

KIRBY IN SITU OIL SANDS PROJECT AER DIRECTIVE 54 ANNUAL PERFORMANCE PRESENTATION

November 2016

PREMIUM VALUE. DEFINED GROWTH. INDEPENDENT.

Outline – Subsurface



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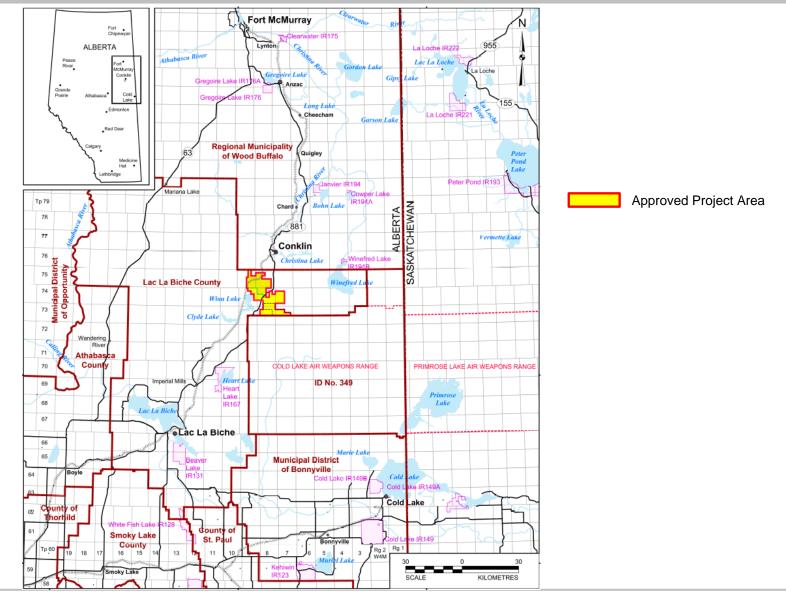
Outline – Surface



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Background Location of Kirby Project





Background Scheme Approval 114750 Project Area



- 30 - 21 - 32-- 33 24 - 26 - 38 31 32 33 34 35 36 30 - 29 28 -27 ... 28-28 - 30 29 28 - 27 20 - 25 23 19 20 21... 24 28-24 24 23 ing. - 20 75-09W4 075-08/0/4 075-07W4 ŵ ÷ġ. 18 - 17 10 -18 17 15 10 rie. - 18-10 12 -+-. . 10 ÷. 12 10 -12 4...... . . . - * - 8-÷ - 23 34 35 38 - 22 34 -25 - 20 31 32 33 . M 30 28 27 26 - 29 -28 - 28 - 20 . 50 20 2 28 23 23 -20 - 20 24 - 10 - 21 --- 24 22 - 20 23 074-09W4 074-08W4 074-07W4 16 · 16 · · 18 . 17 ŵ 18 ÷Ŕ - 10-18 116 -----10 . . 12 ÷ ÷ ÷. ÷... ÷ . . ÷---÷... · · · · . · * · · 4..... 2 -- 5 33 * 38 -* 31 - ----- 34 -- se · 21 · · - - - - --38--32 38. - 78 -27 28 25 10 29 28-25 30 29 -27 28 28 27 28 25 -22 23 10 20-- 21 - 22 24 19 20 21 23 24 23 - 22 073-09W4 073 d8W4 073 07W4
- Recovery Process: Steam Assisted Gravity Drainage (SAGD)

AER Coordinated Operational Assessment



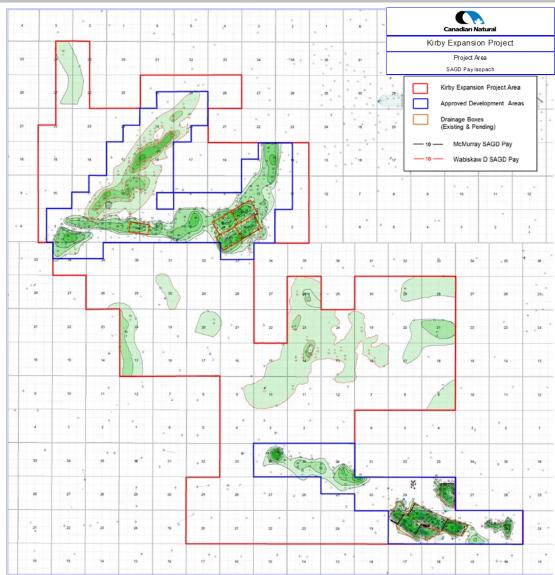
- AER conducted COA of the Kirby Project May to August 2016
 - -intended to confirm compliance with all requirements stipulated under the Oil Sands Conservation Act, including applicable directives, EPEA, Public Lands Act and Water Act.
- Two rounds of desktop information requests
 - Included a comprehensive review of records in relation to applications, licenses, monitoring programs, reports and previous contraventions
- AER staff on site week of June 20th
 - -Focused on pipelines, facilities and C&R practices
- Overall positive feedback received from AER regarding operations of the Kirby Project.



DIRECTIVE 54 SECTION 3.1.1 SUBSURFACE ISSUES RELATED TO RESOURCE EVALUATION AND RECOVERY

Geology Project Area SAGD Pay Isopach





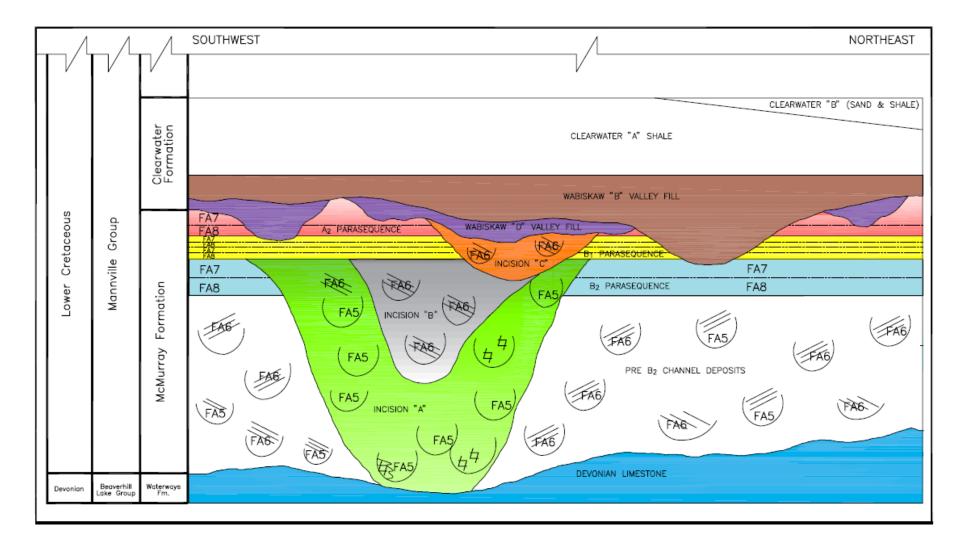


	Average Pay Thickness (m)	Average Oil Saturation (%)	Average Porosity (%)	OBIP (e ³ m ³)
Kirby Approved Project Area	14.8	78.4	32.7	275,864

- Volumetric calculation (for >10m contour):
 - Area above 10m of pay X Pay Thickness X Oil Sat. X Porosity

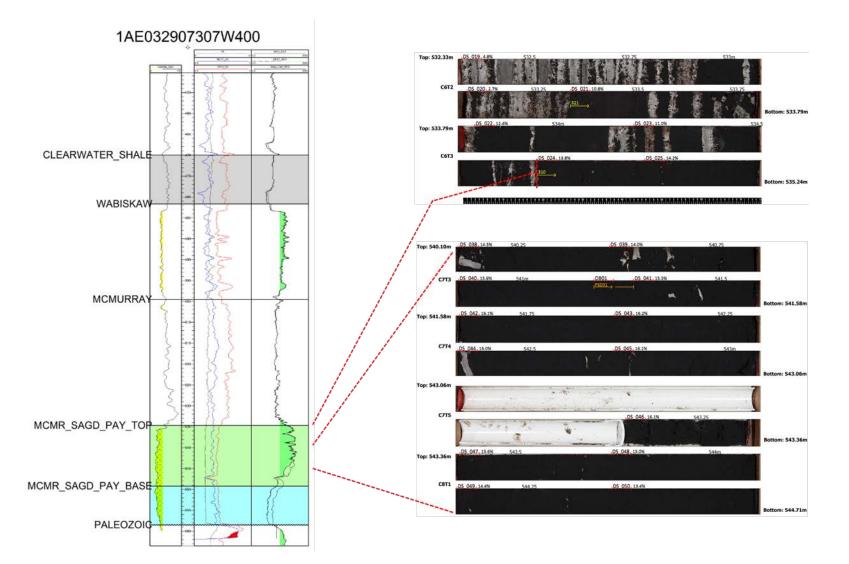
Geology Stratigraphic Schematic





Geology Kirby South Type Log



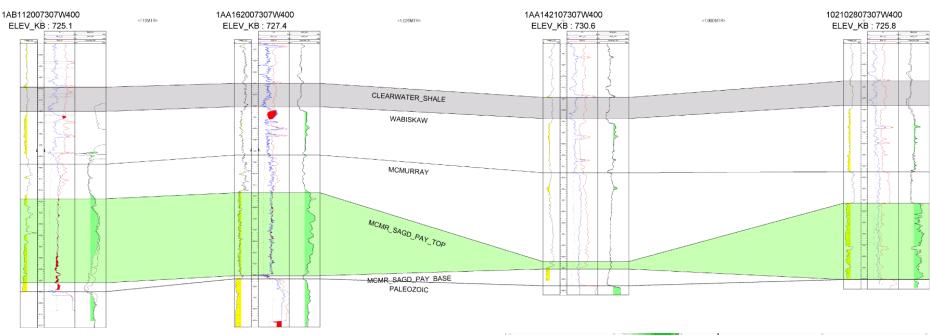


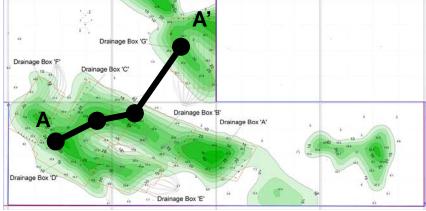
Geology Kirby South Structural Cross-Section



A'

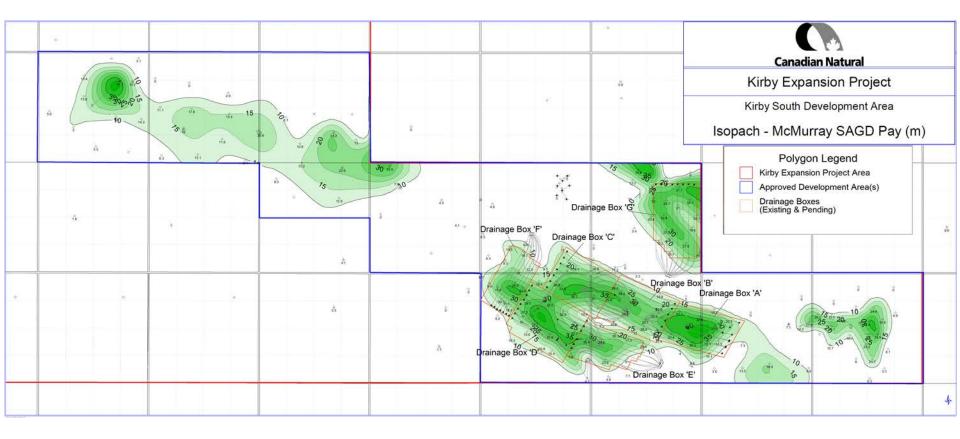
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Geology Kirby South Development Area

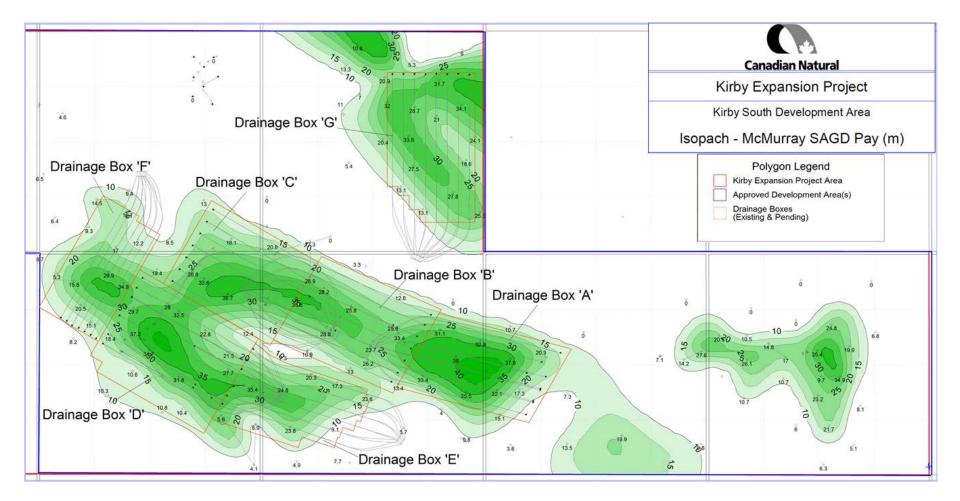




• Recovery Process: Steam Assisted Gravity Drainage (SAGD)

Geology Kirby South SAGD Pay Isopach





Geology Kirby South Development Area Volumetrics



	Average Pay Thickness (m)	Average Oil Saturation (%)	Average Porosity (%)	DBIP (E3m3)
Kirby South Approved Development Area	19.7	76.3	33.2	55 000

- Volumetric calculation (for drainage boxes and >10 m contour):
 - Area above 10 m of pay X Pay Thickness X Oil Sat. X Porosity

Geology Kirby South Drainage Area Volumetrics



Drainage Area	Area (m2)	Oil Saturation (%)	Porosity (%)	Pay Thickness (m)	DBIP (E3m3)
А	600 017	67.9	33.3	28.9	3 920
В	669 345	75.4	32.8	23.45	3 880
С	629 989	78.3	33.4	25.36	4 180
D	792 398	79.5	33.3	26.27	5 510
E	502 828	75.5	34.2	23.08	3 000
F	462 018	77.6	33.3	21.03	2 510
G	654 516	82.9	33.2	25.17	4 530

- Volumetric calculation (for drainage boxes and >10 m contour):
 - Area above 10 m of pay **X** Pay Thickness **X** Oil Sat. **X** Porosity



	Initial Reservoir Pressure (kPa)	Initial Bottom Water Pressure (kPa)	Initial Reservoir	Average Depth of Reservoir, McMR SAGD Pay Top (mTVD)	Average Pay Thickness (m)	Average Porosity, Φ (%)
Kirby South Operating Area	~2600	~2550	13	530	21.9	33.2
Kirby Approved Project Area	~2600	~2550	13	490	14.8	32.7

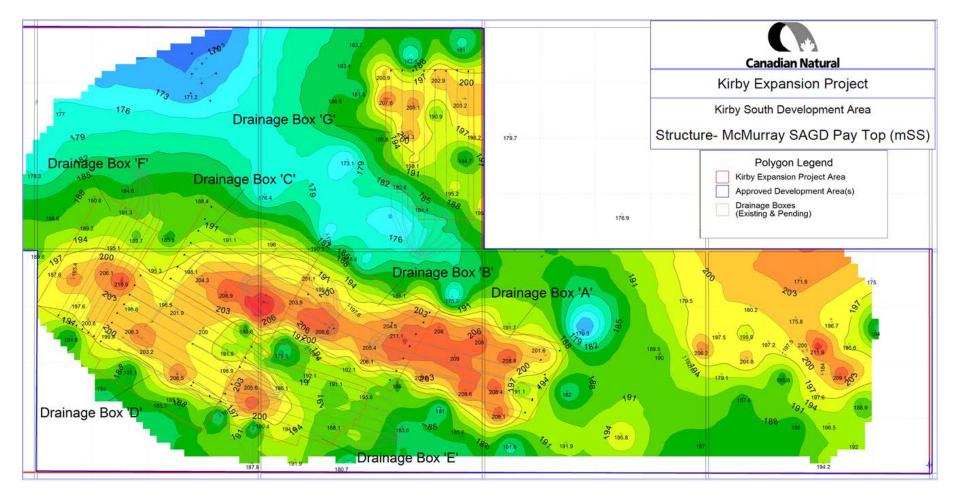
	Average Oil Saturation (%)	Average Water Saturation (%)	Average Horizontal Permeability from OB plugs, Kh (mD)	•	Kv/Kh Ratio
Kirby South Operating Area	74.8	25.2	6410	5260	0.82
Kirby Approved Project Area	78.4	21.6	6560	5510	0.84



No additional Kirby South stratigraphic wells drilled in 2016
 –No cores cut and no special core analysis performed

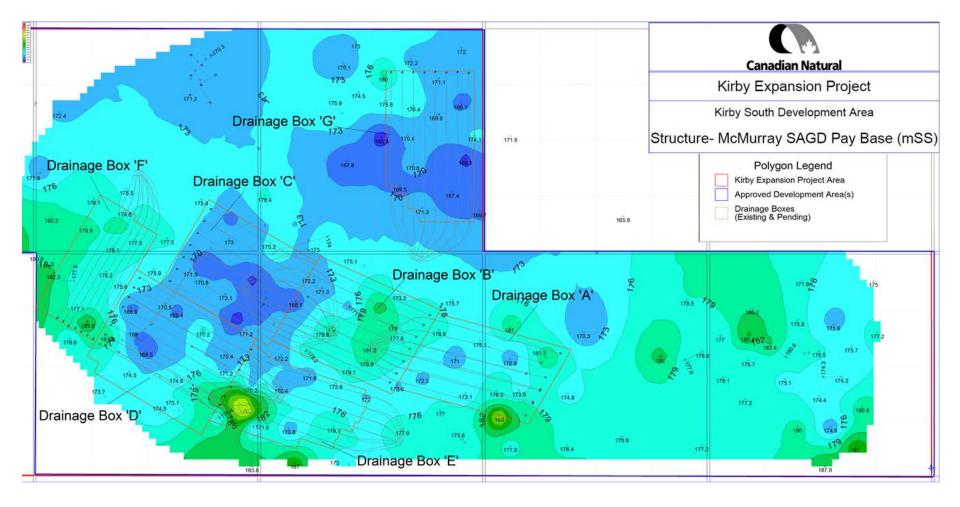
Geology Kirby South SAGD Pay Top Structure





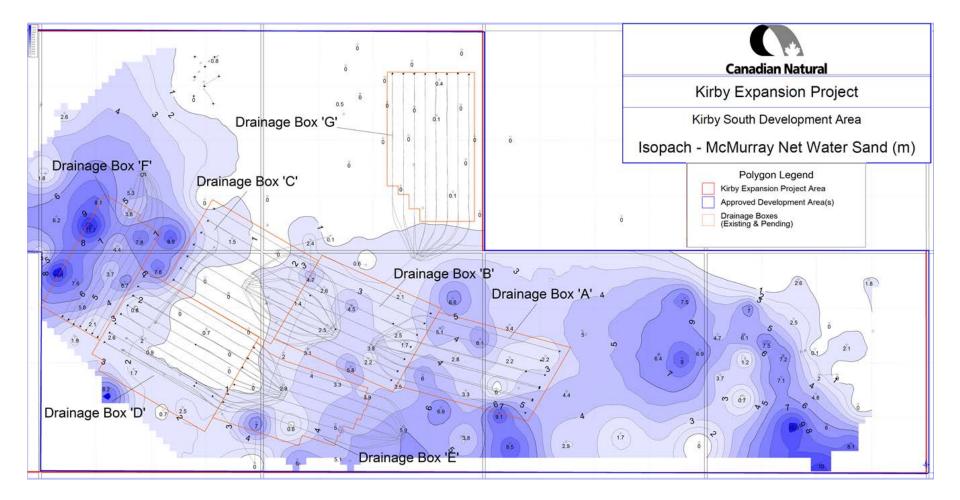
Geology Kirby South SAGD Pay Base Structure





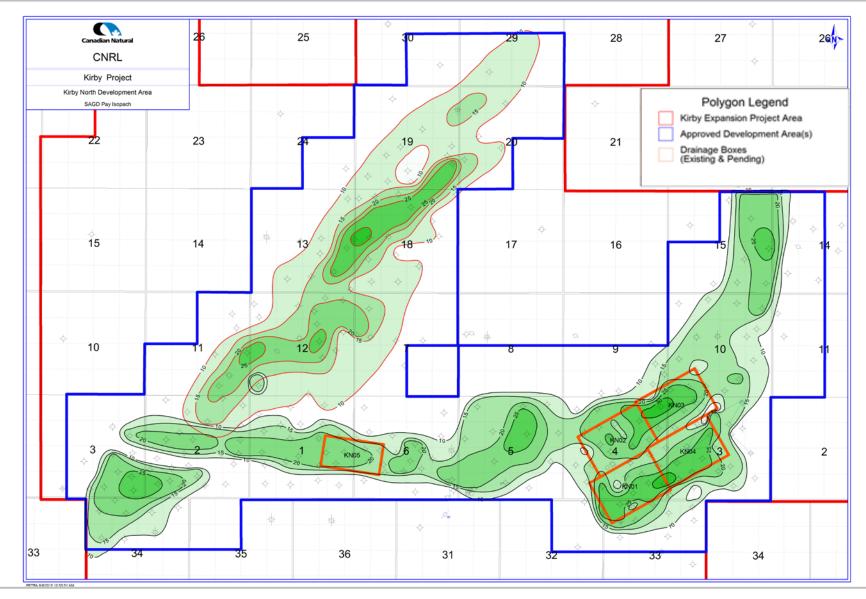
Geology Kirby South Net Water Sand Isopach





Geology Kirby North SAGD Pay Isopach





Geology Kirby North Development Area Volumetrics

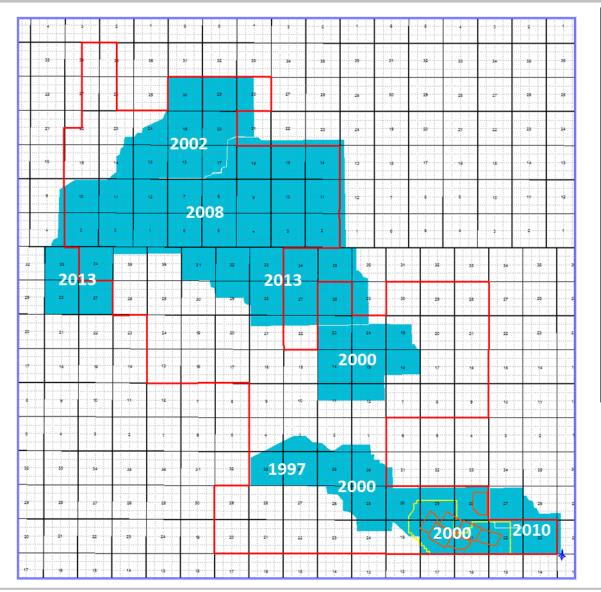


	Average Pay Thickness (m)	Average Oil Saturation (%)	Average Porosity (%)	OBIP (e ³ m ³)
Wabiskaw D Reservoir	15.6	77.5	32.8	43,691
McMurray Reservoir	18.2	80.0	32.3	78,237
Kirby North Approved Development Area				121,928

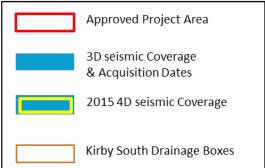
- Volumetric calculation (for >10m contour):
 - Area above 10m of pay X Pay Thickness X Oil Sat. X Porosity

Geology Seismic Coverage



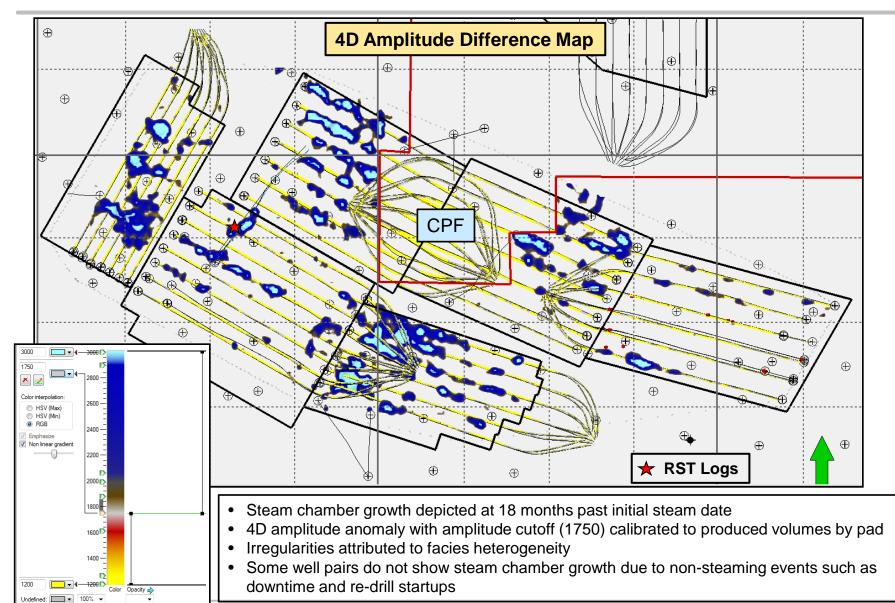


- 4D Seismic acquired March 2015
- Processing completed June 2015. Interpretation completed Sept 2015.
- Calibrated 4D observations against engineering data (TFO, produced volumes)
- Measured extent of steam chamber based on amplitude difference mapping
- Results impacted by location of CPF, re-drills and steam injection downtime



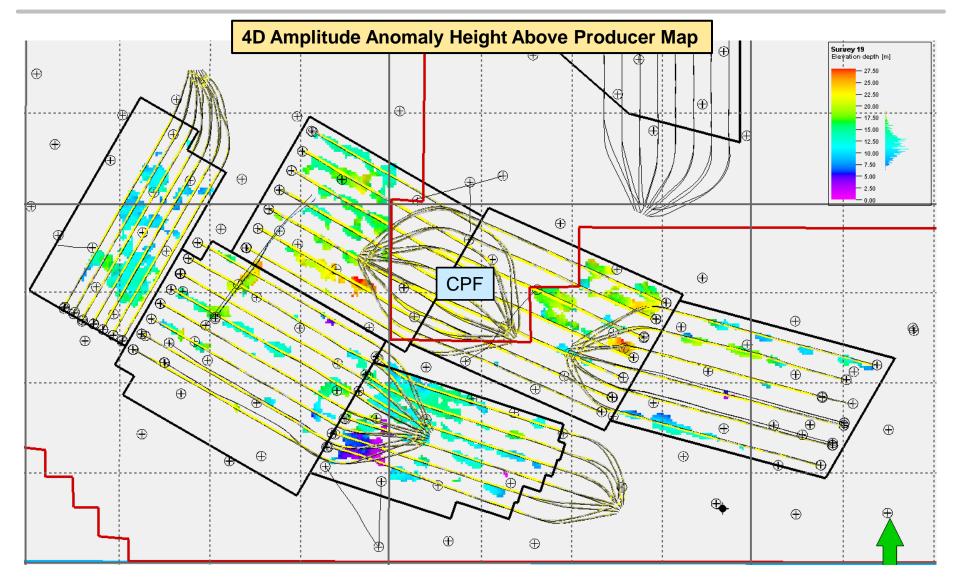
Kirby South 4D Seismic - March 2015





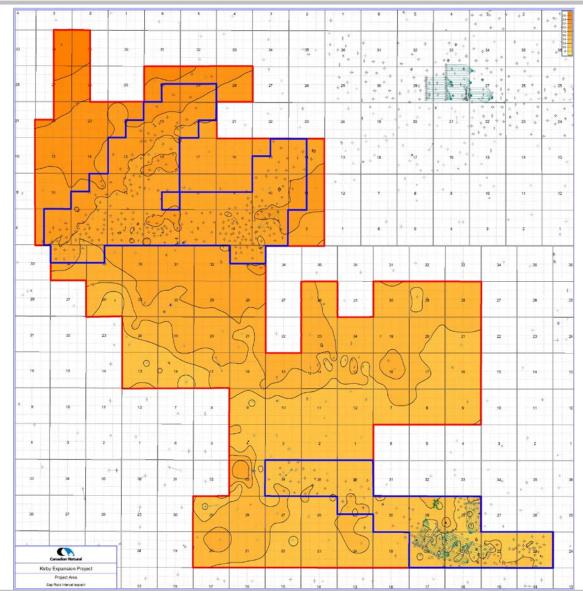
Kirby South 4D Seismic – March 2015





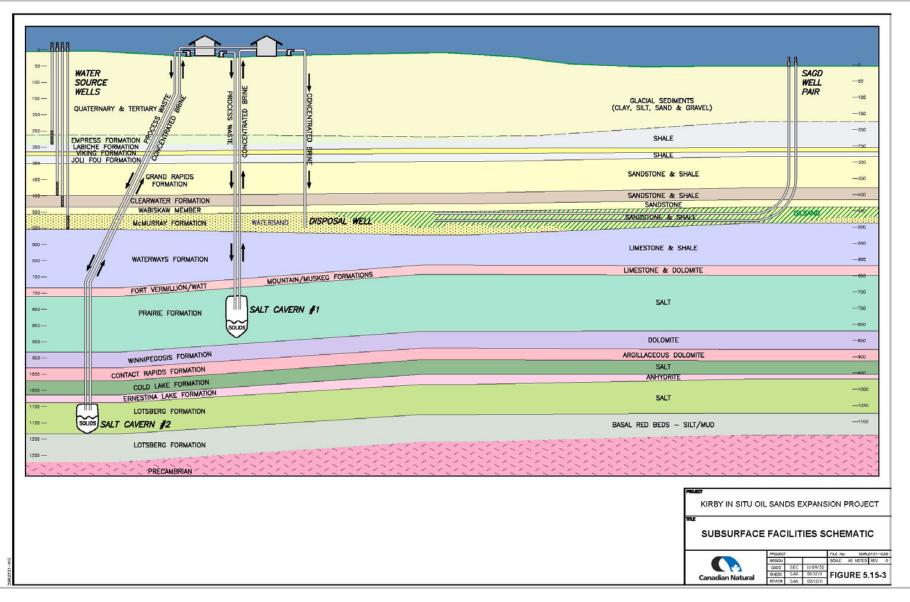
Cap Rock Isopach Map





Kirby South Formation and Well Placement Overview







• Production: majority of wells are equipped with ESPs.

AL Type	Well Count	Lift Capacity (m3/d)	Operating Temperature (DegC)
ESP	47	150-1000	<250
Rod Pump	2	0-300	<250

- Injection: majority of wells are completed with a heel and toe string
- Completions are continually optimized as required by well behavior
 - Outflow control devices are installed to improve steam distribution in the injector
 - Scab liners are installed to enhance toe production in the producer and reduce heel hot spots
 - Inflow control devices are installed to limit single point breakthrough and/or to control to wellbore hydraulics
 - Well pairs with ICD: B2, D6, D7, F5 and F6
 - Well pairs with OCD: B4, C2, C3, D1, D4, E1, E2, E5, E6, F1, F2 and F4

Completion Tool	OCD	Scab Liner	ICD
Well Count	12	22	5

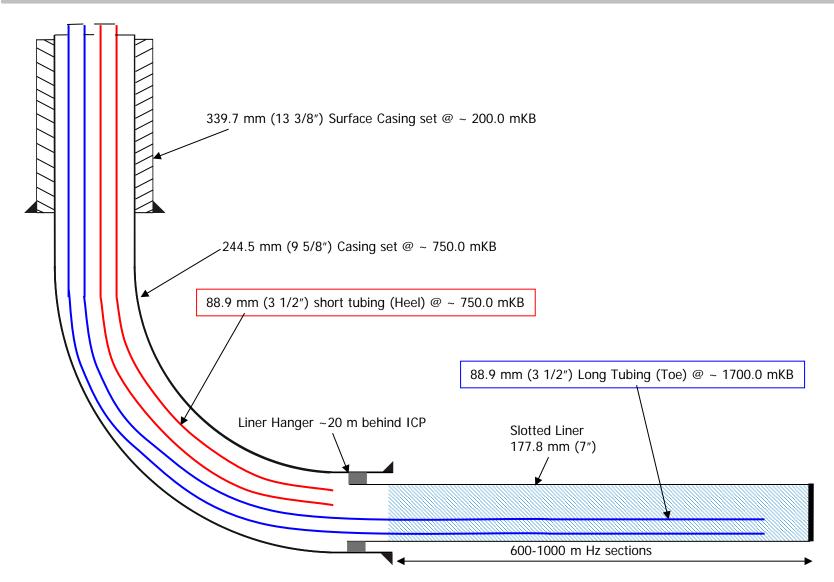
CNQ Some OCDs and ICDs are shiftable tools in the closed position.



- Blanket gas pressures are used to monitor bottom hole pressures for SAGD injection wells.
- SAGD producers are equipped with fiber optic temperature monitoring (DTS) along the lateral and bubble tubes with surface measurement for heel or toe pressure.
- Observation wells gather multiple temperatures and pressures at various elevations.

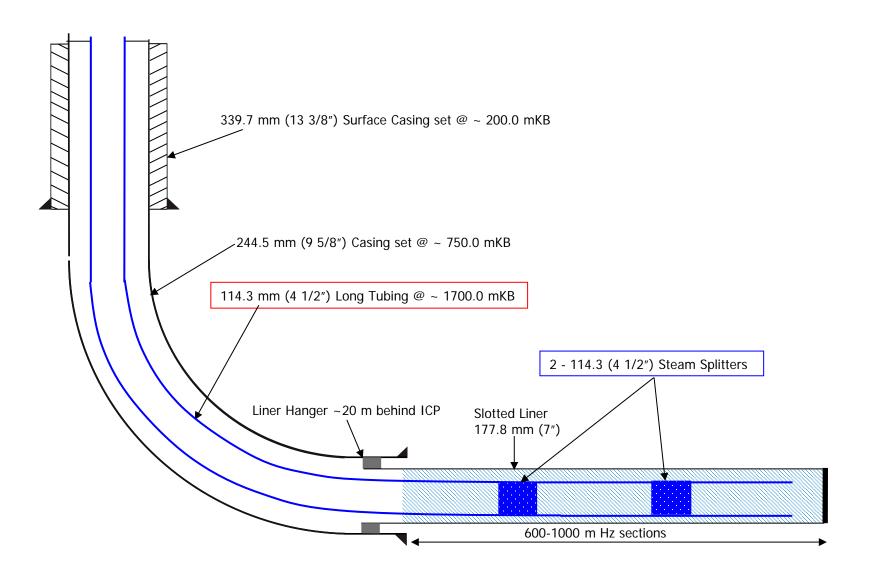
Well Schematics Injection Well (Dual String)





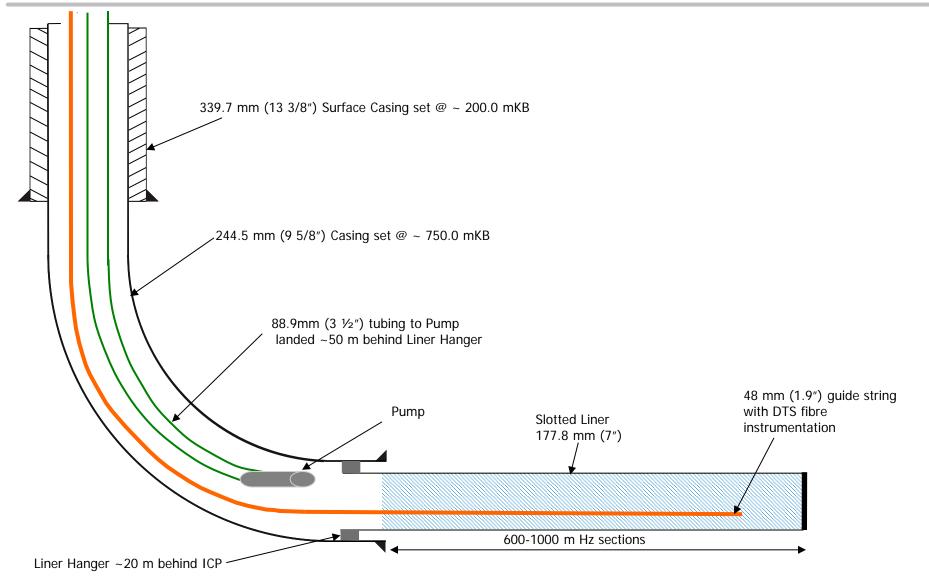
Well Schematics Injection Well (Single String)





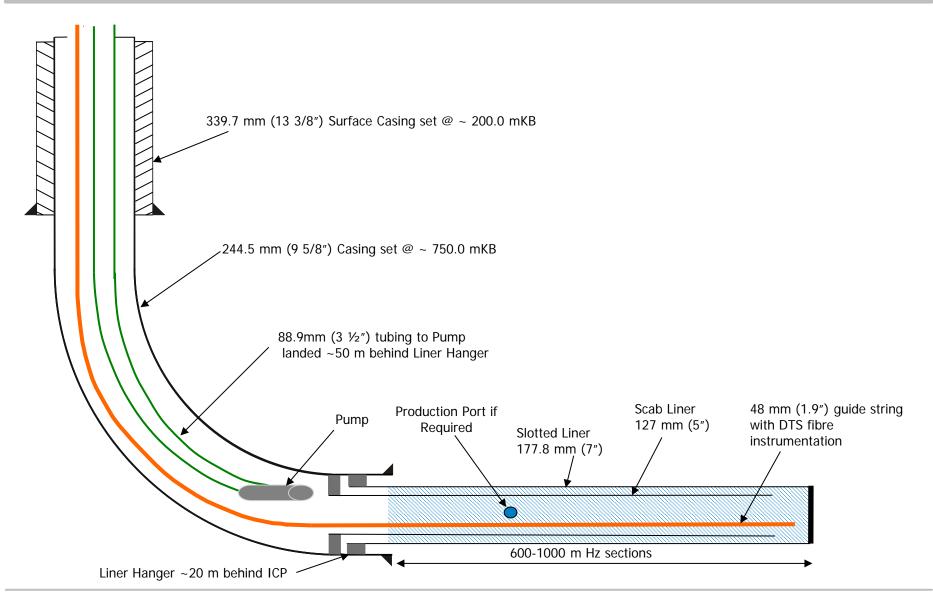
Well Schematics Production Well





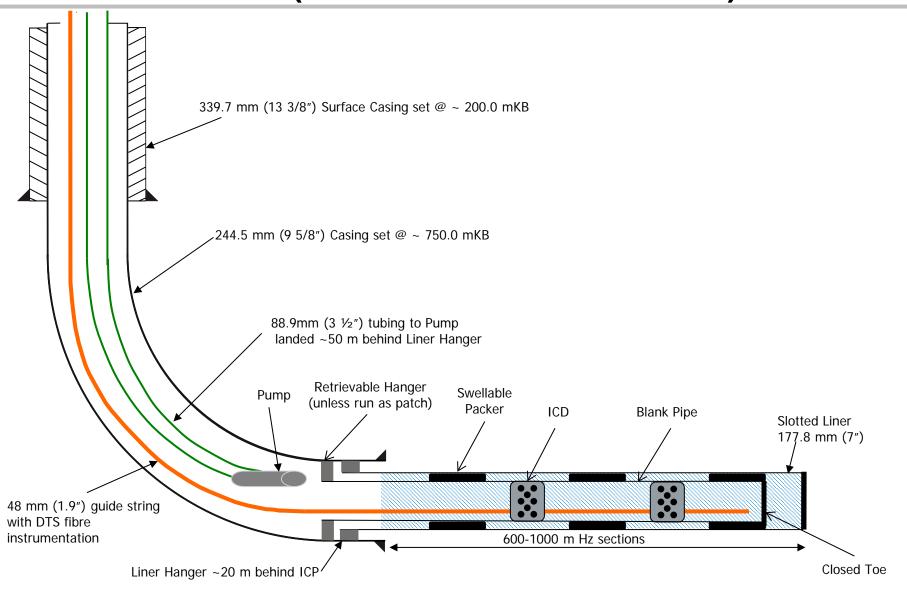
Well Schematics Production Well (Scab Liner)





Well Schematics Production Well (Swellable Packers and ICDs)





Completion Optimization



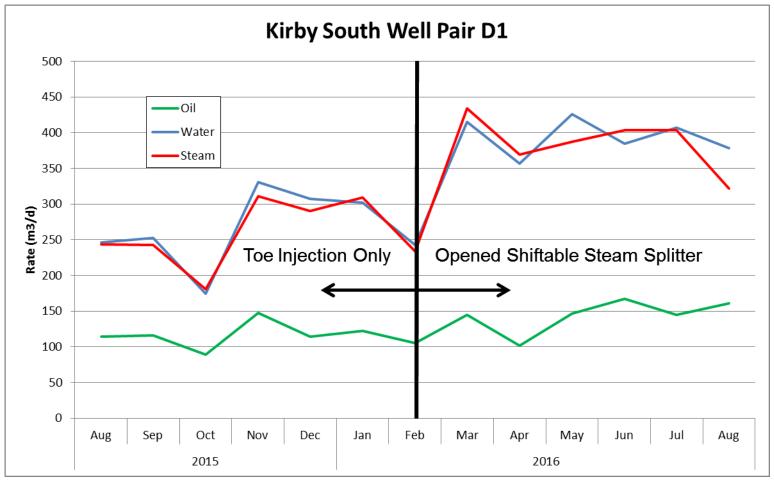
- Steam splitter and scab liner installations/removals were selected based on specific opportunities for each well.
 - -Steam splitters to target a specific stream distribution in the injector
 - -Scab liner installs to encourage toe development and minimize heel temperature variations
 - Scab liner removals to promote heel development after toe fluids are mobile
- ICDs and swellable packers strings were used to limit single point breakthrough and/or to control to wellbore hydraulics
- Impact on well performance has been well pair specific

 In general, the results of completion optimization workovers have been encouraging.

Completion Optimization Example



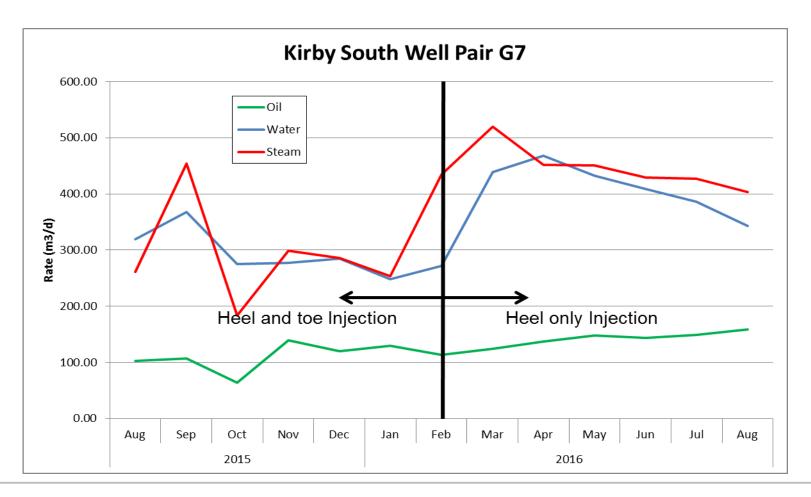
D1I was injecting out of the toe only on its single string, shiftable splitter design. After the toe was developed, the splitter was opened to allow for steam to access and mobilize more of the reservoir.



Completion Optimization Example

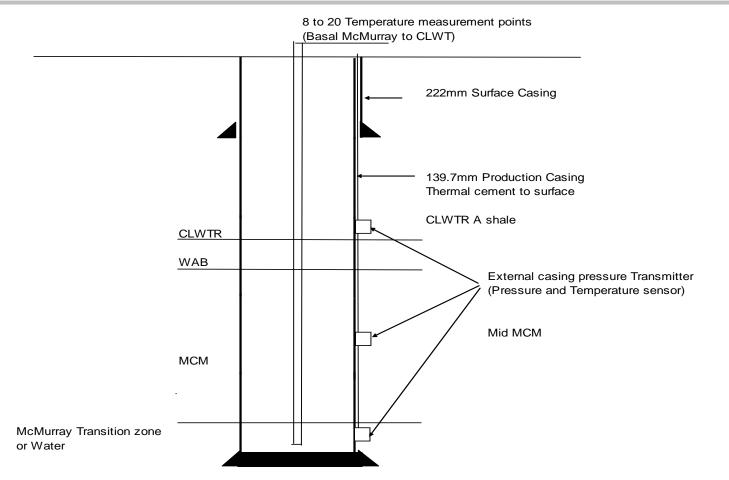


G7I was injecting out of the heel and toe string. To increase the quality of steam, the long string was pulled back to heel, but the performance of the well has not changed from the expected ramp up of the well.



Well Schematics Observation Well

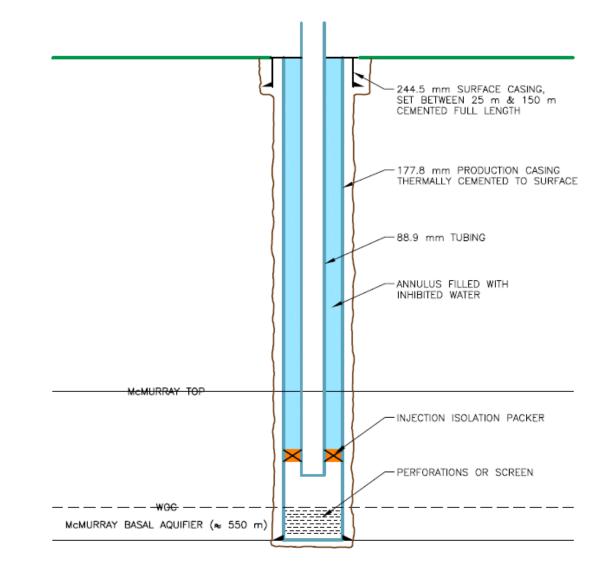




Note: Shows a plan for 2011-2013 drilled observation wells, as previous wells don't have external casing transmitters

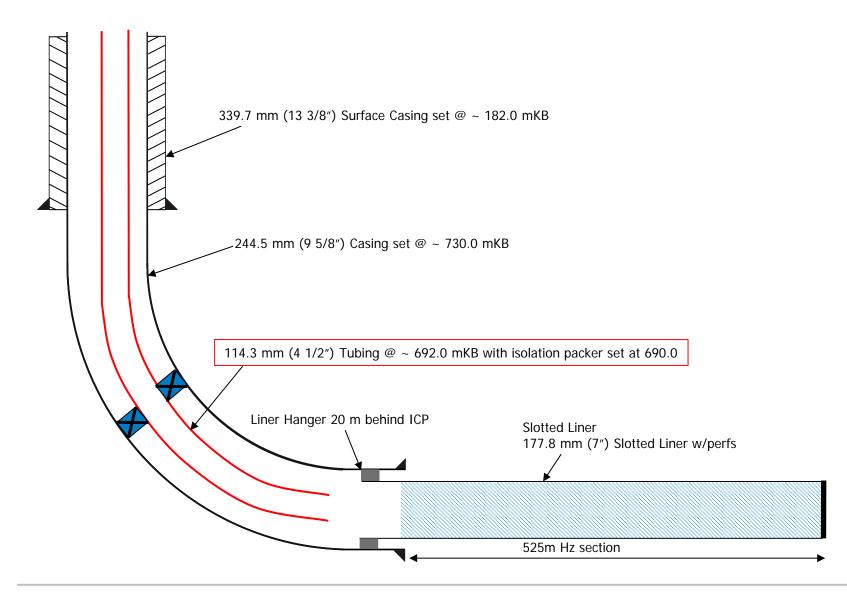
Well Schematics Disposal Well





Well Schematics 13-20 Hz Water Disposal Well





Operational Strategy SAGD



- Injection Strategies
 - Steam down heel and toe string in dual string completion
 - Steam down single long string with steam splitters
- Pump fluid from producer using artificial lift
- Operate wells based on a target steam chamber pressure and target subcool
- Steam chamber pressure is measured by blanket gas pressure in the injector and is controlled by the steam injection rate
 - Target pressure chosen to balance bottom water where it exists, typically 2.5 MPa to 3.5 MPa (Pads A to F)
 - For pads without bottom water influence, pressures may increase up to 5 MPa (Pad G)

Operational Strategy SAGD Continued



- Subcool is the difference between saturated temperature at producer pressure and the highest temperature along the producer lateral
 - Target chosen to maximize production and minimize live steam production
- To optimize pressure and subcool target, a combination of parameters are monitored including:
 - Water retention in reservoir
 - Chlorides concentration in produced water
 - SOR
 - Bottom hole pressures

Kirby South Drilling Activity Update



 No drilling at Kirby South between August 20, 2015 and August 17, 2016

Kirby South SAGD Well Spacing



Pad	Number of Well Pairs	Inter well Spacing (m)	
A	6	100	
В	7	100	
С	7	100	
D	8	80	
Е	6	80	
F	7	50	
G	8	80	

 Infill wells are being considered for wider SAGD pads.

- Original well spacing on Pads A, B, & C were 100 m.
- Well spacing was optimized from 100 m to 80 m to achieve improved CDOR, SOR and recovery factors for wells with less bottom water influence.
- F Pad spacing was decreased to 50 m where thicker bottom water exists to lessen the slumping of oil and therefore improve CDOR, SOR and recovery factor.

Kirby South Performance Pad Recoveries

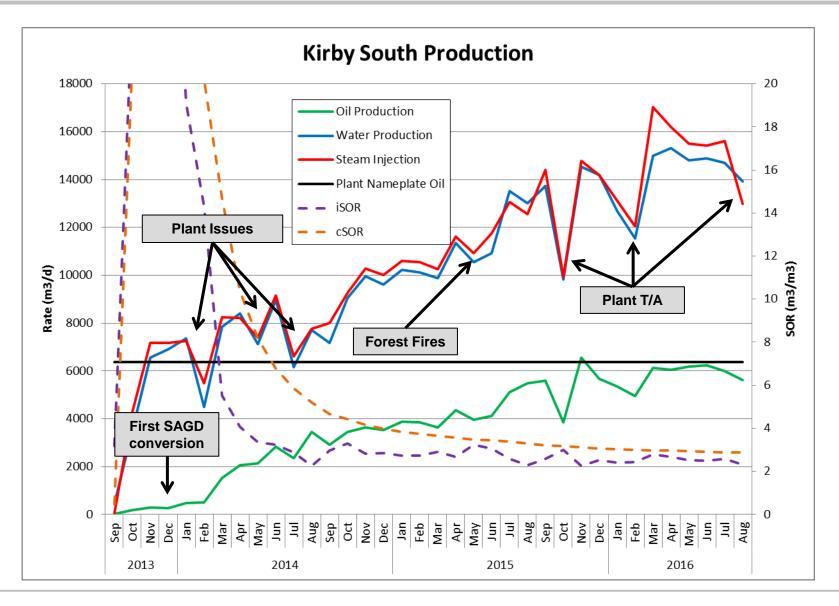


Pad	OBIP (E3m3)	Ult. Recovery (E3m3)	Cum Oil (E3m3)	RF (%)
А	3,920	2,352	375	10
В	3,880	2,328	602	16
С	4,180	2,508	830	20
D	5,510	3,306	613	11
E	3,000	1,800	634	21
F	2,510	1,506	335	13
G	4,530	2,718	562	12
Total	27,530	16,518	3952	14

Recovery as of August 17, 2016

Kirby South Performance Kirby Field Production





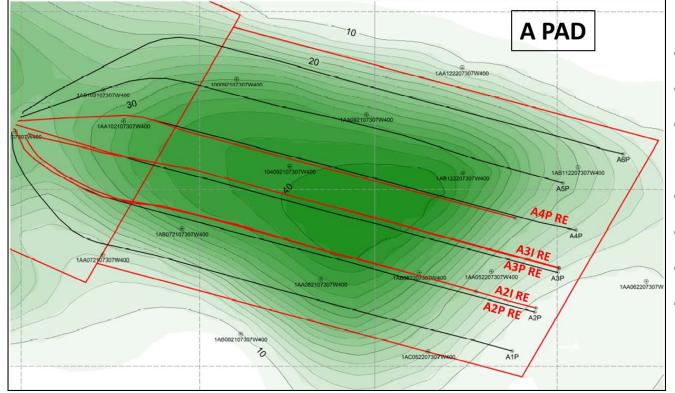
Kirby South Performance Summary



- Reservoir performance is similar to expectations, currently optimizing well-pair conformance.
- Plant turnarounds:
 - Oct 2015: Evap cleanings and Boiler 2 inspection
 - -Jan/Feb 2016: Evap 3 cleaning and Boiler 5 regulatory inspection/TA
 - Feb/Mar 2016: Boiler 3 and 4 regulatory inspection/TA and Evap 2 cleaning
 - -Aug 2016: Boiler 1 regulatory inspection/TA and Evap 1 cleaning
- Record oil production to date ~6850 m³/d (43 100 bbl/d)
- 9 wells lost sand control, 7 wells remediated
 - Installed ICDs on 4 well pairs
 - Installed bridge plugs on 3 well pairs
- Pad G being operated at an increased pressure target of 3.5 MPa

Kirby South Performance – Low Recovery Pad A

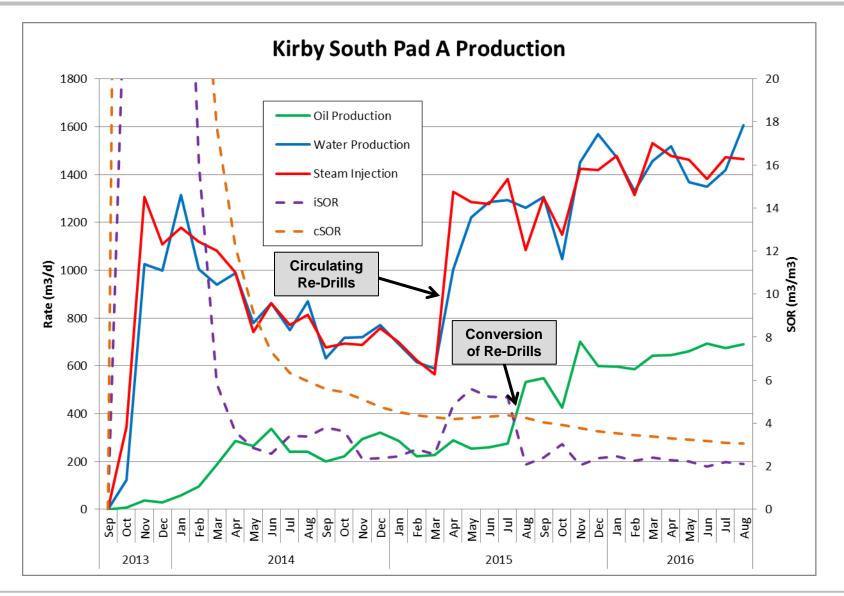




- SAGD well pair: 6
- First steam: Oct. 2013
- Inter-well pair spacing:
 100 m
- Avg. net pay: 29 m
- Avg. So: 68%
- Avg. porosity: 33%
- Current RF: 10%

Kirby South Performance Pad A Production



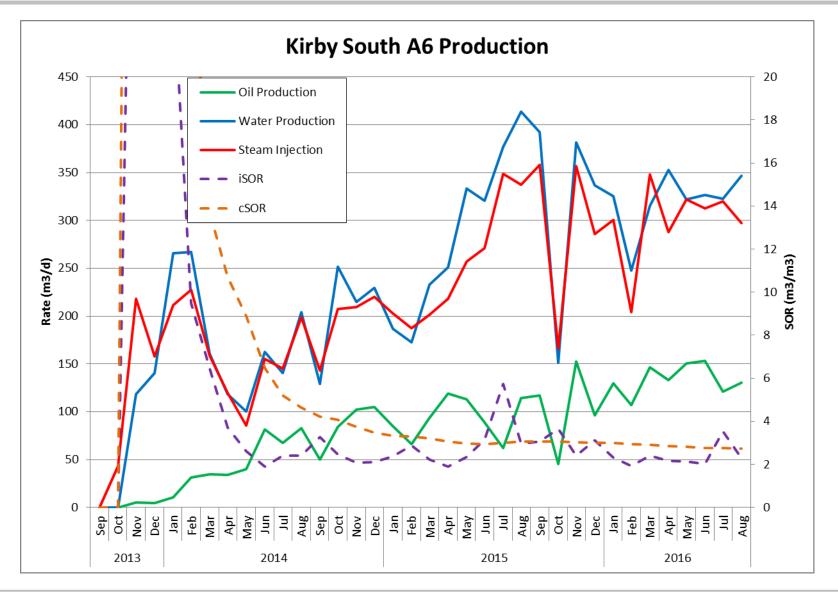


Re-drills successfully targeted better reservoir.

Kirby South Performance High Recovery Pad A Well Pair

CNQ

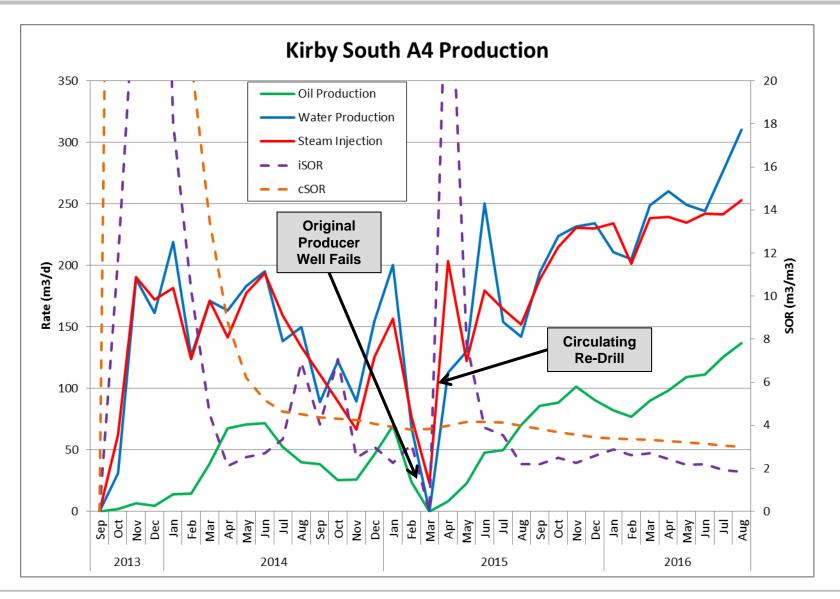




Best performer of A pad ramped up to the expected performance

Kirby South Performance Low Recovery Pad A Well Pair

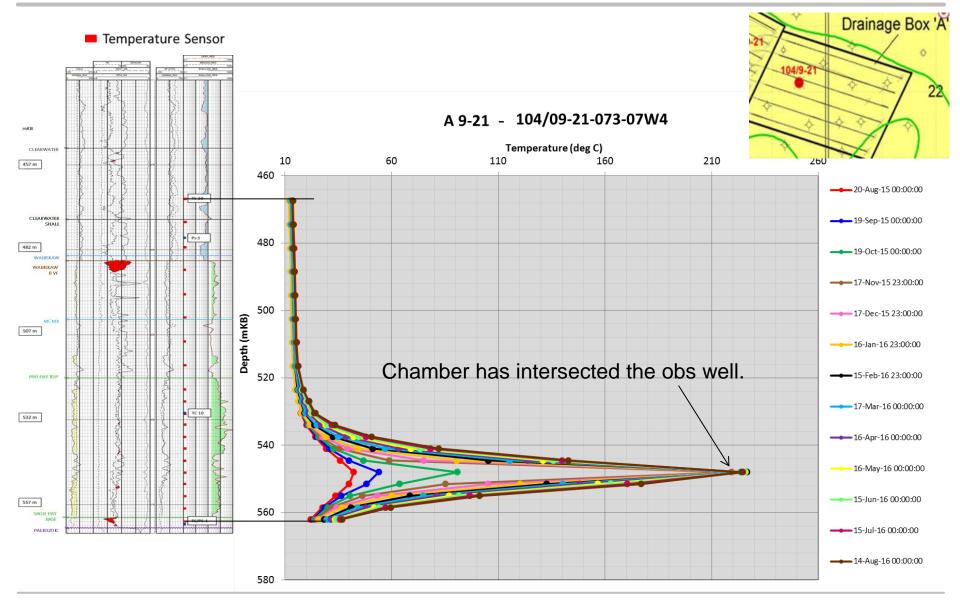




Re-drill successful, ramping to targeted performance

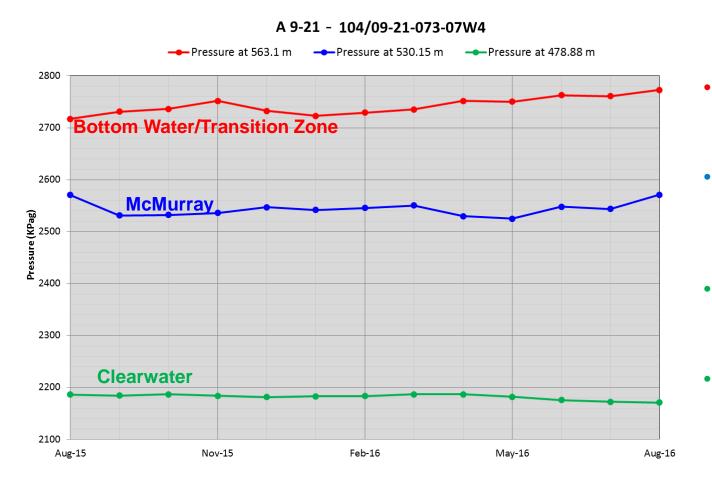
Kirby South Performance Pad A Obs Well – 26 metres from A4





Kirby South Performance Pad A Obs Well Pressures





- BW pressure changes as pad pressures are increased / decreased
- McMurray pressure is being influenced by SAGD pressure (26m from A4)
- Clearwater gauge landed in impermeable shale
- Clearwater declining pressure result of gauge effects and does not indicate change in cap rock properties

Kirby South Performance Pad A Key Learnings

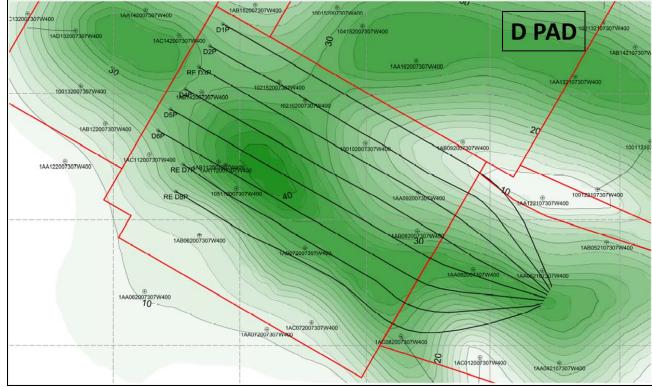


- Pad A has performed at reservoir expectations through this year.
- Re-drills have been successful in improving pad performance

-Continuing to evaluate the economic potential to re-drill A1.

Kirby South Performance – Mid Recovery Pad D



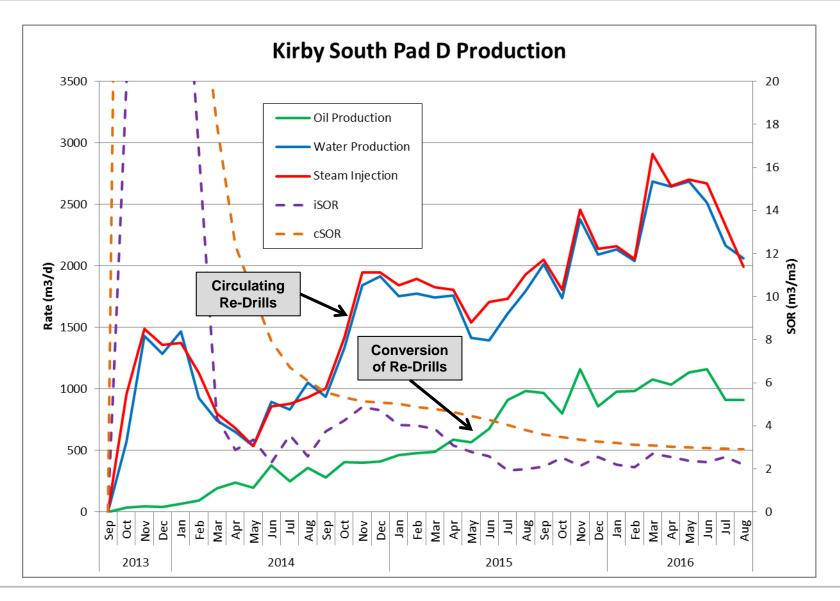


- •SAGD well pair: 8
- First steam: Oct. 2013
- Inter-well pair spacing:
 80 m
- •Avg. net pay: 26 m
- •Avg. So: 80%
- •Avg. porosity: 33%
- •Current RF: 11%

Kirby South Performance Pad D Production

CNQ

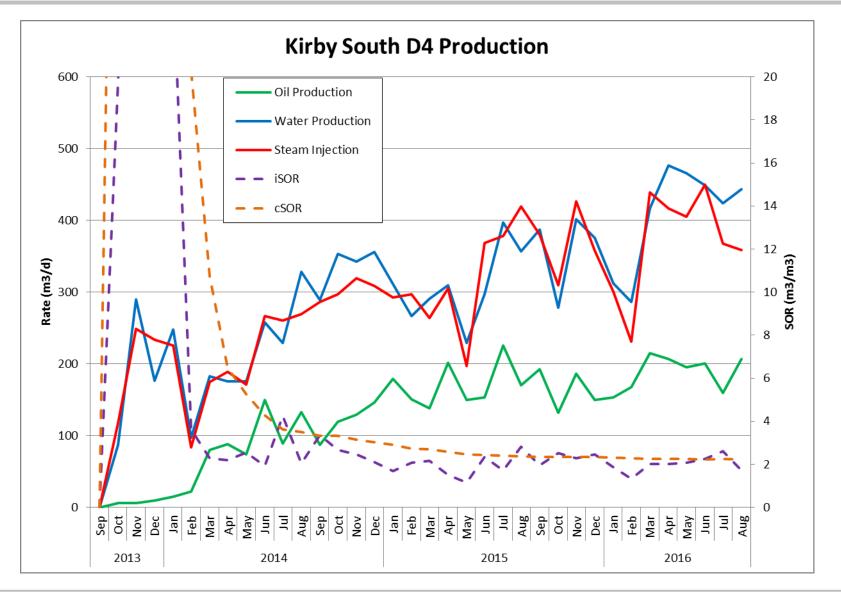




Re-drills are successfully ramping to the expected peak rate

Kirby South Performance High Recovery Pad D Well Pair

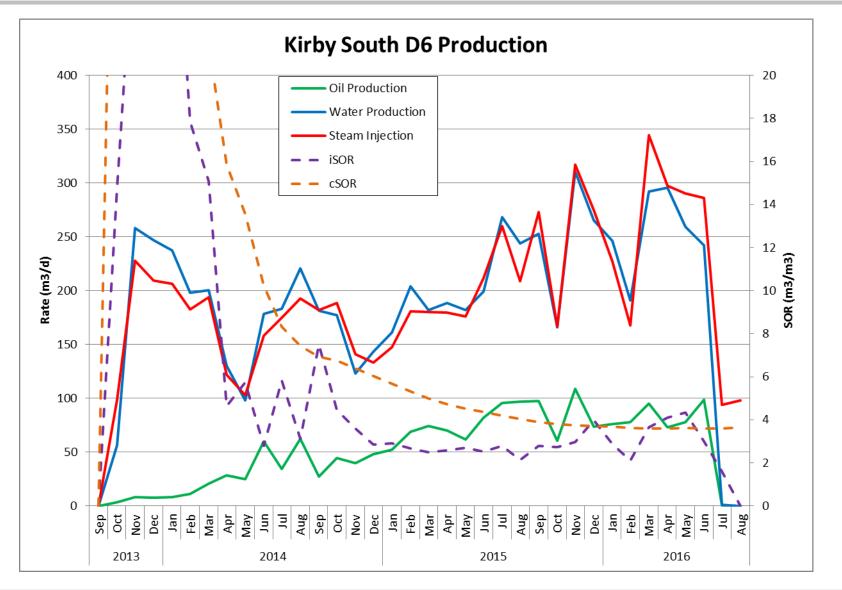




Best performer of D pad

Kirby South Performance Low Recovery Pad D Well Pair

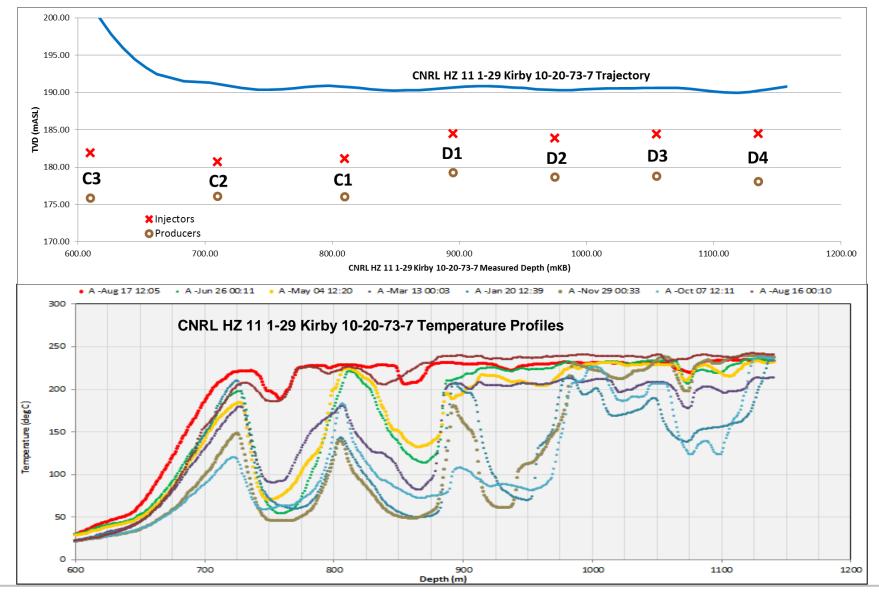




D6 successfully ramping to the peak rate

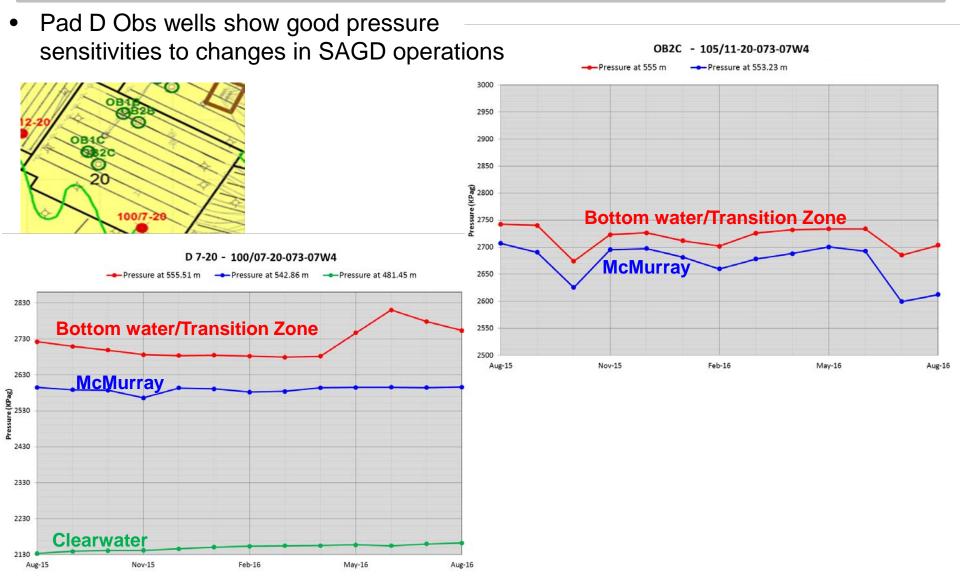
Kirby South Performance Horizontal Observation Well





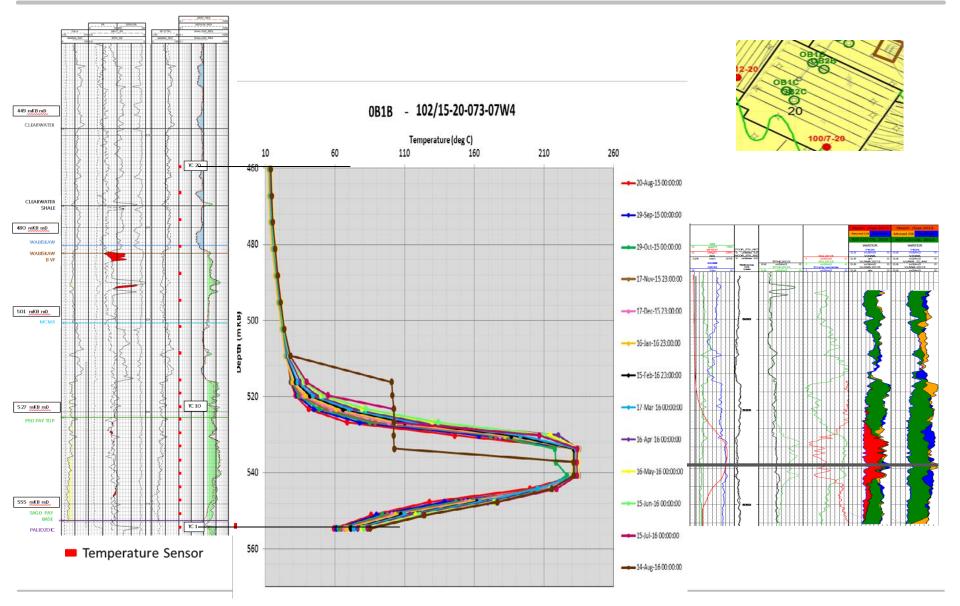
Kirby South Performance Pad D Obs Well Pressures





Kirby South Performance Pad D Obs Well – 5 m From D2





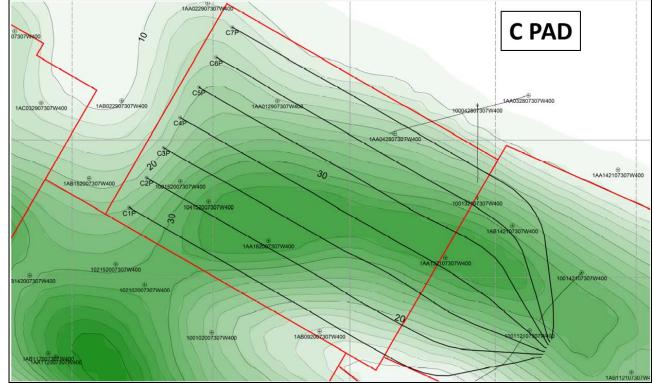
Kirby South Performance Pad D Key Learnings



- Reservoir performance is meeting expectations
- All re-drills on SAGD operation as of Q2 2015
- Known communication through old RAX SAGD pilot
 - -To date no performance issues due to RAX pilot to date
 - -Long term strategy to balance pressures between C & D pad
 - -Continually monitor RAX pressure and temperatures
- Steam splitters reconfigured on D1 to improve temperature conformance

Kirby South Performance Pad C – High Recovery Pad

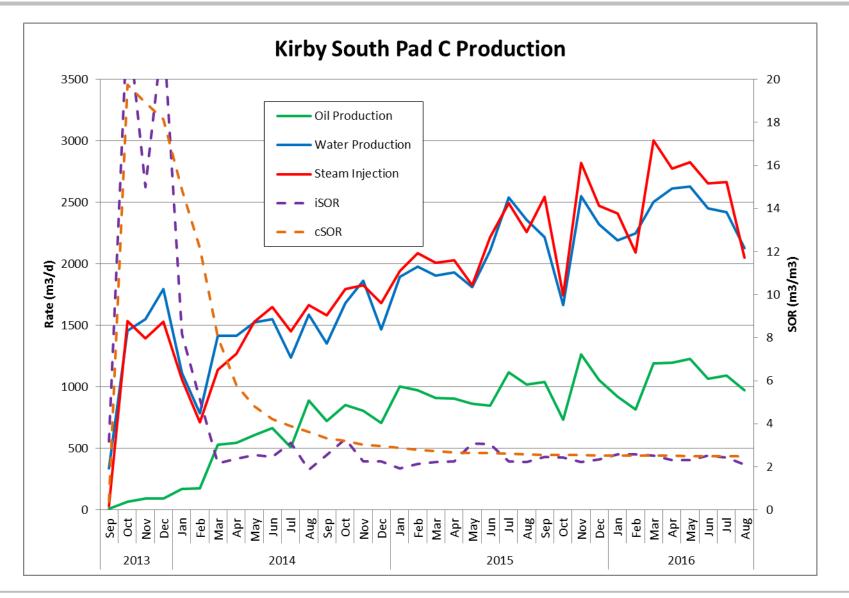




- SAGD well pair: 7
- First steam: Sept. 2013
- Inter-well pair spacing: 100 m
- Avg. net pay: 25 m
- Avg. So: 78%
- Avg. porosity: 33%
- Current RF: 20%

Kirby South Performance Pad C Production



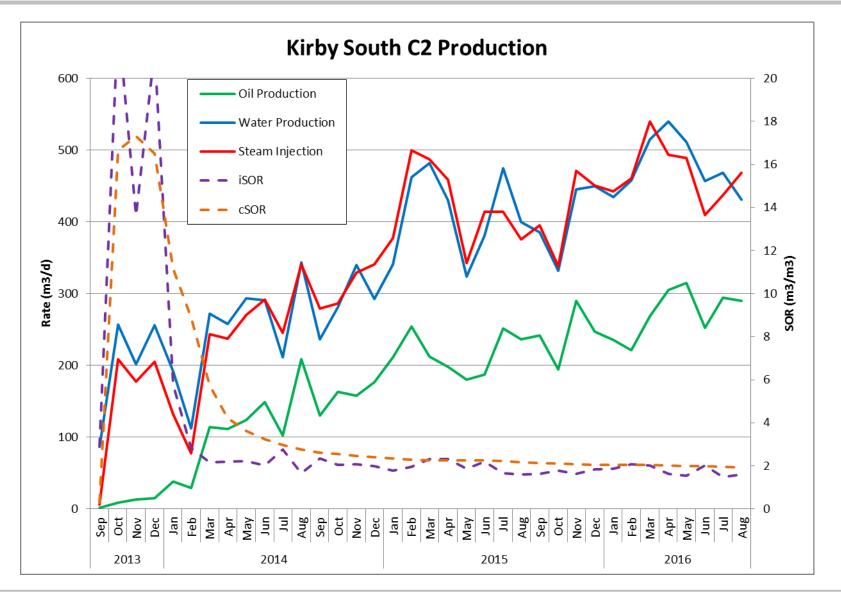


CNQ Pad C is one of the best performers among KBS pads with 20 % RF so far

Kirby South Performance High Recovery Pad C Well Pair

CNQ

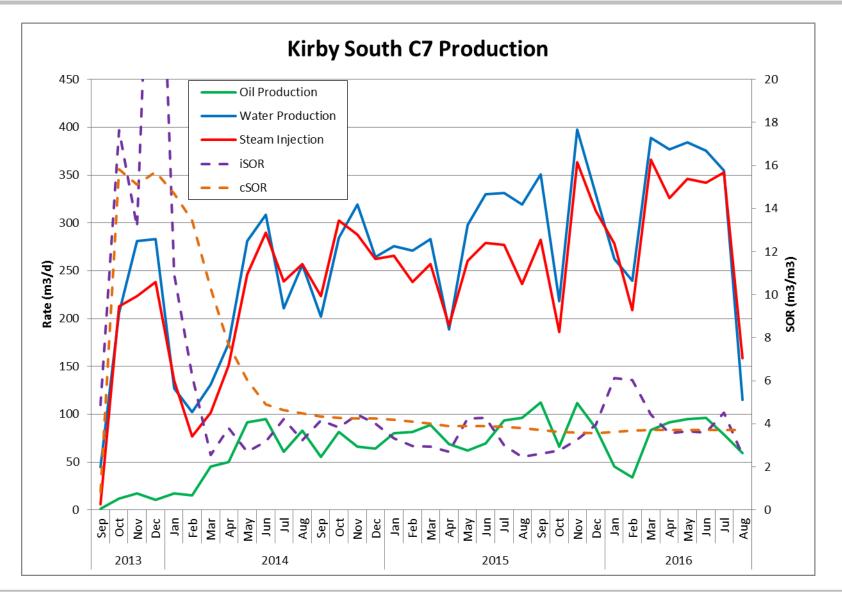




C2 is the best performer on C pad with ramp up to 300 m3/d

Kirby South Performance Low Recovery Pad C Well Pair

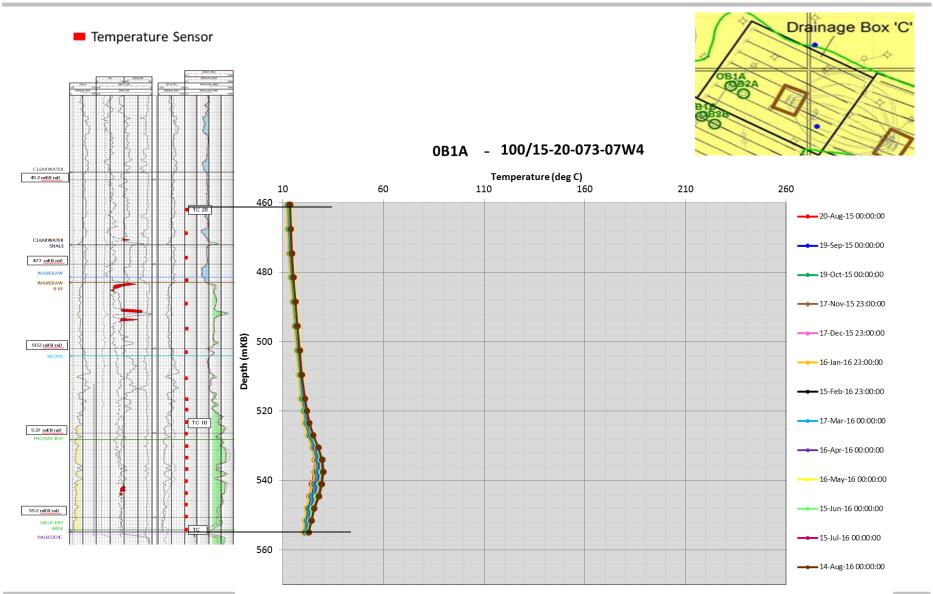




C7 is an example of a low performer on pad C

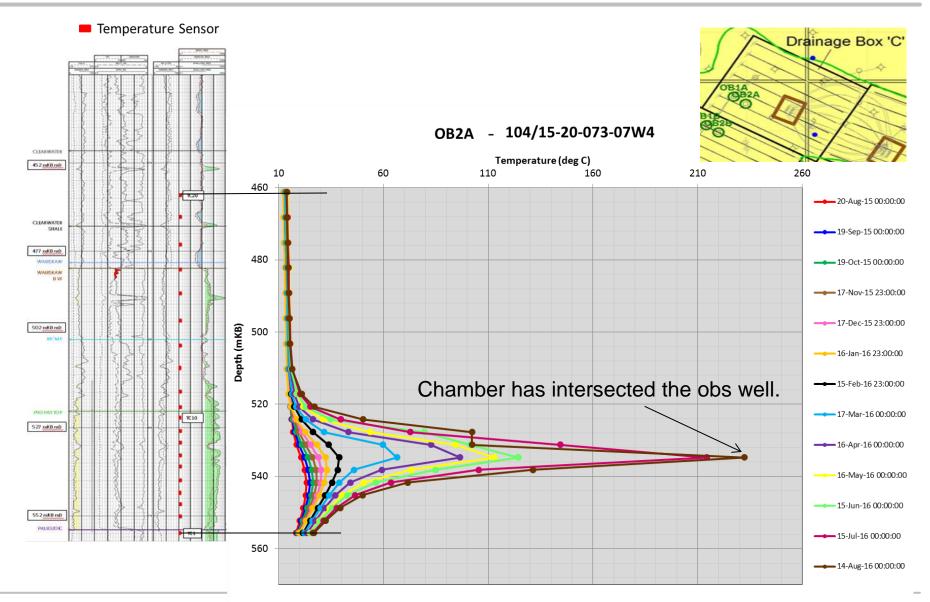
Kirby South Performance Pad C Obs Well – 36 m From C2





Kirby South Performance Pad C Obs Well – 27 m From C2





Kirby South Performance Pad C Key Learnings



- Reservoir performance is meeting expectations
- Known communication through old RAX SAGD pilot
 - -No impact on production

Kirby South Performance 5 Year Outlook – Pad Abandonments



• No expected pad abandonments in the next 5 years

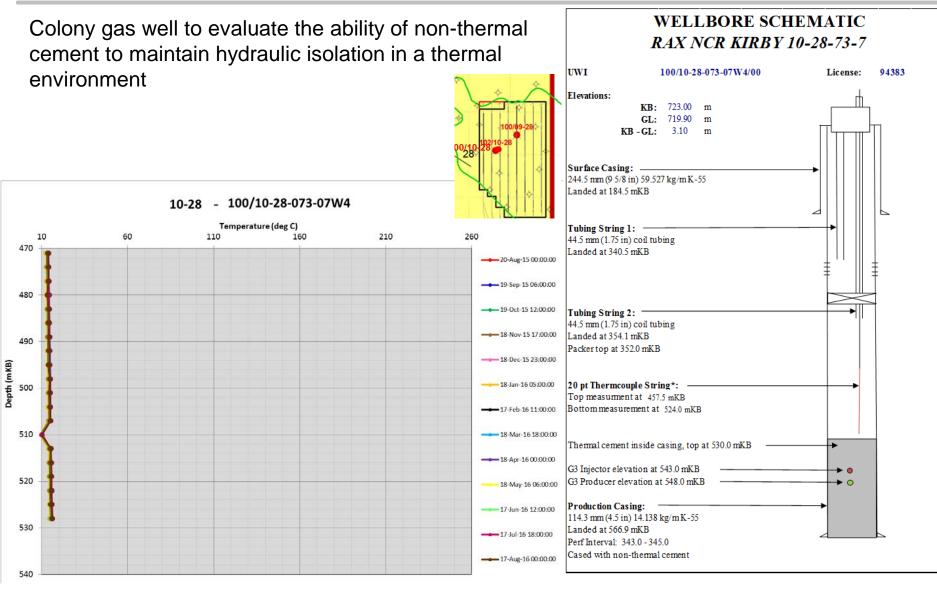
Kirby South Performance Wellhead Steam Quality



- During steady operations, wellhead quality should be 95% or greater
- No other fluids are injected with the steam

Kirby South Observation Well Results 100/10-28-073-07W4 – 4 m From G3





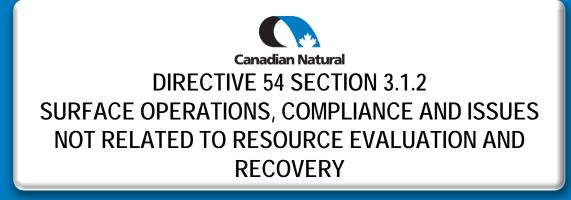
CNQ

Non-thermal cement is maintaining hydraulic isolation

Future Plans – Subsurface Summary



- Continue to optimize SAGD pairs
- Pending favorable economic conditions, the following future plans are contemplated:
 - Potential resumption of B2 (failed producer liner) and A1 (performance).
 - F Pad: Drill remaining approved wells (F8, F9, F10)
 - D Pad: Drill D9 and D10
 - -G Pad: Drill G9 and G10
 - Drill strat wells to evaluate the above drilling
 - Scheme Amendment applications (additional pads)
- Disposal: adding disposal well to one of the existing pads
- Kirby North Development
 - Canadian Natural announced in 2015 that the Kirby North Project would be deferred due to several external factors including commodity prices
 - Construction suspended August 2015



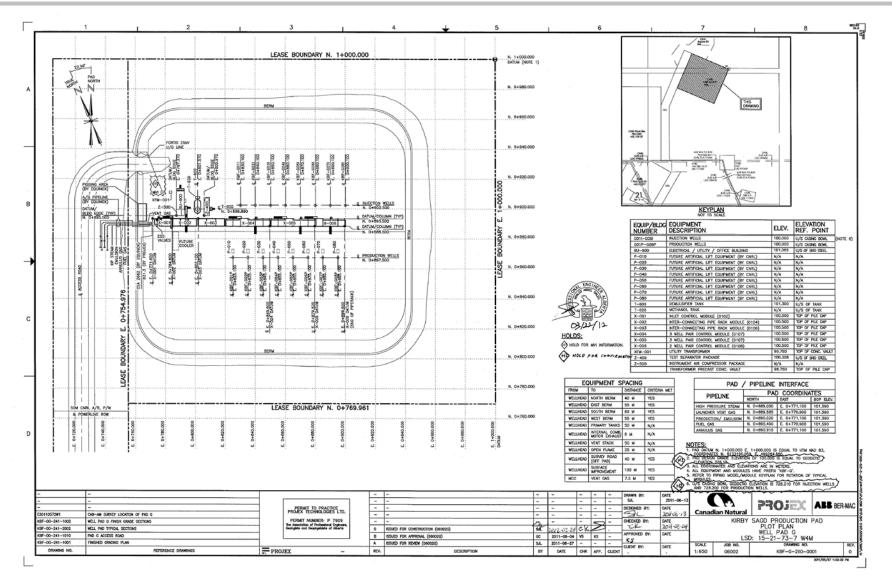
Surface Facilities Overview Plot Plans



- Detailed Site Plot Plans:
 - -Kirby SAGD Production Pad Plot Plan
 - Dwg No. KBF-G-210-0001
 - -Kirby South Central Plant Plot Plan
 - Dwg No. KBP-00-210-0002
- Simplified Schematic:
 - -Kirby In-Situ Oil Sands Project Simplified Schematic

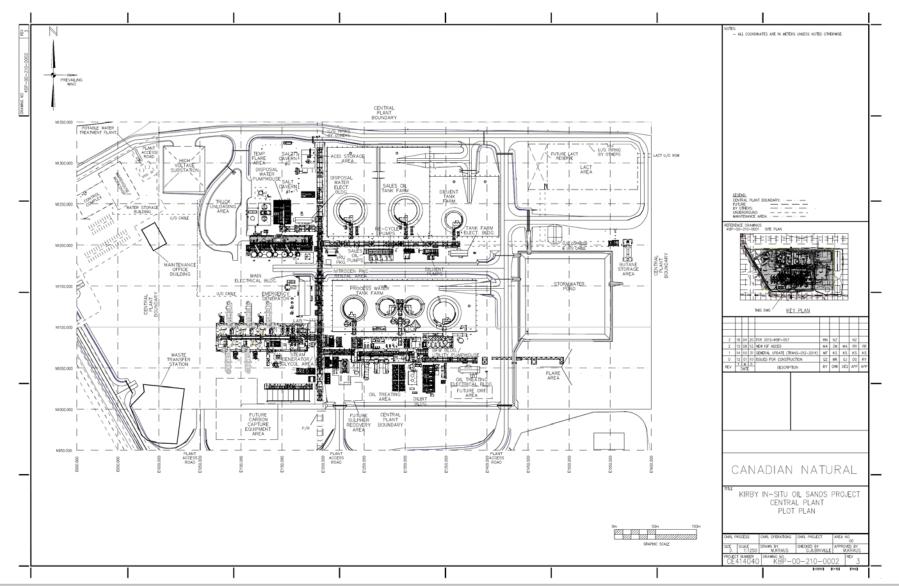
Surface Facilities Overview Kirby South SAGD Production Pad Plot Plan





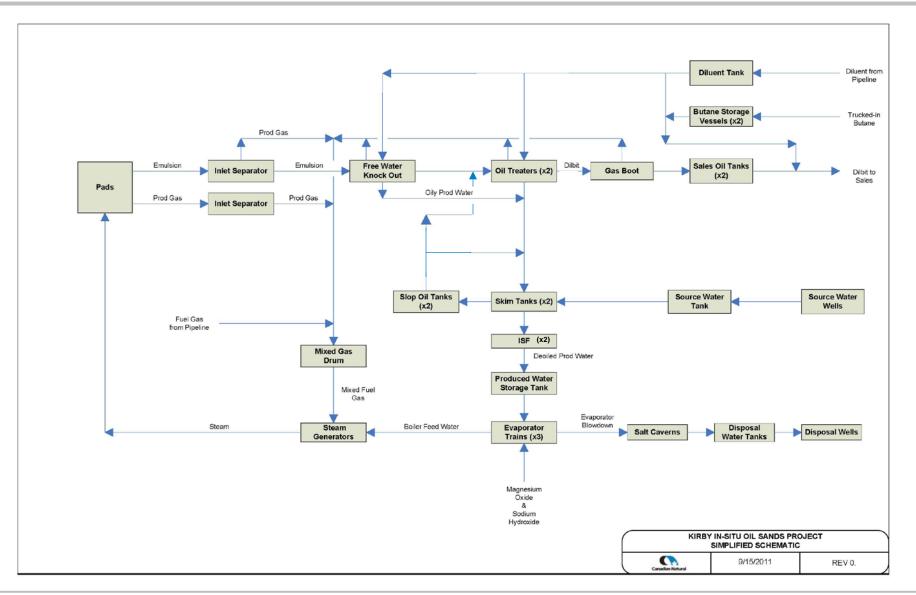
Surface Facilities Overview Kirby South Central Plant Plot Plan





Surface Facilities Overview Kirby Simplified Schematic





Surface Facilities Overview Kirby South Modifications



- Summary of Modifications since August 2015
 - A second ISF was added to further prevent oil fouling in the Evaporators
 - A mist eliminator hood trial was added to the vapor suction in Evaporator 1
 - Two additional decanting tanks were added for further handling of off spec streams
 - Additional disposal water filtration was added to improve performance of the disposal wells

Kirby South Facility Performance Oil Treating/Produced Water De-oiling Area



- Overall water quality and oil treating targets have been met
 - Oil treating is running very stable, short term upsets from well ramp ups during maintenance activities is still experienced, but are decreasing in frequency
 - The addition of the additional ISF has helped to maintain on spec produced water
 - Optimization work continues on the chemical program
 - PW de-oiling upsets leading to evaporator fouling and additional cleanings has been greatly reduced
 - New production record reached November 7th, of 43,100 BPD.
 - Challenges in keeping up with slop generation
 - Improvements have been made in reducing the slop generated on site, through process and chemical program optimization
 - The flexibility of recycle locations has been increased to allow high water and oil streams to be recycled separately

Kirby South Facility Performance Water Treatment Area



- In general good performance in the evaporators meeting design expectations
- Water upsets affecting evaporator performance has greatly decreased, increasing steam availability
- Disposal well injectivity decreases have lead to steam limitations
 - Additional filtration and water flushes of the disposal wells has slowed the injectivity decreases
 - The disposal lines are being pigged to remove any solids build up

Kirby South Facility Performance Boilers



Boiler failures

- -Tube header failures discovered in April 2014 and Furnace tube failures discovered in July 2014 causing steam limitation
- -Engineering solution implemented to protect boilers in 2015
 - Tubes were replaced, refractory was installed on the furnace, burners were tuned to shift heat away from furnace, refractory has been modified and burners re-tuned
- –In 2016 the above mention solutions were implemented on all the boilers, all boilers were inspected and optimization work has continued
- In 2017 the boilers will be monitored and the next regulatory inspection is in 2018

Kirby South Facility Performance Salt Caverns



- Salt caverns continue to manage evaporator blowdown solids
- Some optimization ongoing to cavern return filtration
- 2016 Sonar Logging
 - Cavern 1 scheduled for this fall
 - Cavern 2 complete
- Both salt caverns have passed their MIT
 - -MIT will be performed on a five year cycle.

Kirby South Facility Performance Power Consumption



• Power Consumption on a monthly basis

Month	Total Power Consumption (kWh)	
Sep -15	16,715,901	
Oct -15	14,029,476	
Nov -15	16,473,386	
Dec -15	16,477,421	
Jan -16	16,230,327	
Feb -16	14,617,843	
Mar -16	18,186,521	
Apr -16	16,922,270	
May -16	17,226,669	
Jun -16	16,625,731	
Jul -16	17,444,296	
Aug-16	16,831,718	

Kirby South Facility Performance Gas Usage



• Gas Usage on a monthly basis

Month	Total Purchased Gas e3m3	Total Gas Produced e3m3	Total Gas Vented e3m3	Total Solution Gas to Flare e3m3	Solution Gas Recovered %
Sep-15	24,980	602	_	0.0	100
Oct-15	18,175	325	_	0.5	99.8
Nov-15	25,388	564	_	0.0	100
Dec-15	24,590	1026	-	5.4	99.5
Jan-16	22,625	914	-	3.6	99.6
Feb-16	19,700	741	-	0.0	100
Mar-16	30,052	770	-	0.0	100
Apr-16	26,724	843	-	0.0	100
May-16	26,896	743	-	0.2	100
Jun-16	26,278	552	-	1.5	99.7
Jul-16	27,150	729	_	0.0	100
Aug-16	26,004	512	-	0.0	100

Recovering greater than 99% solution gas

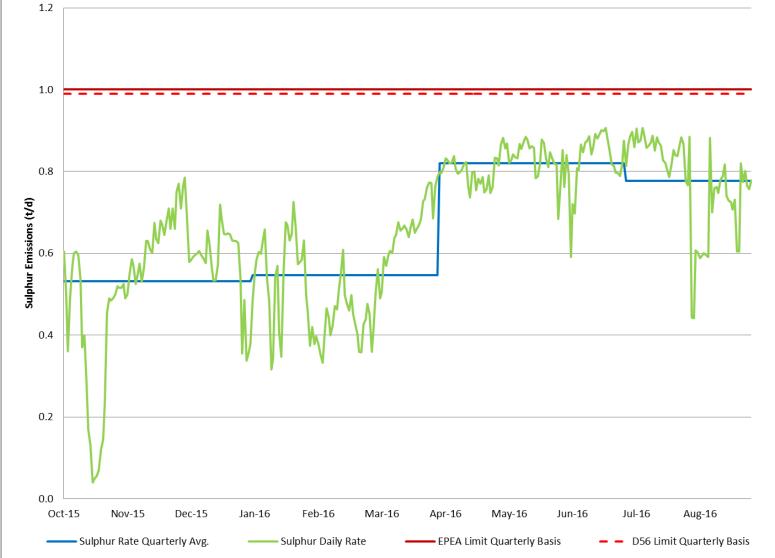
Kirby South Facility Performance Emissions



- Kirby Greenhouse Gas Emissions
 - Currently establishing baseline in accordance with the Specified Gas Emitters Regulation (SGER).
- Kirby Sulphur Emissions
 - No exceedance of the EPEA daily SO2 emissions limit of 2.0 t/d
 - -No exceedance of the AER D56 calendar quarterly sulphur limit of 0.99 t/d
 - No plans for sulphur recovery installation at this time
 - Contingency plan is to reduce production if the sulphur emission rate approaches the EPEA or D56 limit

Kirby South Facility Performance Sulphur Emissions





Kirby South Facility Performance Ambient Air Quality Results



- During the monitoring periods, there were no ambient SO2 or NO2 readings above the Alberta Ambient Air Quality Objective (AAAQO).
- There were four H2S readings above the hourly and daily AAAQO in December 2015 and January 2016.
 - -Determined to be due to a gas leak on the annulus gas line at a flange at G8 production well.

Measurement and Reporting Summary



- MARP approved in October 2011 and last updated in August 2016
 - Mainly minor updates and corrections
 - Disposal well 00/09-19-073-08W4 was added to the document
 - A few of the out of service meters were removed from the document, and the potable water meters as these are part of the camp.
- Methods for estimating well production and injection volumes:
 - Produced emulsion from the scheme is commingled at the battery. Bitumen and water production from the battery will be prorated to each well using monthly proration test data and proration factors
 - Total Battery Oil (Water) / Total Test Oil (Water) at Wells = Oil (Water) Proration Factor
 - Oil (Water) Proration Factor * Each Well Test Oil (Water) Volume = Oil (Water) Allocated to Each Well
 - Gas is allocated to each well using a battery GOR
 - Total Solution Gas Produced / Total Battery Oil = Gas Oil Ratio
 - Gas Oil Ratio * Oil Allocated to Each Well = Gas Allocated to Each Well
 - Injected steam volumes will be continuously measured at the wellhead and prorated to the total steam leaving the injection facility
- Test Durations
 - Based on operating experience to date, well test duration has been optimized at 1 hour and each well is tested 3 to 4 times per day.

Measurement and Reporting KS Battery & Injection Reporting Codes



Kirby South Battery

Location: 14-21-73-07W4M

Registry Code: ABBT0116017

Registry Sub Type: 344 - Crude Bitumen Multi-Well Proration Battery

Kirby South Steam Plant

Location: 14-21-73-07W4M

Registry Code: ABIF0116018

Registry Sub Type: 506 - In Situ Oil Sands

Kirby South Disposal Wells

Location: Various

Registry Code: ABIF0117173

Registry Sub Type: 503 - Disposal

Kirby South Salt Cavern #1

Location: 14-21-73-07W4M

Registry Code: ABWP0116019

Registry Sub Type: 702 - Cavern Waste

Kirby South Salt Cavern #2

Location: 14-21-73-07W4M

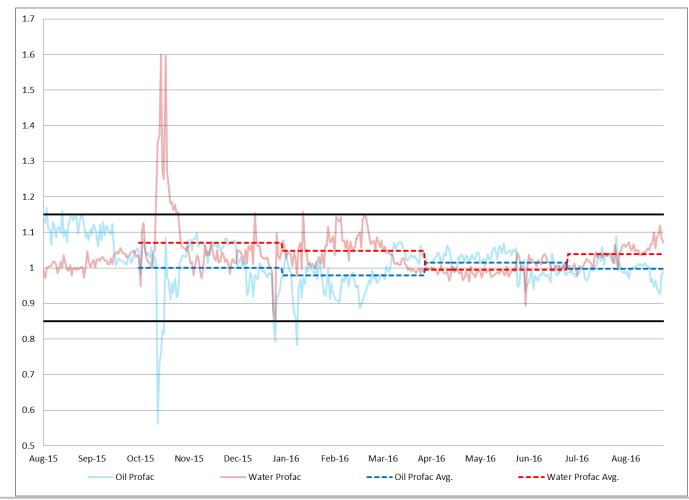
Registry Code: ABWP0117526

Registry Sub Type: 702 - Cavern Waste

Measurement and Reporting Proration Factors



- 100% compliance with D17 (3-month avg. range 0.85-1.15)
- The spike in October 2015 is due to a plant maintenance outage



Future Plans – Surface Kirby South Planned 2016 – 2017 Activities



Central Plant

- -Boiler burner optimization.
- -Disposal filtration optimization.
- Pads
 - -Piping modifications on step outs and re-drills
 - -Disposal well tie-in

Kirby North Site Activities Summary



- Canadian Natural announced in January 2015 that the Kirby North project would be deferred due to several external factors including commodity prices.
- Construction suspended August 2015.

Water Treatment Technology Summary

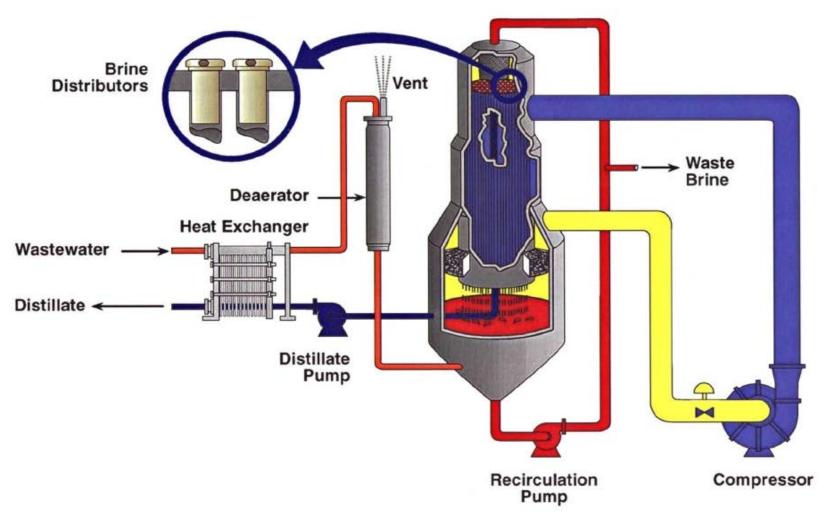


- Mechanical Vapor Compression (MVC) evaporators selected for BFW treatment
 - -Treatment of both recycled produced water and makeup water
 - -Evaporator blow down solids disposal to on-site salt cavern
 - -Silica Sorption process selected vs. high pH process from application

Water Treatment Technology Schematic

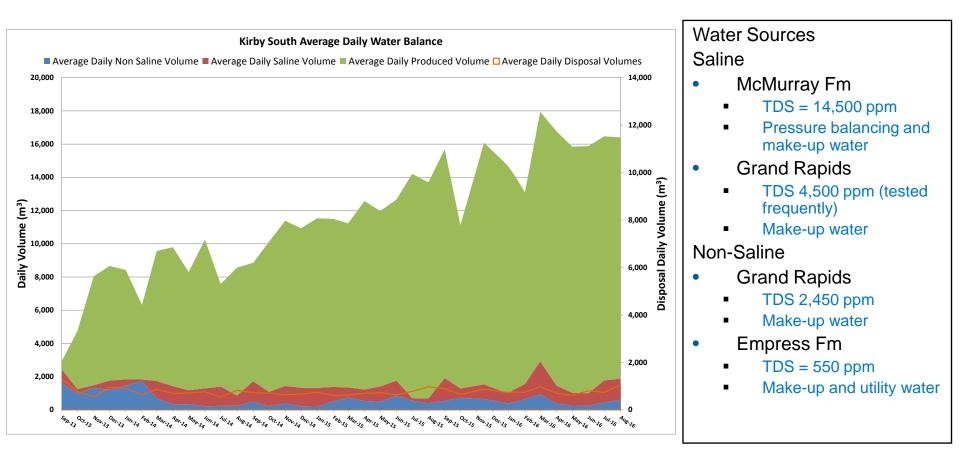


Mechanical Vapor Compression Evaporator:



Kirby South Produced and Make-up Water Usage





Kirby South Produced and Make-up Water Usage

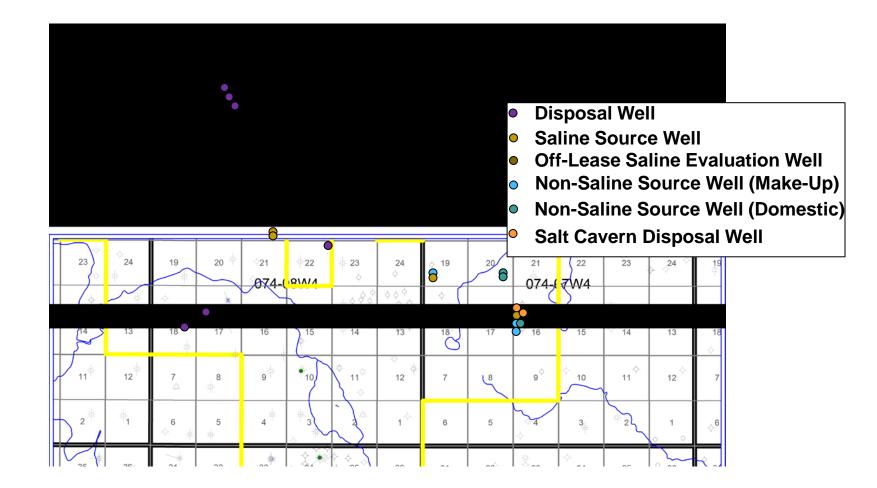


Month	Non-saline Volume	Saline Volume	Non Saline Make-Up Percentage	Injection	Produced	PWR
	m ³	m ³	%	m ³	m ³	%
Sep-15	15,997	41,414	28	26,715	413,078	94
Oct-15	22,504	17,451	56	20,154	304,873	93
Nov-15	19,451	26,523	42	26,120	436,516	94
Dec-15	12,176	18,636	40	22,591	425,334	95
Jan-16	14,396	24,381	37	23,233	397,765	94
Feb-16	18,756	26,431	42	21,475	334,619	94
Mar-16	29,026	61,753	32	30,269	465,541	93
Apr-16	11,187	32,735	25	20,960	459,339	95
May-16	8,010	23,796	25	19,102	459,451	96
Jun-16	7,631	22,387	25	23,998	446,373	95
Jul-16	13,787	41,040	25	22,967	455,675	95
Aug-16	18,737	39,458	32	32,411	450,388	93
2015-2016 Totals	191,658	376,004	34	289,996	5,048,952	94

- Water Act Diversion License renewed in August, 2015
- Directive 81 Disposal Limit = 11%, Actual Disposal = 5% for 2015-2016
- Also used a total of 14,655 m3 of non-saline/potable water to supply camps and office complex

Kirby South Source and Disposal Well Map







Well Name	Use	Unique Well Identifier
McMurray Source Wells		
CNRL WSW01 Kirby 14-30-73-7	Make-up Source (not used)	1F1/14-30-73-7W4M
CNRL WSW MC01 Kirby 10-33-73-8	Make-up Source	1F1/10-33-73-8 W4M
CNRL WSW MC02 Kirby 10-33-73-8	Make-up Source	1F2/10-33-73-8 W4M
Grand Rapids Source Well		
CNRL WSW GR01 Kirby 13-21-73-7	Make-up Source	1F3/13-21-073-07W4M



Well Name	Use	Unique Well Identifier		
GRAND RAPIDS Formation				
Grand Rapids Source Wells				
CNRL WSW02 Kirby 14-30-73-7	Make-up Source	1F2/14-30-73-8W4M		
EMPRESS Formation Source Wells				
CNRL WSW Kirby 13-21-73-7	Utility Source	1F2/13-21-73-07W4M		
CNRL WSW EMP03 12-21-73-7	Utility Source	1F1/12-21-73-07W4M		
MURIEL LAKE Formation - Source Wells				
CNRL WSW ML03 Kirby 13-21-73-7	Domestic Source	1F4/13-21-73-7W4M		
ETHEL LAKE Formation - Source and Standby Wells				
CNRL WSW EL01 Kirby 16-29-73-7	Domestic Source	1F1/16-29-73-7W4M		
CNRL WSW EL02 Kirby 15-29-73-7	Domestic Source	No UWI No license required		

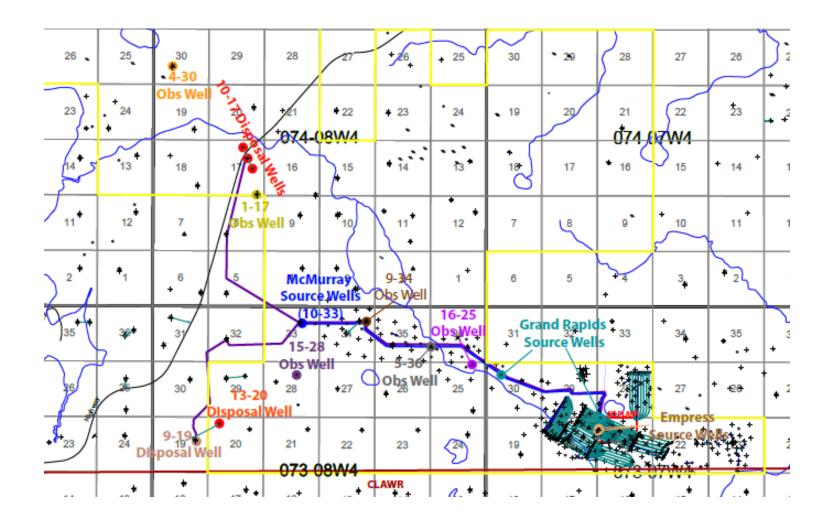


Well Name	Use	Unique Well Identifier
McMurray Disposal Wells		
RAX Kirby 9-34-73-8	Disposal (not currently used)	00/09-34-073-08W4M
CNRL WDW01 Kirby 8-17-74-8	Disposal	00/08-17-074-08W4M
CNRL WDW02 Kirby 10-17-74-8	Disposal	02/10-17-074-08W4M
CNRL WDW03 Kirby 15-17-74-8	Disposal	00/15-17-074-08W4M
CNRL WDW HZ MCM05 Kirby 13-20-73-8	Disposal	00/13-20-073-08W4M
CNRL WDW MCM06 Kirby 9-19-73-8	Disposal	100/09-19-073-08W4M

Salt Cavern Wells		
CNRL CAVERN VERT KIRBY 13-21-73-7	Lotsburg	00/13-21-073-07W4M
CNRL CAVERN DD KIRBY 4-28-73-7	Prairie Evaporate	02/04-28-073-07W4M

Kirby South Pressure Balance Scheme Update

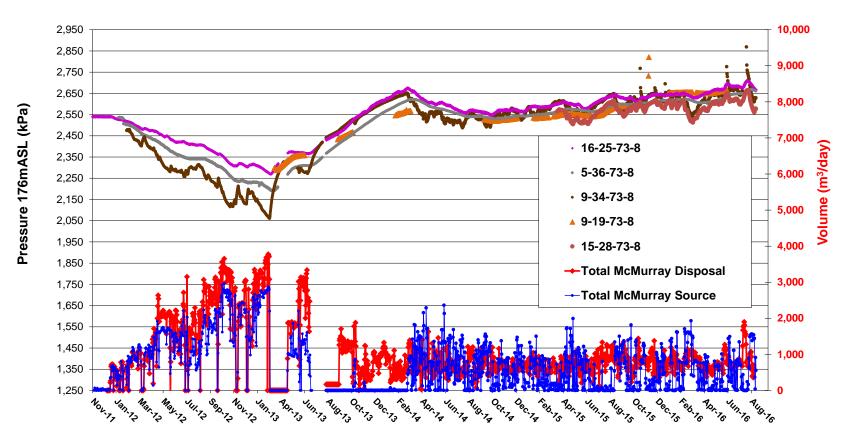




Kirby South Pressure Balance Scheme Update



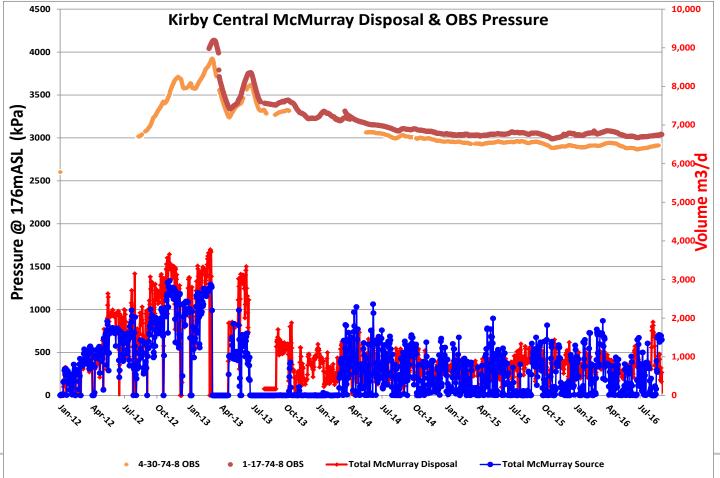
- After initial declines, pressure in Basal McMurray Aquifer now almost equal to initial pressure in all observation wells in South sourcing/disposal area
 - High pressure spikes in 9-34 due to produced water disposal in 9-34



Kirby South Pressure Balance Scheme Update



- McMurray Fm Basal Aquifer pressure near 10-17-74-8 disposal area
 - Pressure increased in aquifer early on during cavern washing, but has now decreased to ~ 3,000 kPa and holding
 - Obtained chemistry sample at 1-17 obs well in March, 2014, TDS ~12,500, which is background concentration



Kirby South Disposal

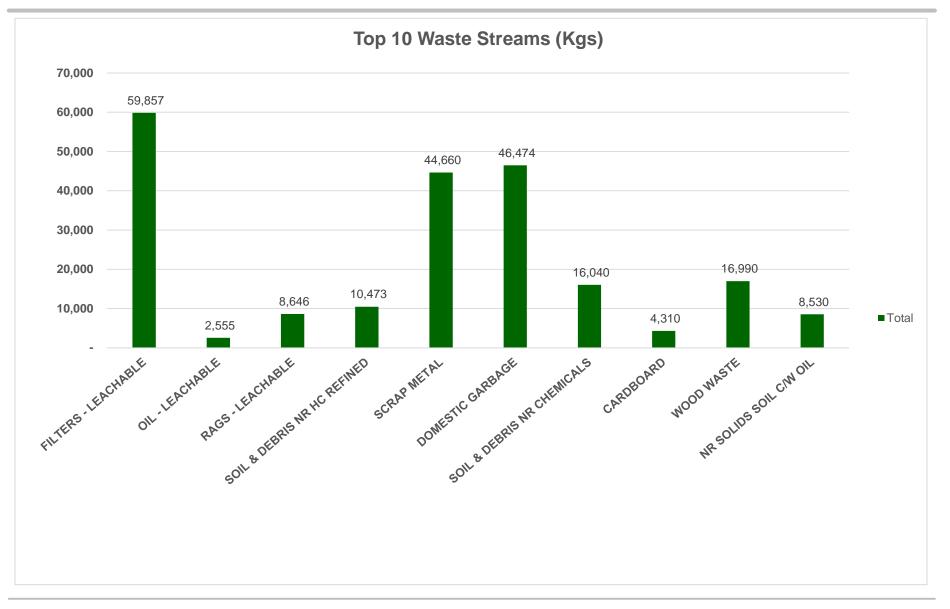


Disposal issues

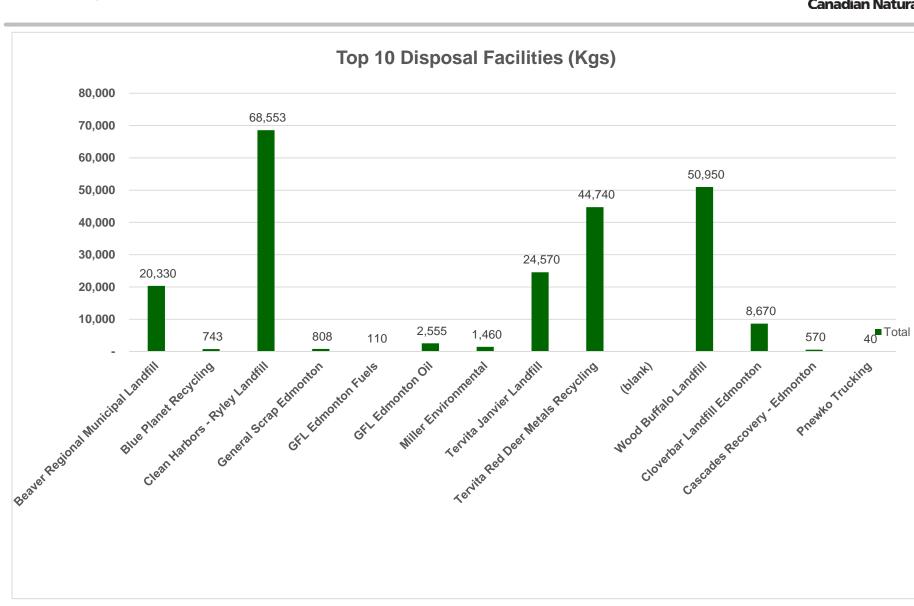
- Experiencing decreasing injectivity over time.
 - Plugging
 - Oil Carryover
 - Scale buildup in pipelines
- Operating close to MWHIP
- Acid stimulations showing diminishing returns
- Produced water flushes of the disposal well have been successful in short term returns of injectivity
- Additional filtering of the disposal water before injection has slowed the injectivity decrease of the wells
- Pipeline solids accumulation ongoing pigging
- Potential future work
 - Filter optimization.
 - Drilling new disposal wells
 - Produced water flush and stimulation work as required

Kirby South Waste Disposal





Kirby South Waste Disposal







- Wildlife Mitigation Plan and Monitoring Program
 - Monitoring mitigation efficacy (above ground pipelines, barriers to wildlife movement, effects of human presence)
 - -21 remote cameras deployed throughout the project
 - 13 species detected, including three provincially sensitive species and one federally threatened species (woodland caribou)
 - Frequent caribou sightings near Kirby South Plant reported by onsite staff
 - -23 camera stations monitoring linear deactivation, initiated in Feb 2015
 - 10 mammal species recorded
 - Noted correlation between low carnivore detections along treated lines
 - 22 species of concern (17 bird species, 5 mammals) observed in the Kirby Project area in 2015
 - Comprehensive wildlife report to be completed in 2017



- Wetland and Waterbody Monitoring Program
 - Two monitoring stations showed water level response is sensitive to discharges of industrial waste water from nearby pads or the Kirby South CPF.
 - Two culvert surveys completed at Kirby South and Kirby North in 2015.
 - Mitigation measures applied to most problematic culverts following the surveys.
 - Additional mitigation measures being applied throughout the year to meet target of repairing all damaged culverts within one year from time of assessment.
 - Overall indication that project infrastructure has some effect on wetlands in Kirby South.
 - Corrective measures include improvements to road and culvert design in problematic areas to alleviate water impoundment



- Groundwater Monitoring Program
 - Well pad monitoring program to monitor potential effect of steam injection on mineral solubility and mobilization of trace elements
 - I monitoring well on each Pad B, Pad D, Pad F
 - No impacts to groundwater quality identified
 - Sub-regional groundwater monitoring program focusing on deeper, Quaternary- and Tertiary-aged aquifers.
 - Central Plant monitoring program monitors groundwater conditions within shallow sediments
 - 20 groundwater monitoring wells at CPF
 - Increase in chloride concentration in monitoring well P12-06.
 - Action plan submitted to AER July 20, 2016



- Air Monitoring
 - Source Monitoring
 - Two RATAs conducted on Generator 1 in 2015
 - CEMS at steam generator measures SO2 and NO2
 - Two cylinder gas audits conducted in 2015
 - Results show CEMS code is met
 - One manual stack survey conducted on Glycol Heater Exhaust Stack in 2015
 - No significant trends in emissions data
 - Ambient Air Monitoring
 - Continuous ambient air monitoring station located 0.7 km from plant site
 - Measured exceedances of AAAQOs did not indicate a significant issue with plant operations
 - Five passive monitoring stations located around the plant site
 - All passive exposure monitoring results for SO2, H2S, NO2 and O3 were low for the monitoring period

Environmental Summary Reclamation Activities



- Reclamation Activities
 - No reclamation activities August 2015 to August 2016.
- Reclamation Monitoring
 - Objectives are to ensure:
 - Iand is reclaimed to an equivalent land capability
 - appropriate replacement of all salvaged topsoil on re-contoured areas
 - sustainable, diverse vegetation growth on all disturbed areas
 - pre-disturbance wildlife carrying capacities are obtained
 - Regular site monitoring throughout reclaimed areas within the Project Area

Environmental Summary Provincial/Federal Programs



- Lower Athabasca Regional Plan (LARP)
 - Participation in the South Athabasca Oil Sands (SAOS) area for Groundwater Management
- Joint Canada/Alberta Implementation Plan for Oil Sands Environmental Monitoring
 - Participation in the implementation of the program until June 2016 when AEMERA was cancelled
 - Working directly with researchers on environmental monitoring
- Provincial and Federal Woodland Caribou Recovery Policies
 - Participating in GOA processes to develop and implement range-level caribou recovery plans and province-wide action plan (CAPP).
 - Participating in caribou research (COSIA, RICC, FLMF)
 - Engaging with the GOA and Government of Canada to understand opportunities for knowledge transfer and to address data gaps (COSIA and CAPP).
- Alberta Wetland Policy
 - Participating in discussions with AEP and the AER regarding implementation of the policy in the Green Area of Alberta (CAPP)
- Alberta's Climate Leadership Plan (CLP)
 - Working with AER and GOA on development of various aspects of the CLP including the oil sands emission limit and performance standards

Approvals Commercial Oil Sands Scheme



Commercial Oil Sands Scheme		
11475	September 2010	Commercial Oil Sands Scheme Approval
11475A	November 2010	Revise initial development Pads A to G
11475B	November 2011	Change inter-well spacing Drainage Area D
11475C	December 2011	Change inter-well spacing in Drainage Area B
11475D	May 2012	Change inter-well spacing in Drainage Area E
11475E	June 2012	Evaluation of on-lease McMurray brackish water
11475F	August 2012	Change inter-well spacing in Drainage Area G
11475G	September 2012	Change inter-well spacing in Drainage Area F Addition to Drainage Area D
11475H	April 2013	Evaluation of off-lease Clearwater brackish water

Approvals Commercial Oil Sands Scheme



Commercial Oil Sands Scheme		
114751	January 2014	Operational Strategy amendment
11475J	March 2014	Trajectory and lateral length modifications in Drainage Area G
11475K	May 2014	Approval of Kirby In Situ Oil Sands Expansion Project
11475L	November 2014	Revise initial Kirby North development Pads KN01-KN05
11475M	December 2014	Redrill well pairs A1, A2, A3
11475N	May 2015	Additional Kirby South and Kirby North disposal wells
114750	July 2016	Conversion of existing Kirby South observation well to disposal well
In Compliance		

Approvals Disposal



		Class 1b Cavern Disposal
11716	November 2011	Cavern Solution Mining
11716A	July 2013	 Class 1b Cavern Disposal Prairie Evaporites formation through well 00/13-21-073- 07W4 Lotsberg formation through well 00/04-28-073-07W4
11716B	June 2015	Modify testing requirements. Approval modified to reference CSA Z341.4
In Compliance		

Approvals Disposal



		Class Ib Disposal
11761	December 2011	Class Ib Disposal • 00/08-17-74-08W4 • 02/10-17-74-08W4 • 00/15-17-74-08W4
11761A	April 2013	Modify pH requirements
11761B	March 2014	Amend MWHIP
11761C	May 2015	 Additional Kirby South disposal well 100/13-21-73-08W4 Additional Kirby North disposal well 02/08-22-74-10W4
11761D	July 2016	Conversion of existing observation well to disposal well100/09-19-73-8W4
		In Compliance

Approvals Disposal (continued)



Class II Disposal		
9113	June 2002	Class II Disposal • 00/08-22-074-10W4/0 • 00/09-34-073-08W4/0
9594	September 2003	Transferred to Canadian Natural from Rio Alto Exploration
9594A	December 2011	Approval of Kirby In Situ Oil Sands Project
9594B	May 2014	Approval of Kirby In Situ Oil Sands Expansion Project
In Compliance		

Approvals Facility License



Facility License		
F42290	October 2010	Kirby South Phase 1 Central Processing Facility
F42290 amended	July 2013	Amended for KS1 CPF to reflect stream day rates and number of compressors and pumps
F44051	July 2014	Kirby North Phase 1 Central Processing Facility
In Compliance		

Approvals EPEA and Water Act



	Environmental F	Protection and Enhancement Act
237382-00-00	April 2011	Approval of Kirby In Situ Oil Sands Project
237382-00-01	July 2014	Approval of Kirby In Situ Oil Sands Expansion Project
237382-00-02	February 2015	Amend Kirby South steam generator NOx limit to include efficiency credit
		Water Act
00334375-00-00 (Kirby South)	August 2013	Groundwater diversion license, Empress Unit 1 and Grand Rapids Formation
00337375-01-00 (Kirby South)	August 2015	Renewal of Groundwater diversion license
00288494-00-00 (Kirby South)	April 2011	Groundwater diversion license, Ethel Lake Formation
00327156-00-00 (Kirby South)	August 2013	Industrial surface runoff diversion license
00303825-00-00 (Kirby North)	July 2014	Preliminary Certificate groundwater diversion, Empress Terrace Formation
00303820-00-00 (Kirby North)	September 2014	Industrial surface runoff diversion license
		In Compliance

Compliance Summary



- Reportable Spills
 - 2 reportable spills: 10 m3 produced water (Aug 2015), 5m3 brackish water (March 2016)
- EPEA Contraventions
 - Three NOx mass emission rate hourly exceedances, Dec 2015 and Feb 2016
 - Four exceedances of H2S AAAQO, Dec 2015 and Jan 2016
 - -CEMS failure to meet 90% uptime, Dec 2015
 - -pH limit exceedance for industrial runoff, March 2016
 - Capping subsoil stockpiles with topsoil*.
- Water Act
 - Water Act License No. 00150748 data not reported to WURS. This license has since been cancelled*.
 - -Water Act License No. 00303820 data not reported to WURS*.

*Identified through the COA and resolved.

Compliance Summary



- Pipelines
 - Steel risers on poly fresh water pipeline system are not cathodically protected and require sacrificial anodes to be installed*.
 - Pipeline Operation and Maintenance Manual to be updated March 2017*.
- Other
 - Failure to keep flaring, incinerating and venting logs*.
 - -Need to update calculation for flared gas volumes (MARP)*.
 - Salt Cavern surface casing vent needs to be directed outside wellhead building*.
- *Identified through the COA and resolved.

Forward Looking Statements



Certain statements relating to Canadian Natural Resources Limited (the "Company") in this document or documents incorporated herein by reference constitute forward-looking statements or information (collectively referred to herein as "forward-looking statements") within the meaning of applicable securities legislation. Forward-looking statements can be identified by the words "believe", "anticipate", "expect", "plan", "estimate", "target", "continue", "could", "intend", "may", "potential", "predict", "should", "will", "objective", "project", "forecast", "goal", "guidance", "outlook", "effort", "seeks", "schedule", "proposed" or expressions of a similar nature suggesting future outcome or statements regarding an outlook. Disclosure related to expected future commodity pricing, forecast or anticipated production volumes, royalties, operating costs, capital expenditures, income tax expenses, and other guidance provided throughout this presentation constitute forward-looking statements. Disclosure of plans relating to and expected results of existing and future developments, including but not limited to the Horizon Oil Sands operations and future expansion, Septimus, Primrose thermal projects, Pelican Lake water and polymer flood project, the Kirby Thermal Oil Sands operations of the proposed Keystone XL Pipeline from Hardisty, Alberta to the US Gulf coast, the proposed Kinder Morgan Trans Mountain pipeline expansion from Edmonton, Alberta to Vancouver, British Columbia, the proposed Energy East pipeline from Hardisty to Eastern Canada, the construction and future operations of the North West Redwater bitumen upgrader and refinery and disclosures relating to the Devon Canada Asset acquisition also constitute forward-looking statements. This forward-looking information is based on annual budgets and multi-year forecasts, and is reviewed and revised throughout the year as necessary in the context of targeted financial ratios, project to certain risks and the reader should not place undue reliance on these forward-loo

In addition, statements relating to "reserves" are deemed to be forward-looking statements as they involve the implied assessment based on certain estimates and assumptions that the reserves described can be profitably produced in the future. There are numerous uncertainties inherent in estimating quantities of proved and proved plus probable crude oil and natural gas and natural gas liquids (NGLs") reserves and in projecting future rates of production and the timing of development expenditures. The total amount or timing of actual future production may vary significantly from reserve and production estimates.

The forward-looking statements are based on current expectations, estimates and projections about the Company and the industry in which the Company to be materially different from any future results, performance or achievements expressed or implied by such forward-looking statements. Such risks and uncertainties include, among other things, impact demand for and market prices of the Company to be materially different from any future results, performance or achievements expressed or implied by such forward-looking statements. Such risks and uncertainties include, among other things, impact demand for and market prices of the Company's products; volatility of and assumptions regarding crude oil and natural gas prices; fluctuations in currency and interest rates; assumptions on which the Company's or or against terrorists, insurgent groups or other conflict including conflict between states; industry capacity; ability of the Company to implement its business strategy, including exploration and development activities; impact of competition; the Company's defines of lawsuits; availability and cost of seismic, drilling and other equipment; ability of the Company and its subsidiaries to complete capital programs; the Company's and its subsidiaries' ability to secure adequate transportation for its products; unexpected disruptions or delays in the resumption of the mining, extracting or upgrading of the Company's and products; availability and cost of seismic, drilling and other delays or changes in plans with respect to exploration or development projects or capital expenditures; availability and products; potential delays or the resumption of the repressor of reserve estimates and exploration and products; potential delays or the resumption of the repressor of reserve estimates and exploration and products; potential delays or the estupy is or prove estimates and exploration or development activities; and other difficulties inherent in the exploration and products; potential delays or the resumption of target and exp

Although the Company believes that the expectations conveyed by the forward-looking statements are reasonable based on information available to it on the date such forward-looking statements are made, no assurances can be given as to future results, levels of activity and achievements. All subsequent forward-looking statements, whether written or oral, attributable to the Company or persons acting on its behalf are expressly qualified in their entirety by these cautionary statements. Except as required by law, the Company assumes no obligation to update forward-looking statements, whether as a result of new information, future events or other factors, or the foregoing factors affecting this information, should circumstances or Management's estimates or opinions change.

Reporting Disclosures



Special Note Regarding Currency, Production and Reserves

In this document, all references to dollars refer to Canadian dollars unless otherwise stated. Reserves and production data are presented on a before royalties basis unless otherwise stated. In addition, reference is made to crude oil and natural gas in common units called barrel of oil equivalent ("BOE"). A BOE is derived by converting six thousand cubic feet of natural gas to one barrel of crude oil (6Mcf:1bbl). This conversion may be misleading, particularly if used in isolation, since the 6Mcf:1bbl ratio is based on an energy equivalency conversion method primarily applicable at the burner tip and does not represent a value equivalency at the wellhead. In comparing the value ratio using current crude oil prices relative to natural gas prices, the 6Mcf:1bbl conversion ratio may be misleading as an indication of value.

This document, herein incorporated by reference, have been prepared in accordance with IFRS, as issued by the International Accounting Standards Board.

For the year ended December 31, 2013 the Company retained Independent Qualified Reserves Evaluators ("Evaluators"), Sproule Associates Limited and Sproule International Limited (together as "Sproule") and GLJ Petroleum Consultants Ltd. ("GLJ"), to evaluate and review all of the Company's proved and proved plus probable reserves with an effective date of December 31, 2013 and a preparation date of February 3, 2014. Sproule evaluated the North America and International light and medium crude oil, primary heavy crude oil, Pelican Lake heavy crude oil, bitumen (thermal oil), natural gas and NGLs reserves. GLJ evaluated the Horizon SCO reserves. The evaluation and review was conducted in accordance with the standards contained in the Canadian Oil and Gas Evaluation Handbook ("COGE Handbook") and disclosed in accordance with National Instrument 51-101 – Standards of Disclosure for Oil and Gas Activities ("NI 51-101") requirements. In previous years, Canadian Natural had been granted an exemption order from the securities regulators in Canada that allowed substitution of U.S. Securities Exchange Commission ("SEC") requirements for certain NI 51-101 reserves disclosures. This exemption expired on December 31, 2010. As a result, the 2011 and 2012 reserves disclosure is presented in accordance with Canadian reporting requirements using forecast prices and escalated costs.

The Company annually discloses net proved reserves and the standardized measure of discounted future net cash flows using 12-month average prices and current costs in accordance with United States Financial Accounting Standards Board Topic 932 "Extractive Activities - Oil and Gas" in the Company's Form 40-F filed with the SEC in the "Supplementary Oil and Gas Information" section of the Company's Annual Report targeted to be released in late March 2013

Resources Other Than Reserves

The contingent resources other than reserves ("resources") estimates provided in this presentation are internally evaluated by qualified reserves evaluators in accordance with the COGE Handbook as directed by NI 51-101. No independent third party evaluation or audit was completed. Resources provided are best estimates as of December 31, 2012. The resources are evaluated using deterministic methods which represent the expected outcome with no optimism or conservatism.

Resources, as per the COGE Handbook definition, are those quantities of petroleum estimated, as of a given date, to be potentially recoverable from known accumulations using established technology or technology under development, but are not currently considered commercially viable due to one or more contingencies. There is no certainty that it will be commercially viable to produce any portion of these resources.

Due to the inherent differences in standards and requirements employed in the evaluation of reserves and contingent resources, the total volumes of reserves or resources are not to be considered indicative of total volumes that may actually be recovered and are provided for illustrative purposes only.

Crude oil, bitumen or natural gas initially-in-place volumes provided are discovered resources which include production, reserves, contingent resources and unrecoverable volumes.

Special Note Regarding non-GAAP Financial Measures

This document includes references to financial measures commonly used in the crude oil and natural gas industry, such as adjusted net earnings from operations, cash production costs and net asset value. These financial measures are not defined by International Financial Reporting Standards ("IFRS") and therefore are referred to as non-GAAP measures. The non-GAAP measures used by the Company may not be comparable to similar measures presented by other companies. The Company uses these non-GAAP measures to evaluate its performance. The non-GAAP measures should not be considered an alternative to or more meaningful than net earnings, as determined in accordance with IFRS, as an indication of the Company's performance. The non-GAAP measures are reconciled to net earnings, as determined in accordance with IFRS, in the "Financial Highlights" section of the Company's MD&A. The derivation of cash production costs is included in the "Operating Highlights – Oil Sands Mining and Upgrading" section of the Company's MD&A. The Company also presents certain non-GAAP financial ratios and their derivation in the "Liquidity and Capital Resources" section of the Company's MD&A.

Volumes shown are Company share before royalties unless otherwise stated.

