

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

SEPTEMBER 22 TO OCTOBER 19, 2015

1 Introduction

The Canadian Natural Resources Limited Primrose South in situ oil sands project is located in the Cold Lake Air Weapons Range 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 along the west shoreline and 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) to address environmental issues related to the FTS area. Requirements of the EPO included the preparation of a Comprehensive Remedial Plan (CRP), as well as the preparation of a monthly progress report in connection with the assessment and remediation efforts carried out at the FTS site. This report addresses the requirement of the progress report and includes data collected and reported between September 22 and October 19, 2015.

2 Summary of Activities to Date

2.1 Individual Plan Submissions

As required by the EPO, the CRP included the development, submission, and implementation of several specific work plans. As of October 19, 2015, the status of these plans has not changed from that reported for the previous reporting period.

2.2 2015 Wall Removal/Water Body Dewatering

As part of the water body restoration phase of the EPO, the containment wall within the water body requires removal. In order to allow for the removal of the containment wall during the winter of 2015/2016 the water body was dewatered between September 26 and October 15, 2015. The water is being stored for refilling of the water body in spring of 2016.

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 Fen

Staff gauges were monitored daily, throughout and following dewatering which took place from September 25 to October 16, 2015 at all locations (Figure 1). The 15-SG6 staff gauge was dry as of

October 10, 2015 and 15-SG12 staff gauge was dry as of October 1, 2015; and no subsequent readings could be taken. The results of the staff gauge readings and corresponding water elevations for Basins 3 and 4 are shown in Appendix A1. The results of the staff gauge readings and corresponding water elevations for the fen located south and west of the water body are shown in Appendix A2. The increased water levels at 15-SG2, measured since June 2015, were determined to have been caused by a beaver dam constructed near the staff gauge location.

3.2 Water Quality Monitoring

Water quality was compared to the *Environmental Quality Guidelines for Alberta Surface Waters* (ESRD 2014). Sampling locations are shown on Figures 2 and 3.

3.2.1 Basins 1, 3, and 4, and Fen

No routine water quality samples were collected during the reporting period as per the approved schedule. The next sampling event is scheduled for Spring 2016.

3.2.2 Within Containment Structure

The area inside the containment wall was dewatered during the reporting period. No water levels or water quality samples were collected from within the containment area prior to dewatering.

3.2.3 Aquatic Surveillance

The water body as well as the discharge and storage areas associated with dewatering were monitored daily from September 22 to October 16, 2015. There were no reported occurrences of bitumen emulsion or sheen on the water body with the exception of a small volume (~150 mL) of bitumen emulsion that was observed in Basin 3 on October 15, 2015 that was likely residual bitumen emulsion from that released in June 2013. The observed bitumen emulsion was attached to vegetation and was collected in a glass sample jar and disposed of in the onsite hazardous waste bin.

On October 16, 2015, one water quality sample was collected from within Basin 3 in the vicinity of the bitumen emulsion found the previous day (15-SW82) and a second sample from within the discharge location into Basin 4 (15-SW83; Figure 2). All water quality results were less than laboratory detection limits. Laboratory analysis of the water samples collected from within Basin 3 and discharge area to Basin 4 were tested in the laboratory for benzene, toluene, ethylbenzene, and xylenes (BTEX); petroleum hydrocarbons fraction 1 (C₆-C₁₀, excluding BTEX) and fraction 2 (C_{>10}-C₁₆); and polycyclic aromatic hydrocarbons. The findings are provided in Appendix B.

4 Erosion and Sedimentation Prevention

Erosion and Sediment Control (ESC) monitoring was conducted as part of the dewatering activities. ESC control structures were put in place at each discharge location and daily monitoring was conducted between September 26 and October 16, 2015, to assess potential erosion and sedimentation and to determine whether the control structures were adequate to attenuate flows. Field turbidity measurements were also taken. No signs of erosion or sedimentation were noted. .

5 Bitumen Emulsion Containment

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

6 Wildlife Management

Amphibian and muskrat monitoring activities related to the dewatering program were conducted throughout the reporting period. No amphibians were observed and all muskrats observed within the water body have moved to nearby water bodies.

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.

8 Summary

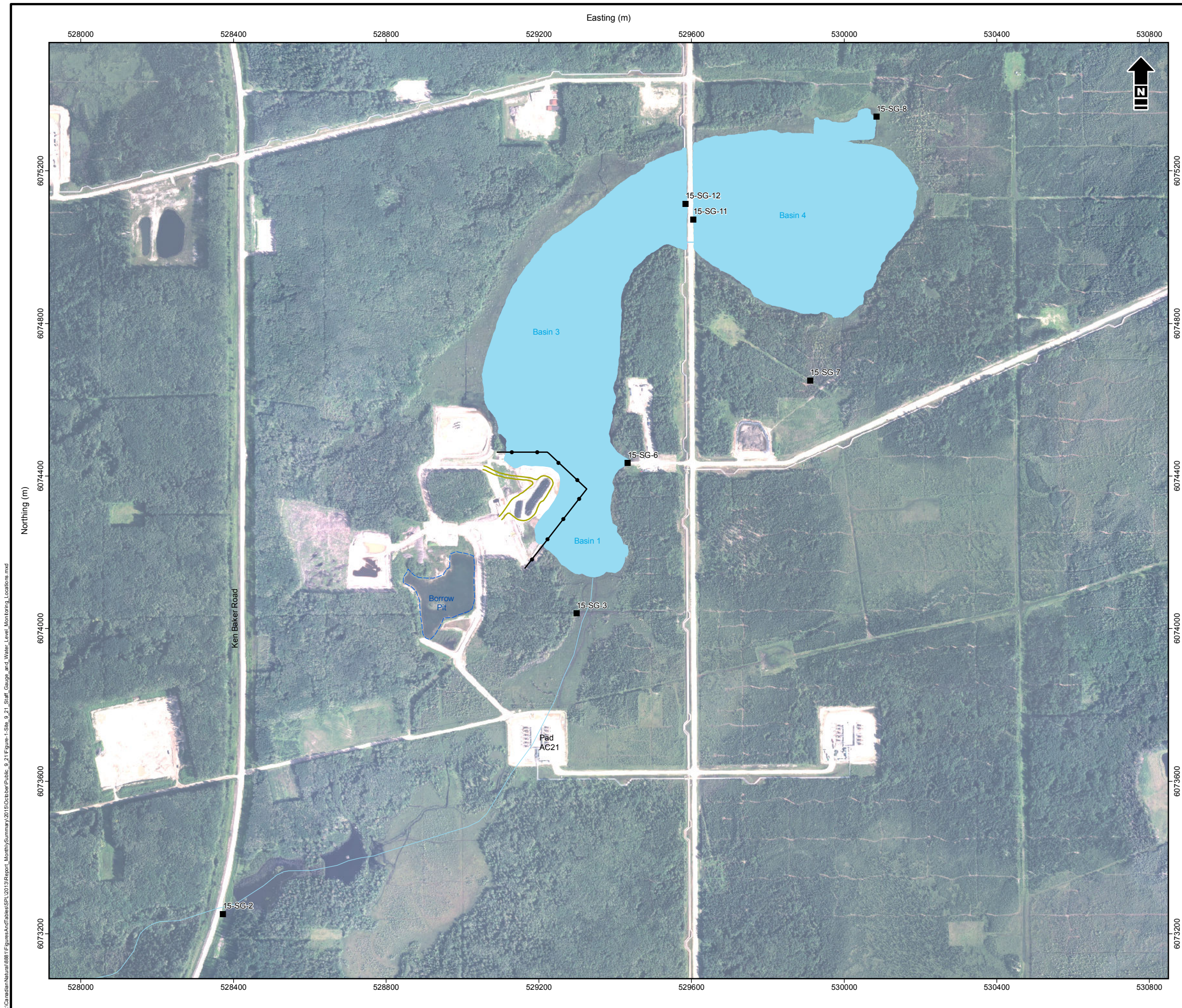
Monthly monitoring activities at the 9-21 FTS site were completed between September 22 and October 19, 2015. The scheduled field activities completed over the reporting period included the following:

- dewatering from within the Basin 1, Basin 3 and the containment area, and storage of water for later backfilling of the water body
- bitumen emulsion monitoring on the water body and related surface water quality sampling within the water body
- monitoring of water quantity and discharge point erosion and sedimentation during dewatering activities
- staff gauge surveying and water level readings in the water body and fen
- monitoring wildlife activity near the water body (amphibians and muskrats)

The water body was dewatered in preparation for containment wall removal. Other 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 periods.

9 Reference

Alberta Environment and Sustainable Resource Development (ESRD). 2014. *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-2014.pdf>



- Water Body
- Watercourse
- Containment Wall
- Top of Access Pad
- Staff Gauge Location

Reference: Data obtained from Atlas LIS © Government of Alberta and GeoBase® used under license. Site features provided through Matrix Solutions Inc. field efforts. Imagery (dated August 2014) obtained from Canadian Natural Resources Limited (September 2014) used under license.

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 NAD 1983 UTM Zone 12N



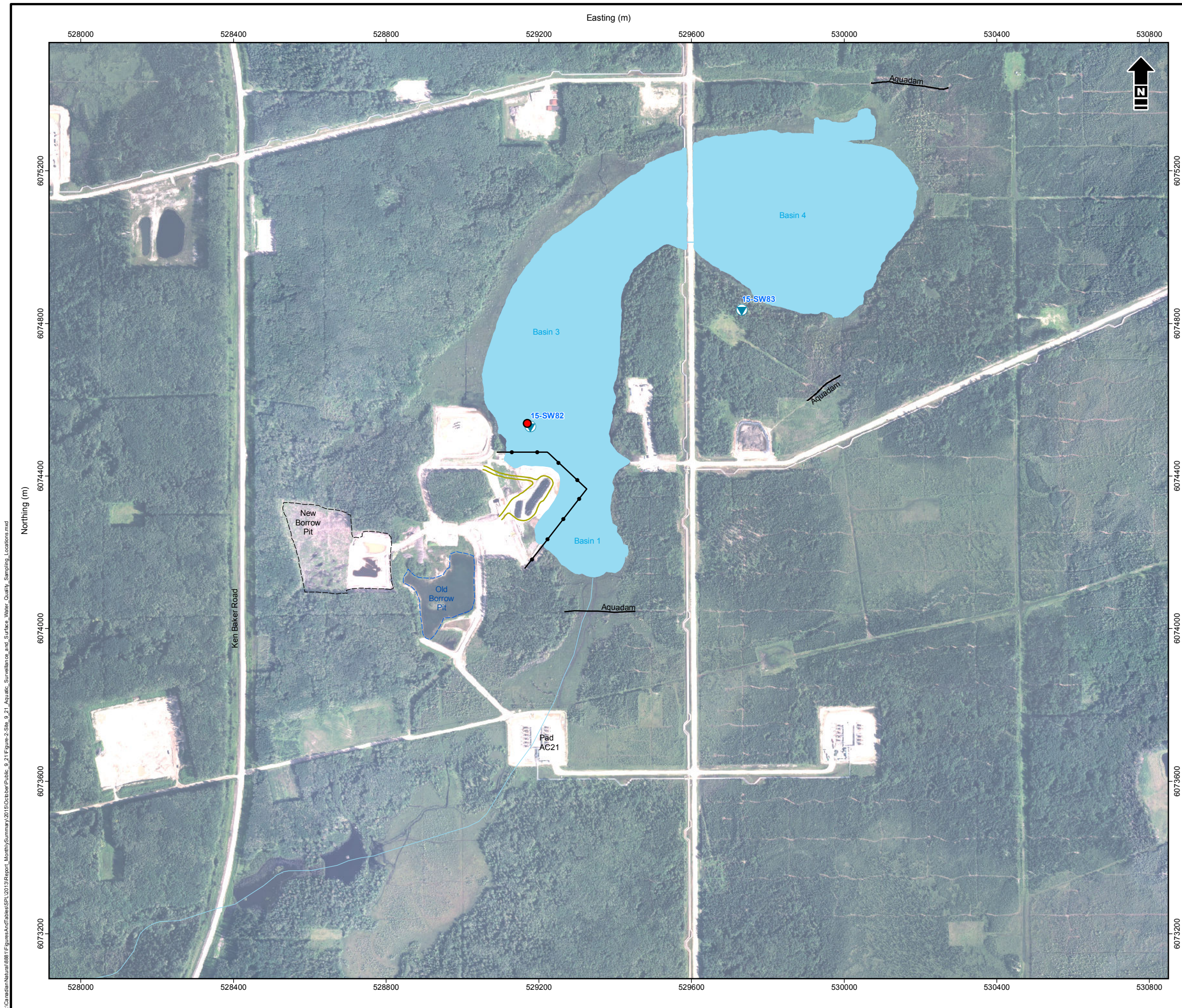
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Site 9-21 Staff Gauge and Water Level Monitoring Locations

Date: 23 Oct 2015 Project: 8881-523 Technical: E. Henson Reviewer: H. de Pennart Drawn: R. Keller

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- Water Body
- Watercourse
- Containment Wall
- Top of Access Pad
- Bitumen Emulsion Pellet
- ▼ Surface Water Sample Location

Reference: Data obtained from Atlas LIS © Government of Alberta and GeoBase® used under license. Site features provided through Matrix Solutions Inc. field efforts; Imagery (dated August 2014) obtained from Canadian Natural Resources Limited (September 2014) used under license.

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 NAD 1983 UTM Zone 12N



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**Site 9-21 Aquatic Surveillance and
 Surface Water Quality Sampling Locations**

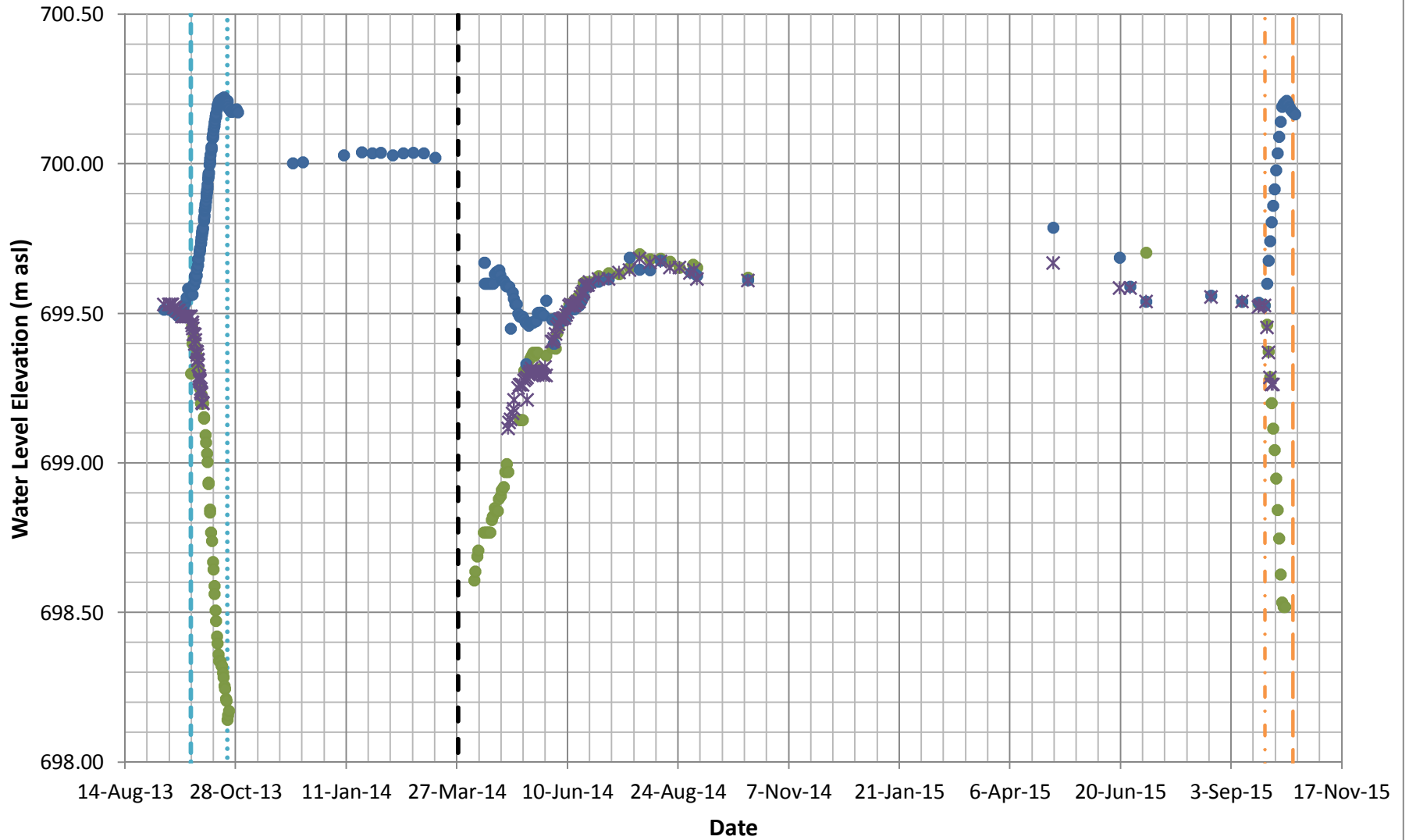
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|--|-------------------|----------------------|-------------------------|------------------|
| Date: 23 Oct 2015 | Project: 8881-522 | Technical: E. Henson | Reviewer: H. de Pennart | Drawn: R. Keller |
| <small>Disclaimer: The information contained 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.</small> | | | | Figure 2 |

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APPENDIX A

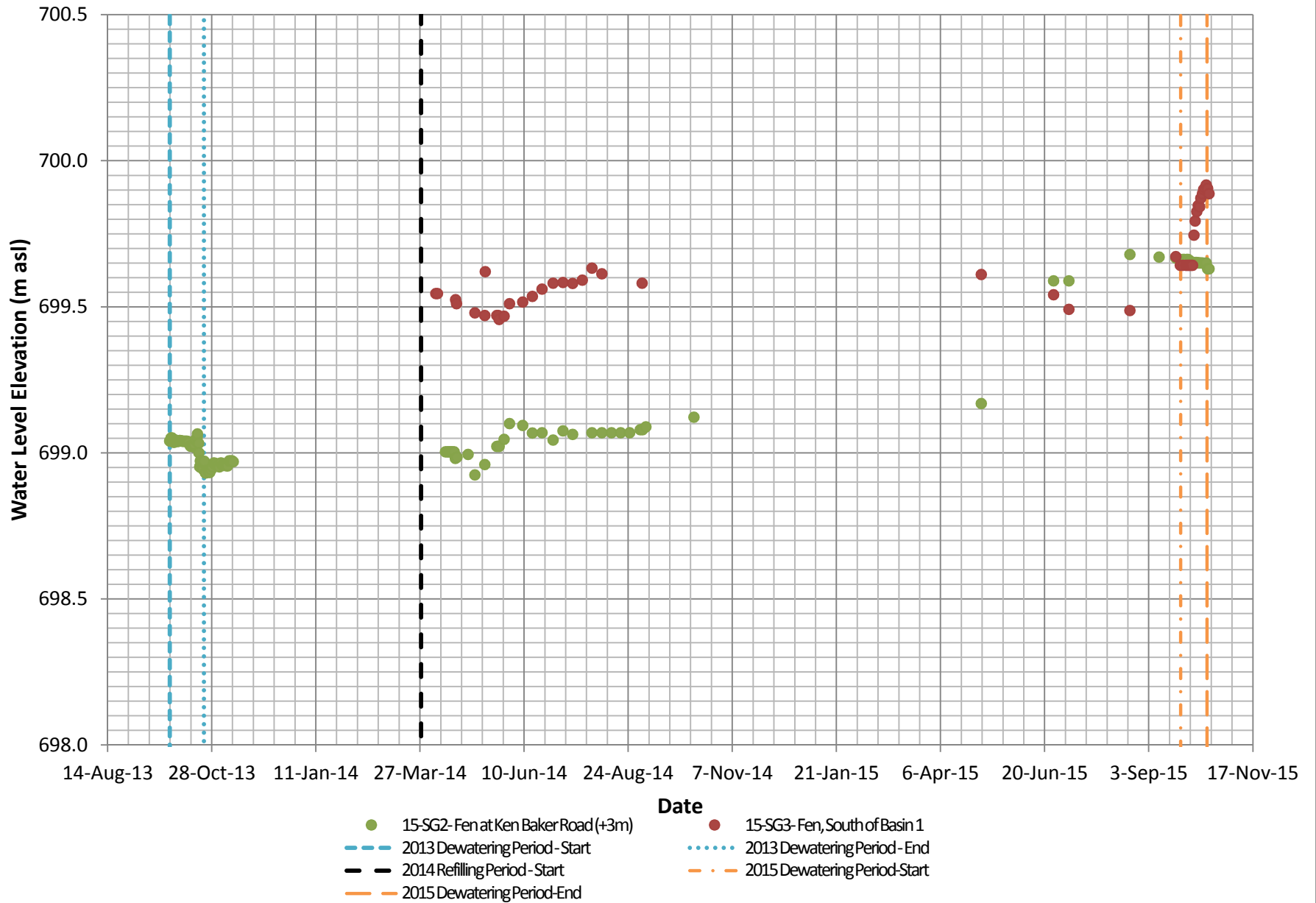
Water Levels

Appendix A1: Water Levels at 9-21 Water Body



- 15-SG6- Basin 3- Centre
- 15-SG11- Basin 4 at East Ladder Rd
- × 15-SG12 N-S East Ladder Road at Basin 3
- - - 2013 Dewatering Period - Start
- ⋯ 2013 Dewatering Period - End
- - - 2014 Refilling Period- Start
- . - 2015 Dewatering Period-Start
- - - 2015 Dewatering Period-End

Appendix A2: Water Levels in the Downstream Fen



APPENDIX B

Water Quality Results

APPENDIX B1.

SURFACE WATER QUALITY RESULTS - DISSOLVED HYDROCARBONS

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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 |
|---------------------------------------|-------------|--------------|---------------|-------------------|--------------|--|--|--|--|
| Basin 3 15-SW82 | 16-Oct-15 | <0.00040 | <0.00040 | <0.00040 | <0.00080 | <0.10 | <0.10 | --- | --- |
| Basin 4 15-SW83 | 16-Oct-15 | <0.00040 | <0.00040 | <0.00040 | <0.00080 | <0.10 | <0.10 | --- | --- |
| ESRD Freshwater Aquatic Life* | | 0.04 | 0.0005 | 0.09 | 0.03 | NSST | NSST | NS | NS |
| ESRD Agriculture - Irrigation* | | NS | NS | NS | NS | NS | NS | NS | NS |
| ESRD Agriculture - Livestock* | | NS | 0.024 | 0.0024 | NS | NS | NS | NS | NS |

Notes:

--- - not analyzed

NS - guideline not specified

ST - see applicable guidelines for short-term exposure guideline

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

Italics - indicates values do not meet applicable guidelines

APPENDIX B2.

SURFACE WATER QUALITY RESULTS - POLYCYCLIC AROMATIC HYDROCARBONS

Canadian Natural Resources Limited

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| Sample Point | Date | Acenaphthene µg/L | Acenaphthylene µg/L | Acridine µg/L | Anthracene µg/L | Benzo[a]anthracene µg/L | Benzo[b+g]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 |
|--------------------------------|-----------|----------------------|------------------------|------------------|--------------------|----------------------------|--------------------------------|------------------------------|------------------------------|------------------------------|------------------------|------------------------|------------------|-------------------------------|----------------------|------------------|--------------------------------|---------------------|-----------------------------|------------------|----------------------|----------------|-------------------|-------------------|
| Basin 3 15-SW82 | 16-Oct-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 |
| Basin 4 15-SW83 | 16-Oct-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 |
| 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 |
| ESRD Agriculture - Irrigation* | | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| ESRD Agriculture - Livestock* | | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

Notes:

--- - not analyzed

NS - not specified

ND - not detected

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

Italics - indicates values do not meet applicable guidelines