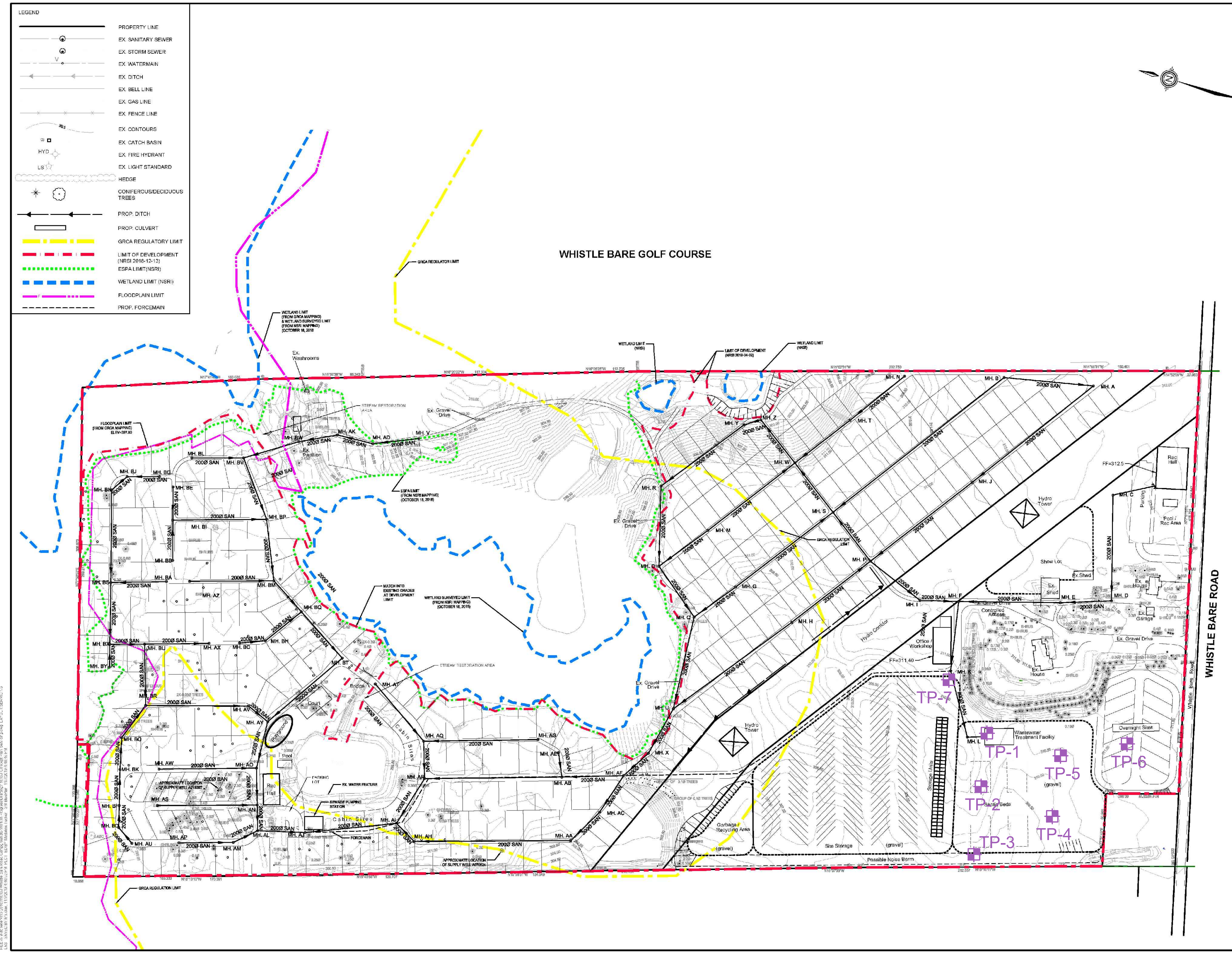
Stantec

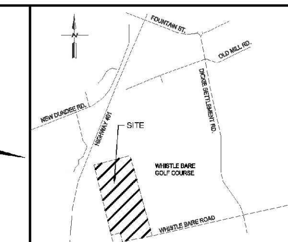
GRAIN SIZE DISTRIBUTION

Whistle Bear Campground - 00009-2

Figure No. 1

Project No. 122450173.200





TOWNSHIP OF NORTH DUMFRIES

KEY PLAN

NOT TO SCALE

NOTES :

1. TOPOGRAPHICAL SURVEY COMPLETED BY ACI SURVEY CONSULTANTS DATED MAY 31, 2017.
2. CONCEPT PLAN COMPLETED BY GSP GROUP DATED APRIL 2, 2019.

BENCH MARKS :

THE POSITION OF POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND, WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED.

BEFORE STARTING WORK, THE CONTRACTOR SHALL INFORM HIMSELF OF THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES, AND SHALL ASSUME ALL LIABILITY FOR ANY DAMAGE TO THEM.

D R A F T
GM BluePlan Engineering

NO.	DATE	REVISION DESCRIPTION	CH'KD
1.	-/-/-	ISSUED FOR REVIEW	S.J.P.

GM BluePlan ENGINEERING

GUELPH | OWEN SOUND | LISTOWEL | KITCHENER | LONDON | HAMILTON | GTA

WHISTLE BARE ROAD CAMPGROUNDS

1912 WHISTLE BARE ROAD

THE TOWNSHIP OF NORTH DUMFRIES (CAMBRIDGE)

PRELIMINARY SANITARY SERVICING PLAN

DRAWN BY :	APPROVED BY :	PROJECT NO. :	DRAWING NO. :
A.M.	S.J.P.	416130	3
DESIGNED BY :	DATE :	SCALE :	
S.J.P.	NOVEMBER 2017	1:1500	

APPENDIX C:
Stormwater Management Analysis

Existing Condition Modelling Files
Post-Development Condition Modeling Files
Water Budget

```
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"                MIDUSS created                           Sunday, February 07, 2010"
"           10   Units used:                                                ie METRIC"
"                Job folder:                                 W:\Kitchener\416-2016\"
"                416130 Whistle Bare Road Campground\5 Work in Progress\Design
Calcs\MIDUSS"
"                Output filename:                                    416130_EX_2.out"
"                Licensee name:                                                gmbp"
"                Company                                                       gmbp"
"                Date & Time last used:                    9/13/2019 at 2:07:02 PM"
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"     1500.000   Max. Hydrograph"
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"        0.761   Exponent C"
"        0.400   Fraction R"
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"        1.000   Time step multiplier"
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"             Total depth                  32.362    mm"
"            6   002hyd   Hydrograph extension used in this file"
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"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           10   Catchment 10"
"       15.000   % Impervious"
"       28.600   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"       24.310   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        4.290   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.162   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
```

```
"        0.838   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.820     0.000     0.000     0.000 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           24.310     4.290      28.600     hectare"
"             Time of concentration  55.708     4.452      31.290     minutes"
"             Time to Centroid       172.274    95.832     135.857    minutes"
"             Rainfall depth         32.362     32.362     32.362     mm"
"             Rainfall volume        7867.18    1388.33    9255.50    c.m"
"             Rainfall losses        27.103     5.249      23.825     mm"
"             Runoff depth           5.259      27.113     8.537      mm"
"             Runoff volume          1278.38    1163.13    2441.52    c.m"
"             Runoff coefficient     0.162      0.838      0.264      "
"             Maximum flow           0.177      0.800      0.820      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.820     0.820     0.000     0.000"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   Catchment 20"
"        0.000   % Impervious"
"       10.000   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"       10.000   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.162   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.073     0.820     0.000     0.000 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
"             Surface Area           10.000     0.000      10.000     hectare"
"             Time of concentration  55.708     4.452      55.708     minutes"
"             Time to Centroid       172.274    0.000      172.274    minutes"
```

```
"             Rainfall depth         32.362     32.362     32.362     mm"
"             Rainfall volume        3236.19    0.00       3236.19    c.m"
"             Rainfall losses        27.103     32.362     27.103     mm"
"             Runoff depth           5.259      0.000      5.259      mm"
"             Runoff volume          525.87     0.00       525.87     c.m"
"             Runoff coefficient     0.162      0.000      0.162      "
"             Maximum flow           0.073      0.000      0.073      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                    0.073     0.829     0.000     0.000"
" 38          START/RE-START TOTALS 20"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    38.600    hectare"
"             Total Impervious area                    4.290    hectare"
"             Total % impervious                      11.114"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                           Sunday, February 07, 2010"
"           10   Units used:                                                ie METRIC"
"                Job folder:                                 W:\Kitchener\416-2016\"
"                416130 Whistle Bare Road Campground\5 Work in Progress\Design
Calcs\MIDUSS"
"                Output filename:                                    416130_EX_5.out"
"                Licensee name:                                                gmbp"
"                Company                                                       gmbp"
"                Date & Time last used:                    9/13/2019 at 2:14:43 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1219.800   Coefficient A"
"       10.500   Constant B"
"        0.823   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           127.834    mm/hr"
"             Total depth                  48.647    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           10   Catchment 10"
"       15.000   % Impervious"
"       28.600   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"       24.310   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        4.290   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.266   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
```

```
"        0.881   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     1.248     0.000     0.000     0.000 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           24.310     4.290      28.600     hectare"
"             Time of concentration  37.755     3.958      25.275     minutes"
"             Time to Centroid       147.066    93.045     127.118    minutes"
"             Rainfall depth         48.647     48.647     48.647     mm"
"             Rainfall volume        1.1826     0.2087     1.3913     ha-m"
"             Rainfall losses        35.722     5.767      31.229     mm"
"             Runoff depth           12.925     42.880     17.418     mm"
"             Runoff volume          3141.96    1839.57    4981.53    c.m"
"             Runoff coefficient     0.266      0.881      0.358      "
"             Maximum flow           0.638      1.132      1.248      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     1.248     1.248     0.000     0.000"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   Catchment 20"
"        0.000   % Impervious"
"       10.000   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"       10.000   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.266   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.262     1.248     0.000     0.000 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
"             Surface Area           10.000     0.000      10.000     hectare"
"             Time of concentration  37.755     3.958      37.755     minutes"
"             Time to Centroid       147.066    93.045     147.066    minutes"
```

```
"             Rainfall depth         48.647     48.647     48.647     mm"
"             Rainfall volume        4864.70    0.00       4864.70    c.m"
"             Rainfall losses        35.722     5.767      35.722     mm"
"             Runoff depth           12.925     42.880     12.925     mm"
"             Runoff volume          1292.45    0.00       1292.46    c.m"
"             Runoff coefficient     0.266      0.000      0.266      "
"             Maximum flow           0.262      0.000      0.262      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.262     1.296     0.000     0.000"
" 38          START/RE-START TOTALS 20"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    38.600    hectare"
"             Total Impervious area                    4.290    hectare"
"             Total % impervious                      11.114"
" 19          EXIT"
```

```
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"           10   Units used:                                                ie METRIC"
"                Job folder:                                 W:\Kitchener\416-2016\"
"                416130 Whistle Bare Road Campground\5 Work in Progress\Design
Calcs\MIDUSS"
"                Output filename:                                  416130_EX_100.out"
"                Licensee name:                                                 gmbp"
"                Company                                                        gmbp"
"                Date & Time last used:                    9/13/2019 at 2:15:39 PM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     3015.100   Coefficient A"
"       21.000   Constant B"
"        0.870   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           177.123    mm/hr"
"             Total depth                  89.669    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 10"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           10   Catchment 10"
"       15.000   % Impervious"
"       28.600   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"       24.310   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        4.290   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.443   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
```

```
"        0.922   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     3.171     0.000     0.000     0.000 c.m/sec"
"             Catchment 10           Pervious   Impervious Total Area "
"             Surface Area           24.310     4.290      28.600     hectare"
"             Time of concentration  25.591     3.434      19.638     minutes"
"             Time to Centroid       128.770    91.156     118.663    minutes"
"             Rainfall depth         89.669     89.669     89.669     mm"
"             Rainfall volume        2.1799     0.3847     2.5645     ha-m"
"             Rainfall losses        49.970     7.015      43.526     mm"
"             Runoff depth           39.699     82.654     46.143     mm"
"             Runoff volume          0.9651     0.3546     1.3197     ha-m"
"             Runoff coefficient     0.443      0.922      0.515      "
"             Maximum flow           2.613      1.695      3.171      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     3.171     3.171     0.000     0.000"
" 33          CATCHMENT 20"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"           20   Catchment 20"
"        0.000   % Impervious"
"       10.000   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"       10.000   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.443   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     1.075     3.171     0.000     0.000 c.m/sec"
"             Catchment 20           Pervious   Impervious Total Area "
"             Surface Area           10.000     0.000      10.000     hectare"
"             Time of concentration  25.591     3.434      25.591     minutes"
"             Time to Centroid       128.770    91.156     128.770    minutes"
```

```
                                  416130_EX_100
"             Rainfall depth         89.669     89.669     89.669     mm"
"             Rainfall volume        8966.89    0.01       8966.90    c.m"
"             Rainfall losses        49.970     7.015      49.970     mm"
"             Runoff depth           39.699     82.654     39.699     mm"
"             Runoff volume          3969.94    0.01       3969.94    c.m"
"             Runoff coefficient     0.443      0.000      0.443      "
"             Maximum flow           1.075      0.000      1.075      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     1.075     4.231     0.000     0.000"
" 38          START/RE-START TOTALS 20"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                      38.600    hectare"
"             Total Impervious area                      4.290    hectare"
"             Total % impervious                        11.114"
" 19          EXIT"
```

```
"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                           Sunday, February 07, 2010"
"           10   Units used:                                                ie METRIC"
"                Job folder:                                 W:\Kitchener\416-2016\"
"                416130 Whistle Bare Road Campground\5 Work in Progress\Design
Calcs\MIDUSS"
"                Output filename:                              416130_PrePOST_2.out"
"                Licensee name:                                                gmbp"
"                Company                                                       gmbp"
"                Date & Time last used:                   11/7/2019 at 10:57:30 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"      573.100   Coefficient A"
"        5.000   Constant B"
"        0.761   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity            99.364    mm/hr"
"             Total depth                  32.362    mm"
"            6   002hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          100   Catchment 100"
"       40.000   % Impervious"
"        7.600   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"        4.560   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        3.040   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.162   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
```

```
"        0.838   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.571     0.000     0.000     0.000 c.m/sec"
"             Catchment 100          Pervious   Impervious Total Area "
"             Surface Area           4.560      3.040      7.600      hectare"
"             Time of concentration  55.708     4.452      16.003     minutes"
"             Time to Centroid       172.274    95.832     113.059    minutes"
"             Rainfall depth         32.362     32.362     32.362     mm"
"             Rainfall volume        1475.70    983.80     2459.50    c.m"
"             Rainfall losses        27.103     5.249      18.362     mm"
"             Runoff depth           5.259      27.113     14.000     mm"
"             Runoff volume          239.80     824.22     1064.02    c.m"
"             Runoff coefficient     0.162      0.838      0.433      "
"             Maximum flow           0.033      0.567      0.571      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.571     0.571     0.000     0.000"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Catchment 101"
"       30.000   % Impervious"
"       12.600   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"        8.820   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        3.780   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.162   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.838   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.712     0.571     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           8.820      3.780      12.600     hectare"
"             Time of concentration  55.708     4.452      20.421     minutes"
"             Time to Centroid       172.274    95.832     119.648    minutes"
```

```
"             Rainfall depth         32.362     32.362     32.362     mm"
"             Rainfall volume        2854.32    1223.28    4077.60    c.m"
"             Rainfall losses        27.103     5.249      20.547     mm"
"             Runoff depth           5.259      27.113     11.815     mm"
"             Runoff volume          463.81     1024.86    1488.67    c.m"
"             Runoff coefficient     0.162      0.838      0.365      "
"             Maximum flow           0.064      0.705      0.712      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.712     1.283     0.000     0.000"
" 33          CATCHMENT 102"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          102   Catchment 102"
"       75.000   % Impervious"
"        8.400   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"        2.100   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        6.300   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.162   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.838   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     1.177     1.283     0.000     0.000 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           2.100      6.300      8.400      hectare"
"             Time of concentration  55.708     4.452      7.564      minutes"
"             Time to Centroid       172.274    95.832     100.474    minutes"
"             Rainfall depth         32.362     32.362     32.362     mm"
"             Rainfall volume        679.60     2038.80    2718.40    c.m"
"             Rainfall losses        27.103     5.249      10.713     mm"
"             Runoff depth           5.259      27.113     21.649     mm"
"             Runoff volume          110.43     1708.10    1818.53    c.m"
"             Runoff coefficient     0.162      0.838      0.669      "
"             Maximum flow           0.015      1.175      1.177      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                     1.177     2.460     0.000     0.000"
" 33          CATCHMENT 200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          200   Catchment 200"
"        0.000   % Impervious"
"       10.000   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"       10.000   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.162   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.073     2.460     0.000     0.000 c.m/sec"
"             Catchment 200          Pervious   Impervious Total Area "
"             Surface Area           10.000     0.000      10.000     hectare"
"             Time of concentration  55.708     4.452      55.708     minutes"
"             Time to Centroid       172.274    95.832     172.273    minutes"
"             Rainfall depth         32.362     32.362     32.362     mm"
"             Rainfall volume        3236.19    0.00       3236.19    c.m"
"             Rainfall losses        27.103     5.249      27.103     mm"
"             Runoff depth           5.259      27.113     5.259      mm"
"             Runoff volume          525.87     0.00       525.87     c.m"
"             Runoff coefficient     0.162      0.000      0.162      "
"             Maximum flow           0.073      0.000      0.073      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.073     2.469     0.000     0.000"
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"                MIDUSS Output ------------------------------------------------>"
"                MIDUSS version                              Version 2.25  rev. 473"
"                MIDUSS created                           Sunday, February 07, 2010"
"           10   Units used:                                                ie METRIC"
"                Job folder:                                 W:\Kitchener\416-2016\"
"                416130 Whistle Bare Road Campground\5 Work in Progress\Design
Calcs\MIDUSS"
"                Output filename:                              416130_PrePOST_5.out"
"                Licensee name:                                                gmbp"
"                Company                                                       gmbp"
"                Date & Time last used:                   11/7/2019 at 11:02:03 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     1219.800   Coefficient A"
"       10.500   Constant B"
"        0.823   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           127.834    mm/hr"
"             Total depth                  48.647    mm"
"            6   005hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          100   Catchment 100"
"       40.000   % Impervious"
"        7.600   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"        4.560   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        3.040   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.266   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
```

```
"        0.881   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.824     0.000     0.000     0.000 c.m/sec"
"             Catchment 100          Pervious   Impervious Total Area "
"             Surface Area           4.560      3.040      7.600      hectare"
"             Time of concentration  37.755     3.958      14.481     minutes"
"             Time to Centroid       147.066    93.045     109.865    minutes"
"             Rainfall depth         48.647     48.647     48.647     mm"
"             Rainfall volume        2218.30    1478.87    3697.17    c.m"
"             Rainfall losses        35.722     5.767      23.740     mm"
"             Runoff depth           12.925     42.880     24.907     mm"
"             Runoff volume          589.36     1303.56    1892.92    c.m"
"             Runoff coefficient     0.266      0.881      0.512      "
"             Maximum flow           0.120      0.802      0.824      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.824     0.824     0.000     0.000"
" 33          CATCHMENT 101"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          101   Catchment 101"
"       30.000   % Impervious"
"       12.600   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"        8.820   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        3.780   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.266   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.881   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     1.040     0.824     0.000     0.000 c.m/sec"
"             Catchment 101          Pervious   Impervious Total Area "
"             Surface Area           8.820      3.780      12.600     hectare"
"             Time of concentration  37.755     3.958      17.913     minutes"
"             Time to Centroid       147.066    93.045     115.351    minutes"
```

```
"             Rainfall depth         48.647     48.647     48.647     mm"
"             Rainfall volume        4290.67    1838.86    6129.53    c.m"
"             Rainfall losses        35.722     5.767      26.736     mm"
"             Runoff depth           12.925     42.880     21.911     mm"
"             Runoff volume          1139.94    1620.88    2760.82    c.m"
"             Runoff coefficient     0.266      0.881      0.450      "
"             Maximum flow           0.231      0.997      1.040      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     1.040     1.863     0.000     0.000"
" 33          CATCHMENT 102"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          102   Catchment 102"
"       75.000   % Impervious"
"        8.400   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"        2.100   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        6.300   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.266   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.881   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     1.672     1.863     0.000     0.000 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           2.100      6.300      8.400      hectare"
"             Time of concentration  37.755     3.958      7.044      minutes"
"             Time to Centroid       147.066    93.045     97.977     minutes"
"             Rainfall depth         48.647     48.647     48.647     mm"
"             Rainfall volume        1021.59    3064.76    4086.35    c.m"
"             Rainfall losses        35.722     5.767      13.256     mm"
"             Runoff depth           12.925     42.880     35.391     mm"
"             Runoff volume          271.42     2701.46    2972.88    c.m"
"             Runoff coefficient     0.266      0.881      0.728      "
"             Maximum flow           0.055      1.662      1.672      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                     1.672     3.536     0.000     0.000"
" 33          CATCHMENT 200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          200   Catchment 200"
"        0.000   % Impervious"
"       10.000   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"       10.000   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.266   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     0.262     3.536     0.000     0.000 c.m/sec"
"             Catchment 200          Pervious   Impervious Total Area "
"             Surface Area           10.000     0.000      10.000     hectare"
"             Time of concentration  37.755     3.958      37.755     minutes"
"             Time to Centroid       147.066    93.045     147.066    minutes"
"             Rainfall depth         48.647     48.647     48.647     mm"
"             Rainfall volume        4864.70    0.00       4864.70    c.m"
"             Rainfall losses        35.722     5.767      35.722     mm"
"             Runoff depth           12.925     42.880     12.925     mm"
"             Runoff volume          1292.45    0.00       1292.46    c.m"
"             Runoff coefficient     0.266      0.000      0.266      "
"             Maximum flow           0.262      0.000      0.262      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     0.262     3.584     0.000     0.000"
```

```
"                MIDUSS Output ----------------------------------------------->"
"                MIDUSS version                            Version 2.25  rev. 473"
"                MIDUSS created                         Sunday, February 07, 2010"
"           10   Units used:                                            ie METRIC"
"                Job folder:                              W:\Kitchener\416-2016\"
"                416130 Whistle Bare Road Campground\5 Work in Progress\Design
Calcs\MIDUSS"
"                Output filename:                          416130_PrePOST_100.out"
"                Licensee name:                                              gmbp"
"                Company                                                     gmbp"
"                Date & Time last used:                 11/7/2019 at 11:05:16 AM"
" 31          TIME PARAMETERS"
"        5.000   Time Step"
"      180.000   Max. Storm length"
"     1500.000   Max. Hydrograph"
" 32          STORM Chicago storm"
"            1   Chicago storm"
"     3015.100   Coefficient A"
"       21.000   Constant B"
"        0.870   Exponent C"
"        0.400   Fraction R"
"      180.000   Duration"
"        1.000   Time step multiplier"
"             Maximum intensity           177.123    mm/hr"
"             Total depth                  89.669    mm"
"            6   100hyd   Hydrograph extension used in this file"
" 33          CATCHMENT 100"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          100   Catchment 100"
"       40.000   % Impervious"
"        7.600   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"        4.560   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        3.040   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.443   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
```

```
"         0.922   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      1.342     0.000     0.000     0.000 c.m/sec"
"              Catchment 100          Pervious   Impervious Total Area "
"              Surface Area           4.560      3.040      7.600      hectare"
"              Time of concentration  25.591     3.434      12.712     minutes"
"              Time to Centroid       128.770    91.156     106.907    minutes"
"              Rainfall depth         89.669     89.669     89.669     mm"
"              Rainfall volume        4088.91    2725.94    6814.84    c.m"
"              Rainfall losses        49.970     7.015      32.788     mm"
"              Runoff depth           39.699     82.654     56.881     mm"
"              Runoff volume          1810.29    2512.69    4322.98    c.m"
"              Runoff coefficient     0.443      0.922      0.634      "
"              Maximum flow           0.490      1.201      1.342      c.m/sec"
" 40           HYDROGRAPH Add Runoff "
"             4   Add Runoff "
"                      1.342     1.342     0.000     0.000"
" 33           CATCHMENT 101"
"             1   Triangular SCS"
"             1   Equal length"
"             1   SCS method"
"           101   Catchment 101"
"        30.000   % Impervious"
"        12.600   Total Area"
"        90.000   Flow length"
"         2.000   Overland Slope"
"         8.820   Pervious Area"
"        90.000   Pervious length"
"         2.000   Pervious slope"
"         3.780   Impervious Area"
"        90.000   Impervious length"
"         2.000   Impervious slope"
"         0.250   Pervious Manning 'n'"
"        75.000   Pervious SCS Curve No."
"         0.443   Pervious Runoff coefficient"
"         0.100   Pervious Ia/S coefficient"
"         8.467   Pervious Initial abstraction"
"         0.015   Impervious Manning 'n'"
"        98.000   Impervious SCS Curve No."
"         0.922   Impervious Runoff coefficient"
"         0.100   Impervious Ia/S coefficient"
"         0.518   Impervious Initial abstraction"
"                      1.774     1.342     0.000     0.000 c.m/sec"
"              Catchment 101          Pervious   Impervious Total Area "
"              Surface Area           8.820      3.780      12.600     hectare"
"              Time of concentration  25.591     3.434      15.143     minutes"
"              Time to Centroid       128.770    91.156     111.033    minutes"
```

```
"             Rainfall depth         89.669     89.669     89.669     mm"
"             Rainfall volume        0.7909     0.3389     1.1298     ha-m"
"             Rainfall losses        49.970     7.015      37.083     mm"
"             Runoff depth           39.699     82.654     52.586     mm"
"             Runoff volume          3501.49    3124.33    6625.82    c.m"
"             Runoff coefficient     0.443      0.922      0.586      "
"             Maximum flow           0.948      1.494      1.774      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     1.774     3.116     0.000     0.000"
" 33          CATCHMENT 102"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          102   Catchment 102"
"       75.000   % Impervious"
"        8.400   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"        2.100   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        6.300   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.443   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.922   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     2.538     3.116     0.000     0.000 c.m/sec"
"             Catchment 102          Pervious   Impervious Total Area "
"             Surface Area           2.100      6.300      8.400      hectare"
"             Time of concentration  25.591     3.434      6.491      minutes"
"             Time to Centroid       128.770    91.156     96.347     minutes"
"             Rainfall depth         89.669     89.669     89.669     mm"
"             Rainfall volume        1883.05    5649.15    7532.20    c.m"
"             Rainfall losses        49.970     7.015      17.754     mm"
"             Runoff depth           39.699     82.654     71.915     mm"
"             Runoff volume          833.69     5207.21    6040.90    c.m"
"             Runoff coefficient     0.443      0.922      0.802      "
"             Maximum flow           0.226      2.489      2.538      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
```

```
"            4   Add Runoff "
"                     2.538     5.654     0.000     0.000"
" 33          CATCHMENT 200"
"            1   Triangular SCS"
"            1   Equal length"
"            1   SCS method"
"          200   Catchment 200"
"        0.000   % Impervious"
"       10.000   Total Area"
"       90.000   Flow length"
"        2.000   Overland Slope"
"       10.000   Pervious Area"
"       90.000   Pervious length"
"        2.000   Pervious slope"
"        0.000   Impervious Area"
"       90.000   Impervious length"
"        2.000   Impervious slope"
"        0.250   Pervious Manning 'n'"
"       75.000   Pervious SCS Curve No."
"        0.443   Pervious Runoff coefficient"
"        0.100   Pervious Ia/S coefficient"
"        8.467   Pervious Initial abstraction"
"        0.015   Impervious Manning 'n'"
"       98.000   Impervious SCS Curve No."
"        0.000   Impervious Runoff coefficient"
"        0.100   Impervious Ia/S coefficient"
"        0.518   Impervious Initial abstraction"
"                     1.075     5.654     0.000     0.000 c.m/sec"
"             Catchment 200          Pervious   Impervious Total Area "
"             Surface Area           10.000     0.000      10.000     hectare"
"             Time of concentration  25.591     3.434      25.591     minutes"
"             Time to Centroid       128.770    91.156     128.770    minutes"
"             Rainfall depth         89.669     89.669     89.669     mm"
"             Rainfall volume        8966.89    0.01       8966.90    c.m"
"             Rainfall losses        49.970     7.015      49.970     mm"
"             Runoff depth           39.699     82.654     39.699     mm"
"             Runoff volume          3969.94    0.01       3969.94    c.m"
"             Runoff coefficient     0.443      0.000      0.443      "
"             Maximum flow           1.075      0.000      1.075      c.m/sec"
" 40          HYDROGRAPH Add Runoff "
"            4   Add Runoff "
"                     1.075     5.987     0.000     0.000"
" 38          START/RE-START TOTALS 200"
"            3   Runoff Totals on EXIT"
"             Total Catchment area                    38.600    hectare"
"             Total Impervious area                   13.120    hectare"
"             Total % impervious                      33.990"
" 19          EXIT"
```

Preliminary Annual Water Balance - Existing and Post-Development Conditions
1898 Whislte Bare Road

	Existing Conditions				Existing Conditions Summary	Post-Development Conditions								Post-Development Conditions Summary	Totals			
	Catchment 10		Catchment 20			Catchment 100		Catchment 101		Catchment 102		Catchment 200						
	Existing camp sites, residences, gravel drive aisles, landscaped areas		Existing Natural Features			Proposed gravel drive aisles, camp sites, playground, cabins, and landscaped areas		Proposed additional camp site areas, including gravel roadways, landscaped areas		Proposed gravel drive aisles, site storage area, wastewater treatment facility, overnight area, existing residences, Rec Hall, and landscaped areas		Existing Natural Features				Existing	Post-Development	% Diff.
	Impervious	Pervious	Impervious	Pervious		Impervious	Pervious	Impervious	Pervious	Impervious	Pervious	Impervious	Pervious					
Total Area (ha)	28.600		10.000		**38.600**	7.600		12.600		8.400		10.000		**38.600**	**Area (ha)**	**38.60**	**38.60**	
Imperviousness	15%		0%		**20%**	40%		30%		75%		0%		**40%**				
Area (ha)	4.2900	24.310	0.0000	10.000		3.0400	4.560	3.7800	8.820	6.3000	2.100	0.0000	10.000					
Area (m^2)	42,900	243,100	0	100,000	386,000	30,400	45,600	37,800	88,200	63,000	21,000	0	100,000	386,000				
Annual Precipitation (Waterloo Wellington) (mm)	*916*		*916*			*916*		*916*		*916*		*916*						
Precipitation (m^3)	39,296	222,680	0	91,600		27,846	41,770	34,625	80,791	57,708	19,236	0	91,600					
Total Precipitation (m^3/year)	261,976		91,600		**353,576**	69,616		115,416		76,944		91,600		**353,576**	**Precipitation (m^3/year)**	**353,576**	**353,576**	0%
Annual Evapotranspiration (mm)	*125*	*530*	*125*	*530*		*125*	*530*	*125*	*530*	*125*	*530*	*125*	*530*					
Evapotranspiration (m^3)	5,363	128,843	0	53,000		3,800	24,168	4,725	46,746	7,875	11,130	0	53,000					
Total Evapotranspiration (m^3/year)	134,206		53,000		**187,206**	27,968		51,471		19,005		53,000		**151,444**	**Evapotranspiration (m^3/year)**	**187,206**	**151,444**	-19%
Available for Recharge & Runoff (mm)	*791*	*386*	*791*	*386*		*791*	*386*	*791*	*386*	*791*	*386*	*791*	*370*					
Recharge & Runoff (m^3)	33,934	93,837	0	38,600		24,046	17,602	29,900	34,045	49,833	8,106	0	37,000					
Total Recharge & Runoff (m^3/year)	127,771		38,600		**166,371**	41,648		63,945		57,939		37,000		**200,532**	**Recharge & Runoff (m^3/year)**	**166,371**	**200,532**	21%
Annual Natural Recharge (mm) (Sand):	*0*	*347*	*0*	*347*		*0*	*347*	*0*	*347*	*0*	*347*	*0*	*347*					
Pervious @ 347 mm/year		84,356		34,700	119,056		15,823		30,605		7,287		34,700	88,416				
Impervious @ 0 mm/year	0		0		0	0		0		0		0		0				
Total Annual Natural Recharge (m^3/year)	84,356		34,700		**119,056**	15,823		30,605		7,287		34,700		**88,416**	**Natural Recharge (m^3/year)**	**119,056**	**88,416**	-26%
Annual Runoff (mm) (Sand):	*791*	*39*	*791*	*39*		*791*	*39*	*791*	*39*	*791*	*39*	*791*	*39*					
Pervious @ 39 mm/year		9,481		3,900	13,381		1,778		3,440		819		3,900	9,937				
Impervious @ 791 mm/year	33,934		0		33,934	24,046		29,900		49,833		0		103,779				
Total Annual Runoff (m^3/year)	43,415		3,900		**47,315**	25,825		33,340		50,652		3,900		**113,716**	**Annual Runoff (m^3/year)**	**47,315**	**113,716**	140%
Additional Recharge:																		
Catchment Percent Infiltrated[1]								95%										
Infiltrated m^3/year			0	0		0	0	28,405	3,268	0	0	0	0	31,673	**Additional Recharge (m^3/year)**	**0**	**31,673**	
Total Annual Recharge (m^3/year)	84,356		34,700		119,056	15,823		62,278		7,287		34,700		120,088	**Annual Recharge (m^3/year)**	**119,056**	**120,088**	1%
Total Annual Runoff (m^3/year)	43,415		3,900		47,315	25,825		1,667		50,652		3,900		82,044	**Total Annual Runoff (m^3/year)**	**47,315**	**82,044**	73%

Notes:
1) 95% is an approximation of the percent of annual precipitation that falls during storm events less than, or equal to, the 2-year storm in magnitude.