

**Harbourside Commercial Park
Sydney, NS**

2009 Groundwater Monitoring Program



**August 2010
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2009 GROUNDWATER MONITORING PROGRAM

HARBOURSIDE COMMERCIAL PARK

SLR REF: 210.05479.00.23

Submitted by
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for
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1.0 BACKGROUND AND PURPOSE

This report presents the results of a groundwater monitoring program conducted between November 16 and December 4, 2009 at the Harbourside Commercial Park (the Site). The program was conducted by SLR Consulting (Canada) Ltd. at the request of Nova Scotia Lands Inc. In accordance with our work plan dated 4 November, 2009.

The former Sydney Steel Corporation (SYSCO) property, located in Sydney, Nova Scotia, is being redeveloped as the Harbourside Commercial Park. Nova Scotia Lands Inc. (NS Lands) is a provincial Crown Corporation with the mandate to complete the reclamation of the former steel plant site through demolition, site remediation and redevelopment of the property. NS Lands is a subsidiary of Harbourside Commercial Park Inc. (HCPI), which has a mandate to operate the commercial park. Environmental Site Assessments (ESAs) conducted to date throughout the Site have identified several groundwater constituents of interest (COI) in excess of evaluation criteria. Some of the COI that were often detected included Polycyclic Aromatic Hydrocarbons (PAHs), Benzene, Toluene, Ethylbenzene and Xylenes (BTEX) and Total Petroleum Hydrocarbons (TPH). Other COI that exceeded criteria included mercury, various other metals, and vinyl chloride.

In evaluating the significance of these ESA results, it is noted that most of the original samples contained excessive turbidity, likely attributed to the sampling method (Waterra foot valve method). This program was conducted using a low-flow sampling method designed to provide minimal sediment mobilization. Fifty-five monitor wells were monitored, of which 51 were sampled and compared to the following standards:

- TPH/BTEX - Atlantic PIRI Tier 1 Risk Based Screening Levels (RBSLs);
- PAHs, Metals, VOCs, General Chemistry and Dioxins and Furans - Ontario Ministry of the Environment (MOE) Groundwater Standards for use Under the Environmental Protection Act; and
- General Chemistry – Health Canada's Canadian Drinking Water Quality Guidelines (CDWQG).

Refer to Drawing 1, following the text, for the Monitor Well Location Plan.

2.0 FIELD PROGRAM METHODS

Groundwater samples were collected in accordance with SLR's Standard Field Procedures, industry-accepted protocols and NS Lands-approved protocols to maintain accurate collection of field data and interpretation of conditions.

Sampling was conducted via low-flow purging and sampling methods, as it is considered to be the most defensible method for the collection of representative formation water. Low-flow purging and sampling is the preferred method for all semi-volatile and non-volatile/inorganic analyses (i.e. C₁₀₋₅₀ hydrocarbons, metals, PAHs), and is defined as purging groundwater from a well at a rate of less than 1 L/min and minimizing draw-down of the static water level to less than 10 cm.

During the purging process, extracted groundwater was determined to be representative of natural formation water through geochemical parameter stabilization monitoring. Once the

geochemical parameters were determined to have stabilized, groundwater samples were subsequently collected.

In the parameter stabilization method, extracted groundwater was passed continuously through a 'flow-through' cell and select geochemical parameters were monitored to assess their stabilization as an indication that representative formation water was being extracted. Parameters monitored for stabilization included pH, temperature, specific conductance, dissolved oxygen, redox and turbidity. Temperature, pH and conductivity are the three minimum parameters required for stabilization. Groundwater samples collected for metals analysis were field filtered and preserved prior to laboratory submission.

Fifty-five monitor wells were included in the 2009 Groundwater Monitoring Program. One monitor well (SCU17-012-MW) was dry and not sampled. Three monitor wells (i.e. SCU10-004-MW, SCU31-002-MWA and SCU31-002-MWB) contained free product and were not sampled.

Field monitoring forms/groundwater sampling records are provided in Appendix A.

3.0 RESULTS

In total 56 groundwater samples (including 5 duplicates) were submitted for PAH, BTEX/TPH and Metals analyses to Maxxam Analytics Inc (Maxxam) in Sydney, Nova Scotia. In addition, five of the monitor wells were sampled for VOCs, one for Dioxins and Furans and one for General Chemistry. Analyses were selected based on previous results for each well.

Results are provided in Tables 1 through 6, following the text, for PAHs, BTEX/TPH, Metals and Volatile Organic Compounds (VOCs), General Chemistry and Dioxins and Furans, respectively.

3.1 Groundwater PAHs

The groundwater samples submitted for PAH analysis contained concentrations below applicable guidelines, with the exception of SCU6-004-MW and SCU26-007-MW. The following PAH parameters exceeded MOE guidelines:

- Benzo (g,h,i) perylene (guideline criterion of 0.2 ug/L) - SCU6-004-MW (0.59 ug/L);
- Benzo(k) fluoranthene (guideline criterion of 0.4 ug/L) - SCU6-004-MW (0.45 ug/L) and SCU26-007-MW (0.64 ug/L); and
- Indeno (1,2,3-cd) pyrene (guideline criterion of 0.27 ug/L) - SCU6-004-MW (0.58 ug/L).

Analytical data is provided in Table 1 and analytical certificates in Appendix B.

3.2 Groundwater BTEX and TPH

The groundwater samples submitted for TPH/BTEX analysis were either non-detect or contained concentrations below the Atlantic PIRI Tier I RBSL for a Commercial site with Non-Potable groundwater usage and coarse-grained soil.

The following samples contained free product and were not submitted for analysis:

- SCU10-004-MW (measured product thickness of 1.39 m – suspected to be related to known coal tar impacts in this area);

- SCU31-002-MWA (measured product thickness of 2.14 m – suspected to be related to known bunker C impacts in this area); and
- SCU31-002-MWB (measured product thickness of 2.76 m – suspected to be related to known bunker C impacts in this area).

Samples SCU17-010-MWB and SCU17-010-MWC had a measured product thickness of 8.5 m and 9.38 m, respectively based on the oil/water interface probe. Visual and olfactory observations did not support this conclusion and samples were collected. Concentrations of TPH/BTEX were not detected in either sample. Subsequent monitoring of this well has not identified product.

Analytical data is provided in Table 2 and analytical certificates in Appendix B.

3.3 Groundwater Metals (including Mercury)

Groundwater results for samples submitted for dissolved Metals analysis were either non-detect or contained concentrations below the *OMOE guidelines* with the exceptions of Dup B (SCU17-010-MWA) and SCU25-004-MW. Both samples exceed the *OMOE guideline* for mercury (0.12 ug/L) as follows:

- Dup B - 0.13 ug/L; and
- SCU25-004-MW - 0.13 ug/L.

No other metal parameters were in excess of the guidelines.

Analytical data is provided in Table 3 and analytical certificates in Appendix B.

3.4 Groundwater VOCs

In total five groundwater samples were submitted for VOC analysis. All results were below applicable guidelines with the exception of SCU10-001-MW. Groundwater analysis indicated a concentrations of 79 ug/L for cis-1,2-Dichloroethylene and 5.7 ug/L of Vinyl Chloride, which exceed the *MOE guidelines* of 70 ug/L and 0.5 ug/L, respectively. No other VOC parameters were in excess of the guidelines.

Analytical data is provided in Table 4 and analytical certificates in Appendix B.

3.5 Groundwater General Chemistry

One groundwater sample (i.e. SCU16-004-MW) was submitted for General Chemistry analysis. Concentrations were compared to *MOE guidelines* as well as *CDWQG*. All parameters were within guidelines with the exception of turbidity with a value of 85 NTU that exceeds the *CDWQG*. The *CDWQG* for turbidity is an aesthetic objective for drinking water and thus, does not apply to groundwater results for the Site, but is used for screening purposes.

Analytical data is provided in Table 5 and analytical certificates in Appendix B.

3.6 Groundwater Dioxins and Furans

One groundwater sample (SCU17-004-MW) was submitted for Dioxins and Furans analysis, as Phase II ESA results indicated an exceedance of this parameter in 2005. The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors were used to determine the final concentrations of each parameter listed. The Total Toxic Equivalent (TEQ) was determined to be 1.93 pg/L and thus, exceeded the MOE guideline for Dioxin/Furan of 0.015 pg/L.

Analytical data is provided in Table 6 and analytical certificates in Appendix B.

3.7 Groundwater QA/QC

Under the project quality assurance/quality control (QA/QC) program, five duplicate groundwater samples were submitted for PAH, metals and TPH/BTEX analyses. The duplicates submitted were as follows:

- Dup A-SCU7-006-MWA (November 16, 2009);
- Dup B-SCU-17-010-MWA (November 20, 2009);
- Dup C-SCU-31-013-MWB (November 24, 2009);
- Dup D-SCU24-007-MWB (November 27, 2009); and
- DupE-SCU18-009-MW (December 4, 2009).

The duplicate samples were reviewed and were within acceptable QC limits.

Three trip blanks were submitted for TPH/BTEX analysis during the groundwater program as follows:

- Trip Blank 1 (November 20, 2009);
- Trip Blank 2 (November 30, 2009); and
- Trip Blank 3 (December 1, 2009).

TPH/BTEX was not detected in any of the three trip blanks.

Laboratory comments in regards to sample quality included:

- SCU11-004-MW (November 24, 2009): the color of the sample was much lighter yellow (almost clear) than normal/expected.
- SCU25-005-MWB (November 25, 2009): precipitate was present after sample digestion. Sample was filtered before running on instrument. ICPMS reporting limits were evaluated due to the required dilution for interfering compounds.
- SCU25-005-MWC (November 25, 2009): precipitate was present after sample digestion. Sample was filtered before running on instrument. ICPMS reporting limits were evaluated due to the required dilution for interfering compounds.
- On December 1, 2009, the laboratory reported Dissolved Silver as not being in range for batch number 2023857 (i.e. samples SCU31-013-MWB, SCU31-013-MWC, SCU18-007MW, SCU17-014-MW, SCU13-003-MW, and Dup C). The QC test type was a matrix spike.

- On December 2, 2009, the laboratory reported Chrysene as not being in range for batch number 2023654. The QC test type was for a matrix spike on groundwater sample SCU12-001-MW.

The QA/QC laboratory comments were reviewed and are considered acceptable.

4.0 CONCLUSIONS

Samples were collected from fifty-one monitor wells and submitted for a combination of PAH, BTEX/TPH, Metals, VOC, General Chemistry, and/or Dioxin and Furan analyses. The fieldwork for this monitoring program was conducted between November 16 and December 4, 2009. Sampling was conducted via low-flow purging and sampling methods, as it is considered to be the most defensible method for the collection of representative formation water. The results of the monitoring program are as follows:

- A concentration of 0.59 ug/L Benzo(g,h,i)perylene, 0.45 ug/L of Benzo(k)fluoranthene and 0.58 ug/L Indeno(1,2,3-cd)pyrene was reported in SCU6-004-MW, which exceeds the MOE guidelines of 0.2 ug/L, 0.4 ug/L and 0.27 ug/L, respectively. SCU26-007-MW (0.64 ug/L) also contained concentrations of Benzo(k)fluoranthene in excess of the guideline. All other PAH concentrations were below *Ontario Table 3 guidelines*.
- The groundwater samples submitted for TPH/BTEX analysis were either non-detect or contained concentrations below the Atlantic PIRI Tier I RBSL for a Commercial site with non-potable groundwater usage and coarse-grained soil.
- A concentration of 0.13 ug/L mercury was reported in both Duplicate B (SCU17-010-MWA) and SCU25-004-MW exceeding the MOE guideline of 0.12 ug/L. All other concentration of Dissolved Metals analysed contained concentrations below *Ontario Table 3 guidelines*.
- Groundwater analysis indicated a concentrations of 79 ug/L for cis-1,2-Dichloroethylene and 5.7 ug/L of Vinyl Chloride in monitor well SCU10-001-MW, which exceed the *Ontario Table 3 guidelines* of 70 ug/L and 0.5 ug/L respectively. All other VOC concentrations were below MOE *guidelines*.
- The groundwater sample submitted for General Chemistry analysis (from SCU16-004-MW) indicated concentrations within MOE and CDWQG guidelines with the exception of turbidity with a value of 85 NTU. The CDWQG for turbidity is an aesthetic objective for drinking water and thus, does not directly apply to groundwater results, but is used for screening purposes.
- One groundwater sample (SCU17-004-MW) was submitted for Dioxin and Furan analysis. The results exceed the MOE guideline for Dioxin/Furans.
- Four wells were excluded from the groundwater sampling program. Three of the wells contained visible product (SCU10-004-MW, SCU31-002-MWA, SCU31-002-MWB) and were excluded from sample submission. The product is assumed to be associated with know free product occurrences in these areas. One well (SCU17-012-MW) did not contain enough water to retrieve a proper sample.

5.0 STATEMENT OF LIMITATION

This report has been prepared and the work referred to in this report has been undertaken by SLR for NS Lands Inc. It is intended for the sole and exclusive use of NS Lands and its authorized agents for the purpose(s) set out in this report. Any use of, reliance on or decision made based on this report by any person other than NS Lands for any purpose, or by NS Lands for a purpose other than the purpose(s) set out in this report, is the sole responsibility of such other person or NS Lands. NS Lands and SLR make no representation or warranty to any other person with regard to this report and the work referred to in this report and they accept no duty of care to any other person or any liability or responsibility whatsoever for any losses, expenses, damages, fines, penalties or other harm that may be suffered or incurred by any other person as a result of the use of, reliance on, any decision made or any action taken based on this report or the work referred to in this report.

The investigation undertaken by SLR with respect to this report and any conclusions or recommendations made in this report reflect SLR's judgment based on the site conditions observed at the time of the groundwater monitoring program on the date(s) set out in this report, on information available at the time of preparation of this report, on the interpretation of data collected from the field investigation, and on the results of laboratory analyses, which were limited to the quantification in select samples of those substances specifically identified in the report. This report has been prepared for specific application to this site and it is based, in part upon visual observation of the site and specific analysis of specific chemical parameters and materials during a specific time interval, all as described in this report. Unless otherwise stated, the findings cannot be extended to previous or future site conditions, or chemical parameters, materials or analysis which were not addressed. Substances other than those addressed by the investigation described in this report may exist within the site; substances addressed by the investigation may exist in areas of the site not investigated and concentrations of substances addressed which are different than those reported may exist in areas other than the locations from which samples were taken. SLR expresses no warranty with respect to the accuracy of the laboratory analyses, methodologies used, or presentation of analytical results by the laboratory. Actual concentrations of the substances identified in the samples submitted may vary according to the extraction and testing procedures used.

As the evaluation and conclusions reported herein do not preclude the existence of other chemical compounds and/or that variations of conditions within the site may be possible, this report should be used for informational purposes only and should absolutely not be construed as a comprehensive hydrogeological or chemical characterization of the site. If site conditions change or if any additional information becomes available at a future date, modifications to the findings, conclusions and recommendations in this report may be necessary.

Nothing in this report is intended to constitute or provide a legal opinion. SLR makes no representation as to the requirements of or compliance with environmental laws, rules, regulations or policies established by federal, provincial or local government bodies. Revisions to the regulatory standards referred to in this report may be expected over time. As a result, modifications to the findings, conclusions and recommendations in this report may be necessary.

Other than by NS Lands and as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of SLR.

NS Lands may submit this report to the Nova Scotia Environment and/or related Nova Scotia environmental regulatory authorities or persons for review and comment purposes.

TABLES

Summary of Analytical Results

Groundwater Monitoring Program

Harbourside Commercial Park, Sydney, NS

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