Agenda

• Current Approvals
• Geological Overview
• Drilling, Completions, and Artificial Lift
• Field Performance and Surveillance
• Cap Rock Integrity & Monitoring
• Future Development Plans
• Facilities
• Measuring & Reporting
• Facility Future Plans
• Water Use, Conservation & Disposal
• AER Compliance
• Conclusions
Primary and Enhanced Approval Regions

Enhanced Recovery Schemes
- 10147
- 9673
- 10787
- 10423

Primary Recovery Schemes
- 6619
- 9466
- 9884
Produced Oil Viscosity Map
• Upper Wabiskaw Sand
  ▪ Depth of 300-425m TVD
  ▪ Net Pay Range 1 – 9m
  ▪ Porosity 28 – 32%
  ▪ Permeability 300 – 3000md
  ▪ Temperature 13-17 deg. C
  ▪ Water Saturation 30 – 40%
  ▪ Oil Viscosity (dead oil) 800 – 80,000cp @ 15 deg. C
  ▪ Initial Reservoir Pressure 1900 – 2600kpa
Drilling, Completions, and Artificial Lift
• Well spacing is largely controlled by existing primary development
• CNRL has generally experienced that 100-200m interwell spacing provides the best balance between efficient recovery and flood stability while managing the risks in placement of horizontal wells.
• The range in interwell spacing is dependent on reservoir conditions (oil viscosity, net pay)
Typical Well Configurations

- **Producer**

  - Intermediate Casing landed in Wabiskaw sand (producers and injectors).
EOR History and Current Approvals
Polymer Flood Development
Approximately 62% of the approved EOR scheme areas are currently developed and under flood as of the end of 2013.
Field Performance and Surveillance
100% of Approval Area under Polymerflood
Approval 10147 Production Update

Company:
On Stream: 03/01/1997
Field: BRINTNELL
Current Status:
Gp: 69,021 ft
Np: 19,772,252 ft
Wp: 10,868,889 ft
Qcond: 0.000 ft

2013: Significant injection shut-in for depressurization in preparation for offset drilling operations.
• Contains the most mature polymer flood patterns including the original pilot area which began flooding in 2005.
• Entire scheme area is currently under flood. No changes to patterns or well counts in 2013.
• First Polymer Response in April 2006 from the HTL6 Pilot area.
• Peak production occurred from mid 2007 to early 2010 at 650 m³/d oil.
• Gradual increase in watercut since early 2010 to 60% has resulted in a declining oil rate.
• Throughout 2013, a significant portion of injection was shut-in due to offset drilling operations.
• Cumulative oil recovered to date is 1.977 E6m³ (12.4 MMbbl)
• Oil viscosity ranges from 1,300 cp to 2,800 cP.
Approval 10423

70% of Approval Area under Polymerflood
2006 – 2008: Gradual ramp up in volumes due to multiple small expansion phases.

2009 - 2010: Significant number of production wells converted to injection.

Started Polymer Injection
• Polymerflood started in 2006 covering roughly 5% of the approval area split between 3 small groups. The flood was expanded every year up to 2010. In 2012, small area from PRSA 9884 was added to the approval.
• Currently 70% of the approval area in under flood.
• Small portion of approval area under waterflood starting in 2003. This area was converted to polymer in 2008 and 2010.
• First polymer response occurred in July 2007.
• Oil volumes continued to ramp up through 2013 and does not appear to have plateaued; watercut has remained flat through 2013.
• Significant portions of the approval area are affected by higher in-situ water saturation and/or oil viscosity. Response in these regions has been more delayed and erratic when compared to other portions of the pool.
Main expansion phases occurred in 2009 & 2010 and involved significant reduction in production wells for conversion to injection. By converting rather than infilling, the initial fillup volume per injector was higher and therefore initial oil response occurred over a longer timeframe.

Drilled 26 wells in the approval area in 2013. 15 of these wells have been or will be completed as new injectors in the flood. The remaining 11 wells are completed and will remain as producers.

3 additional wells were planned for the 2013 program but spilled over into the 2014 drill program.

Included in the 2013 program were 4 JV wells partnered with Cenovus along the borders of our landbases.

Cumulative oil recovered to date is 14.804 E6m3 (93.1 MMbbl).

Oil viscosity ranges from 1,100 cp to 50,000 cp.
Approval 10787

45% of Approval Area under Polymerflood
Approval 10787 Production Update

Nov 2012 – May 2013: Lack of facility capacity and related treating issues
Polymerflood started in Dec 2007 covering roughly 4% of the approval area split into 2 small groups. There were no expansions until 2010, since then there has been an expansion completed in every year including 2013. Currently 45% of the approval area is under flood.

- First polymer response occurred in November 2008.
- Polymer injection was commenced in the Peerless and Sandy Lake portions of the area in 2013; production wells are activated/reactivated as dictated by fluid levels and/or surface pressure readings.
- Oil production remained flat through 2013; the west block experienced production issues with sand in a few wells which resulted in lost production and offset the ramp up volumes in the rest of the group.
  - A series of workovers performed in late 2013/early 2014 have restored much of the lost production from this region
• The south and east blocks had production restricted in early 2013 due to issues with field treating capacity. Comparatively large primary production in these areas was targeted instead of active flood regions.

• Volumes restored by mid-2013 and continued to ramp up with new producer startups in the flood areas.

• Drilled 7 wells in the approval area in 2013. 1 of these wells has been completed as a new injector in the flood. The remaining 6 wells are completed as producers.

• Cumulative oil recovered to date is 6.840 E6m3 (43.0 MMbbl).

• Oil viscosity ranges from 1,100 cp to 14,400 cp.
Approval 9673

70% of Approval Area under Polymerflood
2011-2012: Reduced injection rates to try and reduce or heal channeling resulting from the previous waterflooding. Drop in watercut and total produced fluid rates as a result.

2013: Maintained constant injection rates to determine what impact the reduced injection has on the flood performance.
• Originally approved for waterflood in 2004; waterflood was expanded in 2005/2006 to cover roughly 40% of the current approval area.

• Waterflood peak production occurred from late 2007 to early 2009 at 1850 m³/d oil.

• Polymerflood began in Sept 2008 covering 6% of approval area. Existing waterflood patterns remained unchanged at this time.

• In 2009 all waterflood areas were converted to polymer and a small expansion area from primary was added; additional small expansions from primary were conducted in each year from 2010 to 2012. Currently 70% of the approval area is under flood.

• First polymer response occurred in Sept 2009 but due to declining production from the waterflood areas, have only recently started to see a ramp up in oil volumes from the polymer flood.
The conversion from water to polymer allowed injection rates to be reduced while maintaining similar reservoir pressure; decreases in watercut were also expected due to the improved conformance.

Following two years of reducing injection rates and declining watercuts, injection was held fairly stable in 2013 to assess what impact the reduction in injection had in reducing the watercut.

Throughout 2013, there have been signs of improved conformance from the polymer flood with increasing oil volumes and a steady decline in watercut with the stable injection rate.

2013 drill program included 1 JV well partnered with Cenovus along the border of our landbases in this approval area.

Cumulative oil recovered to date 5.756 $E6m3$ (36.2 MMbbl).

Oil viscosity ranges from 600 cp to 13,000 cp.
Estimated Ultimate Recovery Factors for Flooded Areas

**Approval 9673**
Total area OBIP 97,439,555 m³
OBIP under flood: 78,437,884 m³
RF to date: 7%
Estimated ultimate recovery factors: 14-18%

**Approval 10787**
Total area OBIP 205,220,952 m³
OBIP under flood: 81,382,556 m³
RF to date: 6%
Estimated ultimate recovery factors: 19-24%

**Approval 10147**
Total area OBIP 8,987,327 m³
OBIP under flood: 8,987,327 m³
RF to date: 22%
Estimated ultimate recovery factors: 28-32%

**Approval 10423**
Total area OBIP 229,018,235 m³
OBIP under flood: 162,832,446 m³
RF to date: 9%
Estimated ultimate recovery factors: 20-23%

*The recovery factors shown for each area represent the recovery for the portions of the scheme approval areas that are currently under polymer flood.*
Good Performance – HTL1

• HTL1 Pad

  ▪ Well list and allocation factors:
    – 100/13-31-081-22W4/0 (100%)
    – 100/14-31-081-22W4/0 (100%)
    – 100/15-31-081-22W4/0 (100%)
    – 102/13-31-081-22W4/0 (100%)
    – 102/14-31-081-22W4/0 (100%)
    – 102/15-31-081-22W4/0 (100%)
    – 103/13-31-081-22W4/0 (100%)

Approval 10147
Good Performance – HTL1

Polymer flood after Primary

Liquid Rate (m³/d)
Oil Rate (m³/d)
Wt Cut (%)

Water Injection Pressure (kPa)

Date

Date

1997 98 99 00 01 02 03 04 05 06 07 08 09 10 11 12 13

0 60 120 180 240 300

0 60 120 180 240

0 20 40 60 80 100

0 375 300 250 200

0 5000 4500 4000 3500 3000 2500 2000 1500 1000 500 0

0 150 100 50

0 75 150
Average Performance – WB 24

- **WB Pad 24: 100/15-25 Pattern**
  - **Well List and allocation factors:**
    - 100/02-25-081-23W4/0 (50%)
    - 100/03-25-081-23W4/0 (50%)
    - 100/06-25-081-23W4/0 (50%)
    - 100/07-25-081-23W4/0 (50%)
    - 100/15-25-081-23W4/0 (100%)
Average Performance – WB 24

Polymer flood after Primary

- Liquid Rate (m³/d)
- Oil Rate (m³/d)
- Water Inj. (m³/d)
- Water Injection Pressure (kPa)

Date: 1995 to 2013
Below Average Performance – SB 26

• SB 26 103/10-24 Pattern
  ▪ Well List and allocation factors:
    – 102/11-24-080-22W4/0 (50%)
    – 103/10-24-080-22W4/2 (100%)
    – 104/07-24-080-22W4/0 (50%)
Below Average Performance – SB 26

SB 26
Polymer flood after Primary

Liquid Rate (m³/d)
Oil Rate (m³/d)

Date

Water Injection Pressure (kPa)

Date
Summary of Good/Average/Poor Areas

RF vs PV Inj

- Response Times
- Slope of RF Curve

SB26, WB24, HTLP1
Cap Rock Integrity
## Cap Rock Integrity - Anomalies

### 2013 Anomalies:

<table>
<thead>
<tr>
<th>Date of Event</th>
<th>Location</th>
<th>Cause of Alarm</th>
<th>Details/Description of Anomalous Event</th>
<th>Operations Review of Injection Well</th>
<th>Initial Injection Pressure</th>
<th>Anomalous Pressure</th>
<th>Initial Injection Rate</th>
<th>Anomalous Rate</th>
<th>Cause of Anomaly</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 15, 2013</td>
<td>SLP 6 00/16-32-79-21W4</td>
<td>Drop in injection pressure</td>
<td>Over a 24 hour period, injection pressure dropped by 1550 KPa from 4874 KPa to 3324 KPa. During that time frame, the injection rate increased by 13 m3/d from 134 m3/d to 147 m3/d.</td>
<td>Everything working properly</td>
<td>4874</td>
<td>3324</td>
<td>130</td>
<td>147</td>
<td>Accessing new highly permeable reservoir</td>
</tr>
<tr>
<td>August 17, 2013</td>
<td>BP 18 00/01-16-081-22W4/0</td>
<td>Drop in injection pressure</td>
<td>Over 8 days, well experienced a staggered pressure drop of roughly 1700kPa from roughly 5838 kPa to 4157 kPa</td>
<td>Everything working properly</td>
<td>5838</td>
<td>4157</td>
<td>50</td>
<td>50</td>
<td>Breakthrough</td>
</tr>
<tr>
<td>November 3, 2013</td>
<td>SLP4 04/13D-32-079-22W4</td>
<td>Drop in injection pressure</td>
<td>On Nov 3 at about 6:30pm the pressure on this well dropped off from around normal pressure of about 5600kpa down to about 4300kpa where it is currently at. At the same time the flow rate increased from an average of about 25m3/d to over 100m3/d.</td>
<td>Everything working properly</td>
<td>5600</td>
<td>4300</td>
<td>25</td>
<td>100</td>
<td>Accessing new highly permeable reservoir</td>
</tr>
<tr>
<td>November 30, 2013</td>
<td>CBP 17 02/03-080-21W4/0</td>
<td>Drop in injection pressure</td>
<td>During a 5 hour period, the pressure dropped from around 5570kPa to roughly 4000 kPa while in that same time frame the rate increased from 66 m3/d to nearly 280 m3/d</td>
<td>Everything working properly</td>
<td>5570</td>
<td>4000</td>
<td>55</td>
<td>280</td>
<td>Accessing new highly permeable reservoir</td>
</tr>
</tbody>
</table>

### 9 anomalies in 2012; 18 anomalies in 2011
Cap Rock Integrity - Anomalies

- Anomaly refers to an increase in polymer injection rate accompanied by a loss in injection pressure neither of which are linked to an operational change.
- An anomaly as described above, will occur quickly, often within hours.
- Due to the use of long horizontal wells, there are often differences in permeability along the wellbore length. Many of the anomalies have been linked to accessing new reservoir which, in essence, is accessing these different permeability regions. Localized gas caps may also result in a change in injectivity as they are encountered.
- These types of anomalies occur early in the flood life. CNRL has seen a drop in these anomalies in the past two years due to comparatively fewer new injection well startups.
Anomaly occurred due to the breakdown of a wellbore sand obstruction or near wellbore lower perm barrier which allowed injection fluids to access a new, higher perm, portion of the reservoir. Injection was temporarily shut-in to allow the near wellbore region to equalize and stabilize under new downhole conditions.

Well has returned to pre-anomaly operating conditions and has no indications that cap rock integrity has been affected.
The Hall plot is used to identify changes in flow conditions in the injection well. Changes in slope indicate either an improvement or reduction of injectivity.

Hall slope briefly shallowed indicating an improvement in injectivity. After the shut-in equalization period, slope has returned to the normal trend.
Future Development Plans
Future Development Plans

- Canadian Natural plans to continue with the expansion of the polymer flood at Brintnell over the next several years. Expansion will push the flood to the southeastern and western edges of the pool.

- The focus of the 2014 capital program will be:
  - Complete 2013 injection well program bordering Cenovus lands, as part of joint well agreement
  - Infill drill regions in Scheme areas 10423 and 10787 to optimize existing flood patterns
  - Implement flood expansion in western portion of Scheme area 10423
  - Re-drill two existing wells in Scheme area 9673
  - Primary drilling in Scheme area 10787

- CNRL received approval in 2012 to implement a surfactant pilot in the field. Presently, CNRL is re-evaluating the pilot area and conducting further lab testing prior to moving ahead. No field work has taken place at this time to support a pilot.
Facilities
Brintnell Batteries

12-09 CHOPS Battery: Online mid May 2013. Old Central Brintnell Battery converted to Truck in CHOPS battery

New Central Battery. Online mid May 2013.
Facility: NB 07-27-82-21W4 Battery Plot Plan

Refer to Appendix A
Facility: BT 12-09-81-22W4 Battery Plot Plan

Refer to Appendix C
Facility: CB 01-36-80-22W4 Battery Plot Plan

Refer to Appendix D
CB 01-36-80-22W4 Battery
Facility: Typical Brintnell Battery PFD

Refer to Appendix E
Facility Modifications

- **Reasons for Modifications:**
  
  - **Oil Treating:**
    - 1-36 Battery Online (May 2013): may require more heat input to process.
    - 12-09 Battery is off the grid. Converted to CHOPS battery only (May 2013)
    - Heat integration: investigating indirect heating of fluid to reduce OPEX.
  
  - **Integrity:**
    - Continue working details of plan to rebuild all existing flood areas over next several years; future flood areas to be rebuilt as the flood is expanded (identify higher risk areas to complete first).
    - All high risk sour pipelines have been lined as of February 2014
## Battery Performance

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>North Brintnell 7-27</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Produced Water (m³)</td>
<td>1,374,731</td>
<td>1,775,300</td>
<td>2,096,258</td>
<td>2,292,879</td>
<td>2,386,085</td>
<td>1,484,277</td>
<td>1,795,440</td>
<td>1,567,398</td>
</tr>
<tr>
<td>Produce Recycle (%)</td>
<td>88.8%</td>
<td>100.2%</td>
<td>98.1%</td>
<td>97.6%</td>
<td>97.7%</td>
<td>97.9%</td>
<td>99.5%</td>
<td>99.5%</td>
</tr>
<tr>
<td>Average Daily Recycle (m³/d)</td>
<td>3,344</td>
<td>4,874</td>
<td>5,621</td>
<td>6,134</td>
<td>6,385</td>
<td>3,982</td>
<td>4,881</td>
<td>4,272</td>
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<tr>
<td><strong>Central Brintnell 12-09</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Produced Water (m³)</td>
<td>167,755</td>
<td>193,349</td>
<td>267,607</td>
<td>378,988</td>
<td>323,086</td>
<td>402,772</td>
<td>402,822</td>
<td>143,284</td>
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<tr>
<td>Produce Recycle (%)</td>
<td>0.0%</td>
<td>13.9%</td>
<td>59.5%</td>
<td>91.4%</td>
<td>93.4%</td>
<td>88.6%</td>
<td>81.9%</td>
<td>73.0%</td>
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<tr>
<td>Average Daily Recycle (m³/d)</td>
<td>0</td>
<td>73</td>
<td>435</td>
<td>949</td>
<td>827</td>
<td>978</td>
<td>901</td>
<td>775</td>
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<td><strong>Central Brintnell 1-36</strong></td>
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<tr>
<td>Produced Water (m³)</td>
<td>638,159</td>
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<tr>
<td>Produce Recycle (%)</td>
<td>88.6%</td>
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<tr>
<td>Average Daily Recycle (m³/d)</td>
<td>2,457</td>
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<tr>
<td><strong>South Brintnell 9-02</strong></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Produced Water (m³)</td>
<td>341,034</td>
<td>413,480</td>
<td>501,318</td>
<td>544,390</td>
<td>776,095</td>
<td>1,014,789</td>
<td>1,505,539</td>
<td>1,384,546</td>
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<tr>
<td>Produce Recycle (%)</td>
<td>0.0%</td>
<td>5.4%</td>
<td>34.5%</td>
<td>37.6%</td>
<td>22.3%</td>
<td>81.1%</td>
<td>93.9%</td>
<td>92.0%</td>
</tr>
<tr>
<td>Average Daily Recycle (m³/d)</td>
<td>0</td>
<td>62</td>
<td>473</td>
<td>561</td>
<td>474</td>
<td>2,255</td>
<td>3,861</td>
<td>3,491</td>
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<tr>
<td><strong>Total Water Volumes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Produced Water (m³)</td>
<td>1,883,520</td>
<td>2,382,129</td>
<td>2,865,183</td>
<td>3,216,258</td>
<td>3,485,267</td>
<td>2,901,838</td>
<td>3,703,800</td>
<td>3,733,387</td>
</tr>
<tr>
<td>Fresh Water (m³)</td>
<td>512,766</td>
<td>1,026,684</td>
<td>1,493,264</td>
<td>1,433,242</td>
<td>1,553,045</td>
<td>1,479,780</td>
<td>1,876,840</td>
<td>2,042,937</td>
</tr>
<tr>
<td>Brackish Water (m³)</td>
<td>1,438,110</td>
<td>1,661,989</td>
<td>764,664</td>
<td>2,963,684</td>
<td>3,999,848</td>
<td>6,274,361</td>
<td>4,780,011</td>
<td>3,800,437</td>
</tr>
<tr>
<td>Disposal Volume (m³)</td>
<td>663,038</td>
<td>553,678</td>
<td>475,723</td>
<td>426,373</td>
<td>680,010</td>
<td>268,333</td>
<td>174,739</td>
<td>222,200</td>
</tr>
<tr>
<td>Total Produce Recycle (%)</td>
<td>64.8%</td>
<td>76.8%</td>
<td>83.4%</td>
<td>86.7%</td>
<td>80.5%</td>
<td>90.8%</td>
<td>95.3%</td>
<td>93.8%</td>
</tr>
<tr>
<td>Average Daily Recycle (m³/d)</td>
<td>3,344</td>
<td>5,009</td>
<td>6,529</td>
<td>7,644</td>
<td>7,686</td>
<td>7,215</td>
<td>9,642</td>
<td>9,598</td>
</tr>
</tbody>
</table>
Measuring and Reporting
Measurement and Reporting

• Methods of Measurement:
  - Oil and Water: flow meters and test tanks.
  - Solution Gas: orifice meters/GOR Testing

• Typical Well Testing:
  - Frequency and duration: well testing as per Directive 17.
  - Meter installations to replace test tanks (high volume and flood producers).
    – Part of all new pad expansions and rebuilds.

• Field Proration Factors:
  - Within acceptable range (Oil: 0.905, Water: 1.047).
• Optimization:
  - **Remove test tanks and install flow meters on pads/wells**
    - Increase testing frequency and duration
    - Improve proration factors
    - Perform testing inline
    - Eliminates gas venting from tanks
    - Reduces fuel gas consumption
    - Reduces potential for spill
  - **Standardize testing equipment across field**
    - Reduce downtime and maintenance
    - Increase reliability in calibration
    - Improve & revise BS&W testing procedures for better accuracy
• In 2012 finished interconnecting emulsion pipelines to all 3 batteries
  ▪ Installed micro-motion flow meters to measure the volumes transferred between facilities
  ▪ Allowed us to maximize the available capacity of each battery
  ▪ Continues to minimize lost production during plant outages
  ▪ 3 Batteries for the area: North Brintnell 7-27, Central Brintnell 1-36, South Brintnell 9-02
• Possible future OSR amalgamation (OSR 101 and OSR 006) would allow for more simplified accounting processes
Future Facility Plans
Facility Future Plans

• Major Activities:
  ▪ Pad Rebuilds
  ▪ Continue with Polymer Expansion(s) as corporate budgets allow
Water Use
Non-Saline Water Use

- Canadian Natural currently has license 00249595-00-00 with Alberta Environment and Water for the annual diversion of up to 2,151,310 m³ of non-saline water for injection with an expire date of 2014-01-25.
  - **CNRL received a renewal of this license in early 2014.**
- Canadian Natural has not increased the amount of licensed non-saline water since 2006, yet has significantly increased the amount of area under flood as seen in the polymer flood section of this presentation.
- **Working to optimize the use of fresh water for polymer hydration to maximize its benefit**
- **Significant investment has been made in infrastructure and increased operating cost in order to continue to expand the polymer flood without the use of additional non-saline water to our current license.**
- **In Compliance with Alberta Environment and Water regarding monthly reporting, observation well monitoring, and all other terms of the License.**
Brintnell Total Injection

Brintnell Total Injection

- Saline Make-Up Water
- Fresh Make-Up Water
- PW to Injection
## 2013 Injection Water Summary

### Polymer Injection Volumes (m³)

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Produced Water to Injection</strong></td>
<td>248,896</td>
<td>242,899</td>
<td>270,297</td>
<td>252,948</td>
<td>299,679</td>
<td>318,993</td>
<td>327,544</td>
<td>326,197</td>
<td>315,359</td>
<td>315,296</td>
<td>291,706</td>
<td>312,856</td>
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<tr>
<td><strong>Fresh Make-Up Water</strong></td>
<td>142,898</td>
<td>147,449</td>
<td>172,144</td>
<td>165,509</td>
<td>173,708</td>
<td>172,430</td>
<td>178,609</td>
<td>177,233</td>
<td>178,530</td>
<td>181,307</td>
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<tr>
<td><strong>Saline Make-Up Water</strong></td>
<td>366,027</td>
<td>362,393</td>
<td>380,014</td>
<td>372,042</td>
<td>321,279</td>
<td>308,439</td>
<td>339,168</td>
<td>335,170</td>
<td>276,551</td>
<td>250,636</td>
<td>253,570</td>
<td>235,148</td>
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<tr>
<td><strong>Total</strong></td>
<td>757,820</td>
<td>752,741</td>
<td>822,455</td>
<td>790,499</td>
<td>794,666</td>
<td>799,862</td>
<td>845,321</td>
<td>838,601</td>
<td>770,440</td>
<td>747,240</td>
<td>720,022</td>
<td>725,379</td>
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### Total Injection Volumes (m³)

<table>
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<tr>
<th></th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
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<tbody>
<tr>
<td><strong>Fresh Make-Up Water</strong></td>
<td>1,026,684</td>
<td>1,493,264</td>
<td>1,433,242</td>
<td>1,553,045</td>
<td>1,479,780</td>
<td>1,479,780</td>
<td>1,479,780</td>
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<tr>
<td><strong>Saline Make-Up Water</strong></td>
<td>1,661,989</td>
<td>764,664</td>
<td>2,963,684</td>
<td>3,999,848</td>
<td>6,274,361</td>
<td>4,780,011</td>
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<tr>
<td><strong>Total</strong></td>
<td>5,070,802</td>
<td>5,123,111</td>
<td>7,613,184</td>
<td>9,038,160</td>
<td>10,655,979</td>
<td>10,044,856</td>
<td>9,365,047</td>
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Non-Saline Well Locations
## Non-Saline Water Make up Wells

<table>
<thead>
<tr>
<th>Well Name</th>
<th>JWI</th>
<th>Production Interval</th>
<th>Maximum Rate of Diversion (m³/day)</th>
<th>Maximum Annual Diversion Vol (m³)</th>
<th>2013 Average Diversion Volumes (m³/day)</th>
<th>Annualized Max Daily diversion Volume (M³/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>WSW BP25 - QUAT</td>
<td>100/08-04-081-22W4/00</td>
<td>53.3 - 65.2</td>
<td>818</td>
<td>247,470</td>
<td>681</td>
<td>678</td>
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<tr>
<td>WSW BP11 - QUAT</td>
<td>1F2/13-04-081-22W4/00</td>
<td>34.3 - 38.8</td>
<td>1,200</td>
<td>153,300</td>
<td>425</td>
<td>420</td>
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<tr>
<td>WSW BP2 - GR</td>
<td>1A/12-16-081-22W4/02</td>
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<td>1,750,540</td>
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<td>897</td>
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<td>WSW BP11 - GR</td>
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<td>734</td>
<td>607</td>
<td>607</td>
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<td>WSW HTP2 - GR</td>
<td>1F1/13-29-081-22W4/00</td>
<td>264.8 - 317.8</td>
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<td>1,488</td>
<td>1,683</td>
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<td>WSW HTP6 - GR</td>
<td>1F1/15-27-081-22W4/00</td>
<td>265.8 - 326.8</td>
<td>468</td>
<td>346</td>
<td>350</td>
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<tr>
<td>WSW NHTP16 - GR</td>
<td>1F1/01-17-082-23W4/00</td>
<td>253.0 - 310.0</td>
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<td>541</td>
<td>698</td>
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<tr>
<td>WSW WBP30 - GR</td>
<td>100/15-20-081-22W4/00</td>
<td>260-315</td>
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<td>169</td>
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<td>WSW NHP 13 - GR</td>
<td>100/07-05-082-23W4/00</td>
<td>232-302</td>
<td>325</td>
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<td>WSW HHP 15 - GR</td>
<td>100/08-08-082-23W4/00</td>
<td>243-305</td>
<td>225</td>
<td>141</td>
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</table>

### Total Fresh Water 2013

![Total Fresh Water 2013 Graph](image)

- **Cumm. Diversion**
- **License**
- **% Difference**

- **Dates:**
  - 31-Dec-12 to 19-Feb-13
  - 10-Apr-13 to 30-May-13
  - 7-Jun-13 to 16-Sep-13
  - 27-Oct-13 to 13-Nov-13
  - 1-Dec-13

- **Percentage Differences:**
  - 0.00%
  - -5.00%
  - -10.00%
  - -15.00%
  - -20.00%
  - -25.00%
Saline Water Source Map
# 2013 Saline Water Source Well Diversion Volumes (m³)

<table>
<thead>
<tr>
<th>Well Name</th>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>BR NORTH 1F1/11-26-082-21W4/00 SRC</td>
<td>27,884</td>
<td>25,548</td>
<td>26,413</td>
<td>28,290</td>
<td>37,022</td>
<td>54,381</td>
<td>57,134</td>
<td>63,281</td>
<td>53,492</td>
<td>59,748</td>
<td>62,444</td>
<td>3,800,437</td>
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<tr>
<td>BR NORTH NBP24 1F1/06-02-082-20W4/00</td>
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<td>-</td>
<td>3,346</td>
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<td>-</td>
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<tr>
<td>BR NORTH NBP24 1F1/11-26-082-20W4/00</td>
<td>-</td>
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<tr>
<td>BR NORTH NBP24 1F1/12-27-082-21W4/00 SRC</td>
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<td>3,346</td>
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<tr>
<td>BR NORTH NBP5 1F1/06-02-082-22W4/00</td>
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<tr>
<td>BR NORTH NHP9 1F2/14-11-082-22W4/00</td>
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</tr>
<tr>
<td>BR SOUTH SBP16 1F1/13-26-080-22W4/00</td>
<td>32,686</td>
<td>35,758</td>
<td>39,840</td>
<td>36,705</td>
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<td>BR SOUTH SBP28 1F1/12-14-080-22W4/00</td>
<td>43,574</td>
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<td>63,510</td>
<td>10,583</td>
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<td>24,232</td>
<td>31,174</td>
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<td>17,618</td>
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<td>42,634</td>
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<td>21,837</td>
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<td>39,894</td>
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<td>64,030</td>
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<td>51,159</td>
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<td>57,251</td>
<td>75,291</td>
<td>77,050</td>
<td>108,718</td>
<td>50,892</td>
<td>6,220</td>
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<td>75</td>
<td>700,187</td>
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<tr>
<td>BR SOUTH WSW 1F1/12-01-081-23W4/00</td>
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<td>20,803</td>
<td>83,012</td>
<td>57,428</td>
<td>38,977</td>
<td>14,685</td>
<td>51,841</td>
<td>81,362</td>
<td>58,264</td>
<td>61,192</td>
<td>69,794</td>
<td>64,196</td>
<td>601,554</td>
</tr>
<tr>
<td>BRINTNEL BP9 1F1/08-08-081-22W4/00</td>
<td>101,977</td>
<td>85,011</td>
<td>35,371</td>
<td>95,282</td>
<td>64,463</td>
<td>58,105</td>
<td>12,701</td>
<td>17,264</td>
<td>34,241</td>
<td>12,364</td>
<td>16,605</td>
<td>7,208</td>
<td>540,592</td>
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<tr>
<td><strong>Totals</strong></td>
<td>366,027</td>
<td>362,393</td>
<td>380,014</td>
<td>372,042</td>
<td>321,279</td>
<td>308,439</td>
<td>339,168</td>
<td>335,170</td>
<td>276,551</td>
<td>250,636</td>
<td>253,570</td>
<td>235,148</td>
<td>3,800,437</td>
</tr>
</tbody>
</table>
Water Usage and Disposal

- Improvements over past year on water handling capability at batteries to reduce disposal water and increase produced water recycling ratios.
  - **2013 recycle at 94.0%**.
- CNRL continues to be in compliance with AENV water diversion license.
## Pelican Lake Water Information

### 2006-2013

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
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</thead>
<tbody>
<tr>
<td>Fresh Water (m³/day)</td>
<td>1405</td>
<td>2813</td>
<td>4091</td>
<td>3927</td>
<td>4255</td>
<td>4054</td>
<td>5142</td>
<td>5594</td>
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<tr>
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<td>3940</td>
<td>4553</td>
<td>2095</td>
<td>8120</td>
<td>10958</td>
<td>17190</td>
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<td>10412</td>
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<td>Total Water (m³/day)</td>
<td>5345</td>
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<td>6186</td>
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<td>15213</td>
<td>21244</td>
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<td>1.1</td>
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<td>1.1</td>
<td>2.1</td>
<td>2.6</td>
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<td>0.5</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.7</td>
<td>0.8</td>
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<tr>
<td>Produced Water Recycle (m³/day)</td>
<td>3344</td>
<td>5009</td>
<td>6546</td>
<td>7644</td>
<td>7686</td>
<td>7215</td>
<td>9669</td>
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<td>Recycle Rates</td>
<td>64.8%</td>
<td>76.8%</td>
<td>83.4%</td>
<td>86.7%</td>
<td>80.5%</td>
<td>90.8%</td>
<td>95.3%</td>
<td>94.0%</td>
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<td>Oil Produced (bbl/day)</td>
<td>29570</td>
<td>34269</td>
<td>37035</td>
<td>36612</td>
<td>36726</td>
<td>36372</td>
<td>38656</td>
<td>42934</td>
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### 2013 Monthly

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<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
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</thead>
<tbody>
<tr>
<td>Fresh Water (m³/day)</td>
<td>4,610</td>
<td>5,266</td>
<td>5,535</td>
<td>5,517</td>
<td>5,603</td>
<td>5,748</td>
<td>5,762</td>
<td>5,717</td>
<td>5,951</td>
<td>5,849</td>
<td>5,825</td>
<td>5,722</td>
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<tr>
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<td>11,807</td>
<td>12,943</td>
<td>12,259</td>
<td>12,401</td>
<td>10,364</td>
<td>10,281</td>
<td>10,941</td>
<td>10,812</td>
<td>9,218</td>
<td>8,085</td>
<td>8,452</td>
<td>7,585</td>
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<tr>
<td>Total Water (m³/day)</td>
<td>16,417</td>
<td>18,209</td>
<td>17,812</td>
<td>17,918</td>
<td>15,967</td>
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<td>16,529</td>
<td>15,169</td>
<td>13,934</td>
<td>14,277</td>
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<td>Total Water per barrel of oil</td>
<td>2.8</td>
<td>2.9</td>
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<td>2.9</td>
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<td>2.2</td>
<td>2.3</td>
<td>2.3</td>
<td>2.1</td>
<td>1.9</td>
<td>1.9</td>
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<tr>
<td>Brackish Water per barrel of oil</td>
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<td>2.1</td>
<td>2.0</td>
<td>2.0</td>
<td>1.6</td>
<td>1.4</td>
<td>1.5</td>
<td>1.5</td>
<td>1.3</td>
<td>1.1</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>Fresh Water per barrel of oil</td>
<td>0.8</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
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<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Produced Water Recycle (m³/day)</td>
<td>8029</td>
<td>8675</td>
<td>8719</td>
<td>8432</td>
<td>9667</td>
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<td>10171</td>
<td>7972</td>
<td>10092</td>
</tr>
<tr>
<td>Recycle Rates</td>
<td>93.30%</td>
<td>92.97%</td>
<td>93.96%</td>
<td>94.19%</td>
<td>95.05%</td>
<td>97.18%</td>
<td>97.28%</td>
<td>96.83%</td>
<td>96.41%</td>
<td>91.30%</td>
<td>90.01%</td>
<td>89.54%</td>
</tr>
<tr>
<td>Oil Produced (bbl/day)</td>
<td>36,802</td>
<td>38,903</td>
<td>38,881</td>
<td>38,223</td>
<td>40,176</td>
<td>46,066</td>
<td>45,558</td>
<td>45,439</td>
<td>46,218</td>
<td>45,796</td>
<td>46,186</td>
<td>46,964</td>
</tr>
</tbody>
</table>
Water and Oilfield Disposal Map
Disposal Well Data

00/01-36-080-22W4/00

00/02-35-080-22W4/00

00/04-12-081-23W4/03

00/05-02-081-23W4/03

Injected Volume (m3)  Injection Pressure (kPa)
AER Compliance
Hydrogen Sulphide

• Sourcing of production to occur over time, currently in Engineering and Construction phase to ensure compliance across the entire Field to handle sour production (<1% H2S).
• H2S produced at padsites and batteries is expected to be in low concentration and volume.
• CNRL collects solution gas at batteries and wellsites in a common solution gas gathering system.
• Some well sites with total produced gas < 2e³m³ are now being scrubbed and vented if they have D60 approvals.
• Gas to be sweetened in field and at major facility sites (emulsion batteries, compressor station).
AER Compliance

• CNRL continues to work with AER regarding injection well integrity:
  - Formation/hydraulic isolation
  - Cement bond
  - Casing corrosion

• Facility souring – gas gathering system conversion to handle solution gas production before it becomes an issue (integrity, licensing, environmental).

• Process of upgrading existing batteries and wellsite facilities to meet current regulations and codes for the expected service (higher WCT, higher TDS, less than 1% H2S). Timeline to be completed over next 3-5 years throughout field (existing facilities met regulations at time of original construction).
  - Priority on areas where we have seen corrosion through inspections, and areas with high water cut
AER Compliance

• Canadian Natural Resources is not aware of any outstanding compliance issues regarding the current approvals.

• CNRL currently in compliance with other regulatory bodies (SRD, DFO, AENV).

• Reclamation programs: Well and Pipeline abandonments as required by Directives 65 and 13.

• Inactive wells: currently compliant.
  ▪ Long Term Inactives.
  ▪ Review future flood areas to properly downhole suspend/abandon wells within a reasonable time of start of injection (some wells to be completed for flood monitoring).
Outstanding Applications

- Application 1785511 (Approval 9673)
  - Proposing to redrill the existing NBP8 00/04-23-082-21W4 injection well
Conclusion

• Canadian Natural continues to be committed to maximizing the value of the resource for the both itself and the Province of Alberta through it’s Royalty Interest
• Results from the polymer flood continue to be encouraging
  ▪ Continuing to evaluate the impacts of oil viscosity and water production on the ultimate performance and recovery under polymer flooding
• CNRL continues to optimize the operation of the flood and expand to new, more challenging areas
• CNRL has improved produced water recycle to record high levels
• New technology is under investigation to reduce costs, and increase recovery factor
• Compliance with all AER regulations, including cap rock integrity monitoring, and communication with the AER continues to be a top priority.
THE FUTURE CLEARLY DEFINED