Husky Oil Operations Limited

Sunrise Thermal Project

Commercial Scheme No.10419

Annual Performance Presentation

Alberta Energy Regulator

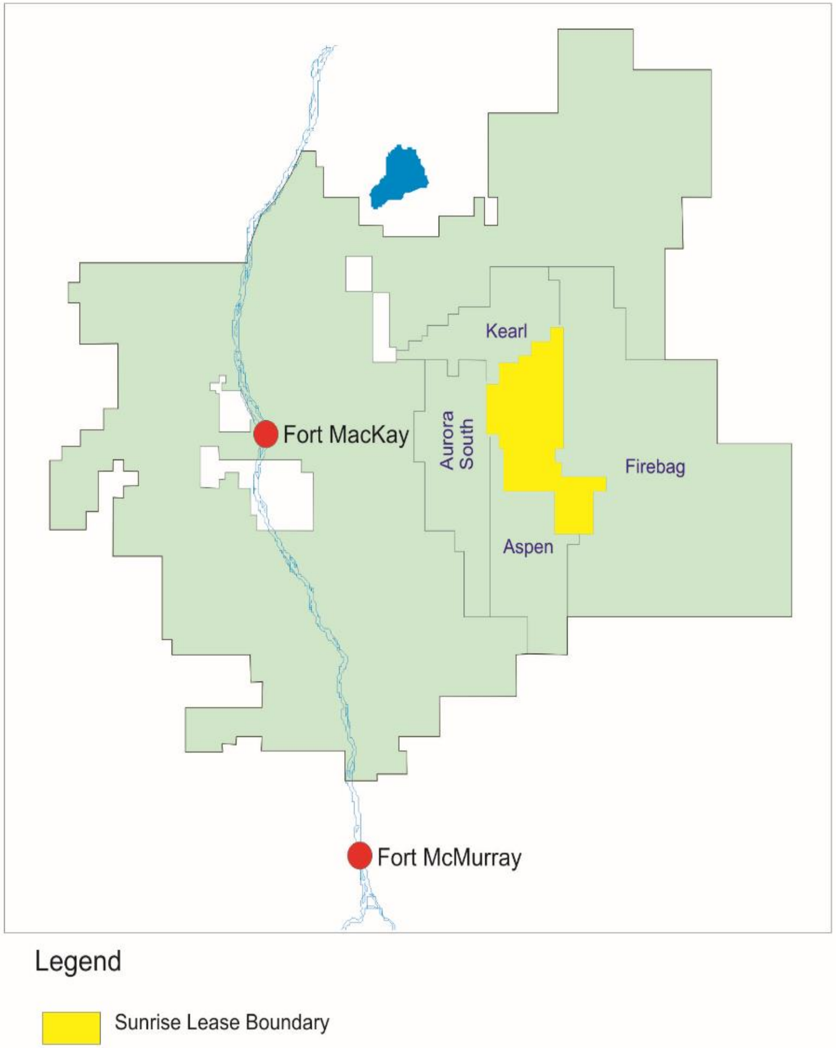
October 4, 2017

3.1.1. Subsurface Issues – Table of Contents

1. Brief Background

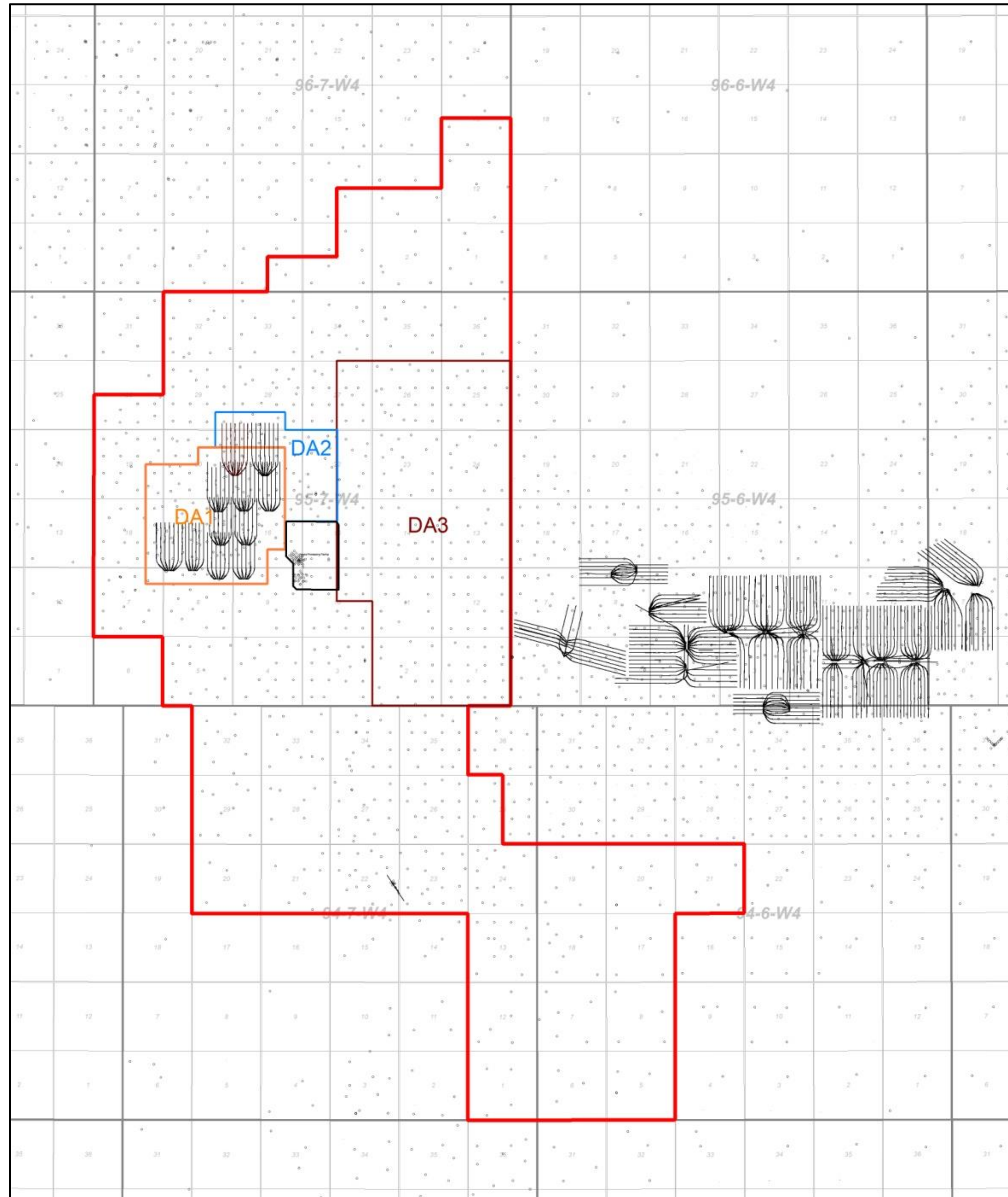
Project Overview

- AER Approval No's. 10419 and 206355-01-00, as amended
- 31,798 m^3 /d (200,000 BOPD) SAGD Project
- Phase 1 – 10,970 m^3/d (69,000 BOPD)
- McMurray Formation
- 7-9º API Bitumen
- 50% Partnership with BP
- First Steam December 12, 2014
- First Production March 8, 2015



Project Development Area

- Approval Area:
  - 64 ¼ sections over TWP 94, 95 and 96, RGE 6 and 7 W4M
- Project Life Development:
  - Approx. 600 well pairs
  - Approx. 40 year life
- Development Area 1 (DA1):
  - Nine well pads
  - 55 well pairs
- Development Area 2 (DA2):
  - Six well pads
  - 37 well pairs
  - Drill / tied in two well pads (B05-21 and B06-21)
  - Sustain 10,970 m^3/d (69,000 BOPD)
- Development Area 3 (DA3):
  - 18 well pads
  - 222 well pairs
  - AER Approved Jan 25, 2016



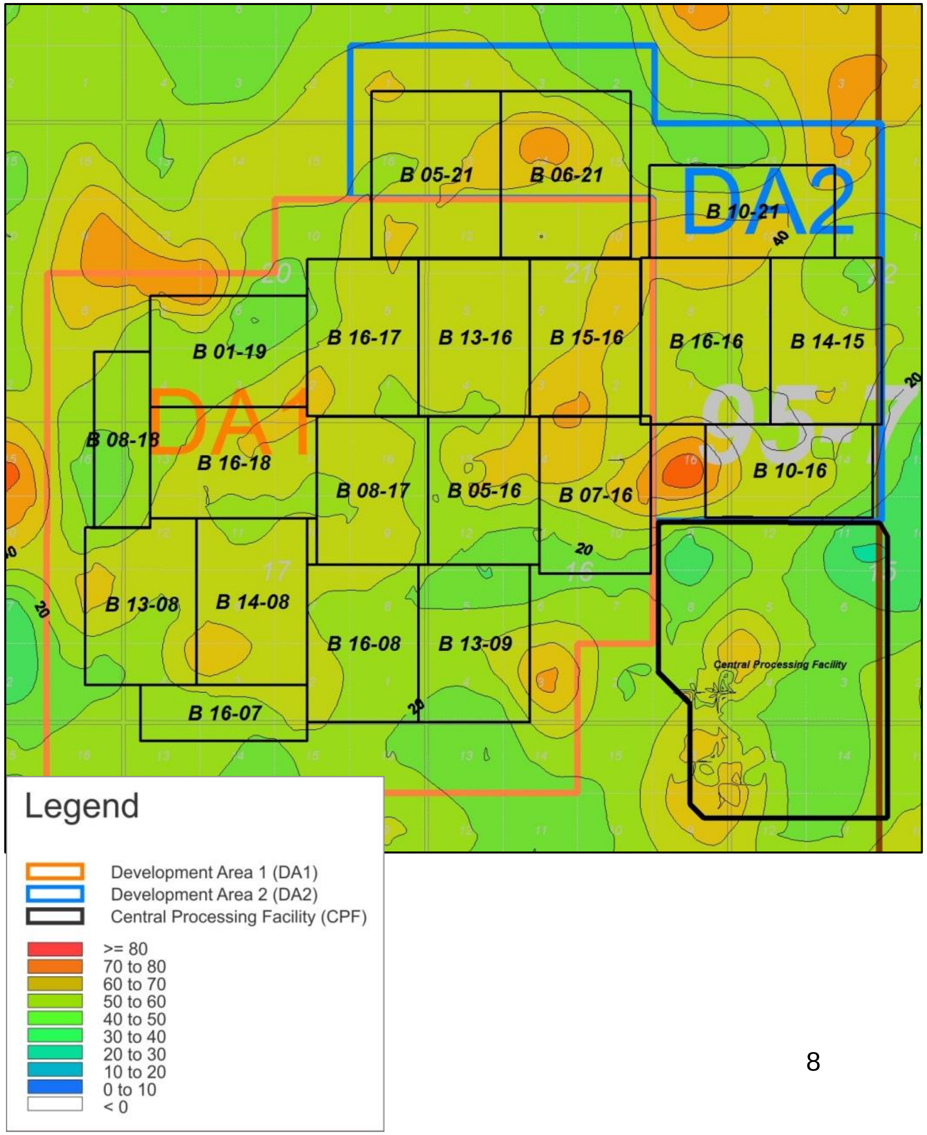
Site Overview

- 69 horizontal well pairs drilled:
  - 55 well pairs in DA1 on production
  - 14 well pairs in DA2 drilled and tied in
- Field Facilities:
  - 11 well pads constructed and tied in
- Central Plant Facility:
  - Bitumen treating – 10,970 m^3/d (69,000 bbl/day)
  - Water Treatment – 43,860 m^3/d (276,000 bbl/day)
  - Steam Generation – 32,890 m^3 /d (207,000 bbl/day) CWE
  - Utilities
- Water Source & Disposal Wells
- Observation Wells
- Borrow Sources
- Class 1 Landfill
- Metering and Export Pipelines to Fort Saskatchewan via Norealis Terminal and Cheecham

2. Geosciences

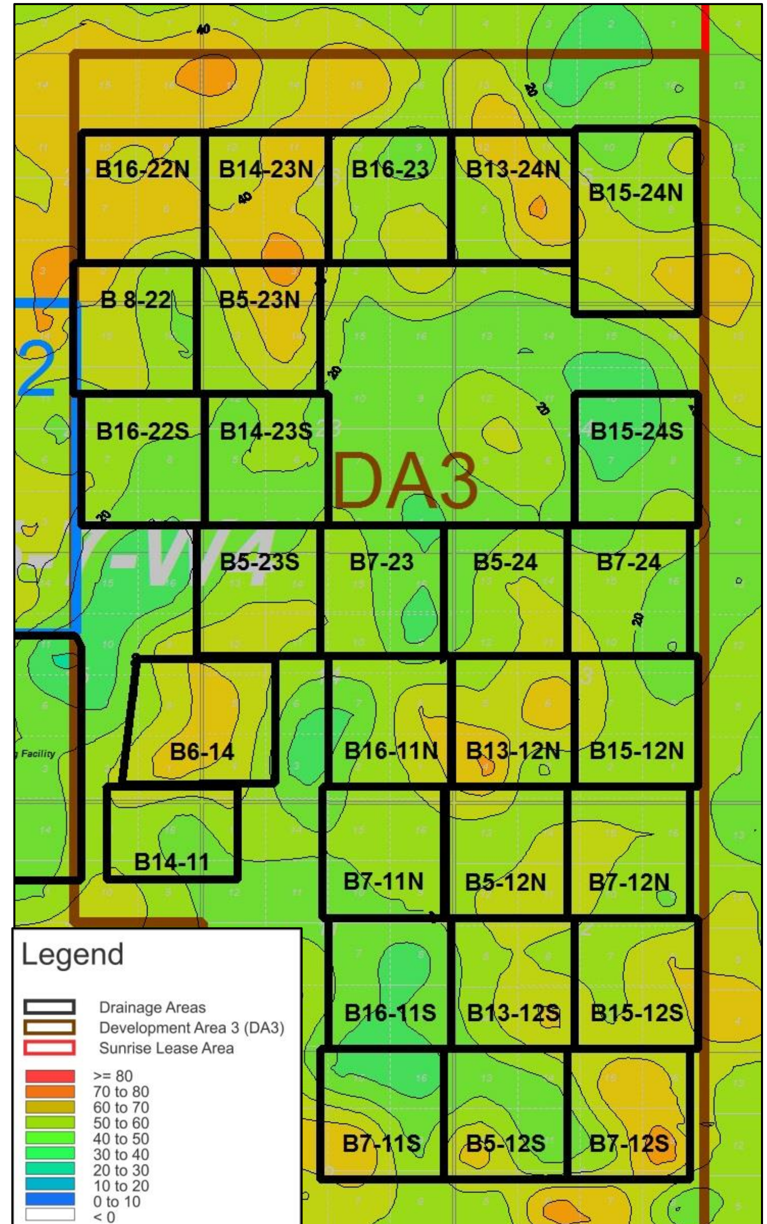
Average Reservoir Characteristics & OBIP – DA1 & DA2

Drainage Pattern	Area $10^4 m^2$	Net Pay Thickness (m)	Porosity (%)	Bitumen Saturation (%)	Developable OBIP ($10^3 m^3$)
B16-07	27	25.4	30	79	1,628
B13-08	62.1	24.8	31	81	3,868
B14-08	45.9	36.5	32	82	4,394
B16-08	51	24.4	32	81	3,219
B13-09	51	21.4	31	79	2,677
B08-18	28.5	24.0	30	78	1,600
B08-17	48	28.4	31	79	3,334
B05-16	51	25.3	32	81	3,351
B07-16	51	24.6	31	84	3,265
B16-18	54	32.1	32	78	4,326
B01-19	51	26.2	31	84	3,484
B16-17	51	29.9	32	82	3,999
B13-16	51	31.3	33	82	4,325
B15-16	51	32.5	31	85	4,374
B05-21	63	35.6	31	81	5,628
B06-21	63	33.0	31	80	5,160
B10-21	50	33.0	30	81	4,004
B16-16	63	27.5	31	78	4,185
B14-15	54	28.2	30	81	3,700
B10-16	45	24.2	31	81	2,733



Average Reservoir Characteristics & OBIP - DA3

Drainage Pattern	Area $10^4 m^2$	Net Pay Thickness (m)	Porosity (%)	Bitumen Saturation (%)	Developable OBIP ($10^3 m^3$)
B05-12N	68	26.2	31.7	76.4	4,310
B05-12S	68	22.0	29.2	79.2	3,460
B07-12N	68	26.3	31.6	81.3	4,600
B07-12S	68	31.3	31.8	81.8	5,530
B13-12N	68	28.3	31.7	79.7	4,860
B13-12S	68	20.1	31.1	78.5	3,340
B15-12N	68	21.5	31.3	84	3,840
B15-12S	68	26.2	31.6	83.5	4,700
B06-14	76.6	27.4	31	84.1	5,480
B07-11N	68	21.0	30.3	79	3,420
B07-11S	68	23.9	31.2	74.4	3,770
B14-11	51	21.3	30.7	81.4	2,720
B16-11N	68	24.5	30.5	79.7	4,050
B16-11S	68	11.0	31.2	74.4	1,730
B13-24	68	37.5	30.8	84.4	6,620
B14-23N	68	33.2	32.2	79	5,750
B14-23S	68	16.8	31.9	81.1	2,950
B15-24N	95.3	23.2	31.3	83.6	5.79
B15-24S	68	14.2	30.4	78.1	2,290
B16-22N	68	29.6	32.7	78.4	5,160
B16-22S	68	15.4	32.4	75.9	2,580
B16-23	68	30.1	31.3	83	5,310
B05-23N	68	30.0	31	79.9	5,050
B05-23S	68	22.4	32.7	75.2	3,740
B05-24	68	25.3	29.6	80.5	4,100
B07-23	68	20.7	30.6	79.7	3,430
B07-24	68	20.7	29.9	79	3,330
B08-24	68	23.8	30	84.7	4,120



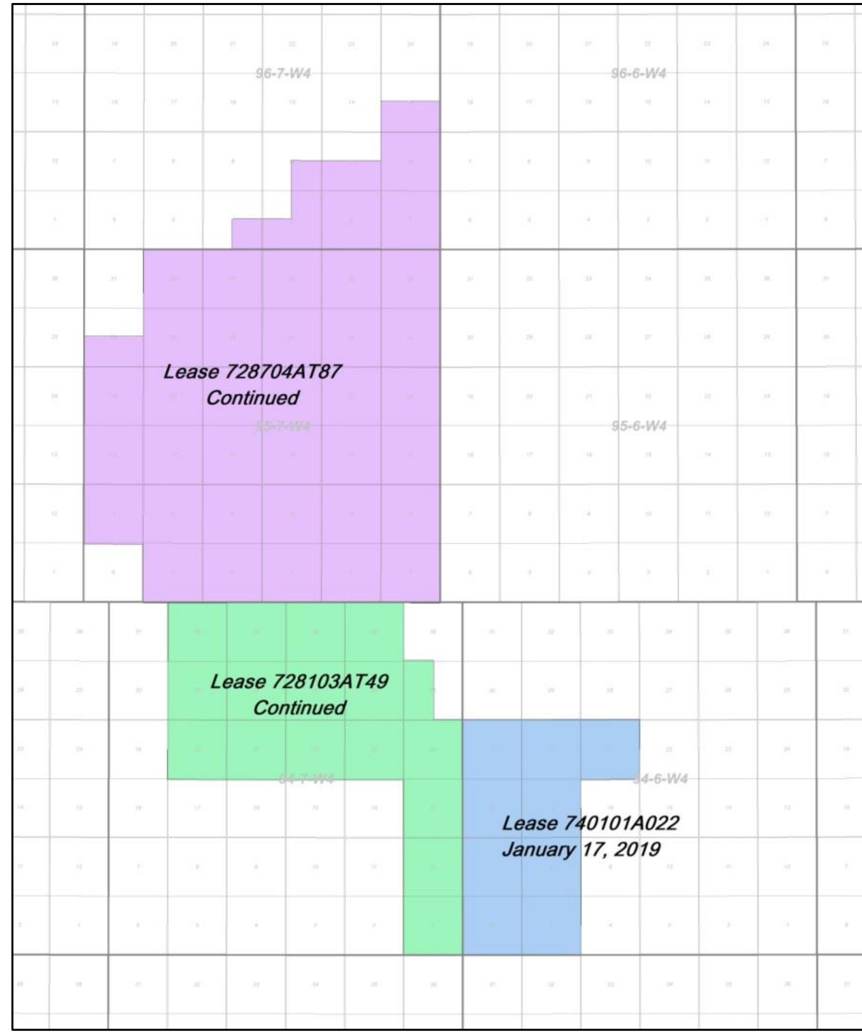
OBIP Project Area

Methodology

- Volumetric Calculation
  - OBIP = Area (m2) times HPV (m)
  - HPV = net thickness x net bitumen Saturation x effective Porosity
  - Cut off 6% BWO

- Geographix Application

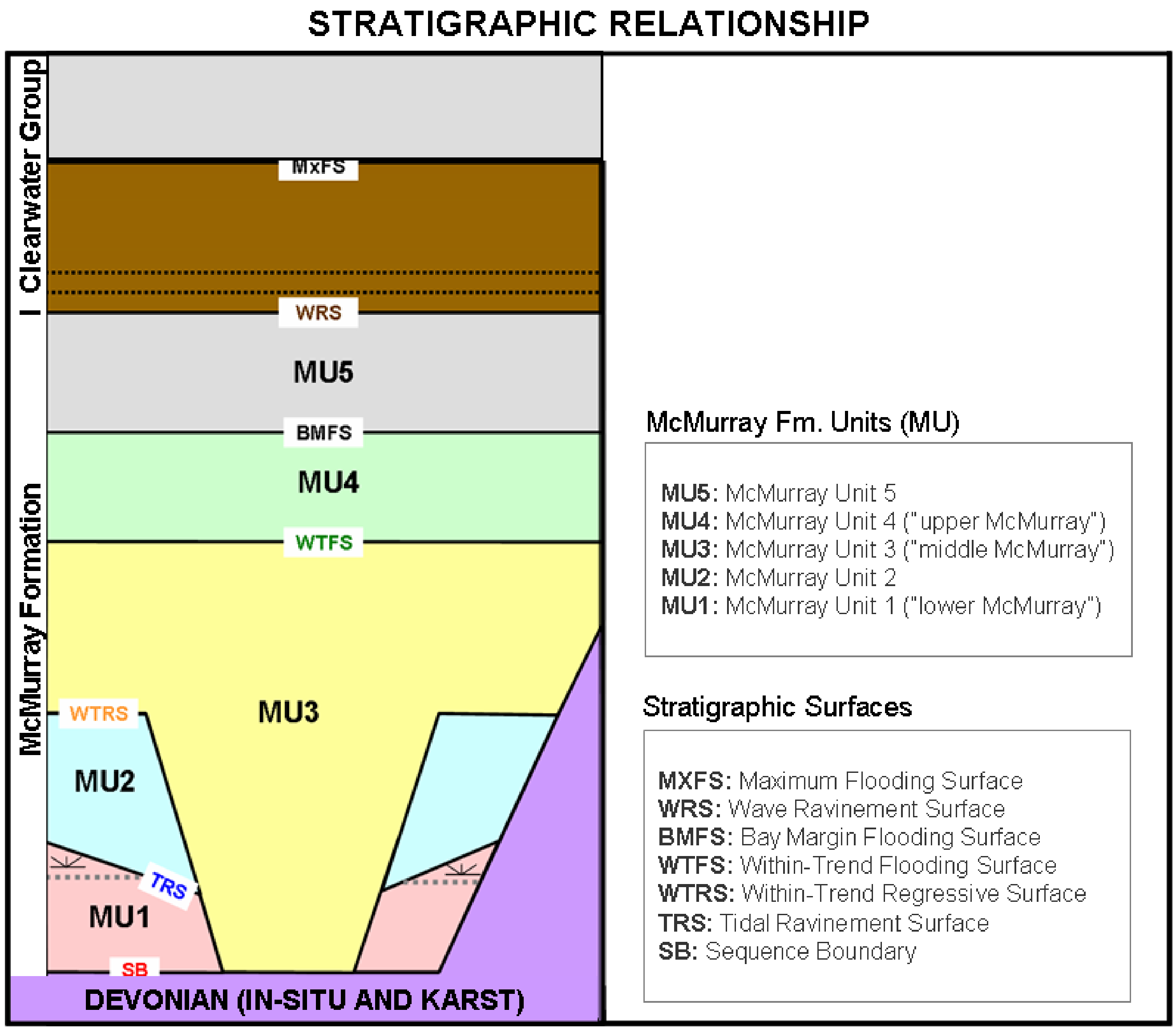
Lease	OBIP 6% BWO cutoff (10^3 m^3)	Gross Thickness (m)	Porosity (%)	Bitumen Saturation (%)
Total	1,410,565	36.0	30.4	77.5



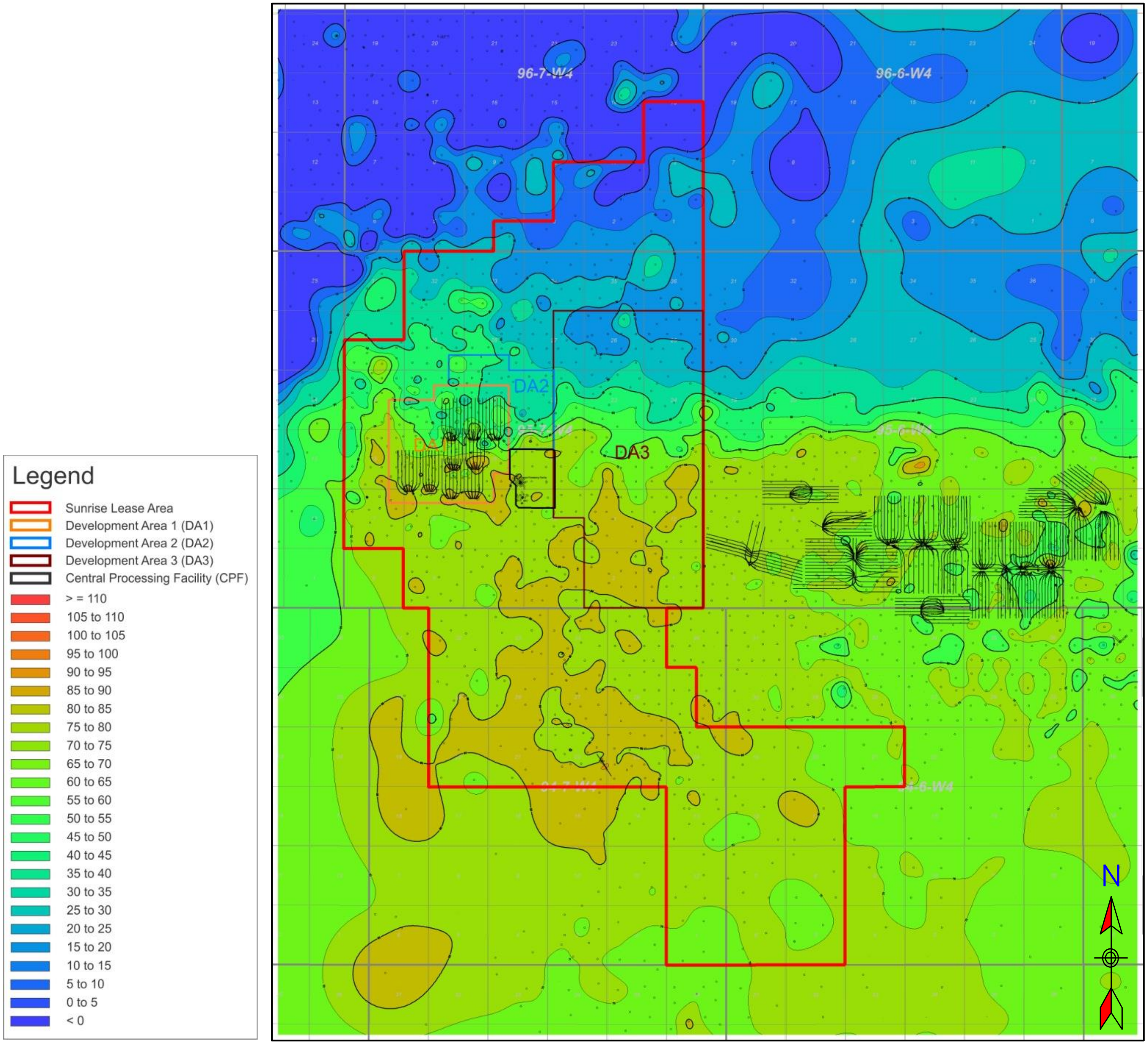
Reservoir Properties

Property	Value
Initial Reservoir Pressure (kPa_g)	450 at 300 masl
Reservoir Temperature (°C)	7
Depth to Reservoir (m)	160 – 200
Average Net Pay (m)	24
Average Horizontal Permeability (mD)	3700
Average Vertical Permeability (mD)	2000

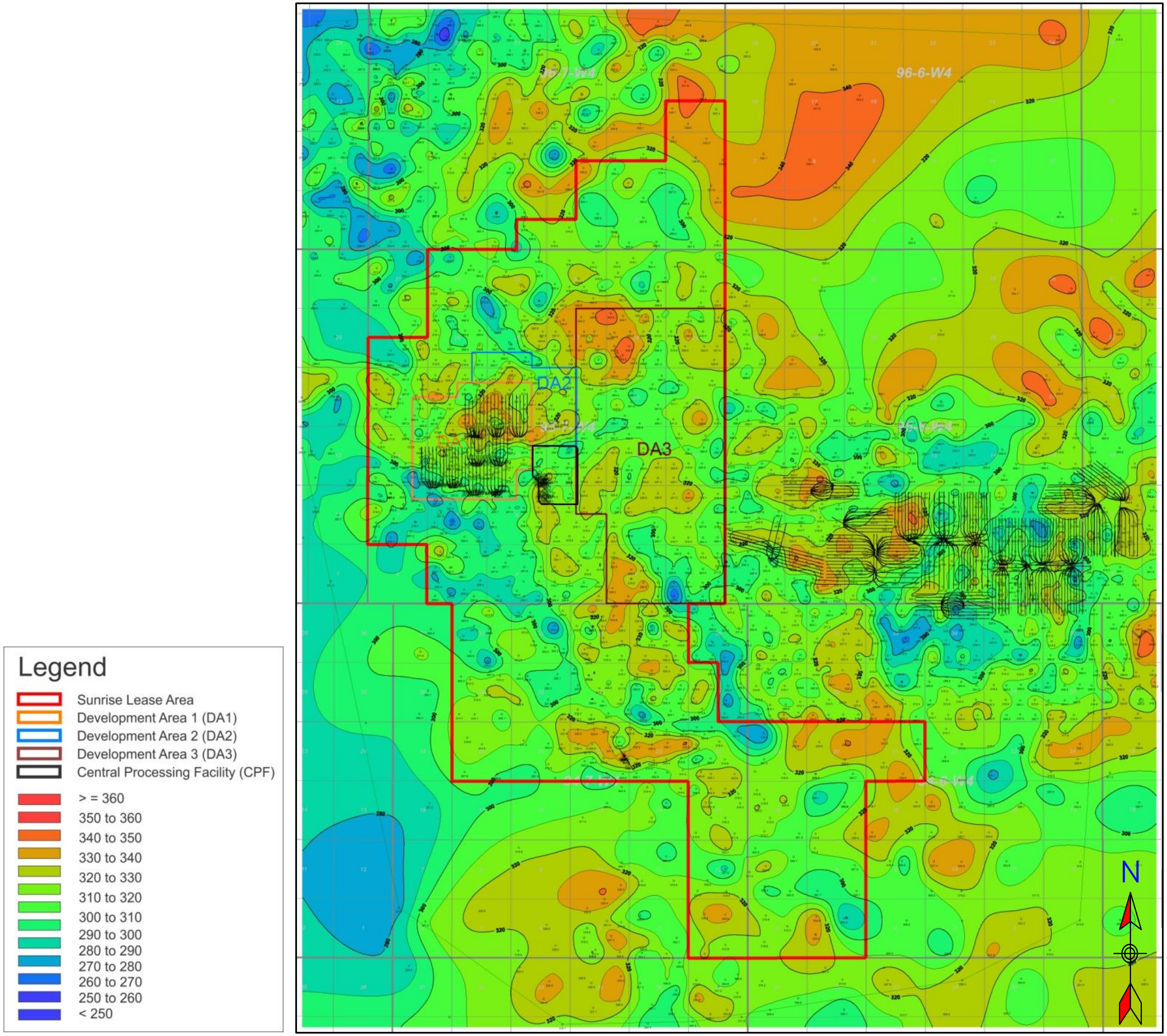
Sunrise Stratigraphic Column



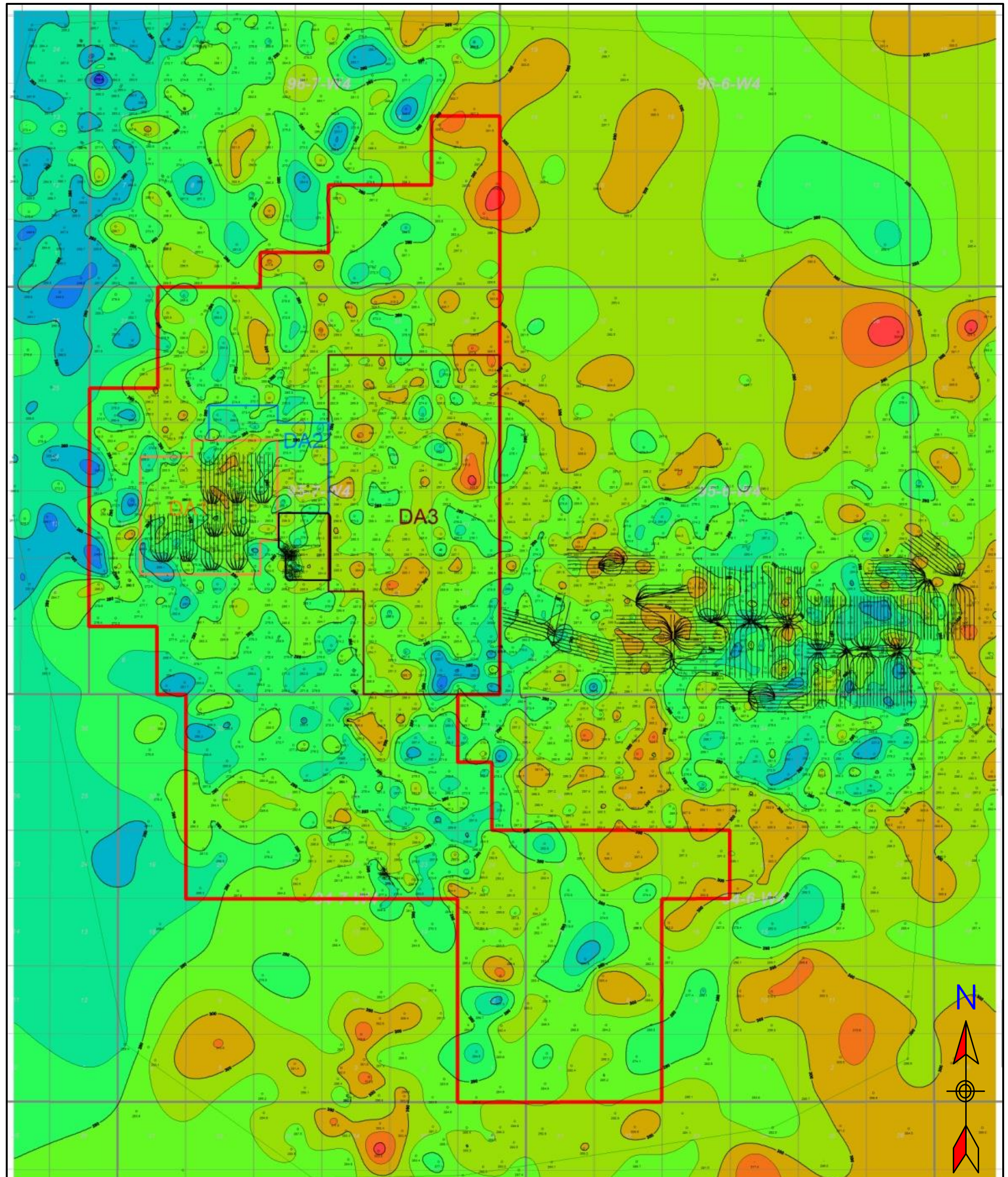
Clearwater Formation Isopach Map



Structure Contour Map Top of Pay



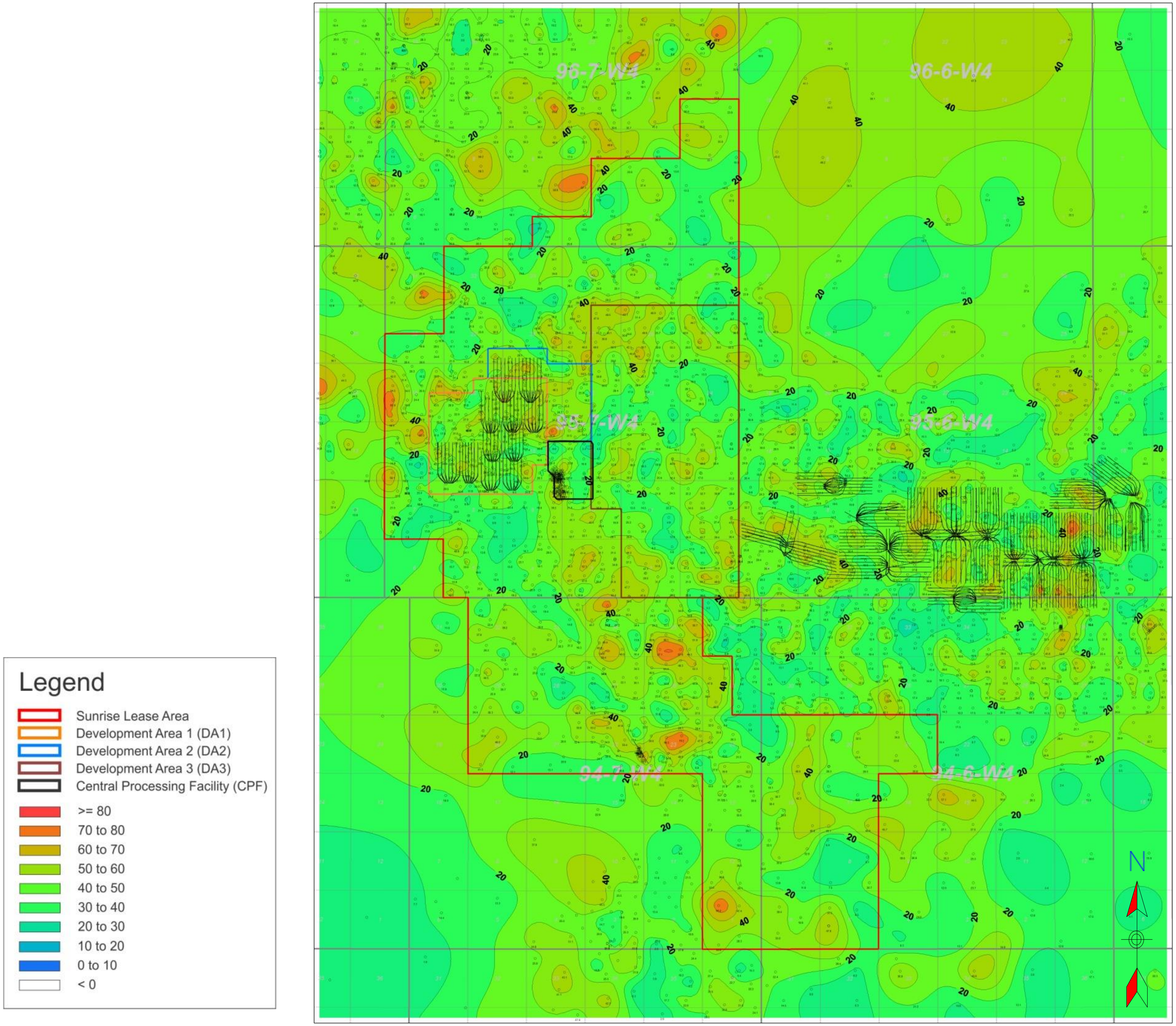
Structure Contour Map Base of Pay



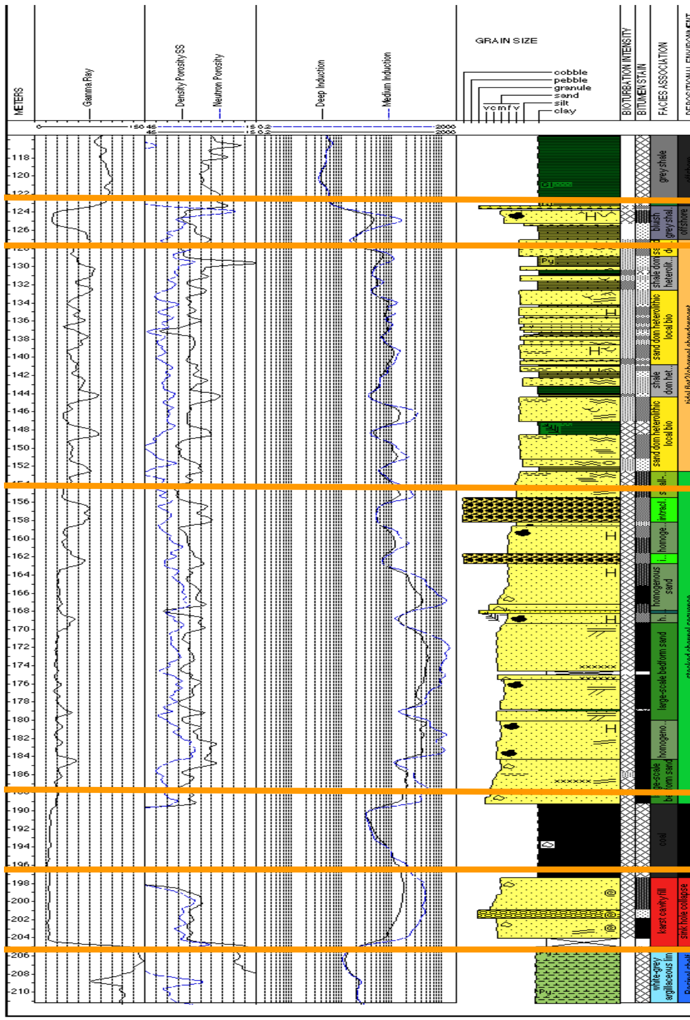
Legend

- Sunrise Lease Area
- Development Area 1 (DA1)
- Development Area 2 (DA2)
- Development Area 3 (DA3)
- Central Processing Facility (CPF)
- > = 330
- 320 to 330
- 310 to 320
- 300 to 310
- 290 to 300
- 280 to 290
- 270 to 280
- 260 to 270
- 250 to 260
- 240 to 250
- 230 to 240
- < 230

Isopach Map of the Main Pay Zone



Depositional Environment



Marine Shale **Clearwater**

Marine Sands and Shales **McMurray**

Tidal Flats/IHS

Estuarine Channels

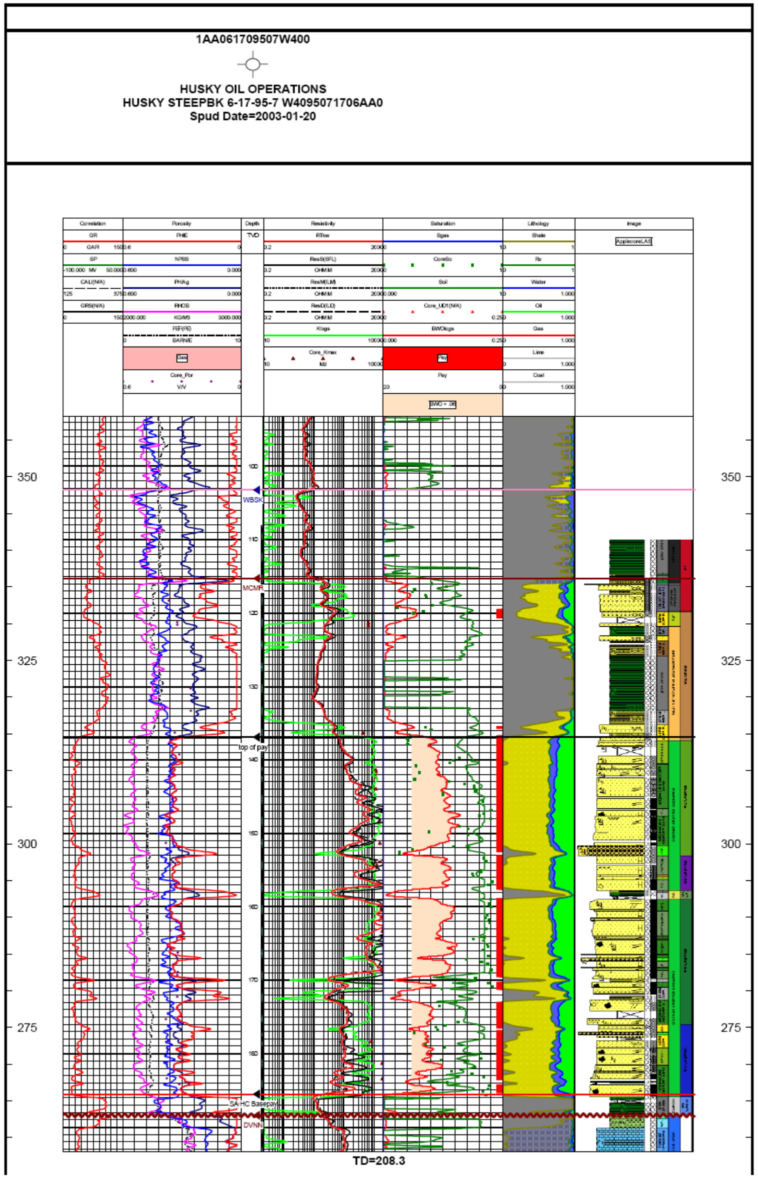
Coal/Marsh

Lower Channel

Devonian

Composite Well Log

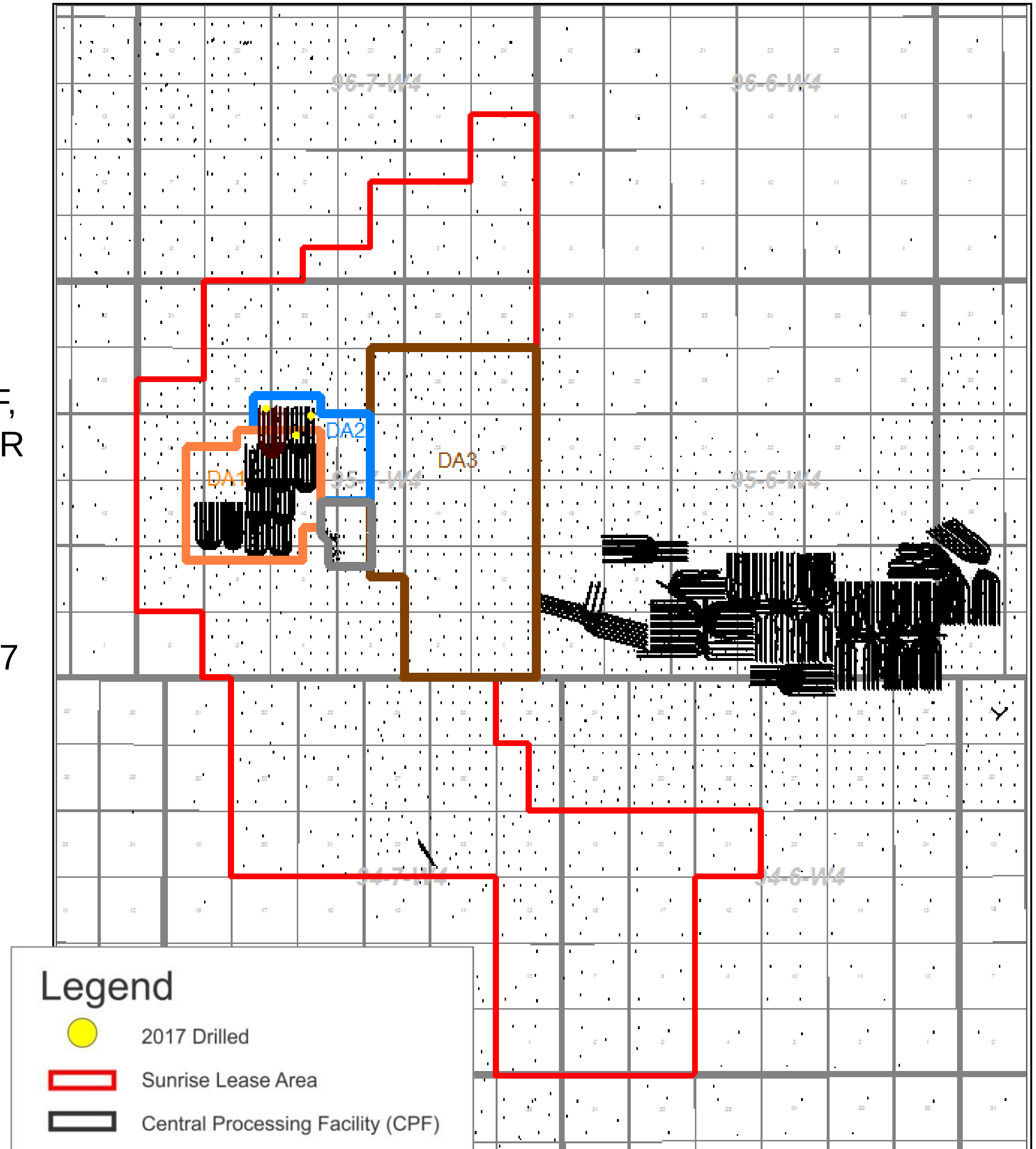
- Well 06-17-095-07W4M



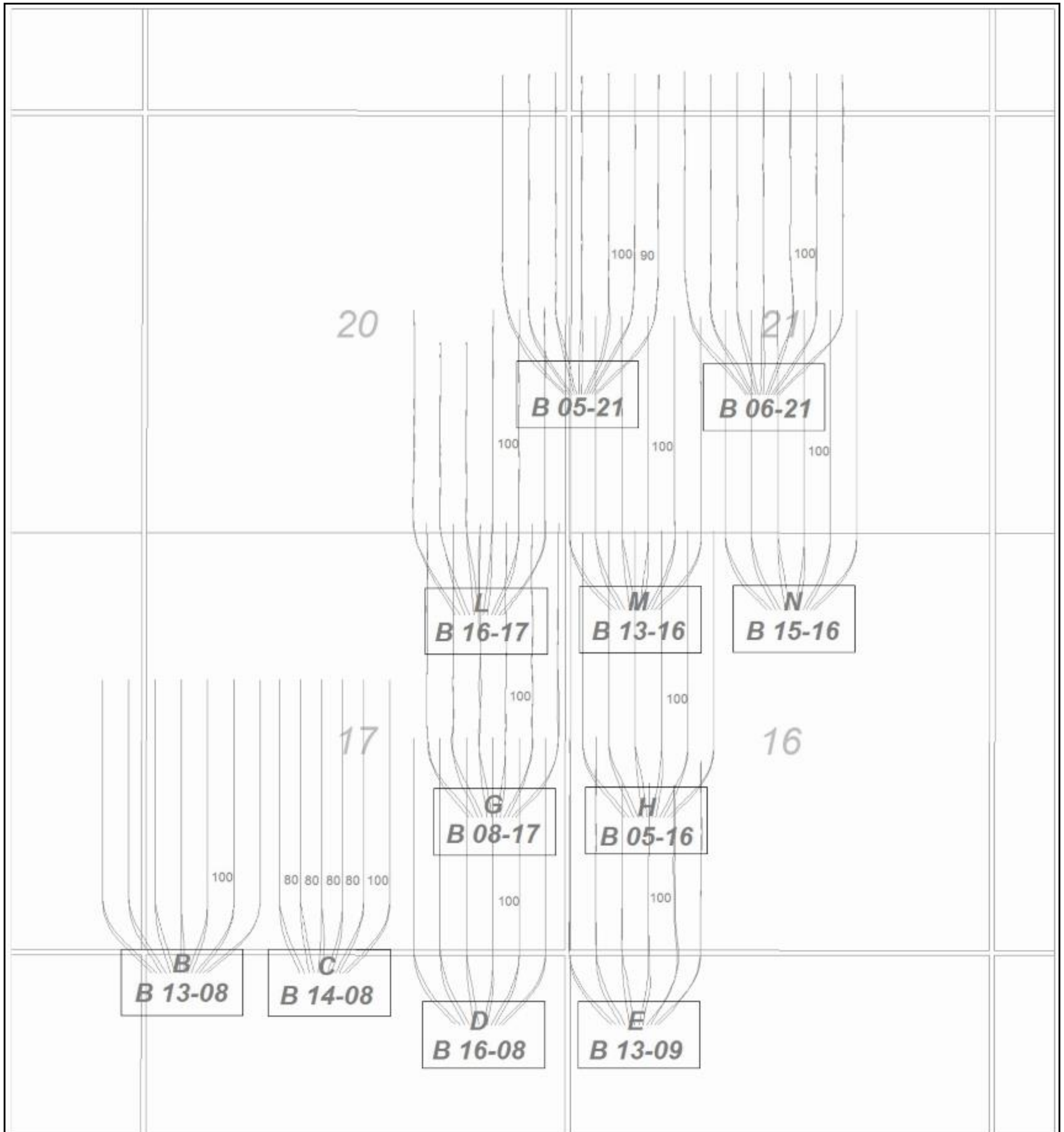
Vertical and Horizontal Wells

2016 Program:
- No vertical wells
- No horizontal wells

2017 Program:
- One vertical well in DA2
- HZ wells:
  - 3 replacement wells (D6F, H1F, N1F) – received AER Approval (letter) June 1, 2017
  - 2 infill wells - received AER Scheme Approval (10419T) August 24, 2017



Pad Interwell Spacing Schematic



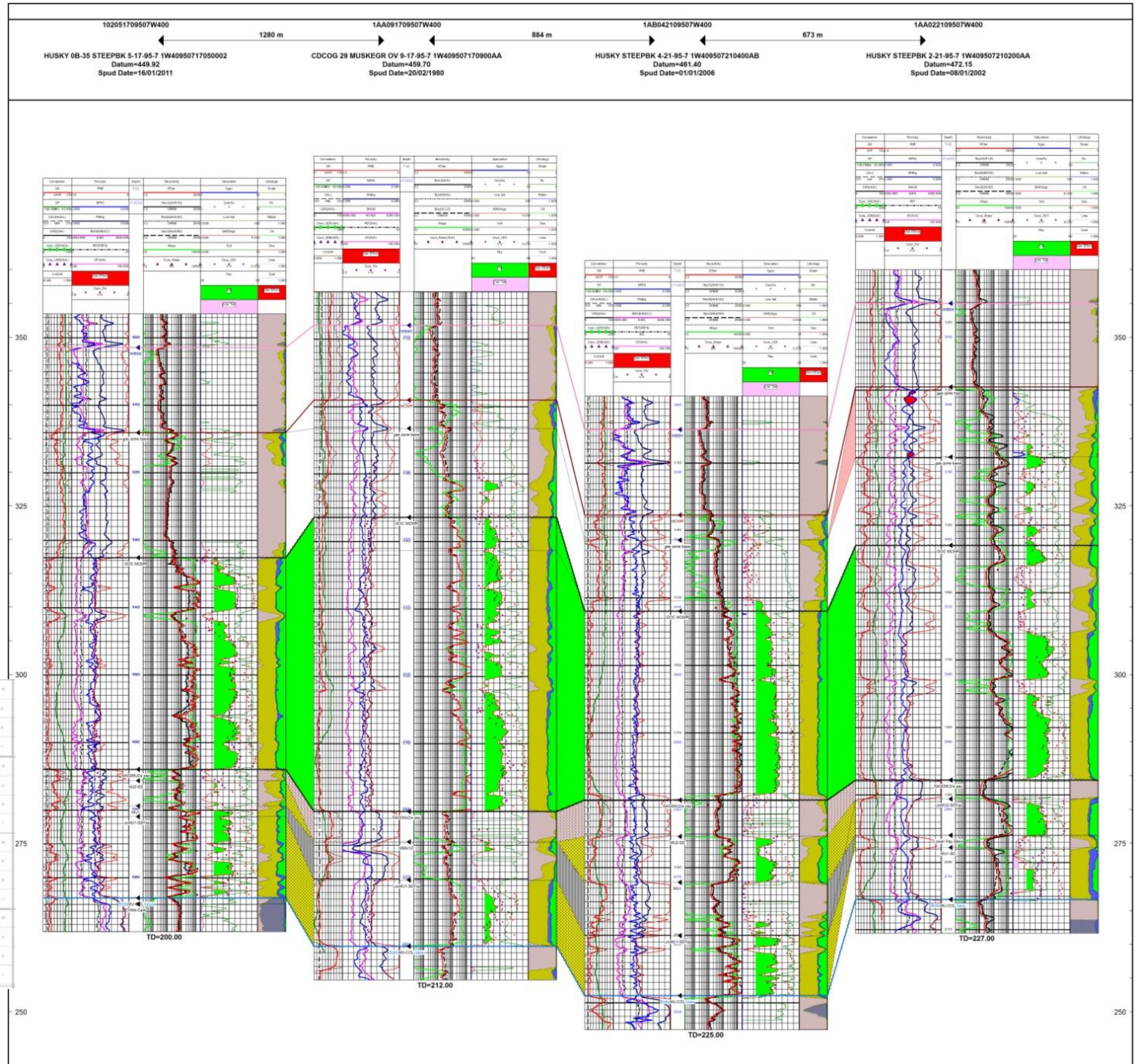
Pad Inter-well Spacing

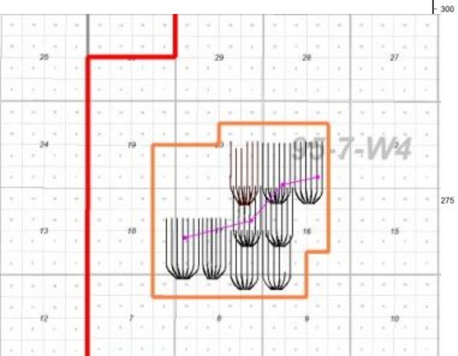
Well Pad	Inter-well Spacing (meters)
B13-08	100
B14-08	80-100
B16-08	100
B13-09	100
B08-17	100
B05-16	100
B16-17	100
B13-16	100
B15-16	100
B05-21	100 (P6-7 90)
B06-21	100

Petrographic Analysis

- No petrographic analysis was done during the reporting period

Representative Structural E-W Cross-section through the Approval DA1





Geomechanical Data

- No geomechanical data was acquired during the reporting period

Maximum Operating Pressure by Drainage Pattern

Drainage Pattern	Maximum Operating Pressure (kPa_g)
B13-08 (B)	1,770*
B14-08 (C)	1,780*
B16-08 (D)	1,950*
B13-09 (E)	2,200*
B08-17 (G)	1,810*
B05-16 (H)	1,970*
B16-17 (L)	1,750
B13-16 (M)	1,830*
B15-16 (N)	1,940*
B06-21 (P)	1,750
B05-21 (Q)	1,750

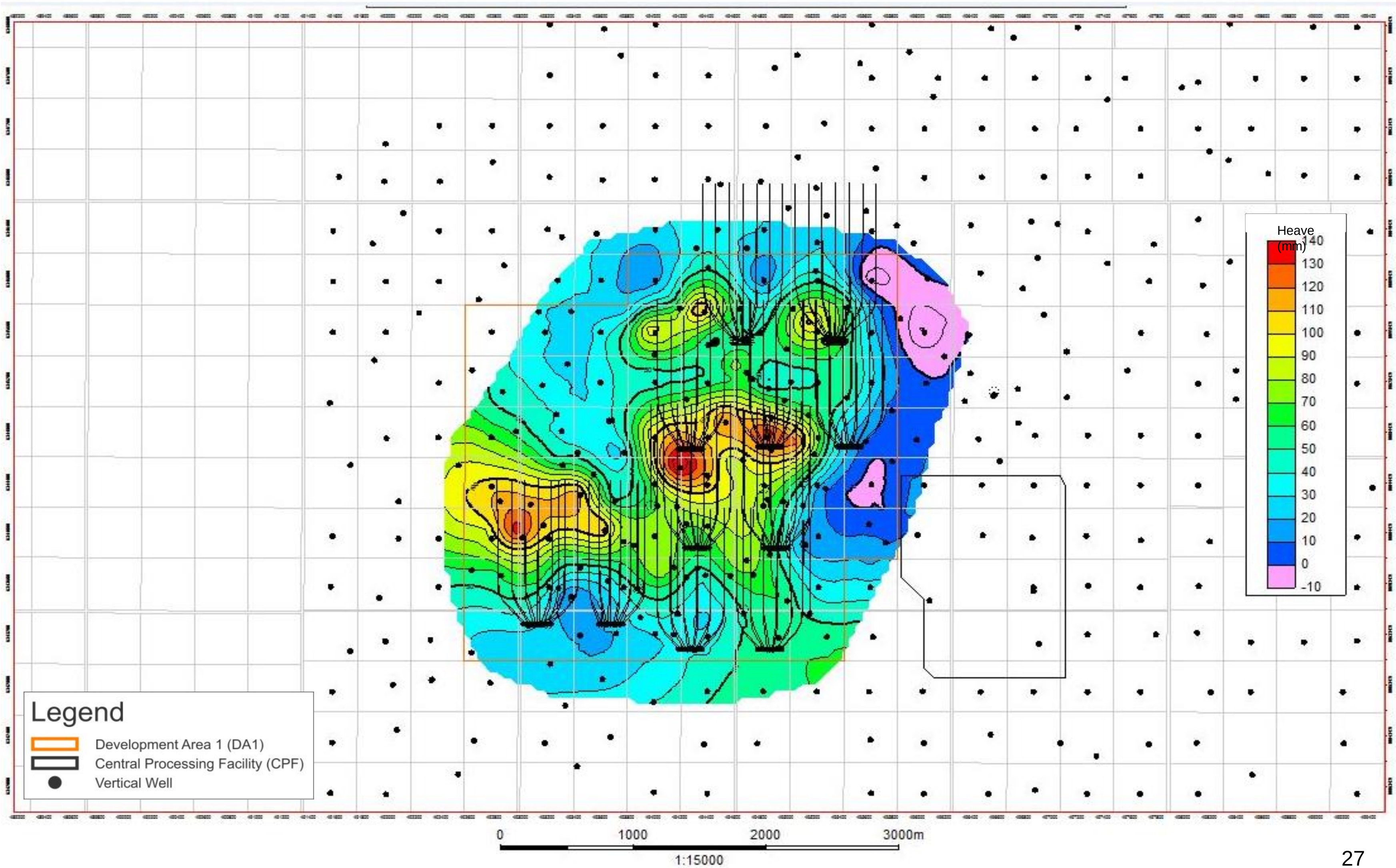
*Increase MOP AER Scheme Approval (No. 10419Q) – condition expires on August 31, 2021

Well Integrity Updates

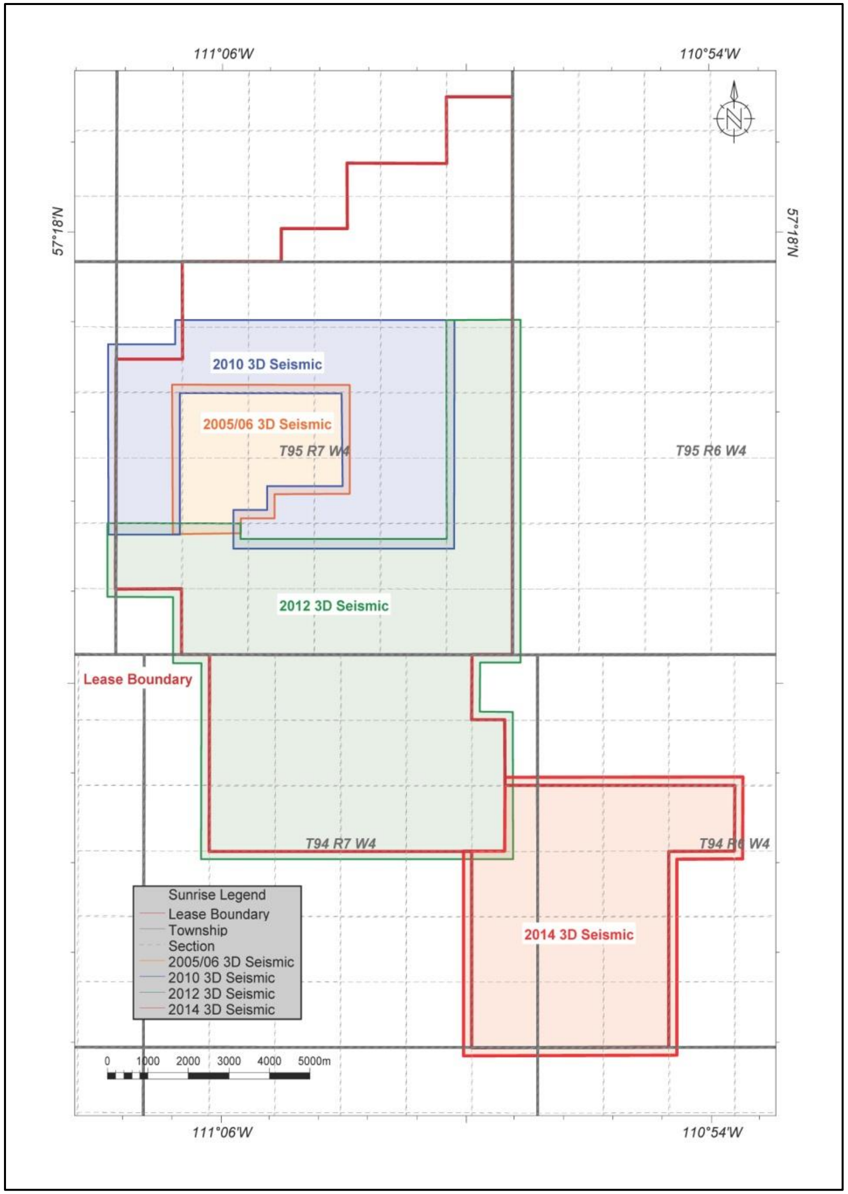
- No liner or casing failures occurred during the reporting period

Surface Heave

- Data as of June 9, 2017



3D Seismic Coverage



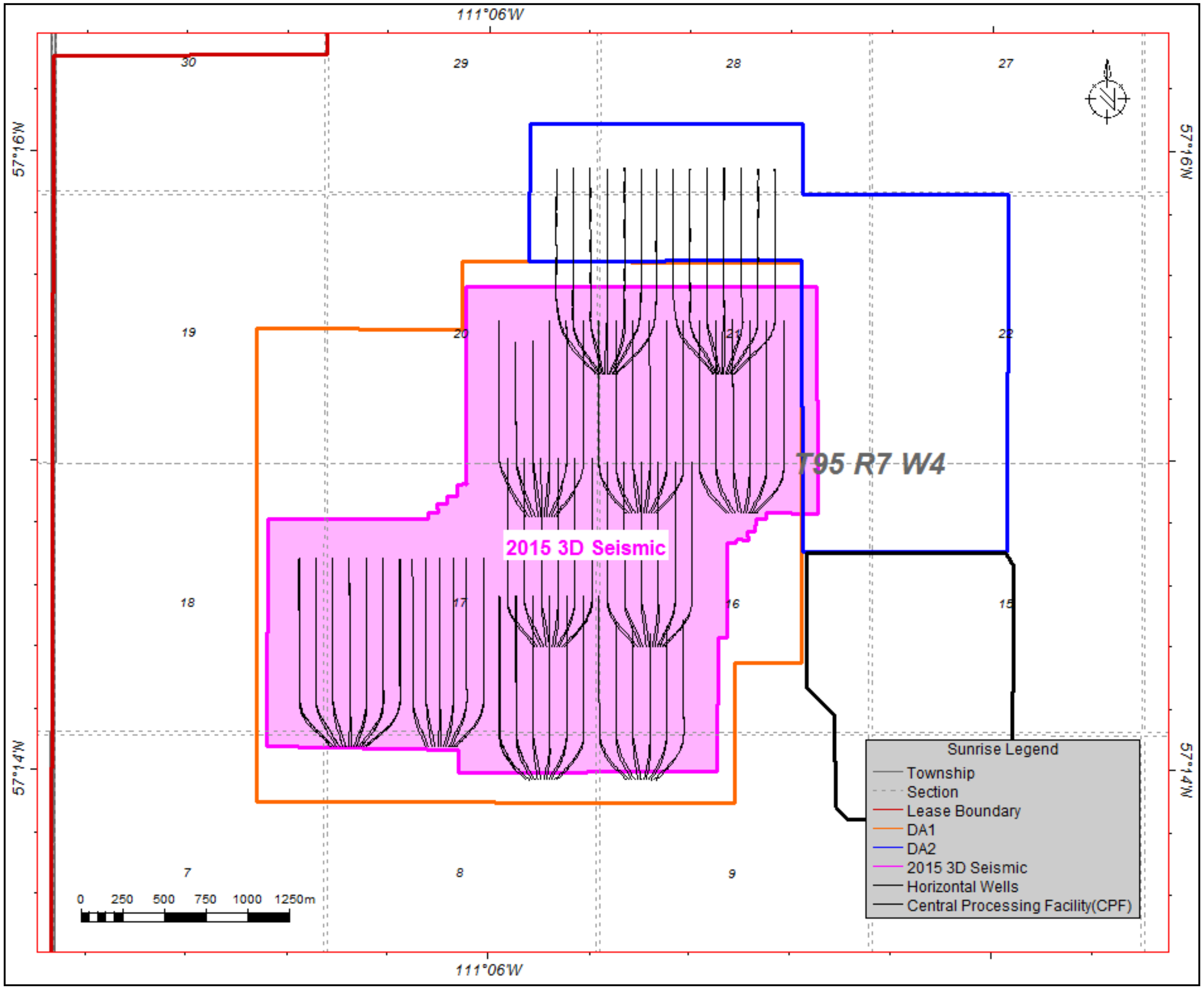
3D Seismic

2016 Program:

- Processing for 2015 baseline seismic data is completed.

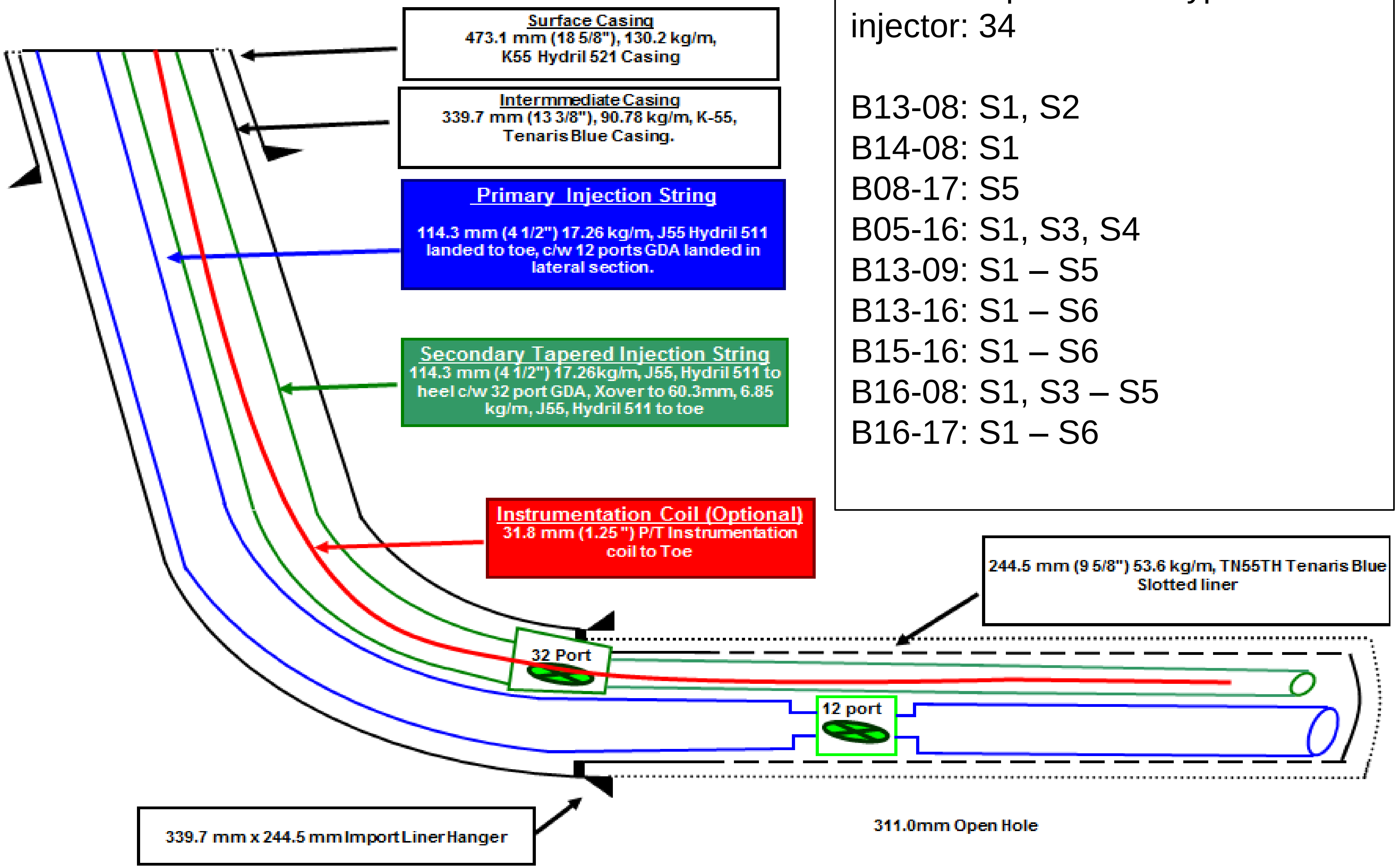
2017 Program:

- No program



3. Drilling and Completions

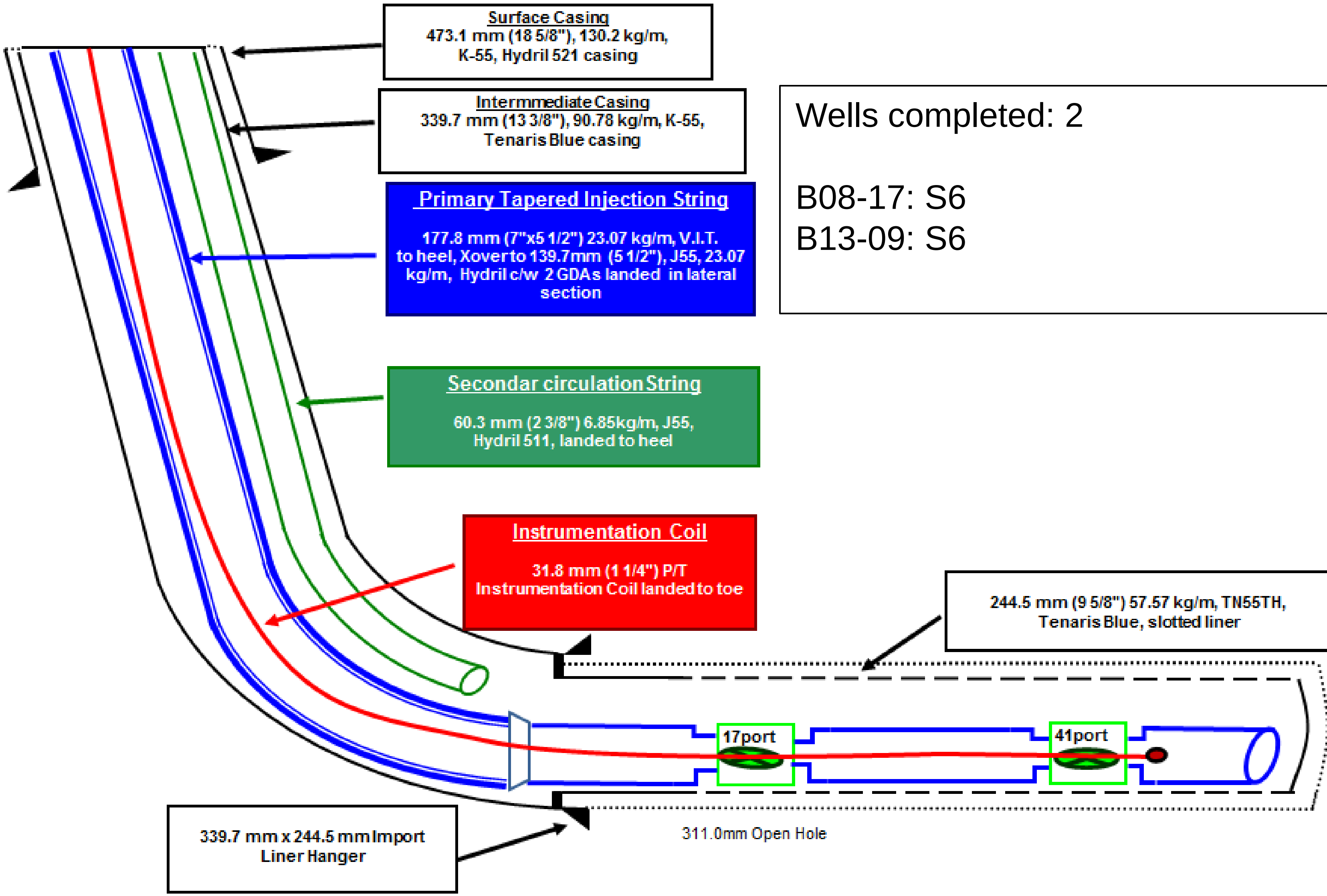
SAGD Well Design: Typical Injector Well (DA1)



Wells completed with typical injector: 34

B13-08: S1, S2
B14-08: S1
B08-17: S5
B05-16: S1, S3, S4
B13-09: S1 – S5
B13-16: S1 – S6
B15-16: S1 – S6
B16-08: S1, S3 – S5
B16-17: S1 – S6

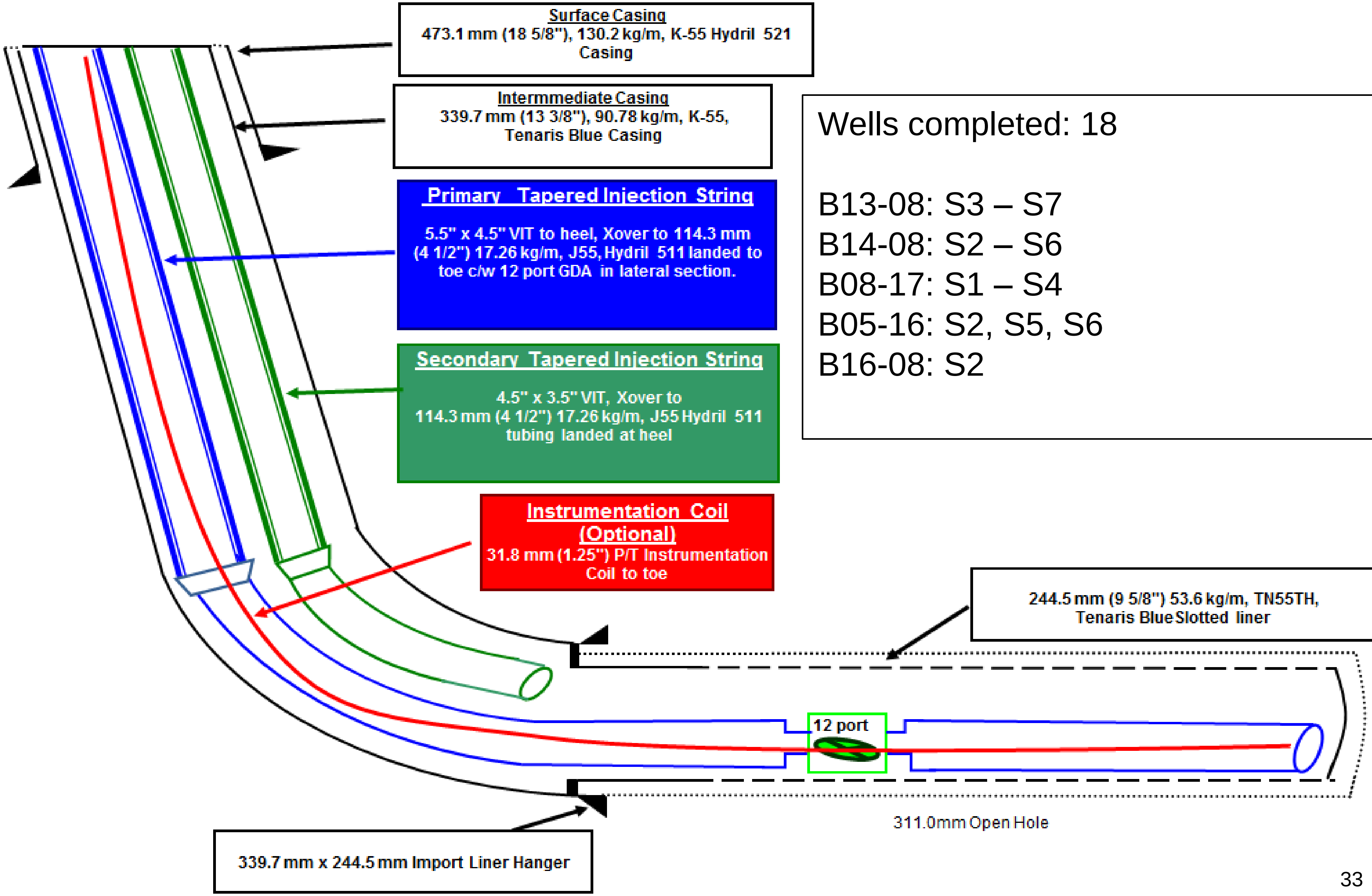
SAGD Well Design: Injector Well (DA1)



Wells completed: 2

B08-17: S6
B13-09: S6

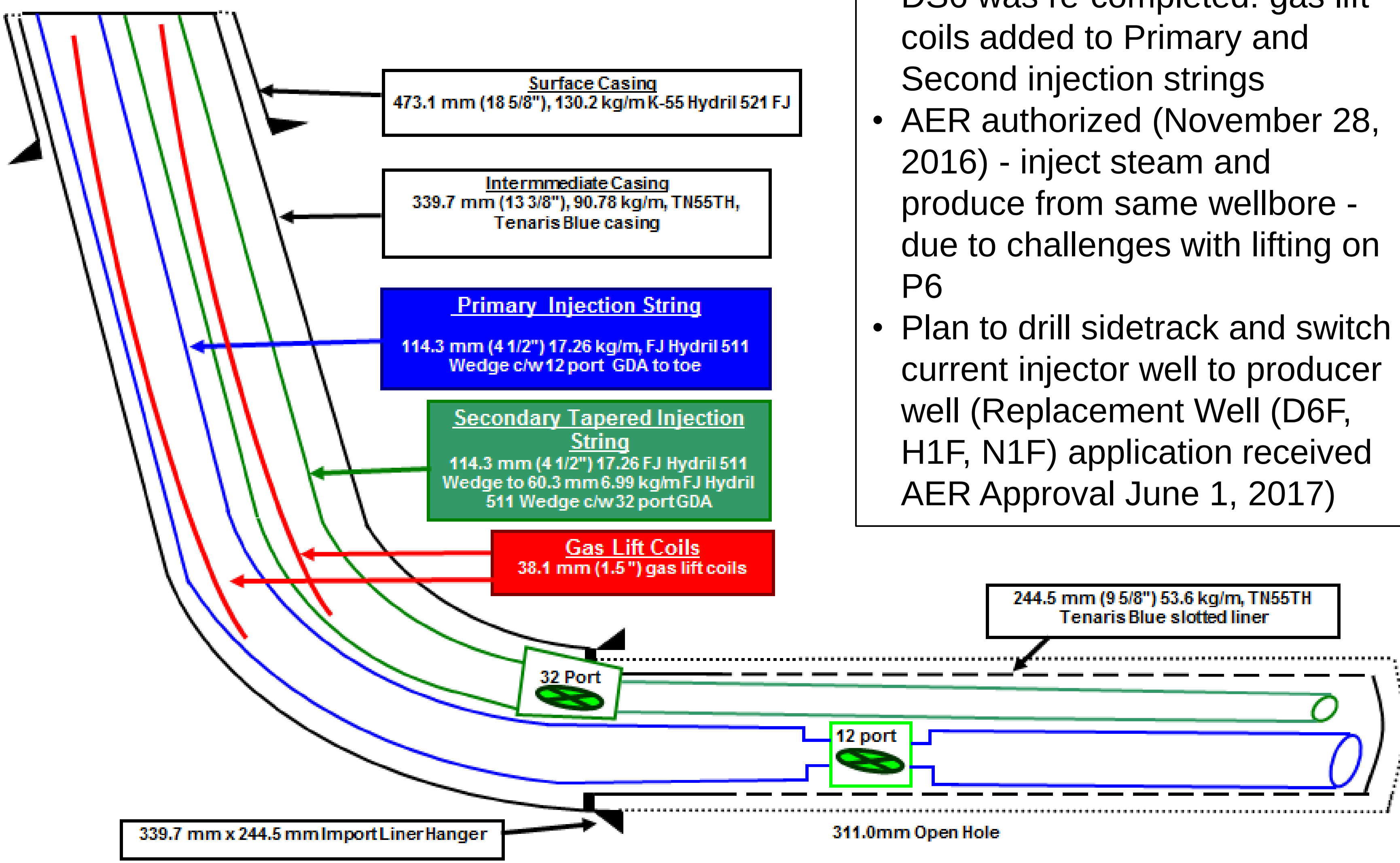
SAGD Well Design: Injector Well – (DA1)



Wells completed: 18

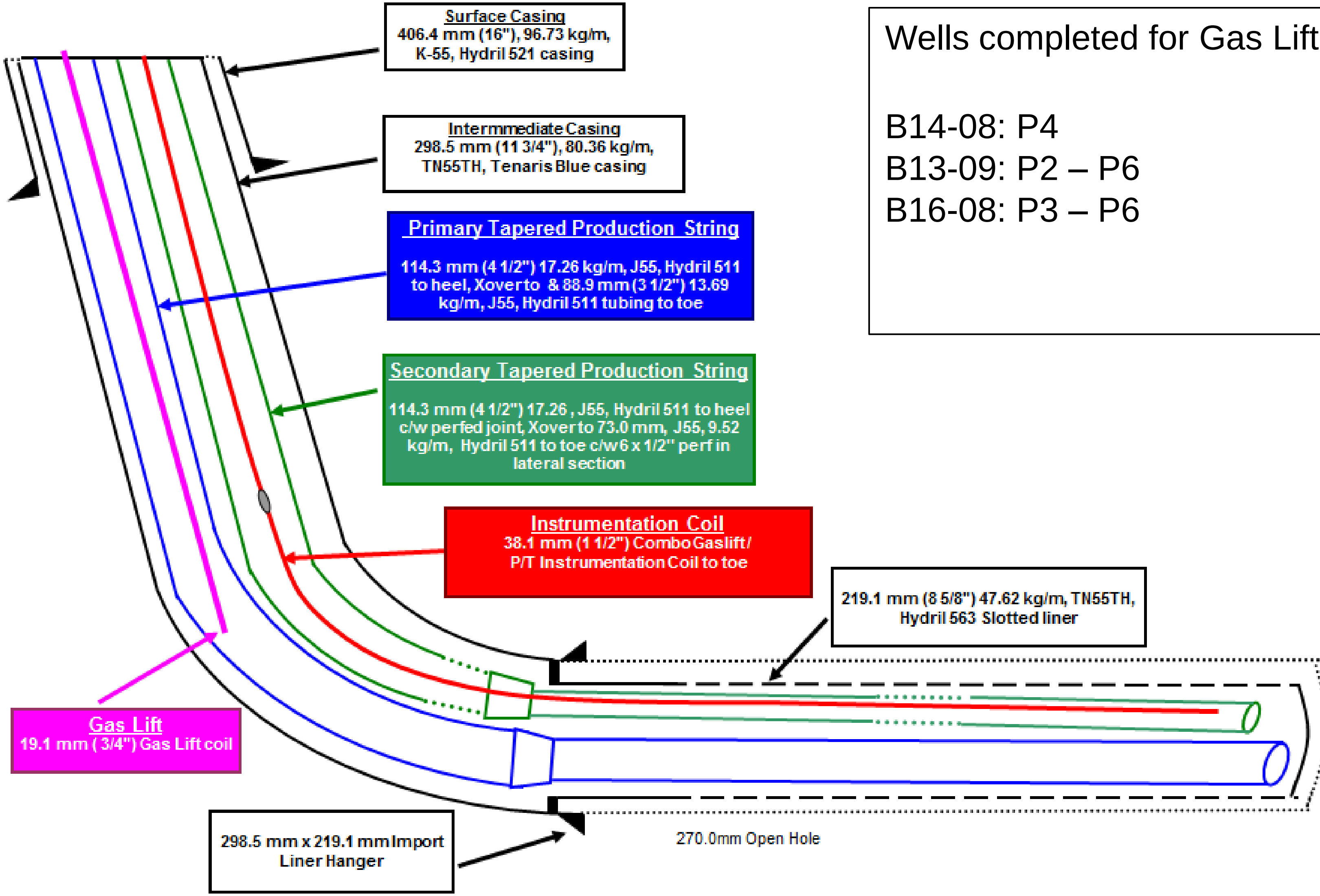
B13-08: S3 – S7
B14-08: S2 – S6
B08-17: S1 – S4
B05-16: S2, S5, S6
B16-08: S2

SAGD Well Design: Injector Well B16-08 (D) S6



- DS6 was re-completed: gas lift coils added to Primary and Second injection strings
- AER authorized (November 28, 2016) - inject steam and produce from same wellbore - due to challenges with lifting on P6
- Plan to drill sidetrack and switch current injector well to producer well (Replacement Well (D6F, H1F, N1F) application received AER Approval June 1, 2017)

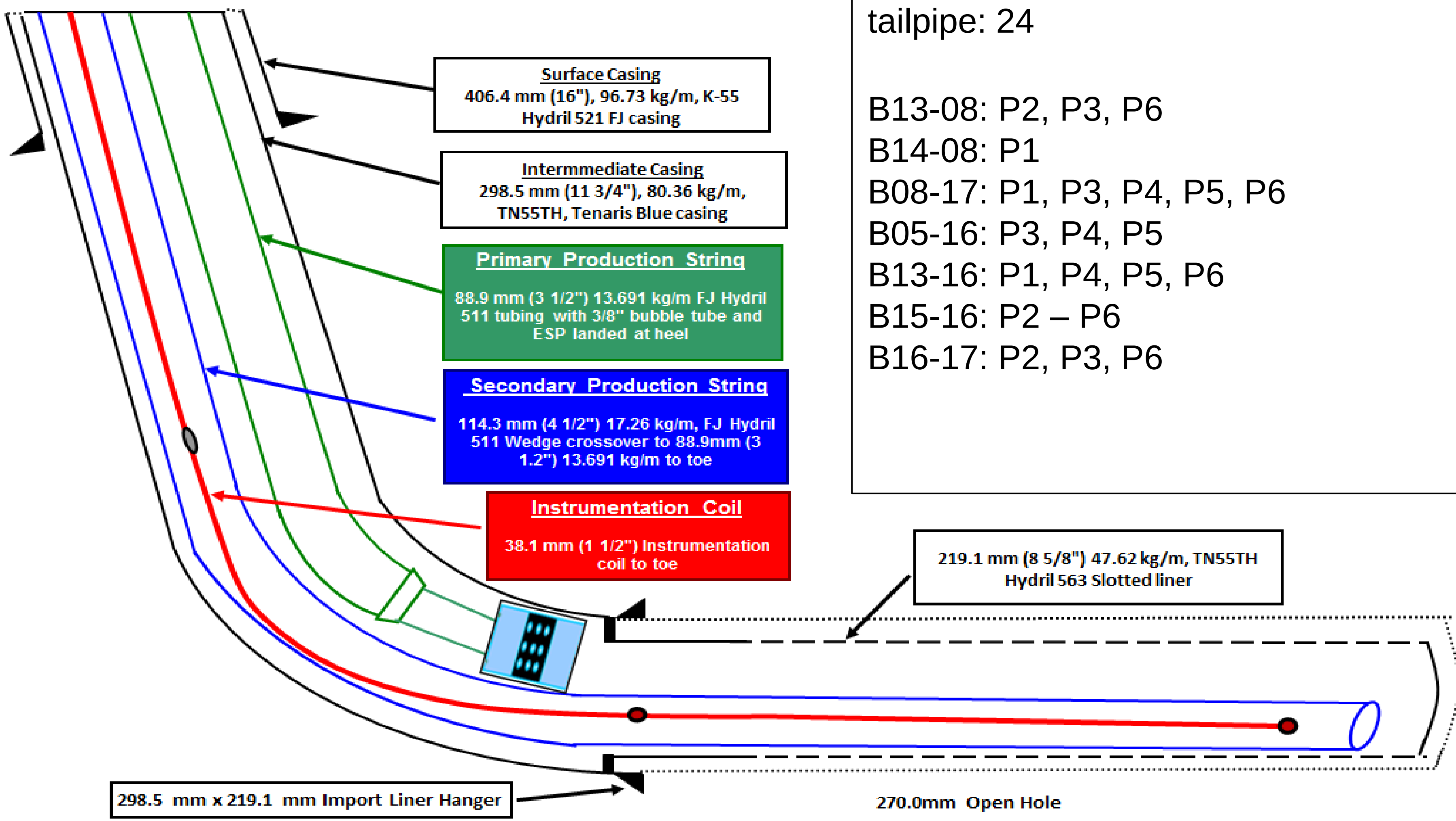
SAGD Well Design: Typical Producer Well – Gas Lift (DA1)



Wells completed for Gas Lift: 10

B14-08: P4
B13-09: P2 – P6
B16-08: P3 – P6

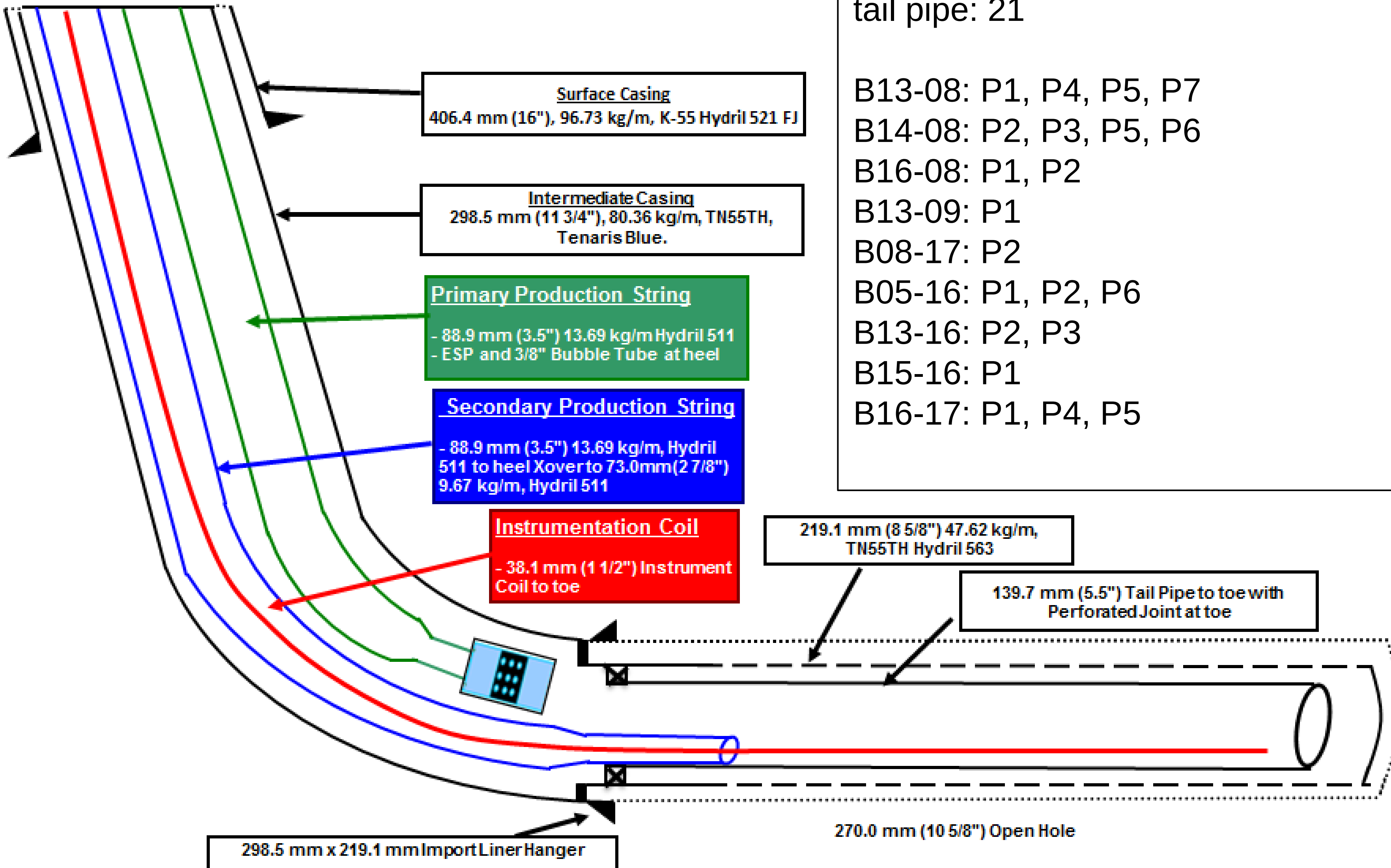
SAGD Well Design: Typical Producer Well – ESP without Tailpipe (DA1)



Wells completed for ESP without tailpipe: 24

B13-08: P2, P3, P6
B14-08: P1
B08-17: P1, P3, P4, P5, P6
B05-16: P3, P4, P5
B13-16: P1, P4, P5, P6
B15-16: P2 – P6
B16-17: P2, P3, P6

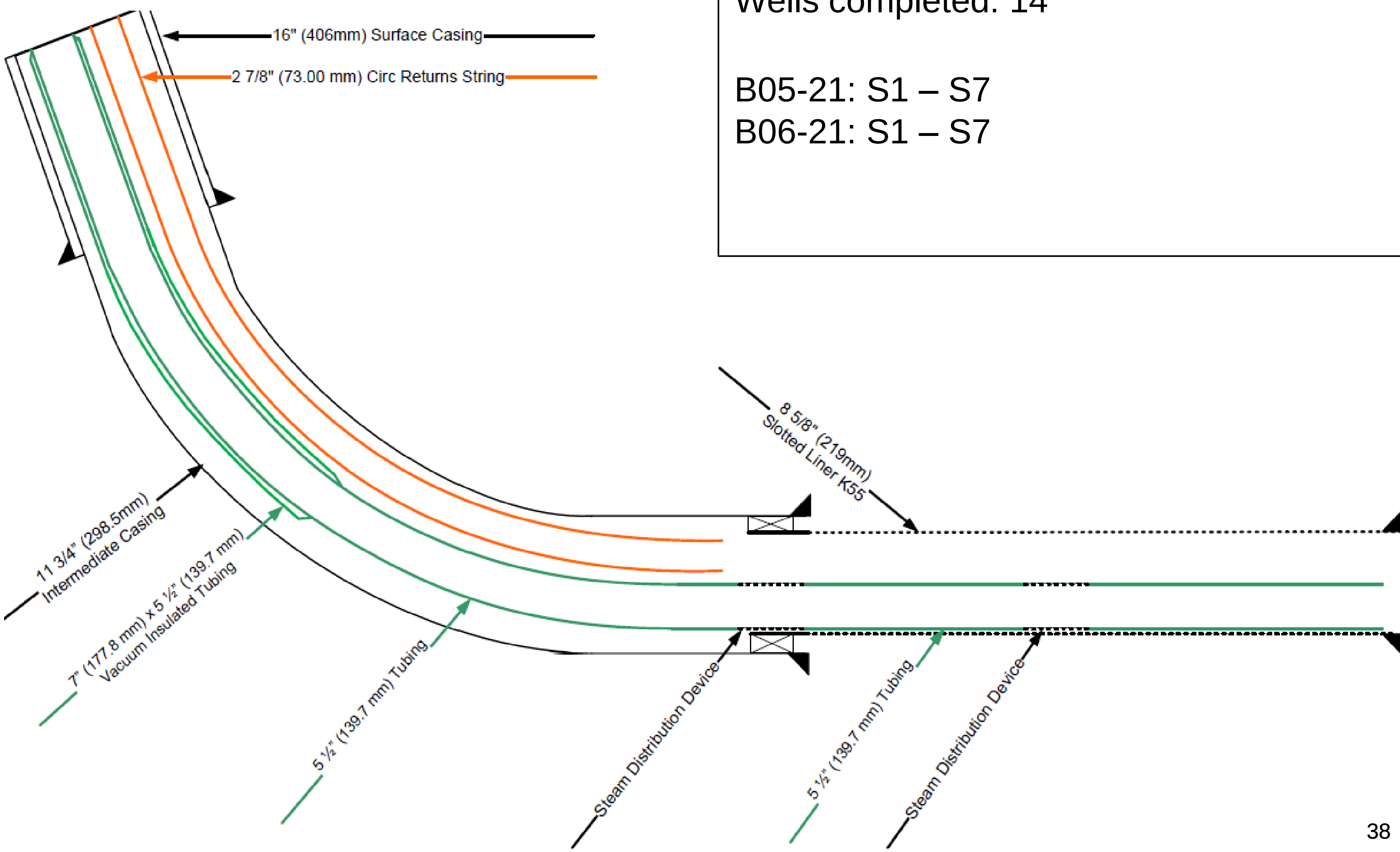
SAGD Well Design: Typical Producer Well – ESP with tail pipe (DA1)



Wells completed for ESP with tail pipe: 21

B13-08: P1, P4, P5, P7
B14-08: P2, P3, P5, P6
B16-08: P1, P2
B13-09: P1
B08-17: P2
B05-16: P1, P2, P6
B13-16: P2, P3
B15-16: P1
B16-17: P1, P4, P5

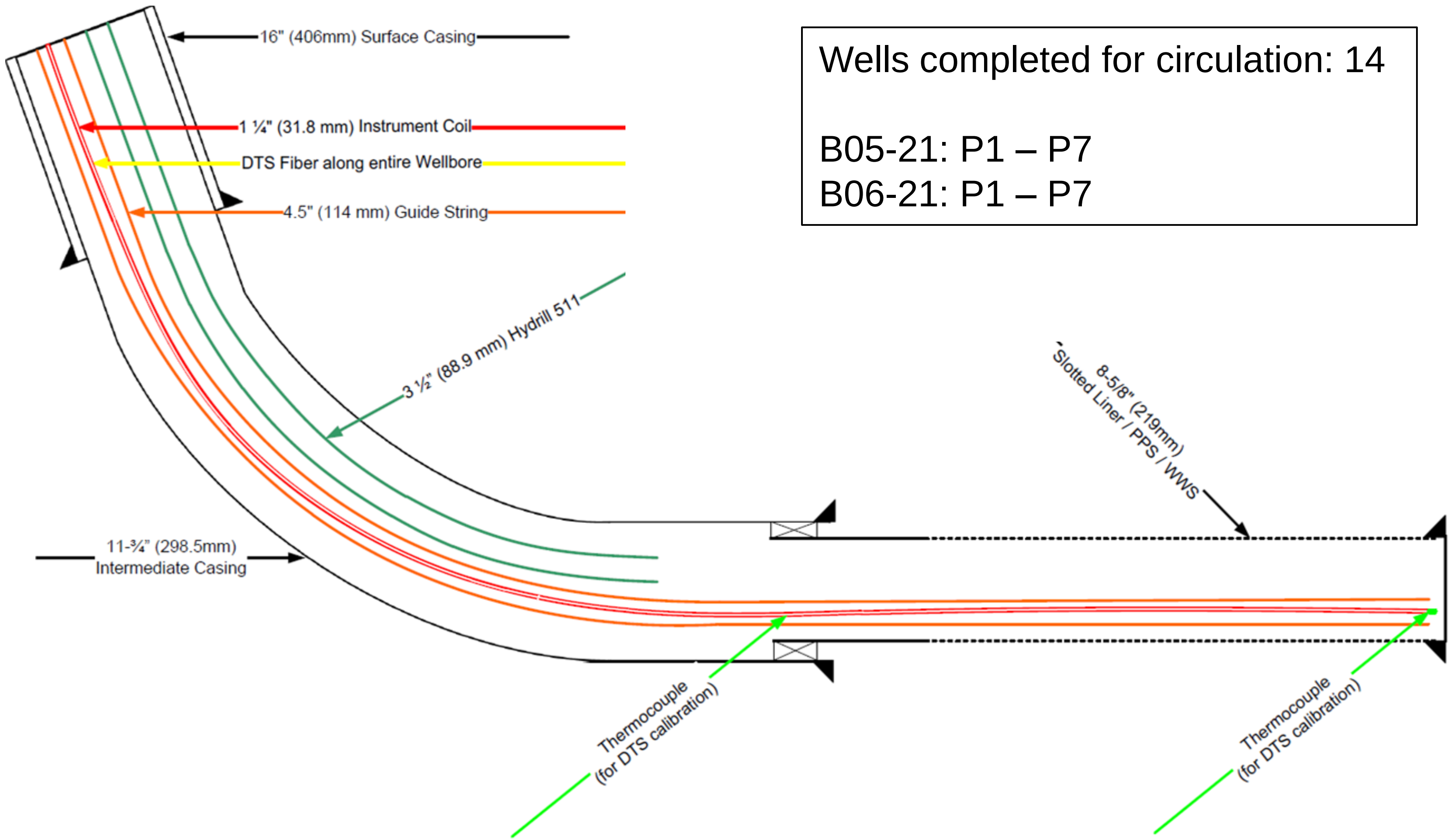
SAGD Well Design: Typical Injector Well – (DA2)



Wells completed: 14

B05-21: S1 – S7
B06-21: S1 – S7

SAGD Well Design: Typical Producer Well (DA2)



Wells completed for circulation: 14

B05-21: P1 – P7
B06-21: P1 – P7

4. Artificial Lift

Artificial Lift

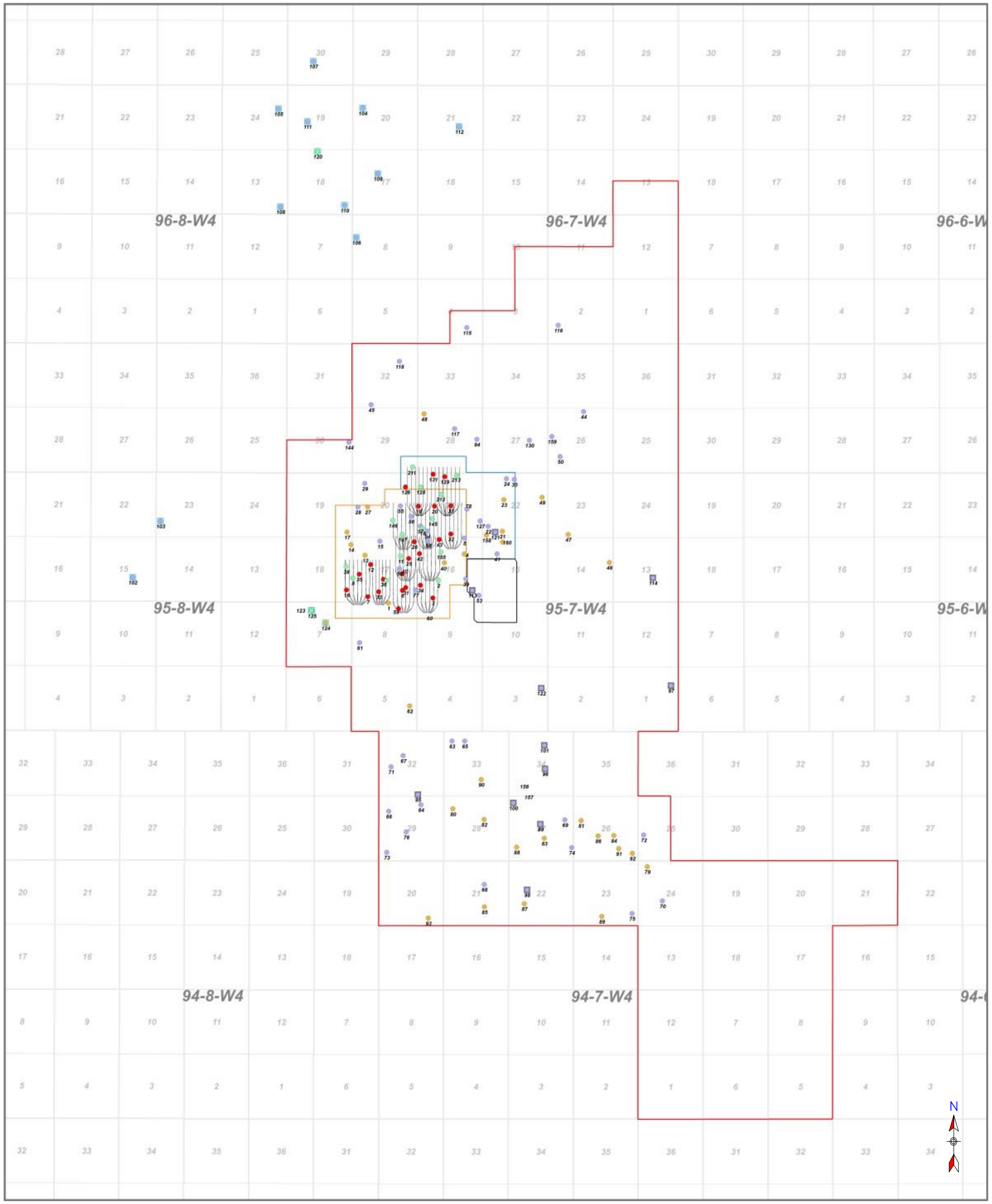
- All producer wells on SAGD mode are equipped with either gas-lift or electric submersible pumps (ESPs). DA2 producer wells will be equipped with ESPs after circulation.
- Gas-lift operational parameters:
  - Bottom hole Pressure: 1,000 kPa – 1,600 kPa
  - Bottom hole Temperature: 180 – 200 ºC
  - Surface Temperature: 140 – 200 ºC
  - Gas Injection rate: 1,000 – 10,000 Sm^3/day
- ESP operational parameters:
  - Bottom hole Pressure: 600 kPa – 1,700 kPa
  - Bottom hole Temperature: 180 – 200 ºC
  - Surface Temperature: 140 – 200 ºC
  - Emulsion Production rate: 200 – 1,600 m^3/day

Gas Lift Production (10 wells)	**B14-08: P4** **B13-09: P2 – P6** **B16-08: P3 – P5, S6***
ESP Production (45 wells)	**B13-08: P1 – P7** **B14-08: P1, P2, P3, P5, P6** **B16-08: P1, P2** **B13-09: P1** **B08-17: P1 – P6** **B05-16: P1 – P6** **B13-16: P1 – P6** **B15-16: P1 – P6** **B16-17: P1 – P6**

*DS6 has been re-completed with gas lift coil inside injection tubing; steam injection and production from the same well.
DP6 has been shut-in and plan to drill sidetrack and switch current injector well to producer well (Replacement Well Application Approved June 1, 2017) for future re-drill.

5. Instrumentation in Wells

Instrumentation – Observation Wells Map



Legend

- Sunrise Lease Area
- Development Area 1 (DA1)
- Development Area 2 (DA2)
- Central Processing Facility (CPF)
- Drilled Horizontal Well
- Proposed Horizontal Well
- Temperature Sensor
- Pressure & Temperature
- Pressure Sensor
- Cased No Instrument
- Water Disposal Well
- Water Source Well

Instrumentation – Observation Wells List

New Well Name	License Number	Downhole Instrumentation - Piezometers (P) or Pressure/Temperature Gauge (PG)	Downhole Instrumentation - Thermocouples	Spud Date
HUSKY OB-1 STEEPBK 15-8-95-7	0387616			24/01/2008
HUSKY OB-2 STEEPBK 6-16-95-7	0388000	P (5)	T	23/02/2008
HUSKY OB-3 STEEPBK 4-16-95-7	0387999		T	21/01/2008
HUSKY OB-4 STEEPBK 10-16-95-7	0387993	Cased	Cased	11/01/2008
HUSKY OB-5 STEEPBK 15-16-95-7	0387992	P (5)		26/02/2008
HUSKY OB-6 STEEPBK 1-17-95-7	0387662		T	05/01/2008
HUSKY OB-7 STEEPBK 4-17-95-7	0388001		T	15/01/2008
HUSKY OB-8 STEEPBK 5-17-95-7	0387994	P (5)	T	11/02/2008
HUSKY OB-9 STEEPBK 7-17-95-7	0388098	P (5)	T	16/02/2008
HUSKY OB-10 STEEPBK 8-17-95-7	0388099		T	07/01/2008
HUSKY OB-11 STEEPBK 10-17-95-7	0388100	P (4) + B.T. (1)	T	20/02/2008
HUSKY OB-12 STEEPBK 11-17-95-7	0388101		T	12/01/2008
HUSKY OB-13 STEEPBK 12-17-95-7	0388102	Cased	Cased	17/01/2008
HUSKY OB-14 STEEPBK 16-18-95-7	0387991	Cased	Cased	21/01/2008
HUSKY OB-15 STEEPBK 14-17-95-7	0323815	P (5) + B.T. (1)	cemented	27/06/2005
HUSKY OB-16 STEEPBK 1-18-95-7	0387995		T	05/02/2008
HUSKY OB-17 STEEPBK 1-19-95-7	0388807	Cased	Cased	10/03/2008
HUSKY OB-18 STEEPBK 4-21-95-7	0388806	P (3)	T	02/03/2008
HUSKY OB-19 STEEPBK 5-21-95-7	0388805		T	12/03/2008
HUSKY OB-20 STEEPBK 6-21-95-7	0388808		T	10/03/2008
HUSKY OB-21 STEEPBK 3-22-95-7	0388104	Cased	Cased	07/02/2008
HUSKY OB-22 STEEPBK 4-22-95-7	0391296	P (8)		04/03/2008
HUSKY OB-23 STEEPBK 11-22-95-7	0388105	Cased	Cased	04/02/2008
HUSKY OB-24 STEEPBK 14-22-95-7	0388106	PG		04/03/2008
HUSKY OB-25 STEEPBK 9-17-95-7	0430827		T	10/02/2011
HUSKY OB-26 STEEPBK 16-17-95-7	0428000		T	22/01/2011
HUSKY OB-27 STEEPBK 5-20-95-7	0428458	Cased	Cased	12/01/2011
HUSKY OB-28 STEEPBK 5-20-95-7	0428380	P (5)		06/01/2011
HUSKY OB-29 STEEPBK 13-20-95-7	0428593	P (5)		06/01/2011
HUSKY OB-30 STEEPBK 14-22-95-7	0430161	PG		17/02/2011
HUSKY OB-31 STEEPBK 1-17-95-7	0428815		T	05/02/2011
HUSKY OB-32 STEEPBK 2-21-95-7	0428146		T	12/02/2011
HUSKY OB-33 STEEPBK 3-17-95-7	0428809		T	20/01/2011
HUSKY OB 34 STEEPBK 5-16-95-7	0428818		T	01/02/2011
HUSKY OB-35 STEEPBK 5-17-95-7	0428145		T	16/01/2011
HUSKY OB-36 STEEPBK 6-17-95-7	0428403		T	08/02/2011
HUSKY OB-37 STEEPBK 7-21-95-7	0428399		T	15/02/2011
HUSKY OB-38 STEEPBK 9-18-95-7	0428404	P (5)	T	11/01/2011
HUSKY OB-39 STEEPBK 7-16-95-7	0439378	P (5)		04/01/2012
HUSKY OB-40 STEEPBK 11-16-95-7	0428256	Cased	Cased	06/02/2011
HUSKY OB-41 STEEPBK 12-15-95-7	0429570	P (5)		16/01/2011
HUSKY OB-42 STEEPBK 12-16-95-7	0428713		T	13/02/2011
HUSKY OB-43 STEEPBK 14-16-95-7	0428111		T	01/02/2011
HUSKY OB-44 STEEPBK 15-26-95-7	0430112	PG		19/02/2011
HUSKY OB-45 STEEPBK 3-32-95-7	0430049	PG		07/03/2011
HUSKY OB-46 STEEPBK 9-14-95-7	0430158	Cased	Cased	22/03/2011
HUSKY OB-47 STEEPBK 3-23-95-7	0430887	Cased	Cased	15/03/2011
HUSKY OB-48 STEEPBK 13-28-95-7	0429927	Cased	Cased	03/03/2011
HUSKY OB-49 STEEPBK 9-22-95-7	0430163	Cased	Cased	18/03/2011
HUSKY OB-50 STEEPBK 4-26-95-7	0430160	PG		21/02/2011
HUSKY OB-51 MFOB D STEEPBK 14-17-9	0343952	P (8)	cemented	07/01/2006
HUSKY OB-52 STEEPBK 10-17-95-7	0323817	P (5) + B.T. (1)	cemented	06/02/2005
HUSKY OB-53 C STEEPBK 1-16-95-7	0343949	P (4)	cemented	15/12/2005
HUSKY OB-54 1Y01 STEEPBK 4-21-95-7	0417750	P (2)	cemented	16/02/2010
HUSKY OB-55 1AB STEEPBK 7-20-95-7	0417694	P (2)	cemented	26/01/2010
HUSKY OB-56 STEEPBK 8-20-95-7	0418062	P (2)	cemented	21/02/2010
HUSKY OB-57 1Y6 STEEPBK 4-21-95-7	0417837	P (2)	cemented	02/02/2010
HUSKY OB-58 1Y7 STEEPBK 13-16-95-7	0417754	P (2)	cemented	11/02/2010
HUSKY OB-59 STEEPBK 15-8-95-7	Y0002686		T	22/03/1964
HUSKY OB-60 B 13-9 P5 STEEPBK 4-16-9	0434958		T	10/02/2011
HUSKY OB-61 STEEPBK 5-8-95-7	0441331	PG		06/02/2012
HUSKY OB-62 STEEPBK 8-5-95-7	0440567	Cased	Cased	14/02/2012
HUSKY OB-63 STEEPBK 13-33-94-7	0452132	P (2)		17/03/2013
HUSKY OB-64 STEEPBK 15-29-94-7	0452096	P (4)		09/03/2013
HUSKY OB-65 STEEPBK 14-33-94-7	0452081	P (3)		26/03/2013
HUSKY OB-66 STEEPBK 13-29-94-7	0451950	P (4)		13/03/2013
HUSKY OB-67 STEEPBK 11-32-94-7	0451966	P (3)		13/03/2013
HUSKY OB-68 STEEPBK 10-21-94-7	0451963	P (3)		25/02/2013
HUSKY OB-69 STEEPBK 9-27-94-7	0452011	P (3)		04/03/2013
HUSKY OB-70 STEEPBK 6-24-94-7	0453872	P (3)		25/02/2013
HUSKY OB-71 STEEPBK 5-32-94-7	0452211	P (3)		08/03/2013
HUSKY OB-72 STEEPBK 5-25-94-7	0452259	P (3)		10/01/2013
HUSKY OB-73 STEEPBK 4-29-94-7	0453641	P (3)		20/02/2013
HUSKY OB-74 STEEPBK 1-27-94-7	0451935	P (3)		03/03/2013
HUSKY OB-75 STEEPBK 1-23-94-7	0451815	P (3)		19/02/2013
HUSKY OB-76 STEEPBK 6-29-94-7	0451933	P (3)		17/03/2013
HUSKY OB-77 STEEPBK 1-17-95-7	0452022	P (3)	T	03/01/2013
HUSKY OB-78 STEEPBK 8-21-95-7	0451944	P (3)		09/01/2013
HUSKY OB-79 STEEPBK 13-24-94-7	0451938	Cased	Cased	17/02/2013
HUSKY OB-80 STEEPBK 13-28-94-7	0451945	Cased	Cased	03/03/2013
HUSKY OB-81 STEEPBK 12-26-94-7	0452023	Cased	Cased	12/02/2013
HUSKY OB-82 STEEPBK 10-28-94-7	0451937	Cased	Cased	07/03/2013
HUSKY OB-83 STEEPBK 7-27-94-7	0452215	Cased	Cased	04/01/2013
HUSKY OB-84 STEEPBK 7-26-94-7	0451970	Cased	Cased	18/01/2013
HUSKY OB-85 STEEPBK 7-21-94-7	0452021	Cased	Cased	20/02/2013
HUSKY OB-86 STEEPBK 6-26-94-7	0452084	Cased	Cased	07/02/2013
HUSKY OB-87 STEEPBK 5-22-94-7	0452024	Cased	Cased	02/03/2013
HUSKY OB-88 STEEPBK 4-27-94-7	0452083	Cased	Cased	11/01/2013
HUSKY OB-89 STEEPBK 3-23-94-7	0452029	Cased	Cased	15/02/2013
HUSKY OB-90 STEEPBK 7-33-94-7	0453639	Cased	Cased	06/03/2013
HUSKY OB-91 STEEPBK 2-26-94-7	0453807	Cased	Cased	26/02/2013
HUSKY OB-92 STEEPBK 1-26-94-7	0452210	Cased	Cased	22/02/2013
HUSKY OB-93 STEEPBK 1-20-94-7	0451942	Cased	Cased	15/02/2013
HUSKY OB-94 STEEPBK 9-28-95-7	0451951	PG		04/01/2013
HUSKY KR-OB-95 STEEPBK 2-32-94-7	0452332	P(2)		24/02/2013
HUSKY KR-OB-96 STEEPBK 7-34-94-7	0452291	P(2)		04/02/2013
HUSKY KR-OB-97 STEEPBK 9-1-95-7	0452736	P(2)		12/02/2013
HUSKY KR-OB-98 STEEPBK 11-22-94-7	0452280	P(2)		25/01/2013
HUSKY KR-OB-99 STEEPBK 11-27-94-7	0452270	P(2)		25/01/2013
HUSKY KR-OB-100 STEEPBK 13-27-94-7	0452281	P(2)		18/01/2013
HUSKY KR-OB-101 STEEPBK 15-34-94-7	0452269	P(2)		31/01/2013
HUSKY SRC-OB-102 SUNRISE 7-15-95-8	0373494	P (2)		09/02/2007
HUSKY SRC-OB-103 SUNRISE 5-23-95-8	0373506	P (3)		13/02/2007
HUSKY SRC-OB-104 SUNRISE 12-20-96-7	0389637	P (2)		26/01/2008
HUSKY SRC-OB-105 SUNRISE 9-24-96-8	0363115	P (2)		18/09/2006
HUSKY SRC-OB-106 SUNRISE 12-8-96-7	0362523	P (2)		13/09/2006
HUSKY SRC-OB-107 SUNRISE 6-30-96-7	0389630	P (2)		14/02/2008
HUSKY SRC-OB-108 SUNRISE 1-13-96-8	0391346	P (2)		19/02/2008
HUSKY SRC-OB-109 SUNRISE 11-17-96-7	0389636	P (2)		19/01/2008
HUSKY SRC-OB-110 SUNRISE 1-18-96-7	0362866	P (2)		15/09/2006
HUSKY SRC-OB-111 SUNRISE 6-19-96-7	0362577	P (2)		13/09/2006
HUSKY SRC-OB-112 SUNRISE 7-21-96-7	0389635	P (2)		03/02/2008
HUSKY KR-OB-113 AZ1 STEEPBK 1-16-95	0316284	P		22/10/2004
HUSKY KR-OB-114 STEEPBK 7-13-95-7	0305423	P		15/03/2004
HUSKY PM-OB-115 STEEPBK 1-4-96-7	0452212	P (3)		14/03/2013
HUSKY PM-OB-116 STEEPBK 5-2-96-7	0452226	P (3)		10/03/2013
HUSKY PM-OB-117 STEEPBK 10-28-95-7	0453724	P (3)		12/03/2013
HUSKY PM-OB-118 STEEPBK 10-32-95-7	0453768	P (3)		18/03/2013
HUSKY SWS-OB-119 SUNRISE 9-21-93-9	0442976	Cased	Cased	25/02/2012
HUSKY SRC-OB-120 SUNRISE 14-18-96-7	0362870	P (2)		17/09/2006
HUSKY SWD-OB-121 STEEPBK 4-22-95-7	0431972	PG		15/03/2011
HUSKY SWD-OB-122 STEEPBK 9-3-95-7	0431974	PG		24/03/2011
HUSKY SRC-OB-123 STEEPBK 14-7-95-7	0304979	PG		14/03/2004
HUSKY SRC-OB-124 STEEPBK 10-7-95-7	0304964	Cased	Cased	09/03/2004
HUSKY SRC-OB-125 STEEPBK 14-7-95-7	0305114	Cased	Cased	15/03/2004
HUSKY OB-126 STEEPBK 16-20-95-7	0461747		T	11/01/2014
HUSKY OB-127 STEEPBK 8-21-95-7	0461748	P (6)		18/02/2014
HUSKY OB-128 STEEPBK 13-21-95-7	0461549	P (6)	T	16/01/2014
HUSKY OB-129 STEEPBK 14-21-95-7	0461765		T	20/01/2014
HUSKY OB-130 STEEPBK 10-27-95-7	0462203	PG		07/01/2014
HUSKY OB-131 STEEPBK 13-21-95-7	0461937		T	28/01/2014
HUSKY OB-144 STEEPBK 8-30-95-7	0462043	P (4)		03/03/2014
HUSKY OB-145 STEEPBK 5-21-95-7	0462143	P (6)	T	21/01/2014
HUSKY OB- 146 STEEPBK 7-20-95-7	0462141	P (6)	T	26/01/2014
HUSKY OB- 147 STEEPBK 1-20-95-7	0462142	P (5)	T	14/02/2014
HUSKY OB-155 STEEPBK 14-16-95-7	0462196	P (5)	T	11/02/2014
HUSKY KR-OB-156 STEEPBK 4-34-94-7	0462284	PG		31/01/2014
HUSKY KR-OB-157 STEEPBK 3-34-94-7	0462372	PG		05/02/2014
HUSKY OB-158 STEEPBK 4-22-95-7	0462359	Cased	Cased	03/02/2014
HUSKY OB-159 STEEPBK 12-26-95-7	0462065	PG		07/01/2014
HUSKY OB-160 STEEPBK 14-15-95-7	0461803	Cased	Cased	08/02/2014
HUSKY OB-211 STEEPBK 1-29-95-7	0481495	P (6)	T	02/16/2017
HUSKY OB-212 STEEPBK 11-21-95-7	0481496	P (6)	T	02/23/2017
HUSKY OB-213 STEEPBK 15-21-95-7	0480952	P (6)	T	02/19/2017

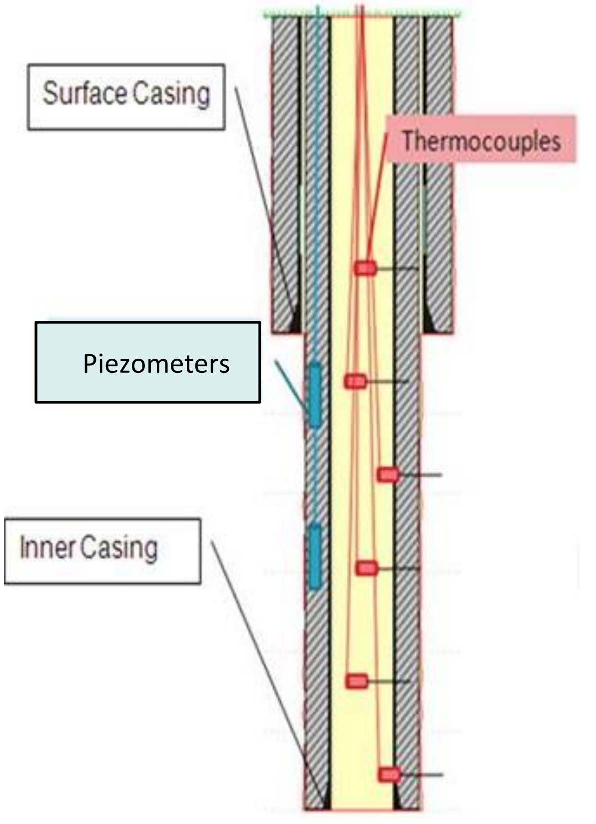
Instrumentation in SAGD OBS Wells

- 84 OBS Wells with Instrumentation:
  - 24 wells with thermocouple only
  - 45 wells with piezometer only
  - 15 wells with piezometer and thermocouples

- 68 OBS Wells connected to SCADA:
  - 24 wells with thermocouple only
  - 29 wells with piezometers only
  - 15 wells with piezometer and thermocouples

- Thermocouples: Up to 24 thermocouples per well, the majority of which are placed across the pay interval

- Piezometers: Up to 8 piezometers per well. Cemented behind casing. Placed within the Clearwater, Wabiskaw, IHS and/or the McMurray Intervals



Typical SAGD Observation Well

Instrumentation in SAGD OBS Wells

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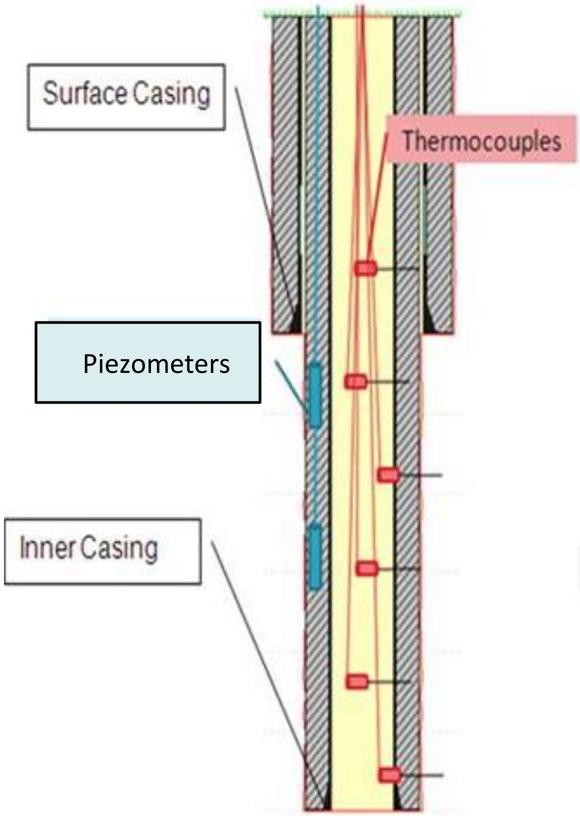


Typical SAGD Observation Well

Measurement Method

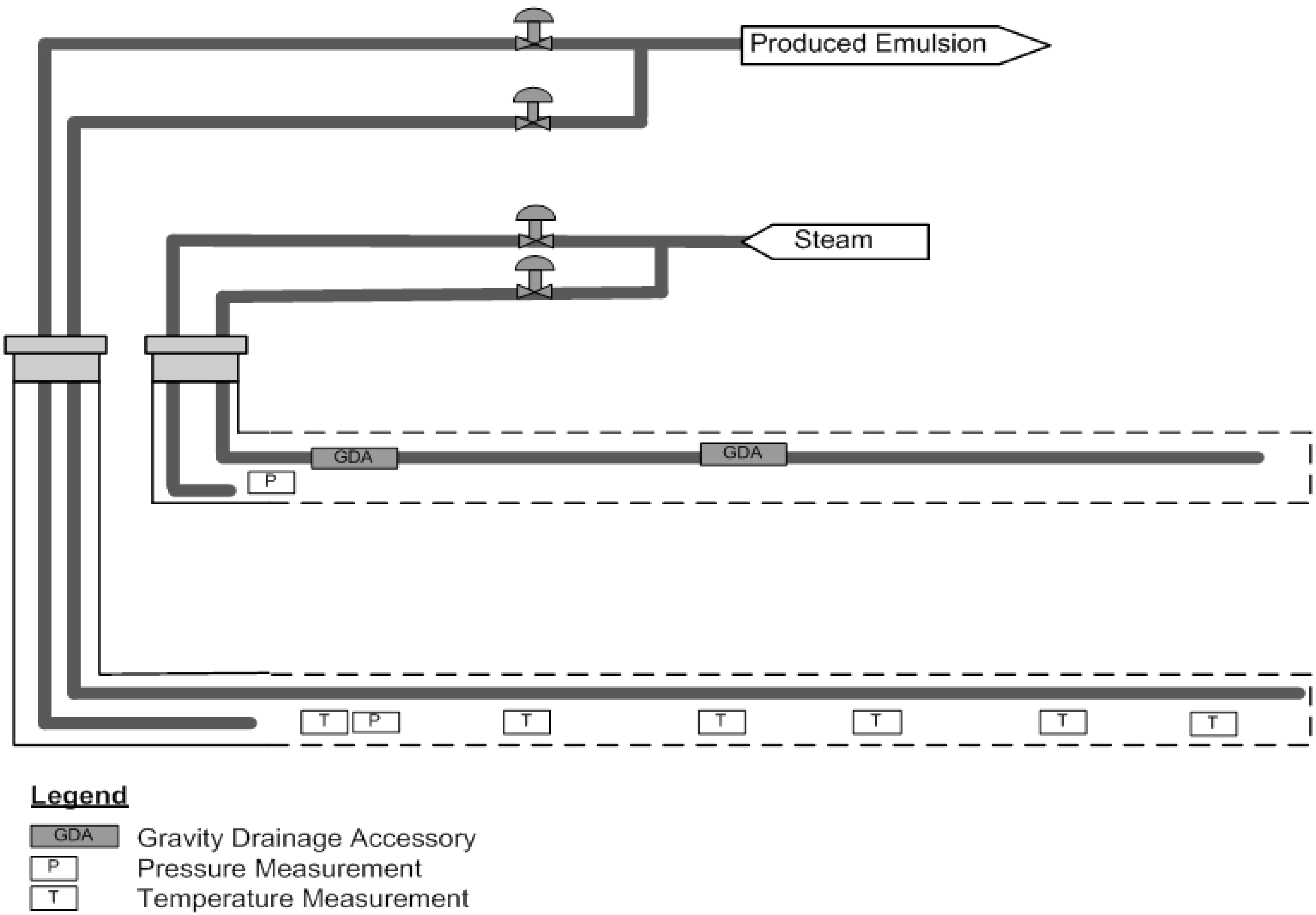
Pressure – Injectors:

- Downhole measurement is blanket gas pressure in the annulus of the well
- The blanket gas system provides a direct measurement of steam injection pressure inside the horizontal well
- This system is used to ensure that injection pressures do not exceed the approved drainage pattern-specific MOP

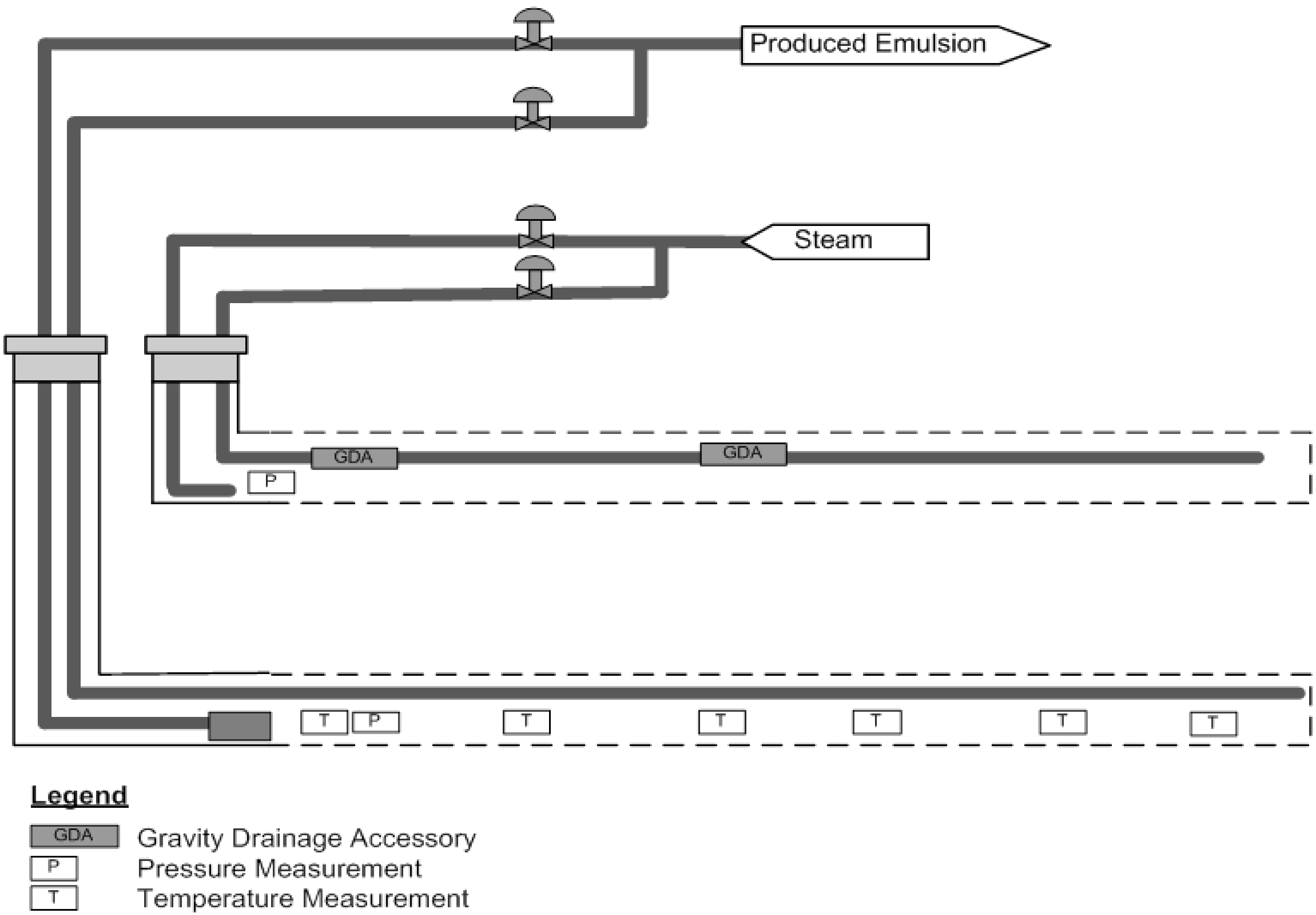
Pressure and Temperature – Producers:

- Downhole temperature is measured wells using fiber-optic distributed temperature sensing (DTS)
- For gas lift, the downhole pressure measurement is blanket gas pressure in the annulus of the well
- For ESPs, the downhole pressure measurement is the bubble tube pressure near the horizontal intake of the ESP

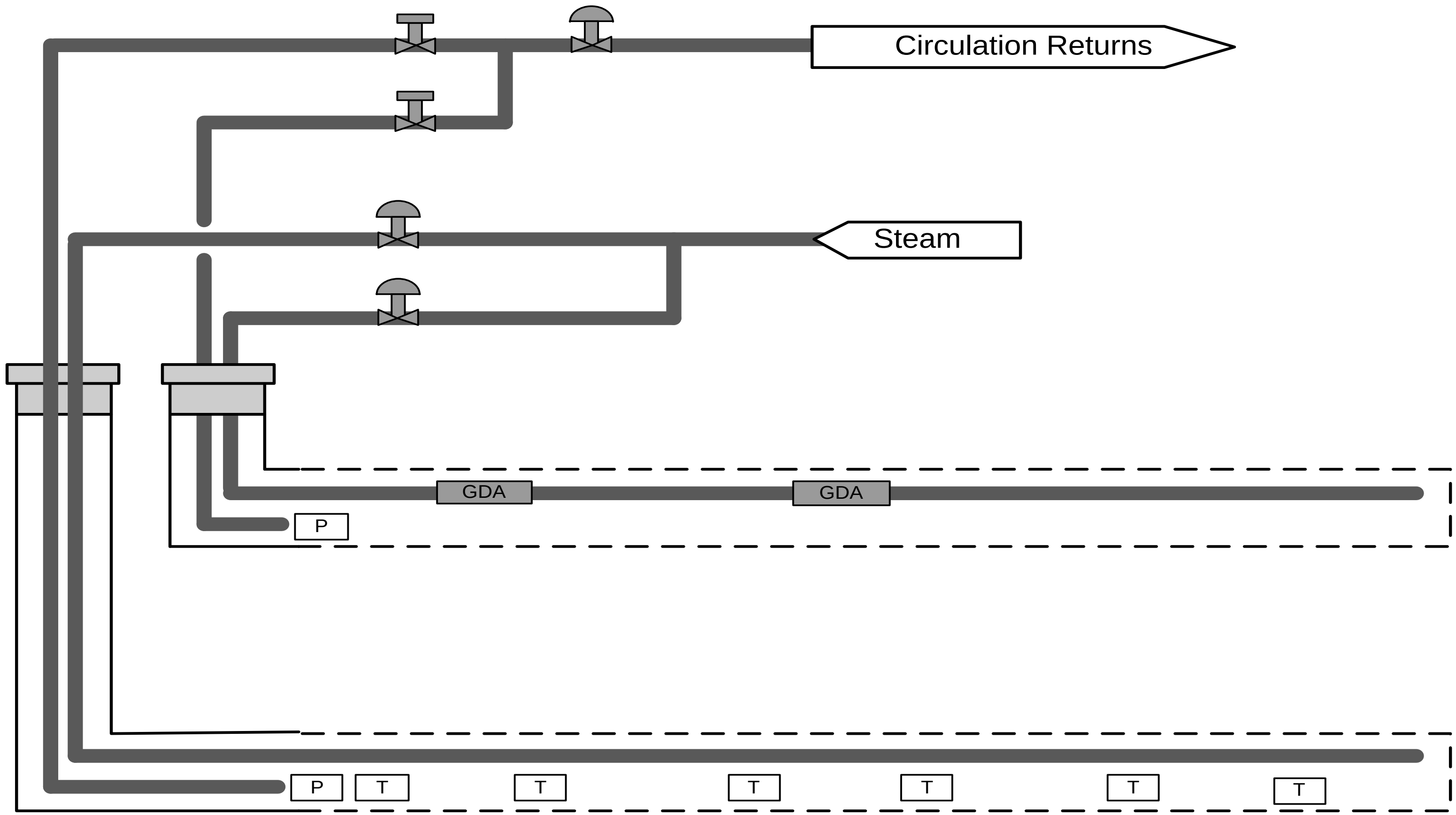
Temperature and Pressure Measurement - Gas Lift (DA1)



Temperature and Pressure Measurement - ESP (DA1)



Temperature and Pressure Measurement – Circulation (DA2)



Legend

GDA Gravity Drainage Accessory
P Pressure Measurement
T Temperature Measurement

6. 4D Seismic

4D Seismic Data

- No 4D seismic programs were carried out in the reporting period

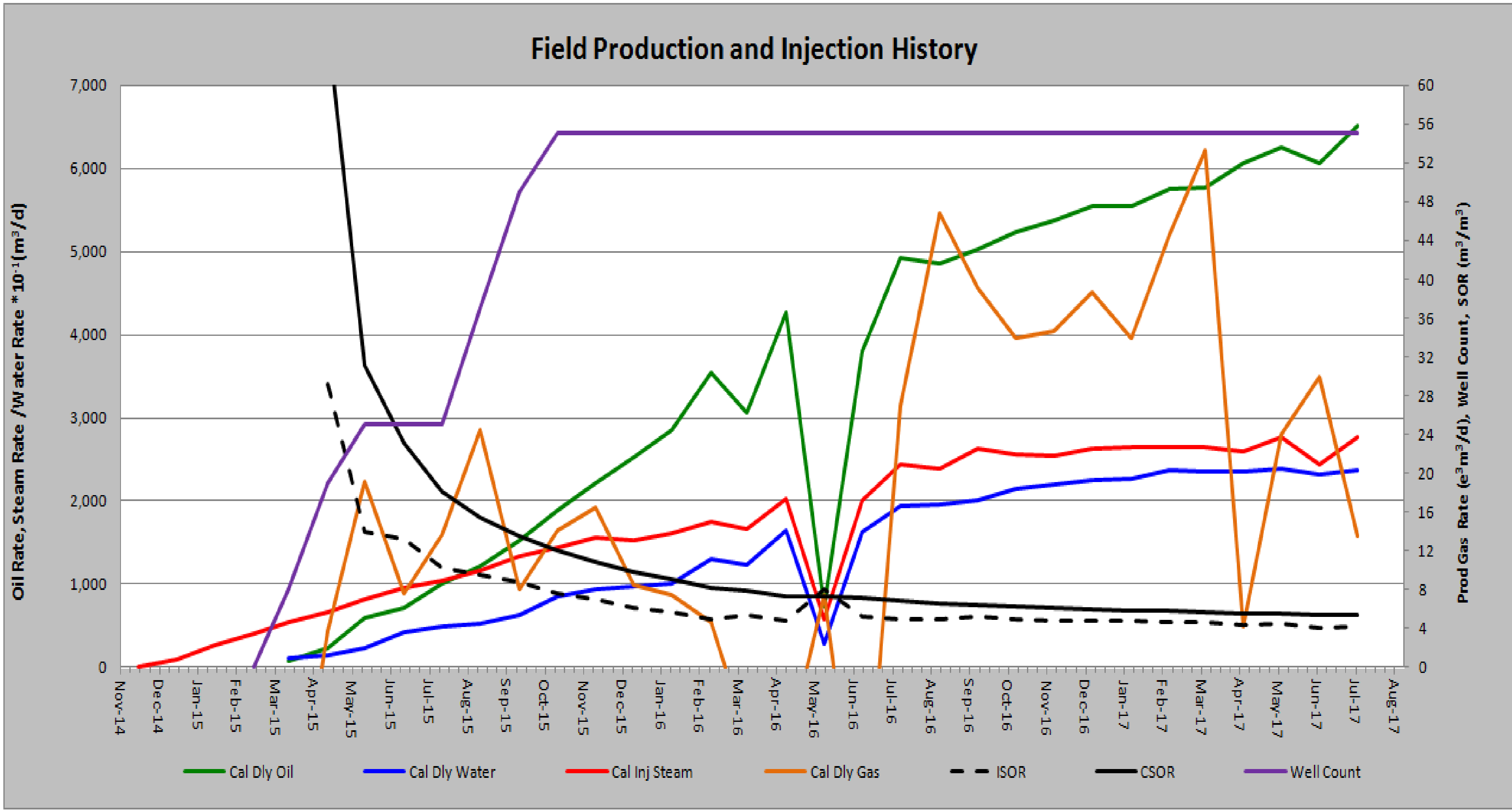
7. Scheme Performance

Scheme Performance Prediction Methodology

- Current performance prediction built on:
  - Actual performance
  - Analysis of analogous SAGD projects
  - Updated geological model supplemented with simulation and analytical models

- Simulation and Analytical models will be periodically history matched to actual performance

Field Production and Injection History



Field Production and Injection History (cont'd)

- The reservoir gas oil ratio is estimated to be 2 m^3/m^3
- Fluctuations in lift gas are due to variations in well operations and the number of wells on lift gas
- Total gas production is the sum of lift gas injected and the produced reservoir gas
- The majority of the total gas production is the injected lift gas

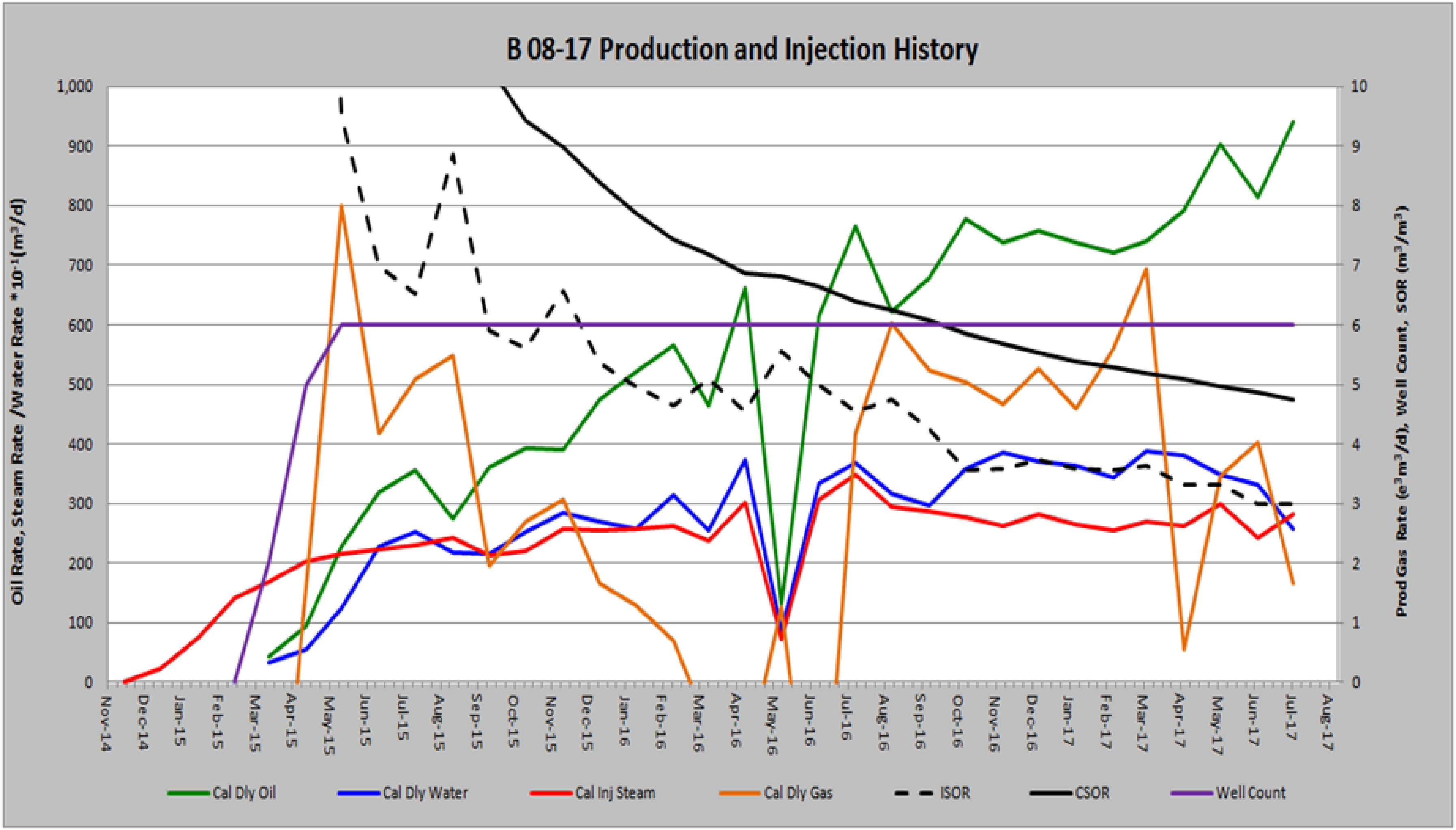
Production

- Highest daily average bitumen production over a one month period during the reporting period was 6,502 m^3/d
- The cumulative oil production for the reporting period was 2,066,921 m^3
- Producing well pairs are currently in ramp-up phase and will continue to increase production rates as the steam chambers develop
- 55 of the 69 total well pairs were on production during the reporting period
- First Steam to well pad B06-21 (Q) was achieved in July 2017
- The average SOR over the reporting period was 4.6 m^3 CWE / m^3
- As of July 31, 2017 the cumulative SOR was 5.3 m^3 CWE / m^3
- The instantaneous and cumulative SOR are expected to drop as bitumen production ramps up

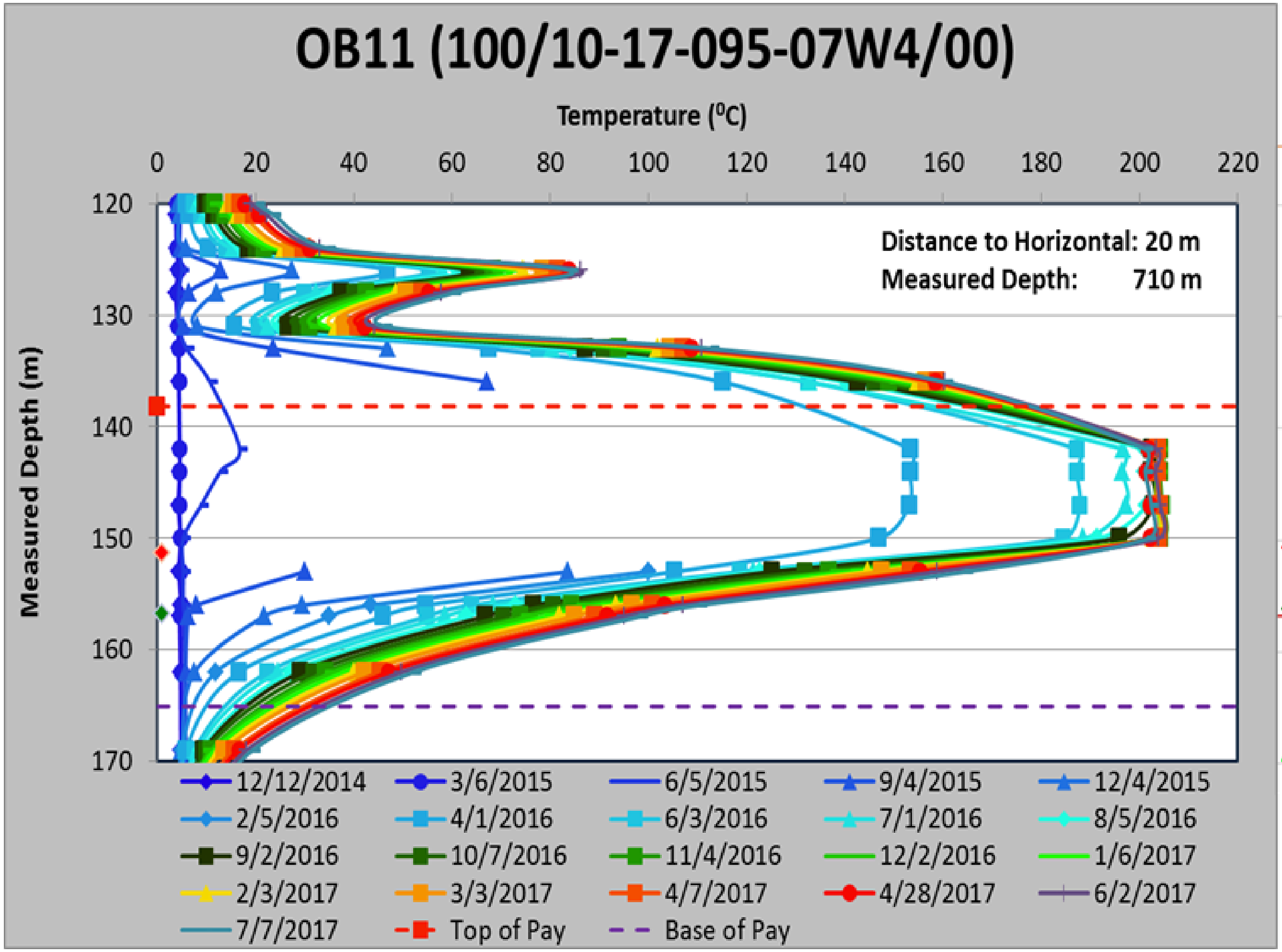
Production vs. Approval Capacity Variance

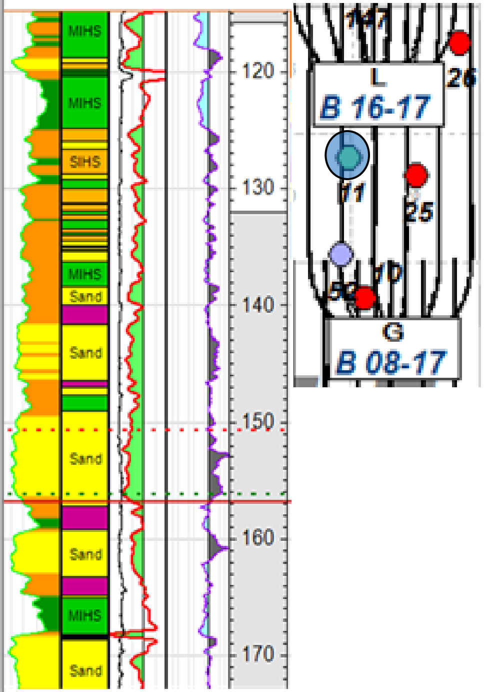
- Ramp-up towards approval capacity will continue during the next reporting period

Pad B08-17 (G) Production and Injection History (High Recovery Pad)

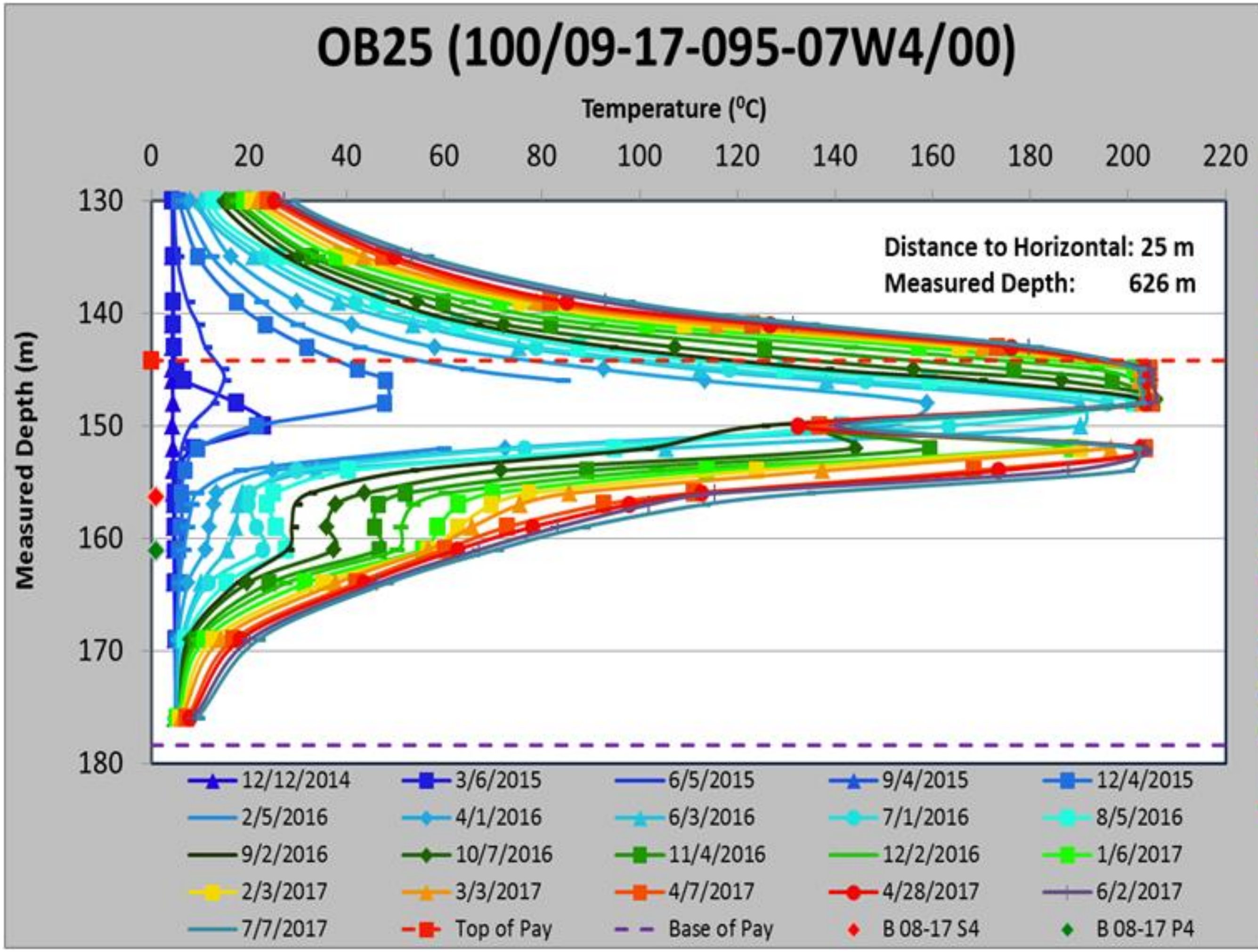


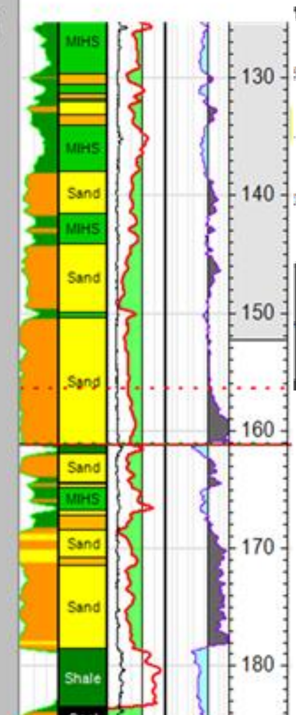
Pad B08-17 (G) Mid Observation Well

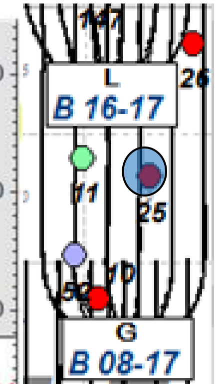




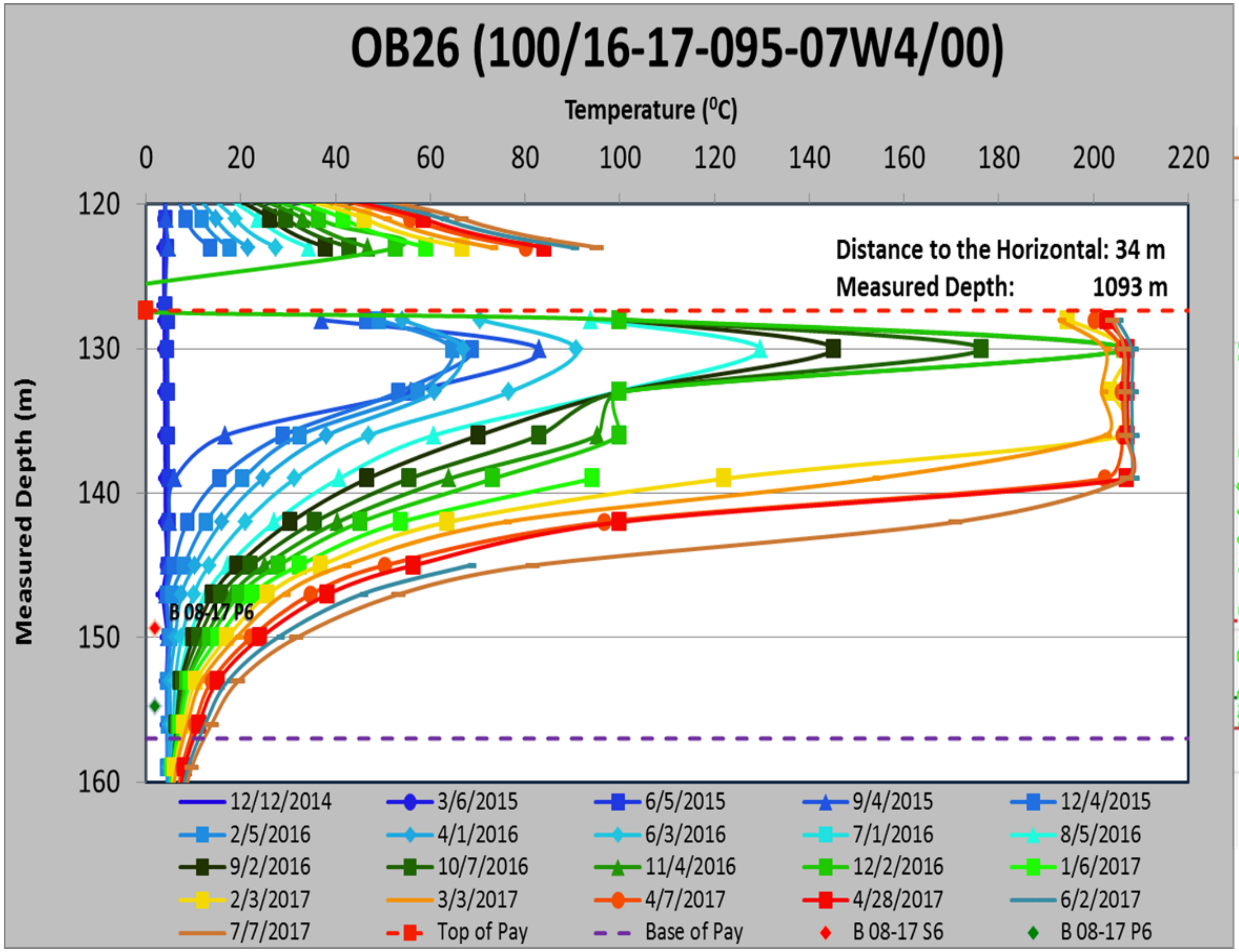
Pad B08-17 (G) Mid Observation Well

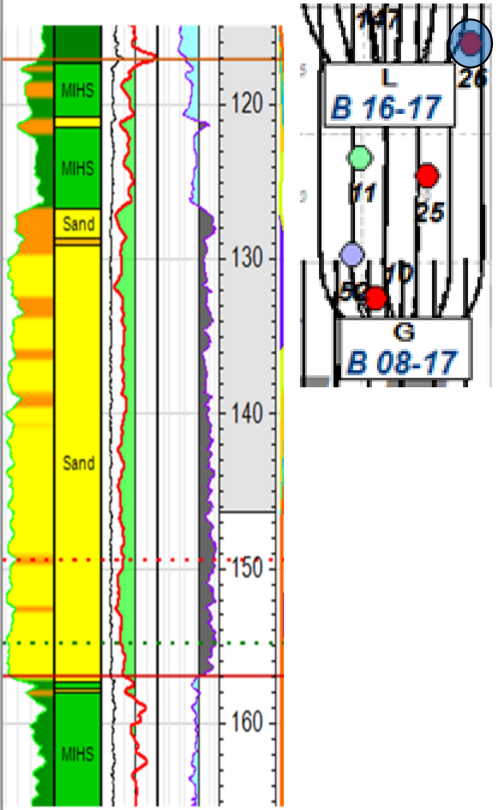






Pad B08-17 (G) Toe Observation Well

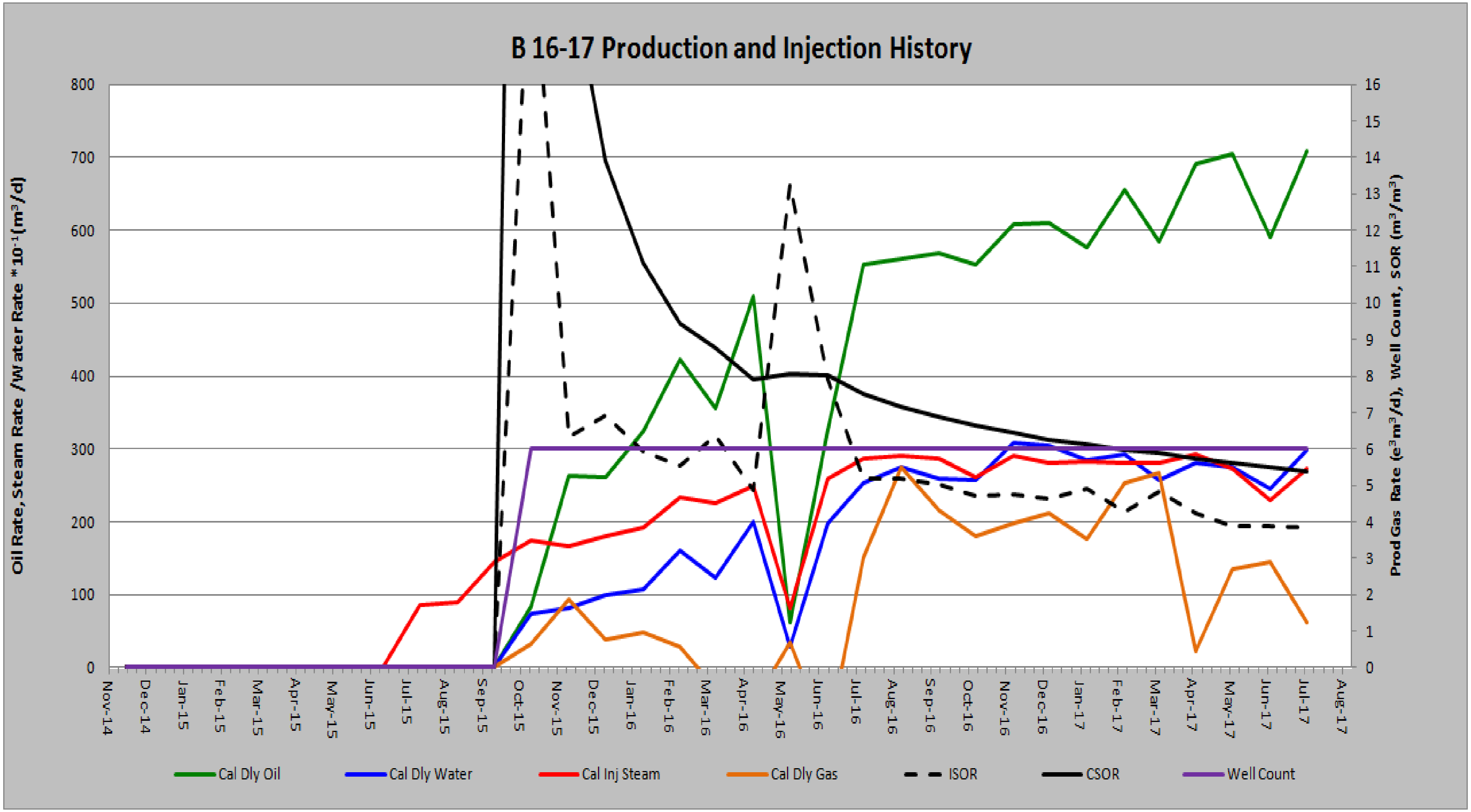




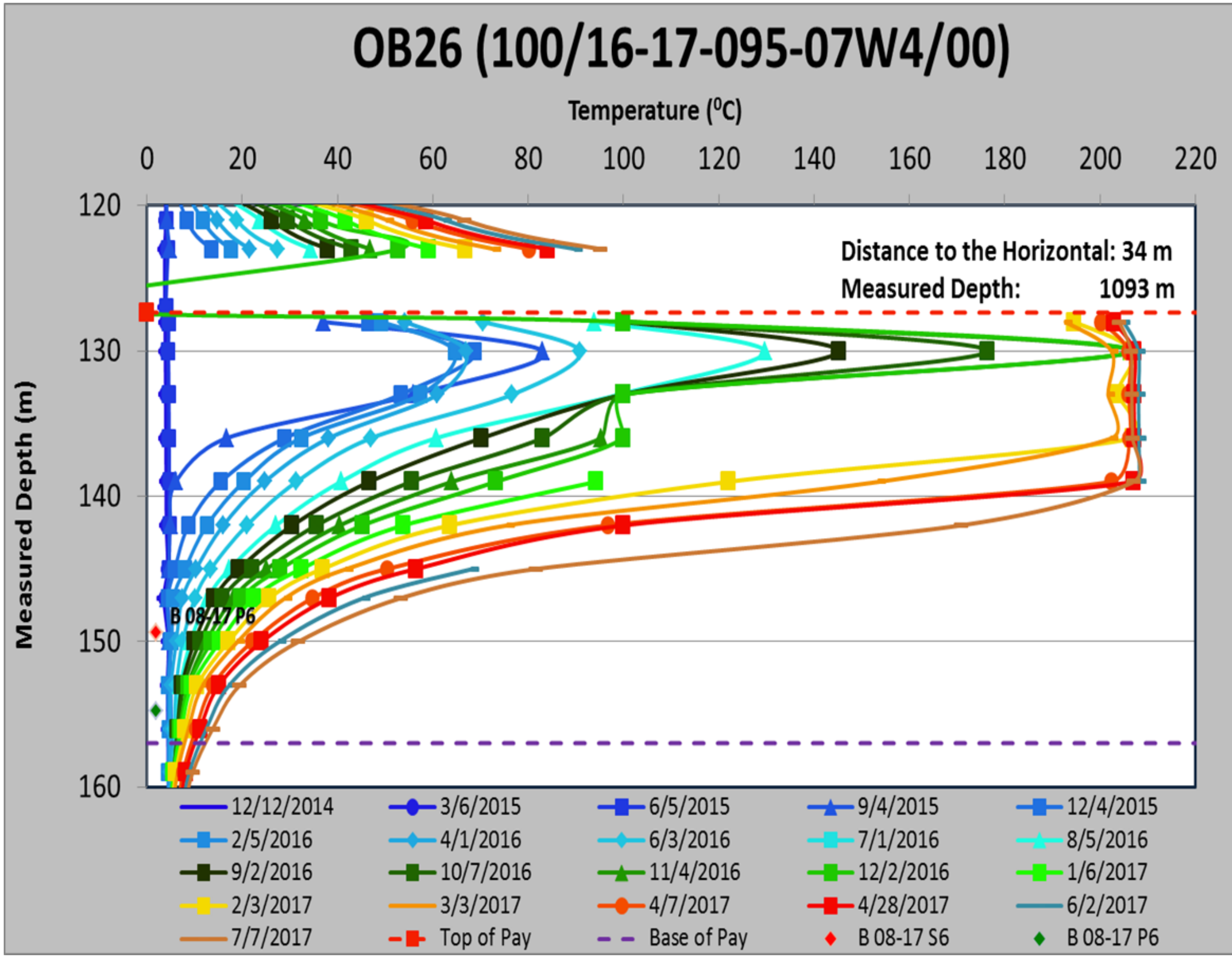
Discussion of Pad B08-17 (G) Performance

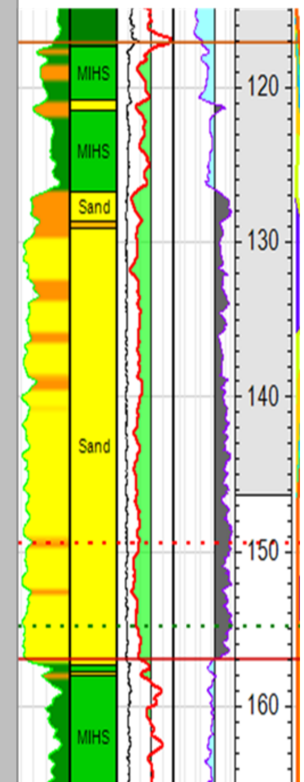
- Overall bitumen and steam rates are as per expectations (~900 m^3/d)
- Maximum Operating Pressure (MOP) increase approved to be 1,810 kPa_g compared to the initial MOP of 1,750 kPa_g
- Injection pressure during the reporting period ranged from 1,550 to 1,785 kPa_g
- All 6 producers are currently using ESPs to optimize lift
- All observation wells on well pad B08-17 (G) show vertical and lateral chamber growth
- Pad B08-17 (G) performance indicators as of July 31, 2017:
  - Cum. Oil : 483,202 m^3 (RF = 14.5%)
  - Cum. Steam Injected: 2,292,286 m^3
  - Cum. Water Produced: 2,453,070 m^3
  - CSOR: 4.7 m^3 CWE / m^3

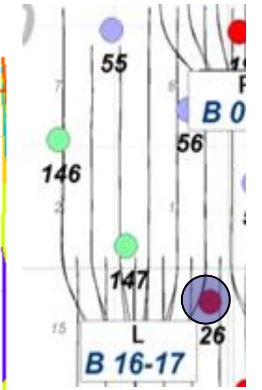
Pad B16-17 (L) Production and Injection History (Medium Recovery Pad)



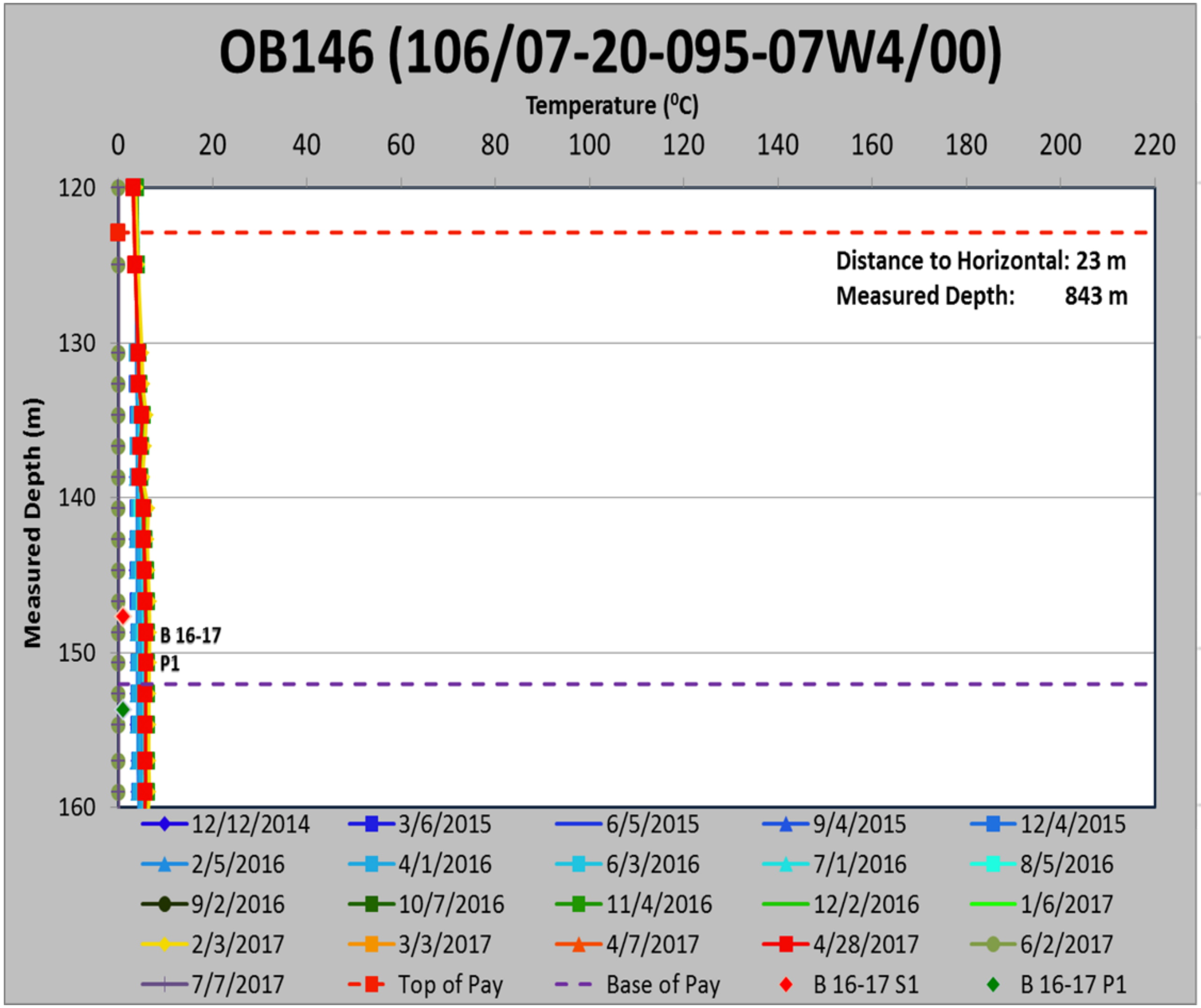
Pad B16-17 (L) Heel Observation Well

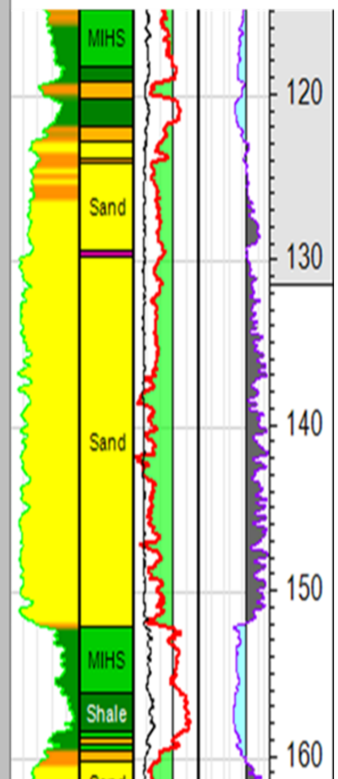


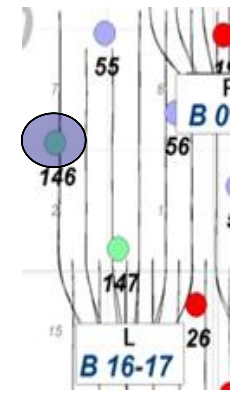




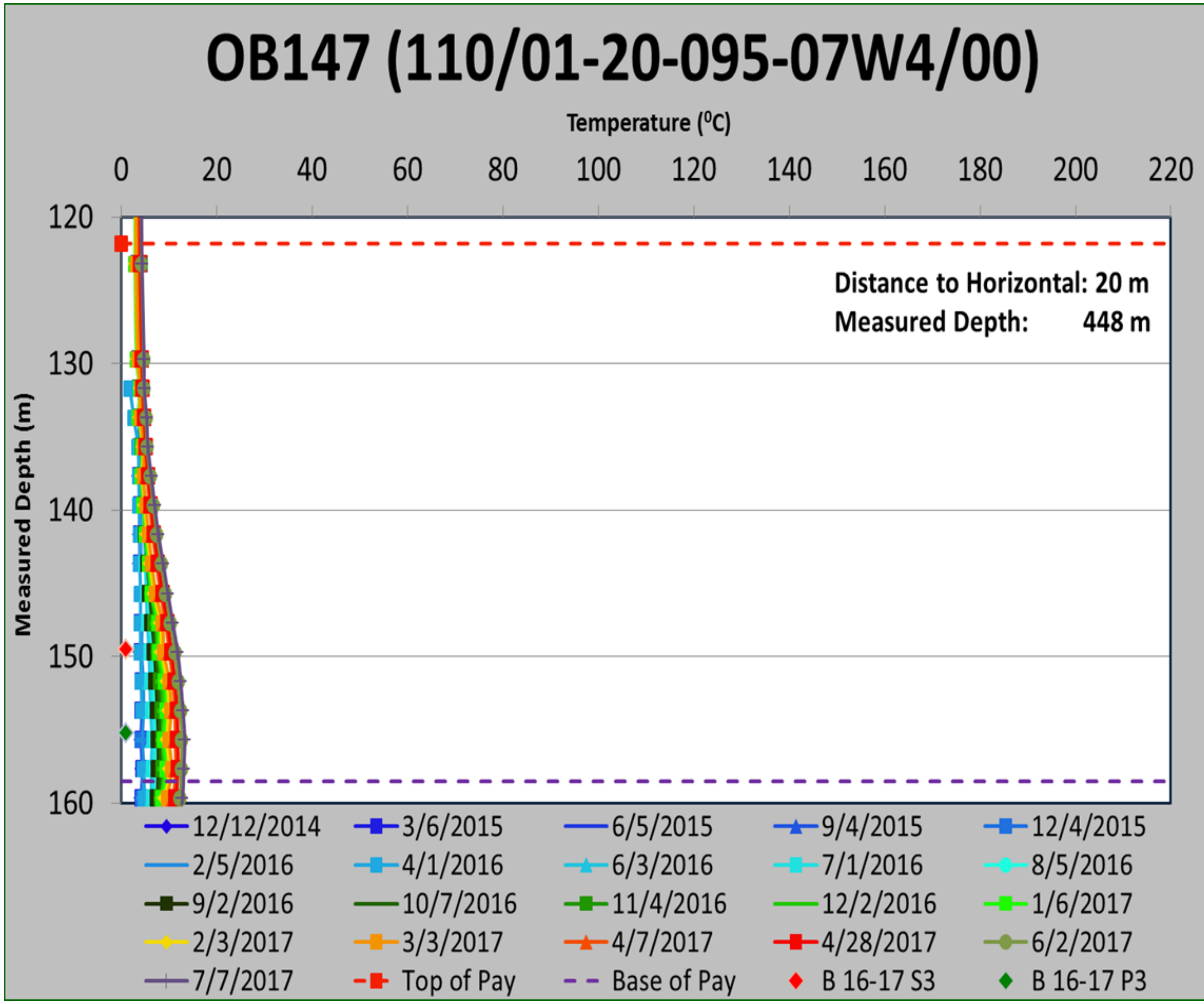
Pad B16-17 (L) Mid Observation Well

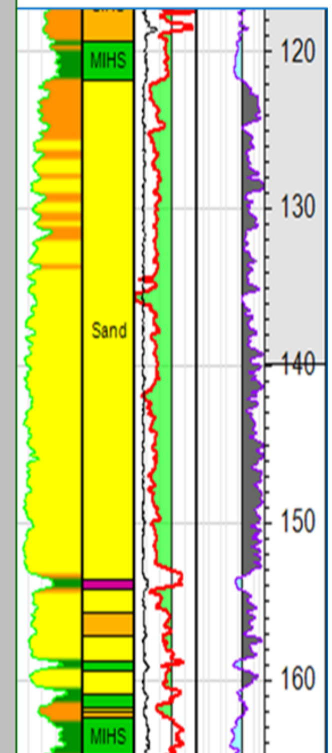


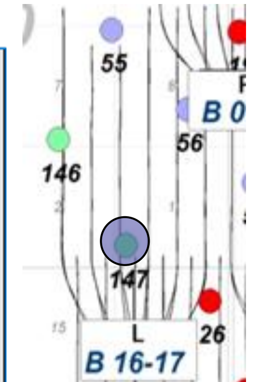




Pad B16-17 (L) Heel Observation Well



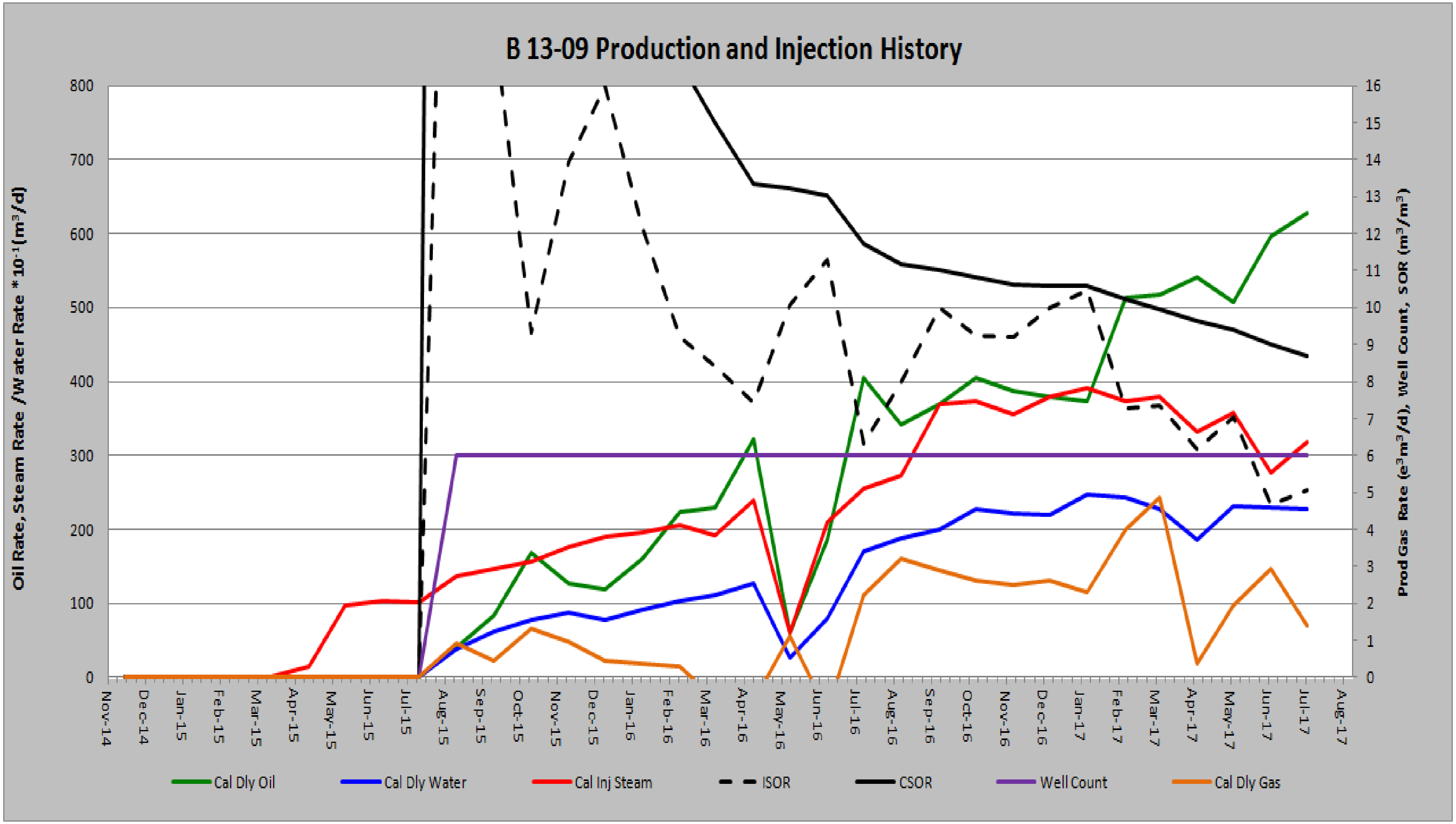




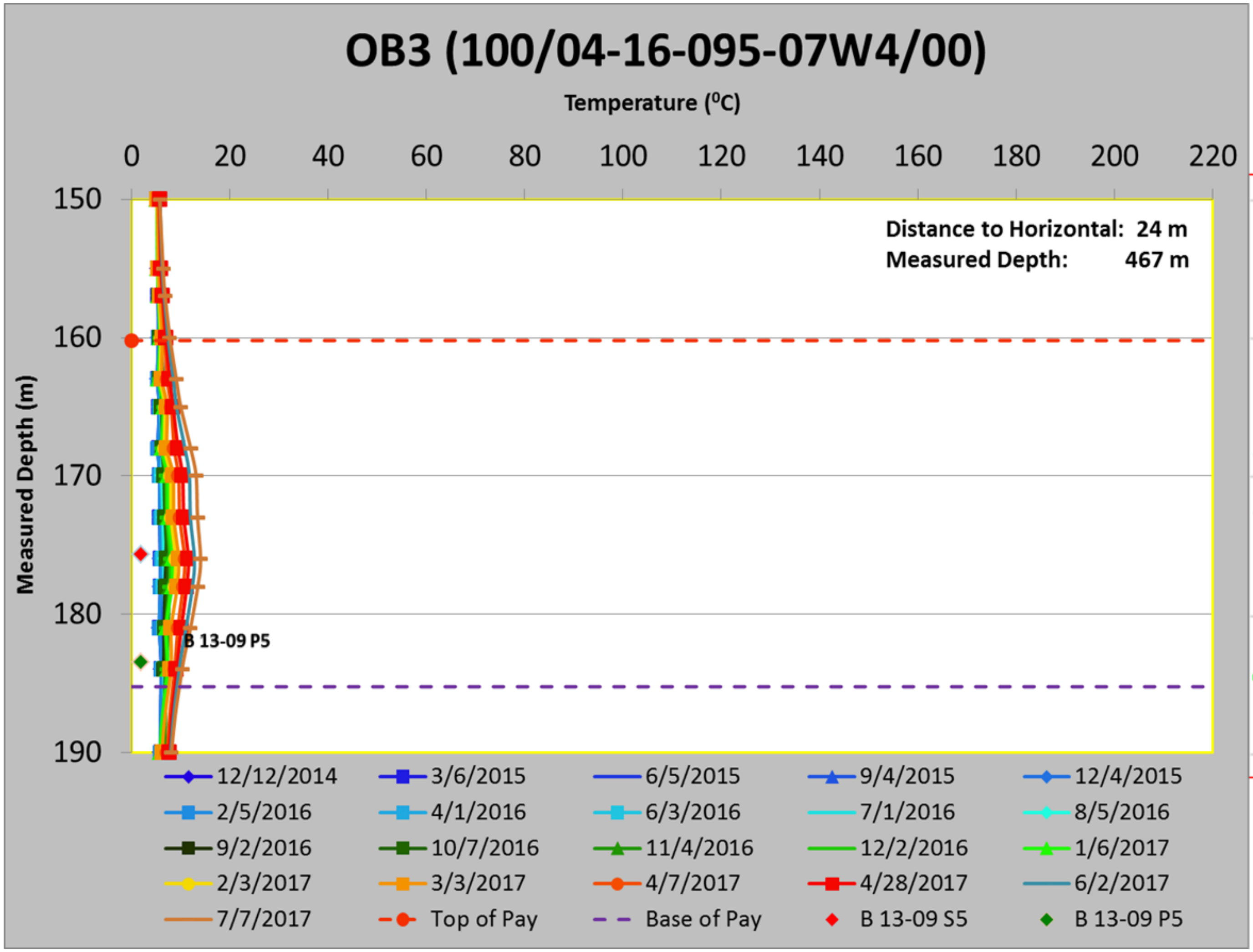
Discussion of B16-17 (L) Performance

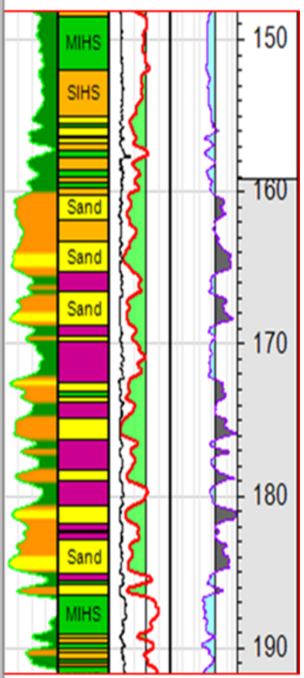
- Currently producing approximately 700 m^3/day of bitumen
- All wells have been operating at 1,725 kPa_g (no MOP increase)
- In March 2017, L1 ESP was upsized and a tailpipe was installed. Tailpipes were also installed on L5 and L6 in March and October, 2016 respectively
- L6 is currently the most challenging well on the pad due to proximity to lean zones and to the higher pressure well pad, B13-16 (M). It also has the lowest oil cut and highest total fluid to steam ratio (TFSR) compared to other wells
- There are four observation wells located on this well pad. To date, there are no signs of steam chamber development. Piezometers are reading expected pressures
- Pad B16-17 (L) performance indicators as of July 31, 2017:
    - Cum. Oil : 321,344 m^3 (RF = 8.0%)
    - Cum. Steam Injected: 1,733,009 m^3
    - Cum. Water Produced: 1,417,559 m^3
    - CSOR: 5.4 m^3 CWE / m^3

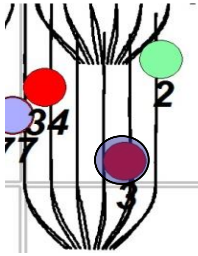
Pad B13-09 (E) Production and Injection History (Low Recovery Pad)



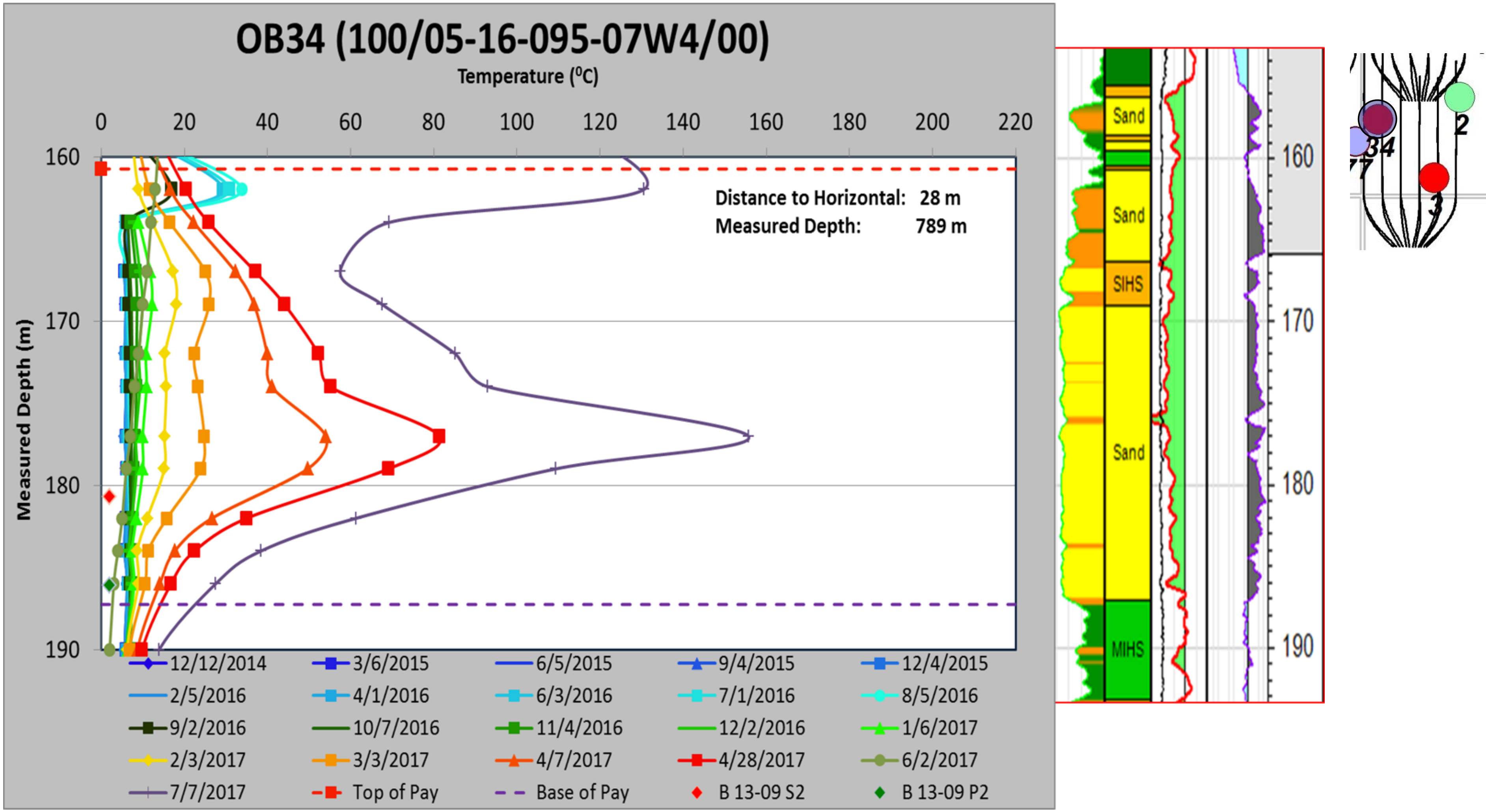
Pad B13-09 (E) Heel Observation Well



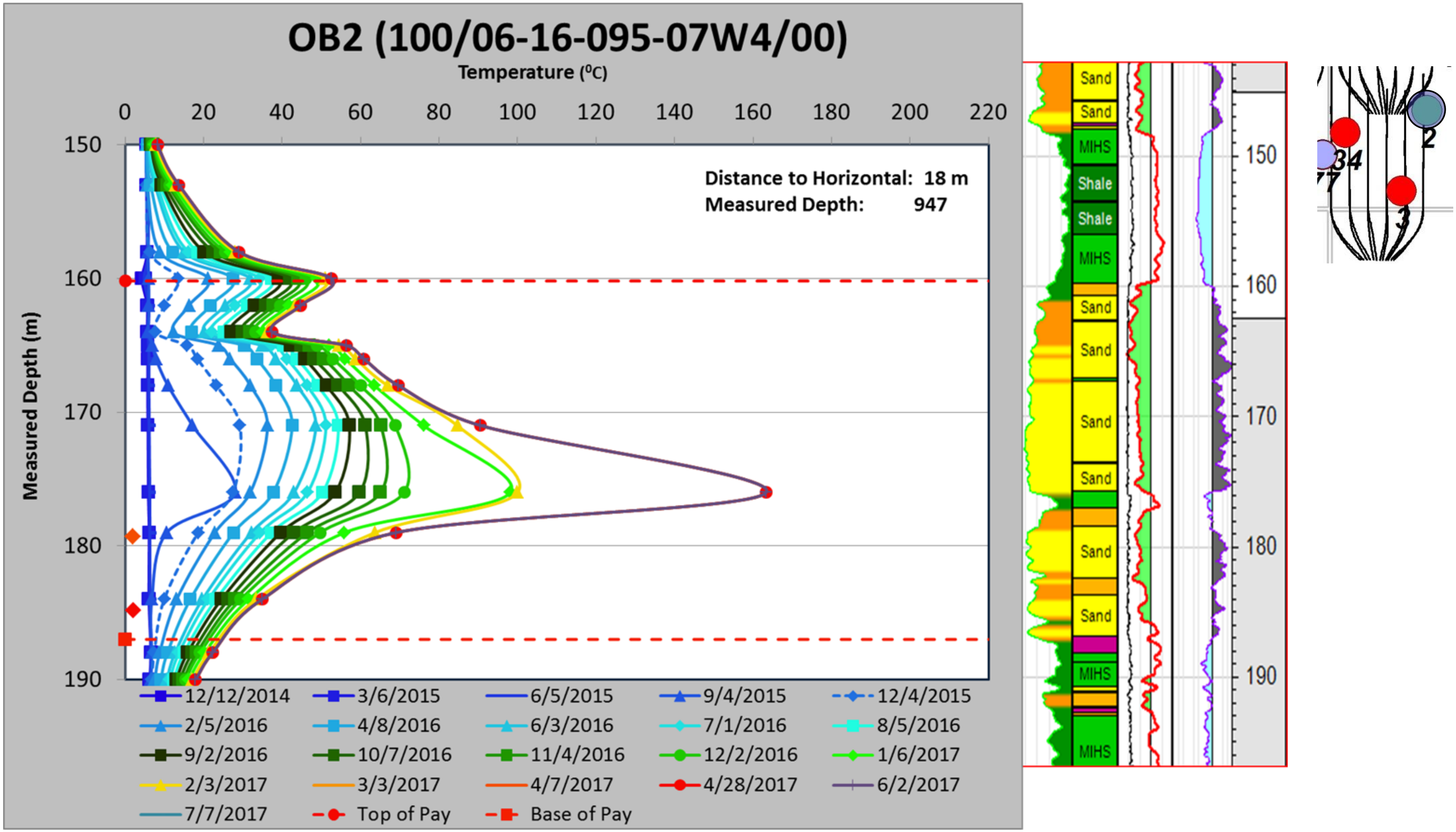




Pad B13-09 (E) Mid Observation Well



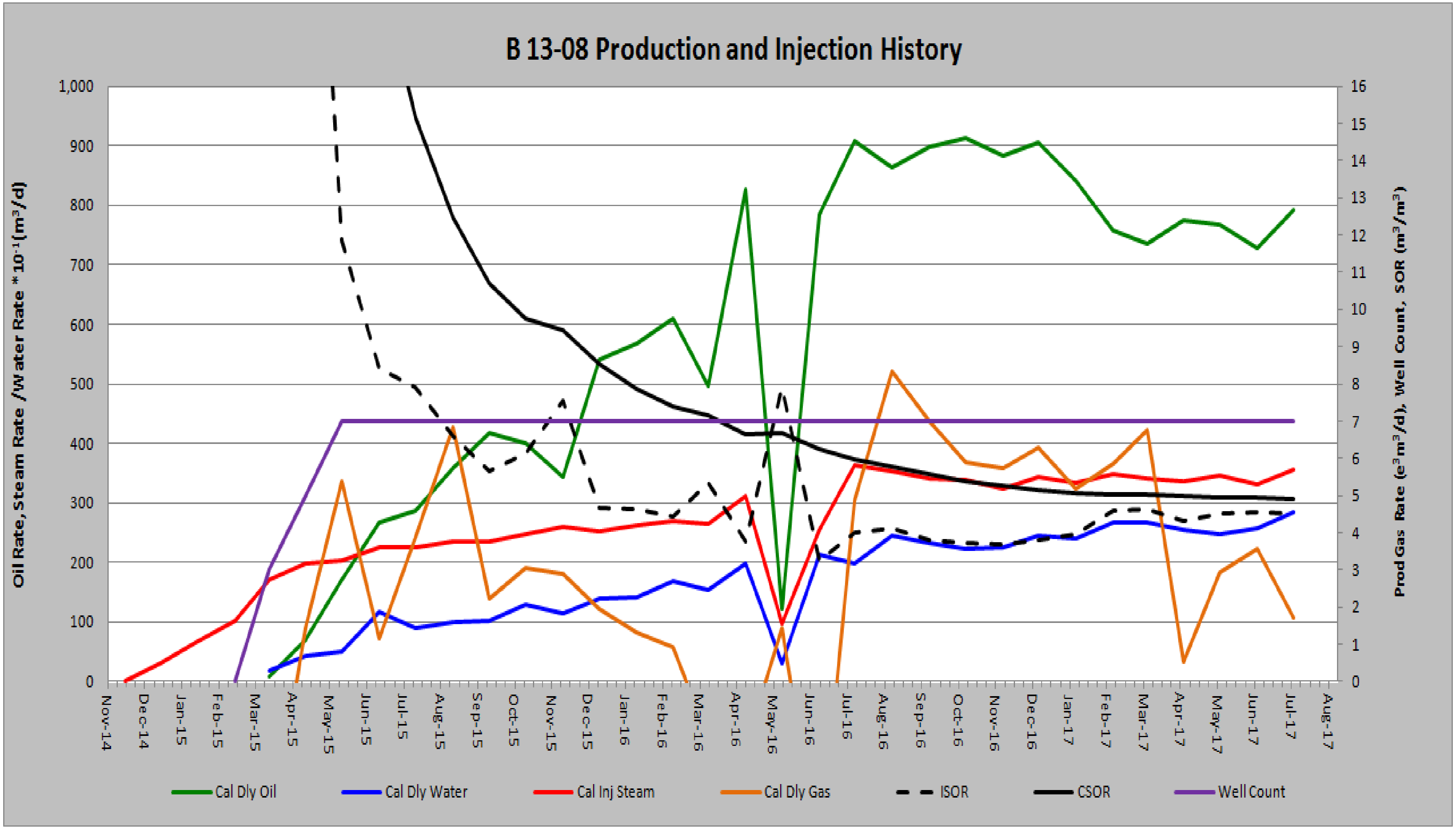
Pad B13-09 (E) Toe Observation Well



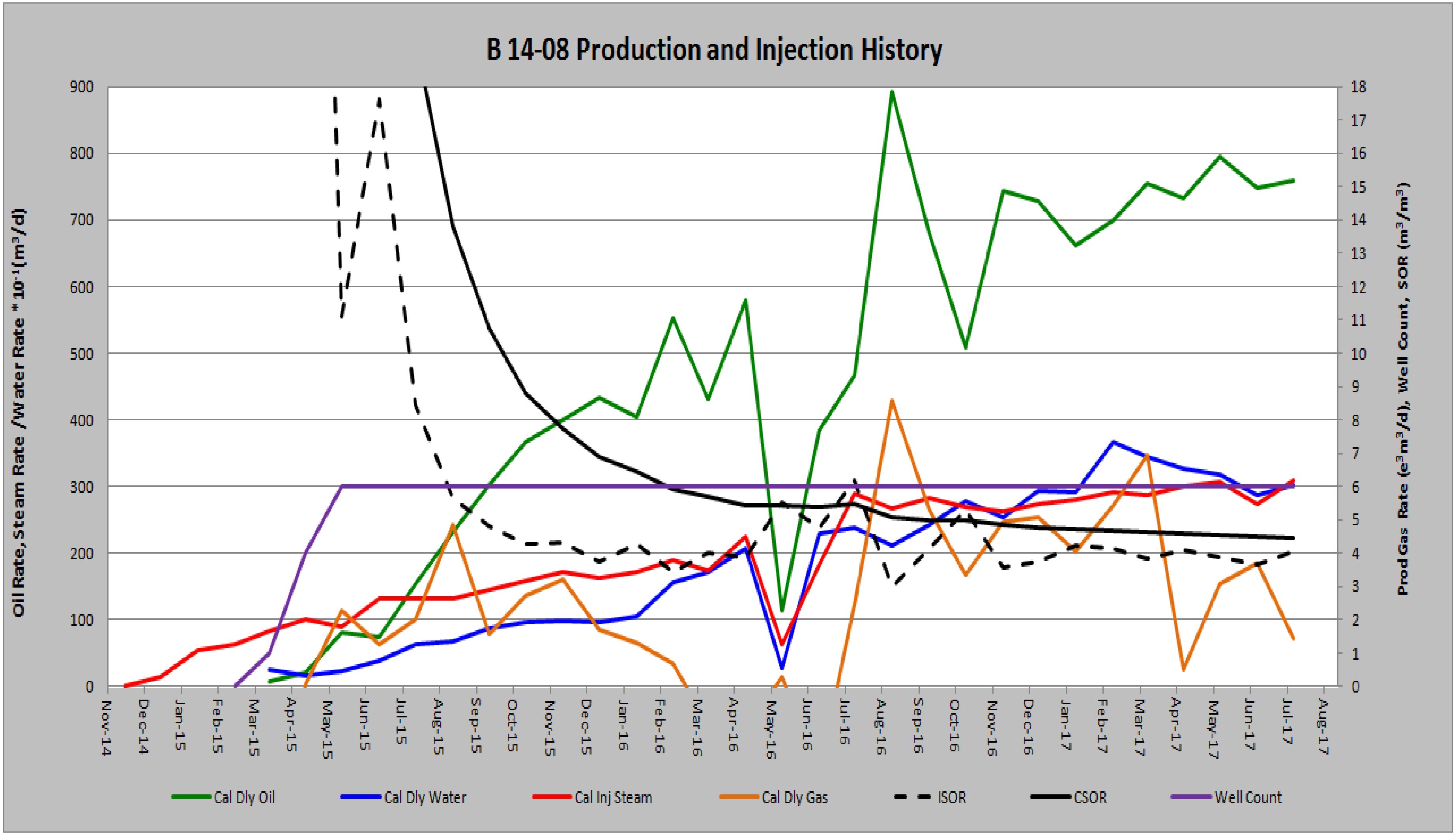
Discussion of Pad B13-09 (E) Performance

- Five wells are currently on gas lift, E1 was recently converted to ESP in June 2017
- Maximum Operating Pressure approved to be 2,200 kPa_g compared to the initial MOP of 1,750 kPa_g
- For all six wells, higher MOP increased total steam and emulsion rate
- Changing the steam rate and lift gas rate split between the heel and toe tubing is the main optimization method for gas lift wells
- Repositioning toe production tubing in producers has been an effective method to control hotspots and optimize well conformance
- Temperature response in the observations wells show progress on chamber growth, however chambers haven't reached top of pay yet
- Overall, Pad E has made progress helped by increase in MOP, and is currently meeting production expectations. Instantaneous SOR has been decrease and is currently 5.1 m^3 CWE / m^3
- Pad B13-09 (E) performance indicators as of July 31, 2017:
  - Cum. Oil : 233,467 m^3 (RF = 8.7%)
  - Cum. Steam Injected: 2,028,015 m^3
  - Cum. Water Produced: 1,125,619 m^3
  - CSOR: 8.7 m^3 CWE / m^3

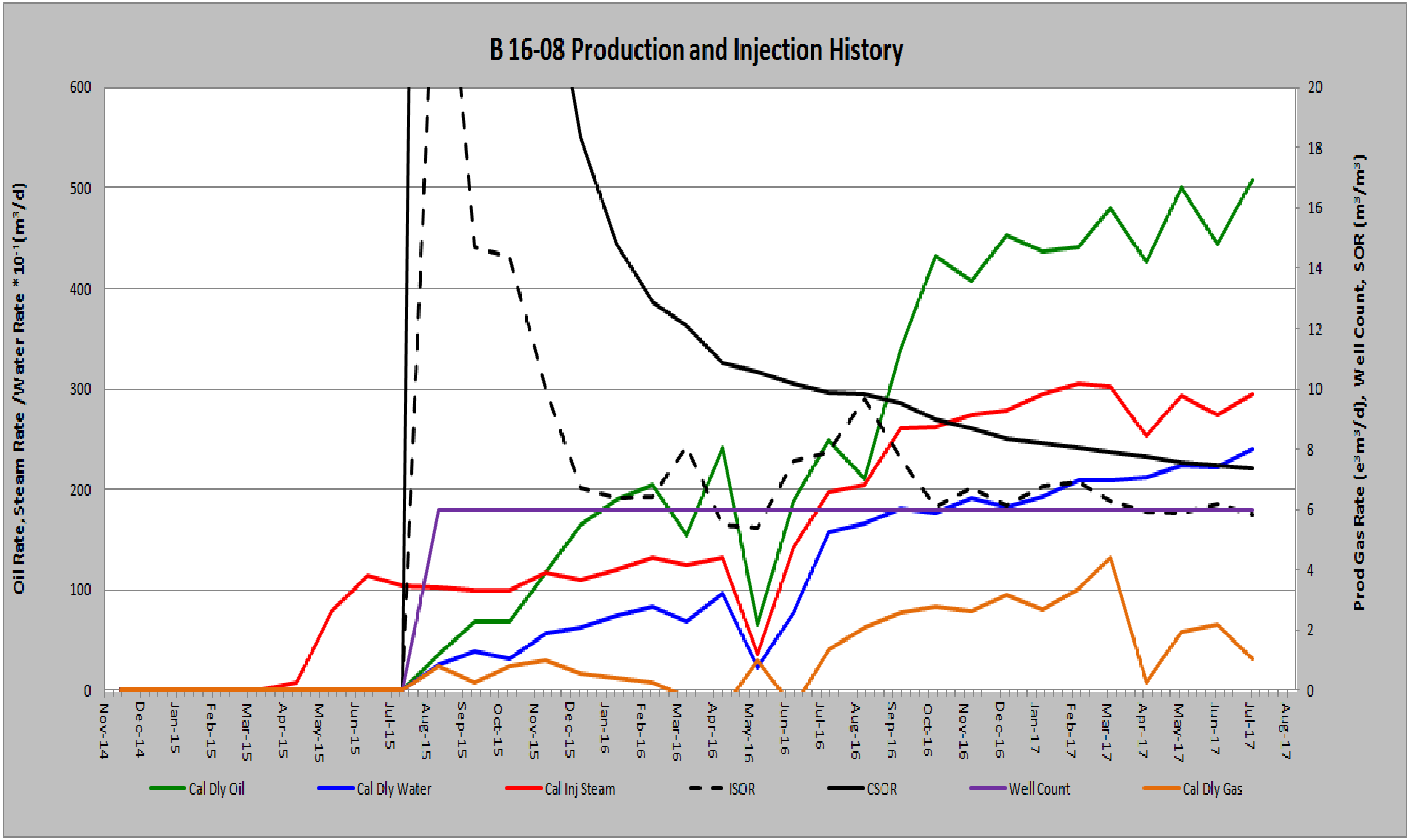
Pad B13-08 (B) Production and Injection History



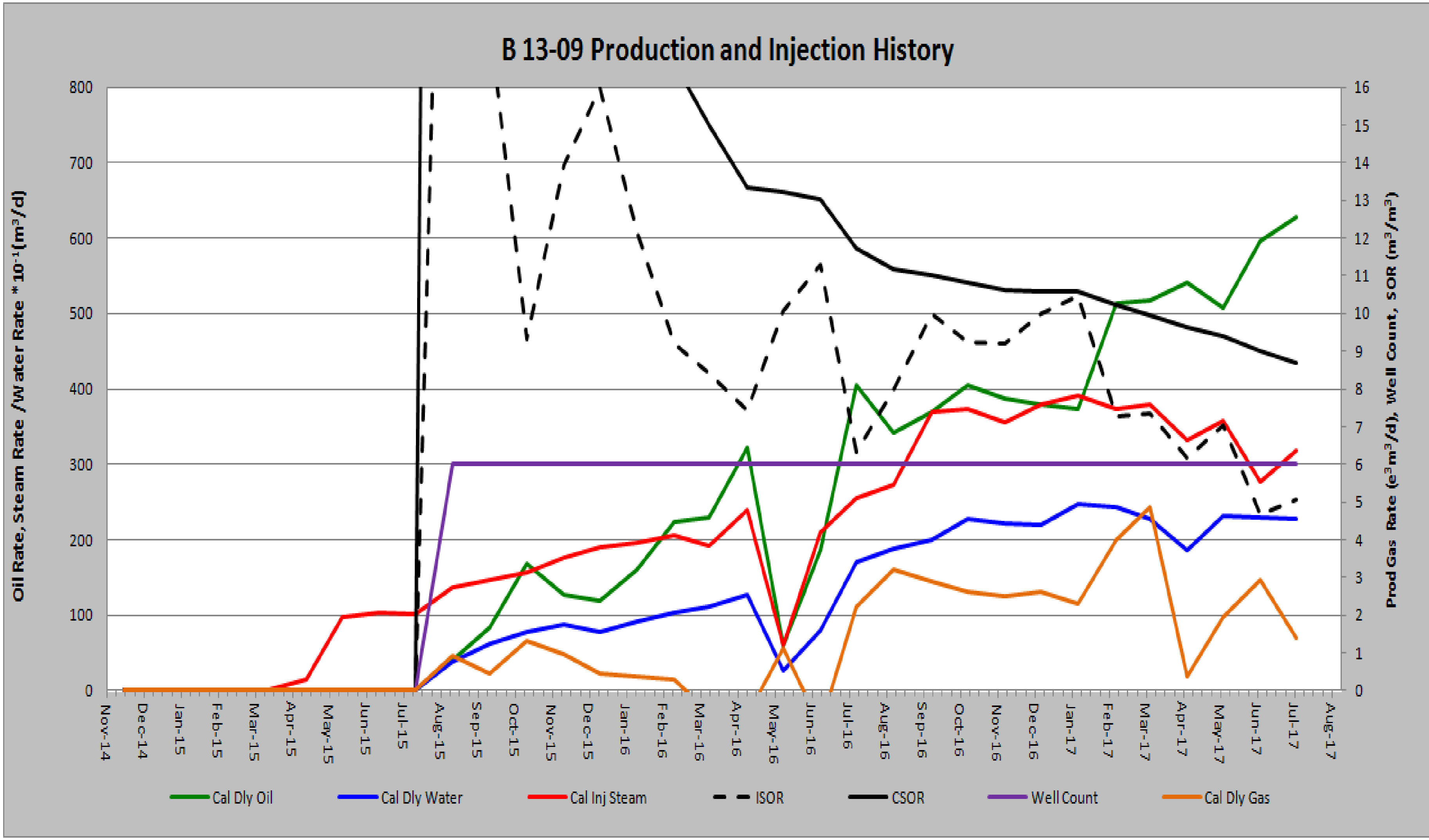
Pad B14-08 (C) Production and Injection History



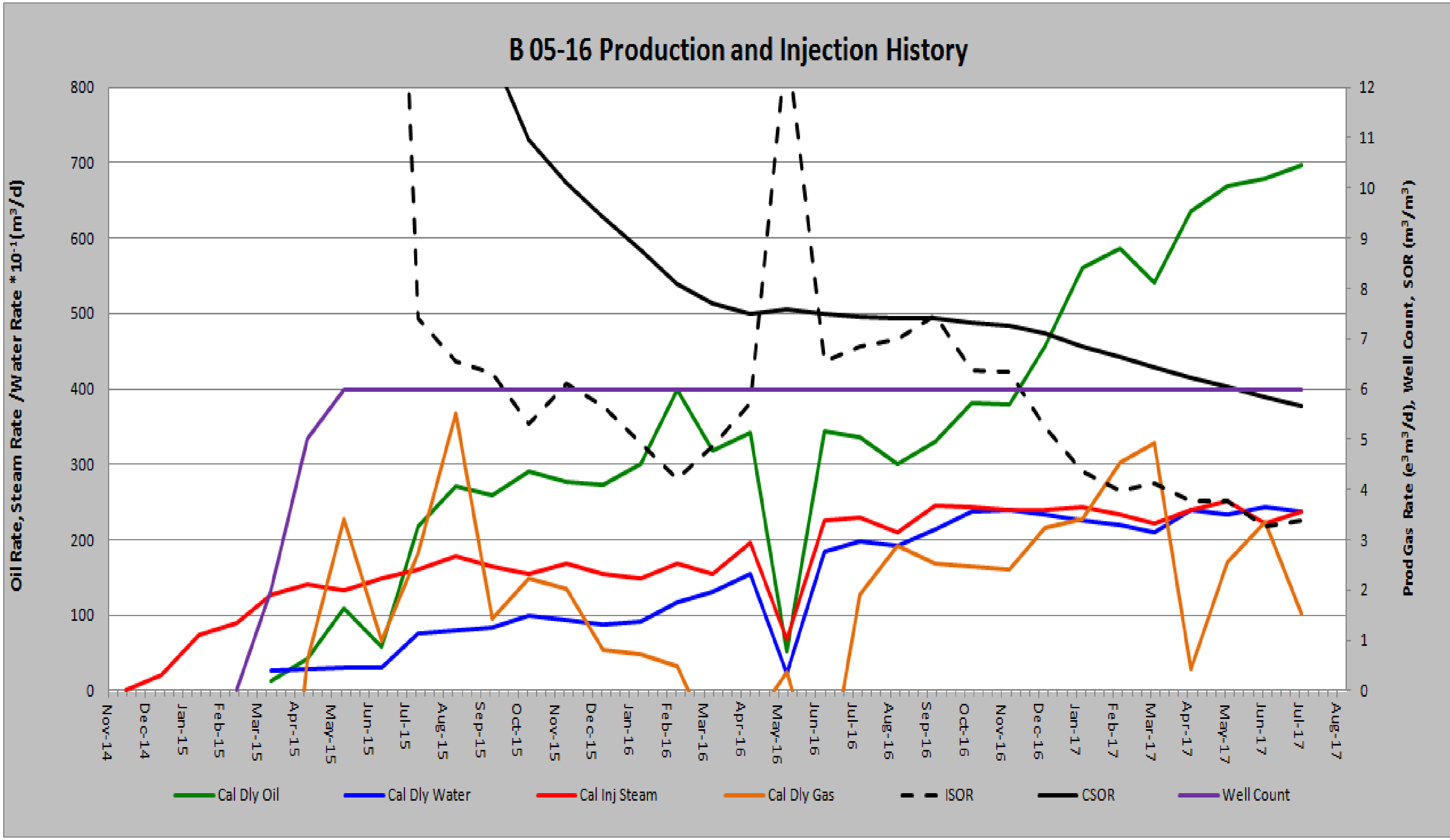
Pad B16-08 (D) Production and Injection History



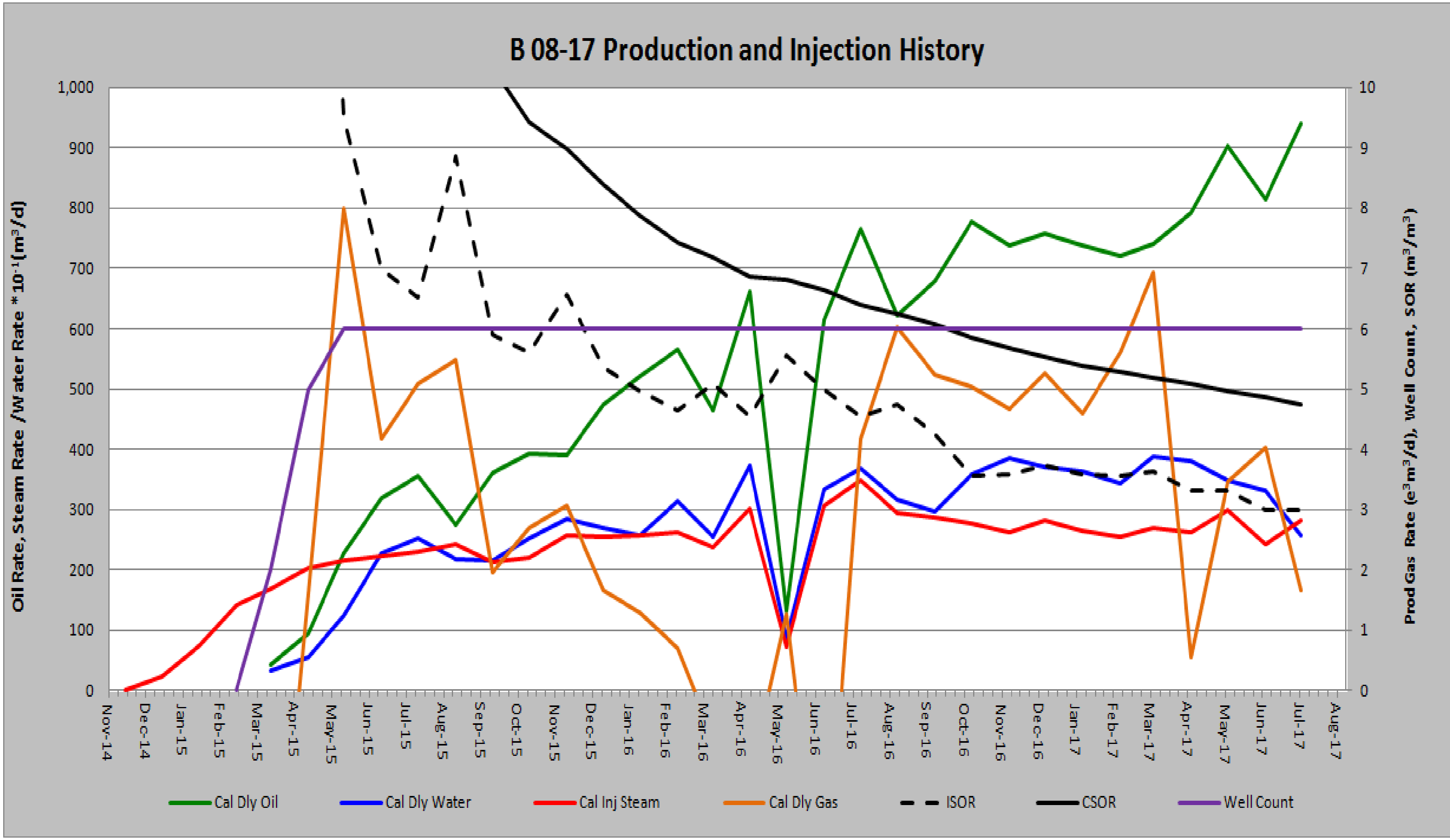
Pad B13-09 (E) Production and Injection History



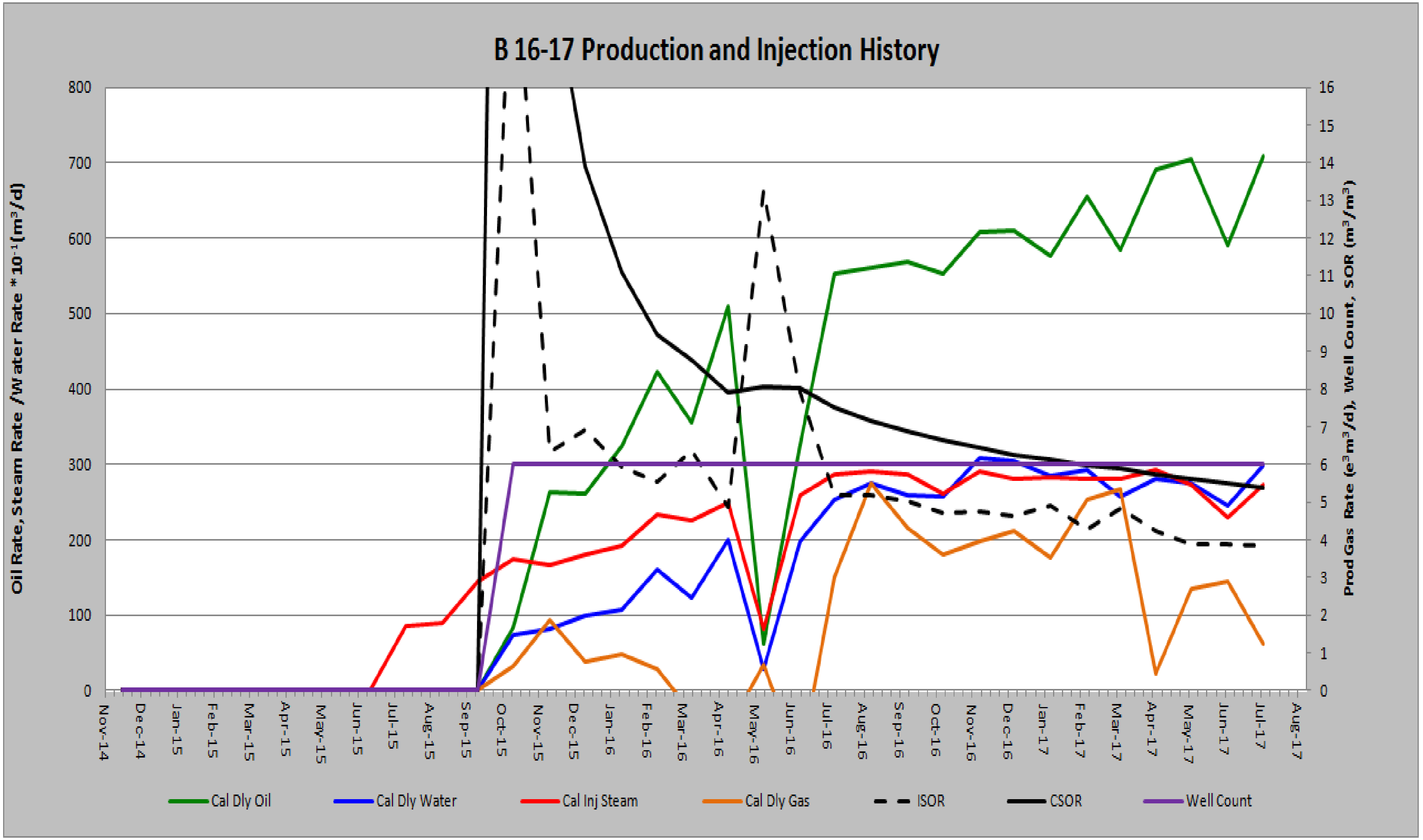
Pad B05-16 (H) Production and Injection History



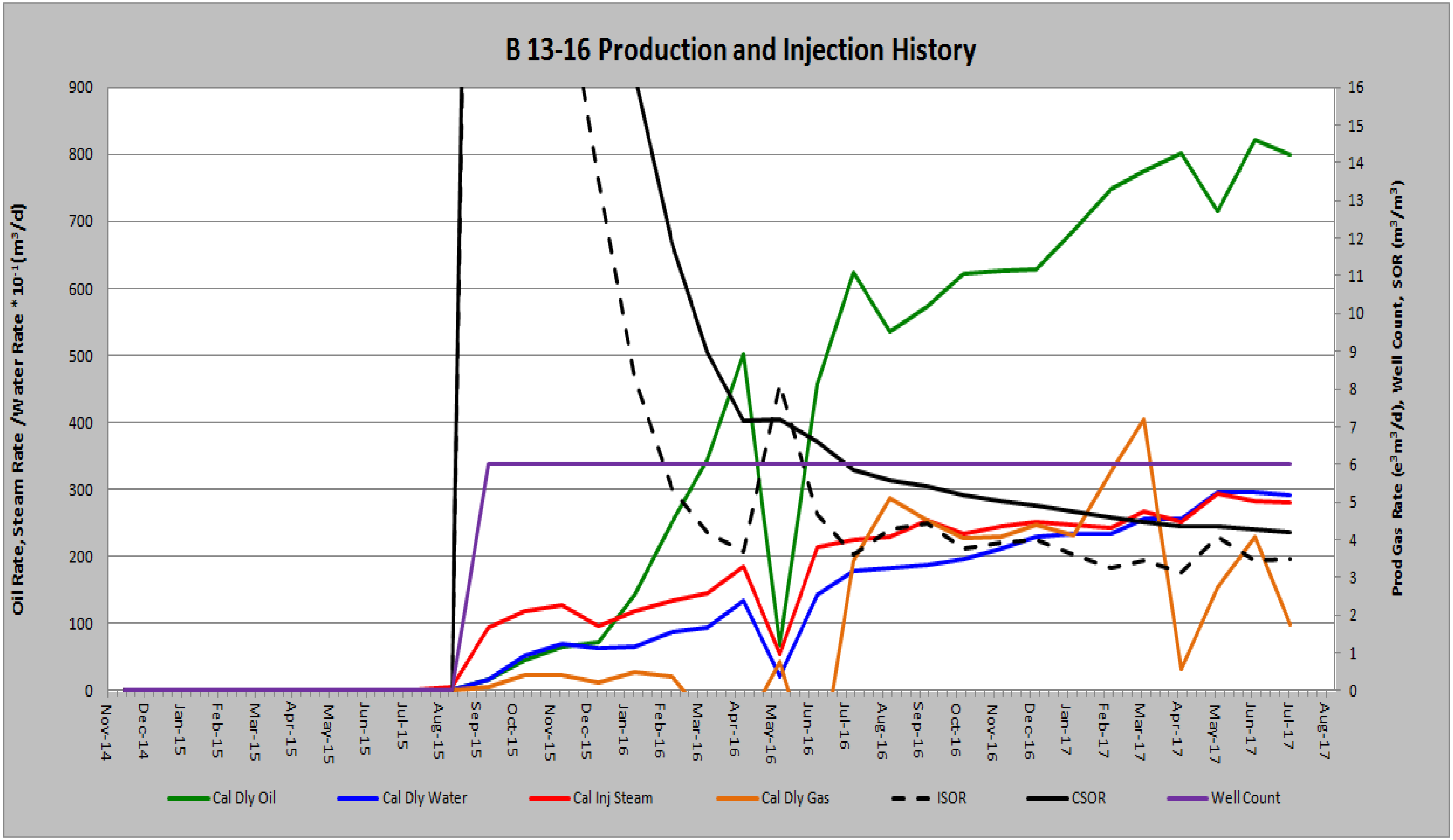
Pad B08-17 (G) Production and Injection History



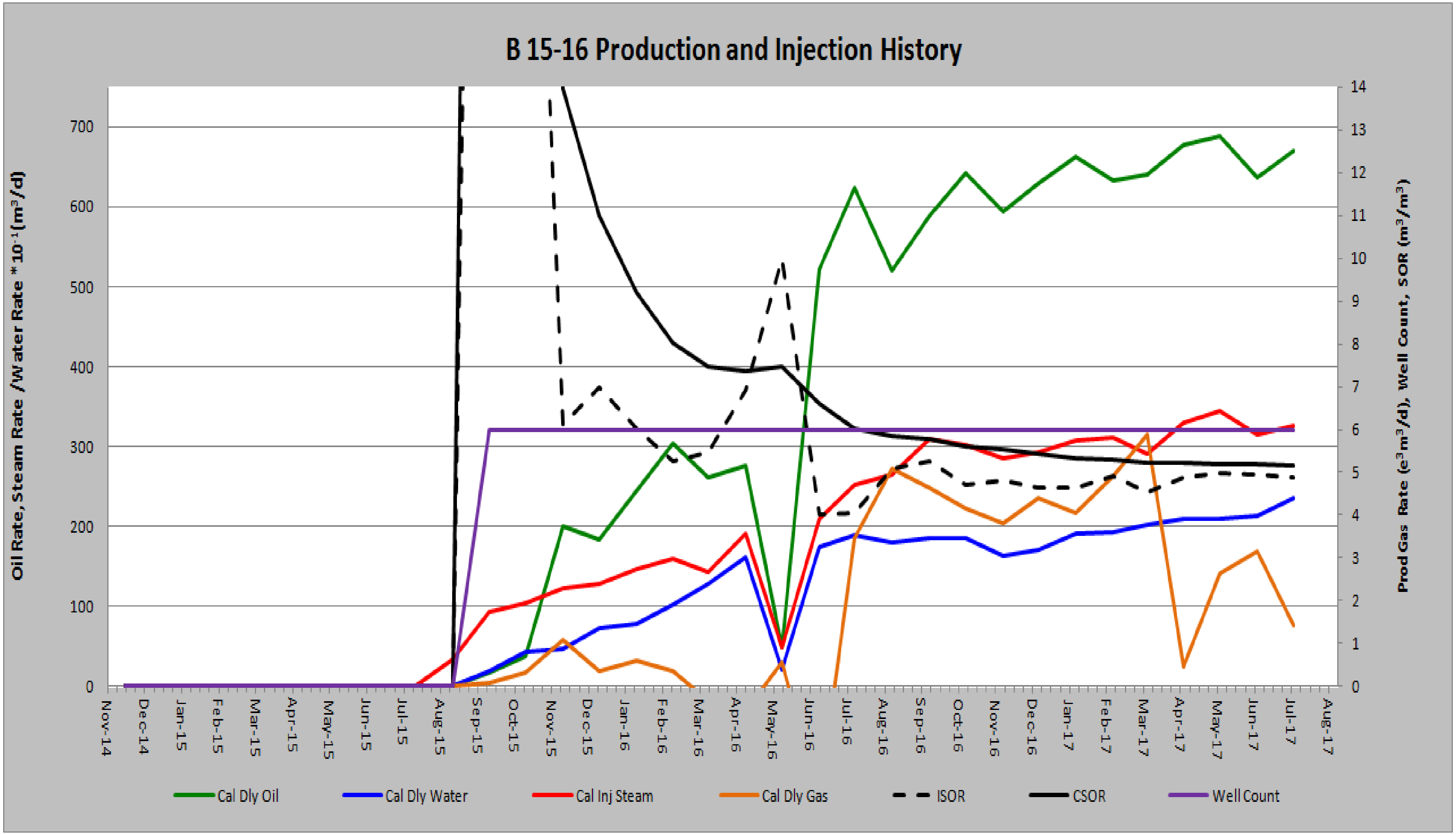
Pad B16-17 (L) Production and Injection History



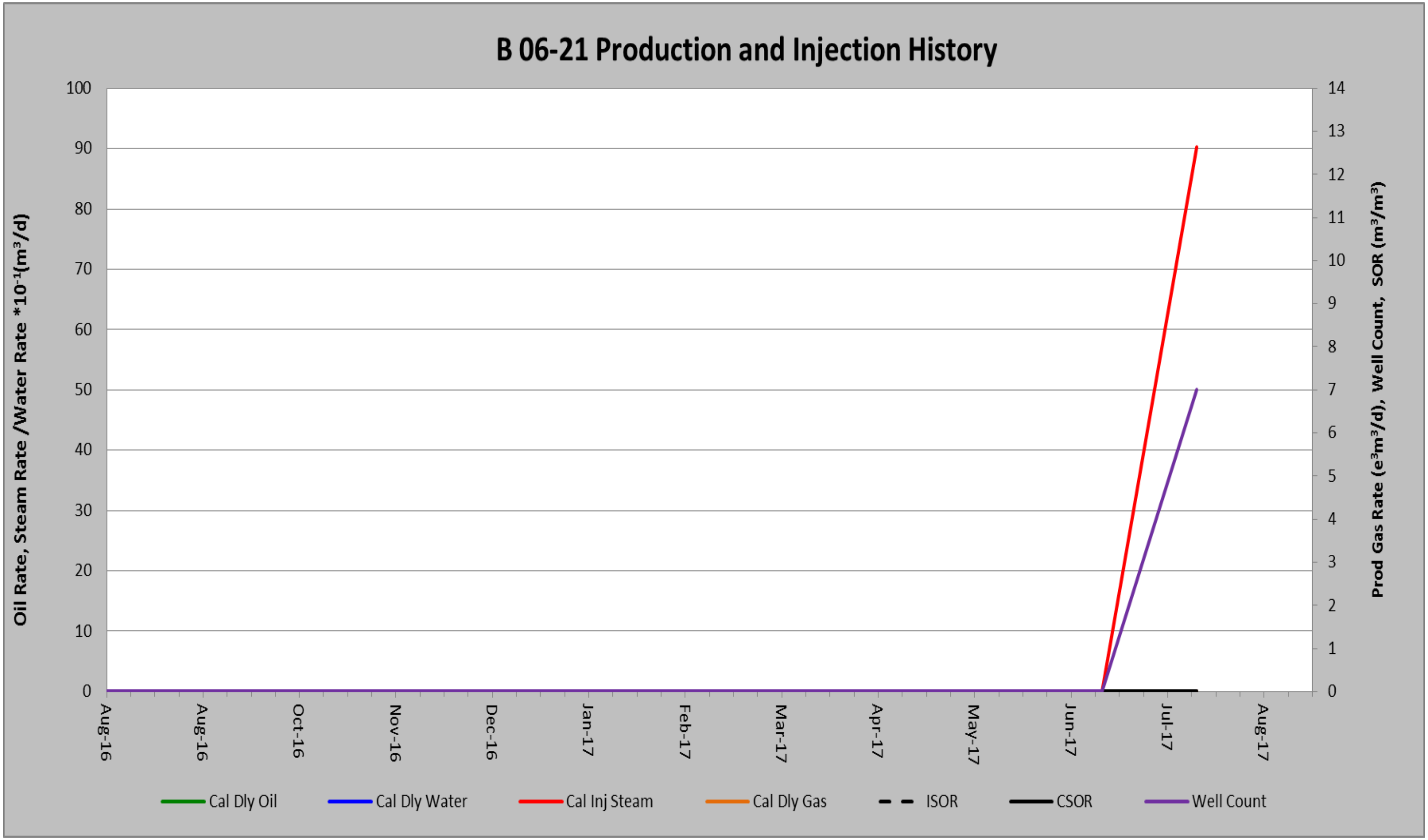
Pad B13-16 (M) Production and Injection History



Pad B15-16 (N) Production and Injection History



Pad B6-21(Q) Production and Injection History



Start-up Strategy / Key Learnings

- Pad B06-21 (Q) start-up process was started during the reporting period. A mixture of bullheading and circulation was used according to steam availability, pressure response, and availability of surface facilities

- Key Learnings:

  - At Sunrise bullheading is the preferred method of well start-up for the following reasons:

    1. Bullheading requires a lower steam injection rate compared to circulation which allows for steam to be redistributed to other well pairs during steam limitations

    2. Due to high water mobility within the reservoir most well pairs can bullhead steam rates high enough to achieve desirable steam quality at the toe of the well

    3. Bullheading provides a comparable start-up to circulation in wells with high initial injectivity

  - Circulation may still be utilized during times of steam availability

  - For well pairs with high background pressure or low injectivity a circulation start-up is required to achieve desirable steam rates and qualities

OBIP and Recoveries by Pad

- OBIP for each pad is calculated from the formula:

$$OBIP = L \times W \times H \times (1-S_w) \times \Phi \times 1/B_o$$

Where

L = Length of Drainage Area

W = Width of Drainage Area

H = Net* Thickness from the Top of Pay to the Base of Pay

Φ = Average Net* Porosity in the Pay zone

S_w = Average Net* Water Saturation in the Pay zone

B_o = Oil Volume factor/Shrinkage factor (taken as 1)

Note:

*Net properties calculated using a 6% BWO Cut-off

OBIP and Recoveries by Pad

Well PAD	Wells	OBIP (10^3 m^3)	Recovery to date July 31, 2017 (10^3 m^3)	Recovery Factor (%)	Estimated Ultimate Recovery (10^3 m^3)	Ultimate RF (%)
B13-08	7	3,868	518.6	13.4	1,934	50
B14-08	6	4,394	417.2	9.5	2,197	50
B16-08	6	3,219	207.7	6.5	1,610	50
B13-09	6	2,677	233.5	8.7	1,339	50
B05-16	6	3,351	307.7	9.2	1,676	50
B13-16	6	4,325	332.1	7.7	2,163	50
B15-16	6	4,374	313.4	7.2	2,187	50
B08-17	6	3,334	483.2	14.5	1,667	50
B16-17	6	3,999	321.3	8.0	2,000	50
B06-21	7	5,160	0	0	2,580	50
B05-21	7	5,628	0	0	2,814	50
Total	**69**	**44,329**	**3134.7**	**7.1**	**22,167**	**50**

5-Year Outlook of Expected Pad Abandonment

- No pad abandonment is anticipated in the next 5 years

Temperature, Pressure and Quality of Steam

- High pressure steam separator delivers steam at a 100% quality
- Steam quality losses are experienced during transportation to the pads
- Steam quality at the wellhead is estimated to be 95%

Composition of Other Injected/Produced Fluids

- Received AER OSCA Scheme Approval (10419S) for the Solvent Injection Pilot application on March 29, 2017

- No solvent was injected during this reporting period

Summary of Key Learnings

- Workovers were a good resource in helping achieve conformance and reservoir optimization. Installation of tail pipes helped improve conformance and ESP conversion helped in cases where a lower down-hole pressure was required

- Differential MOP across well pads helped accelerate ramp-up

- Reservoir features high pressure transmissibility which brought some challenges controlling boundaries between different pressure areas

8. Future Plans

Future Plans (2017/2018)

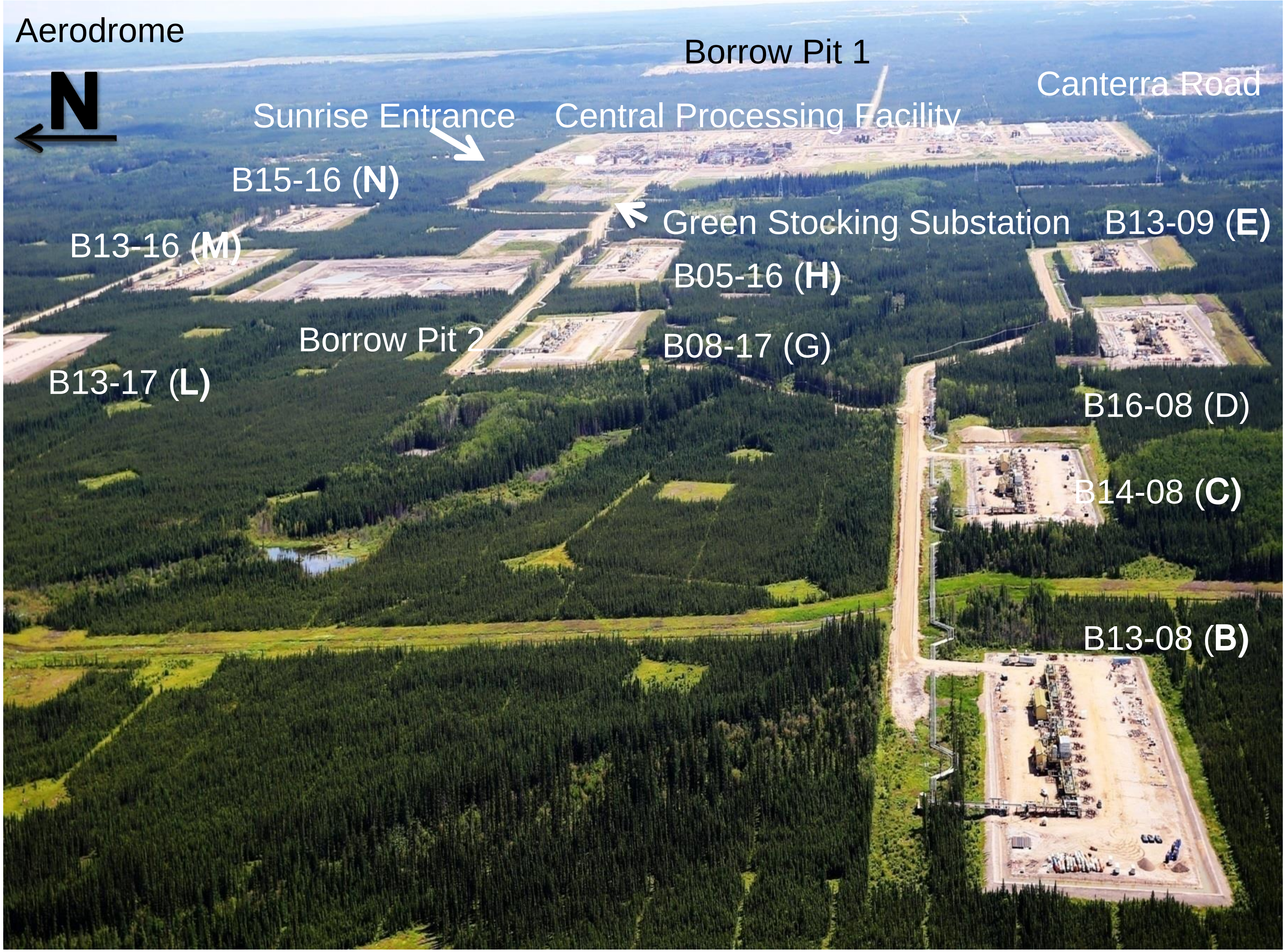
- Development Activities:
  - Finish start-up of first two DA2 well pads (B06-21 (Q) and B05-21 (P))
  - Drill sustaining well pad B10-16 (R) target Q1 2018 ; pending AER review and approval of Application No. 1895180
  - Corner reflector installation
  - Drill two additional observation wells
  - Drill replacement wells (D6F, H1F and N1F) in Q3 2017. Received AER Approval June 1, 2017
  - Drill infill producers to evaluate impact on recovery and SOR. AER OSCA Scheme Approval (10419T) received August 24, 2017
  - DA1 Replacement Well Application – Target AER submission Q3/Q4 2017
  - DA1 Infill Well Application – Target AER submission Q4 2017

- SAGD Operations:
  - Continue to optimize SAGD operations, continue to ramp-up existing wells
  - Ongoing well pair surveillance
  - Ongoing observation wells monitoring
  - Ongoing surface heave monitoring

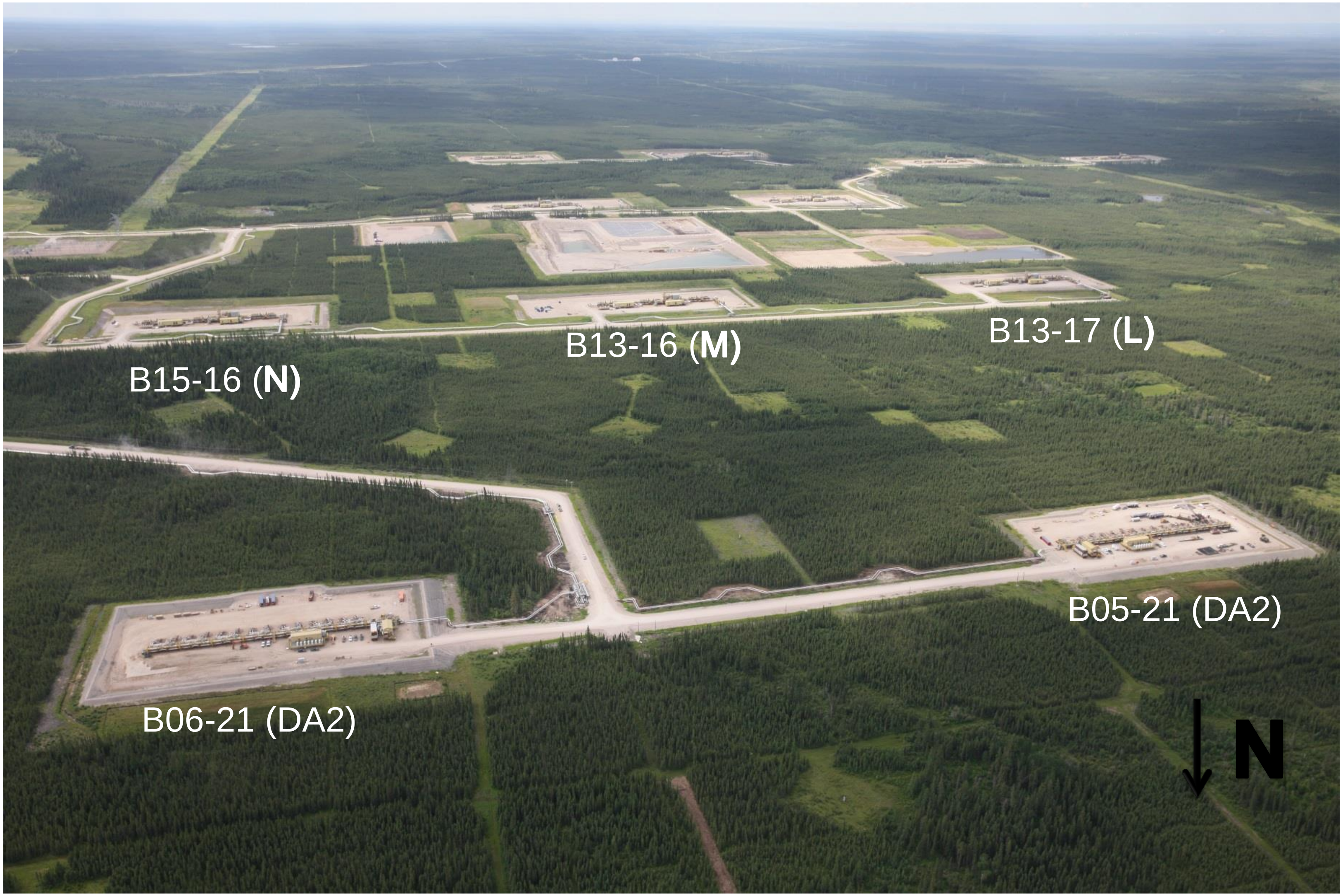
3.1.2. Surface Operations – Table of Contents

1. Facilities

Sunrise Layout

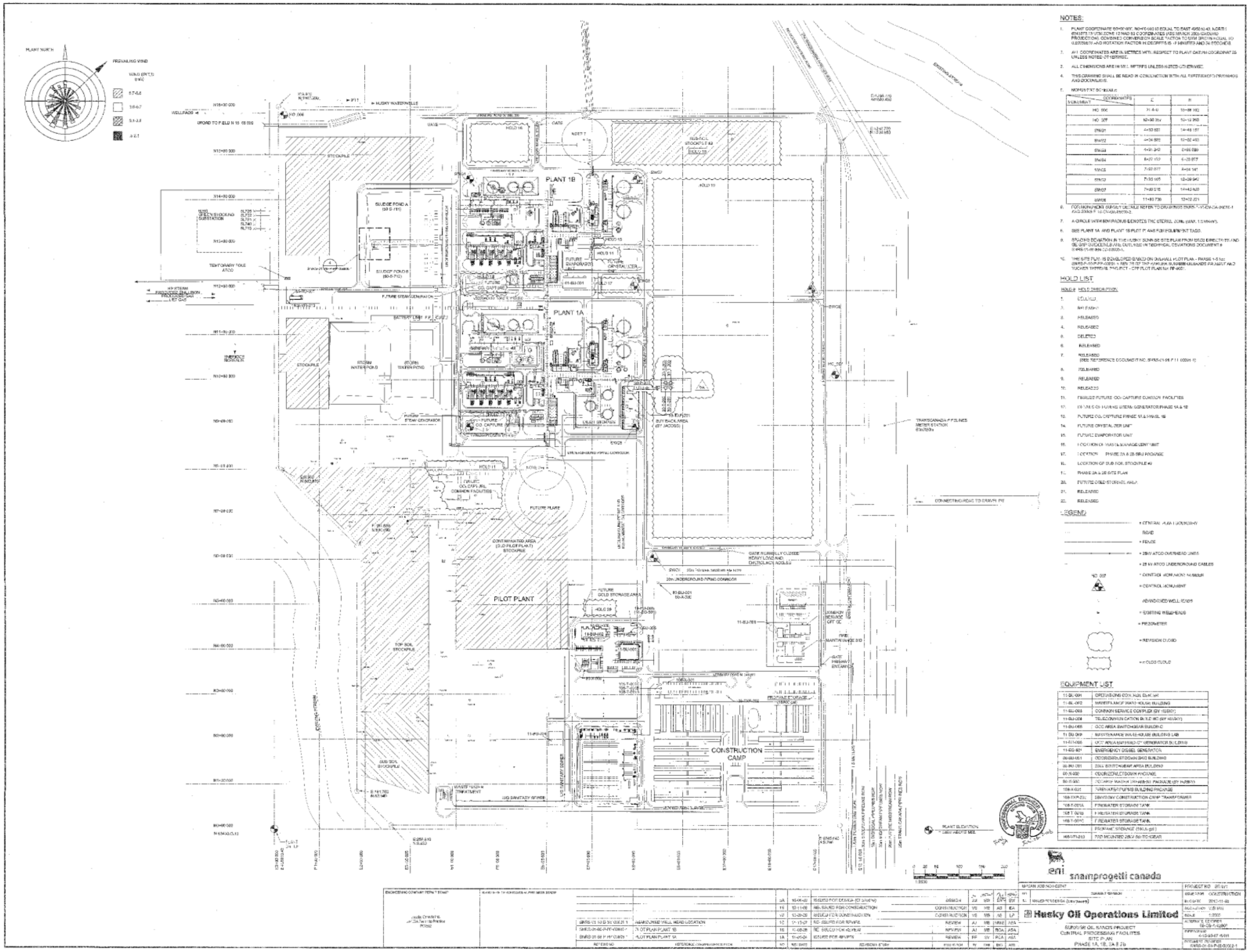


Sunrise Layout (cont'd)

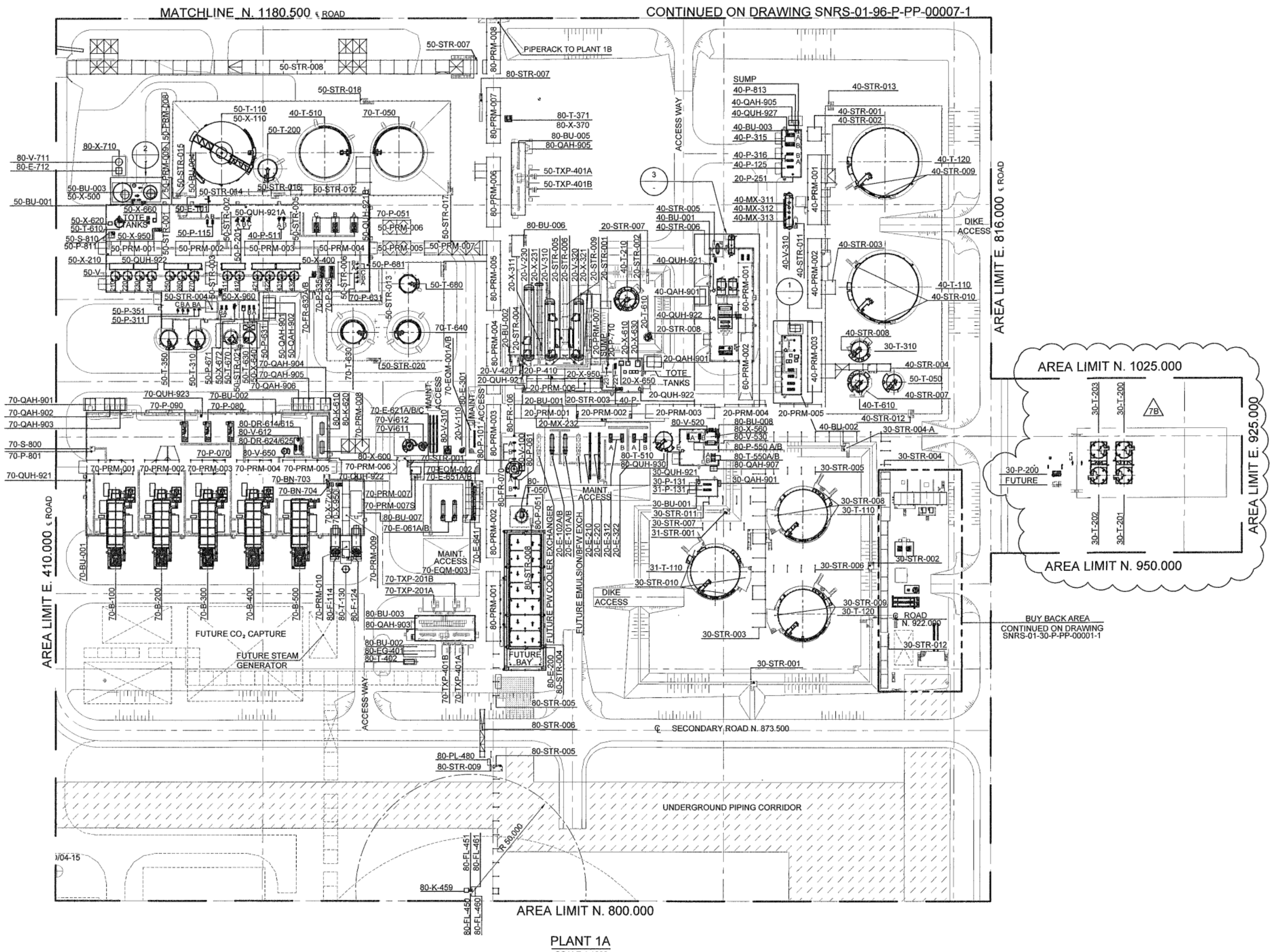


Sunrise Layout (cont'd)

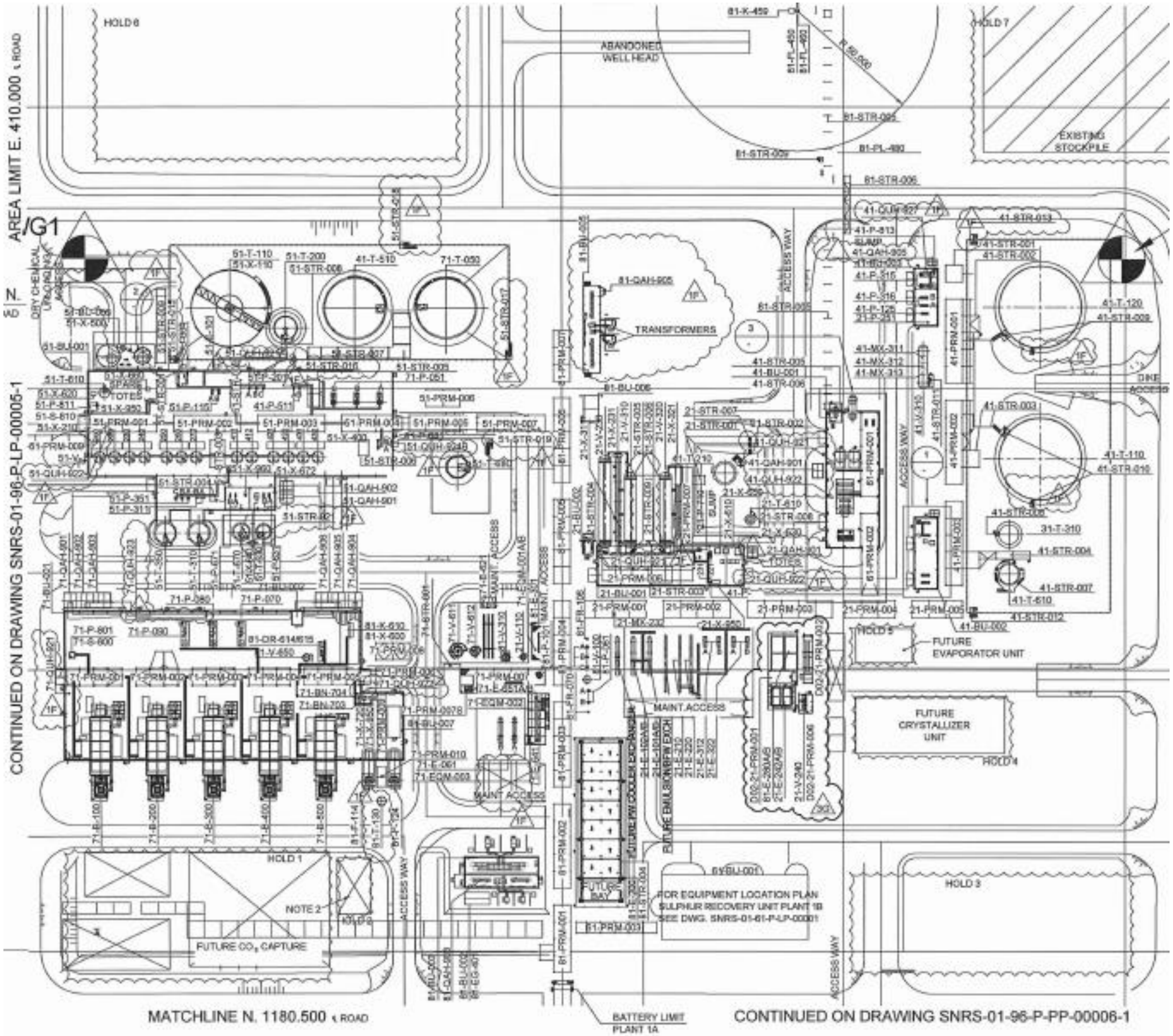
Facility Plot Plan (CPF)



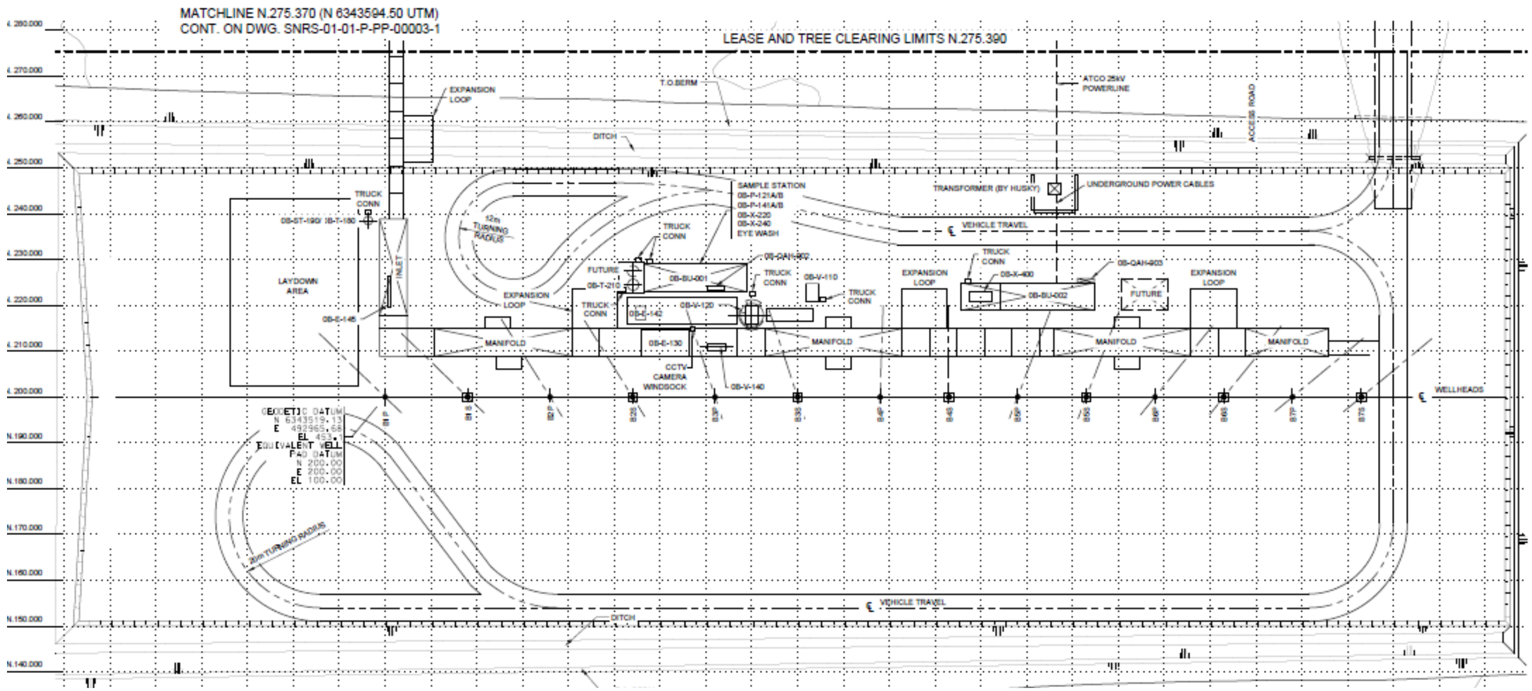
Facility Plot Plan (1A CPF)



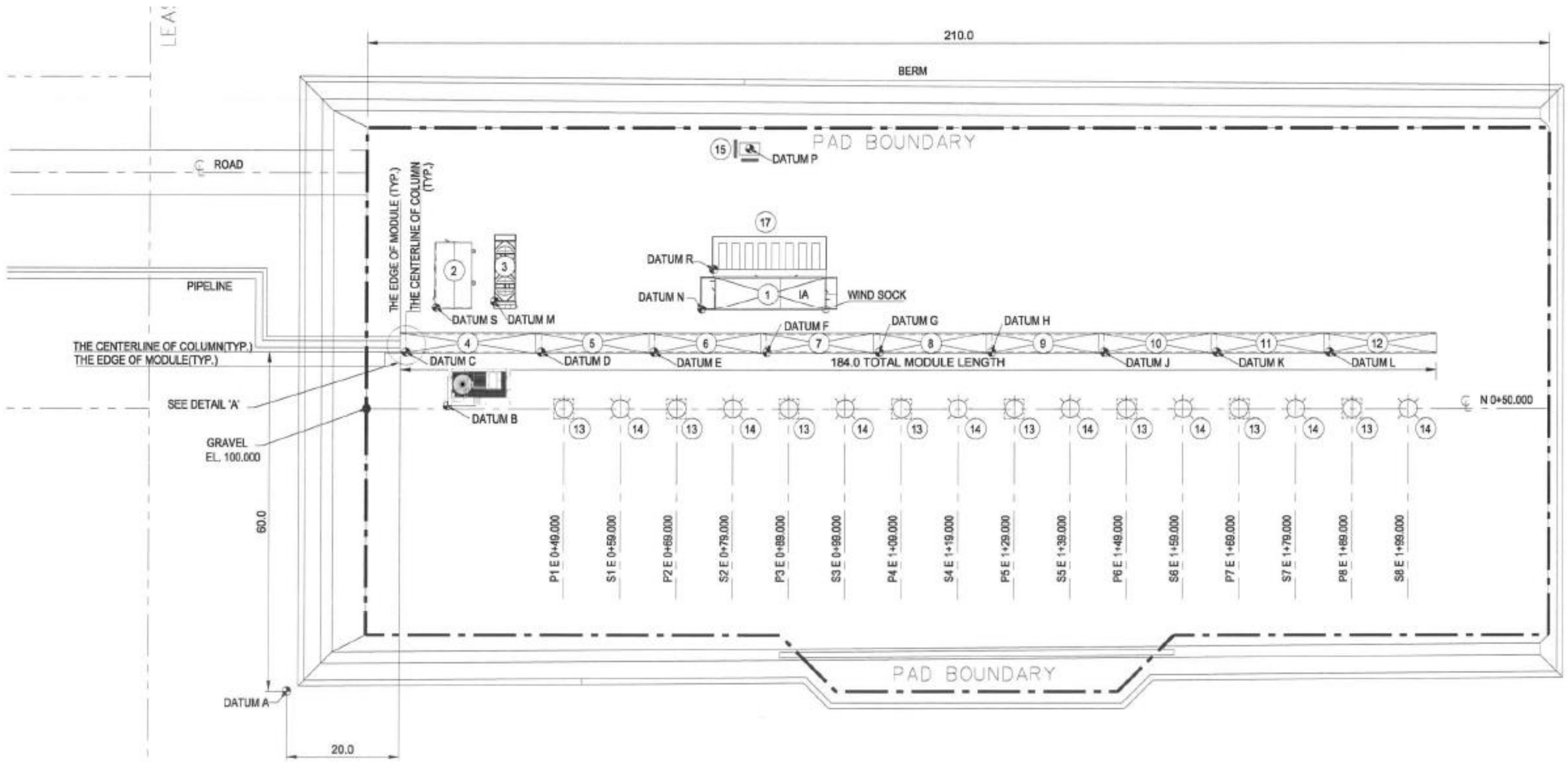
Facility Plot Plan (1B CPF)



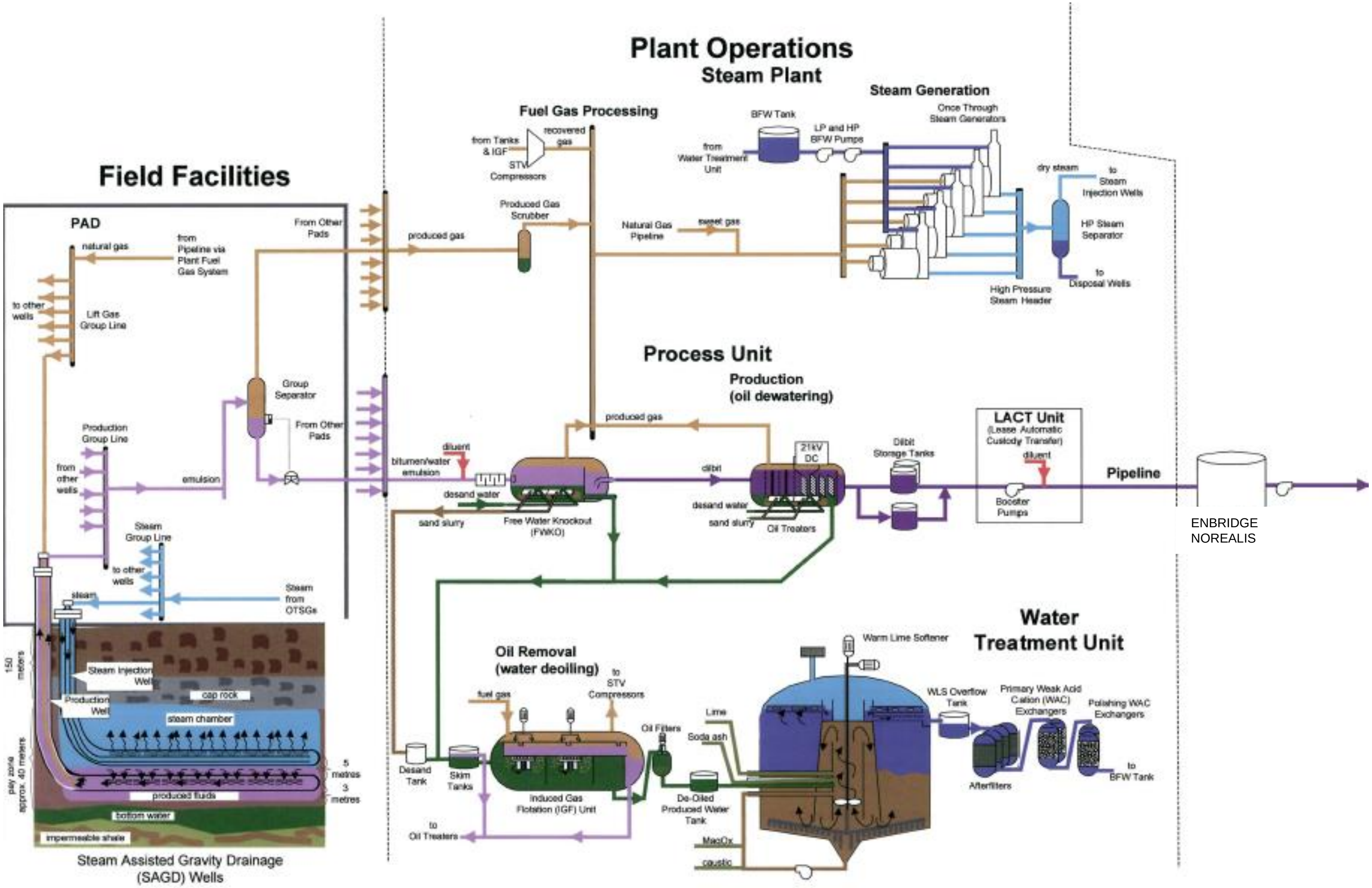
Field Facility Plot Plan (DA1)



Field Facility Plot Plan (DA2)



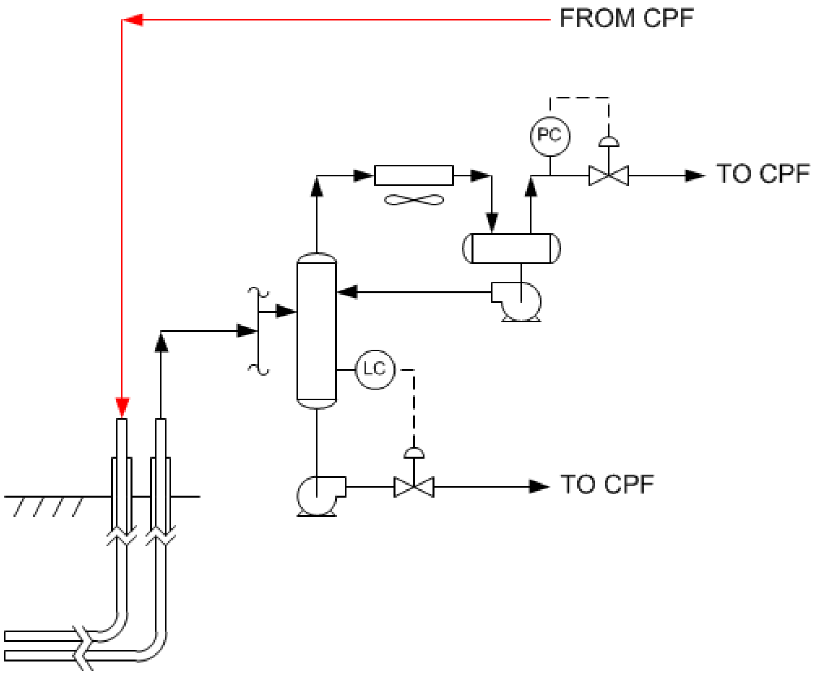
Simplified Plant Schematic



Field Facilities

Initial Development Area field facilities consist of:

- Steam and production pipelines
- Injection and production wells
- Group separator
- Test separator package
- Produced gas condenser
- Produced gas separator
- Emulsion and condensate pumps



Field facilities performance challenges:

- Calibration issues with water cut analyzers (resolved)

Development Area 2 (currently in start-up phase):

- Electric submersible pumps (ESPs)
- Multiphase pumps for casing gas injection in emulsion
- Minimal surface equipment

Oil Treating

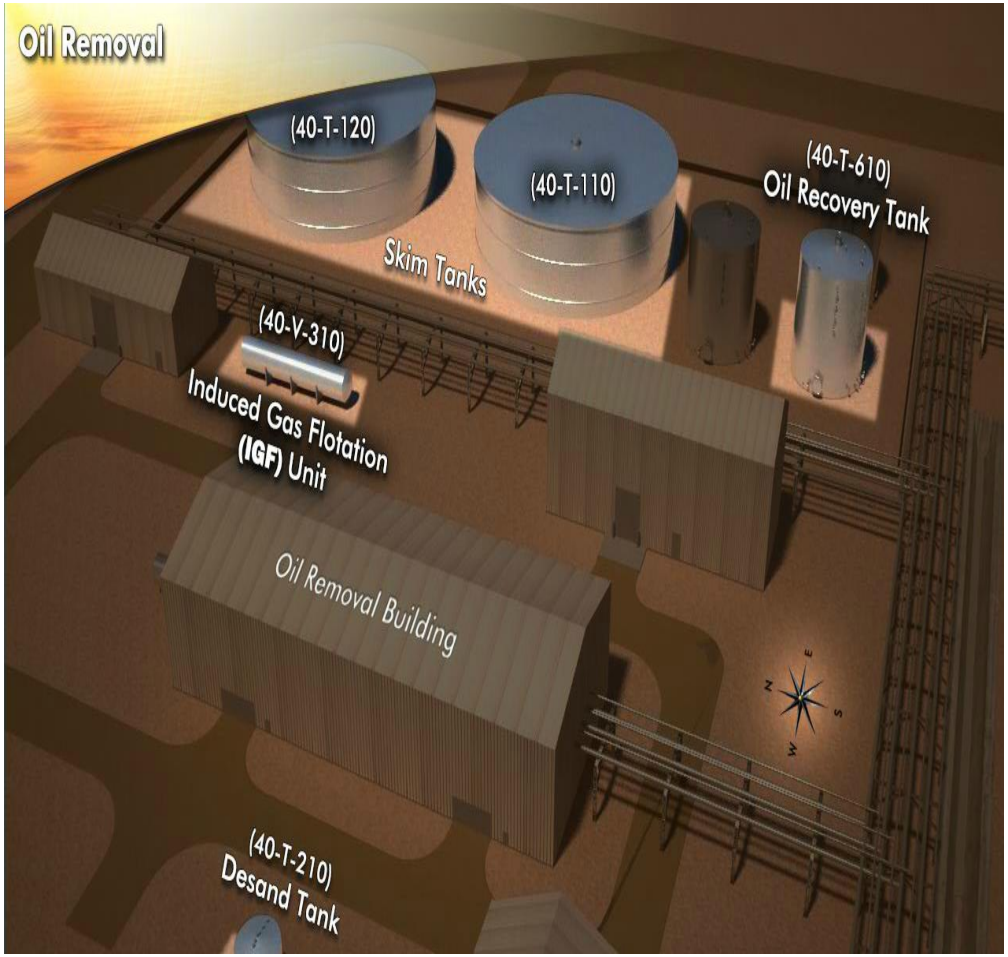
Each Oil Treating train consists of:

- Emulsion Coolers
- 1 Free Water Knock Out
- 2 Treaters
- Sales Oil Coolers
- Produced Water Coolers

The Oil Treating process has improved in the following areas: exchanger fouling, mixing issues, diluent flashing, and fines. Oil and water upsets have been reduced as a result.

Oil Treating KPI's are:

- <0.5% BS&W in Oil (average ~0.4%)
- <500 ppm Oil in PW (average <400 ppm)



Process Water De-Oiling

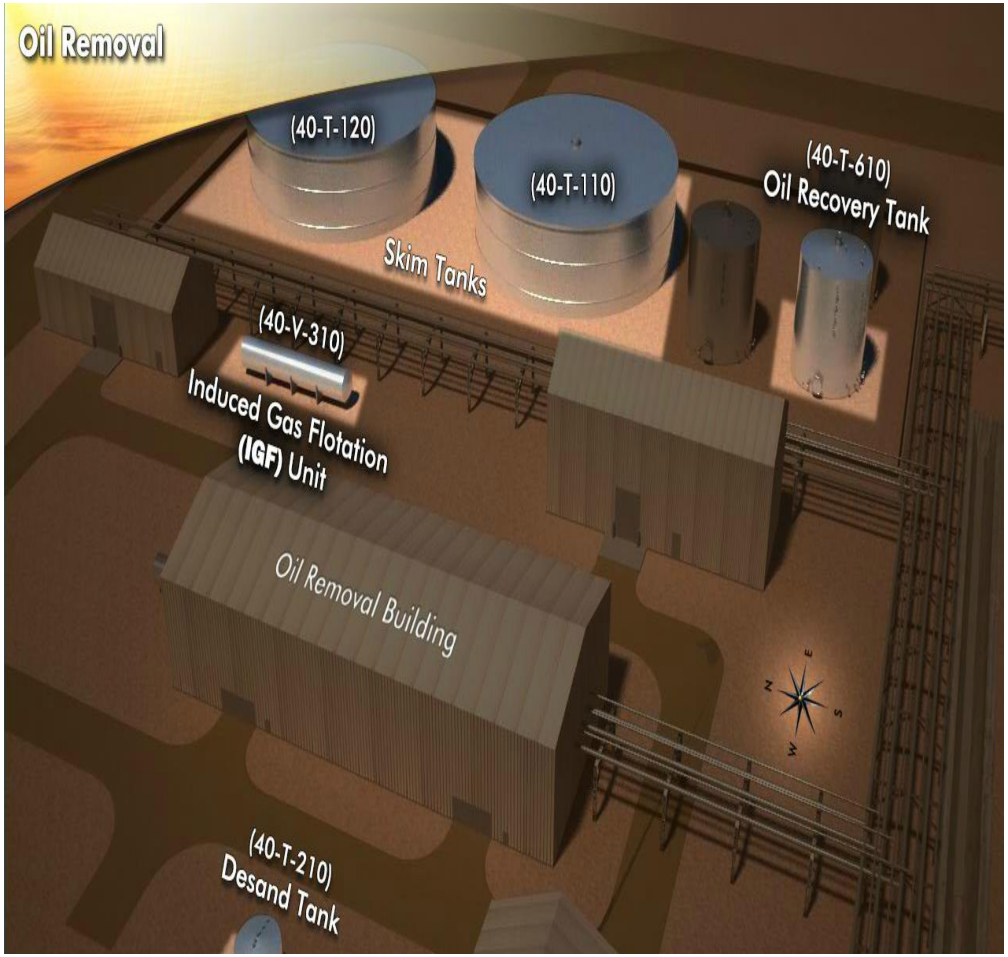
Each de-oiling train consists of:

- 2 Skim Tanks
- 1 Induced Gas Flotation Unit
- 2 Oil Removal Filters
- 1 Oil Recovery Tank
- 1 Desand Tank

The performance of the de-oiling equipment has experienced some challenges including skim tank and ORF performance, chemical optimization trial

De-Oiling KPI's are:

- FWKO – 500 ppm (average 292 ppm)
- IGF Inlet – 100 ppm (average 112 ppm)
- IGF Out – 20 ppm (average 17 ppm)
- ORF Outlet – 3 ppm (average 6 ppm)



Water Treatment

Each Water Treatment train consists of:

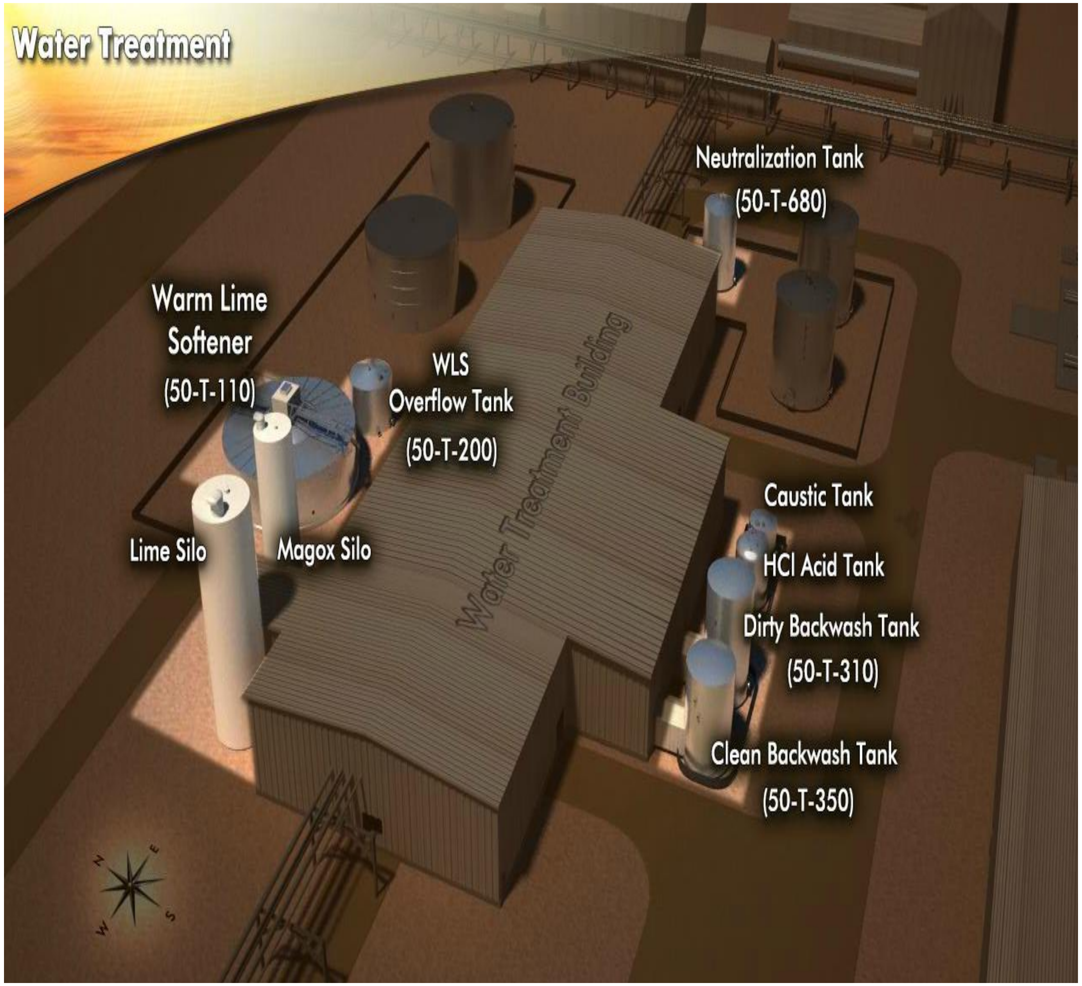
- 1 Warm Lime Softener
- 7 After Filters
- 3 pairs Weak Acid Cation (WAC) Exchangers/Polishers
- Neutralization / Backwash Systems
- Water Treatment Chemical Feed Systems
- Sludge Ponds

The performance of the water treatment equipment has been close to on-spec and is performing well overall.

Currently replacing Plant 1A AF media due to sludge carryover during post-fire startup

Water Treatment KPI's are:

- Total Dissolved Hardness: < 0.5 mg/L
- Silica: < 50 mg/L
- Turbidity < 2 NTU
- Oil in Water < 1.0
- Total Iron: < 300 ppb
- pH: 9.8 to 10.2

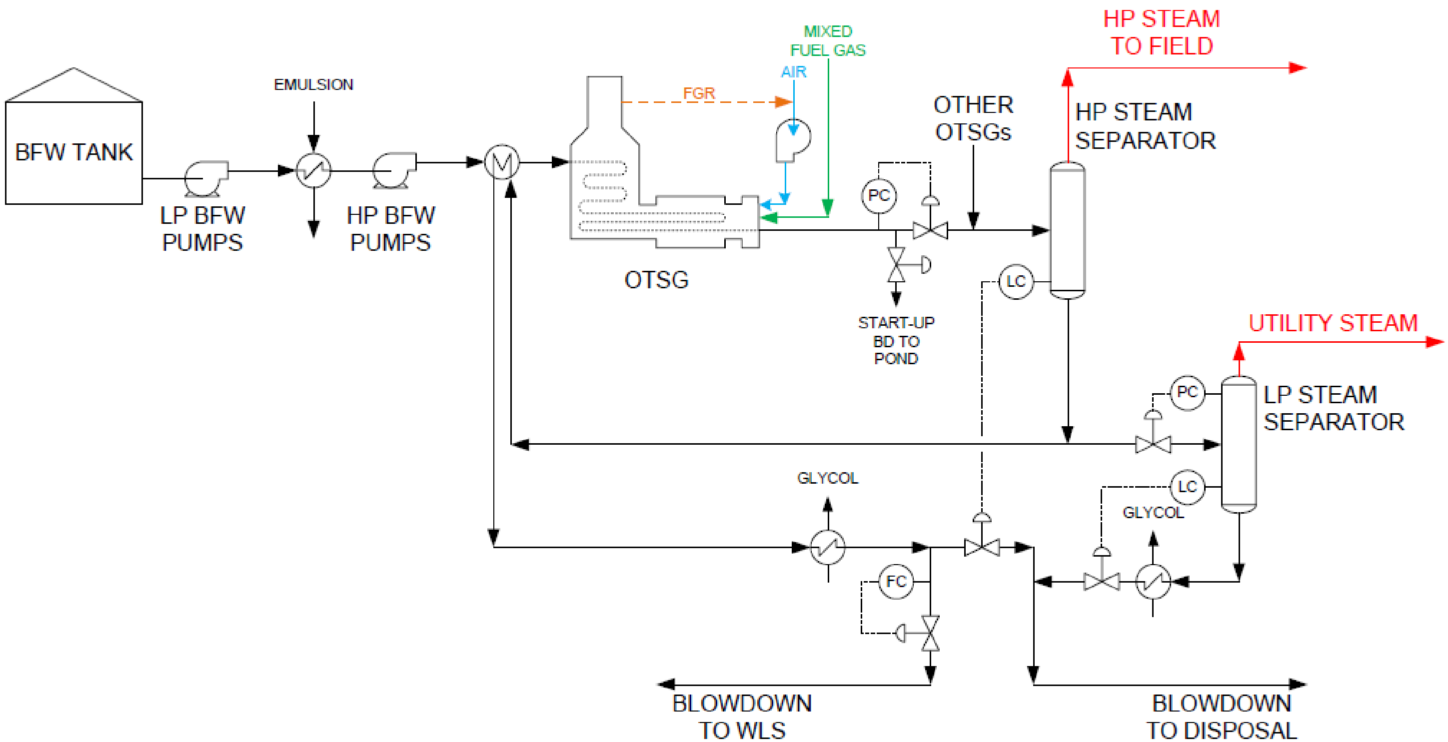


Steam Generation

Each Steam Generation train consists of:

- 5 Once-Through Steam Generators (OTSGs)
- 3 Low Pressure (LP) and 3 High Pressure (HP) Boiler Feed Water (BFW) Pumps
- LP Steam system
- Blowdown cooling and disposal

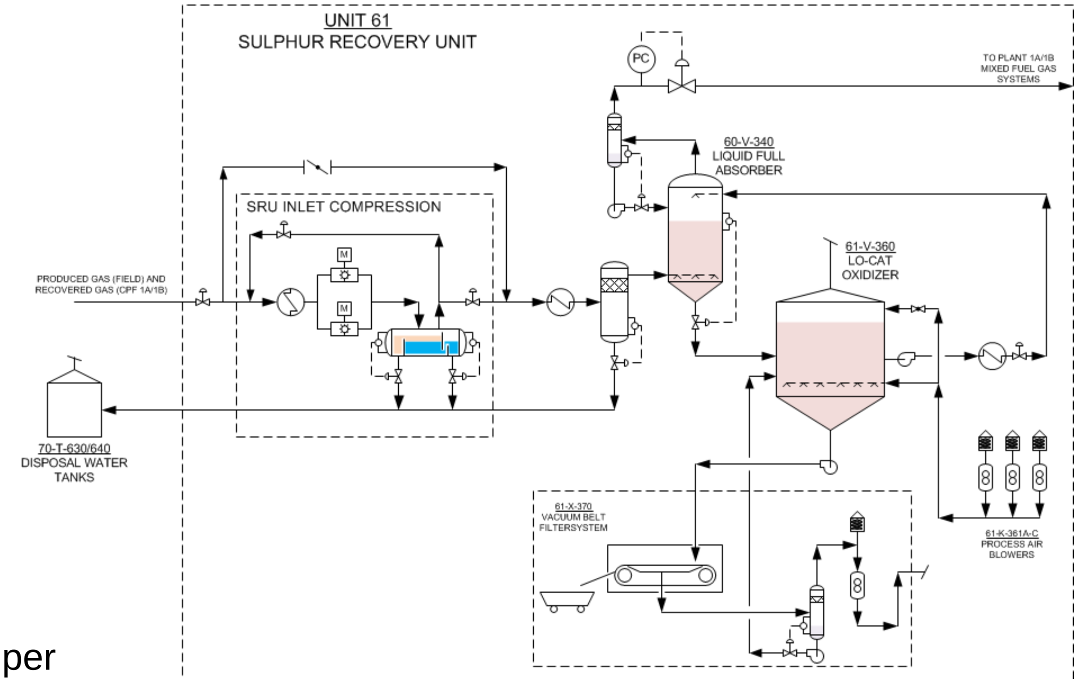
The performance of the Steam Plant is at target quality and operating above original nameplate capacity.



LO-CAT Sulphur Recovery Unit (SRU)

- Permanent SRU online as of October 2015

- SRU consists of:
  - Sour Gas Compression Package
  - Cooler & Coalescing Filter
  - Liquid Full Absorber
  - Absorber Knock Out Pot
  - LO-CAT® Oxidizer
  - Solution Cooler/Heater
  - Process Air Blowers
  - Vacuum Belt Package
  - Circulation, Slurry, and Chemical Feed Pumps, Tanks, and Ancillary Equipment



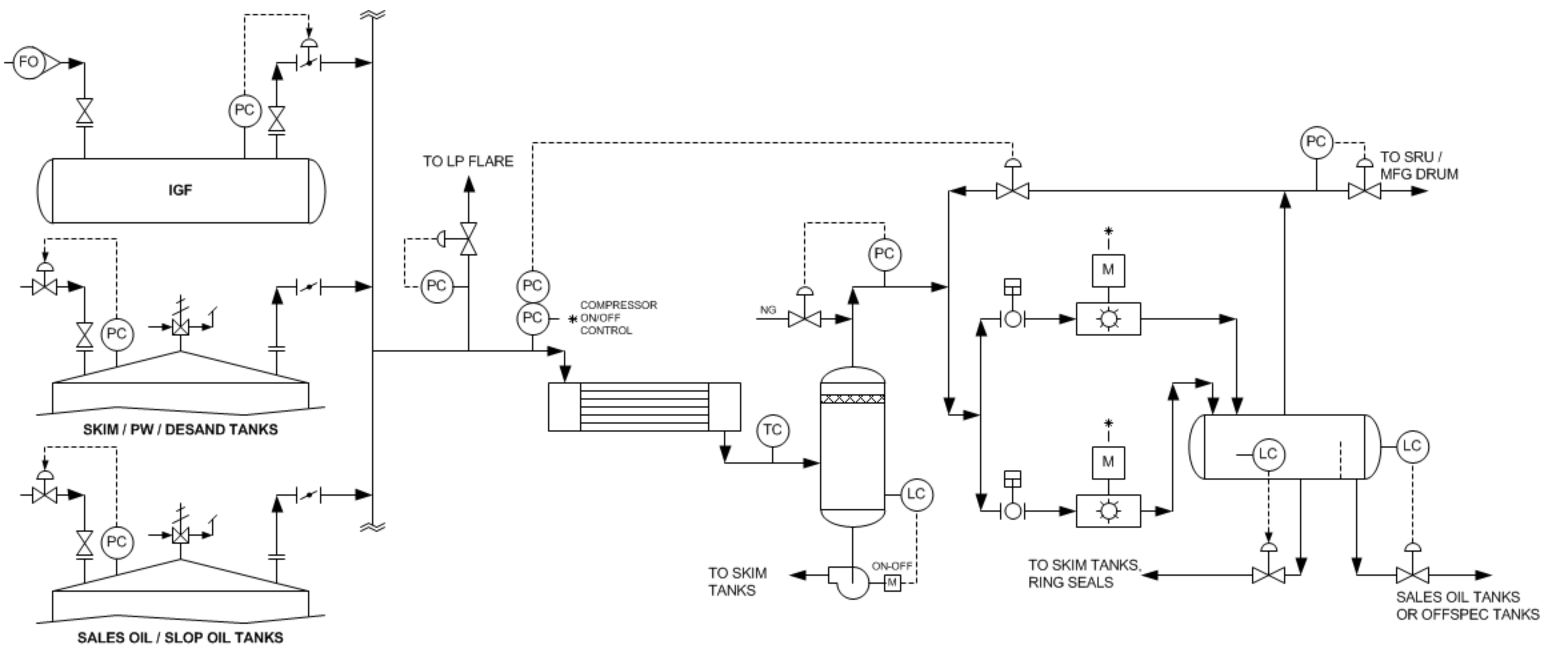
- SRU KPI's are:
  - Sulphur Recovery: minimum 70 % per calendar quarter (currently ~84% average)
  - SO_2 Emission Limit < 1.6 t/d (currently ~0.4 t/d)

- Triazene Scrubber Package
  - Authorization received January 18, 2017

- SRU Turn-Around between June 5 and June 18, 2017
  - Completed successfully

Vapour Recovery

- Each Storage Tank Vapour (STV) recovery system consists of:
  - Collection header with high pressure diversion to LP Flare
  - 1 Inlet Cooler & Suction Scrubber
  - 2 Liquid Ring Compressors
  - 1 Discharge Separator
  - 2 Casing Water Coolers (liquid ring seal water)
  - Condensate Pumps



Facility Modifications

- Oil in produced water (under-carry of emulsion and/or dilbit) (Tank Venting)
  - Treater nuclear profilers installed and internals ordered for replacement
  - Initiated a multi-vendor review of inlet mixing (emulsion and diluent)
    - Original equipment manufacturer
    - Independent Engineering Contractor review
    - Computational fluid dynamics (CFD) review of the inlet mixing system
    - Added new static mixer (Inlet Mixing)
    - Added new diluent injection distributor (Inlet Mixing)

- Rag and slop draining (flashing in tanks)
  - Adding control valve to restrict slop/rag run-down rates in progress

- Produced water cooler fouling (Tank Venting)
  - Make-Up Water Quench (improved heat efficiency and reduced fouling)

- Vapour recovery system (Tank Venting)
  - Reviewed and replaced recycle valve trim and liquid control valves to optimize the system
  - Planned upsize of the discharge scrubber vapor line in 1B STV system
  - Currently diverting fluid from the suction scrubber to the dilbit tank (instead of skim tank) to prevent cycling of light ends, permanent fix in the works
  - Final submission date September 6, 2017

Facility Modifications (cont'd)

- Permanent Varsol Storage
  - Two 20,000 litre diesel storage tanks were converted to store mineral spirits (Varsol™)
  - On site storage reduced trucking deliveries from monthly to annual
  - AER Approval by e-mail notification (April 26, 2017)

- Permanent diluent storage operational (first fill December 2016)

- OTSGs:
  - Flue Gas Recirculation System Suspension Notification (October 17, 2016)
  - Structural reinforcement completed

- Permanent produced water / make-up water quench line

Facility Modifications – OTSGs

Structural Reinforcement:

- OTSGs were experiencing high vibration issues; cracking in the breech section, currently undergoing breech structural reinforcement
- FGR offline and being removed

NOx Reduction

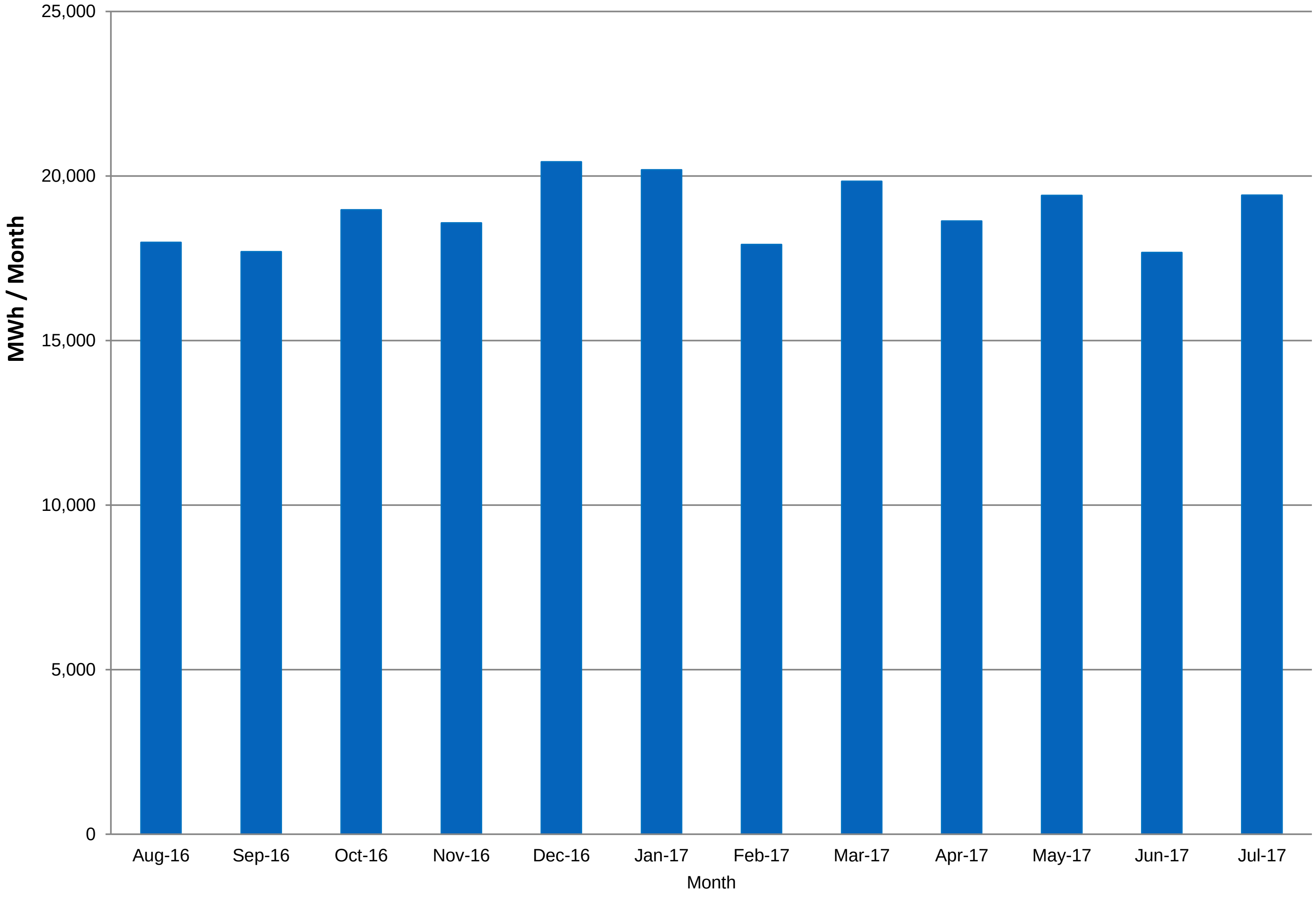
- Investigation with external engineering contractor to change the operating parameters to reduce NOx emissions

2. Facilities Performance

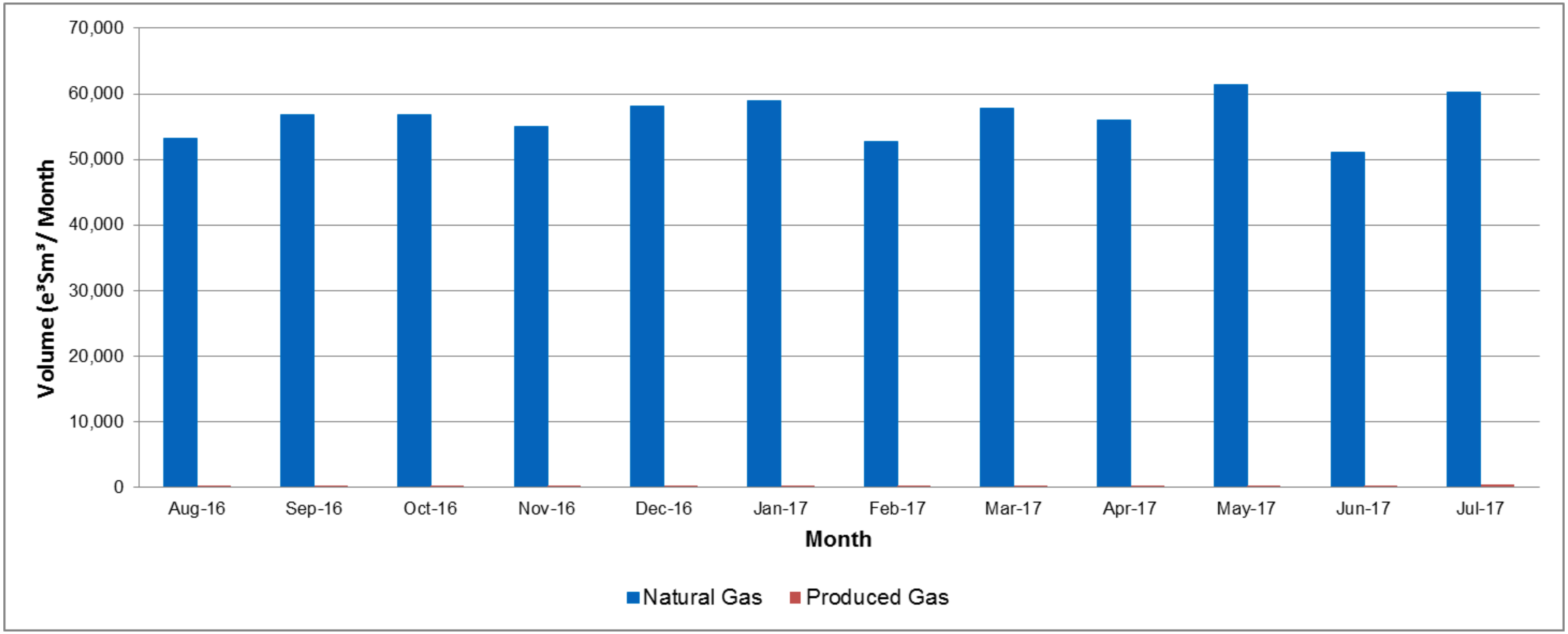
SRU Issues Summary

- October 3, 2016 – Met with AER to present mitigation plan and schedule
- October 21, 2016 – Husky sent letter requesting extension of the June 21, 2016 authorization until March 31, 2018
- October 28, 2016 – AER granted extension request
- Waiver (including turn-around) AER approved May 26, 2017
- Mitigation plan for the SRU oxidizer vent hydrocarbon emissions
  - Produced water / make-up water Quench installed
  - Casing gas bypass / increased Group Separator pressure increase in planning
- CEMS
  - Husky is continuing to sample the oxidizer vent stack for H_2S on a regular basis
  - To date, H_2S has not exceeded the regulatory limit in the vent stream sample

Power Consumption

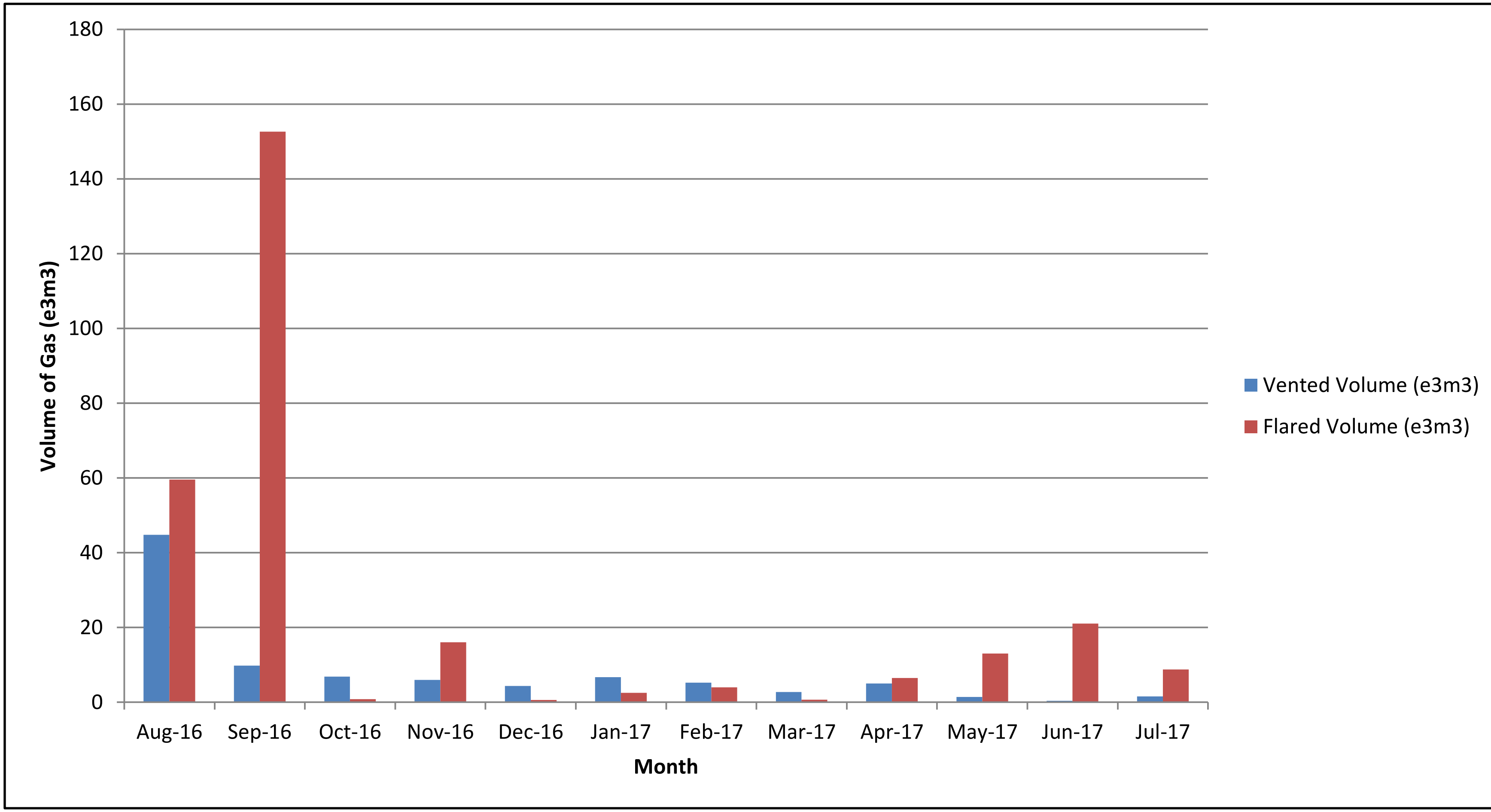


Gas Usage



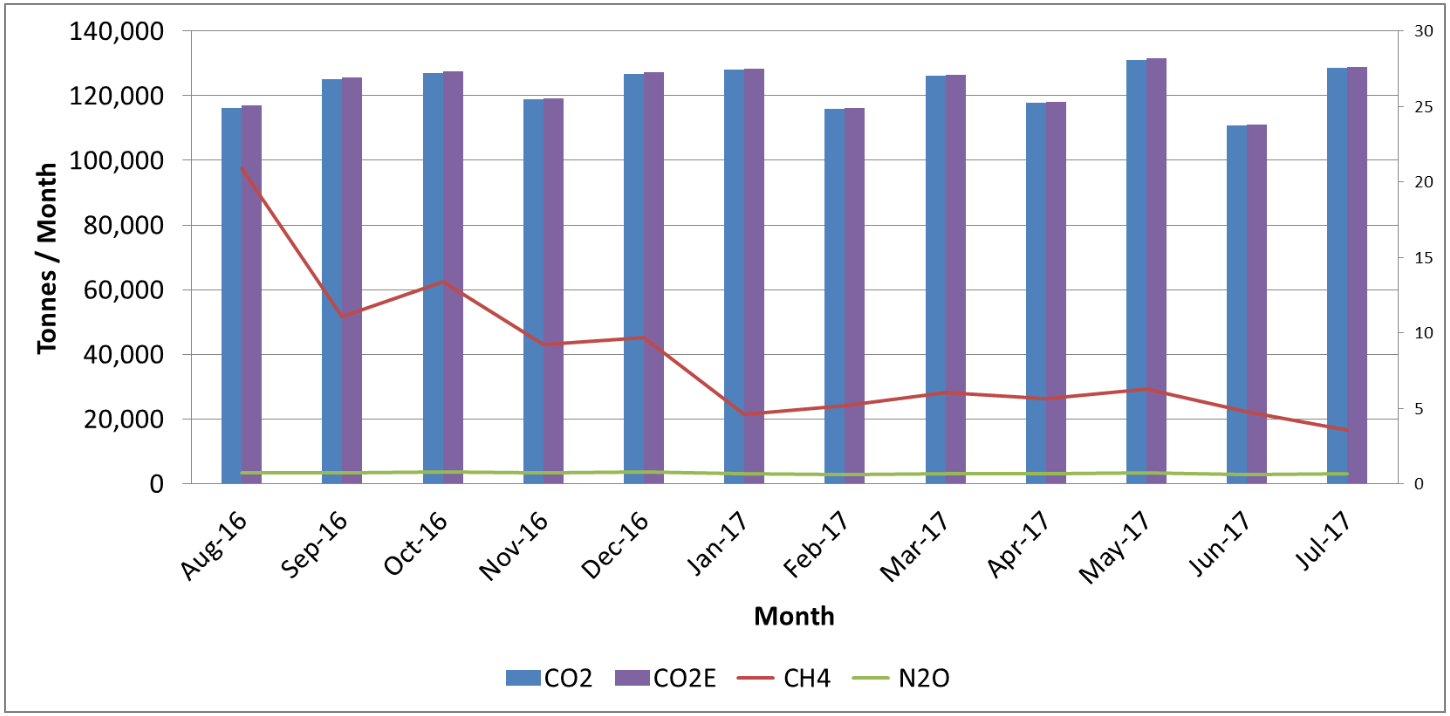
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
Volume (e³Sm³/ Month
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Jan-17
Feb-17
Mar-17
Apr-17
May-17
Jun-17
Jul-17
Month
Natural Gas
Produced Gas

Flaring and Venting



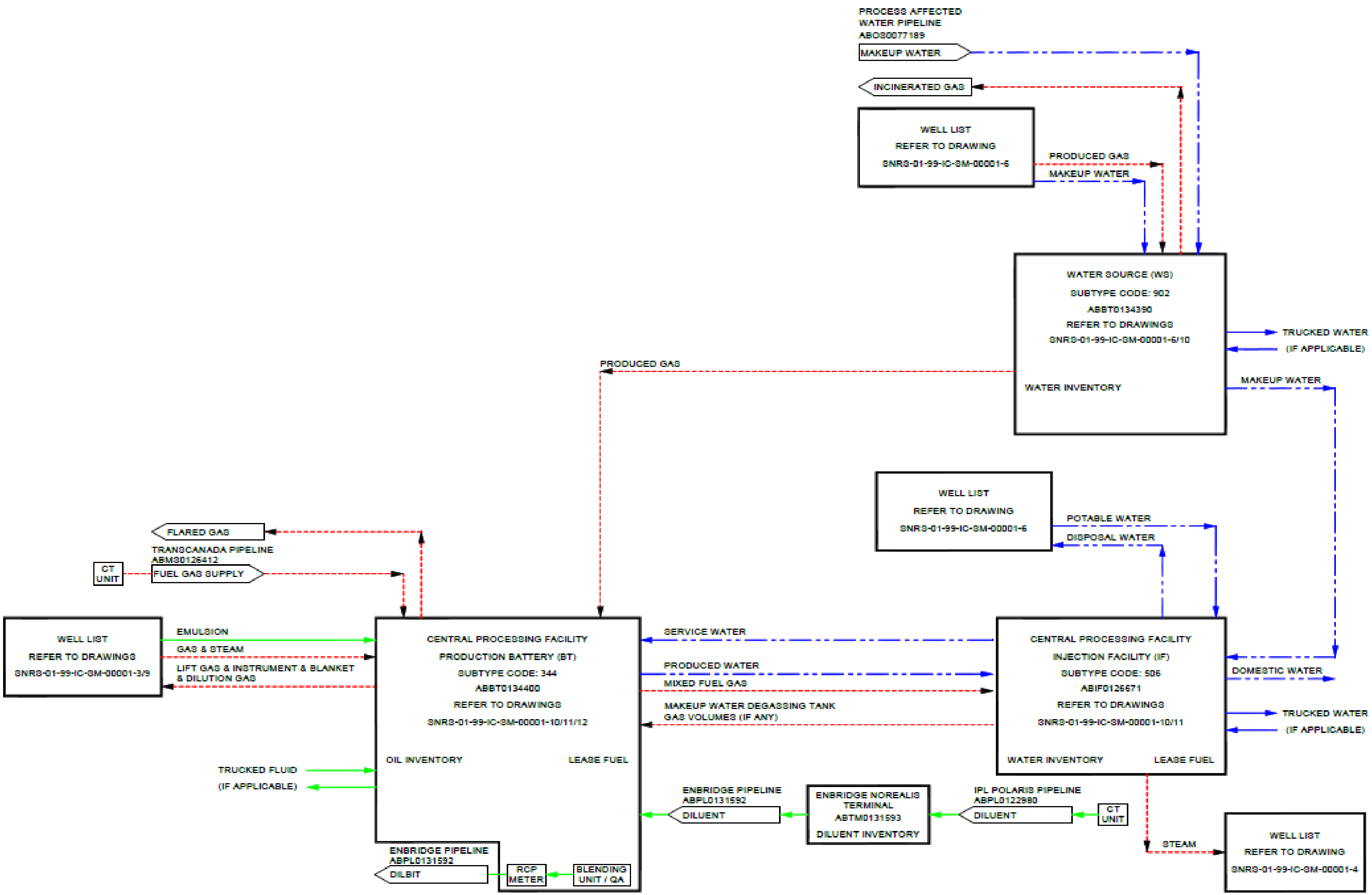
Green House Gas (GHG)

- Emission sources considered include stationary combustion associated with steam generators and glycol heaters, flaring, venting and fugitive emissions. Does not include GHG emissions from fugitives and mobile sources, propane and diesel combustion



3. Measurement and Reporting

Measurement and Reporting - Overview



Measurement and Reporting Water Source Battery ABBT0134390

- Kearl MUW well lists:
  - 09-24-096-08W4
  - 01-13-096-08W4
  - 06-30-096-07W4
  - 12-08-096-07W4
  - 11-17-095-07W4
  - 12-20-096-07W4
  - 14-18-096-07W4
  - 06-19-096-07W4

- Transfer water to Oil Battery from Water Source Battery through the desand tank from September 2016 to November 2016

- Transfer water to Oil Battery from Water Source Battery through the temporary quench line starting December 2016. Permanent quench line in place in September 2017

- Water source battery water balance closed at:

(0% balance is due to assigning water to the temporary quench line)

Date	Water Balance (%)
Aug-16	3.9
Sep-16	0.9
Oct-16	1.3
Nov-16	3.3
Dec-16	1.2
Jan-17	0
Feb-17	0
Mar-17	0
Apr-17	0
May-17	0
Jun-17	0
Jul-17	0

Measurement and Reporting Injection Facility ABIF0126671

- Primary and secondary Boiler Feed Water (BFW) measurement balances within 5%
- Reported Spent Lime Pond inventory:
  - Sources: OTSG blowdown, SWS, leachate from landfill
  - Users: Water treatment
- Fuel gas inlet orifice plate orientation for all 1A OTSG's fixed as of April 2017
- Trucked in/out water loads are accounted for
- Injection Facility closing water balance and steam allocation:

Date	Water Balance (%)	Steam Allocation (%)
Aug-16	2.3	0.98
Sep-16	0.4	1.00
Oct-16	-1.2	0.99
Nov-16	-3.9	1.00
Dec-16	4.7	1.01
Jan-17	3.1	1.01
Feb-17	2.7	0.92
Mar-17	5.4	1.00
Apr-17	3.7	0.98
May-17	3.2	1.01
Jun-17	1.5	0.95
Jul-17	3.3	1.00

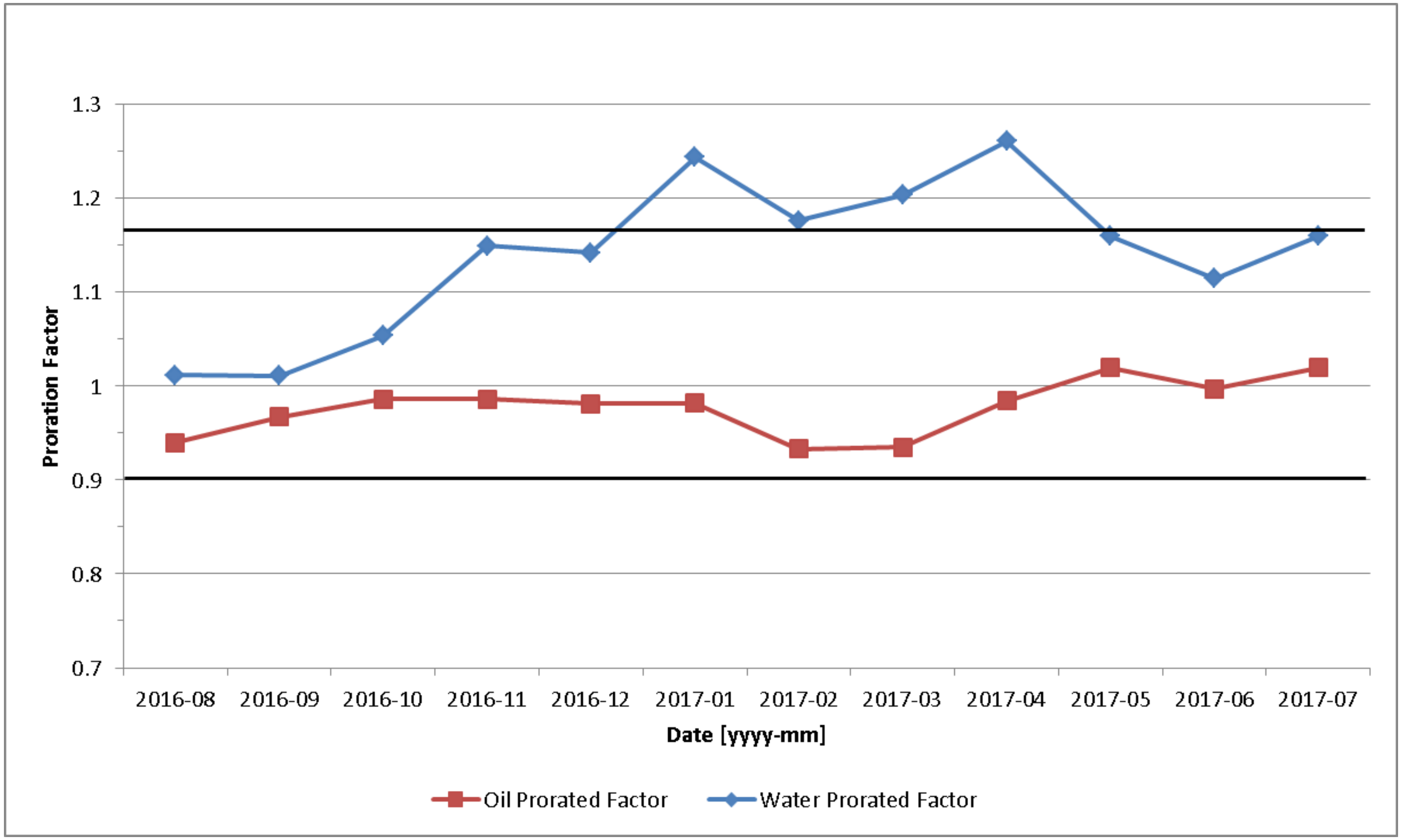
Measurement and Reporting
In Situ Oil Sands Battery ABBT0134400

- Primary and secondary produced water measurement balances within 5%
- Permanent diluent storage tank in place as of January 2017, convert temporary diluent tank back to dilbit storage tank
- Starting to use gas chromatography to calculate diluent loss (June 2017)
- Trucked in/out water and oil loads are accounted for the reporting period

Monthly Battery GOR	
Date	GOR e^3m^3/m^3
Aug-16	0.00966
Sep-16	0.00778
Oct-16	0.00649
Nov-16	0.00646
Dec-16	0.00697
Jan-17	0.00613
Feb-17	0.00774
Mar-17	0.00923
Apr-17	0.00069
May-17	0.00384
Jun-17	0.00494
Jul-17	0.00208

Measurement and Reporting
In Situ Oil Sands Battery ABBT0134400

- Proration factors



4. Water Production, Injection and Uses

Water Usage

Water Sources:

- Quaternary (non-saline)
  - 2 wells – 01-23 and 16-22-095-07W4 – Licence No. 00267760
  - Licenced to divert 202,575 m^3 annually for Industrial (Camp) purposes
    - 2016 Withdrawal: 36,969 m^3
    - Up to 10 m^3/d for SRU RO package feed (starting September/October 2015)
  - Outflow: licenced to divert 202,575 m^3 annually from the *Domestic Waste Water Treatment Plant* for Industrial (injection) purposes
  - Withdrawal from August 1, 2016 – July 31, 2017: 42893 m^3

- Basal McMurray - Kearl (non-saline) – Approval No. 00241442
  - 8 Wells – 09-24, 01-13-096-08W4 and 06-19, 14-18, 12-20, 12-08, 06-30, 11-17-096-07W4
  - Approved to divert 2,190,000 m^3 annually for Industrial (injection) purposes
  - 2016 Withdrawal: 1,630,217 m^3
  - Withdrawal from August 1, 2016 to July 31, 2017: 1,620,053.61 m^3

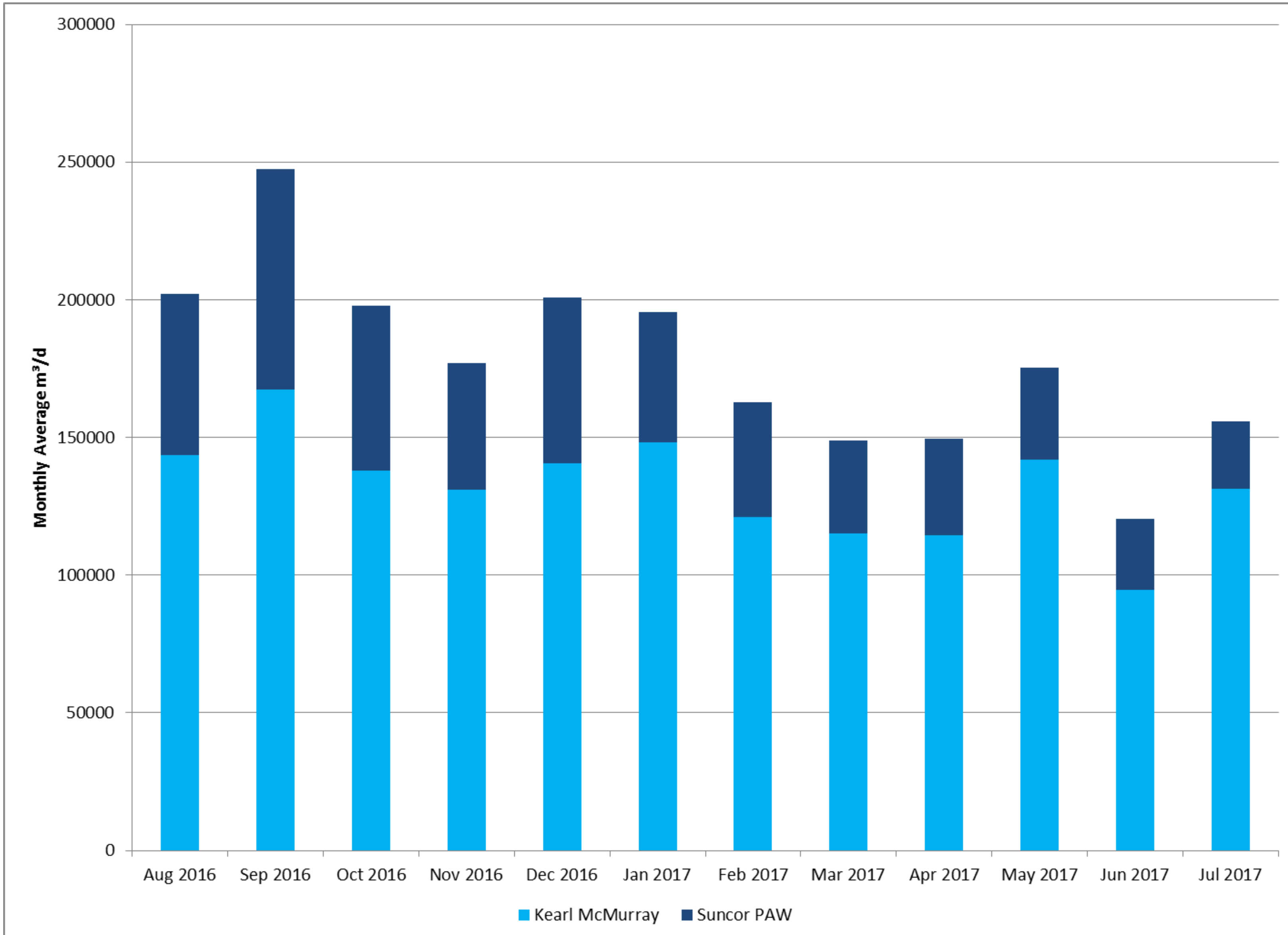
- Process Affected Water - Suncor (PAW) (non-saline) – Licence No. 00331569
  - Licenced to divert 3,650,000 m^3 annually for Industrial (injection) purposes
  - Sourced from Suncor Oil Sands Facility
  - 2016 Withdrawal: 744,698 m^3
  - Withdrawal from August 1, 2016 to July 31, 2017: 545,531 m^3

Water Usage (cont'd)

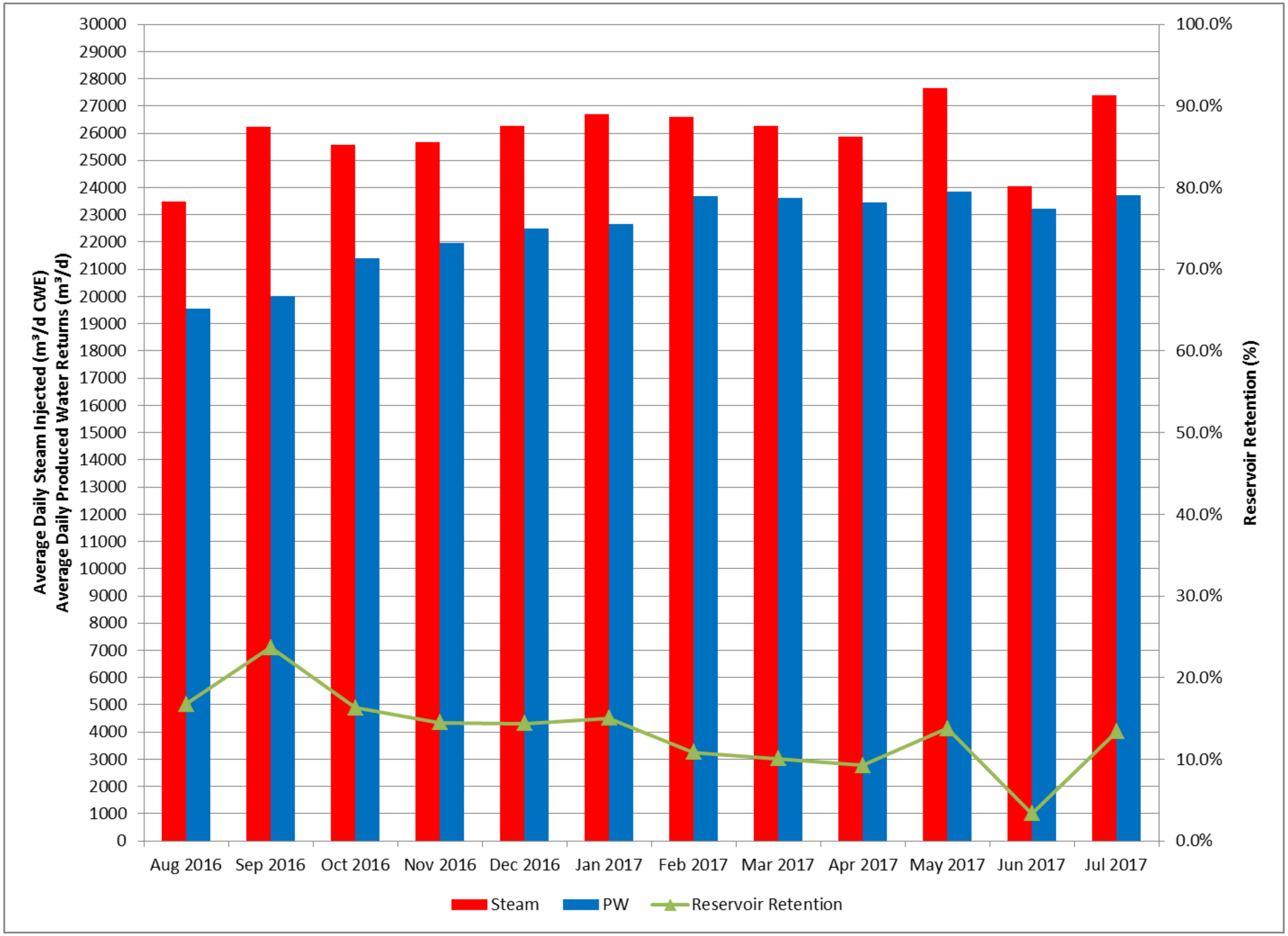
- No Brackish water sources are currently available to Sunrise

- Produced Water
  - All produced water sent to water treatment
  - All neutralized waste from water treatment diverted to pond.
  - All pond supernatant water recycled to water treatment
  - Portion of steam blowdown recycled to water treatment, remainder disposed via deep well injection

Total Make-Up Water Consumption



Produced Water & Steam Injected



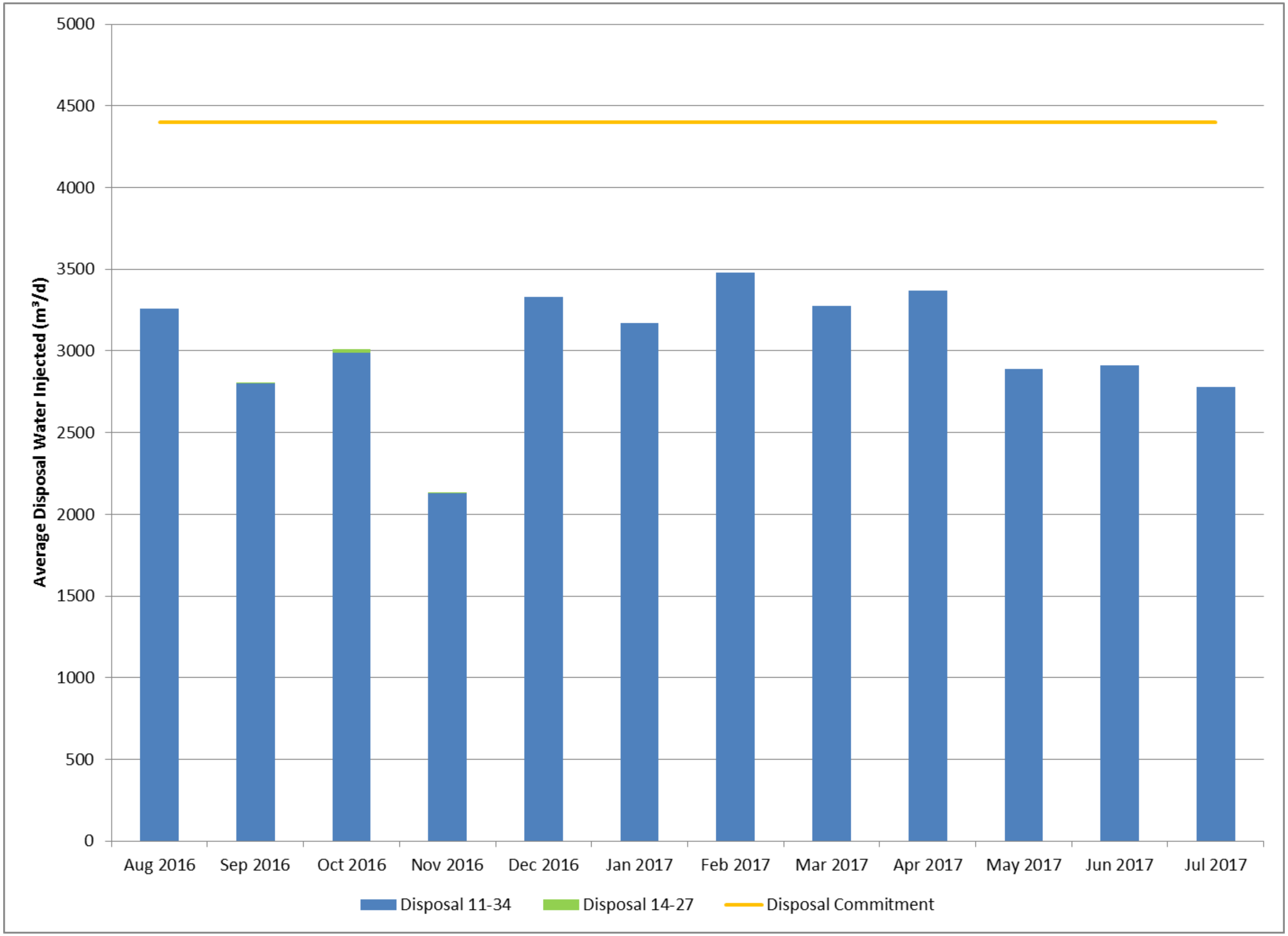
Water Disposal Limits

- Class 1b Disposal Approval 11754C
  - Four disposal wells 14-27, 03-34, 04-34 and 11-34-094-07W4
  - Maximum well head injection pressure: 5,000 kPa_g

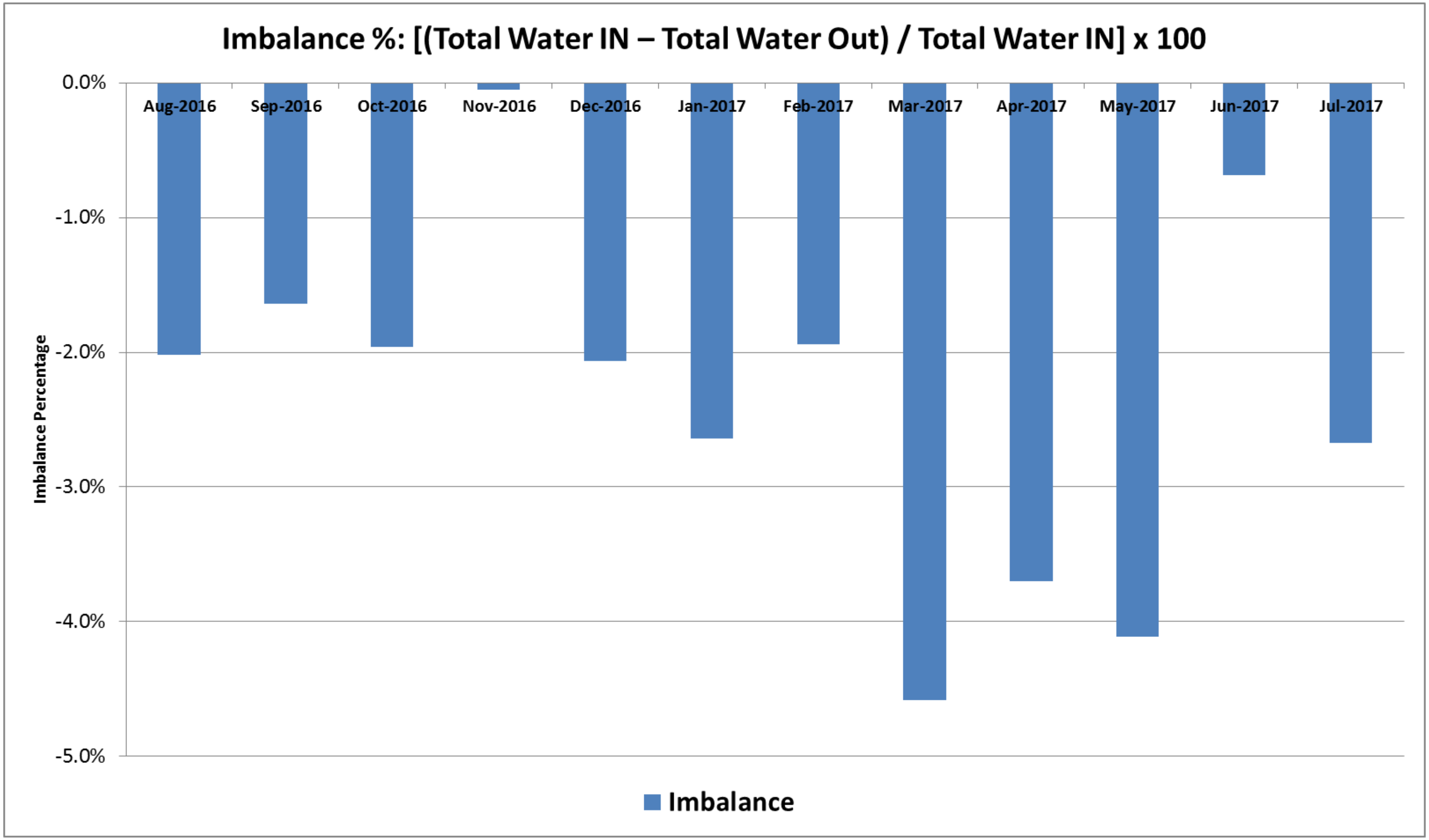
- Daily Disposal Limit Commitment = 4,400 m^3/day
  - 2016 total fluids disposed = 891,255 m^3
  - Fluids disposed for August 1, 2016 to July 31, 2017: 1,125,147 m^3

- Directive 081
  - PAW and Kearl source water well disposal factors = 0.25
  - Produced water disposal factor = 0.10
  - 2016 Disposal Limit (%) = 14.11
  - 2016 Actual Disposal (%) = 9.99

Water Disposal

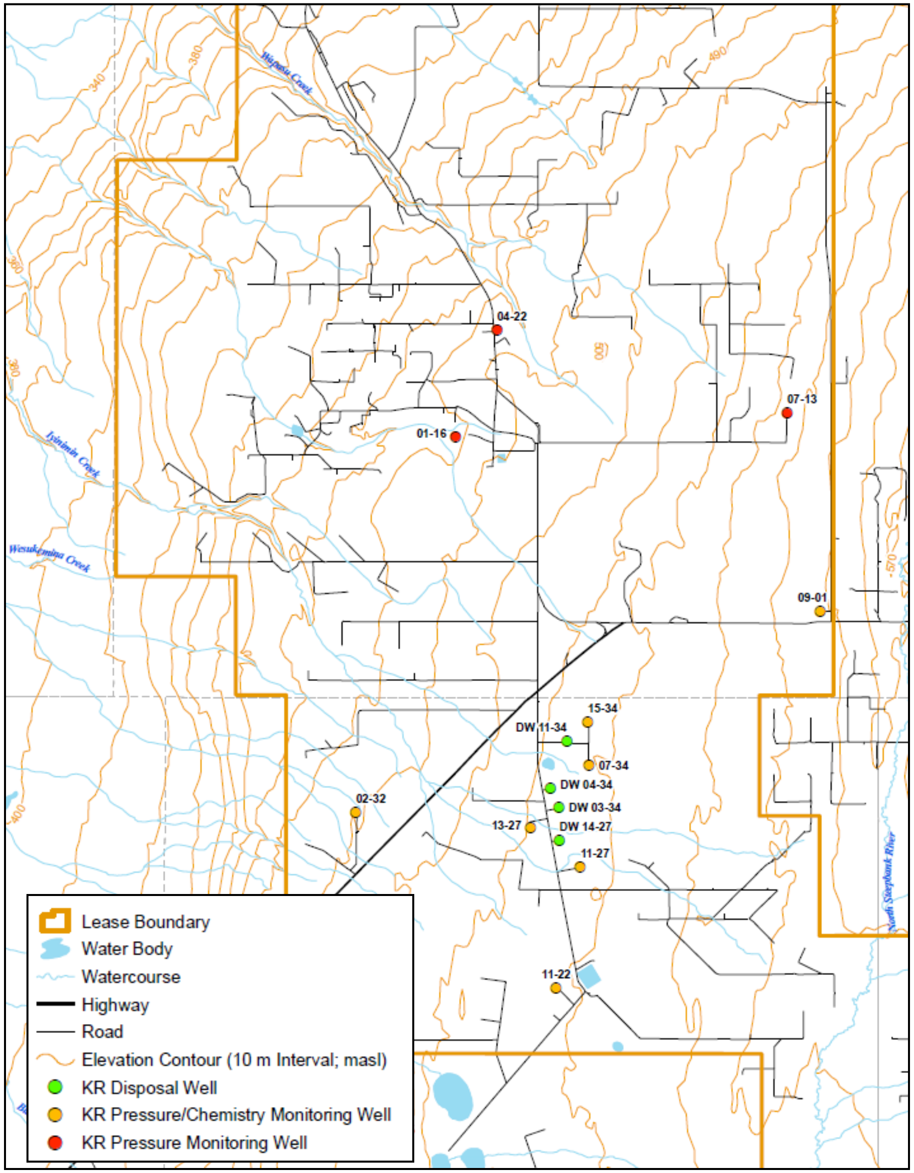


Monthly Injected Water Balance

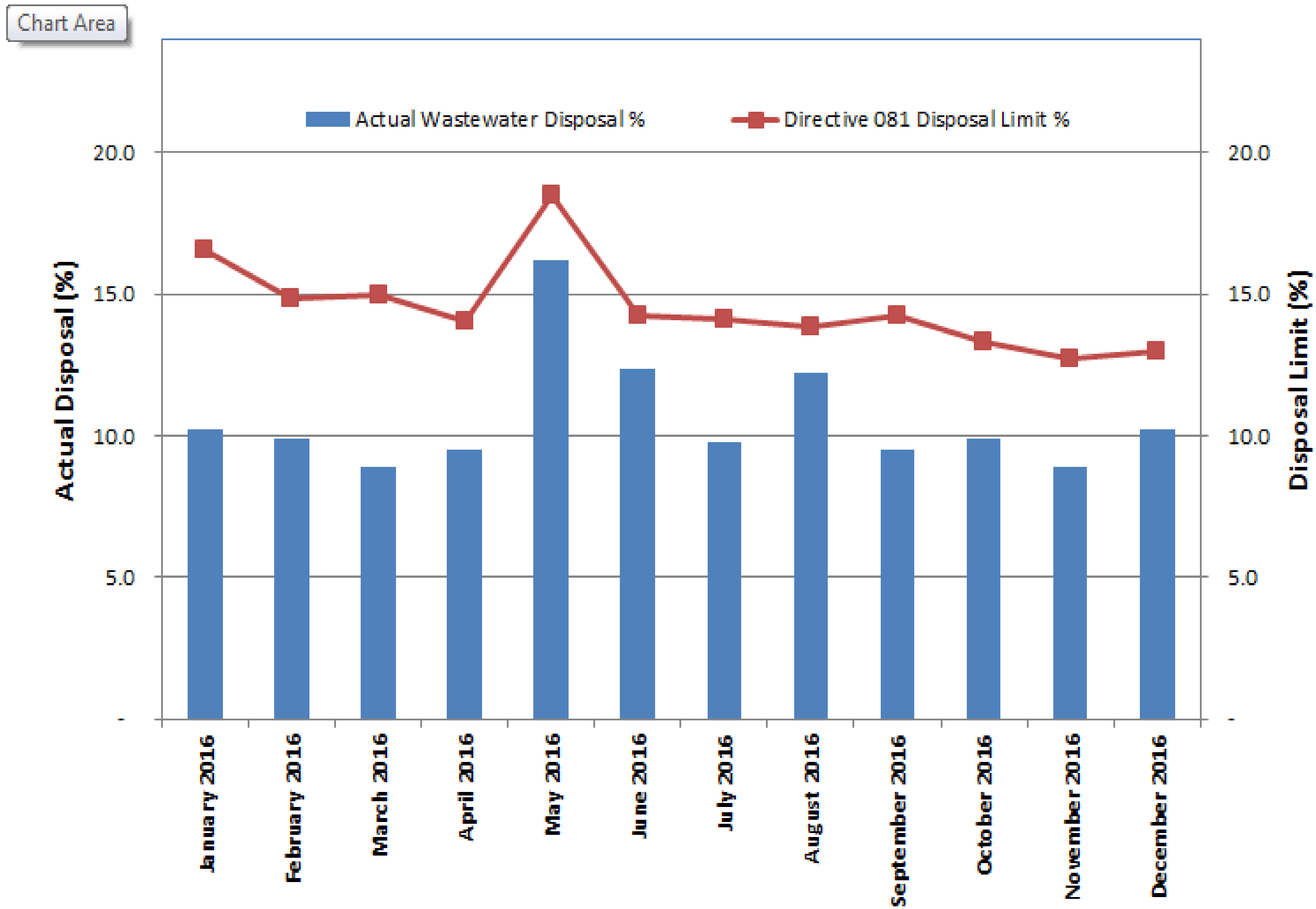


Disposal Wells

- AER Class 1 Approved Disposal Wells (Approval No. 11754C)
  - 100/11-34-094-07W4/00
  - 100/14-27-094-07W4/00
  - 102/03-34-094-07W4/00
  - 100/04-34-094-07W4/00
- Pressure Monitoring Wells
  - 100/01-16-095-07W4/00
  - 100/07-13-095-07W4/00
  - 100/04-22-095-07W4/00
- Pressure/Chemistry Monitoring Wells
  - 100/15-34-094-07W4/00
  - 100/07-34-094-07W4/00
  - 100/13-27-094-07W4/00
  - 100/11-27-094-07W4/00
  - 100/02-32-094-07W4/00
  - 100/11-22-094-07W4/00
  - 100/09-01-095-07W4/00



Monthly D81 Actual Disposal Vs. Disposal Limit



Disposal Summary

- Class 1b Disposal Approval No. 11754C
- 2016 Annual Report submitted to AER; Approved July 21, 2017
- 2016 total fluids disposed = 891,255 m^3
  - Fluids disposed August 1, 2016 – July 31, 2017: 1,125,147 m^3
- No exceedances in the Maximum Well Head Injection Pressure of 5,000 kPa_g
- No exceedances of the Daily Disposal Limit Commitment of 4,400 m^3/d
- The monitoring wells continue to show pressure responses as a result of disposal
- Interpretation of two local and one intermediate flow system to explain the hydraulic head at the monitoring wells has not changed
- Chemistry results indicate effects of disposal from the Project at wells 100/15-34-094-07W4/00 and 100/11-27-094-07W4/00
- Muted pressure response observed in off-reef monitoring well 100/09-01-095-07W4/00

Data Gaps

Pressure Data Gaps >30 days: Monitoring Well 111/01-16-095-07W4/00

- Malfunctioned November 4, 2015 – discussed and alternative plan agreed upon with AER
  - Monitoring well 103/04-22-095-07W4/00 approved by AER in February 2016 as an alternative to well 111/01-16-095-07W4/00 until it can be repaired
  - Monitoring data from well 103/04-22-095-07W4/00 is included for the current reporting period

Landfill Waste Handling

- Class 2 Oil Field Landfill Onsite Approval No. WM139A
- WM139A amendment approval issued February 2016 to accept sulphur waste from the SRU

Waste Description	Receiving Facility	Total	Unit
Contaminated Debris and Soil (crude/condensate)	Husky Sunrise Landfill	28.5	m3
Contaminated Debris and Soil (produced/salt water)	Husky Sunrise Landfill	247.1	m3
Cement	Husky Sunrise Landfill	56	m3
Construction/Demolition Debris	Husky Sunrise Landfill	954.5	m3
Sulphur Waste	Husky Sunrise Landfill	491	m3
Contaminated Debris and Soil (non-halogenated aromatic)	Husky Sunrise Landfill	22	m3
Filters - Water Treatment	Husky Sunrise Landfill	43	m3
Limestone (pH control)	Husky Sunrise Landfill	300	m3

Waste Volumes

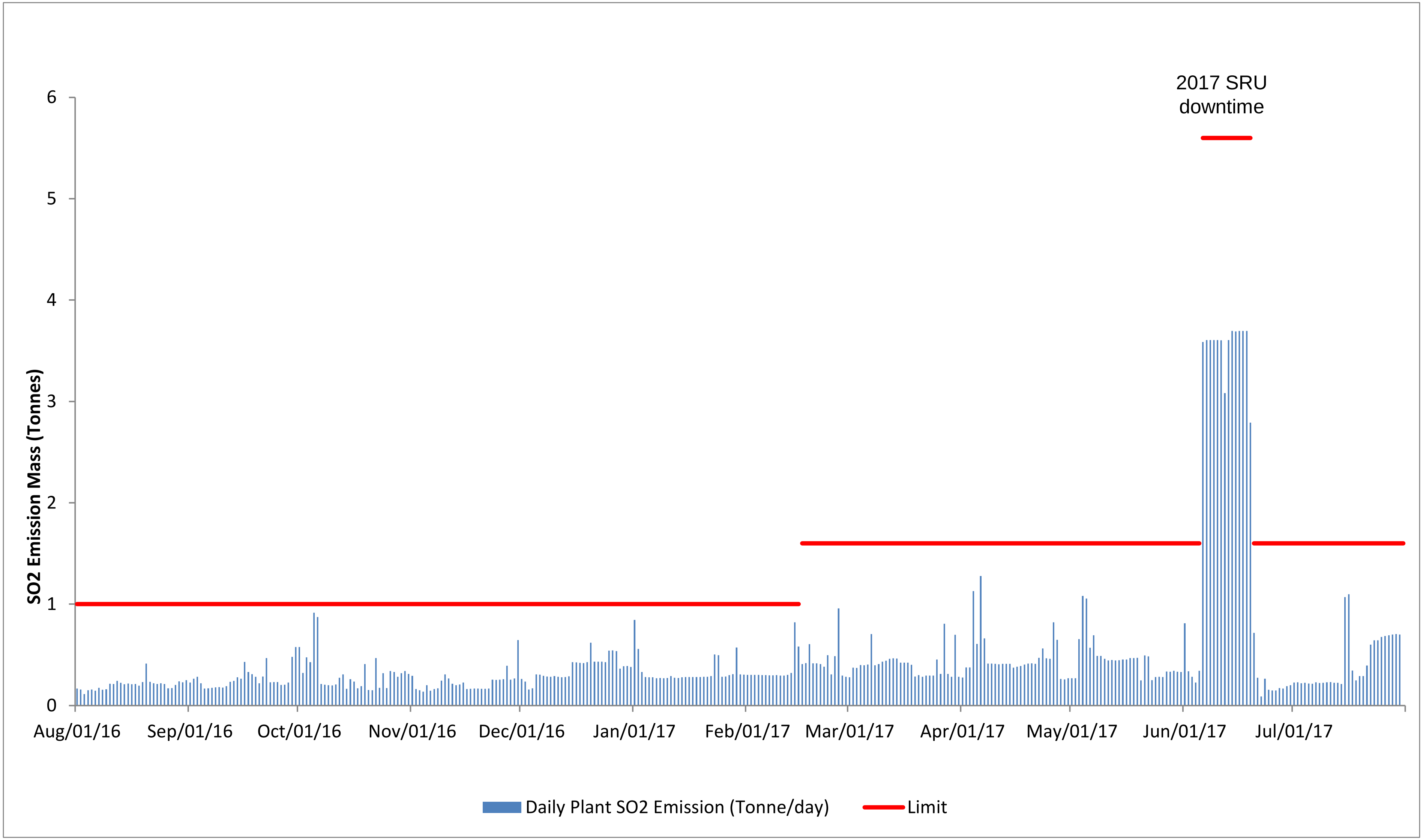
Waste Code	Waste Description	Receiving Facility	Total	Unit
COEMUL	Slop Oil	White Swan Grassland	676	m3
		New Alta Elk Point	1118	m3
		New Alta Fort Mac 881	12362	m3
		New Alta Hughenden	232	m3
		New Alta Red Water	120	m3
	Waste Oil Solids	White Swan Grassland	12	m3
		New Alta Fort Mac 881	326	m3
CAUS	Caustic / Water	New Alta Red Water	225	m3
		White Swan Conklin	111	m3
		White Swan Grassland	625	m3
METHNL	Methanol	White Swan Grassland	13	m3
ACTCRB	Activated Carbon	New Alta Fort Mac 881	18	m3
		White Swan Grassland	19	m3
DRWSGC	Drilling Mud	New Alta Fort Mac 881	128	m3
GLYC Water	Glycol and Water	New Alta Fort Mac 881	19	m3
		New Alta Red Water	17	m3
		White Swan Grassland	9	m3
SWTLIQ	Lo-Cat Solution and Water	New Alta Fort Mac 881	580	m3
		New Alta Hughenden	8	m3
		New Alta Red Water	7	m3
		White Swan Grassland	148	m3
FILPWT	FILPWT Produced / Process Water	White Swan Conklin	20	m3
ACID	Acid solution - Unneutralized	Miller Environmental	1.54	m3
BATT	Batteries - Wet and Dry Cell	General Recycling Industries	1.5	m3
CAUS	Caustic Solutions - Unneutralized, Spent	Miller Environmental	4.6	m3
DOMWST	Contaminated Garbage / Contaminated Domestic Waste	Clean Harbors - Ryley Class 1A	224.02	m3
DOMWST - FT4	4' Fluorescent Tubes	Miller Environmental	2.3	m3

Waste Volumes (cont'd)

Waste Code	Waste Description	Receiving Facility	Total	Unit
DOMWST - NH	Non-Hazardous Garbage - Domestic Waste	Clean Harbors - Ryley Class 1A	25.3	m3
DOMWST - P	Plastic Waste - Plastic Sheeting, Plastic Liners, Waste Shrink Wrap	Clean Harbors - Ryley Class 1A	36.8	m3
EMTCON	Plastics	Pnewko Trucking Ltd.	9.66	m3
EMTCON-A	Aerosol Cans - Empty	Miller Environmental and General Recycling	1.4	m3
EMTCON - P	Empty Container - Plastic Pails, Jugs, etc.	Pnewko Trucking Ltd.	20.7	m3
EMTCON-PD	Empty Container - Plastic Drums (Non-rbw)	Pnewko Trucking Ltd.	0.82	m3
		Blue Planet Recycling	1.435	m3
EMTCON-PT	Empty Container - Plastic Totes (>= 1 m3)	Pnewko Trucking Ltd.	53	m3
EMTCON-SB	Empty Container - Sample Bottles	Clean Harbors - Ryley Class 1A	0.46	m3
FILLUB	Filters - Lube Oil	General Recycling Industries	0.23	m3
GLYCHM	Glycol Solution - Containing Lead or Other Heavy Metals	Clean Harbors - Devon Deepwell Class 1A	1	m3
INOCHM	Chemicals - Inorganic	Miller Environmental	2.355	m3
NORM	Waste - Miscellaneous	Tervita Corportation - NORM Services (NORMCAN)	4.6	m3
OILABS	Absorbents	MCL - Leduc Regional Landfill	4.6	m3
OILRAG	Rags - Oily	MCL - Leduc Regional Landfill	0.23	m3
ORGCHM	Chemicals - Organic	Miller Environmental	4	m3
PLASTIC	Empty Container - Plastic Pails, Jugs, etc.	Pnewko Trucking Ltd.	4.37	m3
SMETAL	Metal - Scrap	Clean Harbors - Ryley Class 1A	2.76	m3
		General Recycling Industries	19.31	m3
SOILCO	Contaminated Debris and Soil - Crude Oil/ Condensate	Secure Energy - Pembina Landfill (Class 2)	6	m3
		Secure Landfill	10	m3
		MCL - Leduc Regional Landfill - Class II	10	m3
		Clean Harbors - Ryley Class 1A	12	m3
SOILCO-DW	Contaminated Debris and Soil	Clean Harbors - Ryley Class 1A	3.3	m3
SOILSU	Contaminated Debris and Soil - Sulphur	Miller Environmental	7.105	m3
WSTCGS	Waste Compressed or Liquified Gases	Recycle Systems Company Inc.	0.205	m3
WSTMIS-R	Waste Hydraulic Hoses (prior to 14/12/17 Waste Rubber)	Clean Harbors - Ryley Class 1A	2.07	m3

5. Sulphur Production

SO_2 Emissions



Sulphur Dioxide (SO_2) Sources

- Ten Once-Through Steam Generators (OTSG) - all operational during the reporting period

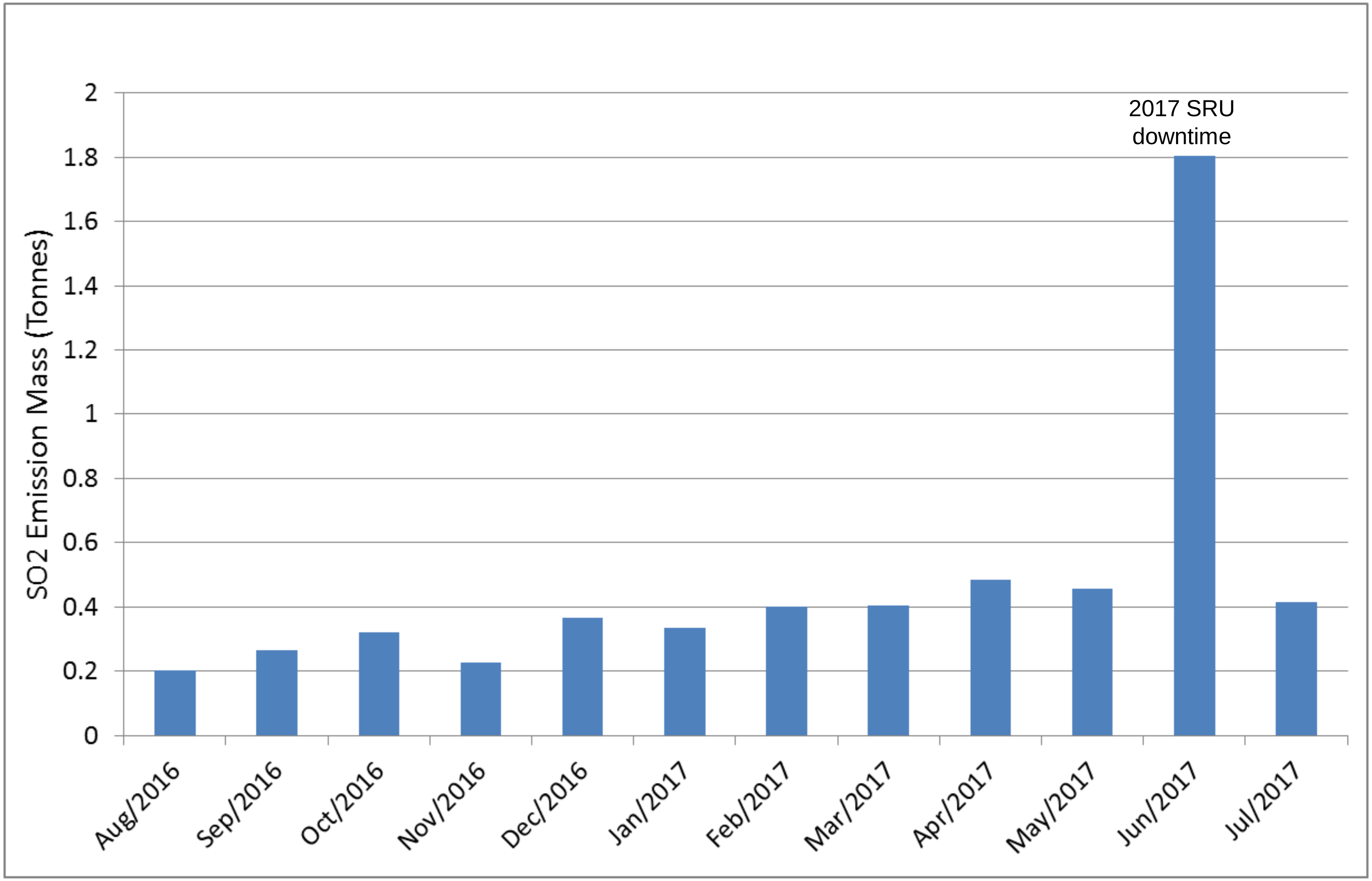
- Two High Pressure Flare Stacks – both operational during the reporting period

- Two Low Pressure Flare Stacks - both operational during the reporting period

Quarterly SO_2 Emissions

2016 Q3 (Aug – Sep)	14.28 tonnes
2016 Q4 (Oct - Dec)	28.13 tonnes
2017 Q1 (Jan – Mar)	34.15 tonnes
2017 Q2 (Apr – June)	82.80 tonnes
2017 Q3 (July)	12.90 tonnes

SO_2 Emissions Trends



Peak and Average SO_2 Emissions

- August 1, 2016 to July 31, 2017:

SO_2 Emissions	
Average Daily (Without SRU Turnaround)	0.317 Tonnes
Average Daily (With SRU Turnaround)	0.38 Tonnes
Maximum Daily (Without SRU Turnaround)	1.28 Tonnes
Maximum Daily (With SRU Turnaround	3.70 Tonnes

- EPEA Approval limit pre February 15, 2017 is 1.0 tonnes/day
- EPEA Approval limit post February 5, 2017 is 1.6 tonnes/day (February 2, 2017)
- SRU downtime from June 6, 2017 – June 20, 2017 had limit of 5.6 tonnes/day
- No exceedences

Ambient Air Monitoring

- Husky installed Permanent Air Monitoring Station (Wapasu AMS; AMS 17)
- Part of WBEA network of ambient monitoring stations and functions as a dual compliance and enhanced deposition station
- Reporting and monitoring is performed by WBEA
- No process related exceedences recorded during the reporting period
- PM2.5 and O_3 exceedences recorded as result of wildfires in the region
- Current monitored data available the following link
  - http://www.wbea.org/monitoring-stations-and-data/monitoring-stations/wapasu
- Historical monitored data available the following link
  - http://www.wbea.org/monitoring-stations-and-data/historical-monitoring-data

6. Environmental Issues

Environmental Issues – Compliance

- EPEA Approval 206355-01-00 (as amended):
  - Husky was in compliance with all regulatory approvals, decisions, regulations and conditions; with the exception of compliance items identified in this presentation
- Alberta Environment and Parks (AEP)
  - No compliance issues during this reporting period
- Federal Environmental and Regulatory Compliance:
  - No compliance issues during this reporting period except one item discussed in this report

Environmental Issues – Compliance (EPEA)

Spent Lime Pond (Release Notification File 294542)

- September 30, 2015: Action Plan Update
  - Completed north pond investigation and repair
  - Discovered defects of the liner at the penetration points of pipes crossing the primary and secondary liners
  - Pond design was retrofitted to remove the pipe penetrations

- January 24, 2016: Action Plan Update and Request for File Closure
  - Process water re-introduced into the north pond on December 10, 2015
  - Water chemistry data collected since the re-introduction of process water have not suggested leakage from the north pond

- March 2017: Husky proposed to replace the modified ALR calculation (ALRmod = X – Y) with a maximum acceptable pumped volume calculated for the North and South Leak Detection Sumps and submitted a technical document to AER for Approval

- June 2017: AER issued a written authorization for the proposed revisions to the monitoring and reporting requirements for the modified Action Leakage Rate (ALR) for the north and south spent lime ponds

Environmental Issues – Compliance (EPEA)

SRU Oxidizer Venting

- Event: October 2015, Husky identified on lease odours related to the SRU operation. Samples collected from the SRU hydrocarbon oxidizer vent stack. The results of the lab analyses indicated that there were concentrations of hydrocarbon compounds in the oxidizer vent stream
- Corrective Action: Husky disclosed to AER (AER File Ref. No. 305604). Husky submitted a request for temporary variance from the venting volumes listed on the Facility's Directive 056 license and from Directive 060 (venting) to allow Husky to continue to operate the SRU while developing a permanent mitigation strategy for the oxidizer vent stream. On January 25, 2017, Husky received AER variance extension until March 31, 2018

SRU Continuous Emissions Monitoring System (CEMS)

- Event: CEMS installed on the SRU vent to monitor H_2S concentration (ppmv) of the vented gas from the SRU exhaust vent did not operate due the sample extracted from the vent being too wet and causing the filter in the sample system to plug
- Corrective Action: Husky disclosed to AER (AER File Ref. No. 305572) and proposed corrected action (sampling system modification) based on recommendations by the CEMS vendor. The modifications did not resolved the issue.

Environmental Issues – Compliance (EPEA)

Late reporting, Low Risk Noncompliance

- Event: On December 12, 2016, AER was notified of a reportable spill 36 hours after it occurred. On December 20, 2016, AER issued a Low-Risk, Notice of Noncompliance (Inspection ID 458231) to Husky for late reporting the spill

- Corrective Action: Site personnel were reminded of the importance of reporting environmental incidents to their supervisors. Lines of communication were reiterated and reinforced. The Sunrise spill management procedure was revised. Action plan was submitted to AER to close the low risk non compliance

Continuous Emissions Monitoring System (CEMS) Operating Availability

- Event: While applying a software update in March 2017, the new update affected the calibration settings, which resulted in invalid data for five days causing CEMS availability <90%, which is a violation of the CEMS Code

- Corrective Action: Software to be updated by qualified vendors going forward

Environmental Issues – Compliance (Public Lands)

Public Lands Act – Unauthorized Use

- Event: On March 10, 2015, Husky notified the AER of a trespass under CIC No. 295762. The incident occurred when Husky excavated a borrow pit (SML 070061) beyond the approved boundary area and onto a neighboring MSL (101714) and LOC (080864) which were not approved for borrow excavation. At the time, Husky applied for a TFA to cover the time required to amend the MSL and LOC dispositions to be incorporated as part of the SML. On September 12, 2017, the TFA had expired and Husky had not submitted the amended lands applications. As such, Husky was issued a low risk inspection notification

- Corrective Action: Upon issue of the trespass, Husky applied for a TFA to cover the areas of the MSL and LOC. On October 19, 2016 amendment applications were submitted to MSL 101714 and SML 070061, a cancellation was submitted to LOC 080864 and a new MLL (160121) application was submitted. On May 31, 2017, a revised Conservation and Reclamation Plan was submitted for the SML which included the new dispositions

Environmental Issues - Releases

Summary of reportable releases during the reporting period:

Spill Material	Number of Incidents	Total Volume (m^3)	AER Notification
Process Affected Water	5	165.8	Release report submitted
Tank Venting	173	90,126.8	7-day letter and DDS report submitted

- Husky tracks all non-reportable spill incidents within the Corporate Incident Management System
- All incidents are reviewed weekly to ensure corrective actions are included and preventative measures are taken
- Submitted on September 6, 2017, a final high level summary of Husky's effort for the first two quarters of 2017 to reduce venting

Environmental - EPEA Submissions

Approval Date	Application Number	Application Name
2016-10-17	N/A	Notification - Suspension of OTSG Flue Gas Recirculation (FGR)
2016-10-28	N/A	Temporary Authorization – Extension Request, SRU Oxidizer Vent Stack CEMS
2016-11-02	N/A	Authorization – Kearl Source Water Wells Gas Management Plan
2017-01-18	N/A	Authorization – Triazine Scrubber Temporary Use
2017-02-16	011-206355	Amendment Application - Debottleneck 1B (Phase 1 production increase and change in sulphur recovery)
2017-05-26	012-206355	Amendment Application - SRU Downtime

N/A – not assigned

Environmental – Biodiversity

- As a requirement of the regulatory approval, Husky conducts an annual Environmental Monitoring Program with data compilation and report submission to the AER every three years (due 2019)
- Monitoring program and findings include:
  - Surface water quality and quantity
    - Discharge data thus far support the conclusion of the EIA that impacts would be below detectable levels
    - Negative effects on water quality attributable to Sunrise have not been found based on monitoring program data collected to date
    - New wetland and waterbody proposal submitted to AER (April); plan approved June 2016
  - Wetlands
    - Water level data observed at the source water wells and associated observation wells do not show evidence of a declining water level in the aquifer
    - General decreasing trend in pH levels will continue to be monitored; no other indications of trends in water quality results
    - No impoundment effect has been observed to date for the two monitored transects
  - Wildlife
    - No evident trend for habitat use and distribution for wildlife species based on dataset thus far
    - Canadian Toads not detected at Project site thus far
    - Tracking and camera surveys indicate the pipeline is crossable for birds and mammals including large ungulates (moose)

Environmental – Biodiversity (cont'd)

- Monitoring program and findings include:
  - Biodiversity
    - Trend showing preliminary higher instances of song bird species associated with edge and open habitat
    - Rare plant species detected during EIA are persisting in Project area
    - Mammal relative abundance and diversity does not appear to be negatively affected by anthropogenic disturbances in Project area based on dataset

Environmental – Wildlife

- Caribou Mitigation and Monitoring Plan
  - Approved by AER January 2015
  - Approved, but not developed, Project facilities to be located within the Richardson Caribou Range are limited to a potential road and single well pad
  - Development potentially within the range may occur after 2027
  - Currently undergoing caribou habitat restoration monitoring and wildlife camera data collection in caribou habitat along previous cut lines and seismic lines
  - Updated plan due October 2017

- Wildlife Mitigation, Enhancement and Monitoring Program
  - Approved by AEP December 2012
  - New monitoring and mitigation proposal submitted to AER (April); plan approved October 2016
  - Objectives and targets developed and monitored to address four key wildlife issues identified in the Environmental Impact Assessment (EIA):
    - Habitat Availability
    - Habitat Effectiveness
    - Disruption of Movement Patterns
    - Wildlife Mortality
  - Husky regularly monitors and reviews mitigation strategies to ensure ongoing effectiveness and evaluate areas for improvement

Environmental - Industrial Wastewater

- Disposal Locations:
  - Four Disposal wells: 100/14-27-094-07W4, 100/11-34-094-07W4, 102/03-34-094-07W4 and100/04-34-094-074W (14-27 and 11-34 are the primary disposal wells)
  - 1,096,707 m^3 of boiler blow-down was disposed using 14-27 and 11-34
  - Wells 3-34 and 4-34 are used for Keg River sampling water disposal
    - 3-34: 189 m^3
    - 4-34: 292.5 m^3
  - Nine Keg River Monitoring Wells (pressures and/or water quality)

- Domestic Wastewater:
  - Domestic wastewater from construction and operational activities was treated on the CPF by the operation of a domestic wastewater treatment plant (WWTP).
  - Domestic wastewater is treated and released to an unnamed tributary of Wapasu Creek located south of the CPF

- Industrial Run-off
  - Total of 12 discharge locations:
  - Pad B13-08 (B), Pad B14-08 (C), Pad B16-08 (D), Pad B13-09 (E), Pad B08-17 (G), Pad B05-16 (H), Pad B16-17 (L), Pad B13-16 (M) Pad B15-16 (N) 6-21 (P) 5-21 (Q) and the CPF Total volumes discharged: 2016 - 2017: 236,047.5 m^3

- All discharges were in compliance with EPEA approval

Environmental – Soils

- No soil monitoring activity conducted in the reporting year

- The next Soil Monitoring Program proposal is being drafted and was submitted on September 20, 2017

- The next Soil Monitoring Program report will be submitted on or before September 30, 2018

Environmental – Air

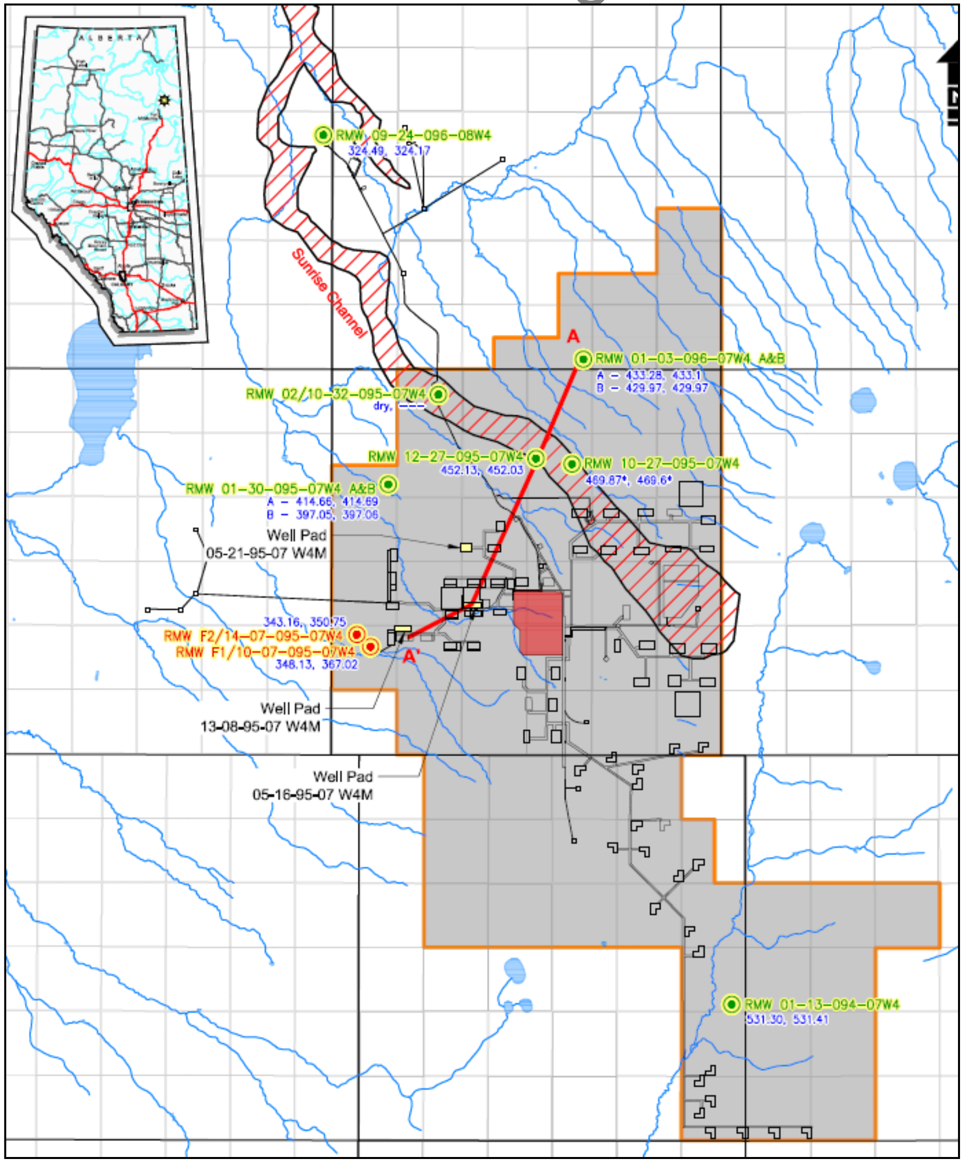
- Site air monitoring includes source monitoring and ambient air monitoring

- Source Monitoring
  - Three CEMS; two for the OTSGs and one for the SRU (note, CEMS SRU was not in operation during this reporting period)
  - Manual gas sampling of SRU oxidizer vent stack gas to ensure no H_2S release
  - Engineering calculations aided by gas metering and sampling or inline GC
  - Fugitive emission leak surveys

- Ambient Air Monitoring
  - Permanent Air Monitoring Station
  - Participation in Wood Buffalo Environmental Association (WBEA) network of ambient air monitoring stations (Wapasu Station)
  - Continuous process area monitoring for LEL and H_2S

Environmental – Groundwater Monitoring

- AER approved the Groundwater Monitoring Proposal Update in September 2016
- 2016 Compliance Groundwater Monitoring Report submitted March 2017
  - Incorporated 2 new CPF monitoring wells and 1 existing CPF monitoring well into the EPEA program
- CPF:
  - 25 wells: 2.4 to 13.7 m depth (base of screen)
- Pad Well:
  - 3 pads: B05-16, B13-08, B05-21
  - 8 wells: 19.5 m to 66.0 m depth (base of screen)
- Regional:
  - 1 McMurray well: 177.5 m depth (base of screen)
  - 9 Quaternary wells: 9.1 m to 61.9 m depth (base of screen)



Environmental – Initiatives

- Husky participates in and/or funds many regional environmental initiatives and committees pertaining to the Sunrise Project, including the following:
  - Monitoring Avian Productivity and Survivorship (MAPS) in the Boreal Region
  - Participation in Wood Buffalo Environmental Committee (WBEA) and Terrestrial Environmental Effects Monitoring Committee (TEEM)
  - Faster Forests Program (COSIA JIP)
  - COSIA Monitoring Priority Area (MPA) Steering Committee
  - Devonian Aquifer Working Group (DAWG) through COSIA
  - CAPP Species Management and Caribou Shadow Committees
  - Petroleum Technology Alliance Canada (PTAC) Ecological Research Planning Committee
  - Industrial Footprint Reduction Options Group (iFROG)
  - Oil Sands Monitoring (formerly JOSM)

Environmental – Reclamation

- Objectives of the Annual Conservation and Reclamation Report (demonstrate and document):
  - Compliance with the development and reclamation approval
  - Site conditions and successful reclamation
  - General project development (surface disturbances) and reclamation activities
  - Problem areas and resolution

- Site perimeter clearing to create firebreaks aligning with Bulletin 2016-12 in response to forest fire in the region
  - Husky conducted a risk assessment for their assets after consulting with on site fire expert
  - Husky provided a summary of clearing activities to AER December 16, 2016 adhering to Bulletin 2016-30
  - AER subsequently conducted a site visit following clearing activities and no areas of concern or follow up actions were identified

- Vegetation Monitoring:
  - Annual weed monitoring and control completed as per Husky's best practices

- Reclamation Activities:
  - Test plots for reclamation at Gravel Pit 1 were started in 2013. A total of approximately 6 ha in Gravel Pit 1 is permanently reclaimed

7. Compliance Statement

Compliance

- OSCA Commercial Scheme Approval 10419 (as amended):
  - Husky was in compliance with all regulatory approvals, decisions, regulations and conditions; with the exception of compliance items identified in this presentation

8. Non-Compliance Events

Non-Compliance with Federal Wastewater Systems Effluent Regulation

Missed quarterly reports for the domestic water treatment plant effluent discharge:

This federal regulation pertains to water that is discharged to environments that are potentially fish bearing

- In 2013, a third party on behalf of Husky registered the Sunrise Domestic Waste Water Treatment Plant to Environment Canada's registry of facilities that fall under the Federal Wastewater Systems Effluent Regulation
- This triggered a requirement for submitting a Quarterly Report
- 2013/2014 reports were submitted by contactor on behalf of Husky. At the end of 2014, a new contractor was hired and the reporting requirement was not passed to new contractor and Husky personnel
- Consequently, the 2015 to 2017 reports were not submitted to the federal government until notification for missed reports and a warning letter were issued
- During the missed reporting period Husky was in compliance with discharge parameters
- Husky submitted all required reports and closed the actions associated with the warning letter

8. Future Plans

Future Plans (2017/2018)

- IPF Pipeline Outage Temporary Diluent Storage Authorization/Notification (authorization received September 7, 2017 (EPEA) and notification received September 22, 2017 (OSCA))
- Husky Diluent Reduction (HDR) Pilot Project Application
- SRU Oxidizer Vent Mitigation Waivers
- H_2S Concentration AER Directive 056 License Amendment(s)
- Debottleneck 2 Amendment Application
- Development Area 4 (DA4) Application
- Development Area 3 (DA3) Amendment Application