MONTHLY UPDATE REPORT - PRIMROSE SOUTH
09-21-067-04 W4M

MAY 19 TO JUNE 22, 2015

1 Introduction

The Canadian Natural Resources Limited Primrose South in situ oil sands project is located in the Cold Lake Air Weapons Range (CLAWR) approximately 65 km north-northeast of Bonnyville, Alberta. Canadian Natural operations staff discovered a bitumen emulsion flow to surface (FTS) area at 09-21-067-04 W4M on June 24, 2013. The bitumen emulsion FTS area is beneath an unnamed water body located within the Canadian Natural Primrose South production area.

On September 24, 2013, Alberta Environment and Sustainable Resource Development (currently Alberta Environment and Parks) issued an Environmental Protection Order (EPO No. EPO-2013-33/NR), requesting the preparation of a Comprehensive Remedial Plan (CRP), as well as the preparation of a monthly progress report. This report addresses the requirement of the progress report and includes data collected and reported between May 19 and 23, 2015 and June 8 and 22, 2015. The gap in the data was because access to the CLAWR was suspended between May 23 and June 8, 2015, due to safety concerns resulting from wildfire activity in the area. No field data was collected or reported during this time period.

2 Summary of Activities to Date

2.1 Individual Plan Submissions

As required by the EPO, the CRP includes the development, submission, and implementation of several specific work plans. As of June 22, 2015, the status of these plans has not changed.

3 Water Body Monitoring

In accordance with the Water Body Restoration Plan, an extensive water quality and water quantity monitoring program was implemented on March 19, 2014. Monitoring as part of this plan complements the ongoing water quality and quantity monitoring implemented in June 2013.

Details of the monitoring programs are provided in the following subsections.

3.1 Water Quantity Monitoring

3.1.1 Basins 1, 3, and 4 and Downstream Fen

Staff gauge and water level monitoring locations are shown on Figure 1. The staff gauges have not been resurveyed since breakup and the water body elevations are approximate; these staff gauges will be resurveyed in July 2015. Staff gauges (13-SG11 and 13-SG12) were monitored on June 19, 2015. The results of the staff gauge readings and corresponding water levels for Basins 3 and 4 are shown on Appendix A. The water level within Basins 3 and 4 is approximately 699.63 +/-0.1 m above sea level.

3.2 Water Quality Monitoring

Water quality was compared to the *Environmental Quality Guidelines for Alberta Surface Waters* (ESRD 2014a). Sampling locations are shown on Figure 2.

3.2.1 Basins 1, 3, and 4 and Downstream Fen

No water quality samples were collected during the reporting period as per the approved schedule. The next sampling event is in July 2015.

3.2.2 Within Containment Structure and/or Trench Beneath Access Pad

The containment structure area is now flooded and considered to be part of the water body although the containment wall remains in place. Water quality samples were collected from within the water collection trench located beneath the access pad (East Sump C2). The trench water was tested in the laboratory and all parameters were within the applicable guidelines. This finding confirmed that the quality of water seeping into the trench from the water body meet the necessary quality requirements to allow the water to be pumped directly back into the water body (Figure 2). Water quality results are provided in Appendix B.

Laboratory analyses of water samples was carried out for benzene, toluene, ethylbenzene, and xylenes (BTEX); petroleum hydrocarbons fraction 1 (C_6-C_{10}, excluding BTEX), fraction 2 ($FC_{>10}$-C_{16}), fraction 3 ($C_{>16}$-C_{34}), and fraction 4 ($C_{>34}$); and polycyclic aromatic hydrocarbons. All water quality results were within applicable guidelines.

3.3 Aquatic Surveillance

Monitoring for bitumen emulsion and sheen within the water body was discontinued on November 8, 2014, due to freezing conditions, and restarted May 13, 2015. The weekly monitoring that was scheduled for the first month of the water body monitoring program in 2015 was interrupted due to suspended CLAWR access between May 23 and June 8, 2015. Therefore, weekly monitoring of the water body resumed on June 8, 2015 and was completed on June 19, 2015. Monthly monitoring will be implemented, as approved, going forward.

The water body was monitored three times during the reporting period (May 20, June 10, and June 19, 2015) and there were no reported occurrences of bitumen emulsion or sheen on the water body.

3.4 Erosion and Sedimentation Prevention

No activities taking place during the reporting period were expected to cause erosion or sedimentation issues and no monitoring activities were completed.

3.5 Bitumen Emulsion Containment

Construction of the fissure containment structure (FCS) is complete and regular monitoring of the bitumen emulsion recovery pipes is ongoing. No bitumen emulsion was recovered from the FCS during this reporting period.

3.6 Wildlife Management

No injured, distressed, or deceased wildlife were observed within or around the water body during this reporting period.

3.7 Waste Management

The recovery of fluids from the FCSs began on December 19, 2014. No fluid was recovered from the FCSs during this reporting period.

4 Summary

Monthly monitoring activities at the 9-21 FTS site were completed between May 19 and 23, 2015, and June 8 and 22, 2015. Access to the CLAWR was suspended between May 23 and June 8, 2015, due to safety concerns resulting from wildfire activity in the area. No field activities were completed during this time. The scheduled field activities completed over the reporting period included the following:

- water sampling from the water collection trench
- staff gauge readings in Basins 3 and 4
- bitumen emulsion monitoring on the water body

The work completed at the 9-21 site over this reporting period was routine and scheduled. The findings were as anticipated and were consistent with those for the previous reporting period.

5 References

Alberta Environment and Sustainable Resource Development (ESRD). 2014a. *Environmental Quality Guidelines for Alberta Surface Waters.* Water Policy Branch, Policy Division. Edmonton, Alberta. July 14, 2014. ISBN: 978-1-4601-1524-4. http://esrd.alberta.ca/water/education-guidelines/documents/EnvironmentalQualitySurfaceWaters-Jul14-2014.pdf

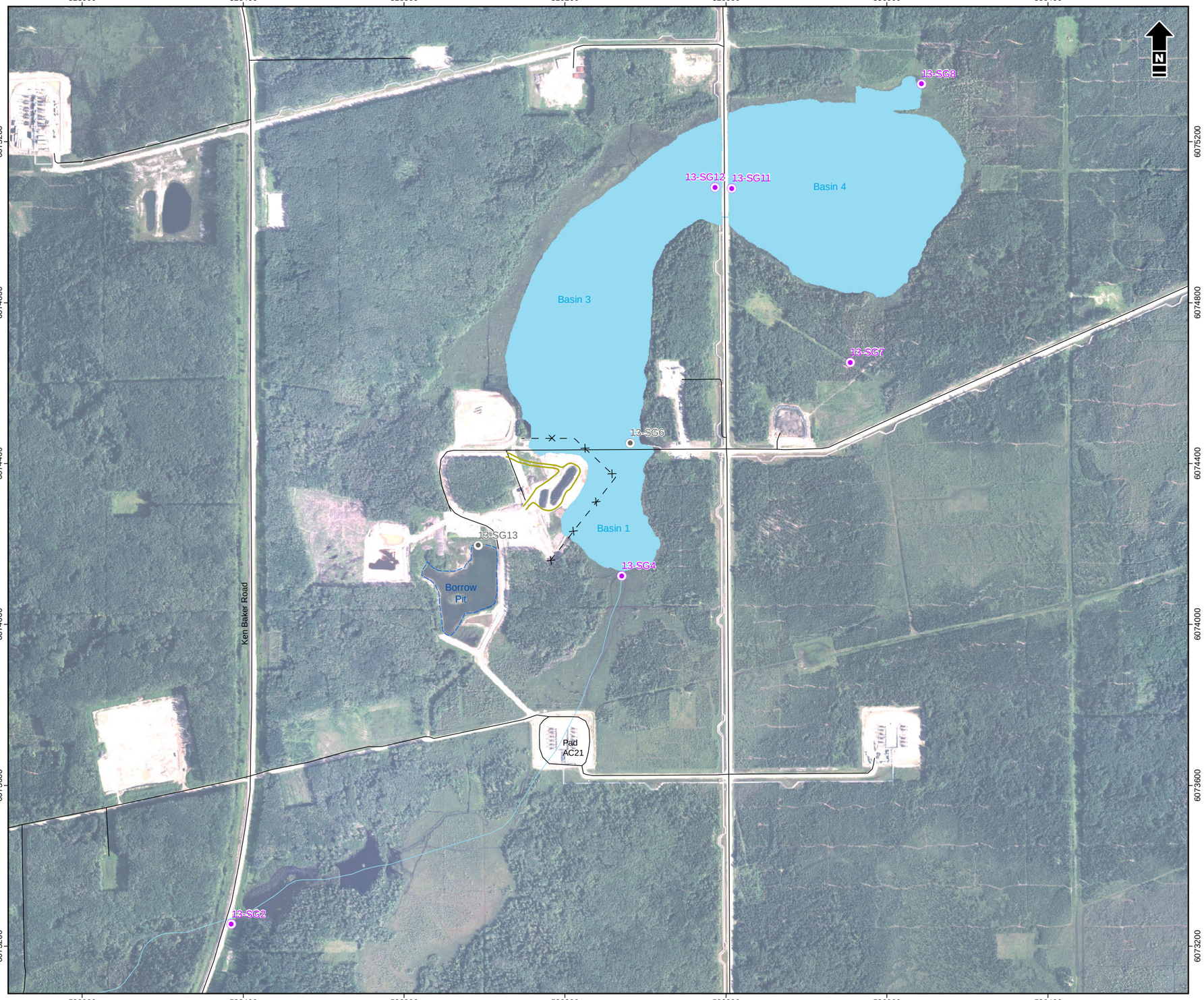
Alberta Environment and Sustainable Resource Development (ESRD). 2014b. *Alberta Tier 1 Soil and Groundwater Remediation Guidelines*. 2014 and Updates. Final Draft. Land and Forestry Policy Branch, Policy Division. Edmonton, Alberta. May 23, 2014. http://esrd.alberta.ca/lands-forests/land-industrial/inspections-and-compliance/documents/AlbertaTier1Guidelines-May23-2014.pdf

Easting (m)

528000 528400 528800 529200 529600 530000 530400

Northing (m)

6075200 6074800 6074400 6074000 6073600 6073200



- Borrow Pit
- Water Body
- Watercourse
- Road
- Containment Wall
- Top of Access Pad
- Staff Gauge Location
- Staff Gauges which were removed in Winter 2014

1:10,000 m

50 0 50 100

NAD 1983 UTM Zone 12N

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Site 9-21 Staff Gauge and Water Level Monitoring Locations

Date:	Project:	Technical:	Reviewer:	Drawn:
22 Jun 2015	8881-523	A. Ward	P. Hum	R. Witty

Figure 1

I:\Canadian Natural\8881\Figures And Tables\SP\1\2013\Report_Monthly Summary\2015\June\Public_9_21\Figure-1-Site_9_21 Staff Gauge and Water Level Monitoring Locations.mxd

- Fissure Containment Structure
- Borrow Pit
- Water Body
- Berm
- Containment Wall
- Fissure within Containment Structure
- Top of Access Pad
- Toe of Access Pad
- Bitumen Emulsion Recovery Pipe
- Flush Pipe
- Former Sump with Automated Pump
- Water Collection Trench Recovery Sump
- Phase II Shallow Monitoring Well

Deep Quaternary Monitoring Well (Screened Formation)

- Ethel Lake Formation Monitoring Well
- Sand River Formation Monitoring Well

1:1,250

10 0 10 20 m

NAD 1983 UTM Zone 12N

Reference: Site features provided through Matrix Solutions Inc. field efforts.

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Site 9-21 Containment Structure and Access Pad Layout

Date:	Project:	Technical:	Reviewer:	Drawn:
22 Jun 2015	8881-523	A. Ward	P. Hum	R. Witty

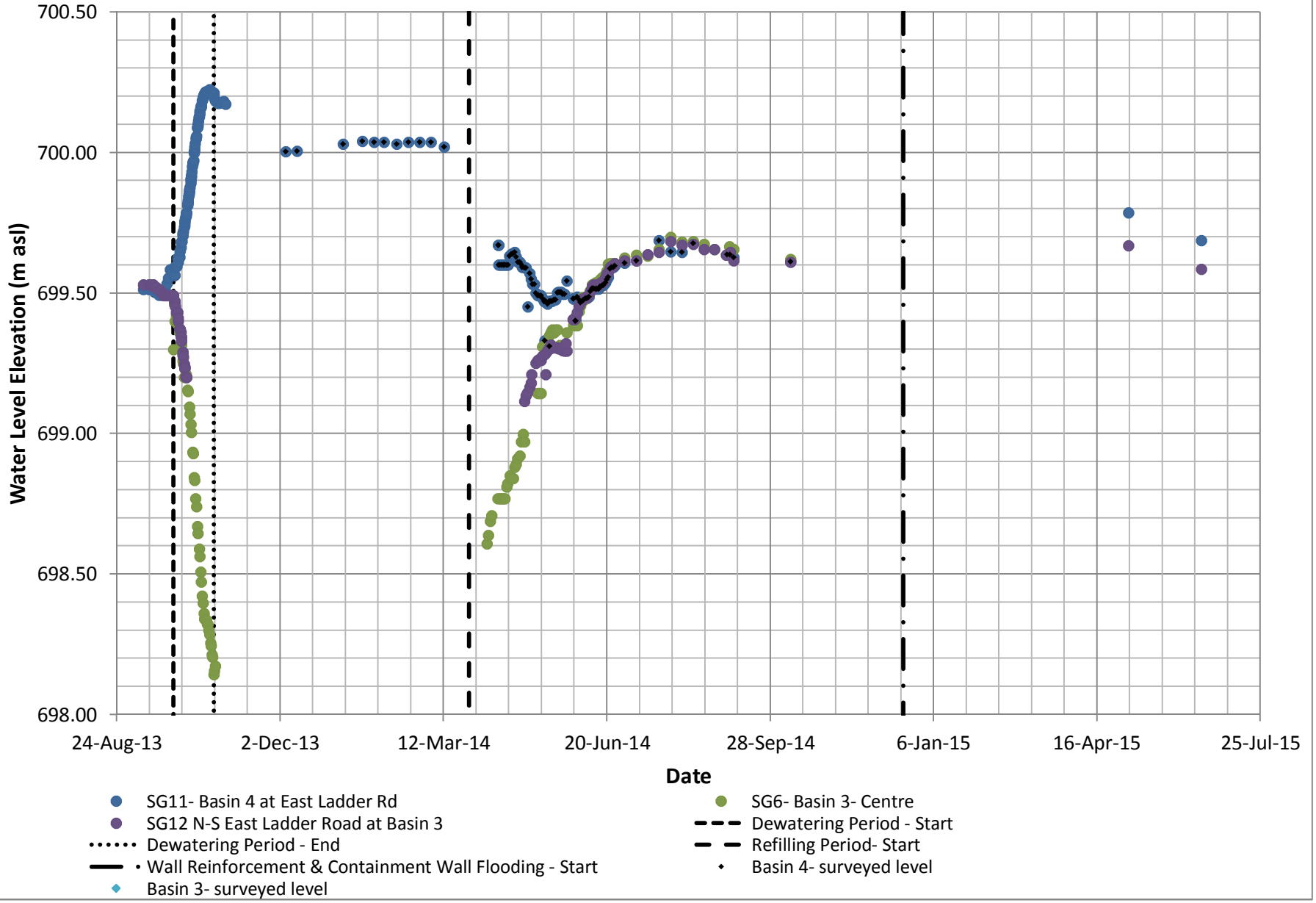
Disclaimer: The information contained herein may be compiled from numerous third party materials that are subject to periodic change without prior notification. While every effort has been made by Matrix Solutions Inc. to ensure the accuracy of the information presented at the time of publication, Matrix Solutions Inc. assumes no liability for any errors, omissions, or inaccuracies in the third party material.

Figure 2

I:\Canada\Natural\8881\Figures\and Tables\SSPL\2013\Report_Monthly\Summary\2015\June\Public_9_21\Figure-2 Site_9_21_Containment_Structure_and_Access_Pad_Layout.mxd

APPENDIX A
Water Levels

Appendix A: Water Levels at 9-21 Water Body



APPENDIX B
Water Quality Results

APPENDIX B1.

WATER QUALITY RESULTS - ROUTINE WATER CHEMISTRY

Canadian Natural Resources Limited

09-21-064-04 W4M

Sample Point	Sample Date	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO_4 mg/L	NO_2-N mg/L	NO_3-N mg/L	NO_3+NO_2-N mg/L	Total Alkalinity mg/L	HCO_3 mg/L	Hardness mg/L	TDS mg/L
East Sump C2	11-Jun-15	7.63	700	100	26	12	6.1	12	18	0.029	0.58	0.61	360	440	360	390
Minimal Detection Limit		**0.1**	**1**	**0.3**	**0.2**	**0.5**	**0.3**	**1**	**0.5**	**0.003**	**0.003**	**0.003**	**0.5**	**0.5**	**0.5**	**10**
ESRD Freshwater Aquatic Life*		**6.5-9.0^{pH}**	**NS**	**NS**	**NS**	**NS**	**NS**	**120^{LT}**	**H^{SO4}**	**Cl^{LT}**	**3^{LT}**	**NS**	**20^{Alk}**	**NS**	**NS**	**NS**
ESRD Agriculture - Irrigation*		**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**100^{crop}**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**500^{crop}**
ESRD Agriculture - Livestock*		**NS**	**NS**	**1000**	**NS**	**NS**	**NS**	**NS**	**1000**	**10**	**NS**	**100**	**NS**	**NS**	**NS**	**3000**

Notes:

--- - not analyzed

NS - not specified

^{crop} - guideline level is crop dependent; criterion shown is most stringent value

H - dependent on hardness value

Cl - dependent on chloride value

^{pH} - not to be altered by more than 0.5 units from background

^{LT} - long-term exposure guideline; see applicable guidelines for further details

^{Alk} - minimum value, unless natural conditions are less

^{SO4} - guideline level is hardness dependent; hardness values greater than 250 mg/L need to be determined based on site water

* - *Environmental Quality Guidelines for Alberta Surface Waters* (ESRD 2014)

Italics - values do not meet applicable guidelines

APPENDIX B2.

WATER QUALITY RESULTS - DISSOLVED HYDROCARBONS

Canadian Natural Resources Limited

09-21-067-04 W4M

Sample Point	Sample Date	Benzene mg/L	Toluene mg/L	Ethylbenzene mg/L	Xylenes mg/L	F1 C_6-C_{10} - BTEX mg/L	F2 $C_{>10}$-C_{16} mg/L	F3 $C_{>16}$-C_{34} mg/L	F4 $C_{>34}$-C_{50} mg/L
North Sump	04-Dec-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	---	---
South Sump	04-Dec-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	---	---
South Sump	13-Dec-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	<0.20	<0.20
South Sump	14-Dec-14	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	<0.20	<0.20
East Sump C2	19-Feb-15	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	<0.20	<0.20
East Sump C2	07-May-15	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	<0.20	<0.20
East Sump C2	11-Jun-15	<0.00040	<0.00040	<0.00040	<0.00080	<0.10	<0.10	---	---
Minimal Detection Limit		**0.0004**	**0.0004**	**0.0004**	**0.0008**	**0.1**	**0.1**	**0.2**	**0.2**
Alberta Tier 1 - Coarse Grained Soils - Natural Areas*		**$0.005^{P,MAC}$**	**$0.021^{P,AO}$**	**$0.0024^{P,AO}$**	**$0.3^{P,AO}$**	**2.2^{P}**	**1.1^{P}**	**NS**	**NS**
ESRD Freshwater Aquatic Life*		**0.04**	**0.0005**	**0.09**	**0.03**	**NS^{ST}**	**NS^{ST}**	**NS**	**NS**

Notes:

NS - not specified

^{A} - indicates guideline for Aquatic Life exposure pathway

^{P} - indicates guideline for Potable Groundwater exposure pathway

^{AO} - aesthetic objective

^{MAC} - maximum acceptable concentration based on health effects

ST - see applicable guidelines for short-term exposure guideline

* - *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (ESRD 2014)

** - *Environmental Quality Guidelines for Alberta Surface Waters* (ESRD 2014)

Italics - values do not meet applicable ESRD guidelines

APPENDIX B3.

WATER QUALITY RESULTS - POLYCYCLIC AROMATIC HYDROCARBONS

Canadian Natural Resources Limited

09-21-067-04 W4M

Sample Point	Date	Acenaphthene µg/L	Acenaphthylene µg/L	Acridine µg/L	Anthracene µg/L	Benz[a]anthracene µg/L	Benzo[b+j]fluoranthene µg/L	Benzo[k]fluoranthene µg/L	Benzo[g,h,i]perylene µg/L	Benzo[c]phenanthrene µg/L	Benzo[a]pyrene µg/L	Benzo[e]pyrene µg/L	Chrysene µg/L	Dibenz[a,h]anthracene µg/L	Fluoranthene µg/L	Fluorene µg/L	Indeno[1,2,3-cd]pyrene µg/L	Naphthalene µg/L	2-Methylnaphthalene µg/L	Perylene µg/L	Phenanthrene µg/L	Pyrene µg/L	Quinoline µg/L	TOTAL PAH µg/L
North Sump	04-Dec-14	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	ND
South Sump	04-Dec-14	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	ND
South Sump	13-Dec-14	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	<0.10	0.15	<0.050	<0.050	***0.026***	<0.20	0.176
South Sump	14-Dec-14	<0.11	<0.11	<0.22	<0.011	<0.0093	<0.0093	<0.0093	<0.0093	<0.055	<0.0082	<0.055	<0.0093	<0.0082	<0.011	<0.055	<0.0093	<0.11	<0.11	<0.055	<0.055	<0.022	<0.22	ND
East Sump C2	19-Feb-15	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	ND
East Sump C2	07-May-15	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	ND
East Sump C2	11-Jun-15	<0.10	<0.10	<0.20	<0.010	<0.0085	<0.0085	<0.0085	<0.0085	<0.050	<0.0075	<0.050	<0.0085	<0.0075	<0.010	<0.050	<0.0085	<0.10	<0.10	<0.050	<0.050	<0.020	<0.20	ND
Minimal Detection Limit		**0.1**	**0.1**	**0.2**	**0.01**	**0.0085**	**0.0085**	**0.0085**	**0.0085**	**0.05**	**0.0075**	**0.05**	**0.0085**	**0.0075**	**0.01**	**0.05**	**0.0085**	**0.1**	**0.1**	**0.05**	**0.05**	**0.02**	**0.2**	**-**
Alberta Tier 1 - Coarse Grained Soils - Natural Areas*		**5.8[A]**	**NS**	**NS**	**0.012[A]**	**0.018[A]**	**0.48[A]**	**NS**	**NS**	**NS**	**0.015[A]**	**NS**	**NS**	**NS**	**0.04[A]**	**3[A]**	**NS**	**1[A]**	**NS**	**NS**	**0.4[A]**	**0.025[A]**	**NS**	**NS**
ESRD Freshwater Aquatic Life*		**5.8**	**NS**	**4.4**	**0.012**	**0.018**	**NS**	**NS**	**NS**	**NS**	**0.015**	**NS**	**NS**	**NS**	**0.04**	**3**	**NS**	**1**	**NS**	**NS**	**0.4**	**0.025**	**3.4**	**NS**

Notes:

--- - not analyzed

ND - not detected

NS - not specified

A - indicates guideline for Aquatic Life exposure pathway

P - indicates guideline for Potable Groundwater exposure pathway

* - *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (ESRD 2014)

** - *Environmental Quality Guidelines for Alberta Surface Waters* (ESRD 2014)

Italics - values do not meet applicable ESRD guidelines