global environmental solutions

Performance Verification Plan
FINAL

9697 190th Street, Surrey, BC

Blake, Cassels & Graydon LLP

July 2016
SLR Ref: 201.88602.00000

PERFORMANCE VERIFICATION PLAN
FINAL

9697 190th STREET, SURREY, BC

SLR Project No.: 201.88602.00000

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1 copy – SLR Consulting (Canada) Ltd.
1 copy – Ministry of Environment

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1.0 INTRODUCTION

SLR Consulting (Canada) Ltd. (SLR) on behalf of Blake, Cassels & Graydon LLP prepared this Performance Verification Plan (PVP) for the former wood treatment facility, located at 9697 190th Street, Surrey, BC (the "Site"). A separate PVP was prepared for the Western Adjacent Neighbouring Property located at 18946 98th Avenue, Surrey, BC (SLR, 2016a), immediately adjacent to the western border of the Site, although the groundwater quality monitoring outlined in this PVP encompass the requirements for both the Site and the Western Adjacent Neighbouring Property.

This PVP was prepared to address contamination at the Site in support of an application for a risk-based Certificate of Compliance (CofC) for the Site. The PVP presents risk management measures to be implemented for the Site to ensure that the CofC will remain valid. This report was prepared in accordance with BC Ministry of Environment (MOE) Administrative Guidance 14: *Performance Verification Plans, Contingency Plans, and Operations and Maintenance Plans* (MOE, 2014).

2.0 BACKGROUND

The Site is an active industrial site that historically operated as a wood treatment facility from 1977 to 2008.

The Site is shown in Drawing 1. The Site legal description is as follows:

> Lot 22, Except: Firstly, Part Subdivided by Plan 11440; Secondly, Part Dedicated Road on Plan BCP27865. Section 4 Township 9 New Westminster District Plan 3736

Environmental investigations conducted at the Site indicated the presence of several metals (arsenic, copper, cadmium, and hexavalent (VI) chromium) and ammonia in groundwater and/or soil above BC CSR numerical standards, associated with historical use of Chromated Copper Arsenate (CCA) and Alkaline Copper Quaternary (ACQ) at the Site as wood treatment preservatives.

The Human Health and Ecological Risk Assessment (HHERA) for the Site was completed by SLR in July 2016 to evaluate potential risks to human and ecological health from soil and groundwater contamination (SLR, 2016b). The HHERA was conducted under the assumption that the current industrial (IL) land use designation for the Site will remain unchanged in the future, and that drinking water will not be used as source of potable water as the drinking water use standards do **not** apply to the Site. Furthermore, it was assumed that the current onsite buildings and asphalt will remain in place in their present configurations.

The results of the HHERA (SLR, 2016b) and Stage 1 Preliminary Site Investigation and Detailed Site Investigation (SLR, 2016c) indicated the following:

- No unacceptable risk to industrial workers, identified as receptors of concern at the Site, from exposure to soil. Only arsenic had a maximum concentration above the CSR IL matrix standard for intake of contaminated soil; however the exposure concentration (statistical value 95th percentile of the upper confidence level of the mean) was less than the CSR IL matrix standard for intake of contaminated soil. Therefore, the soil pathways were considered to be insignificant.

- Although arsenic, trivalent chromium, and copper were identified as COPCs in surface soil (0-1 meters below grade (mbg)) at the Site, soil pathways were considered to be incomplete in the area of buildings and asphalt surface cover, and complete but insignificant in the uncovered area with limited terrestrial habitat per MOE (MOE, 2008) Protocol 13 definition (<1000 m^2 for IL land use).
- The exposure transport pathway of soil leaching to groundwater is incomplete due to the presence of surface cover. If the surface cover is removed, COPCs in surface soil may leach to groundwater.
- There are no surface water bodies at the Site; however, the Fraser River is located approximately 200 m down-gradient in the direction of groundwater flow. Arsenic, cadmium, chromium (VI), copper, and ammonia were identified as COPCs in groundwater at the Site. Arsenic, cadmium, chromium (VI), copper, and ammonia are considered to be delineated and stable and therefore, the groundwater-to-surface water pathway was considered incomplete and insignificant for aquatic receptor exposure to COPCs in groundwater discharging to surface water.
- The source of contamination will remain in soil on the Site and monitoring of groundwater contaminant stability is necessary to verify performance of conditions over time.

The Site is classified as a Risk-Based Remediation Type 2 Site on the basis that the Site meets risk-based standards under current and future Site circumstances, with an engineering control (asphalt cover) required.

3.0 REQUIRED RISK CONTROLS

The required risk controls to manage risk identified in the HHERA are detailed below and in Table 1:

- Soil must remain covered by buildings or asphalt to ensure:
    - No increase of terrestrial habitat that results in a contiguous area exceeding 1000 m^2;
    - No increased exposure of terrestrial receptors to impacted surface soil (e.g., due to breaching/removal of asphalt cover or building foundations); and
    - No increased exposure of impacted soils to precipitation to prevent leaching of contaminants into groundwater.
- Groundwater monitoring of select wells at the Site and wells located on the City of Surrey 98th Avenue Roadway to monitor/verify plume stability.

<u>Surface Cover Inspection</u>

1. Yearly inspection of the Site buildings and surface cover.
2. Notification by tenants of any changes to the integrity and configuration of buildings and surface cover on the Site.
3. Should surface coverage be breached or reduced (e.g., in the event of building demolition or utility maintenance), further soil and groundwater assessment must be conducted to verify that the conclusions of the HHERA remain valid.

Groundwater Sampling and Monitoring

- Monitoring Well Network: The wells that must be sampled include:
    - Thirteen onsite groundwater monitoring wells (MW15-1, MW15-1D, MW15-2, MW15-3, MW15-3D, MW15-4, MW15-4D, MW15-5, MW15-6, MW15-11, MW15-11D, MW15-18, and MW15-26) and;
    - Three 98th Avenue Roadway wells (MW16-33, MW16-34, and MW16-35).
    - Locations of groundwater wells to be sampled are provided on Drawing 1.

- Sampling Frequency:
    - Groundwater monitoring wells must be sampled twice a year (dry and wet season) for two years at high and low water table. Groundwater levels must be measured in every well during each sampling event to determine seasonal effects on the water table. Reduced sampling frequency may be implemented after Year 2 sampling based on results.

- Analytical Parameters (All wells):
    - Redox
    - Dissolved Metals
    - Ammonia
    - The above parameters list may be reduced after 2 years upon review of the data

- Assessment of Groundwater Data and Monitoring Program:
    - Following completion of the 2-year groundwater monitoring and sampling program, evaluate groundwater seasonality and concentration trends for arsenic, cadmium, chromium (VI), copper, and ammonia. Identify the season that results in highest arsenic, cadmium, chromium (VI), copper, and ammonia concentrations.
        1. Thereafter, continue with annual arsenic, cadmium, chromium (VI), copper, and ammonia sampling and groundwater measurement for an additional 8 years (i.e., years 3 to 10) during the season that corresponds with the highest arsenic, cadmium, chromium (VI), copper, and ammonia concentrations.
        2. Evaluate data every year and perform trend analysis at least every 5 years.
        3. Following completion of the 10-year sampling period, evaluate groundwater results and trends and consult an Approved Professional regarding adequacy of sampling plan (sample frequency and analytical parameters).
    - In the event of changes to Site property conditions (e.g., removal of the existing structures or portions of asphalt), assess the potential effects of the changes, which may include re-evaluation of the HHERA conclusions or PVP requirements, and/or conducting more frequent sampling.

Table 1: RISK MANAGEMENT MONITORING PROGRAM

Monitoring Well Locations	Frequency	Parameters	Reporting
YEARS 1 AND 2 (Each Year)			
Annual Inspection of Site Surface Cover and Structures			
9697 190th Street Wells: MW15-1, MW15-1D, MW15-2, MW15-3, MW15-3D, MW15-4, MW15-4D, MW15-5, MW15-6, MW15-11, MW15-11D, MW15-18 and MW15-26 98th Avenue Roadway Wells: MW16-33, MW16-34, MW16-35	Two times per year: High and Low water table seasons	Redox Dissolved Metals Ammonia	Analytical results including groundwater depths measurements Approved Professional (AP) statement prepared annually regarding Site's condition. Submission of the AP Statement to MOE.
YEARS 3 to 10 (Each Year)			
Annual Inspection of Site Surface Cover and Structures			
9697 190th Street Wells: MW15-1, MW15-1D, MW15-2, MW15-3, MW15-3D, MW15-4, MW15-4D, MW15-5, MW15-6, MW15-11, MW15-11D, MW15-18 and MW15-26 98th Avenue Roadway Wells: MW16-33, MW16-34, MW16-35	Once per year	Redox Dissolved Metals Ammonia (parameters may be reduced following Year 1 and 2 data review)	Analytical results including groundwater depths measurements: trend analysis AP statement prepared annually regarding Site's condition. Submission of the AP Statement to MOE.
YEARS 10+ (Each Year)			
Annual Inspection of Site Surface Cover and Structures			
9697 190th Street Wells: MW15-1, MW15-1D, MW15-2, MW15-3, MW15-3D, MW15-4, MW15-4D, MW15-5, MW15-6, MW15-11, MW15-11D, MW15-18 and MW15-26 98th Avenue Roadway Wells: MW16-33, MW16-34, MW16-35 (Wells may be reduced following Year 10 review)	Once per year Review of adequacy by AP and re-evaluation of frequency - i.e., per Section 4.0, Item 2, sub-item 5 in the PVP text	Redox Dissolved Metals Ammonia (parameters may be reduced following Year 1 and 2 data review)	Analytical results including groundwater depths measurements Approved Professional statement prepared annually regarding Site's condition. Submission of the AP Statement to MOE. (Frequency and MOE submission requirement may be reduced following Year 1 to 10 review)

4.0 REQUIRED ACTIONS TO IMPLEMENT THE REQUIRED RISK CONTROLS

Based on the consideration of current and future land use at the Site, and the results of the HHERA (SLR, 2016b), the following performance verification actions are to be implemented for the Site and will be the responsibility of the responsible person (current or future Site owner):

1. Inclusion of an advisory (as item (a) in clause 2 of Schedule B of any Certificate of Compliance issued for the Site) that "Site soil must remain covered by buildings or asphalt to ensure that there is no increase of terrestrial habitat that results in an overall area of exposed soil that exceeds 1000 m^2, and to provide a barrier to precipitation to minimize leaching of soil contaminants into groundwater."

   Notification to the Director is required if the subject of this advisory is breached. The listing of the risk management measure in Schedule B of the CofC meets this requirement.

2. Inclusion of an advisory (as item (b) in clause 2 of Schedule B of any Certificate of Compliance issued for the Site) that "groundwater sampling for arsenic, cadmium, chromium (VI), copper, and ammonia must be performed to monitor groundwater quality and verify plume stability as outlined in this PVP, and must include the following: 1) Select monitoring wells, as indicated in this PVP, must be sampled twice a year (dry and wet season) for two years at high and low water table. Groundwater levels must be measured in every well during each sampling event to determine seasonal effects. All groundwater samples must be analyzed for redox, dissolved metals, and ammonia. 2) Following completion of the 2-year groundwater sampling, evaluate groundwater seasonality and impacts on arsenic, cadmium, chromium (VI), copper, and ammonia concentrations. Identify the season that results in highest arsenic, cadmium, chromium (VI), copper, and ammonia concentrations. 3) Thereafter, continue with annual arsenic, cadmium, chromium (VI), copper, and ammonia sampling and groundwater measurement for an additional 10 years during the season that corresponds with the highest arsenic, cadmium, chromium (VI), copper, and ammonia concentrations. 4) Evaluate data every year and perform trend analysis at least every 5 years. 5) Following completion of the 10-year sampling period, evaluate groundwater results and trends and consult an Approved Professional regarding adequacy of sampling procedures. 6) In the event of changes of Site conditions (e.g., removal of the existing structures or portions of asphalt), assess the potential effects of the changes, which may include re-evaluation of the HHERA conclusions or PVP requirements, and/or returning to more frequent sampling.

   Notification to the Director is required if the subject of this advisory is breached. The listing of the risk management measure in Schedule B of the CofC meets this requirement.

In summary, it is considered that the advisories listed in Schedule B of the CofC are sufficient to ensure performance verification of the risk management measures required for the Site.

5.0 SUMMARY RATIONALE FOR SELECTING REQUIRED PVP ELEMENTS

The Site is classified as a Risk-Based Remediation Type 2 Site on the basis that the Site meets risk-based standards under current and future site circumstances with an engineering control (asphalt cover) in place. The rationale for selecting required PVP elements are briefly discussed below.

Risk assessment was performed assuming that the Site's ground cover (including buildings as currently configured) will remain unchanged for the future. As the majority of the Site is covered by asphalt and structures, the areas affected by contamination do not meet the MOE (MOE, 2008) Protocol 13 – Screening Level Risk Assessment definition of potential terrestrial habitat (i.e., for IL land use, there is an absence of ≥1000 m^2 of contiguous uncovered soil). Based on current surface soil data and assumptions used in the risk assessment, no complete pathways were identified for terrestrial ecological receptors. However, should Site conditions change and the area of exposed ground surface was to exceed 1000 m^2, the Site would meet the Protocol 13 definition of potential terrestrial habitat and possibly be able to sustain a population of terrestrial receptors. This potential change in Site condition would require additional soil characterization to determine potential risk to terrestrial receptors. Also, the exposure transport pathway of soil leaching to groundwater is incomplete due to the surface cover. If portions or all of the surface cover is removed, COPCs in surface soil may leach to groundwater. To ensure, that the conditions at the Site do not change in the future, the requirement in the PVP that surface soil must remain covered was included as a risk management measure in Schedule B of the CofC.

There are no surface water bodies at the Site; however, the Fraser River is located approximately 200 m down-gradient in the direction of groundwater flow. Arsenic, cadmium, chromium (VI), copper, and ammonia were identified as COPCs in groundwater at the Site. Arsenic, cadmium, chromium (VI), copper, and ammonia are considered to be delineated and stable and therefore, the groundwater-to-surface water pathway was considered incomplete and insignificant for aquatic receptors exposure to COPCs in groundwater discharging to surface water. Due to the source soil remaining on the Site, groundwater monitoring of Site conditions was included as a risk management measure in Schedule B of the CofC.

6.0 RECORD KEEPING

Up-to-date records of the above performance verification monitoring actions and results should be maintained by the responsible person (current or future Site owner), and must be provided to the BC MOE if requested by a Director designated under the Environmental Management Act.

Examples of the records to be kept on file include:

- Record/report documenting analytical results for each monitoring event including groundwater depths measurements, trends analysis, etc., must be retained.
- A copy of the Approved Professional statement prepared annually regarding the Site's condition. The letter must also be submitted to the MOE.
- Notification on file when a condition of the PVP has been breached (e.g., breach of the pavement integrity or building demolition).
- Notification on file and records related to when a breached condition has been rectified.
- Records, including copies, of communication with the Site owner/operator related to performance verification actions undertaken for the Site.
- Records of any notifications provided to the Director and any subsequent communication received from the Director related to a breach of a performance verification action.

7.0 REFERENCES

MOE. BC Ministry of the Environment. 2014. British Columbia Ministry of the Environment. Administrative Guidance 14: *Performance Verification Plans, Contingency Plans and Operations and Maintenance Plans*. February 2014. Version 1.0.

MOE. BC Ministry of the Environment. 2008. *Protocol 13 – Screening Level Risk Assessment.* August 1, 2008.

SLR, 2016a. *Performance Verification Plan. 18946 98th Avenue, Surrey, BC. Blake, Cassels, Graydon LLP.* July 27, 2016

SLR, 2016b. *Human Health and Ecological Risk Assessment. Blake, Cassels, Graydon LLP. 9697 190th Street, Surrey, BC.* July 27, 2016.

SLR, 2016c. *Stage 1 Preliminary Site Investigation and Detailed Site Investigation. Blake, Cassels, Graydon LLP. 9697 190th Street, Surrey, BC.* July 27, 2016.

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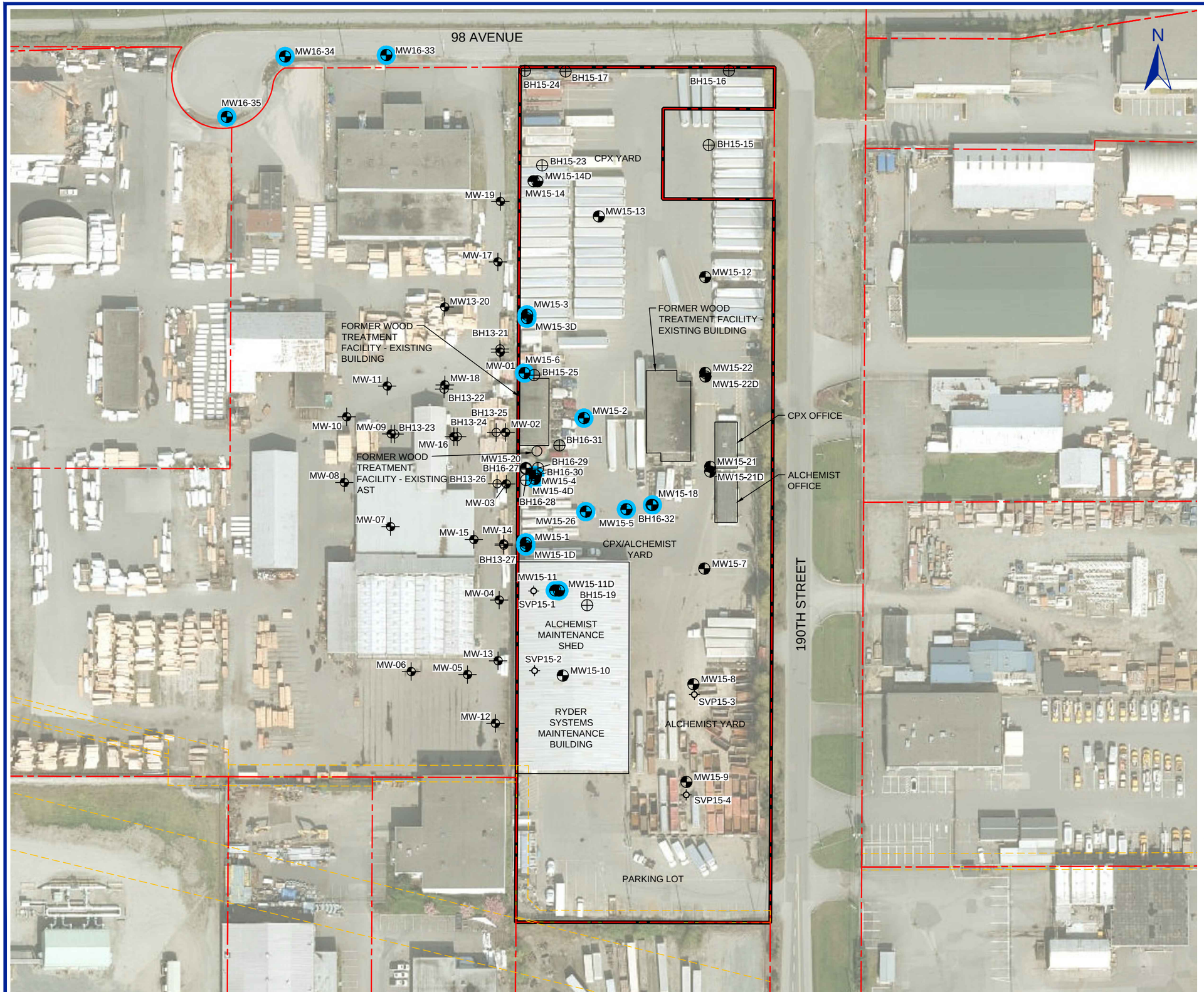
DRAWING

Performance Verification Plan
9697 190th Street, Surrey, BC
SLR Project No.: 201.88602.00000



NOTES:
REFERENCED FROM: CITY OF SURREY OPEN DATA PROPERTY DATASET, COSMOS CITY OF SURREY MAPPING ONLINE SYSTEM, MATSON PECK & TOPLISS SURVEYORS AND ENGINEERS SURVEY (2015), FILE: S-15-17848-MW AND SITE RECONNAISSANCE INFORMATION.

IMAGERY: GOOGLE © 2015 DIGITAL GLOBE (IMAGE DATE: 2015)

LEGAL DESCRIPTION:
LOT 22 PLAN 3736 PID 010996125
SURREY, BC

LEGEND:

- PROPERTY BOUNDARY
- RIGHT-OF-WAY
- SITE BOUNDARY
- BOREHOLE LOCATION
- BOREHOLE LOCATION (SYNERGYASPEN)
- BOREHOLE LOCATION COMPLETED AS A MONITORING WELL
- BOREHOLE LOCATION COMPLETED AS A MONITORING WELL (SYNERGYASPEN)
- SOIL VAPOUR PROBE LOCATION
- GROUNDWATER MONITORING AND SAMPLING LOCATIONS

0 10 20 40 60 80 m

SCALE 1:1,250
WHEN PLOTTED CORRECTLY ON A 11 x 17 PAGE LAYOUT
NAD 1983 UTM Zone 10N

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

BLAKE, CASSELS & GRAYDON LLP
9697 - 190TH STREET
SURREY, BC

PERFORMANCE VERIFICATION PLAN

SITE PLAN - GROUNDWATER MONITORING AND SAMPLING LOCATIONS

Date: July 13, 2016
Project No. 201.88602.00000
Drawing No. 1

SLR global environmental solutions

Cadfile name: S_201-88602-00000-A8.dwg

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