INTRODUCTION

DEVELOPMENT OVERVIEW

SUBSURFACE

- Geoscience
- 4-D Seismic & Monitoring
- Well Design & Instrumentation
- Scheme Performance
- Future Plans

SURFACE OPERATIONS & COMPLIANCE

- Facilities
- Measurement & Reporting
- Facility Performance
- Water Production, Injection & Uses
- Sulphur Production
- Future Plans
- Compliance
PROJECT DETAILS

- First steam September 2010
- Approved processing capacity 40,000 bbl/d
- 7 producing pads
  - 40 horizontal well pairs
  - 13 infill wells
- Approved for development
  - Pad 8 (14 well pairs)
  - Pad 6 infills (4 infills)
  - L7P6 (1 well pair)

INFRASTRUCTURE

- Fuel gas from TransCanada Pipeline (TCPL)
- Dilbit export to Enbridge Cheecham Terminal
- Diluent supply from Enbridge Cheecham Terminal
SURFACE DATA OVERVIEW

GEOSCIENCE DATA ACQUIRED ON 4 WELLS DURING THE REPORTING PERIOD

- Core and petrophysics completed on 4 wells in Pad 7 drainage area

<table>
<thead>
<tr>
<th>Area</th>
<th>Area (km²)</th>
<th>Cored Wells</th>
<th>Image Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lease Area</td>
<td>326</td>
<td>370</td>
<td>625</td>
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<tr>
<td>Development Area</td>
<td>37.4</td>
<td>145</td>
<td>244</td>
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</tbody>
</table>
STRATIGRAPHY AND REFERENCE WELL

AOC Lease Area
Development Area
Pad Drainage Area
Type Well (00/09-33-078-10W4)
SAGD Well-Pair
Infill Well

SAGD PRODUCING WELLPAIRS

UNDIFFERENTIATED QUATERNARY GLACIAL DRIFT & TILL

GRAND RAPIDS FM
- Lower Grand Rapids
- Clearwater Sand
- Upper Grand Rapids

CLEARWATER FM
- Wabiskaw
- Upper Clearwater
- Middle Clearwater
- Lower Clearwater

MCMURRAY FM
- Upper Mcmurray
- Middle Mcmurray
- Lower Mcmurray

BEAVERHILL LAKE GROUP
- Devonian

FACIES
- Sand
- Sandy IHS
- Muddy IHS
- Mudstone
- Limestone

DEPTH (m SSTVD)
SEISMIC
PEAK
TROUGH
HIGH
LOW
RESISTIVITY
HIGH
LOW

Left-Gamma Ray
Right-Resistivity

Depth (m SSTVD)

100/09-33-078-10
Wabiskaw
McMurray

GBIP Base
GBIP Top

Limestone
Mudstone
Muddy IHS
Sandy IHS
Sand

1:130009
GROSS BITUMEN IN PLACE (GBIP)

- GBIP represents the total pay interval accessible via SAGD
- Petrophysical criteria:
  - Gamma Ray (GR) \( \leq 75 \) API
  - Resistivity (RT) \( \geq 40 \text{ ohm-m} \)
  - Porosity (DPSS) \( \geq 27\% \)
- Non-reservoir lithofacies (F6–F7) excluded if greater than 2m

ELEVATION RANGE

- 202 - 241 masl
DEVELOPABLE BITUMEN IN PLACE (DBIP)

- DBIP has the same petrophysical properties as GBIP but is restricted to higher quality lithofacies:
  - F1: Shale-Clast Breccia (if <5m)
  - F2: Trough Cross-Beded Sand
  - F3: Current-Ripple Laminated Sand
  - F4A-B: Sand with 5–10% Mud Interbeds

ELEVATION RANGE

- 202 - 237 masl
TOP STRUCTURE MAP

Elevation Range 202 - 241 masl
BASE STRUCTURE MAP

Elevation Range 193 - 231 masl
BOTTOM WATER THICKNESS MAP

Elevation Range 191 - 213 masl
TOP GAS THICKNESS MAP

MINIMAL GAS THICKNESS AND LIMITED DISTRIBUTION WITHIN DEVELOPMENT AREA

Elevation Range 221-253 masl
2019
o No new caprock core, mini-frac or tri-axial testing completed during the reporting period

HISTORICAL
o Caprock defined as the Clearwater Formation
   • Includes regionally continuous shale of the Wabiskaw Member
   • Mini-frac tests completed at two locations (01-04-079-10W4, 01-28-078-10W4)
o Approved maximum operating pressure is 5,500 kPag
o All injectors operating at ~ 3,000 - 3,300 kPag

SURFACE HEAVE MONITORING
o No new data acquired during reporting period
RESERVOIR PROPERTIES

- Original Reservoir Pressure: 2,300 to 2,600 kPa
- Original Reservoir Temperature: 14°C
- Average Horizontal Permeability: 5 to 6 D
- Average Vertical Permeability: 4 to 5 D
- Depth: 410 to 444 m TVD (-230 to -216 m subsea)
SUBSURFACE
4D SEISMIC & MONITORING
SEISMIC ACQUISITION HISTORY

2020
- Pads 1-6 4D seismic acquisition conducted in Q1

2019
- No new data acquired during the reporting period

HISTORICAL
- Q1 2016: 2.0 km² first 4D survey for Pad 5
- Q1 2015: 9.0 km² 3D survey
  - Third 4D repeat survey (2.2 km² active SAGD Pads 1 & 2)
  - Repeat 3D seismic for higher resolution data
- Q1 2014: 2.1 km² 4D survey (active SAGD Pads 3 & 4)
- Q1 2013: 4.5 km² 3D survey
  - Second repeat survey (4.9 km² of active SAGD Pads 1–4)
- Q1 2012: 8.6 km² 3D survey
  - First 4D survey (4.9 km² of active SAGD Pads 1–4)
  - New baseline survey for Pads 5 and 6 (3.7 km²)
- Q1 2009: 4.9 km² baseline survey (pre-steam) Pads 1–4
RESERVOIR SATURATION LOGGING

2020

- Repeat saturation logs conducted in Q1
  - Pads 1-6 (8 total)
  - Pad 8 (7 total)

2019

- 1 baseline saturation log acquired (Pad 7) during reporting period

HISTORICAL

- Baseline acquired in 2010 - 23 wells
- 2011 - 18 wells
- 2012 - 7 wells
- 2013 - 12 wells
- 2014 - 11 wells
- 2015 - 6 wells
- 2018 - 13 wells
- Saturation log results show steam chamber thickness correlates with observation well temperature profiles
2019
- 5 SAGD well pairs and 4 observation wells drilled on Pad 7 during reporting period

HISTORICAL
- The Leismer project includes a Central Processing Facility (CPF) and seven well pads, with 40 well pairs and 13 infill wells
ARTIFICIAL LIFT

All wells completed with ESP’s with the exception of two infill wells
  - Rod pumps installed on infills L5N3 and L5N4

Typical artificial lift operating conditions:
  - Bottomhole pressure (BHP) range: 2,500-3,300 kPag
  - BHP temperature range: 180-235 °C

<table>
<thead>
<tr>
<th>Artificial Lift Performance</th>
<th>ESP</th>
<th>Rod</th>
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</thead>
<tbody>
<tr>
<td>Typical Minimum Rate (m³/d)</td>
<td>120</td>
<td>100</td>
</tr>
<tr>
<td>Typical Maximum Rate (m³/d)</td>
<td>1,200</td>
<td>300</td>
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</tbody>
</table>
TYPICAL COMPLETION: PADS 1–4

PADS 1-4 COMPLETIONS

- Pads 1-4 injection wells completed with parallel tubing strings
- In production wells, instrumentation carried within a 1.75” coiled tubing
TYPICAL COMPLETION: PADS 5-6

PADS 5-6 COMPLETIONS

- Pads 5-6 injection wells completed with concentric tubing strings
- In production wells, instrumentation carried within a 1.5” coiled tubing (coil runs inside a 2-3/8” guide string)
- 5 of 7 injectors on Pad 5 completed with Vacuum Insulated Tubing (VIT) on long tubing string

Diagram details:
- 9-5/8” intermediate casing
- 2-3/8” guide string
- 3-½” production tubing
- 1.5” Instrumentation coil (10 thermocouples, 2 bubble tubes)
- 6-5/8” WWS with FCDs; or 7” WWS
TYPICAL COMPLETION: PADS 7

PAD 7 COMPLETIONS
- Pads 7 injection wells completed with concentric tubing strings
- In production wells, thermocouple string inside a 2-7/8” to 2-3/8” guide string
- Downhole pump installed with a heel bubble tube and 2 thermocouples
TYPICAL COMPLETION: INFILL WELL

16" x 13-3/8" surface casing

casing gas

3-½" production tubing

2-3/8" x 3-½" guide string

Instrumentation string

11-¾" x 9-5/8" intermediate casing

7" liner (WWS)
INSTRUMENTATION

TEMPERATURE

- Mixture of thermocouples (TC) and fiber measurements
- Both systems adequate for temperature management along the wellbore

PRESSURE

- Injector BHP is measured with blanket gas
- Producer and infill BHP is measured using optical gauges and/or bubble tubes
OBSERVATION WELLS

- Instrumentation used to monitor reservoir pressure and temperature
- 30 thermocouples spaced at 1 m above, below, and within SAGD pay
- 4 OBS wells drilled and instrumented with piezometers and thermocouples in Pad 7 in 2019
- Pad 8 observation wells (4) drilled Q1 2020 (to be instrumented with piezometers and thermocouples)
**FLOW CONTROL DEVICES**

### 2019
- 5 liner deployed FCDs installed in Pad 7
- 1 tubing deployed FCD installed in L4P4
- Continue to evaluate tubing deployed FCD opportunities

### HISTORICAL
- Liner deployed and tubing deployed FCD configurations have been used to optimize asset performance
- Able to operate at lower subcool with positive impact on temperature conformance

### L3P4 TEMPERATURE PROFILES

- **Pre-FCD Install**
- **16 months after FCD Install**

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**SAGD PRODUCING WELLPAIRS**

- **Pad Drainage Area**
- **Development Area**
- **SAGD Well-Pair**
- **Infill Well**
- **Liner Deployed Producer FCD**
- **Liner Deployed Injector FCD**
- **Tubing Deployed Injector FCD**
- **Tubing Deployed Producer FCD**
- **Liner Deployed Producer FCD and Injector FCD**
- **Liner Deployed Producer FCD and Tubing Deployed Injector FCD**
SUBSURFACE SCHEME PERFORMANCE
REPORTING YEAR HIGHLIGHTS

- 7 producing pads (40 SAGD well pairs and 13 infill wells)
- Pad 7 began steaming in summer 2019
- Increased NCG co-injection on Pads 1-4 for SOR management
- Increased field steam capacity to 91,000 bbl/d in Q4 2019
- Initiated disposal into the Clearwater B formation in Q4 2019
# PAD RECOVERY FACTOR

<table>
<thead>
<tr>
<th>Pad</th>
<th>Well Pairs</th>
<th>Infills</th>
<th>Cumulative Production $(10^3 \text{ m}^3)$</th>
<th>Lateral Length (m)</th>
<th>Area $(10^3 \text{ m}^2)$</th>
<th>Oil Saturation (frac)</th>
<th>Porosity (frac)</th>
<th>Net Pay DBIP Above Producer (m)</th>
<th>GBIP $(10^3 \text{ m}^3)$</th>
<th>EUR $(10^6 \text{ m}^3)$</th>
<th>Recovery Factor (%)</th>
<th>EUR (%)</th>
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<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>6</td>
<td>2,621</td>
<td>775</td>
<td>526</td>
<td>0.89</td>
<td>0.33</td>
<td>22.5</td>
<td>2,590</td>
<td>26.7</td>
<td>3,914</td>
<td>58</td>
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<tr>
<td>2</td>
<td>5</td>
<td>3</td>
<td>1,752</td>
<td>745</td>
<td>498</td>
<td>0.86</td>
<td>0.32</td>
<td>19.2</td>
<td>2,857</td>
<td>24.5</td>
<td>3,344</td>
<td>52</td>
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<td>3</td>
<td>6</td>
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<td>1,763</td>
<td>690</td>
<td>411</td>
<td>0.87</td>
<td>0.34</td>
<td>23.6</td>
<td>2,650</td>
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<td>3,443</td>
<td>51</td>
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<td>4</td>
<td>5</td>
<td>0</td>
<td>1,206</td>
<td>695</td>
<td>389</td>
<td>0.86</td>
<td>0.33</td>
<td>19.6</td>
<td>1,747</td>
<td>22.4</td>
<td>2,433</td>
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<td>5</td>
<td>7</td>
<td>4</td>
<td>1,194</td>
<td>900</td>
<td>708</td>
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<td>17.6</td>
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<tr>
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<td>923</td>
<td>860</td>
<td>571</td>
<td>0.86</td>
<td>0.33</td>
<td>25.3</td>
<td>2,914</td>
<td>28.9</td>
<td>3,836</td>
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<td>7</td>
<td>5</td>
<td>0</td>
<td>105</td>
<td>1,250</td>
<td>639</td>
<td>0.86</td>
<td>0.33</td>
<td>15.0</td>
<td>2,766</td>
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<td>3</td>
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<tr>
<td>Total</td>
<td>39</td>
<td>13</td>
<td>9,204</td>
<td>18,263</td>
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</table>

**NOTES:**
- Cumulative production as of February 29, 2020
- Volumetrics include 50 m at heel and toe of well pair
- EUR = Estimated Ultimate Recovery
PAD PERFORMANCE DEPENDS ON GEOLOGY AND OPERATING PARAMETERS

- Pads 7, 3 and 4 selected as examples of high, medium and low performing pads, respectively
  - Selection based on average monthly oil rate and iSOR
  - Differences in the productivity of the wells primarily due to geological variability and lateral length
**PAD PERFORMANCE: HIGH PAD 7**

### PAD 7 SUMMARY

- **First steam June 2019**
- **Peak oil rate during reporting period:**
  \(~811 \text{ m}^3/\text{d} \ (625-1,450 \text{ bbl/d/wellpair})\)
- **iSOR ~2.7**
- **High reservoir quality**
  - *Mostly sandy reservoir*
  - *High oil saturation*
- **1,250 m wells equipped with FCDs**

### PAD 7 PRODUCTION

![Graph showing production data for PAD 7]

- **Oil Rate**
- **Water Rate**
- **Steam Rate**
- **iSOR**
- **cSOR**

<table>
<thead>
<tr>
<th>Fluid Rate (m³/d)</th>
<th>Mar-19</th>
<th>May-19</th>
<th>Jul-19</th>
<th>Sep-19</th>
<th>Nov-19</th>
<th>Jan-20</th>
<th>Mar-20</th>
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<tr>
<td>Oil Rate</td>
<td>0</td>
<td>0</td>
<td>500</td>
<td>1,000</td>
<td>1,500</td>
<td>2,000</td>
<td>2,500</td>
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<tr>
<td>Water Rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steam Rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>iSOR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cSOR</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
**PAD PERFORMANCE: MEDIUM PAD 3**

**PAD 3 SUMMARY**
- First steam 2010
- Peak oil rate during reporting year: ~350 m$^3$/d (100-675 bbl/d/wellpair)
- cSOR ~3.1
- Good reservoir quality
- Steam chamber development since last reporting period
- NCG co-injection started in Jun 2019 for SOR management

**PAD 3 PRODUCTION**

![Temperature Plots](image)

- **Oil Rate**
- **Water Rate**
- **Steam Rate**
- **iSOR**
- **cSOR**

**L3P4M- 103/13-27-078-10W400 (14m from L3P4)**

- **Injection**
- **Producer**
- **Res Top**
- **Res Base**
- **OWC**
- **Dev**

**Temperature Plots**
- Mar 1, 2019
- Mar 1, 2020

**Fluid Rate (m$^3$/d)**

- 3,000
- 2,500
- 2,000
- 1,500
- 1,000
- 500
- 0

PAD PERFORMANCE: LOW PAD 4

PAD 4 SUMMARY

- First steam 2010
- Peak oil rate during reporting year: ~280 m³/d (300-540 bbl/d/wellpair)
- cSOR ~3.4
- Average reservoir quality
- NCG co-injection re-instated on this pad in June 2019

PAD 4 PRODUCTION

L4P3T- 102/16-28-078-10W400 (19m from L4P3)

Temperature Plots

- Mar 1, 2018
- Mar 1, 2019

- Thermocouple
FCD PERFORMANCE

TUBING DEPLOYED FCDS

- Oil production initially increased 125-150% per well
- Tubing deployed FCDs continue to perform above expectations
  - 100 – 200 bbl/d uplift still observed after 2 years
- Continue to evaluate opportunities across the field
SUMMARY

- Pads 1-4 NCG co-injection re-initiated Q2 2019
  - Steam reduced by ~1,500 m³/d (-25%) with an SOR improvement of ~1 (-22%)
  - NCG co-injection rates continue to increase based on reservoir performance
STEAM PRESSURE

- Steam upstream of pads 7,000–9,000 kPa
- Steam pressure let-down to 5,000–6,000 kPa at pads

STEAM QUALITY

- Steam quality decreases during transportation to well pads due to heat losses
  - Estimated at 95% for Pads 1–4, 6 & 7
  - Estimated at 90% at Pad 5 due to longer, larger diameter pipe line
WELL INTEGRITY

- No wellbore integrity failures during the reporting period (liner or casing)

ABANDONMENTS

- 1 producer/injector well pair abandoned February 2020
  - *L2P1 (106/11-27-078-10W4/00)*
  - *L2I1 (100/06-27-078-10W4/00)*
- No near term plans for well pad abandonments
LEISMER FUTURE DEVELOPMENT PLANS

SUBSURFACE DEVELOPMENT PLANS

- Evaluating opportunities for tubing deployed FCDs into producer wells on Pads 1-6
- Pad 8 observation wells (4) drilled Q1 2020
- Pad 6 infills (4) approved September 2018
- Pad 7 additional well pair (1) approved August 2019
- Pad 8 well pairs (14) approved September 2019

PAD ABANDONMENTS

- No pad abandonments anticipated within next five years
MAJOR ACTIVITIES

- Boiler maintenance on three OTSGs (May 2019)
- Well Pad 7 start-up (June 2019)
- Heat Integration and additional water treatment capacity (WAC) installed for OTSG 5 (August 2019)
- Increased field steam capacity to 91,000 bbl/d (Q4 2019)
- 14-28-078-10W4 Injection Facility construction for water disposal (November 2019)
- Pipeline construction to water injection location at 16-10-078-10W4 (winter 2019/2020)
ADDITIONAL HEAT INTEGRATION AND WATER HANDLING ADDED FOR 5TH OTSG
NO CHANGES TO FACILITY SCHEMATIC
SURFACE
MEASUREMENT, ACCOUNTING AND REPORTING PLAN (MARP)
**CPF**
- MARP updated to reflect asset sale of downstream Cheecham Terminal

**WELL TESTING**
- Well tests used to calculate daily bitumen and water production
- Six hour test with 1 hr. purge to improve oil calculation accuracy
- Pads 1, 3, 5 and equipped with full test headers and test separators
- Pad 4 equipped with full test header and Multi-Phase Flow Meters (MPFM)
- Pad 2/7 and 4 equipped with MFPM
- MARP updated to reflect addition of Well Pad 7 and tie into existing infrastructure on Well Pad 2

FQI – flow quantity indicator
AE – analyzer element
OR - orifice plate
Pad 7 start up: challenges with measuring bitumen rates during circulation.

Field ramp down May: quick ramp ups and downs impact proration due to the lag time in testing.

Oct – Dec: field wide sampling program to improve proration.
SURFACE FACILITY PERFORMANCE
SITE RELIABILITY HAS REMAINED HIGH

- CPF availability was 98% for 2019 (facility design 93%)
- Availability calculated based on steam capacity
- Facility down-time mainly associated with boiler repair work (May 2019)
PRODUCTION & ELECTRICITY CONSUMPTION

**Bitumen Production**

- Produced Bitumen (m$^3$)
- OTSG Maintenance

**Electricity Consumption**

- Electricity Consumption (MWh)

**Graphs showing production and consumption trends for Athabasca 2015.**
PURCHASED & PRODUCED GAS VOLUMES

Purchased Gas

Produced Gas

Increased rates for Well Pad 7 lift gas
Note: D060 revision to flare volume calculation (inclusion of purge gas) effective January 1, 2020
SURFACE
WATER PRODUCTION, INJECTION & USES
SOURCE WATER NETWORK

SOURCE WATER WELLS

- 5 Lower Grand Rapids non-saline wells
  - 1F1/16-09-079-10W4/00
  - 1F1/07-10-079-10W4/00
  - F1/04-09-079-10W4/00,
  - 1F1/16-04-079-10W4/00
  - 1F1/03-04-079-10W4/00

- 3 well source water monitoring network
  - 100/03-05-079-10 W4/00
  - 100/11-02-078-10 W4/00
  - 100/03-22-081-08 W4/00
    - Regional monitoring well located outside of mapped area
Increased water use for Pad 7 start up
WATER USE

SOURCE WATER USE
- Water Act license allocation 317,915 m³/year (871 m³/day)
- Total non-saline water use from source wells during reporting period 199,000 m³ (545 m³/d)
  - 55% of license allocation
  - ~98.5% for process use at CPF
  - ~1.5% for domestic use at CPF
- No saline water use

SOURCE WATER MINIMIZATION
- Total source water use reduced by 12% from previous reporting period
- Source water intensity of 0.17 bbl water/bbl bitumen over the reporting period
- Balanced reservoir conditions minimize make-up water volume requirements
- High blowdown recycle rates minimize source water demand

TYPICAL WATER QUALITY

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<tr>
<th>Parameter</th>
<th>Non-Saline Water</th>
<th>Produced Water</th>
<th>Disposal Water</th>
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<tbody>
<tr>
<td>TDS [mg/L]</td>
<td>1,575</td>
<td>1,900</td>
<td>29,200</td>
</tr>
<tr>
<td>pH [-]</td>
<td>8.2</td>
<td>6.9</td>
<td>11.9</td>
</tr>
<tr>
<td>Hardness [mg/L as CaCO₃]</td>
<td>4.3</td>
<td>21</td>
<td>0.9</td>
</tr>
<tr>
<td>Total Alkalinity [mg/L as CaCO₃]</td>
<td>825</td>
<td>245</td>
<td>4,900</td>
</tr>
<tr>
<td>SiO₂ [mg/L]</td>
<td>0</td>
<td>220</td>
<td>210</td>
</tr>
<tr>
<td>Cl [mg/L]</td>
<td>225</td>
<td>1100</td>
<td>13,500</td>
</tr>
</tbody>
</table>
STEAM INJECTION

Monthly Volume (m³)

Monthly Capacity

Monthly Volume

OTSG Maintenance
CLASS 1B DISPOSAL APPROVAL 11479C

- Approval for Clearwater B injection (September 2019)

- 2 Basal McMurray injection wells
  - 00/12-33-078-10W4/00
  - 00/13-33-078-10W4/00

- 2 Clearwater B injection wells
  - F2/01-10-078-10W4/00
  - F2/04-28-078-10W4/00

- Extensive monitoring network
  - Basal McMurray
  - Clearwater B
  - Lower Grand Rapids

CLEARWATER B

- Initiated injection at F2/04-28-078-10W4/00 (November 2019)

- F2/01-10-078-10W4/00 injection well operational after pipeline construction (March 2020)
**DISPOSAL MONITORING**

**BASAL MCMURRAY MONITORING**
- Disposal diverted from McMurray (March 2019)
- McMurray bottom water pressure has stabilized

**CLEARWATER B MONITORING**
- No pressure response observed at Clearwater B monitoring wells (2) since injection initiated

**LOWER GRAND RAPIDS MONITORING**
- Pressure response in Lower Grand Rapids monitoring wells (4) remains consistent with pumping rates of the Lower Grand Rapids source water wells

*No unexpected responses have been observed at any of the monitoring wells during the reporting year.*
Disposal water temperature measured at CPF disposal tank.

1 Disposal water temperature measured at CPF disposal tank.
Disposal limit calculated in accordance with D081. Calculation revised (Nov. 2019) with release of new D081.
**SOLIDS DISPOSAL:**

- Water treatment solids (lime softening) are pumped to settling pond
- Sludge pond dredged and 14,102 tonnes of solids disposed at offsite approved facility
SURFACE
SULPHUR PRODUCTION
SULPHUR & SULPHUR DIOXIDE REPORTING

- EPEA Approval No. 241311 limit is 2.0 t/d of SO₂ emissions
- Average daily SO₂ emissions over period was 1.22 t/d (61% of approval limit)
- SO₂ emissions are calculated based on analytical results of mixed gas samples
- There are no sulphur recovery facilities at Leismer
**Sulphur Dioxide Emissions**

### Avg Quarterly Emissions
- Q1-2019: 1.23 t/d
- Q2-2019: 1.12 t/d
- Q3-2019: 1.29 t/d
- Q4-2019: 1.37 t/d
**SO₂ DAILY AVERAGE**

- Daily SO₂ Emissions for Q4 averaged 1.37 tonnes/day
LEISMER FUTURE PLAN

- CPF debottlenecking to support additional pads/production as required
- Implementation of NCG for SOR reduction
- Continue to evaluate heat integration opportunities for emissions reduction
- Pad facility design as required to support new development
## APPROVALS AND AMENDMENTS

<table>
<thead>
<tr>
<th>Date</th>
<th>Approval/Amendment</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 2019</td>
<td>WA Licenses 00297242, 00322141, 00368609 &amp; 00370676</td>
<td>Amendment clarifying data reporting requirements for water wells</td>
</tr>
<tr>
<td>August 2019</td>
<td>OSCA Approval No. 10935Y</td>
<td>Amendment Pad 7 – expand drainage area for additional well pair</td>
</tr>
<tr>
<td>September 2019</td>
<td>OSCA Approval No. 10935Z</td>
<td>Amendment Pad 8 - downhole spacing for 14 well pairs</td>
</tr>
<tr>
<td>September 2019</td>
<td>Disposal Approval No. 11479C</td>
<td>Approval for 1b disposal in the Clearwater B and McMurray</td>
</tr>
<tr>
<td>October 2019</td>
<td>D056 License F51680</td>
<td>Approval for Injection Facility at 14-28-078-10 W4</td>
</tr>
<tr>
<td>October 2019</td>
<td>D056 License P51231</td>
<td>Approval for disposal pipeline from CPF to 16-10-078-10 W4</td>
</tr>
<tr>
<td>February 2020</td>
<td>WA License No. 00364442</td>
<td>Renewal – CPF storm water use additional 5 year term</td>
</tr>
<tr>
<td>February 2020</td>
<td>EPEA Approval No. 241311</td>
<td>Submission - renewal application for additional 10 year term</td>
</tr>
</tbody>
</table>

**Notes**
- OSCA – Oil Sands Conservation Act (scheme approval)
- EPEA – Environmental Protection and Enhancement Act Approval
- WA - Water Act
## INSPECTIONS

<table>
<thead>
<tr>
<th>Event</th>
<th>Location/License</th>
<th>Inspection ID</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>AER Facility Inspection, April 25, 2019</td>
<td>08-02-079-10W4</td>
<td>486921</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>AER Pipeline Inspection, January 23, 2020</td>
<td>P51231</td>
<td>496631</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>AER Pipeline Inspection, February 5, 2020</td>
<td>P51231</td>
<td>498051</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>AER Wellsite Inspection, February 5, 2020</td>
<td>0496549</td>
<td>498030</td>
<td>Satisfactory</td>
</tr>
</tbody>
</table>
**AUDITS**

<table>
<thead>
<tr>
<th>Event</th>
<th>License</th>
<th>Activity ID</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reclamation Certificate, March, 13, 2019</td>
<td>MLL070189</td>
<td>159791</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Annual Conservation &amp; Reclamation Report, May 1, 2019</td>
<td>241311</td>
<td>N/A</td>
<td>Satisfactory</td>
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<tr>
<td>Annual Groundwater Monitoring Report, June 26, 2019</td>
<td>241311</td>
<td>N/A</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Pipeline License Application, November 18, 2019</td>
<td>P51231</td>
<td>1645478</td>
<td>Satisfactory</td>
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<tr>
<td>Well License Application, December 10, 2019</td>
<td>W0496553</td>
<td>1703577</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>Public Lands Act Applications, January 9, 2020</td>
<td>1630729</td>
<td>1649406 &amp; 1649407</td>
<td>Satisfactory</td>
</tr>
</tbody>
</table>
NON-COMPLIANCE SUMMARY

- No Notices of Non-Compliance were received during the reporting period.
- One approval contravention was reported (Water Act License 00239880-02) for data loss due to failure of a water level transducer. Equipment was repaired and data collection restored.
- There were 6 reportable releases during the reporting period.
AIR QUALITY MONITORING

- Passive air monitoring – no exceedances (SO$_2$, NO$_2$, H$_2$S) of Ambient Air Quality Objectives
- Continuous ambient air monitoring
  - *WBEA air monitoring station onsite during Q4 2019 and Q1 2020*
  - *No exceedances (SO$_2$, NO$_2$, H$_2$S) of Ambient Air Quality Objectives*
- Leismer has 2 CEMS units (OTSG 4 and OTSG 5) reporting data
  - *No issues during reporting period*
COMPLIANCE - MONITORING PROGRAMS

NO\textsubscript{X} MONTHLY AVERAGE

- CEMS units installed on OTSG 4 and OTSG 5

OTSG 4 & 5 - Monthly Average NOx

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>OTSG 4</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
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<td>OTSG 5</td>
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</tbody>
</table>

Limits:
- OTSG 4 Limit: 18 kg/hr
- OTSG 5 Limit: 18 kg/hr
**NO\textsubscript{x}** \textbf{HOURLY RATES}

- Hourly NOx rates for three months (Dec 2019 to March 1, 2020)
## COMPLIANCE – MONITORING PROGRAMS

### INDUSTRIAL RUN-OFF MONITORING

- All discharges completed in compliance with EPEA approval conditions

<table>
<thead>
<tr>
<th>Date</th>
<th>pH</th>
<th>Cl (mg/L)</th>
<th>Oil &amp; Grease (Y/N)</th>
<th>Lab &amp; Sample ID</th>
<th>Discharge Volume (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>03/19/2019</td>
<td>7.99</td>
<td>5.7</td>
<td>N</td>
<td>Maxxam B920260</td>
<td>N/A (initial sample of year)</td>
</tr>
<tr>
<td>04/09/2019</td>
<td>8.12</td>
<td>10</td>
<td>N</td>
<td>Maxxam B927574</td>
<td>5,723</td>
</tr>
<tr>
<td>04/29/2019</td>
<td>7.84</td>
<td>5</td>
<td>N</td>
<td>Maxxam B933465</td>
<td>47.6</td>
</tr>
<tr>
<td>06/28/2019</td>
<td>8.07</td>
<td>13</td>
<td>N</td>
<td>Bureau Veritas B952565</td>
<td>2,510</td>
</tr>
<tr>
<td>06/29/2019</td>
<td>8.15</td>
<td>12</td>
<td>N</td>
<td>Bureau Veritas B952565</td>
<td>2,180</td>
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<tr>
<td>08/13/2019</td>
<td>8.28</td>
<td>12</td>
<td>N</td>
<td>Bureau Veritas B967021</td>
<td>2,725</td>
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<tr>
<td>08/17/2019</td>
<td>8.1</td>
<td>12</td>
<td>N</td>
<td>Bureau Veritas B969157</td>
<td>6,350</td>
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<tr>
<td>09/04/2019</td>
<td>8.27</td>
<td>11</td>
<td>N</td>
<td>Bureau Veritas B976168</td>
<td>275</td>
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<td>09/05/2019</td>
<td>8.22</td>
<td>9</td>
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<td>09/22/2019</td>
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<td>09/23/2019</td>
<td>8.06</td>
<td>11</td>
<td>N</td>
<td>Bureau Veritas B983854</td>
<td>2,180</td>
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</tbody>
</table>
ENVIRONMENTAL PROTECTION & ENHANCEMENT ACT (EPEA) APPROVAL

- EPEA monitoring programs and reports completed during the reporting period:
  - Monthly and annual air emissions
  - Industrial wastewater and runoff
  - Groundwater
  - Soil Management Program authorized by the AER and field program completed
  - Conservation and Reclamation
  - Air Emissions Inventory Report
  - Wildlife Monitoring Program – Amendment approved to reduce field cameras

WATER ACT

- All diversions below license limits, monthly and annual reporting requirements completed
  - Groundwater licenses (0239880, 0029742, 00368609)
  - Surface water licenses (00273542, 00364442, 00364731)

RECLAMATION

- AOC has received reclamation certificates for all OSE programs at Leismer
AOC IS A FUNDING MEMBER OF

- Oil Sands Environmental Monitoring
- Wood Buffalo Environmental Association (WBEA) – air shed monitoring
- Regional Industry Caribou Collaboration (RICC)
- Industrial Footprint Reduction Options Group (iFROG) – wetland reclamation industry collaboration

AOC PARTICIPATION

- Various CAPP Committees
  - Oil Sands Environmental Policy and Regulatory Committee
  - NE Alberta Caribou Working Group
  - Indigenous Affairs Committee
  - Air Issues Committee
ATHABASCA OIL CORPORATION LEISMER PROJECT IS IN COMPLIANCE WITH AER APPROVALS AND REGULATORY REQUIREMENTS

- For the period of March 1, 2019 to February 29, 2020 AOC has no unaddressed non-compliant events