PENGROWTH ENERGY CORPORATION

Lindbergh SAGD Project

2015 Annual Performance Presentation

Scheme Approval No. 6410L

November 2015

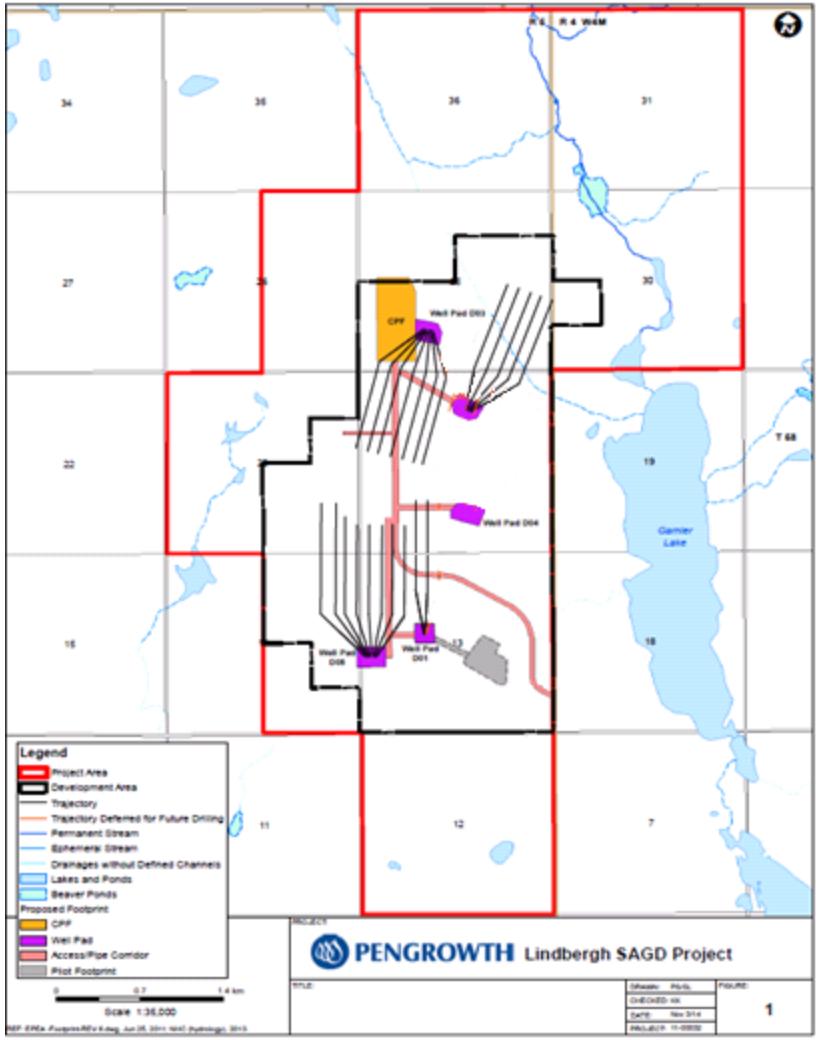
INTRODUCTION AND OVERVIEW

- Introduction
- Subsurface Issues Related to Resource Evaluation and Recovery
  - Directive 054, Section 3.1.1
- Surface Operations, Compliance, and Issues Not Related to Resource Evaluation and Recovery
  - Directive 054, Section 3.1.2

SUBSURFACE ISSUES: TABLE OF CONTENTS

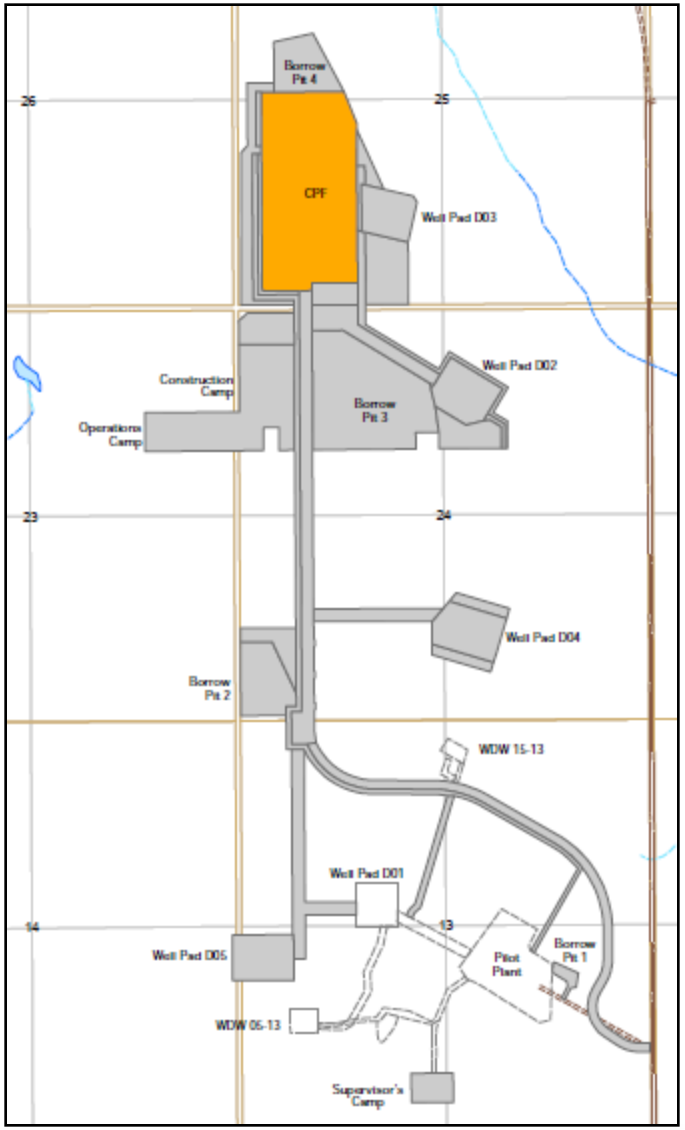
BACKGROUND AND OVERVIEW

PROJECT LOCATION



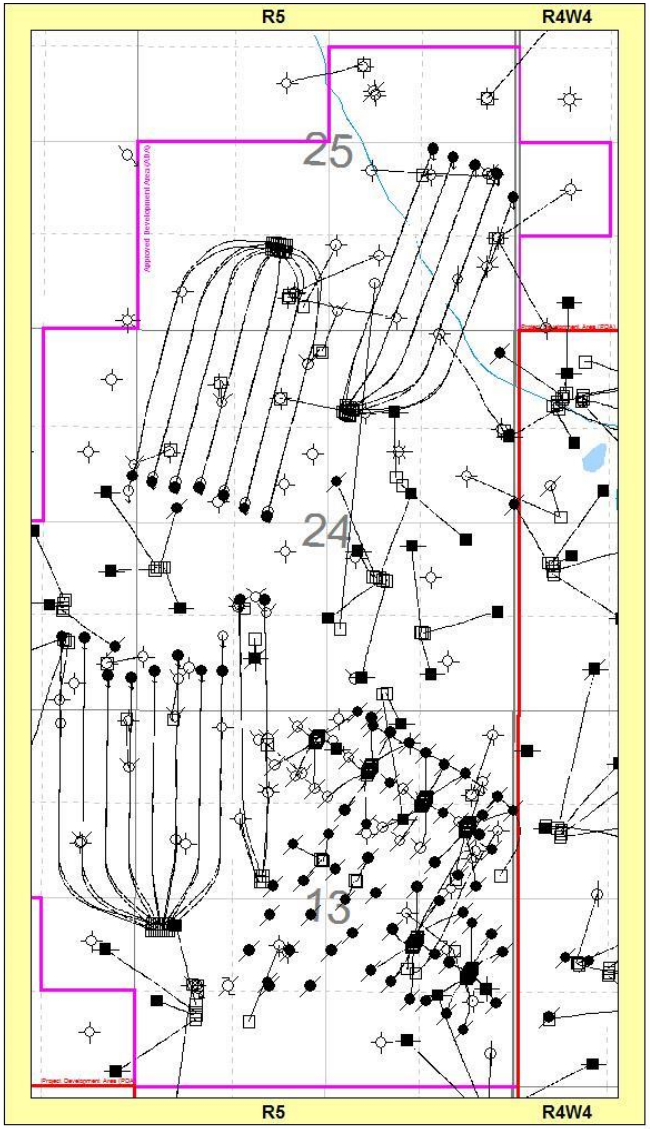
PROJECT OVERVIEW

- Pilot project implemented to evaluate the SAGD recovery process in the Mannville Lloydminster Formation
- 12,500 bpd SAGD facility completed Q4, 2014
  - 2 pilot SAGD wells – began steam circulation Feb 2012
  - 20 new SAGD wells – began steam circulation Dec 2014
- Contingent third pilot well pair approved, not drilled
- Two SAGD well pairs approved to test section 13, not drilled
- Pilot SAGD well production moved to 12,500 bpd facility
- Pilot facility mothballed
- Application 1784285 to increase production to 30,000 bpd submitted December 2013



LINDBERGH HISTORY

- Murphy piloted and then commercialized CSS production in Section 13 from 1972-1998
- Pengrowth acquired the Lindbergh lease from Murphy Canada in April, 2004
- All CSS wells have been abandoned
- Two pilot well pairs are on the western edge of the CSS area
  - Steam circulation commenced Feb 2012
- Commercial 12,500 bpd commissioned Q4 2015
  - Bitumen production from 20 new well pairs and 2 original pilot well pairs
  - Pilot plant mothballed for future use



CSS IMPACT ON FUTURE DEVELOPMENT IN SEC 13

- Murphy produced a total of 2.3 MMbbls of oil and 7.6 MMbbls of water with 8.2 MMbbls (CWE) steam injection
- 71 vertical wells and 3 horizontal wells used in CSS operations
- The average recovery factor for the CSS area is 5-6% of the OOIP (up to 10% in various wells)
- CSS injection operations were at pressures over 10 MPa with injection at various depths within the target formation
- Pengrowth received D78 Category 2 Amendment Approval to install 2 additional horizontal well pairs on well pad 4 to test SAGD production performance in the CSS impacted area
- Potential impacts of the CSS operations are:
  - Channeling of steam, breakthrough to bottom water, increased SOR with decreased recovery, increased water production from residual CSS steam condensate
- Proposal is to drill and complete well pairs in late 2016 with circulation to commence in Q2 2017

LINDBERGH APPLICATION HISTORY

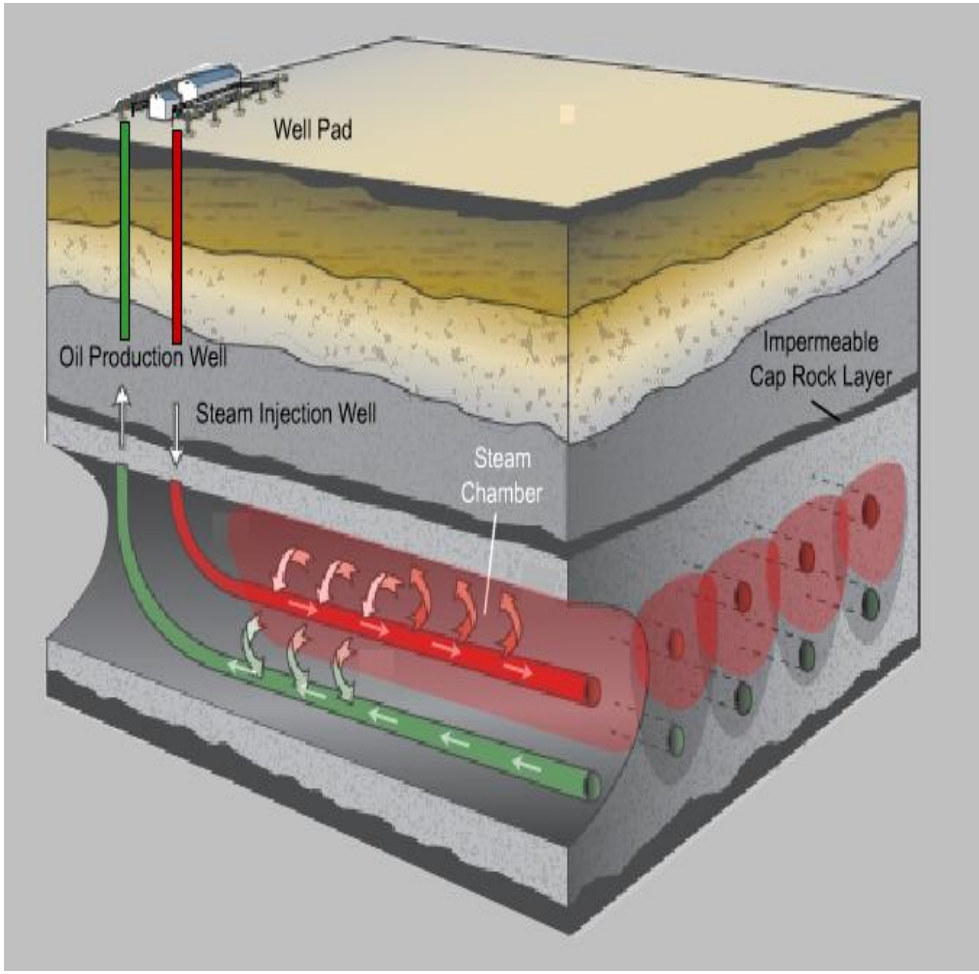
OPERATOR	DATE	EVENT
Murphy	May 1991	ERCB Scheme Approval 6410 granted
	Aug 1993	ERCB Amended Scheme Approval 6410B granted
	Dec 1996	ERCB Amended Scheme Approval 6410C granted
	Aug 1997	ERCB Amended Scheme Approval 6410D granted
	Jun 1999	ERCB Amended Scheme Approval 6410E granted
Pengrowth	Apr 2004	ERCB Amended Scheme Approval 6410F granted
	Apr 2008	Application to Amend for SAGD Production submitted
	Nov 2009	Commercial Scheme Amend 6410G Extension of App Expiry
	Dec 2010	SAGD Application Updated and Re-submitted
	July 2011	EPEA Approval 1581-02-00 granted
	July 2011	Commercial Scheme Amend - 6410H SAGD Pilot Project
	Aug 2012	D78 Cat 3 Amend - 6410I Expansion to 12,500 bopd
	Apr 2014	D78 Cat 2 Amend - 6410J Solvent Soak Trial

LINDBERGH APPLICATION HISTORY (CONTINUED)

OPERATOR	DATE	TYPE	DESCRIPTION
Pengrowth	Dec 2013	D78 Cat 3 Amend App #1784285	Expand to 30,000 bopd
	Sep 2014	D78 Cat 2 Amend App #1808902 Commercial Scheme Amend – 6410K	Debottleneck Oil Train
	Jun 2015	Commercial Scheme Amend – 6410L	Add Sec 13 Well Pairs
	Dec 2014	D56 Sales & Diluent PL Application (PLA#141430, C&R#001-356469)	Tie-in to Husky PL infrastructure

SAGD RECOVERY PROCESS

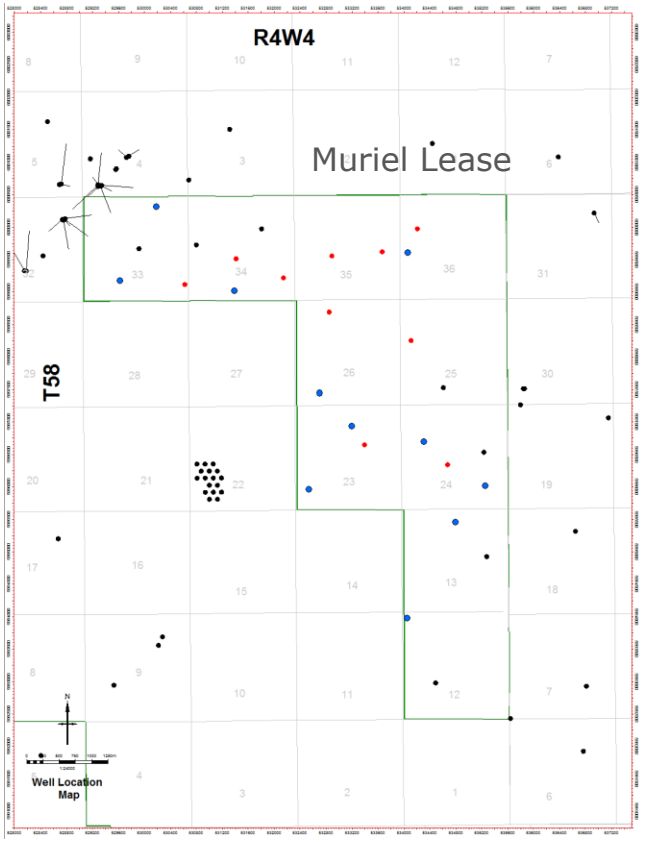
- Stacked horizontal wells
- Steam injected into top well and forms steam chamber
- Steam condenses on boundary of chamber and releases heat into the bitumen
- Bitumen and condensed water drain by gravity to the bottom well
- Bottom well produces liquid bitumen to surface

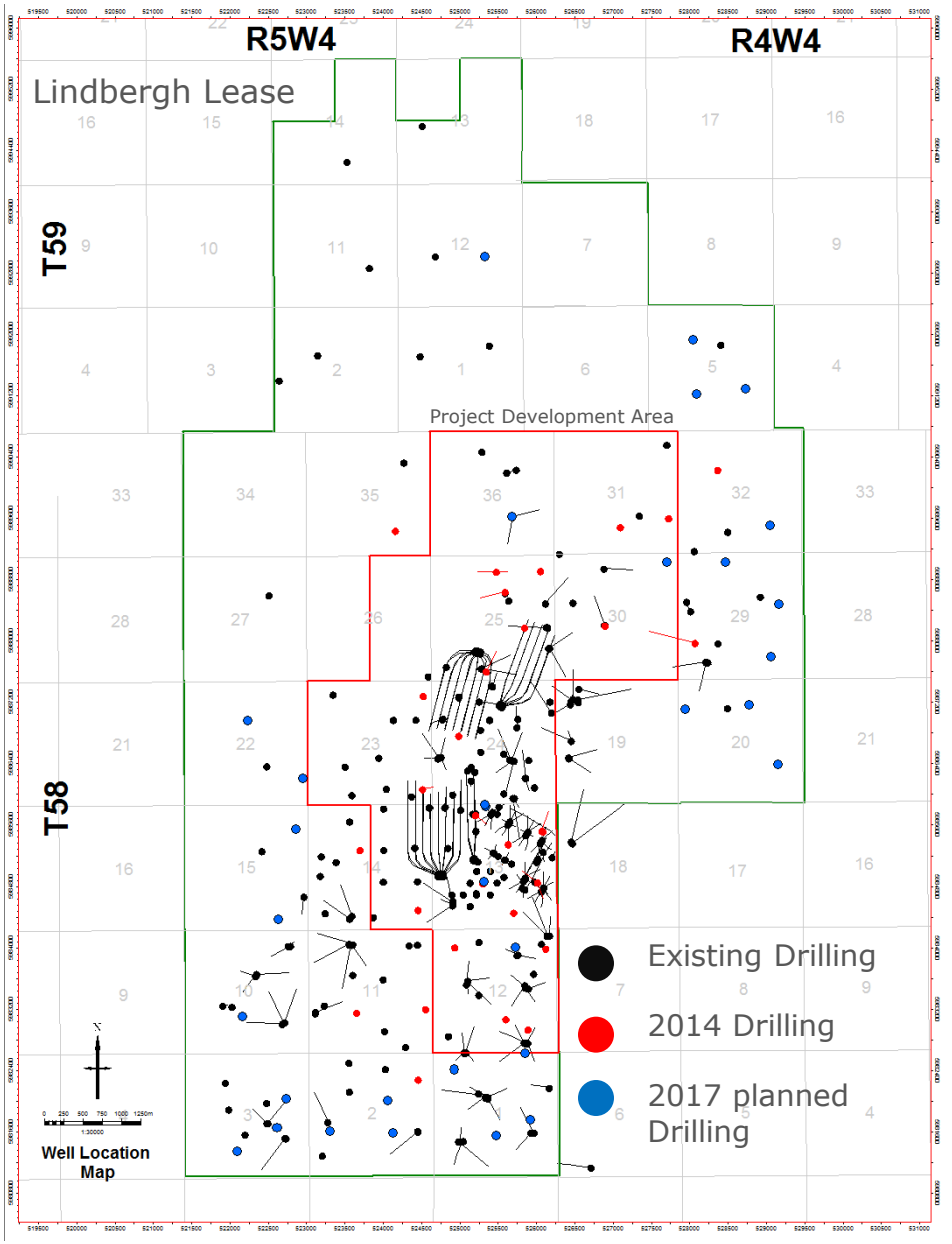


GEOLOGY AND GEOSCIENCE

2014 & 2015 DRILLING

- No delineation wells drilled in 2015 in Lindbergh and Muriel Lake Leases
- 44 delineation wells planned for 2017



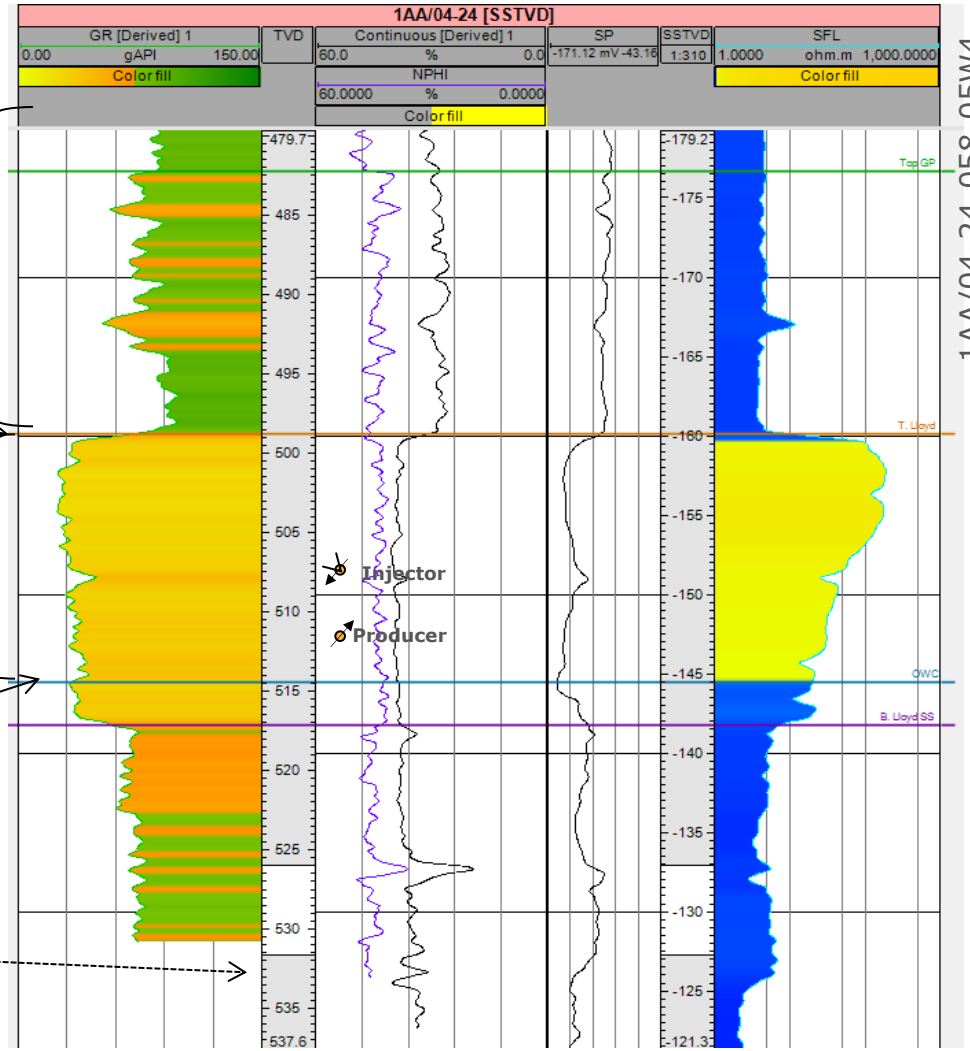


BITUMEN VOLUMES & RESERVOIR PROPERTIES

- All values shown for S_w, Φ and bitumen volume are measured from the Petrel geology model
- Boundaries defining the area and the top and bottom surfaces of the reservoir are used to confine the volume calculation
- Bitumen volume extends below well pairs to the OWC
- S_w, Φ are averages for the volume shown
- Average horizontal permeability = 3500 md: Kv / Kh = 0.86
- Viscosity of the bitumen decreases upwards through the reservoir from approximately 600,000 cP at the base to 50,000 cP near the top
- Mean reservoir thickness is 16.7 m. This includes all areas having a minimum thickness of 10 meters
- Initial reservoir temperature = 20 Celcius, initial reservoir pressure 2800-3000 kPa
- Reservoir pressure in bottom water interval = 2850 kPa
- Reservoir depth ~ 500 mKB

Region	OBIP Volume (m^3)	Porosity (%)	Sw (%)
Wellpad D01	993,543	34.6	26
Wellpad D02	2,022,905	35	22
Wellpad D03	2,725,190	36	20
Wellpad D05	3,003,181	35	22

REPRESENTATIVE COMPOSITE WELL LOG



Cap Rock

Top Lloydminster Fm Reservoir

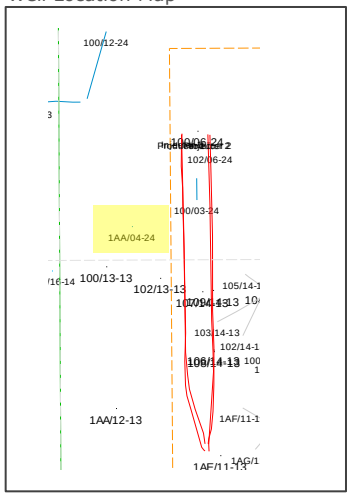
Oil/Water Contact Defined at 10 Ωm

Estimated Top Cummings Fm

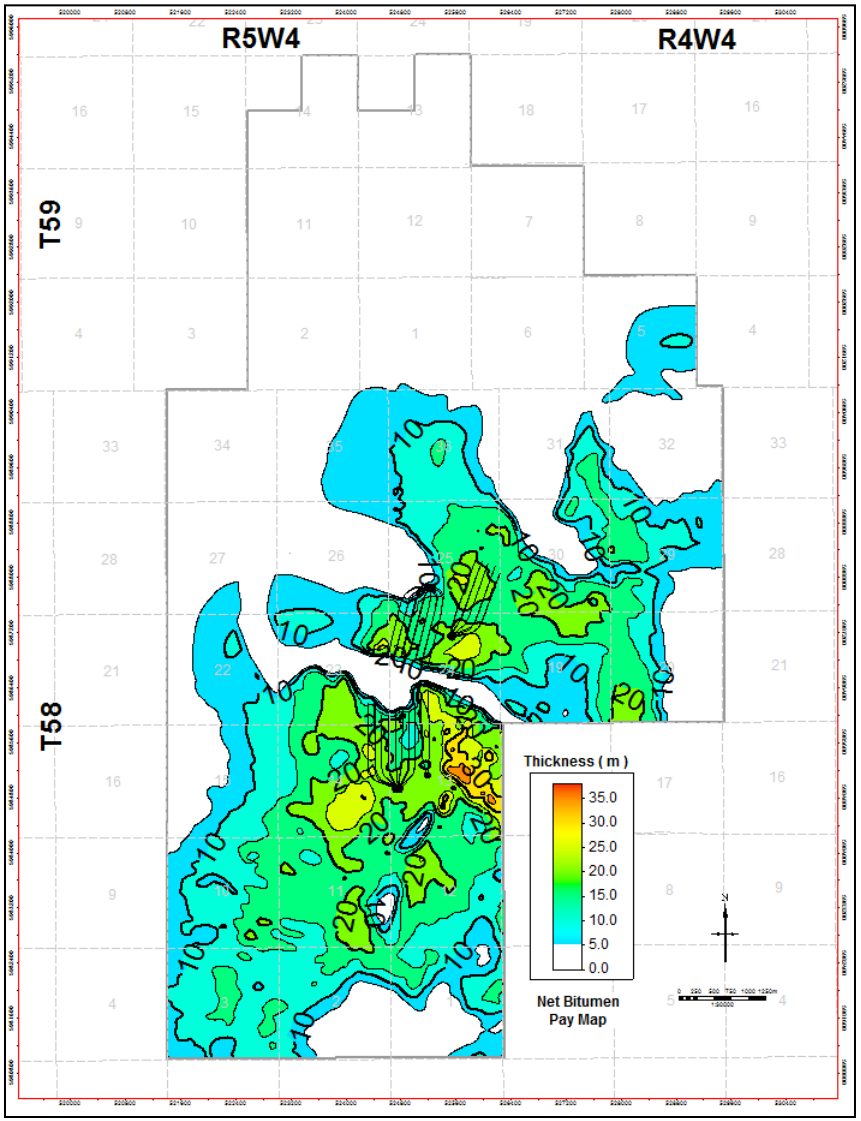
Exploitable Interval

Average Pay Thickness = 20m
Average Producer to Injector Spacing = 5 m
Average O/W to Producer Distance = 3 m

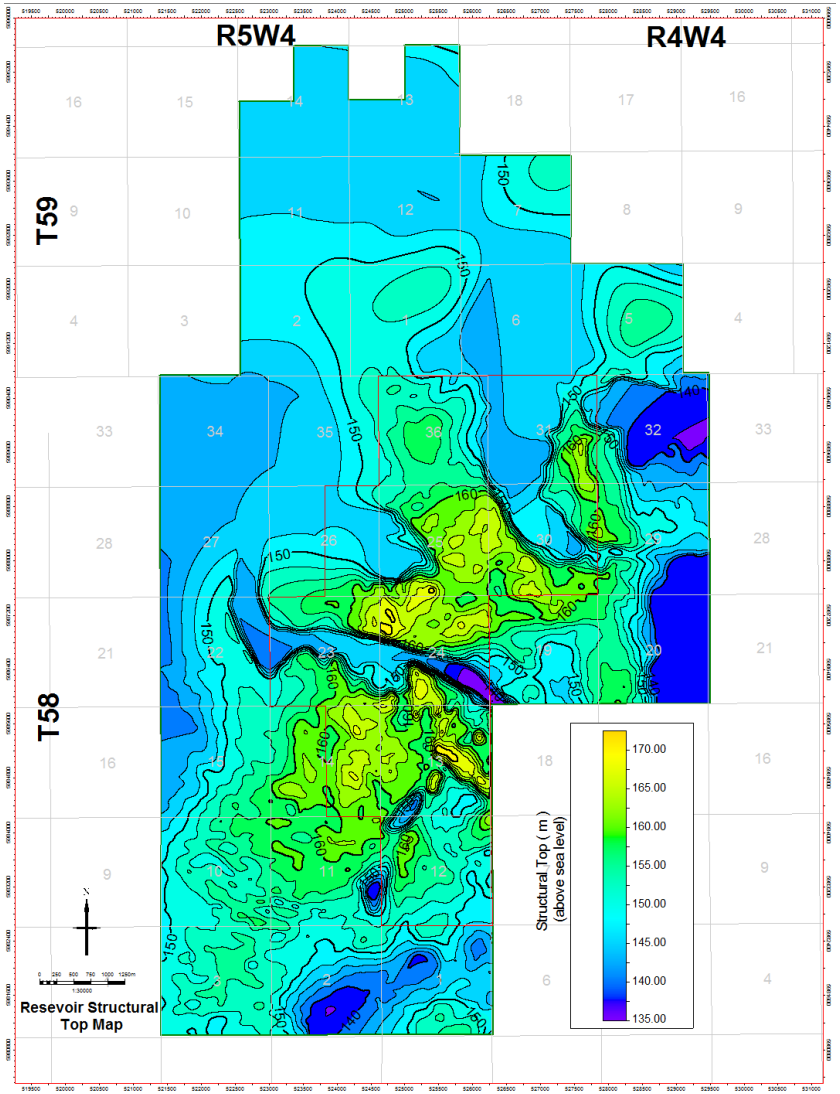
Well Location Map

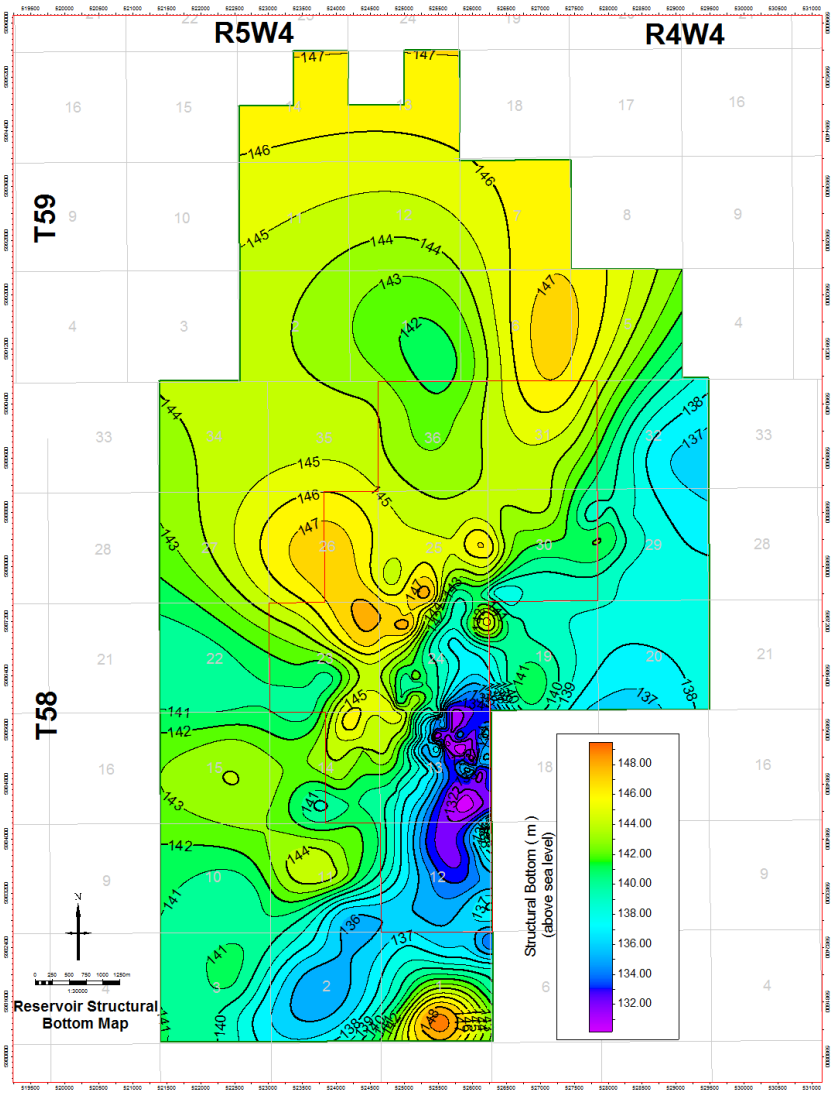


NET BITUMEN PAY

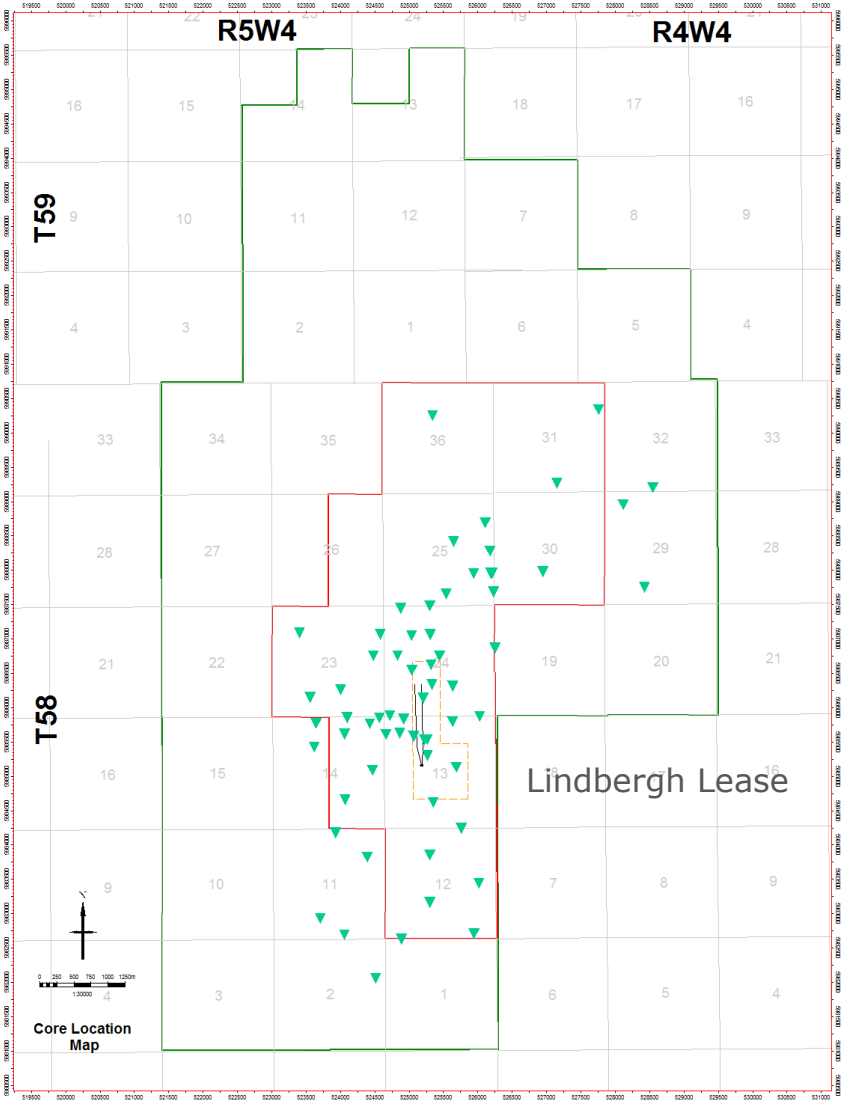


STRUCTURAL TOP AND BOTTOM OF BITUMEN RESERVOIR



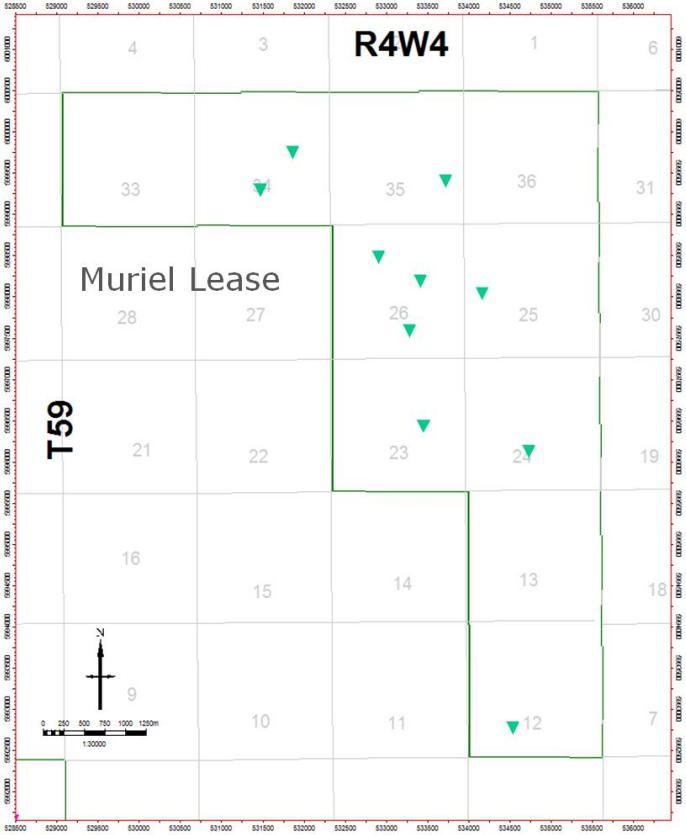


CORED WELLS AND SPECIAL CORE ANALYSIS



Core analysis typically consists of the following:

- Dean-Stark – 1762 samples
- Small plug Φ, K, Sw, - 2000 samples
- Grain size – 37 wells sampled
- Petrographic, XRD – 25 samples from 12 wells
- Special core analysis – 36 samples from 5 wells



TYPICAL LINDBERGH CORE SAMPLE

- Lloydminster sands are continuous and contain rare shale interbeds
- Typically the reservoir is composed of very fine grained sands throughout the interval

1AA/16-24-058-05W4

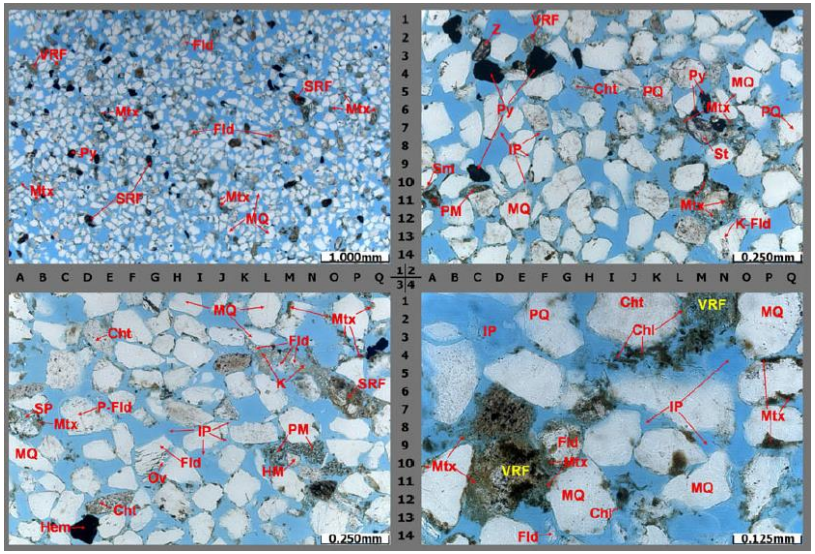
480.1 m

454.1 m

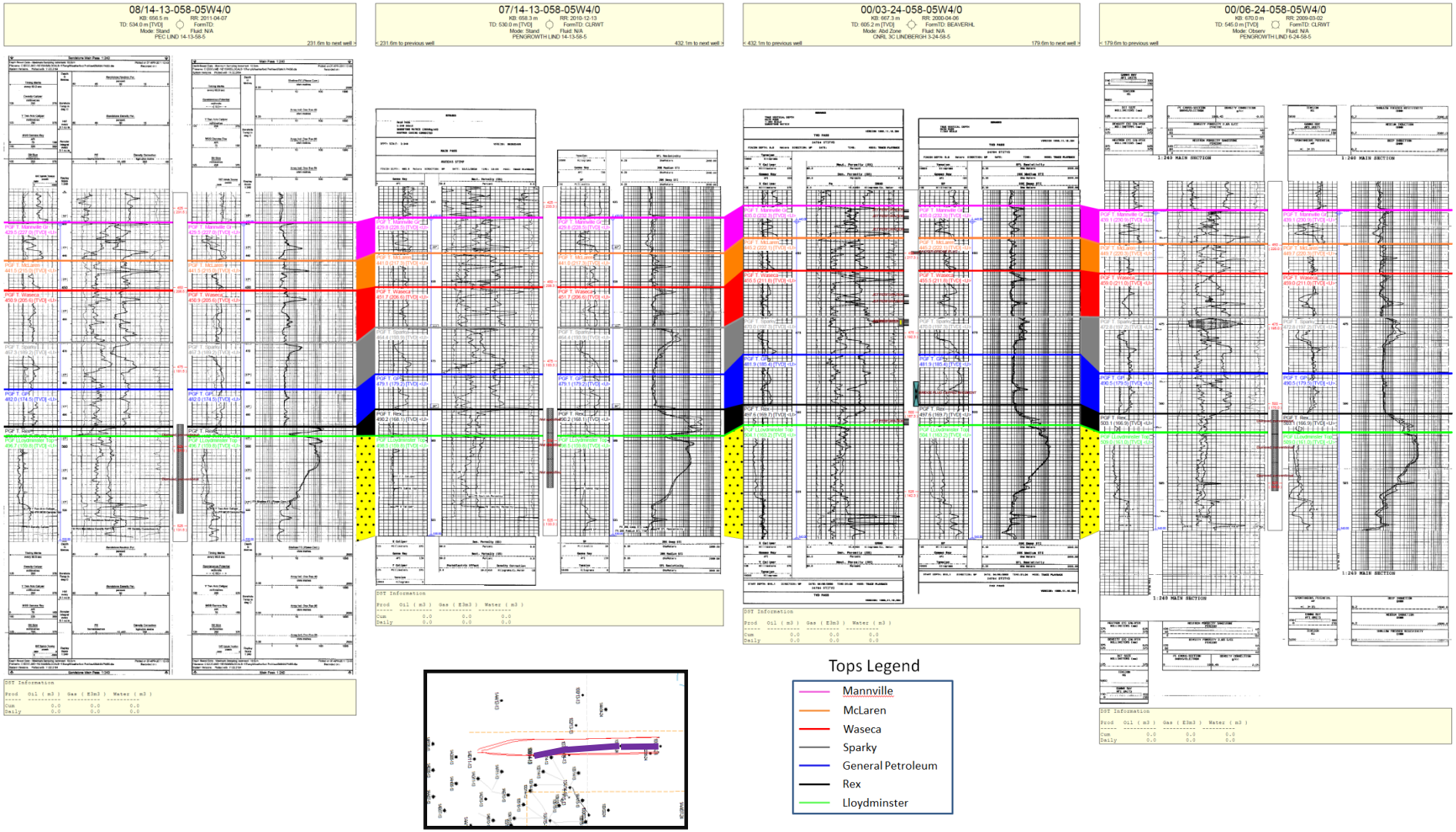
Top of Lloydminster

PETROGRAPHIC ANALYSIS

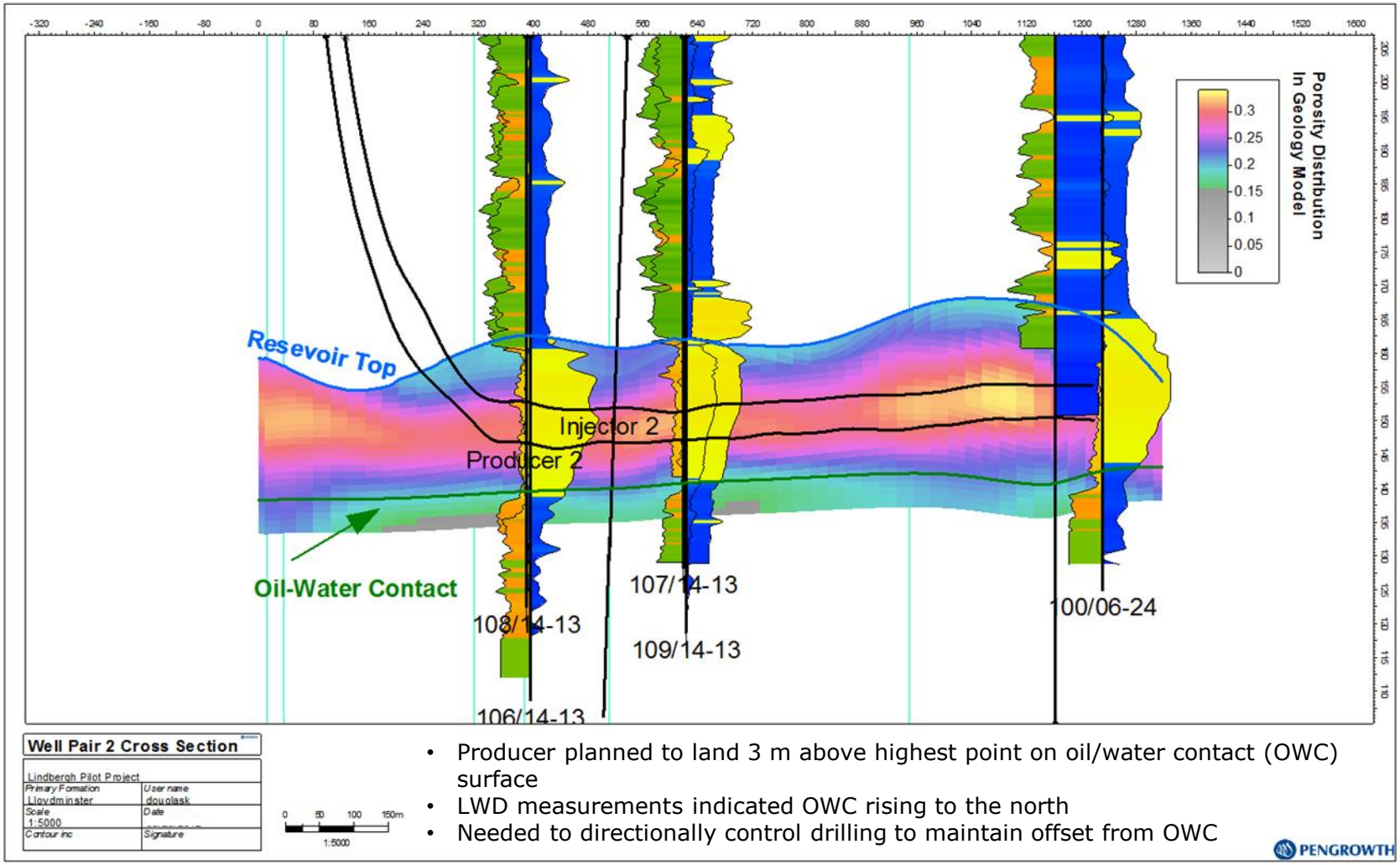
- Some Petrographic analysis has been done on core samples in the Lloydminster Reservoir
- Sands are typically classified as Feldspathic Litharenite to Sublitharenite on the Folk scale (Folk, 1974)
- The clay fraction is less than 10% of the bulk sample
- Grain sizes range from coarse silt to lower medium grained sand
- Critical velocity testing indicates that clays remain non-mobile during steam injection. The clays will not block pore throats



REPRESENTATIVE CROSS SECTION THROUGH PROJECT AREA



REPRESENTATIVE MODEL CROSS SECTION THROUGH PROJECT AREA

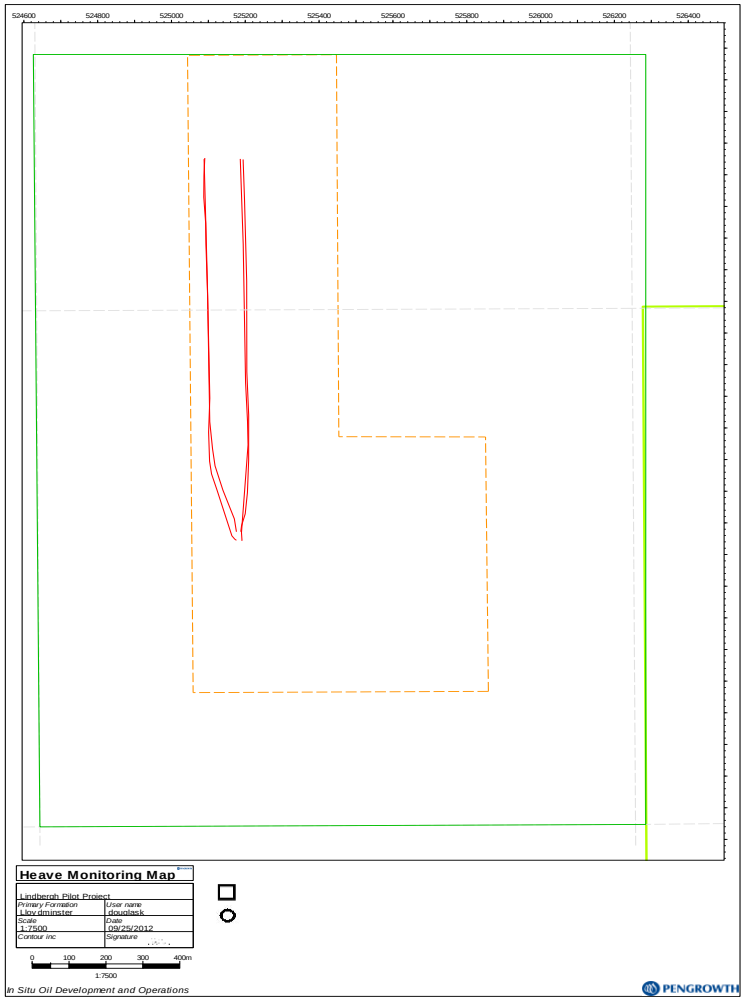


- Producer planned to land 3 m above highest point on oil/water contact (OWC) surface
- LWD measurements indicated OWC rising to the north
- Needed to directionally control drilling to maintain offset from OWC

HEAVE MONUMENTS

- Baseline readings were taken in March 2012
- Most recent observations were taken in February and September of 2014

		Point Differences vs Observation 1		
		ΔN(m)	ΔE(m)	ΔElev(m)
Observation 6 (February 2014)	Control	0 0	0 0	0 0
	WP01	0.051 - 0.022	-0.05 - -0.003	0.019 0.002 0.003
	WP02	0.014 0.046 -	0.011 -0.107 -	0.019 0.003 0.0022
Observation 7 (September 2014)	Control	0 0	0 0	0 0
	WP01	- - 0.016	- - 0.008	0.0019 0.0029 0.004
	WP02	0.012 0.044 0	0.021 -0.09 0.001	0.011 0.005 0.003



CAPROCK INTEGRITY AND RESERVOIR OPERATING PRESSURE

- Mini-frac testing was done on the 1AB/13-13-58-5W4 (March 2011), 100/13-24-58-5W4 (December 2011), and 1AF/10-13-58-5W4 (March 2014)
  - All showed – comparable results
- Approved maximum ongoing operating pressure = 5500 kPa, less than 80% of minimum stress in caprock at reservoir depth

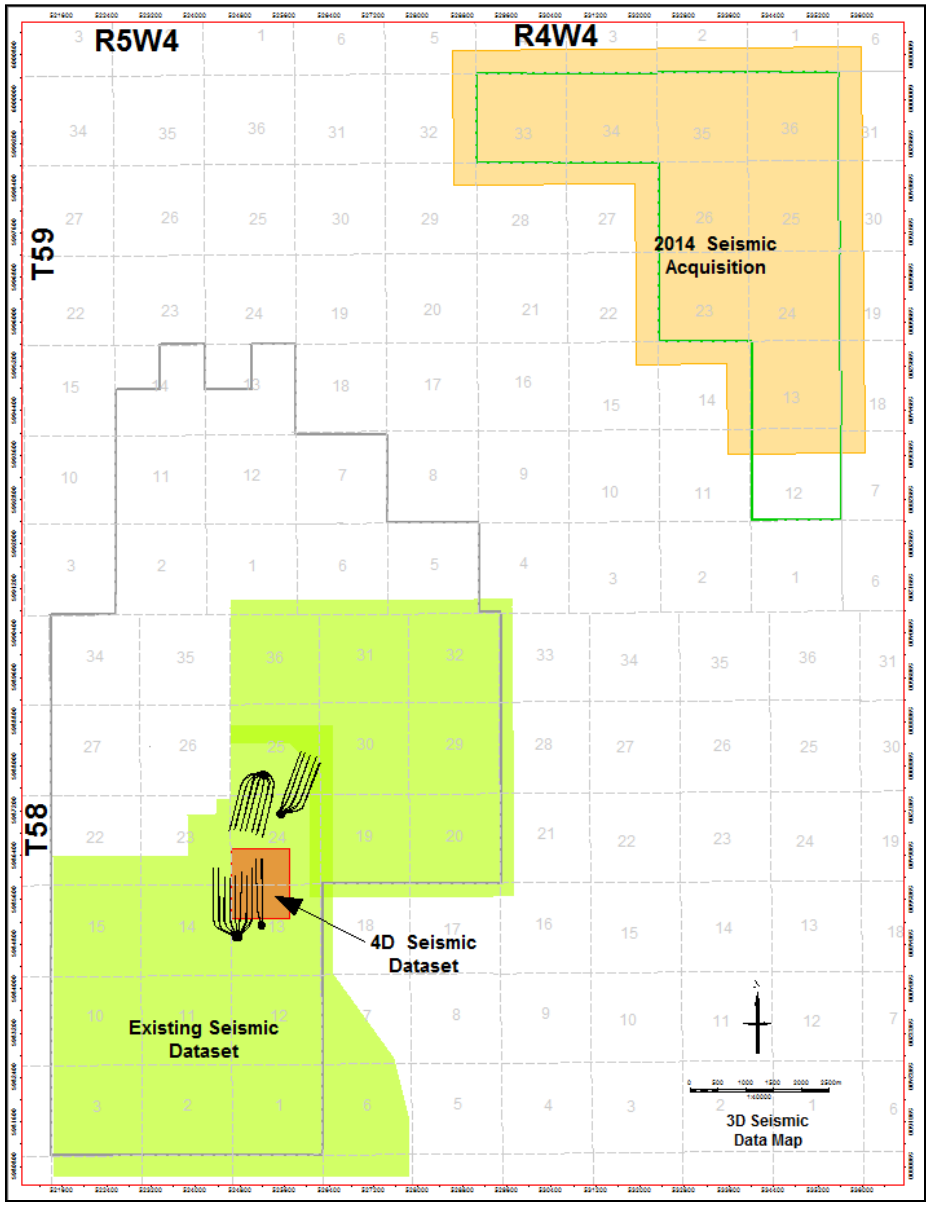
Pengrowth 1AB/13-13-58-05W4M						
Zone	TVD	Min Stress		Vert Stress		Stress Regime
	m	MPa	kPa/m	MPa	kPa/m	
Lloydminster	512.0	5.94	11.60	10.74	20.98	V. frac
GP Zone #1	493.0	7.48	15.17	10.34	20.97	V. frac
GP Zone #2	484.0	7.55	15.60	10.15	20.97	V. frac
GP Zone #3	476.0	6.80	14.29	9.97	20.95	V. Frac

- Caprock Shale Core Preservation on 1AF/10-13-58-5W4 in March 2014 shows several fractures

PENGROWTH 1AF/10-13-058-05W4				
Fracture No.	**Formation**	**Fracture Type**	**Depth (m)**	**Dip (Degrees)**
F1	GP	Small fracture	480.6	65
F2	GP	Small Fracture	480.9	70
F3	GP	Small Fracture	482.9	70
F4	GP	Hairline fracture	484.2	60

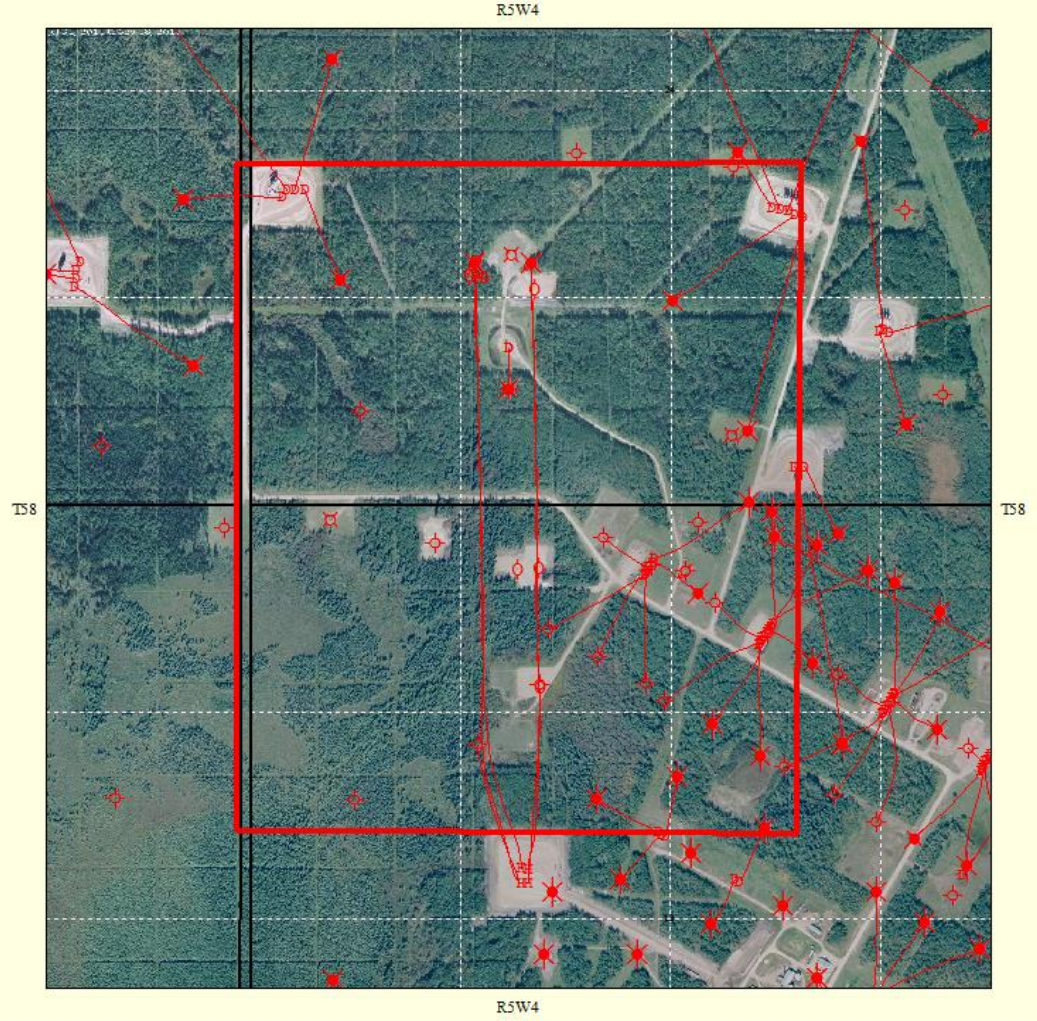
3D SEISMIC DATA COVERAGE

- New 3D seismic data acquired on Muriel Lake Lease in 2014
- New baseline 3D acquisition planned over well pads 2, 3 and 5 in 2017 (will be used for future 4D monitoring)
- 3D data now exists on most of the lease with exploitable resource



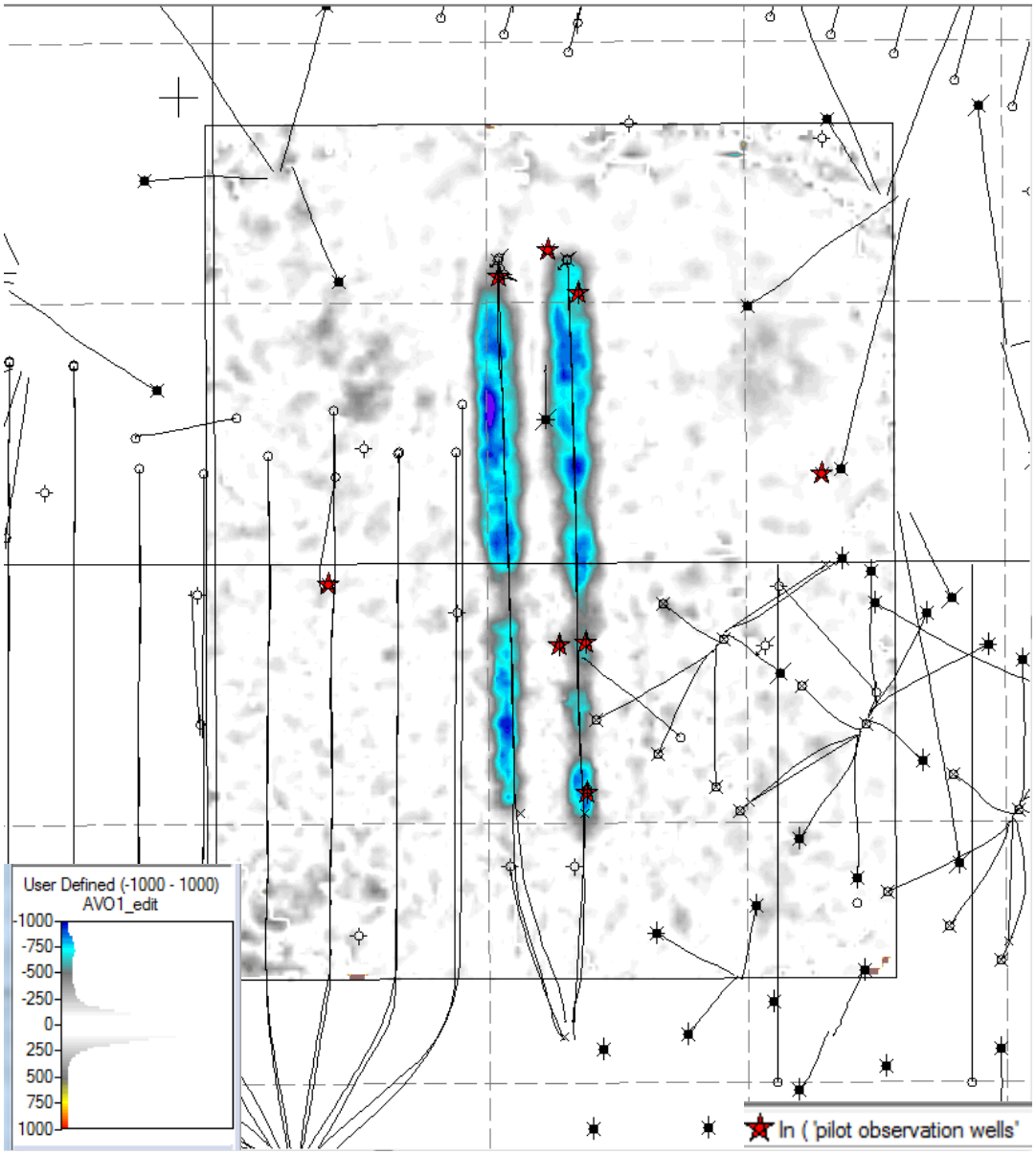
4D SEISMIC

- 1.32 sq km Baseline Survey acquired Feb 2012
  - Source, dynamite 0.25 kg @ 6m
  - Source line interval (E-W) 90m
  - Receiver line interval (N-S) 75m
  - Source and receiver interval 24m
  - Analog geophones 6 over 8m
  - First repeat survey in 2-3 years
- 1.32 sq km Monitor Survey acquired Dec 2013
  - Same acquisition parameters as baseline survey
- Area will be resurveyed in 2017



4D SEISMIC

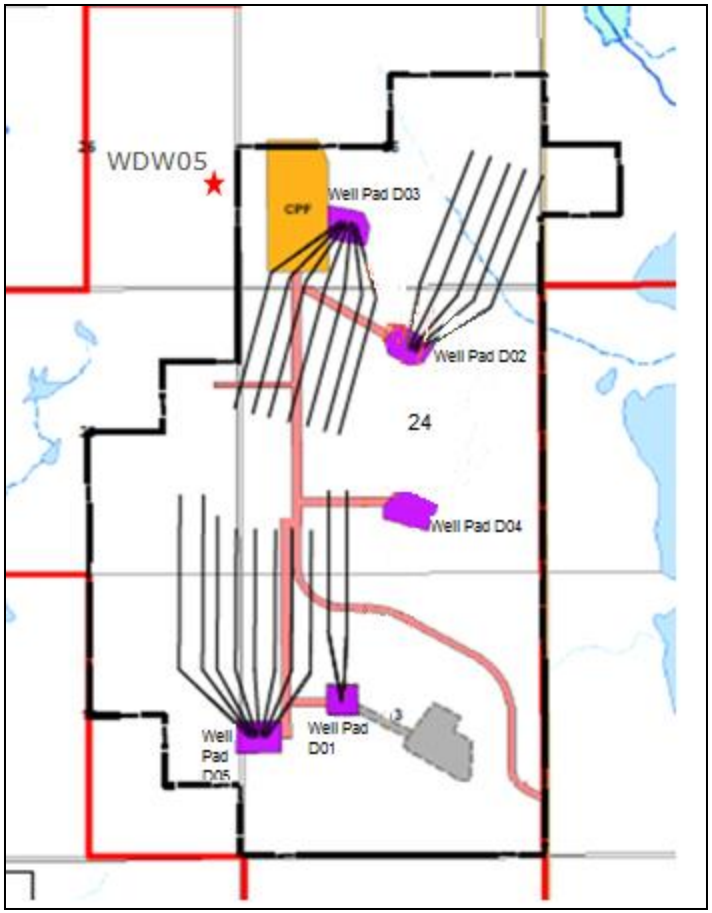
- Time slice from the P impedance difference volume at 150m asl, approximately at injector/producer level
- Shows lower P impedance due to effects of steaming/methane



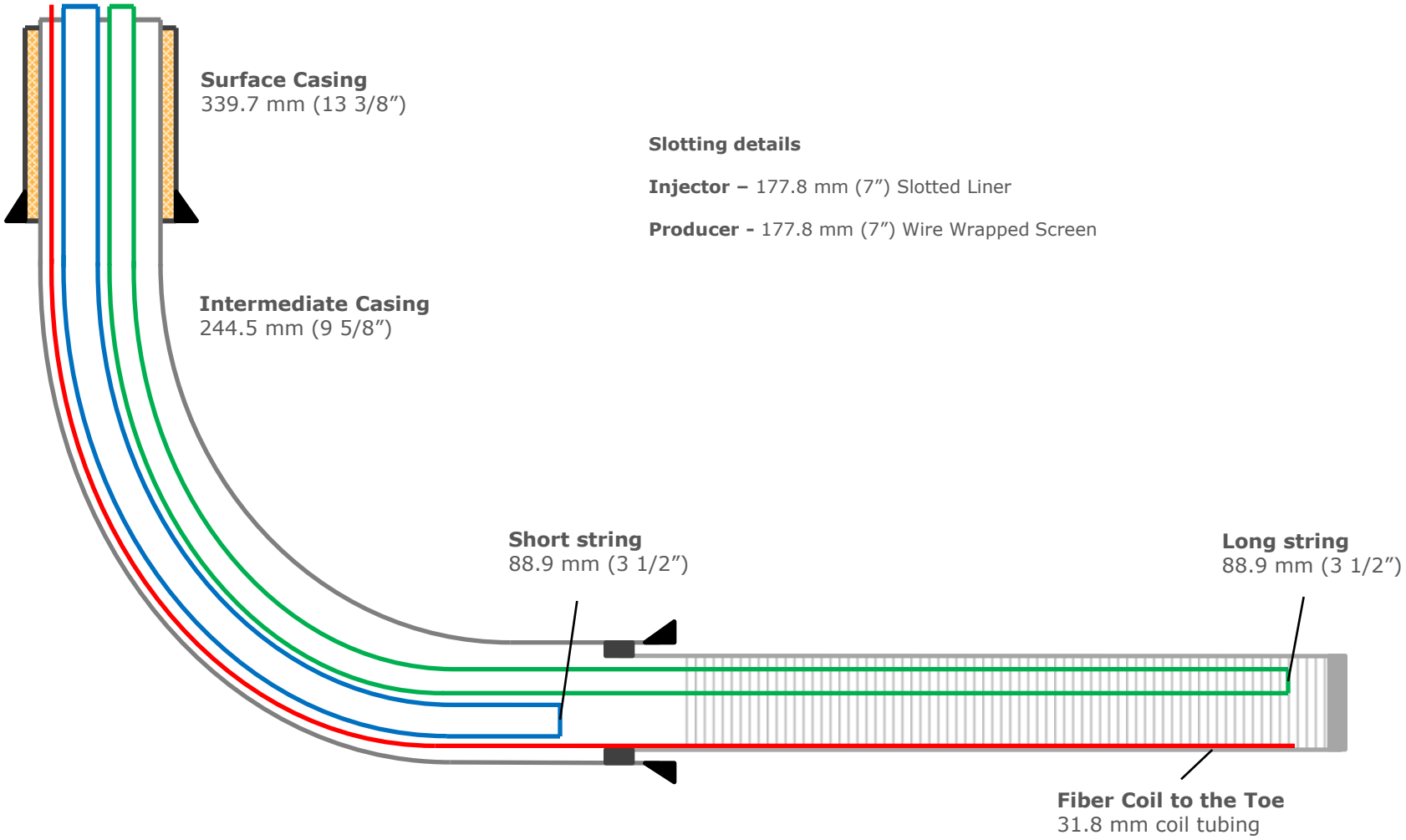
DRILLING AND COMPLETIONS

COMMERCIAL DRILLING & COMPLETIONS

- Artificial lift installed in 20 commercial well pairs on 3 Pads
  - Conversion from circulation to typical SAGD operations
  - Installed first ESP in March 2015; completed all wells by June 2015



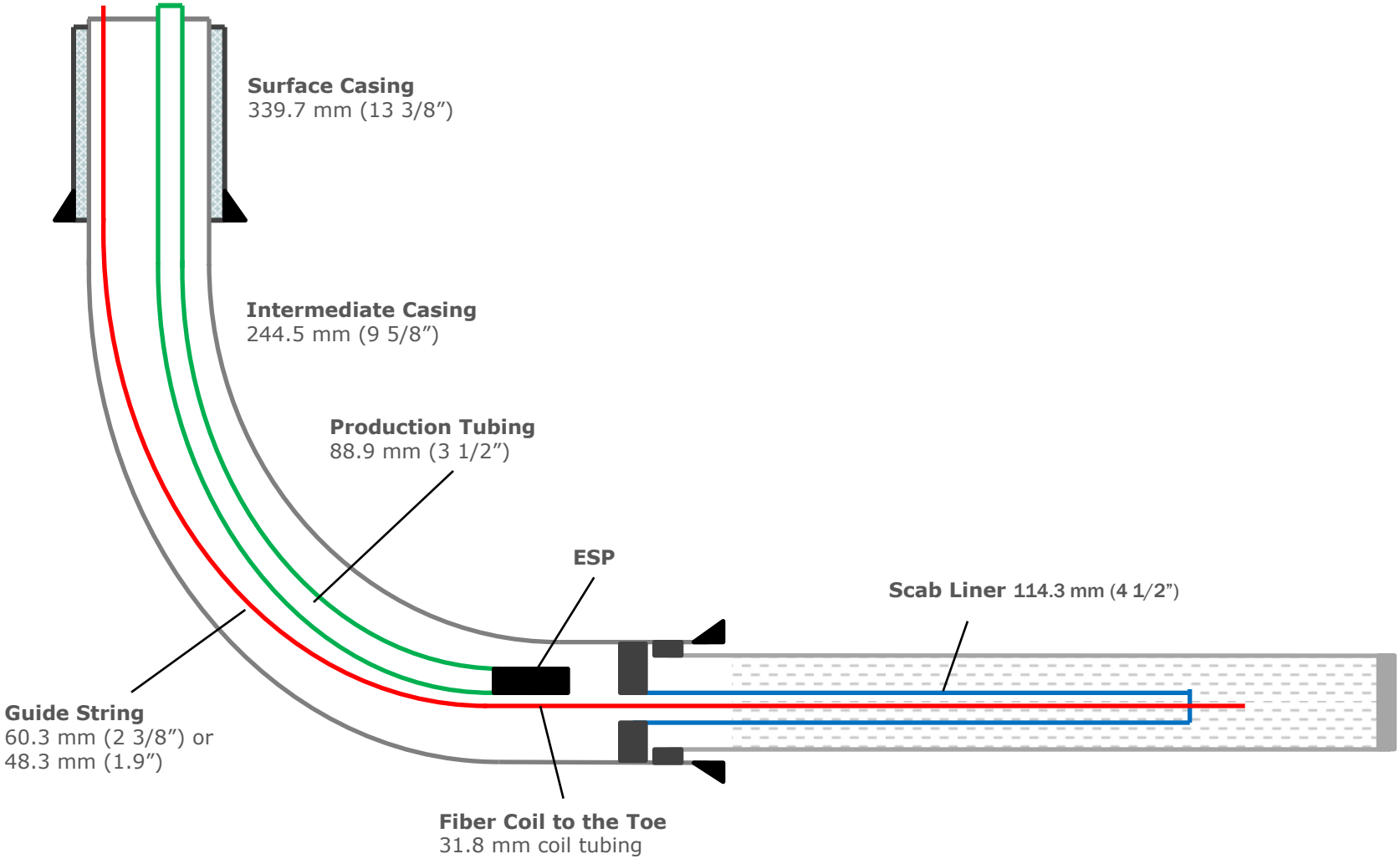
TYPICAL CIRCULATION COMPLETION



LINER DESIGN

- The relatively small grain size, the presence of fines in the reservoir and combined laboratory flow testing indicated a liner slot width of 0.009” would be required
- This small slot width can lead to quality control problems in the manufacturing process
- The presence of fines with the small slot widths increased the potential for slot plugging
- Therefore, Pengrowth chose to utilize wire wrap screens with a 0.009” wrap for the producer well liners
  - This increased the open flow area from about 2.5% to over 9%
- Straight cut slots were utilized in the injector wells
- Inflow control device
  - Liner deployed system installed across D05-P08 to test its performance with thinner pay and bottom water

TYPICAL ARTIFICIAL LIFT COMPLETION



COMPLETION CHANGES

- Scab liner
  - Installed to reduce preferential steam chamber development at the heel
  - Reduce the potential of steam at the pump intake due to immediate installation of artificial lift following circulation
- Production port
  - Allows for a more uniform development of the steam chamber due to uniform drainage and reduces short circuiting at the heel
  - Reduces the draw down or pressure drop required for fluid to get to the pump intake from the formation
- Steam splitters
  - Installed in some cases to promote development in certain areas of the reservoir

COMPLETION CHANGES

Well Name	Well Type	UWI	Steam Splitter(s) Installed
D03-J03	Injector	103122405805W40	1
D03-J04	Injector	104122405805W40	1
D03-J05	Injector	105122405805W40	2
D03-J06	Injector	106122405805W40	1
D03-J07	Injector	102092305805W40	1
D05-J03	Injector	109012305805W40	1
D05-J04	Injector	110012305805W40	1
D05-J06	Injector	107042405805W40	1
D02-J04	Injector	106082505805W40	1
D02-J06	Injector	108082505805W40	1
D02-J07	Injector	109082505805W42	1

Well Name	Well Type	UWI	Scab Liner Installed	Production Ports Installed
D01-P01	Producer	106062405805W42	Y	0
D01-P02	Producer	108062405805W40	Y	1
D03-P01	Producer	103112405805W40	Y	1
D03-P02	Producer	102112405805W40	Y	1
D03-P03	Producer	107122405805W40	Y	1
D03-P04	Producer	102122405805W40	Y	1
D03-P05	Producer	108122405805W40	Y	1
D03-P06	Producer	109122405805W40	Y	1
D03-P07	Producer	103092305805W40	Y	1
D05-P01	Producer	104012305805W42	Y	1
D05-P02	Producer	105012305805W40	Y	1
D05-P03	Producer	106012305805W40	Y	2
D05-P04	Producer	103012305805W40	Y	1
D05-P05	Producer	102042405805W40	Y	1
D05-P06	Producer	103042405805W40	Y	1
D05-P07	Producer	104042405805W40	Y	1
D05-P08	Producer	105042405805W40	N	Liner-conveyed ICD
D02-P04	Producer	102082505805W40	Y	1
D02-P05	Producer	100082505805W40	Y	1
D02-P06	Producer	103082505805W40	Y	1
D02-P07	Producer	104082505805W40	Y	1
D02-P08	Producer	105082505805W42	Y	1

COMPLETION CHANGES

- Scab liners
  - Initially installed in the producers based on shut-in temperature profiles across the lateral, drill profiles of the injector and producer and steam splitter locations in the injectors
  - Typical target landing depth is approximately 50-75% of the lateral length to aid in toe development early in SAGD production and mitigate flow breakthrough at the heel
- Pilot scab liners have been repositioned based on downhole instrumentation and seismic data confirming adequate toe development
  - Both scab liners were pulled back to further the steam chamber development at the heel, reduce wellbore pressure drop and improve overall chamber conformance
- No scab liners have been repositioned in the Commercial well pairs to date

PILOT ARTIFICIAL LIFT

- D01-P01
  - May 2012 - SAGD conversion – ESP install
  - April 2013 – ESP upsize
  - February 2014 – ESP upsize
  - October 2014 – ESP replacement (failure)
- D01-P02
  - May 2012 – SAGD conversion – PCP install
  - April 2013 – PCP replacement (non failure)
  - December 2013 – PCP replacement (failure)
  - Jan 2014 – ESP conversion (PCP failure)
  - February 2014 – ESP upsize

COMMERCIAL ARTIFICIAL LIFT

- Conversion from circulation to typical SAGD operations
- All ESP's (20) installed in Q1-Q2 2015
  - Staggered installation schedule based on pad start-up timing
- D03-07
  - April 2015 – ESP replacement (failure)
  - September 2015 – ESP replacement (failure)
- D05-08
  - October 2015 – ESP upsize

DRILLING SCHEDULE

Anticipate drilling new SAGD well pairs in Q4, 2016 subject to favorable economic conditions.

THERMALLY NON COMPATIBLE WELL REMEDIATION

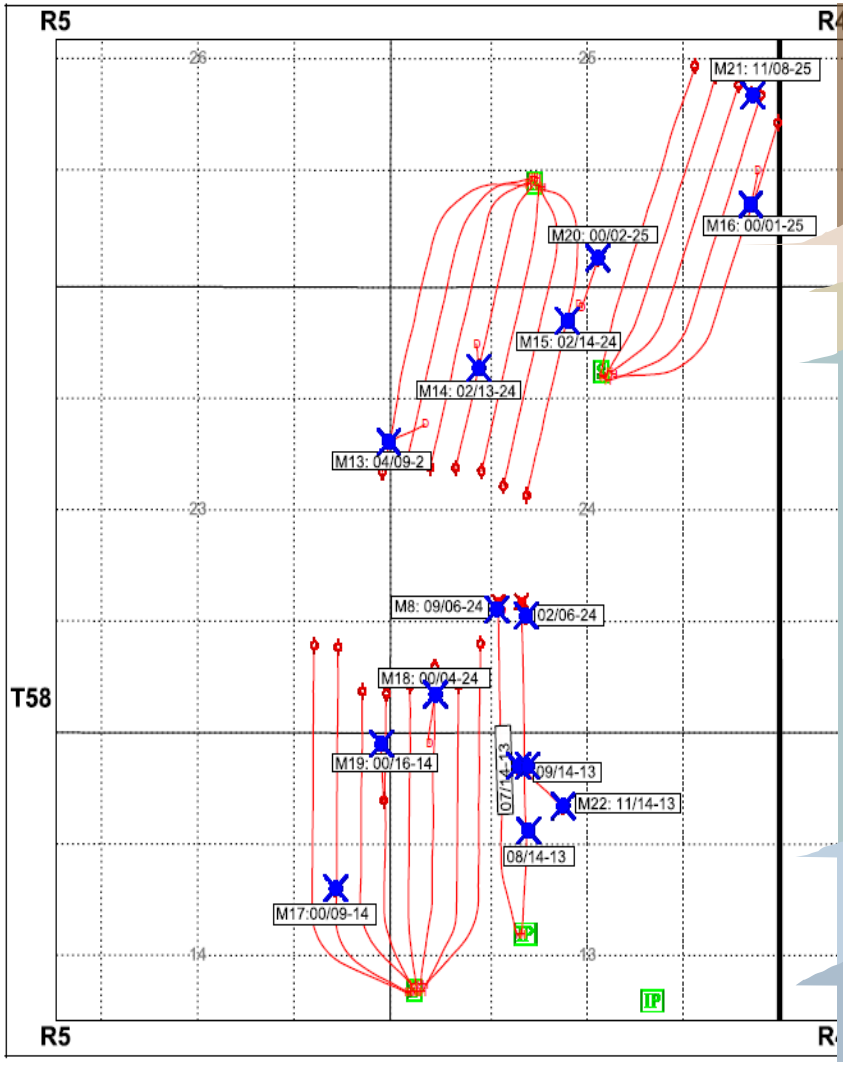
- All wells that will be impacted by thermal SAGD operations in Phase 1 are now compatible with thermal operations
- Thermal compatibility analysis of 26 wells within 300 meters of the drainage areas for Phase 2 well pads is ongoing
- 20 wells within 300 meters of the proposed Section 13 CSS SAGD wells may require repairs and will be undertaken at an appropriate time in advance of steaming

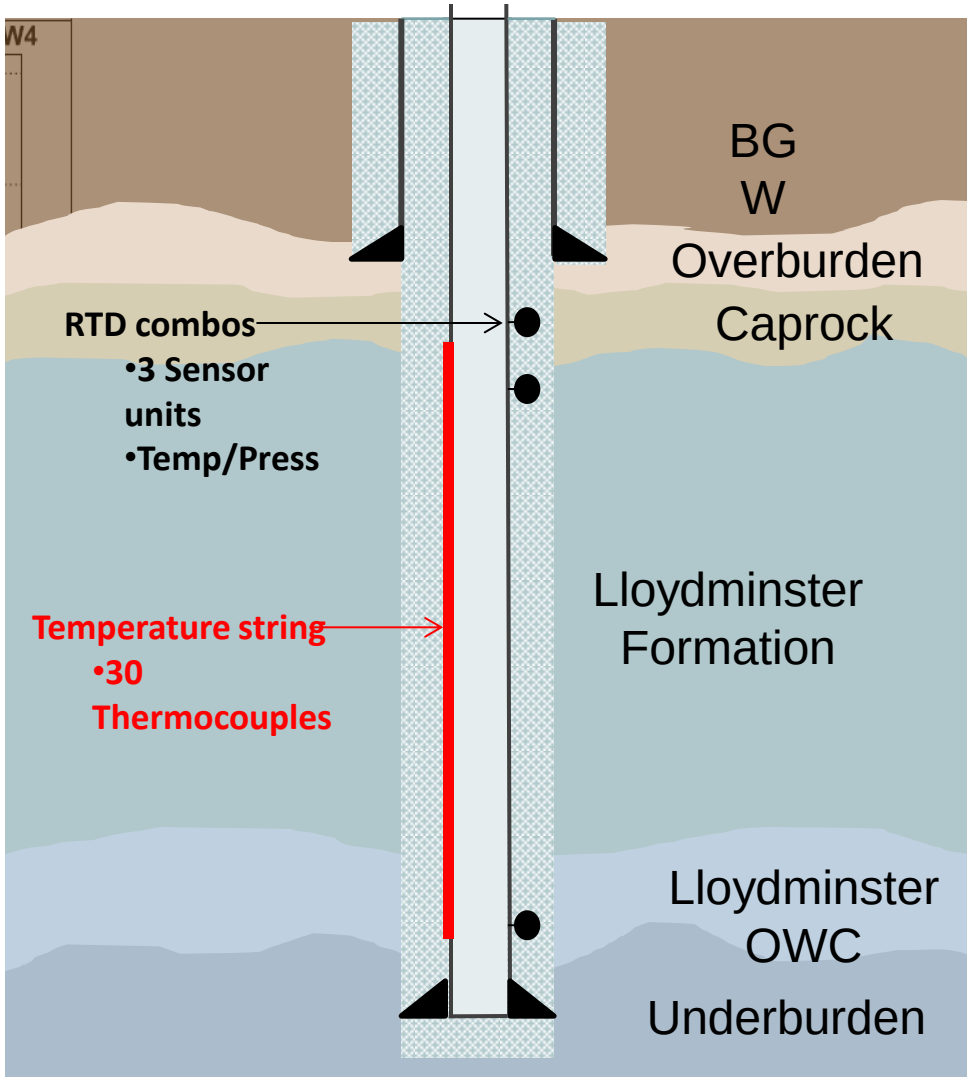
INSTRUMENTATION

SAGD WELL PAIR INSTRUMENTATION

- Single point pressure measurement is taken at the heel of both the injector and producer via bubble tube
  - Methane is injected in the casing of the injector and in the guide string annulus of the producer to provide a reading at surface via a pressure transmitter
  - Gas gradient calculations are accounted for in the pressure reading
  - Purging of the bubble tubes is completed on an as needed basis to limit the overall volume of gas being injected
  - Differential pressure is monitored between the injector and producer to provide insight into the accuracy of the pressure reading and subsequent purge timing
  - Producer bubble tubes are purged more frequently than injector bubble tubes due to the guide string annular volume and potential for plugging
- Fiber optic DTS (distributed temperature sensors) are run in all of the producer wells to provide real-time temperature data along the entire wellbore

OBSERVATION LOCATIONS/ TYPICAL COMPLETION





OBSERVATION LOCATIONS/ TYPICAL COMPLETION

- Downhole pressure/temperature gauge reliability has been good overall
  - As the thermocouple and pressure monitoring equipment is cemented on the backside of the casing, remediation of any failed downhole equipment is challenging
  - Pengrowth therefore runs multiple temperature and pressure points if this is encountered
- Surface equipment reliability has been an issue at times as all observation well locations rely on solar panels/battery combos for power
- Line of sight is also required for the Commercial observation wells to transmit data
- Pengrowth is continuing to work with the vendors on increasing the number of solar panels and battery capacity on location; especially important in winter months
- Data transmission accuracy is also being rectified between Pengrowth and the instrumentation vendors on an as needed basis
- Site Engineers check locations monthly

SCHEME PERFORMANCE

SAGD SUMMARY

- Lindbergh CPF commissioning completed December 2014

- Circulation Learnings
  - Slightly higher differential pressure required than needed with pilot wellpairs to induce communication (125 kPa vs 50 kPa)
  - Solvent soak had no significant impact on circulation
  - Lower wellpair landing depth increased steam loss initially and increased sensitivity bottom hole pressure variation

- Pad D03; seven well pairs had first steam December 15th, 2014
  - ~Ave 3.2 months of circulation

- Pad D05; eight well pairs had first steam January 10th, 2015
  - ~3.3 months of circulation

- Pad D02; five well pairs had first steam January 29th, 2015
  - ~Ave 3.6 months of circulation
    - Service rig equipment failure while on first wellpair SAGD conversion resulted in delay to SAGD

PRE-CIRCULATION SOLVENT SOAKS

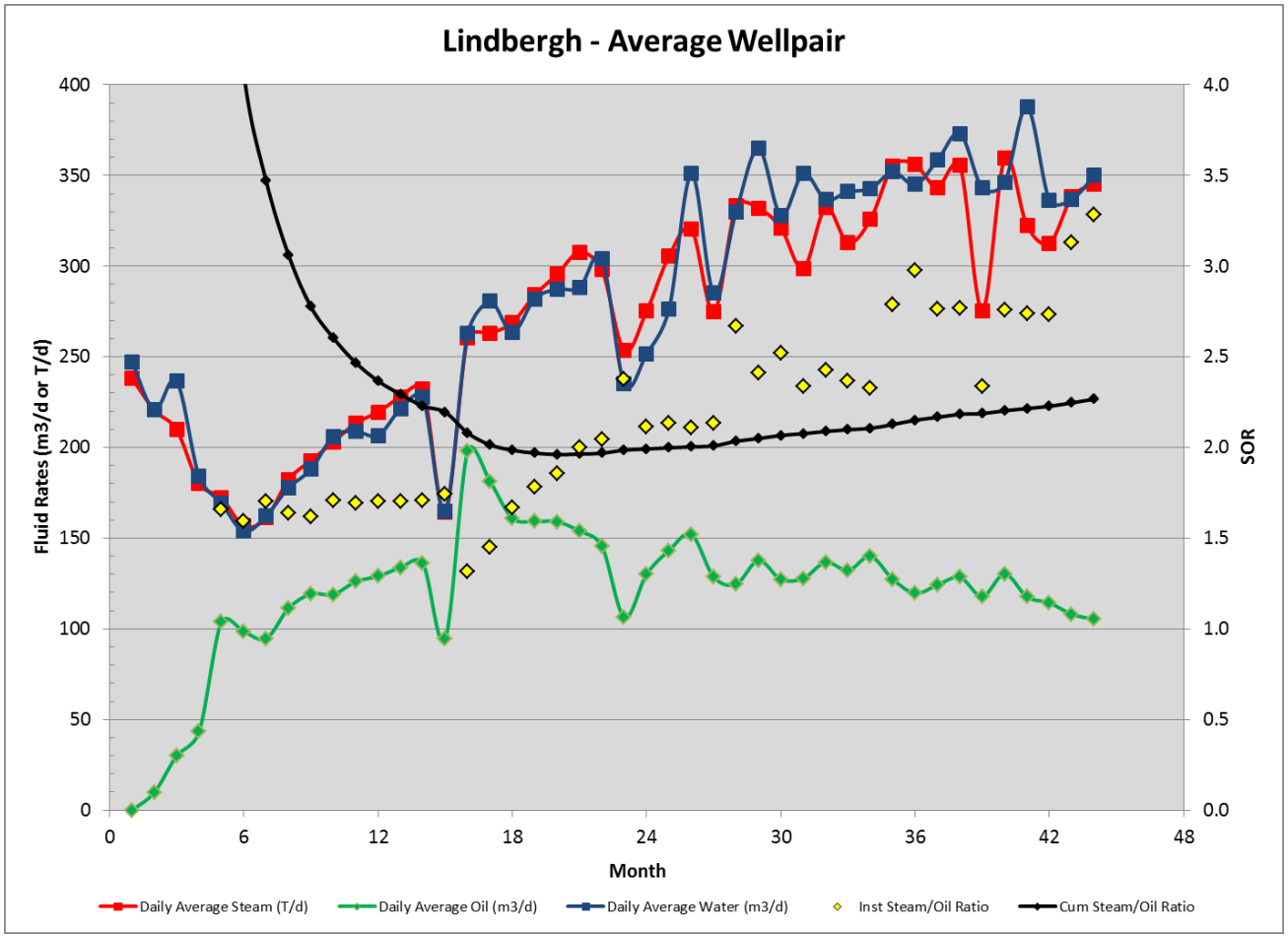
- Solvent was pumped into the injectors on two well pairs; D03-02 and D03-04
- Fort Saskatchewan Condensate utilized
- Forward circulated and spotted 25 m3 of condensate in each injector well
- Drop spool pressure gauges were installed in the wells to monitor the bottom hole pressure and associated leak-off post-injection
- Solvent soak took place for approximately six months prior to circulation start-up
- Nitrogen was injected in the long tubing string at approximately month three to ensure maximum leak-off of the solvent into the formation before start-up

PRE-CIRCULATION SOLVENT SOAKS

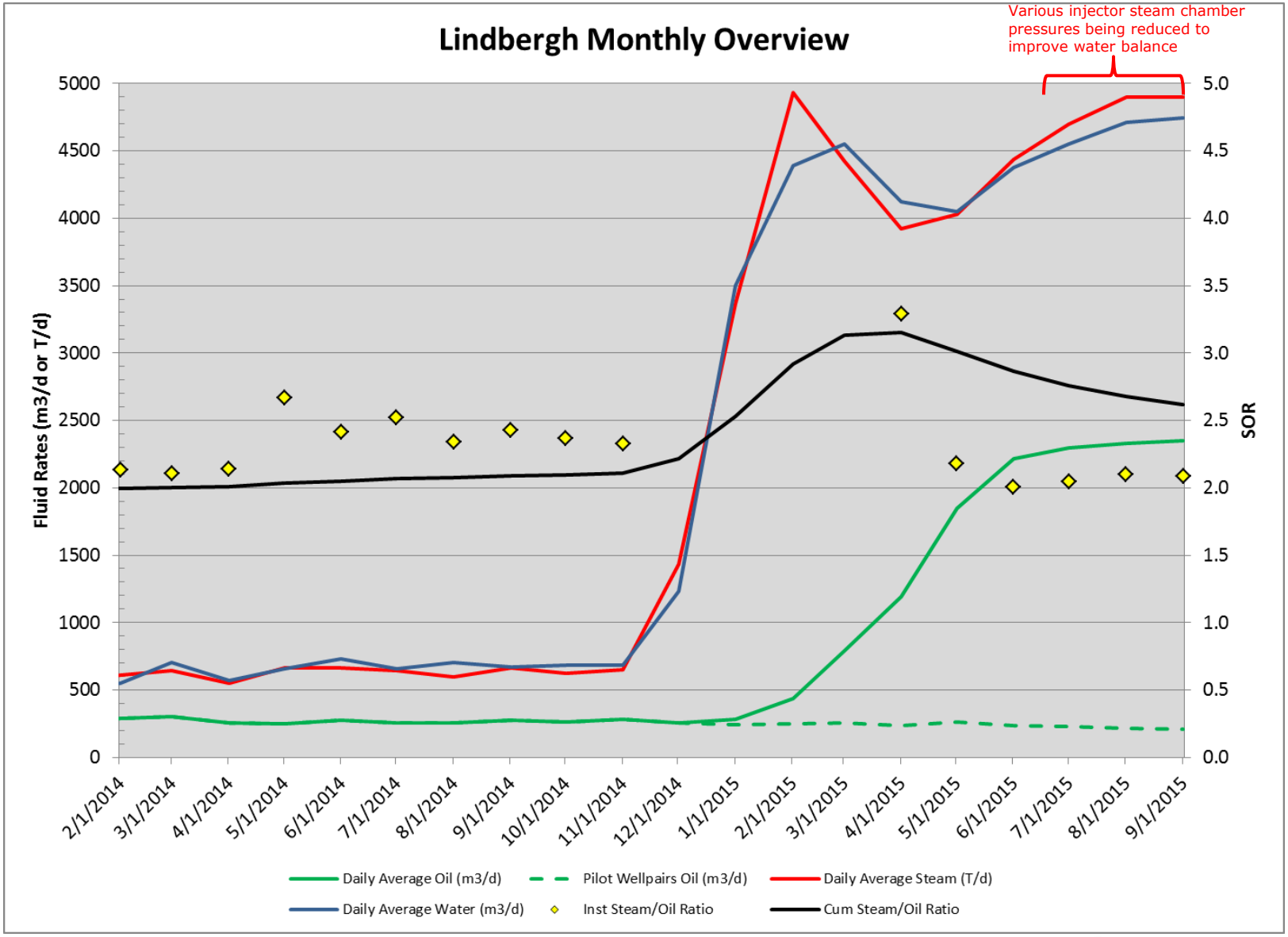
- Total circulation duration of the two solvent soak well pairs was similar to the non-solvent soak well pairs
  - No noticeable timing impact was identified when comparing communication characteristics between the injector and producer
  - Target circulation time was approximately 90 days; pending service rig availability for SAGD conversion
- Cumulative steam volume used in both cases was also similar to well pairs that did not utilize solvent soaks
  - Circulation rates and pressures were identical to that of non-solvent soak start-up wells
  - Differences based on service rig timing for SAGD conversion
- There has been no noticeable production difference in the well pairs to date that can be attributed to the solvent soaks
- No challenges were experienced when circulating the solvent soak well pairs back to the facility

PREDICTING COMMERCIAL SCHEME PERFORMANCE

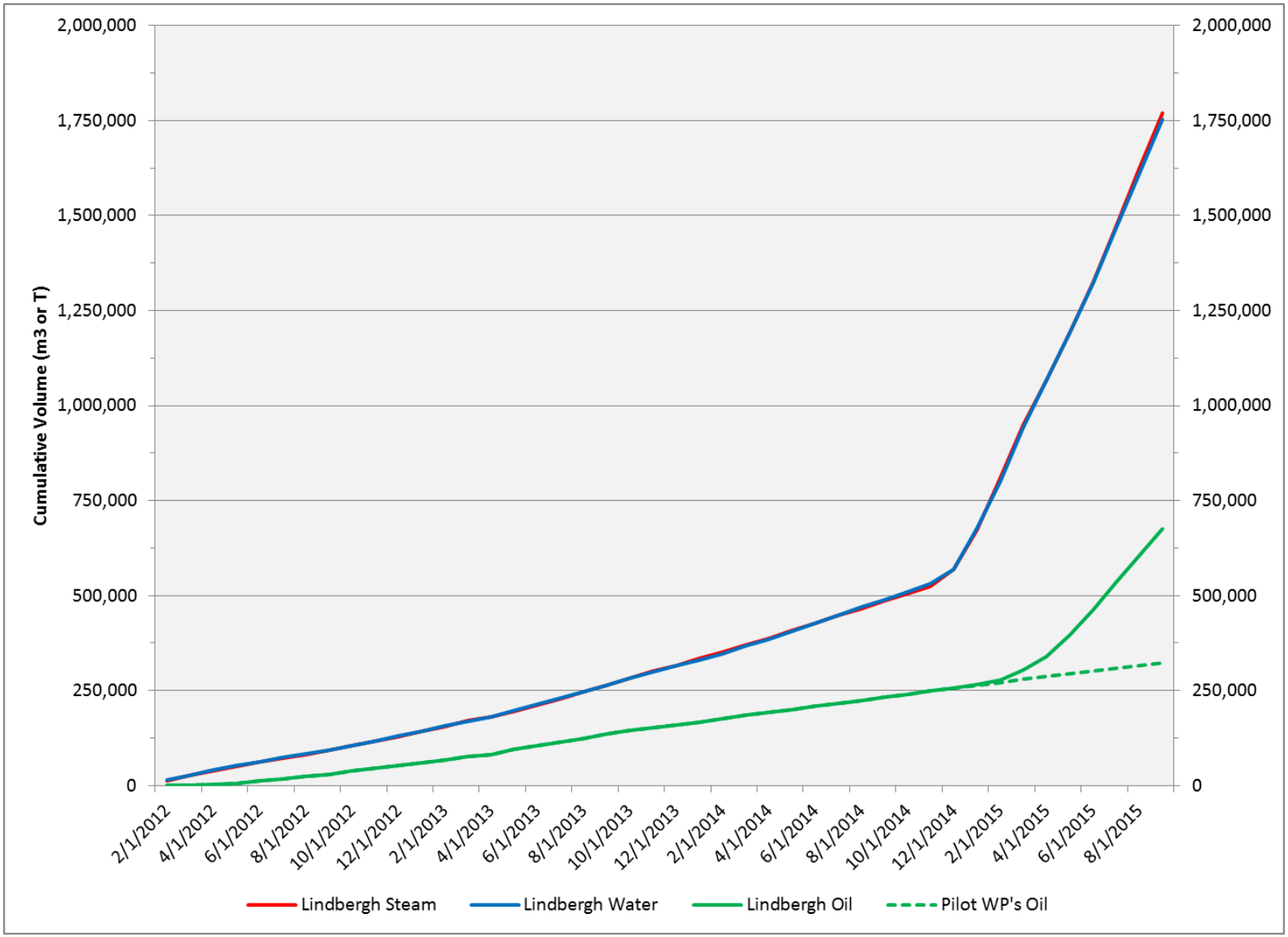
- Analogues
  - Pilot well pairs
- Simulations
  - CSS historical match
  - SAGD modeling
- One of the purposes of the Lindbergh pilot was to establish a baseline for predicting commercial performance



LINDBERGH PERFORMANCE



CUMULATIVE VOLUMES



PAD RECOVERIES

OBIP - Recovery and % recovery by pad

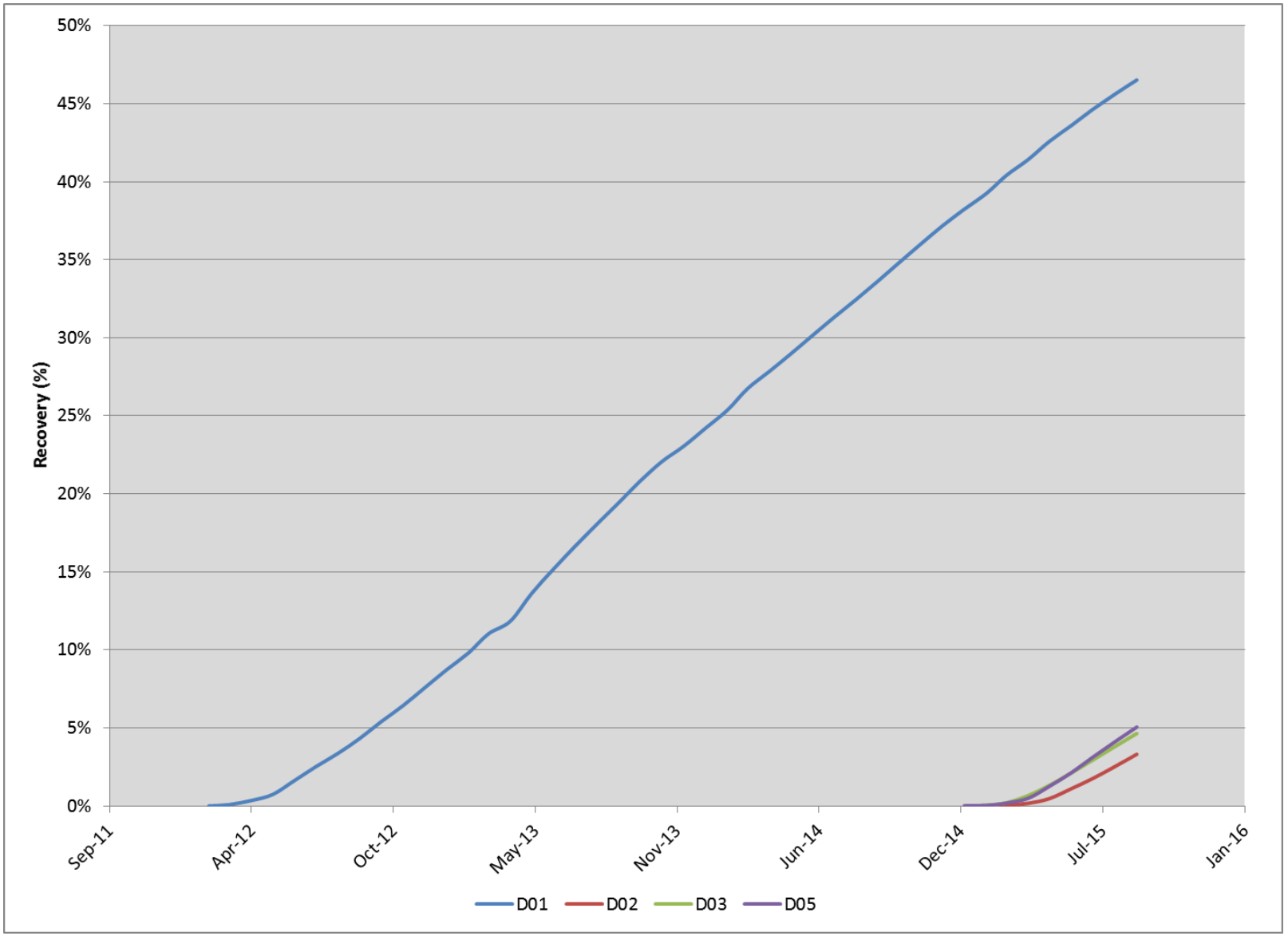
	Thickness	Length*	Spacing	Ave ϕ	Ave So	OBIP	Recovery**	Recovery
Pad	(m)	(m)	(m)	(%)	(%)	(e3m3)	(e3m3)	**(%)**
D01	21.1	900	100	35	74	993.5	321.7	**32.4**
D02	20.0	817	100	35	78	2,265	66.2	**2.9**
D03	18.4	788	100	36	80	2,981	139.3	**4.7**
D05	17.7	800	100	38	78	3,366	139.3	**4.4**

Developed BIP - Recovery and % recovery by pad

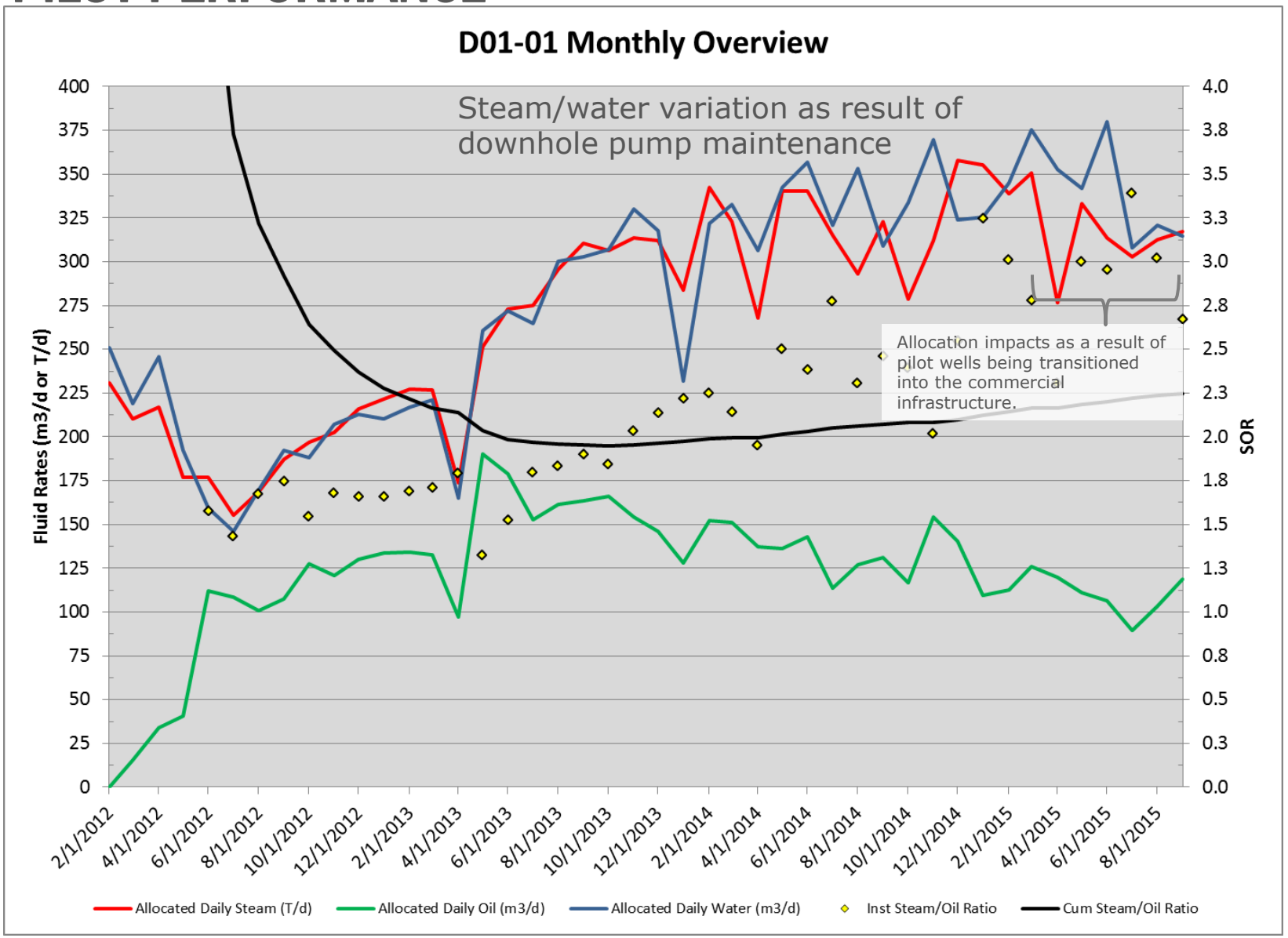
	Thickness	Length *	Spacing	Ave ϕ	Ave So	DBIP	Recovery**	Recovery	EUR
Pad	(m)	(m)	(m)	(%)	(%)	(e3m3)	(e3m3)	**(%)**	(%)
D01	15.3	872.5	100	35	74	692	321.7	**46.5**	60
D02	17.5	817	100	35	79	1,999	66.2	**3.3**	60
D03	15.9	788	100	35	83	2,563	139.3	**5.4**	60
D05	15.2	800	100	37	80	2,940	149	**5.1**	60

*Length is average slotted length plus 25 meters per end (50 m total)
**Recovery to Oct 1 2015

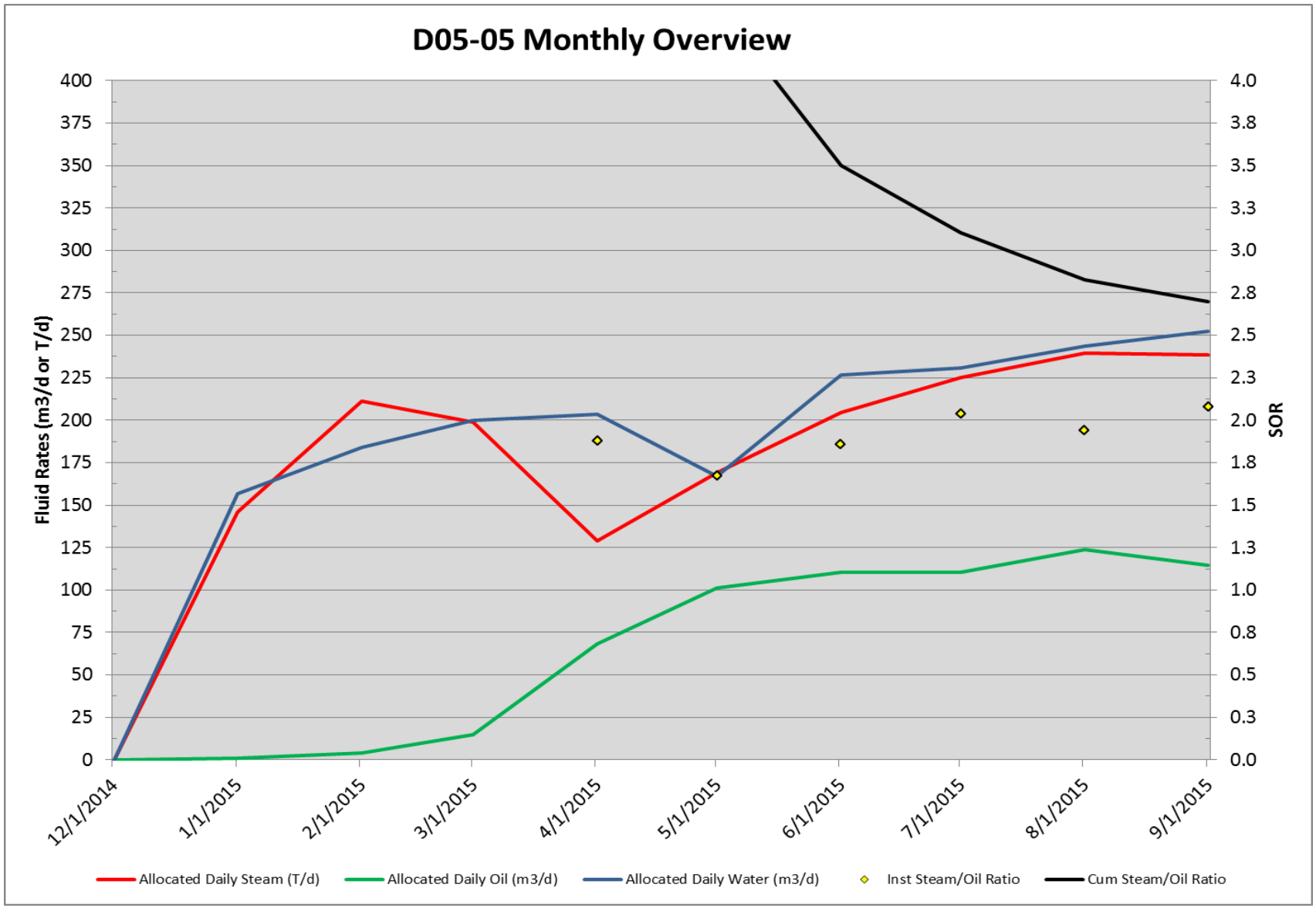
LINDBERGH DEVELOPED RECOVERY



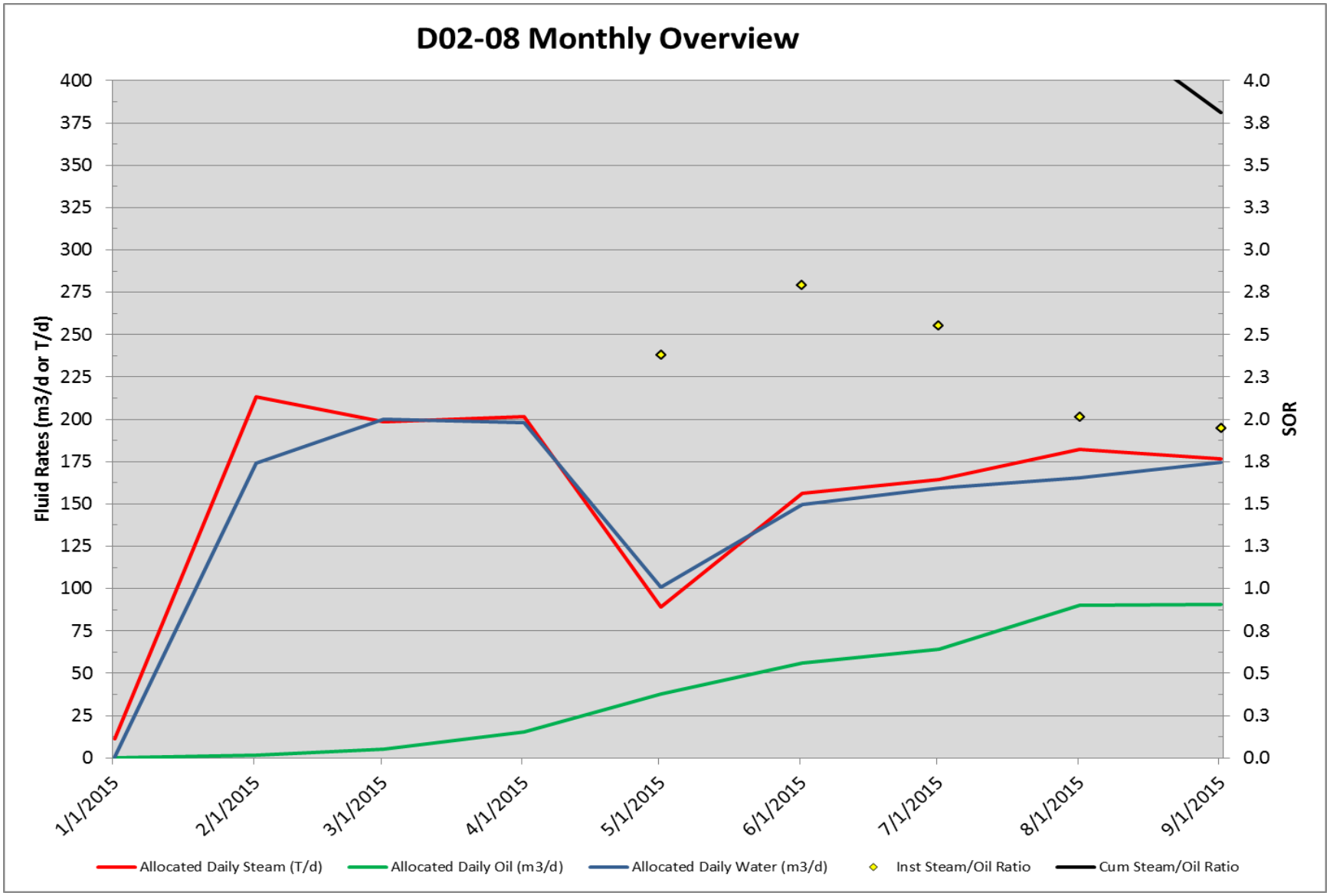
PILOT PERFORMANCE



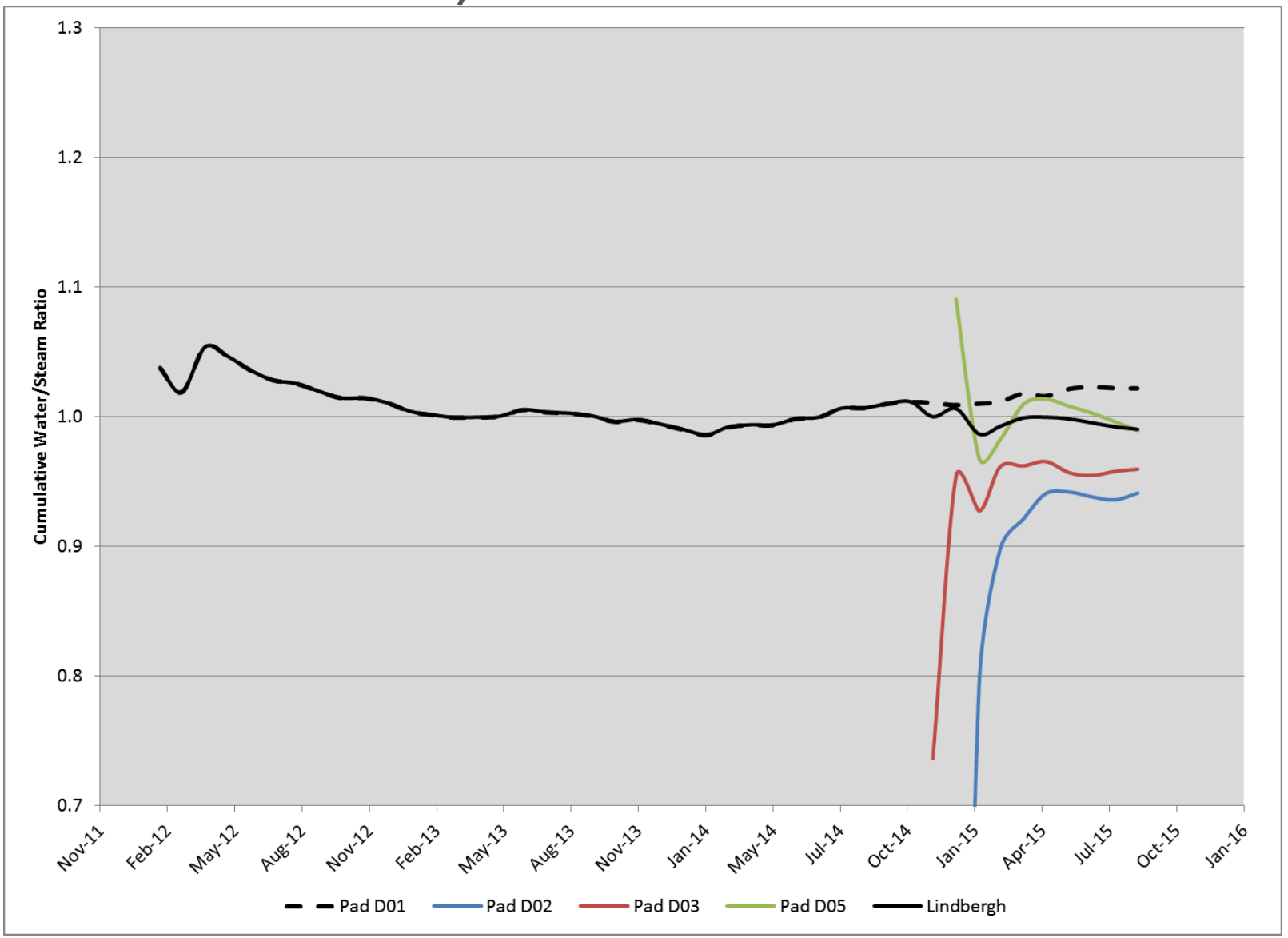
PHASE 1 HIGH PERFORMER



PHASE 1 POOR PERFORMER



CUMULATIVE WATER/STEAM RATIO

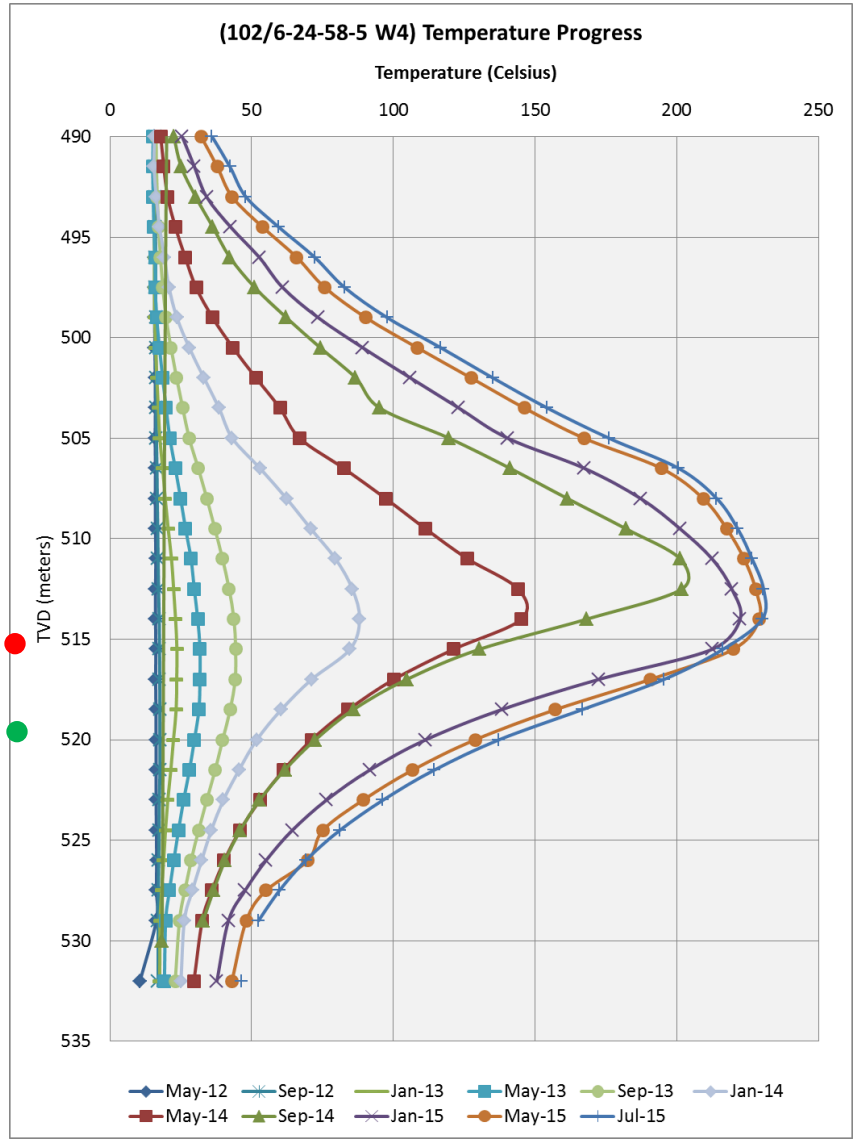


D01-02 OBSERVATION WELL EXAMPLE

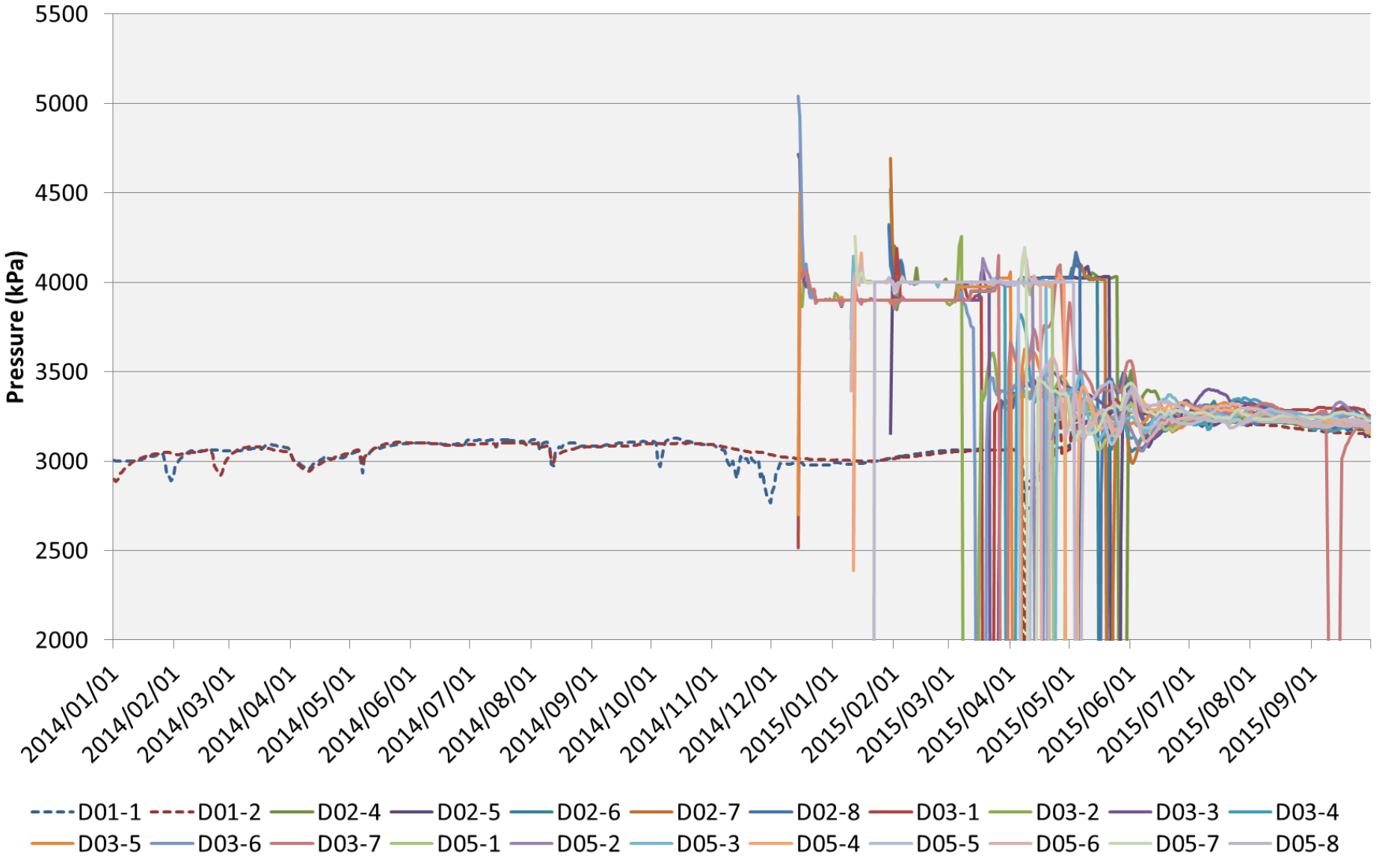
~11 m offsetting WP2

Injector

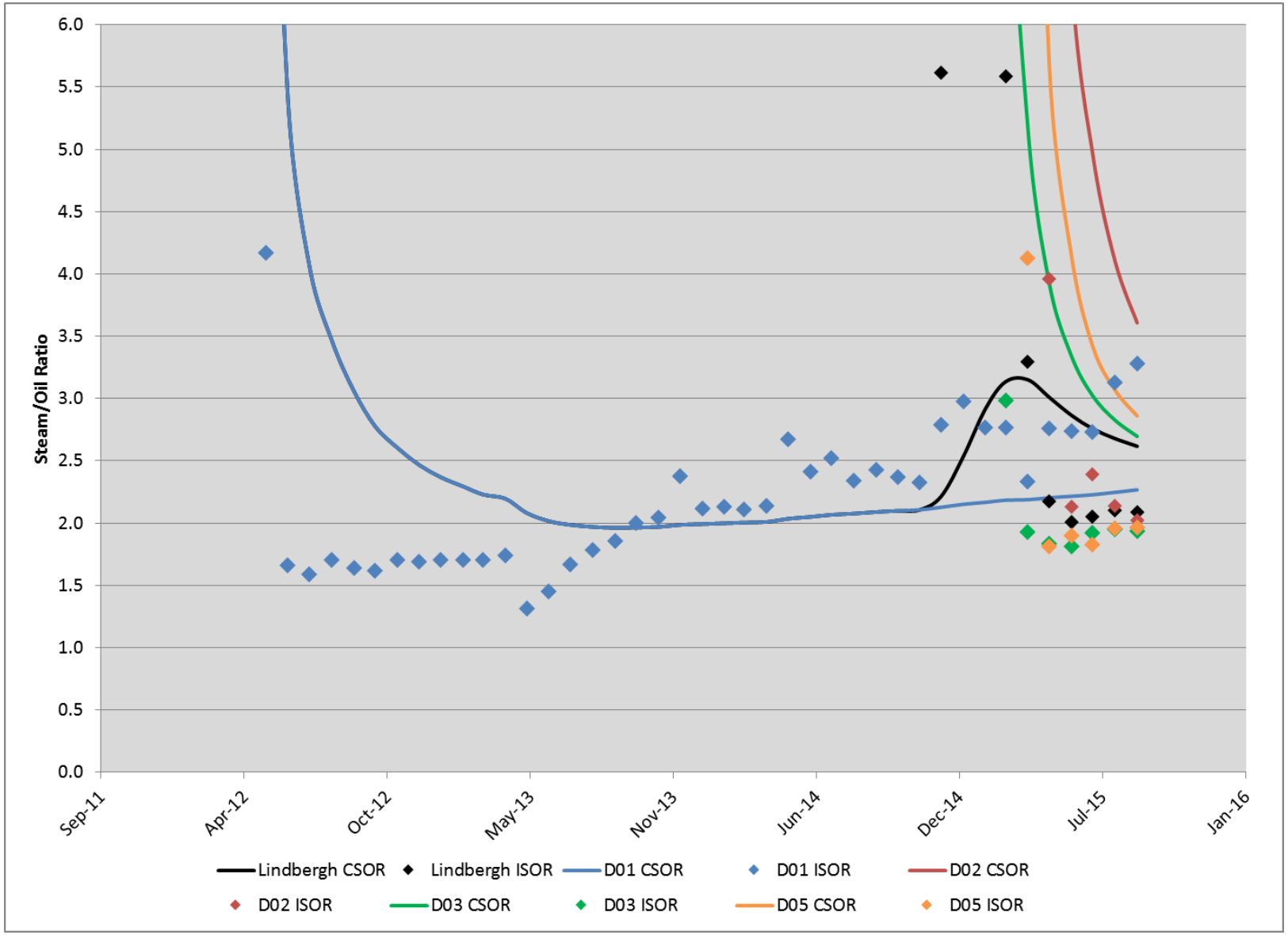
Producer



INJECTOR BOTTOM HOLE PRESSURE



LINDBERGH CSOR AND ISOR



WELLHEAD STEAM QUALITY

- Current steam quality injected at the well pad is ~98%
  - Close proximity to CPF

PAD ABANDONMENTS – 5 YEAR OUTLOOK

- No abandonments of SAGD wells or well pads are expected in the next 5 years

KEY LEARNINGS

- ESP is the preferred artificial lift technology
  - Operability, no surface maintenance and overall longevity
- Bottom hole pressure target changes over time
  - Will vary with oil/water contact changes and steam chamber size
  - Produced water has not shown significant impacts on wire wrap screen
- Smaller well design has not impacted production rates and well operability
- Scab liner design
  - Shorter scab liner preferred when compared to pilot
  - Production port beneficial for uniform fluid level

FUTURE PLANS - SUBSURFACE

FUTURE PLANS - SUBSURFACE

- Maintain steady state

- Future considerations
  - Infill well
  - Section 13 test (2 well pairs)
  - Pad D04 well pad (8 well pairs)
  - Pad D01 and D02 (3 additional well pairs)

FUTURE PLANS – INFILL WELL

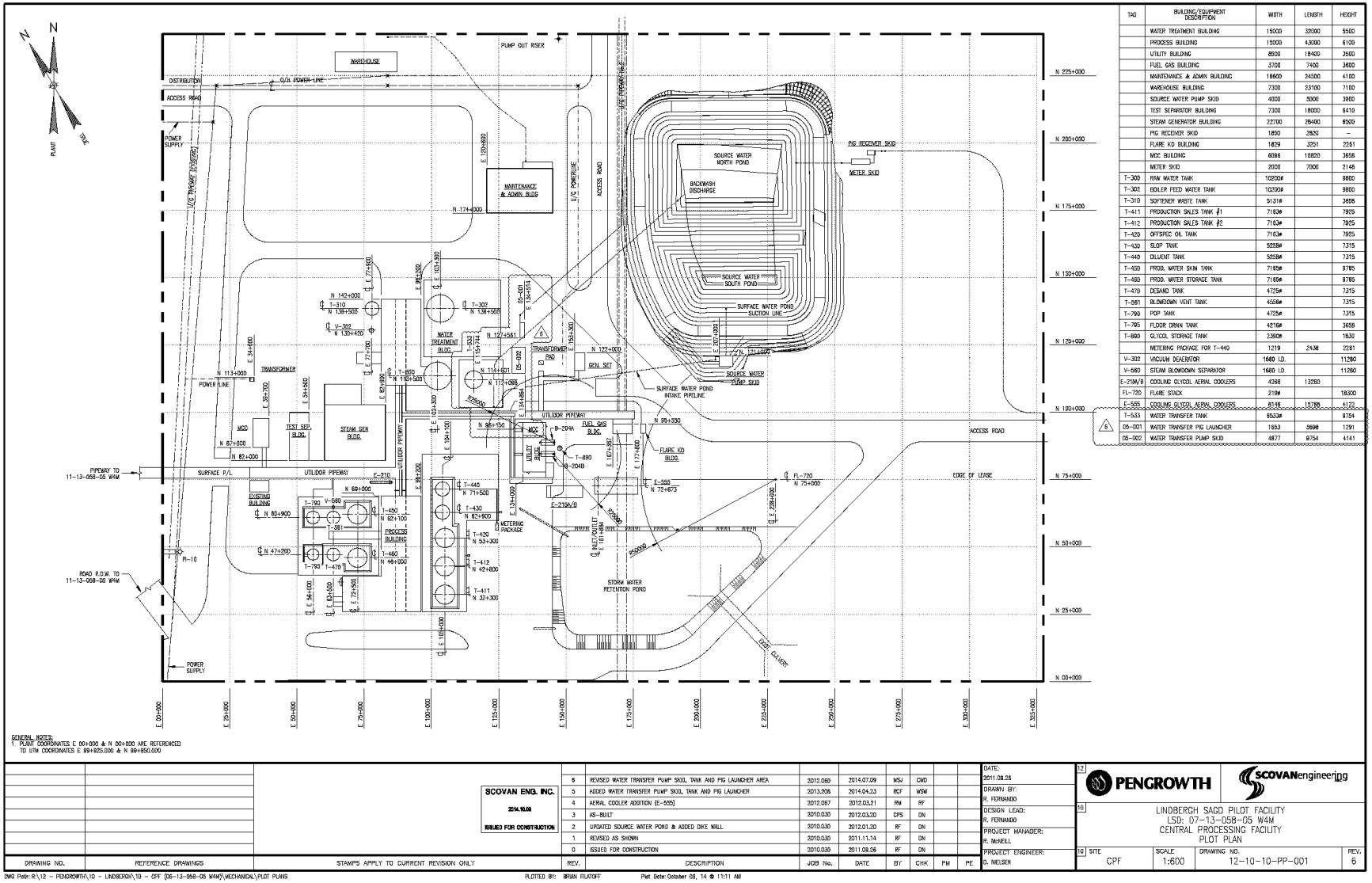
- Infill well planning on-going into 2016
- Current tentative plan is to drill a single infill well on the D01 Pilot Pad
- Well would utilize existing infrastructure with modifications to surface facilities only where required
- Forecasting and simulation work on-going to support project and eventual application
- Project approval is pending favorable economic conditions and business requirement for learning's on future project phases

FACILITIES

LINDBERGH PILOT FACILITY

- 07-13-058-05 W4M pilot facility site
- Design capacity
  - 1000 m3/d CWE for steam generation
  - 200 m3/d oil production (80% steam quality & SOR of 4.0)
- Pilot facility is not equipped to handle produced water recycle
  - Make-up volumes are below 500,000 m3/year
- Qualified and experienced SAGD operations team
- Pilot facility first steam February 2012
- Mothballed oil and steam trains of pilot facility Q2 2015
- Remaining in service:
  - Source water filtration and instrument air for commercial water transfer
  - Glycol heaters for building heat

LINDBERGH PILOT PLOT PLAN



TAG	BUILDING/EQUIPMENT DESCRIPTION	WIDTH	LENGTH	HEIGHT
	WATER TREATMENT BUILDING	15000	32000	5500
	PROCESS BUILDING	15000	43000	6100
	UTILITY BUILDING	8500	18400	3500
	FUEL GAS BUILDING	3700	7400	3600
	MAINTENANCE & ADMIN BUILDING	18600	24500	6100
	WAREHOUSE BUILDING	7300	23100	7100
	SOURCE WATER PUMP SKID	4000	5900	3900
	TEST SEPARATOR BUILDING	7300	18000	6410
	STEAM GENERATOR BUILDING	22700	28400	8500
	PIG RECEIVER SKID	1850	2820	–
	FLARE KO BUILDING	1829	3251	2281
	MCC BUILDING	6096	10820	3656
	METER SKID	2000	7000	2148
T-300	RAW WATER TANK	102004		9800
T-302	BOILER FEED WATER TANK	102004		9800
T-310	SOFTENER WASTE TANK	9131#		3505
T-411	PRODUCTION SALES TANK #1	7163#		7925
T-412	PRODUCTION SALES TANK #2	7163#		7925
T-429	OFFSPEC OIL TANK	7163#		7925
T-430	SLOP TANK	5258#		7315
T-440	DILUENT TANK	5258#		7315
T-450	PROD. WATER SKIM TANK	7165#		9785
T-460	PROD. WATER STORAGE TANK	7165#		9785
T-470	DESAND TANK	4725#		7315
T-561	BLOWDOWN VENT TANK	4556#		7315
T-790	POP TANK	4725#		7315
T-795	FLOOR DRAIN TANK	4216#		3658
T-890	GLYCOL STORAGE TANK	2380#		1830
	METERING PACKAGE FOR T-440	1219	2438	2281
V-302	VACUUM DEAERATOR	1680 I.D.		11280
V-680	STEAM BLOWDOWN SEPARATOR	1680 I.D.		11280
E-219A/B	COOLING GLYCOL AERIAL COOLERS	4268	13250	
FL-720	FLARE STACK	219#		18300
E-555	COOLING GLYCOL AERIAL COOLERS	6146	10788	4122
T-533	WATER TRANSFER TANK	9533#		9754
05-001	WATER TRANSFER PIG LAUNCHER	1853	5898	1291
05-002	WATER TRANSFER PUMP SKID	4877	9754	4141

GENERAL NOTES:
1. PLANT COORDINATES E 00+000 & N 00+000 ARE REFERENCED TO UTM COORDINATES E 89+825.000 & N 89+850.000

REV.	DESCRIPTION	JOB No.	DATE	BY	CHK	PM	PE
6	REVISED WATER TRANSFER PUMP SKID, TANK AND PIG LAUNCHER AREA	2012.050	2014.07.09	WSJ	CWD		
5	ADDED WATER TRANSFER PUMP SKID, TANK AND PIG LAUNCHER	2013.306	2014.04.23	RCF	WSW		
4	AERIAL COOLER ADDITION (E-555)	2012.057	2012.03.21	RW	RF		
3	AS-BUILT	2010.030	2012.03.20	DPS	DN		
2	UPDATED SOURCE WATER POND & ADDED DIKE WALL	2010.030	2012.01.20	RF	DN		
1	REVISED AS SHOWN	2010.030	2011.11.14	RF	DN		
0	ISSUED FOR CONSTRUCTION	2010.030	2011.08.26	RF	DN		

SCOVAN ENG. INC.
2214.10.08
ISSUED FOR CONSTRUCTION

DRAWING NO. | REFERENCE DRAWINGS | STAMPS APPLY TO CURRENT REVISION ONLY

DATE: 2011.08.26
DRAWN BY: R. FERNANDO
DESIGN LEAD: R. FERNANDO
PROJECT MANAGER: R. McNEIL
PROJECT ENGINEER: D. NIELSEN

PENGROWTH | SCOVANengineering

LINDBERGH SAGD PILOT FACILITY
LSD: 07-13-058-05 W4M
CENTRAL PROCESSING FACILITY
PLOT PLAN

SITE	SCALE	DRAWING NO.	REV.
CPF	1:600	12-10-10-PP-001	6

DWG Path: R:\12 - PENGROWTH\10 - LINDBERGH\10 - CPF (06-13-058-05 W4M)\MECHANICAL\PLOT PLANS
PLOTTED BY: BRIAN FLATOFF
Plot Date: October 08, 14 @ 11:11 AM

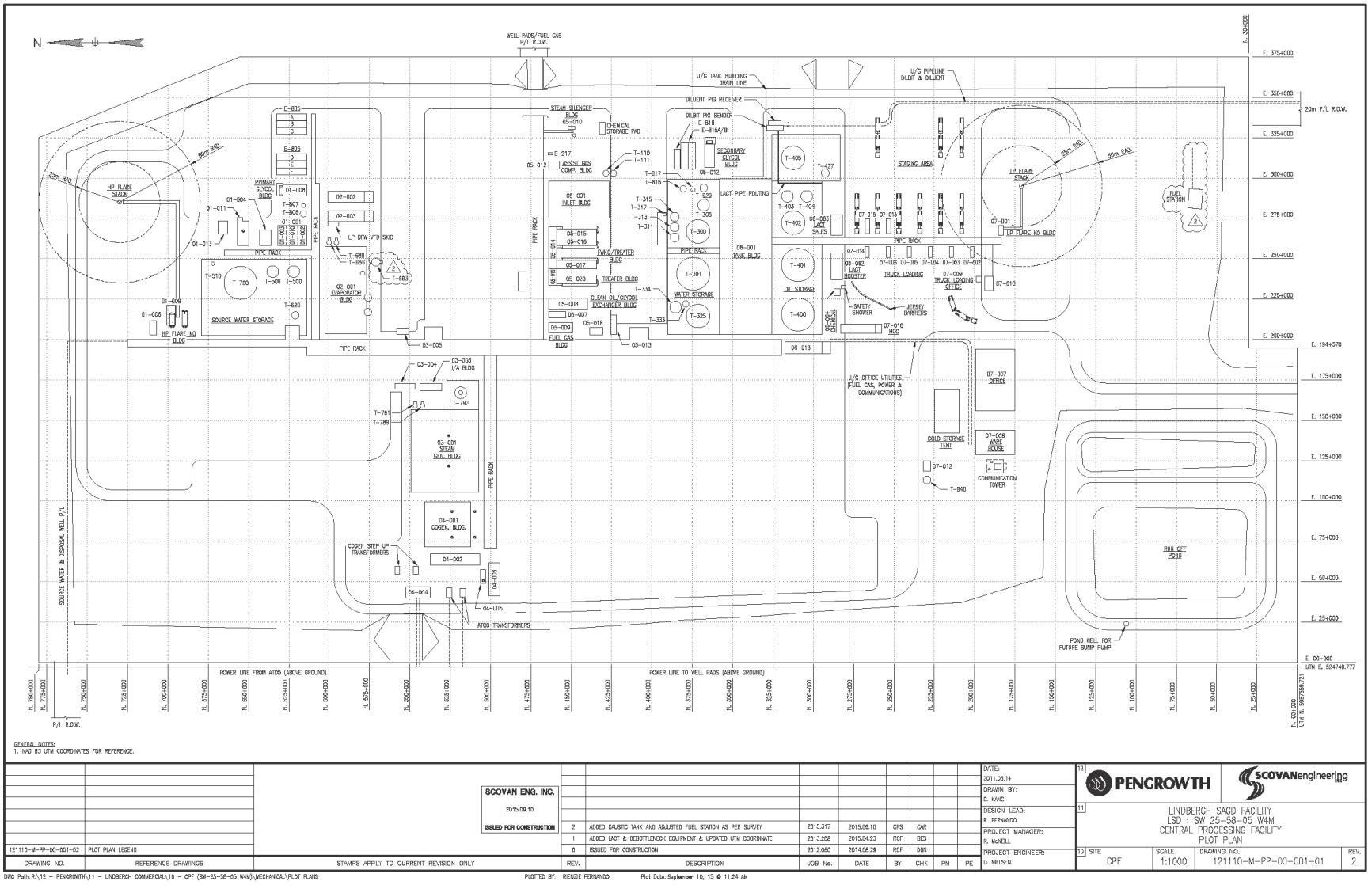
LINDBERGH PILOT FACILITY

- Bitumen treatment
  - H2S scavenger added at truck loading to meet rail shipping requirements
- Water treatment
  - Higher organics content in produced water causing higher than expected HEX fouling
- Steam generation
  - Carry through sediment into upfront SACs
    - Reduction in runtime on SACs, impact to BFW production
    - With commercial water transfer, change to use filtered water as backwash, rather than unfiltered pond water; prevent buildup of sediment under media filters during backwash
- Power consumption
  - Consistent consumption, increase over winter months

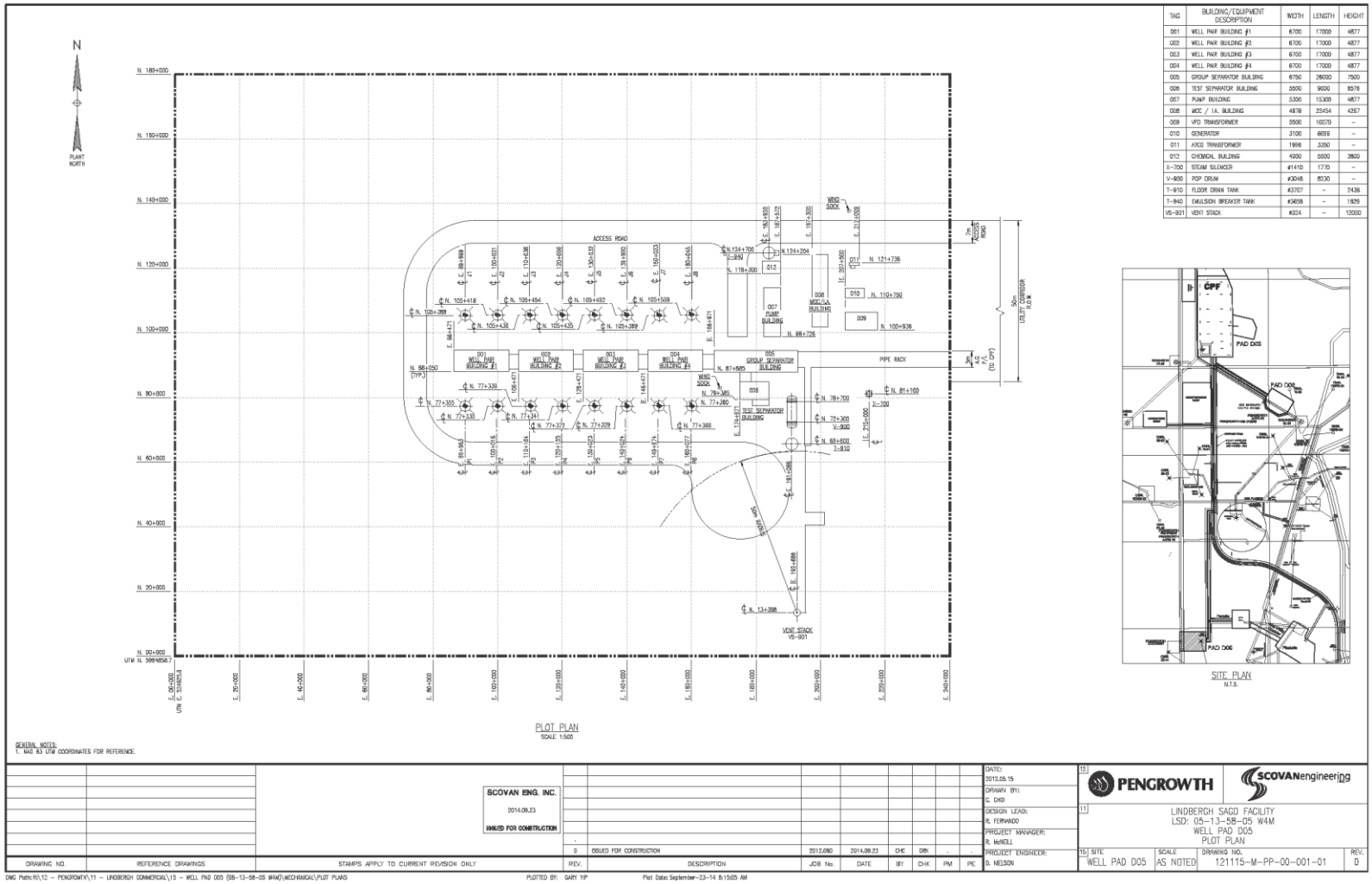
LINDBERGH SAGD COMMERCIAL FACILITY

- SW-25-058-05 W4M CPF site
- Original daily design capacity
  - 8000 m3/d (50,000 bwpd) CWE for steam generation
  - 2208 m3/d (13,888 bopd) bitumen production
  - SOR 3.61
- Commercial facility equipped with water recycle
  - Falling film mechanical vapour compression
  - >90% water recycle rate
- Qualified and experienced SAGD operations team
- Commercial facility first steam December 2014

LINDBERGH COMMERCIAL CPF PLOT PLAN

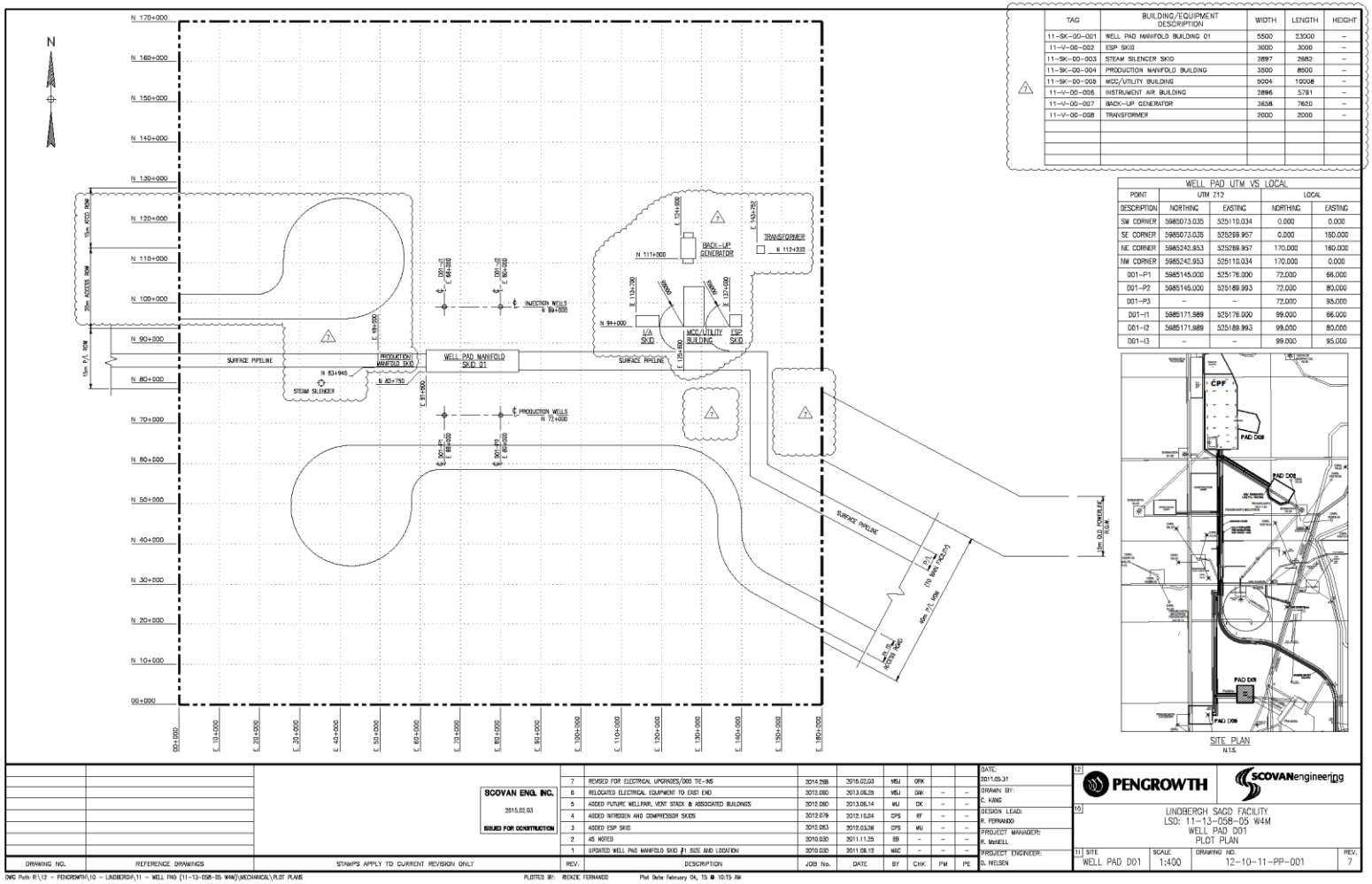


LINDBERGH COMMERCIAL TYPICAL WELLPAD PLOT PLAN



D02 – 5 Well pairs D03 – 7 Well pairs D05 – 8 Well pairs

LINDBERGH COMMERCIAL D01 WELLPAD PLOT PLAN



TAG	BUILDING/EQUIPMENT DESCRIPTION	WIDTH	LENGTH	HEIGHT
11-SK-00-001	WELL PAD MANIFOLD BUILDING 01	5500	23000	–
11-V-00-002	ESP SKID	3000	3000	–
11-SK-00-003	STEAM SILENCER SKID	2897	2682	–
11-SK-00-004	PRODUCTION MANIFOLD BUILDING	3500	8500	–
11-SK-00-005	MCC/UTILITY BUILDING	9004	19008	–
11-V-00-006	INSTRUMENT AIR BUILDING	2896	5791	–
11-V-00-007	BACK-UP GENERATOR	3658	7620	–
11-V-00-008	TRANSFORMER	2000	2000	–

WELL PAD UTM VS LOCAL

POINT	UTM 213		LOCAL	
DESCRIPTION	NORTHING	EASTING	NORTHING	EASTING
SW CORNER	5985073.035	525110.034	0.000	0.000
SE CORNER	5985073.035	525288.957	0.000	180.000
NE CORNER	5985242.953	525288.957	170.000	180.000
NW CORNER	5985242.953	525110.034	170.000	0.000
D01-P1	5985145.000	525176.000	72.000	66.000
D01-P2	5985145.000	525189.993	72.000	80.000
D01-P3	–	–	72.000	95.000
D01-I1	5985171.989	525176.000	99.000	66.000
D01-I2	5985171.989	525189.993	99.000	80.000
D01-I3	–	–	99.000	95.000

REV.	DESCRIPTION	JOB No.	DATE	BY	CHK	PM	PE
7	REVISED FOR ELECTRICAL UPGRADES/D05 TIE-INS	2014.298	2015.02.03	MSJ	GRK		
6	RELOCATED ELECTRICAL EQUIPMENT TO EAST END	2013.080	2013.06.25	MSJ	GAK	–	–
5	ADDED FUTURE WELLPAIR, VENT STACK & ASSOCIATED BUILDINGS	2012.080	2013.06.14	WJ	DK	–	–
4	ADDED NITROGEN AND COMPRESSOR SKIDS	2012.079	2013.10.04	CPS	RF	–	–
3	ADDED ESP SKID	2012.063	2012.03.26	CPS	WJ	–	–
2	AS NOTED	2010.030	2011.11.25	BB	–	–	–
1	UPDATED WELL PAD MANIFOLD SKID #1 SIZE AND LOCATION	2010.030	2011.08.12	MAC	–	–	–

SCOVAN ENGL. INC. 2015.02.03 ISSUED FOR CONSTRUCTION

DRAWING NO. | REFERENCE DRAWINGS | STAMPS APPLY TO CURRENT REVISION ONLY

DWG Path: R:\12 – PENGROWTH\10 – LINDBERGH\11 – WELL PAD (11-13-058-05 W4M)\MECHANICAL\PLOT PLANS

PLOTTED BY: RENZIE FERNANDO Plot Date: February 04, 15 @ 10:15 AM

DATE: 2011.05.31
DRAWN BY: C. KING
DESIGN LEAD: R. FERNANDO
PROJECT MANAGER: R. McNEILL
PROJECT ENGINEER: D. NIELSEN

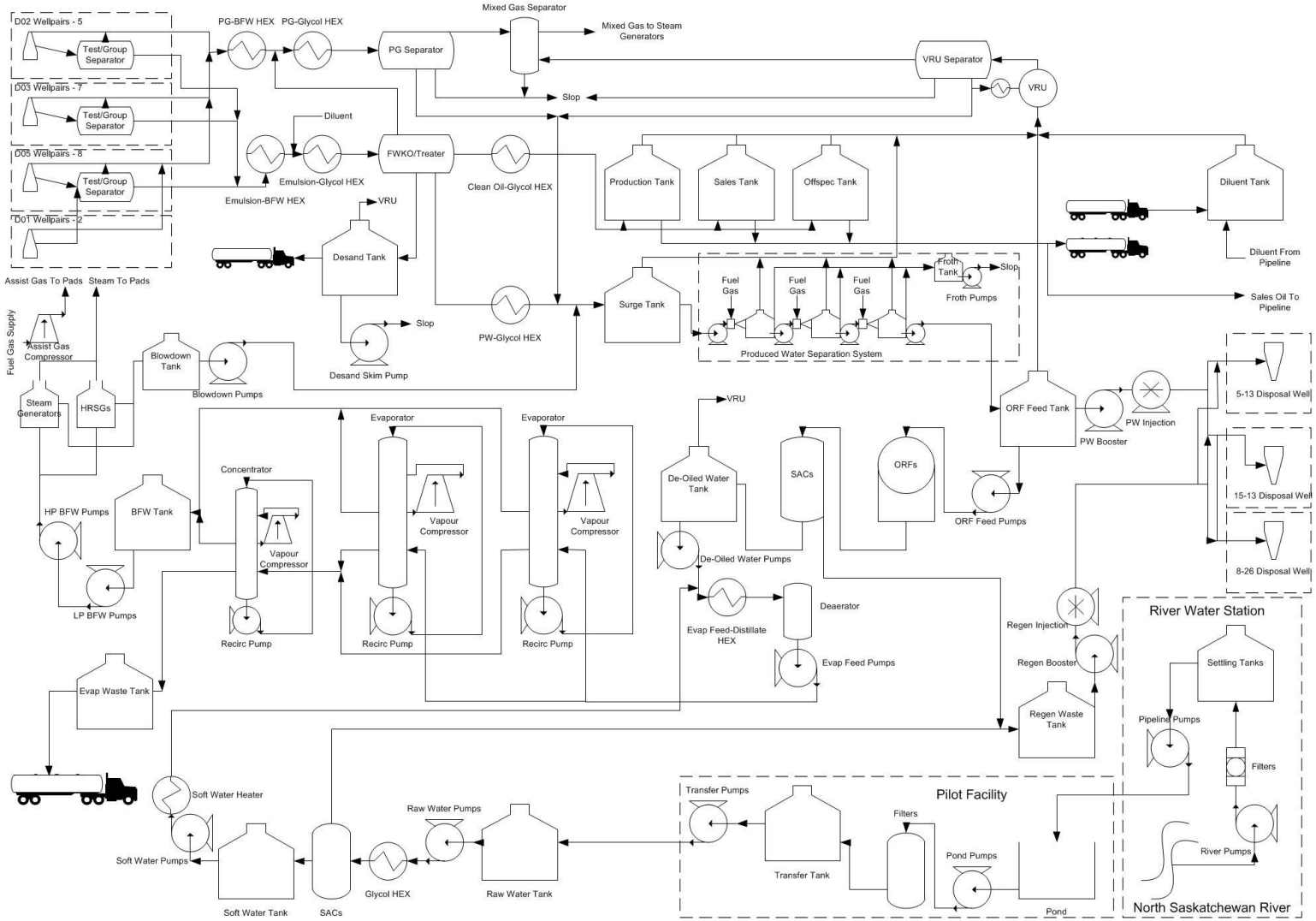
PENGROWTH | SCOVANengineering

LINDBERGH SAGD FACILITY
LSD: 11-13-058-05 W4M
WELL PAD D01
PLOT PLAN

SITE	SCALE	DRAWING NO.	REV.
WELL PAD D01	1:400	12-10-11-PP-001	7

Steam and assist gas from commercial facility. Emulsion and produced gas production to wellpad D05 test and group separators prior to being sent to the commercial CPF for processing.

LINDBERGH SCHEMATIC



LINDBERGH SAGD COMMERCIAL FACILITY

- Addition of LACT facilities for sales and diluent pipeline connections
- Addition of second treater for oil debottlenecking
- Maximum debottlenecked daily design capacity
  - 8000 m3/d (50,000 bwpd) CWE for steam generation
  - 3180 m3/d (20,000 bopd) bitumen production
  - SOR 2.5
- Addition of LPBFW pump VFDs
- Addition of two additional dilbit truck loading stations
- Addition of one additional diluent truck offloading station
- Addition of second bulk caustic storage tank

LINDBERGH SAGD COMMERCIAL FACILITY

- October partial outage executed to inspect/service steam generator PSVs
- During reduced rates opportunity taken to pull failed PG HEX and repair boiler CO leaks
- Bitumen treatment
  - Consistently producing on spec oil with use of lighter density diluent from pipeline
- Water treatment
  - Build up of start-up material in PW surge tank causing suspended colloidal matter carry over into ORFs and PW SACs
- Steam generation
  - CO leaks discovered on steam generators and utility boiler
  - Failed dampener linkage lead to removal of blower discharge louver
  - Repair of HRSG economizer due to failed tubes during commissioning
- Power
  - Generation relatively steady outside of regular maintenance and HRSG repairs
  - Consumption slowly increasing as loading on facility ramps up

LINDBERGH – POWER CONSUMPTION

- Import high in June 2015 due to cogen maintenance
- Import high in September 2015 due to HRSG economizer repairs

	Lindbergh Commercial				Lindbergh Pilot	Lindbergh River Station
	Generation	Consumption	Import	Export	Import/Consumption	Import/Consumption
	MWh	MWh	MWh	MWh	MWh	MWh
Jan-14					577	115
Feb-14					538	104
Mar-14					577	103
Apr-14					528	115
May-14					528	69
Jun-14					504	53
Jul-14					528	48
Aug-14					507	46
Sep-14					530	51
Oct-14					559	73
Nov-14					645	78
Dec-14					673	137
Jan-15	3900	6242	3266	924	658	134
Feb-15	8646	6062	122	2706	617	127
Mar-15	9483	6262	16	3179	629	113
Apr-15	9500	6266	43	3360	Mothballed	56
May-15	9791	6374	75	3395		38
Jun-15	9031	6437	188	2894		34
Jul-15	9746	6923	81	2999		27
Aug-15	10123	7310	3	2816		26
Sep-15	6562	7256	1474	780		28

LINDBERGH – GAS

- Flare high in April 2015 due to impact of lighter diluent switch
- Flare high in August & September 2015 due to inlet PG cooling issues
- Venting amounts in August from oil storage tanks due to heat exchange issues
- No routine venting in the field or at CPF

	Lindbergh Commercial					Lindbergh Pilot			
	FG Purchased (e3m3)	SG Produced (e3m3)	SG Flared (e3m3)	SG Vented (e3m3)	SG Conserved (%)	FG Purchased (e3m3)	SG Produced (e3m3)	SG Flared (e3m3)	SG Conserved (%)
Jan-14						1389	116	4	96.9
Feb-14						1359	120	3	97.8
Mar-14						1618	142	4	97.5
Apr-14						1332	136	4	97.3
May-14						1634	127	8	94.3
Jun-14						1585	155	6	96.2
Jul-14						1593	131	6	95.4
Aug-14						1499	105	7	93.5
Sep-14						1641	86	5	94.8
Oct-14						1594	117	5	95.9
Nov-14						1561	176	5	97.2
Dec-14						1758	188	5	97.3
Jan-15	6395	2691	107	0	96.2	1783	137	6	96.0
Feb-15	8848	4513	134	0	97.1	1636	103	5	95.7
Mar-15	9179	4060	69	0	98.3	1786	138	6	96.0
Apr-15	8672	2894	322	0	90.0	Mothballed			
May-15	9624	2458	108	0	95.8				
Jun-15	9516	2042	91	0	95.7				
Jul-15	10736	1956	109	0	94.7				
Aug-15	10894	3479	420	6*	89.1				
Sep-15	10062	2078	210	0	90.8				

* estimated

LINDBERGH – EMISSIONS

	Pilot Monthly Sulphur				Commercial Monthly Sulphur				
	Total SO2 t/month	Flare Stack t/month	OTSGs t/month	Peak Day t/d	Total SO2 t/month	Flare Stack t/month	Steam Gens t/month	Peak Day t/d	Approved Limit t/d
Jan-14	1.769	0.013	1.757	0.063					1.000
Feb-14	1.398	0.001	1.397	0.064					1.000
Mar-14	1.969	0.008	1.961	0.069					1.000
Apr-14	1.920	0.008	1.912	0.077					1.000
May-14	2.147	0.060	2.087	0.086					1.000
Jun-14	1.991	0.028	1.963	0.073					1.000
Jul-14	1.946	0.025	1.921	0.075					1.000
Aug-14	2.411	0.060	2.351	0.102					1.000
Sep-14	1.304	0.006	1.298	0.054					1.000
Oct-14	2.884	0.010	2.874	0.140					1.000
Nov-14	3.772	0.013	3.759	0.154					1.000
Dec-14	2.781	0.010	2.771	0.109					1.000
Jan-15	3.205	0.011	3.194	0.131	1.434	0.013	1.421	0.069	1.000
Feb-15	2.346	0.001	2.345	0.102	0	0	0	0	1.000
Mar-15	2.823	0.012	2.810	0.102	0	0	0	0	1.000
Apr-15	Mothballed				1.777	0.160	0	0.045	1.000
May-15					5.491	0.015	2.146	0.072	1.000
Jun-15					13.799	0.012	9.258	0.327	1.000
Jul-15					13.439	0.014	8.014	0.272	1.000
Aug-15					19.722	0.491	11.720	0.588	1.000
Sep-15					19.736	0.196	10.683	0.379	1.000

LINDBERGH – EMISSIONS

- Simulations based on historical pilot data do not indicate we will exceed our 1 tonne/day limit with the current production forecast of Phase 1
- Considerations will be given to the incorporation of sulphur recovery for future Phase 2 expansion

Pilot Manual Stack Survey NOx Results – June 2012		
Emission Source	Emission Rate (kg/hr)	Approval Limit (kg/hr)
B-510 (OTSG 1)	1.13	1.71
B-520 (OTSG 2)	1.14	1.71
B-204A (Glycol Boiler 1)	0.0380	0.32
B-204B (Glycol Boiler 2)	0.0216	0.32

- Pilot stack survey dictated as one manual stack survey within 6 months of commissioning.

Commercial Manual Stack Survey NOx Results – May 2015		
Emission Source	Emission Rate (kg/hr)	Approval Limit (kg/hr)
H-710 (Steam Gen 1)	7.56	16.8
H-720 (Steam Gen 2)	6.81	16.8
H-730 (Cogen 1)	1	7.34
H-740 (Cogen 2)	1.16	7.34
H-942 (Utility Boiler)	0.0434	0.46

Commercial CEMS Data - Monthly Average	
	NOx (kg/hr)
Jan-15	6.26
Feb-15	5.35
Mar-15	4.83
Apr-15	4.81
May-15	5.11
Jun-15	5.40
Jul-15	5.10
Aug-15	6.25
Sep-15	7.08

- Commercial stack survey dictated as one manual stack survey within 6 months of commissioning for each source, once per year on a rotating basis for H-710 & H-720, continuous monitoring via CEM for H-710 & H-720, and one manual stack survey per year on each of H-730 & H-740.

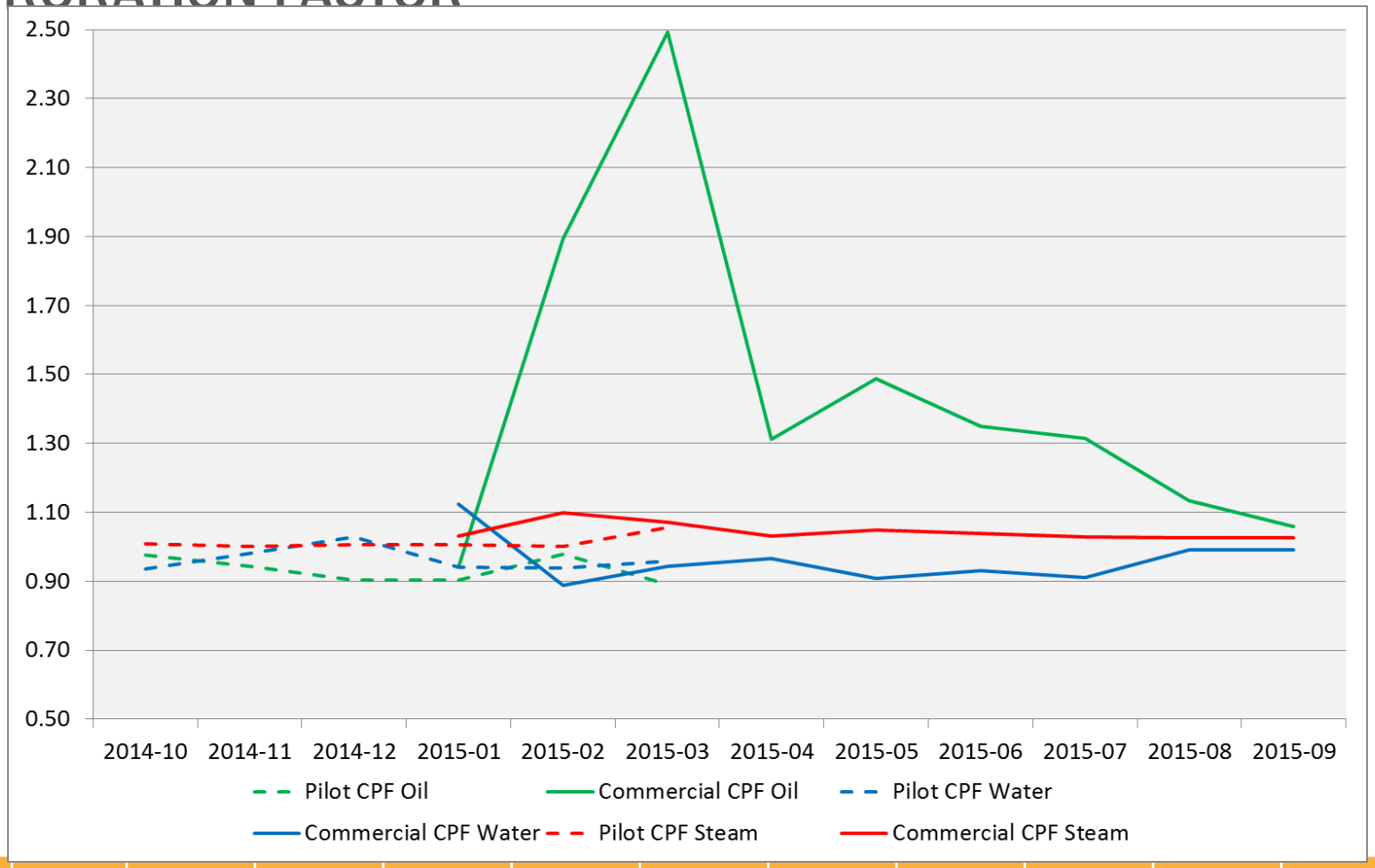
MEASUREMENT AND REPORTING

MARP SUMMARY

- Testing
  - Test separator located at D02, D03 and D05
    - Pad D01 pilot wellpairs tested at D05
  - 12 hour tests
    - Within +/- 10% of previous results to be accepted
  - Individual well gas allocated as a function of facility GOR and monthly allocated production

- Significant difficulty with consistent sample cut results initially
  - Continue to optimize chemical in manual samples
  - Ongoing AGAR calibration utilizing pressurized sample bombs and lab analysis

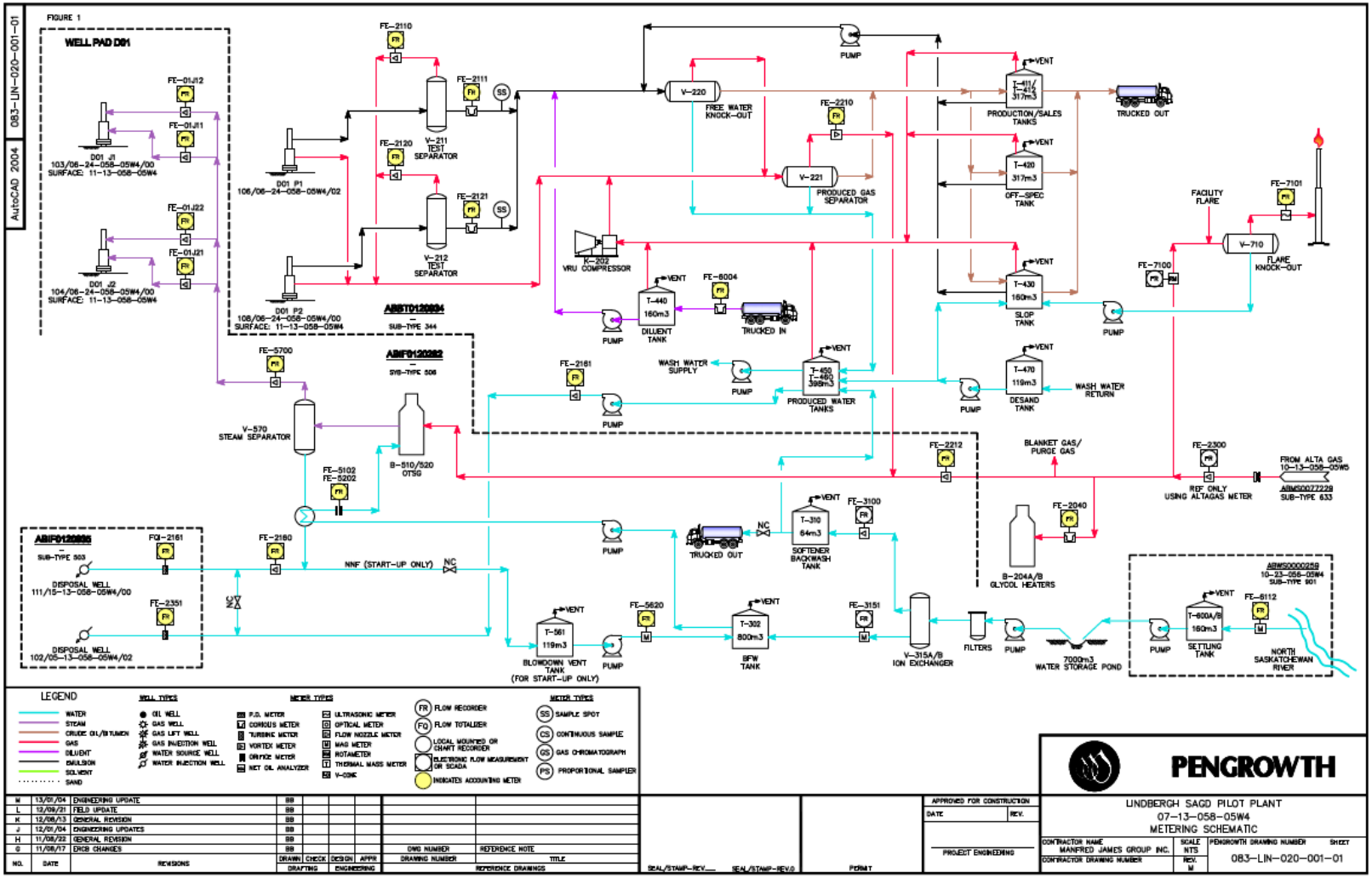
PRORATION FACTOR



	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Jul-15	Aug-15	Sep-15
Pilot CPF Oil	0.98	0.94	0.90	0.90	0.98	0.89						
Comm Oil				0.94	1.89	2.49	1.31	1.49	1.35	1.31	1.13	1.06
Pilot CPF Water	0.94	0.98	1.03	0.94	0.94	0.96						
Comm Water				1.12	0.89	0.94	0.97	0.91	0.93	0.91	0.99	0.99
Pilot CPF Steam	1.008	1.001	1.006	1.005	1.002	1.056						
Comm Steam				1.032	1.099	1.072	1.031	1.049	1.038	1.028	1.027	1.026

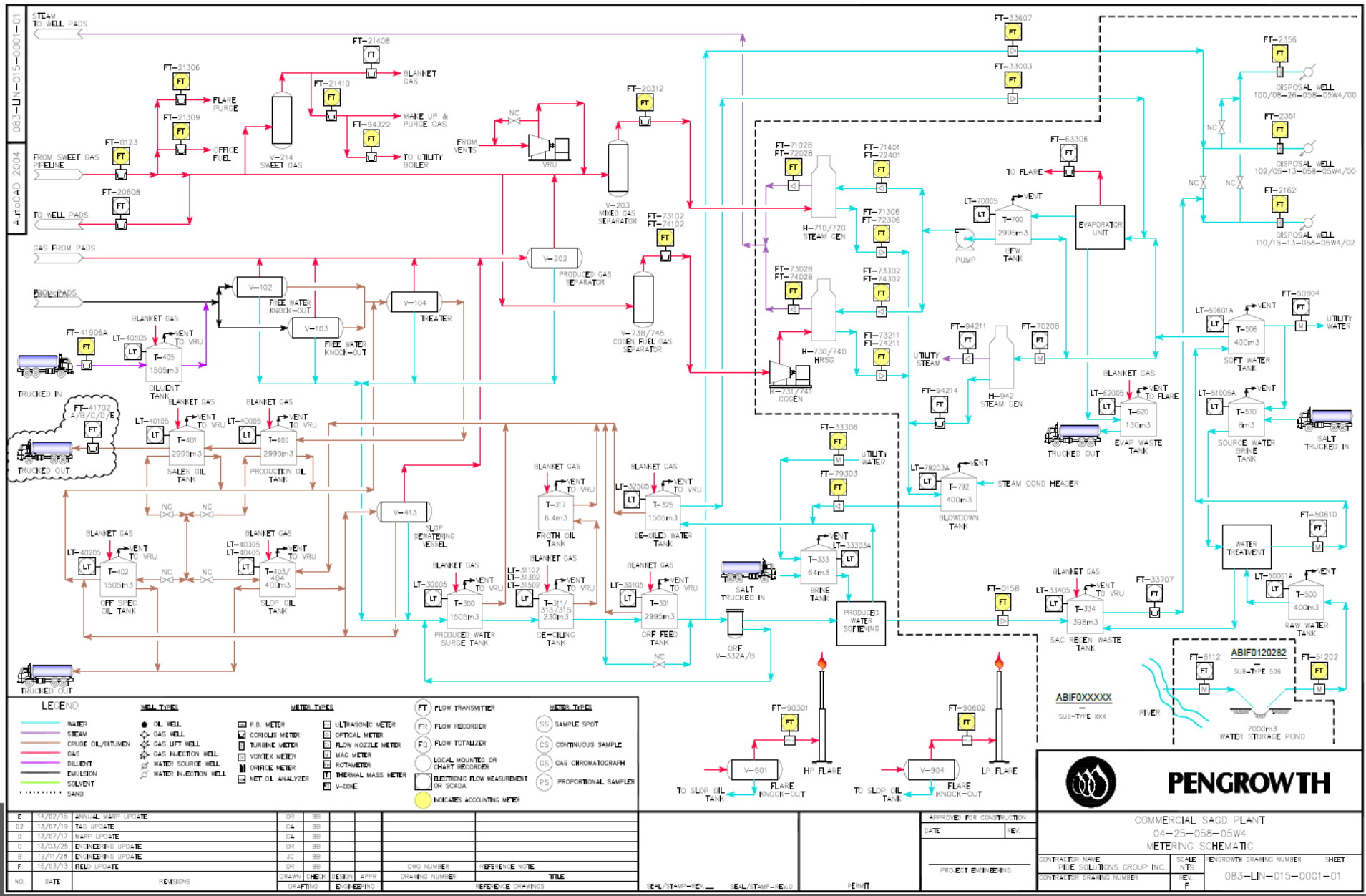
PILOT MARP SCHEMATIC

SAGD Production - BT0120934
SAGD Injection - IF0120282
Disposal - IF0120935



COMMERCIAL MARP SCHEMATIC

SAGD Production - BT0135254
SAGD Injection - IF0134729
Disposal -IF0120935



NO.	DATE	REVISIONS	DRAWN	CHECK	DESIGN	APPR
E	14/02/15	ANNUAL MARP UPDATE	DR	BB		
D2	13/07/19	T4D UPDATE	CA	BB		
D	13/07/17	MARP UPDATE	CA	BB		
C	13/03/25	ENGINEERING UPDATE	DR	BB		
B	12/11/28	ENGINEERING UPDATE	JC	BB		
F	15/03/13	FIELD UPDATE	DR	BB		

DRAFTING ENGINEERING

DWG NUMBER | REFERENCE NOTE
DRAWING NUMBER | TITLE
REFERENCE DRAWINGS

SEAL/STAMP-REV__ SEAL/STAMP-REV.0

PERMIT

APPROVED FOR CONSTRUCTION
DATE | REV.
PROJECT ENGINEERING

CONTRACTOR NAME PILE SOLUTIONS GROUP INC.
CONTRACTOR DRAWING NUMBER
SCALE NTS
REV. F
PENGROWTH DRAWING NUMBER 083-LIN-015-0001-01
SHEET

MARP CALCULATION SUMMARY

Produced Bitumen = $((O_S + DBI_c - DBI_o)/SF) - (D_i + D_{Oi} - D_{Ci})$

$((O_s$	+	DBI_c	-	$DBI_o)$	/	SF)	-	$(D_i$	+	D_{Oi}	-	$D_{Ci})$
Trucked out Oil		*Closing Inventory T-400, T-401, T402, T403 and T-404*		*Opening Inventory T-400, T-401, T402, T403 and T-404*		*Blending Shrinkage Factor*		*FT-41906A Diluent Receipts*		*Opening Inventory T-405*		*Closing Inventory T-405*

7.1.8. Battery Water Production

Dispositions	+	Δ Water Tanks	+	Δ Deoiling Tanks	+	Δ Slop Tank Water	+	Δ Off Spec Tank Water	-
Formula 7.1.9		*Change in water tank inventory for T-300, T-301 & T-325*		*Change in water inventory in T-311, T-313 & T-315*		*Change in water inventory in T-403 & T-404*		*Change in water inventory in T-402*	
Receipt Diluent Water	-	FT-79303	-	Trucked in Water	-	FT-33306			
Water received with diluent FT-41906A		*Blowdown water from IF T-792*		*Water trucked in to T-333 from outside sources*		*Utility water from IF to T-333*			

7.1.9. Battery Water Dispositions

FT-33607	+	FT-33003	+	Sales Water	+	Other water out	+	FT-0158
Water Delivery to Injection Facility for Disposal		*Water Delivery to IF for treatment*		*S&W content of sales dilbit blend*		*Water Content of other fluid trucked out*		*Waste Water to IF T-334*

7.3.1. Primary Steam Calculation

FT-71028	+	FT-72028	+	FT-73028	+	FT-74028
Steam to Pads From Steam Generator		*Steam to Pads From Steam Generator*		*Steam to Pads from HRSG*		*Steam to Pads From HRSG*

7.3.2. Secondary Steam Injection Calculation

FT-71401	+	FT-72401	+	FT-73302	+	FT-74302	-
BFW to Steam Gen H710 from T-700 BFW tank		BFW to Steam Gen H720 from T-700 BFW tank		BFW To Cogen H730 from T-700		BFW to Cogen H740 from T700	
FT-71306	-	FT-72306	-	FT-73211	-	FT-74211	
Steam Condensate from Steam Gens		*Steam Condensate from Steam Gens*		*Steam Condensate from HRSG*		*Steam Condensate from HRSG*	

WATER

LINDBERGH WATER SOURCES

- 10-23-056-05 W4M river water station
  - Fresh water source from the North Saskatchewan River
  - AENV License No.13844

- Pilot
  - Average usage ~900 m3/d for BFW production for steam injection in 2014/2015
  - Pilot mothballed in Q2 2015
    - All go forward water usage associated with the commercial facility

- Commercial
  - ~450m3/d make-up water usage at commercial facility (July-Sept 2015 average)

LINDBERGH SOURCE WATER MAKE UP VOLUMES

- Pilot volumes used for BFW production for steam generation
- Commercial volumes used primarily for soft de-oiled water make-up and miscellaneous utility services

	Source Water Make-Up	
	Commercial (m3/mth)	Pilot (m3/mth)
Jan-14		21813
Feb-14		23319
Mar-14		25696
Apr-14		22978
May-14		27810
Jun-14		27227
Jul-14		25736
Aug-14		27077
Sep-14		25138
Oct-14		27535
Nov-14		40877
Dec-14		39684
Jan-15	5004	31323
Feb-15	5409	26731
Mar-15	8211	26527
Apr-15	9099	Mothballed
May-15	11605	
Jun-15	9753	
Jul-15	13202	
Aug-15	13715	
Sep-15	14086	

LINDBERGH PRODUCED WATER, STEAM, AND RECYCLE

- Pilot has no produced water or blowdown recycle - streams sent to disposal
- Commercial has full blowdown recycle

	Commercial			Pilot	
	Steam (t/mth)	PW (m3/mth)	PW Recycle %	Steam (t/mth)	PW (m3/mth)
Jan-14				17000	20425
Feb-14				16681	15604
Mar-14				19947	20123
Apr-14				16335	16617
May-14				20692	18643
Jun-14				19921	19730
Jul-14				19954	19626
Aug-14				18476	18802
Sep-14				19927	18377
Oct-14				19392	19602
Nov-14				19551	20145
Dec-14				21989	19153
Jan-15	84620	87333	98.9	22070	22046
Feb-15	118828	113725	98.8	19936	21027
Mar-15	118819	115566	98.9	22018	22242
Apr-15	117743	115219	98.6	Mothballed	
May-15	124862	122849	98.3		
Jun-15	133102	128769	98.1		
Jul-15	145642	138787	98.0		
Aug-15	151893	143883	97.9		
Sep-15	146896	140109	97.9		

LINDBERGH COMMERCIAL DISPOSAL LIMITS

- The Lindbergh CPF is equipped with evaporator towers for PW recycle
- With the mothball of the Lindbergh Pilot facility, there is no further concurrent operation between the Pilot and Commercial facilities
- Future pilot operation would require integration of PW recycle to keep the scheme compliant
- Commercial calculated and actual disposal percentages are shown below

	Commercial		
	Disposal Limit %	Actual Disposal %	
Jan-15	9.51	1.13	
Feb-15	9.64	1.16	
Mar-15	9.61	1.10	
Apr-15	9.59	1.40	
May-15	9.53	1.70	
Jun-15	9.53	1.92	
Jul-15	9.51	2.04	
Aug-15	9.49	2.07	
Sep-15	9.47	2.05	
	9.27	5.02	Expected @ Full Rate Simulation Value

- Simulation values are based on 10% make-up due to water loss to the formation

LINDBERGH WATER QUALITY

Raw Water Properties

Turbidity	5 – 1000 NTU
Suspended Solids	5 – 600 mg/l
Total Dissolved Solids	250mg/l
Total Hardness	170 ppm (as $CaCO_3$)
Na	10.7
K	1.2
Mg	13.1
Ca	46.7
Chlorides	10.8 mg/l
Bicarbonate	180 mg/l
CO_3	<0.50 mg/l
Sulphate	44.2
Total Alkalinity	150

Produced Water Properties

Component	mg/l as Ion	mg/l as $CaCO_3$
Calcium (Ca^{++})	34.6	86.5
Magnesium (Mg^{++})	2	8.2
Sodium (Na^{+})	1920.0	4166.4
Potassium (K^{+})	78.2	100.1
Iron (Fe^{++})	0.0	0.0
Manganese (Mn^{++})	2.0	3.6
Hydrogen (H^{+})	0.0	0.0
Barium (Ba^{++})	0.7	0.5
Strontium (Sr^{++})	2.2	2.5
Sum Cations		4367.9
Bicarbonate (HCO_3^{-})	100.0	82.0
Carbonate (CO_3^{-})	0.0	0.0
Hydroxide (OH^{-})	0.0	0.0
Sulphate (SO_4^{-})	100.0	104.0

Chloride (Cl^{-})	3010	4244.1
Sum Anions		4430.1
Total Dissolved Solids (Measured)	5400	
pH (Units)	6.11	
Total Hardness		101.4
Silica (SiO_2)	163.0	
Insoluble Oil (oil & grease)	9	
Total Organic Carbon:		
Normal (non-volatile)	123	
Maximum	300	
Turbidity (NTU) (Max)		
Temperature (°C)	23.0	
Conductivity (µS/cm)	9600	

SAC Waste Properties

CATIONS

Ion	mg/L	meq/L
Na	17300	752
K	230	5.88
Ca	2340	117
Mg	195	16.0
Ba	27.5	0.401
Sr	101	2.30
Fe	0.46	0.0164
H+		

ANIONS

Ion	mg/L	meq/L
Cl	32340	911
HCO3	130	2.12
SO4	81.0	1.69
CO3	<0.50	<0.02
OH	<0.50	<0.03

Total Dissolved Solids (mg/L)

Measured	53000 Calculated
1.039 Relative Density	1.339 Refractive Index
80200 Conductivity (uS/cm)	0.12 Resistivity (ohm-m) @25°
6600 Total Hardness as CaCO3 (mg/L)	110 Total Alkalinity as CaCO3 (mg/L)
13.9 Total Fe (mg/L)	5.65 Total Mn (mg/L)
6.62 Observed pH	FALSE H2S Spot Test

DISPOSAL WELLS

DISPOSAL WELLS

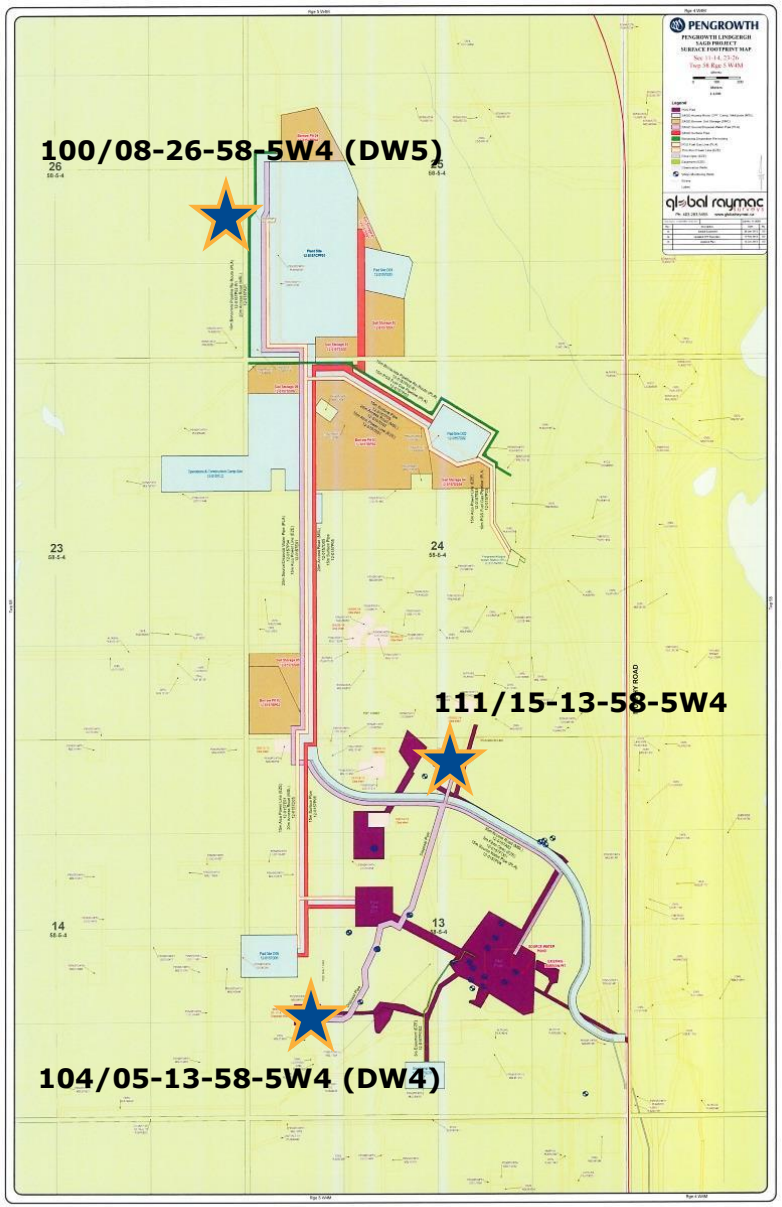
- 111/15-13-58-5W4
  - Well license number – 0126796
  - Disposal approval number – 5565
    - Completed in Basal Cambrian Sands
    - No rate limit
    - Max WHP – 10.9 MPa
  - Former blowdown disposal for Pilot

- 104/05-13-58-5W4 (DW4)
  - Well license number – 0454598
  - Disposal approval number – 12088
    - Completed in Basal Cambrian Sands
    - No rate limit
    - Max WHP – 13 MPa
  - Produced water disposal (if required)

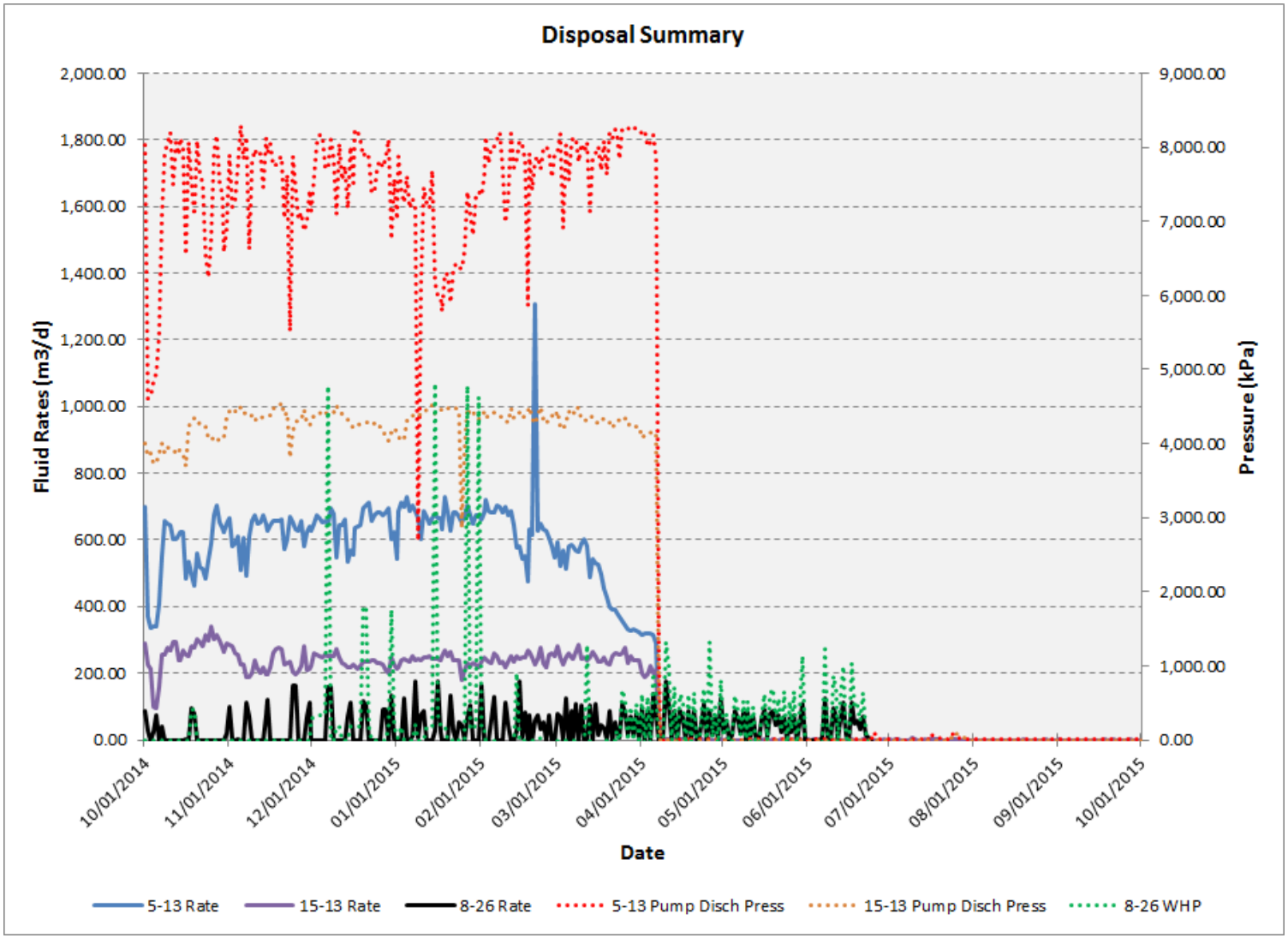
- 100/08-26-58-5W4 (DW5)
  - Well license number – 0469115
  - Disposal approval number – 12088B
    - Completed in Basal Cambrian Sands
    - Screened completion
    - No rate limit
    - Max WHP – 12.6 MPa
  - SAC regen and/or produced water disposal (if required)

DISPOSAL WELLS

- Three water disposal wells (Basal Cambrian Sand) at ~ 1600 meters depth
- 11/15-13 and 04/05-13 were disposing of produced water and boiler blowdown from the pilot
  - Pilot was shut down in Q2, 2015 and all volumes processed at new CPF
- 00/08-26 is new well that was completed in November 2014
- All 3 wells are tied into the commercial CPF
  - 2 disposal streams into these wells are softener regeneration backwash and excess produced water



DISPOSAL HISTORY



OFFSITE DISPOSAL VOLUMES AND LOCATIONS – YTD 2015

	Aquaterra Hillmond (m3)	Aquaterra Kitscoty (m3)	Cen-Alta (m3)	NewAlta Kitscoty (m3)	NewAlta Elk Point (m3)	NewAlta Hughenden (m3)	Tervita Lindbergh (m3)	**Total Offsite (m3)**	05-13 **Pilot** Prod Water (m3)	15-13 **Pilot** Blowdown (m3)	08-26 Softener Backwash (m3)
Oct-14			461.0	2121.0	626.1	94.2	683.1	**3,985**	17,176	5,177	
Nov-14			586.0	983.8	273.5	30.4	428.5	**2,302**	18,776	4,896	
Dec-14			418.0	233.9	682.5	128.3	804.1	**2,267**	20,100	5,527	
Jan-15		454.0	707.0	41.9	405.8	18.6	1,160.9	**2,788**	20,810	5,514	120
Feb-15			328.0		1192.0	89.7	783.6	**2,393**	18,459	5,115	275
Mar-15			204.0		5175.1	31.8	800.8	**6,212**	14,588	5,750	728
Apr-15			41.0	206.7	3489.7	2.25	1,186.7	**4,926**	1,912	981	787
May-15					2230.0		145.7	**2,375**			1,116
Jun-15					922.0		1,790.2	**2,712**			355
Jul-15					217.7		2,546.5	**2,764**			1,337
Aug-15					894.5		1,913.7	**2,808**			1,531
Sep-15	286.0				185.7		2,092.3	**2,564**			1,294

AMBIENT AIR QUALITY

AMBIENT AIR QUALITY

- Continue to actively participate in LICA and the Air Quality Monitoring Program Network as per the Lindbergh SAGD EPEA approval
- We are compliant with the Joint Oilsands Monitoring (JOSM) requirements

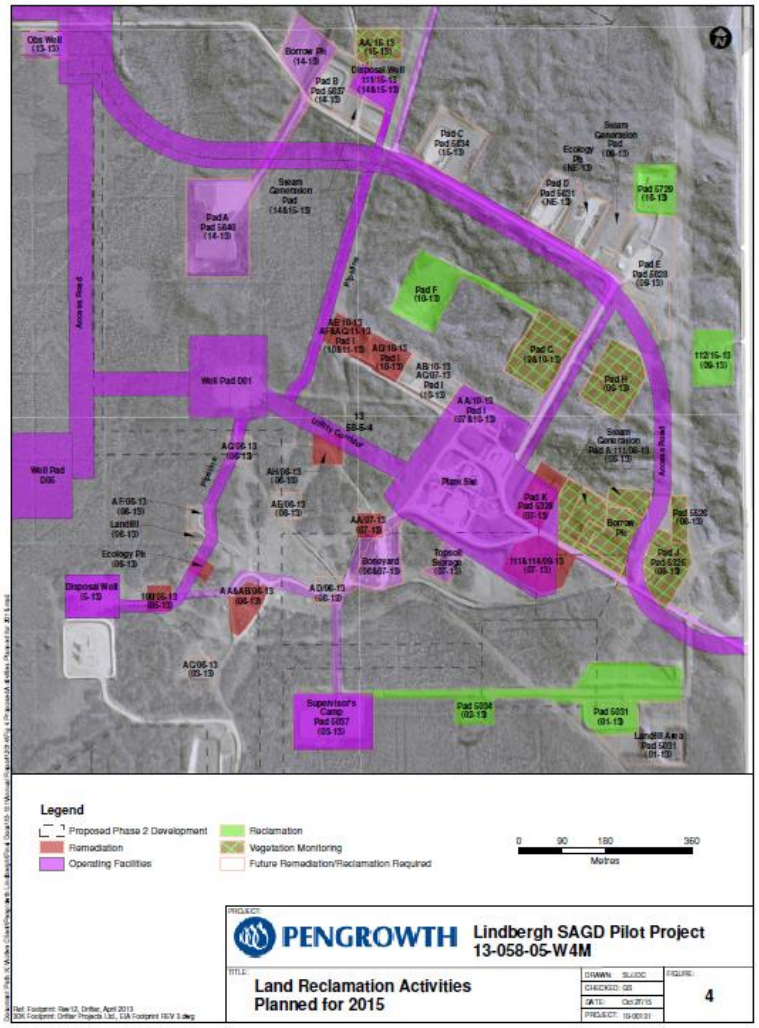
ENVIRONMENTAL ISSUES

ENVIRONMENTAL ISSUES

- Pilot site mothballed for potential future use
- In 2015, 6 sites have undergone remediation, with two other sites scheduled for remediation before the end of 2015
- Two sites require additional assessment and will be completed before the end of 2015
- Reclamation has been carried out on Pad F, Pad 5729 and is currently being carried out at Pads 5034 and Pad 5031. This also includes a borrow pit area at 1-13-058-05 W4M. Reclamation work will be carried out at the 112/15-13-058-05 W4M wellsite located at 9-13-058-05 W4M before the end of 2015
- Pad J, Pad 5526 and the 111/8-13 wellsite have been fenced for reclamation

DECOMMISSIONING AND RECLAMATION

- Located, excavated and abandoned pipelines and risers from old CSS facilities
- Pulled and disposed of piles associated with decommissioned facilities
- Conducted remediation work in various areas in preparation for reclamation work
- Carried out contaminated soil removal for disposal at approved landfill



COMPLIANCE

COMPLIANCE

- Self disclosure submitted December 2012 for increase in licensed H2S to 10 mol/kmol for the surface pipelines associated with the pilot facility
  - ABSA approval received September 16, 2014
  - D56 amendment received January 2015
  - Cut-out analysis submitted April 2015 to meet D56 approval stipulation
  - Pipelines have been mothballed in April 2015 – associated with the pilot facility mothball
- Self disclosure in August 2014 of missing sulphur analysis in monthly report
- Self disclosure in January 2014 of late filing of the required October 2013 Groundwater Monitoring Program Proposal
- July 2015 notification of non-compliance for failure to complete surface abandonment and report surface abandonment with specified time frame (completed upon rig release). Pengrowth has completed work to update DDS with correct and relevant data and Ian Peleshok at the AER has been updated on this work.

COMPLIANCE

- A deficiency of the CEMS installation (monitoring plan) and reporting could not be submitted as a voluntary self- disclosure and therefore was submitted as a contravention to EPEA license 1581-02-01.
  - The CEMS Monitoring Plan was submitted to the AER on September 16 and is currently under review by the AER In-Situ Authorizations group.
  - Pengrowth has submitted one follow up SIR (Supplementary Information Request) and are currently waiting on the 60 day review period, which ends November 16.
  - CEMS certification testing, RATA and manual stack surveys are scheduled for Dec 6-12.
  - Following this testing, the CEMS will be compliant with all applicable regulations.
- Pengrowth believes that the Lindbergh project is in full compliance with AER regulatory approvals and regulatory requirements

FUTURE PLANS

FUTURE PLANS – PILOT FACILITIES

- The Pilot facility has been mothballed and its future potential is under evaluation

FUTURE PLANS – 12,500 BOPD FACILITIES

- Drill 2 Section 13 SAGD well pairs into old CSS area from Pad D04 – application approved – commence Q4, 2016
- Drill and tie in infill well on Pad D01 in Q4, 2016 – application to be submitted
- Obtain core from steam chamber near heel of D01-P02 well – Q3, 2016

FUTURE PLANS

- Drill 8 SAGD well pairs (excluding 2 Sec 13 well pairs) from Pad D04 – commence drilling in Q4, 2016
- Begin construction and drilling for project expansion to 30,000 bopd – EIA application submitted and under review
- Drill 3 SAGD test well pairs into pay zone less than 13 meters thick with significant bottom water interval – application to be submitted

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