AER 2018 Directive 54 Annual Presentation

BOLD IDEAS
FOR ENERGY

PERPETUAL
ENERGY

Panny LEAD Pilot

Experimental Scheme Approval No. 12283C

Dec 10, 2018

CONFIDENTIAL

Agenda

PERPETUAL ENERGY

Subsurface

1. Background
2. Geoscience
3. Drilling & Completions
4. Artificial Lift
5. Instrumentation
6. 4-D Seismic
7. Scheme Performance
8. Future Plans

Surface

1. Facilities
2. Measurement & Reporting
3. Water
4. Environmental
5. Compliance
6. Future Plans

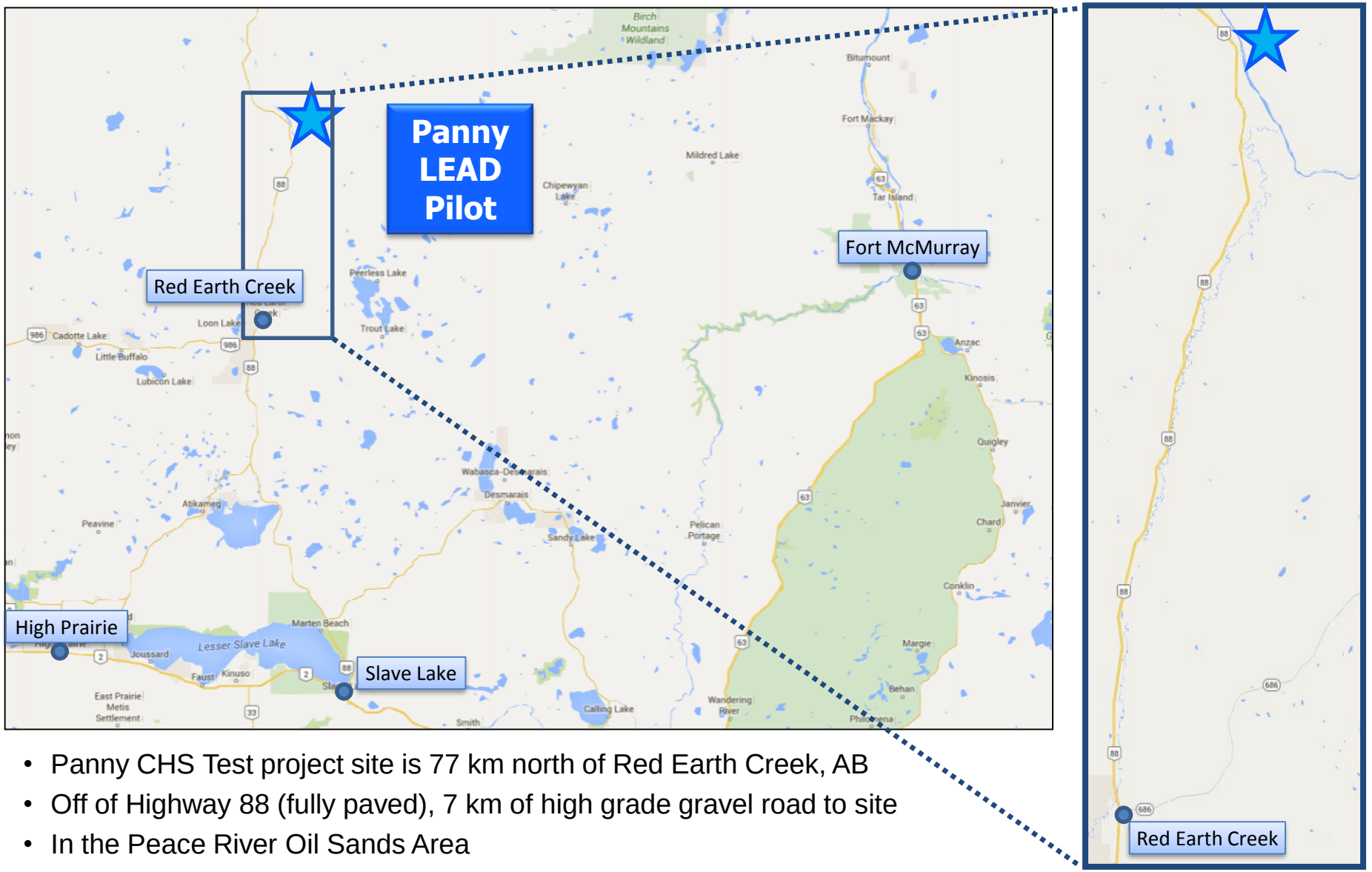
Subsurface

Background

Background

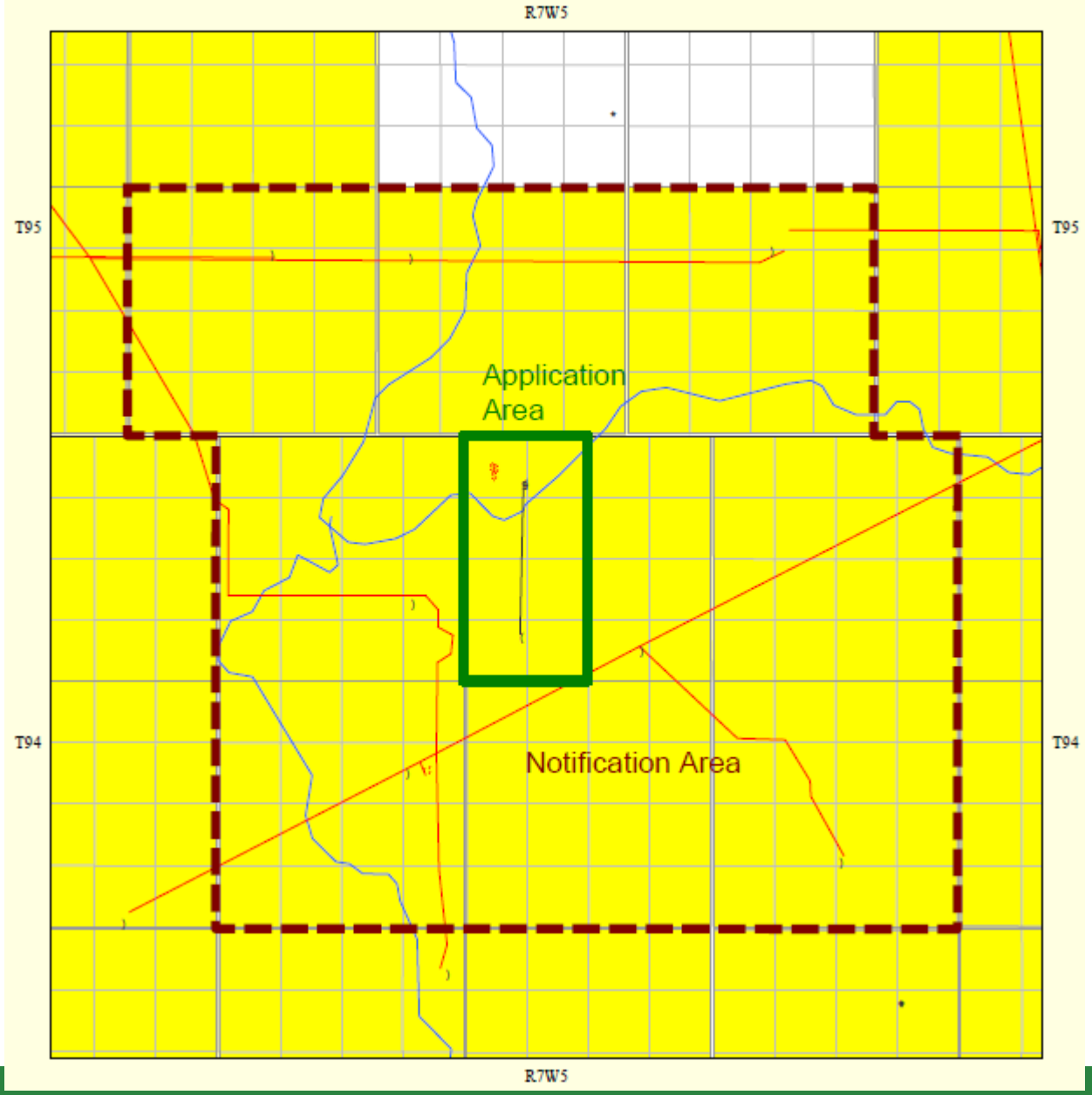
The Panny LEAD (Low-Pressure Electro-Thermally Assisted Drive) Pilot project was conducted in the W½-34-094-07W5 Panny area within the Peace River Oil Sands Area. The pilot surface location was at 13-34-94-7W5. This pilot project evaluated the potential of a low-pressure process that utilizes downhole electric heaters combined with water and/or solvent injection to recover bitumen from the Bluesky formation. This Bluesky formation has an overlying gas cap that had been produced, and so exhibits depleted pressure. This technology has the potential to be commercialized in both the Panny area as well as many other bitumen/heavy oil reservoirs in Alberta.

Location

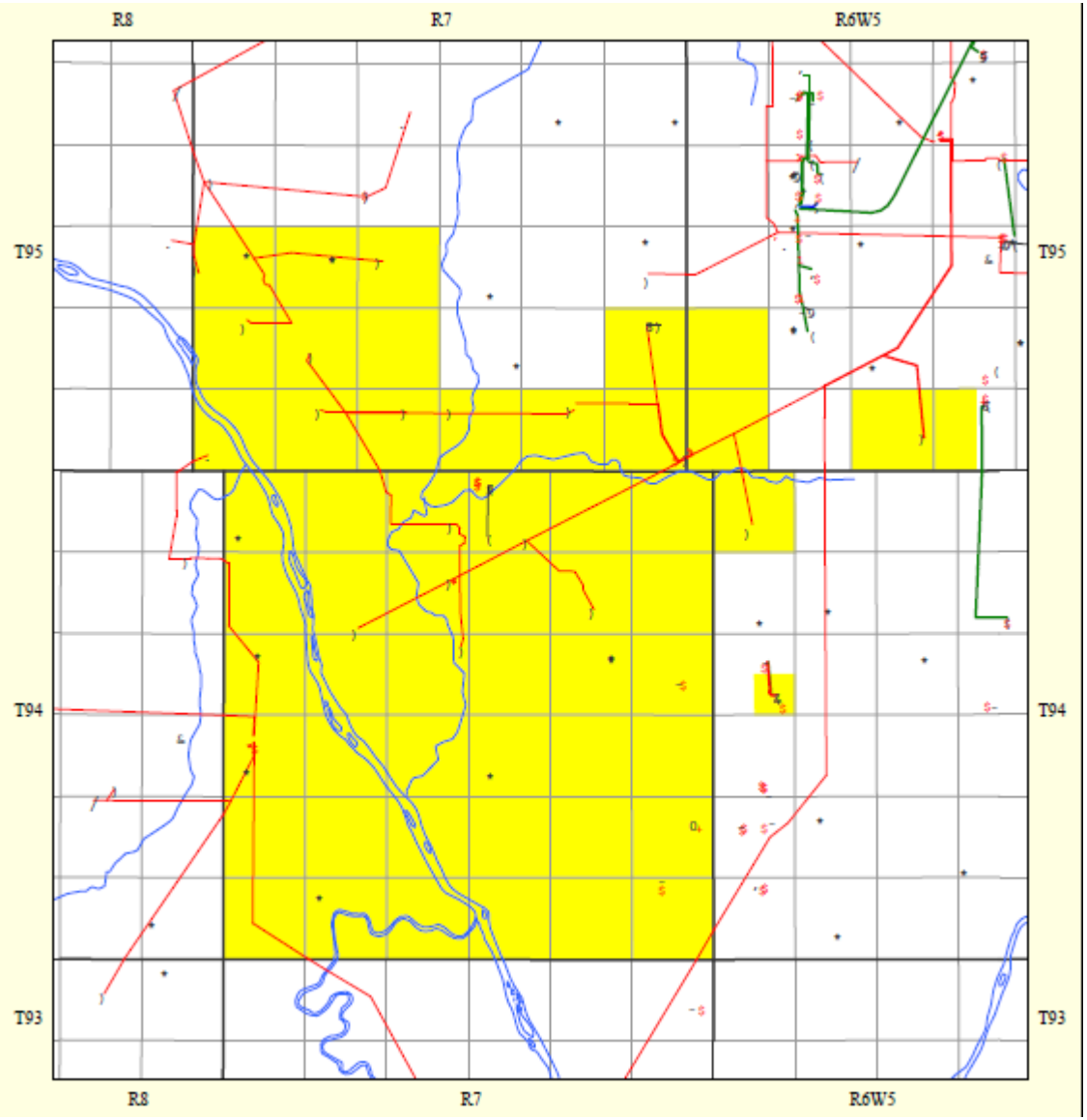


- Panny CHS Test project site is 77 km north of Red Earth Creek, AB
- Off of Highway 88 (fully paved), 7 km of high grade gravel road to site
- In the Peace River Oil Sands Area

Panny Map


R7W5
T95
T95
Application Area
T94
T94
Notification Area
R7W5

Panny Map



LEAD Pilot Stage 1 CHS – Objectives / Scope

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- Primary Objective:
  - Collect significant pressure, temperature, and oil production data in response to conductive heating to tune simulator assumptions and geological understanding
- Secondary Objective:
  - Obtain experience operating electrical resistance heaters
- Scope:
  - Install heater in existing 4-34 Hz well
  - Drill 2 observation wells and install pressure & temperature instrumentations
  - Install onsite electrical generator
  - Use all existing production equipment currently on-site
  - Conduct minimum 3 heating & production cycles as required to obtain necessary data

- Reduce bitumen viscosity using electric cables and possibly injection of water/solvent
- Have concurrent production of bitumen and associated gas cap
- Understand lateral and vertical heat conduction and convection
- Demonstrate commercial production and ultimate recovery factor
- Gather data for accurate numerical simulation to optimize commercial process

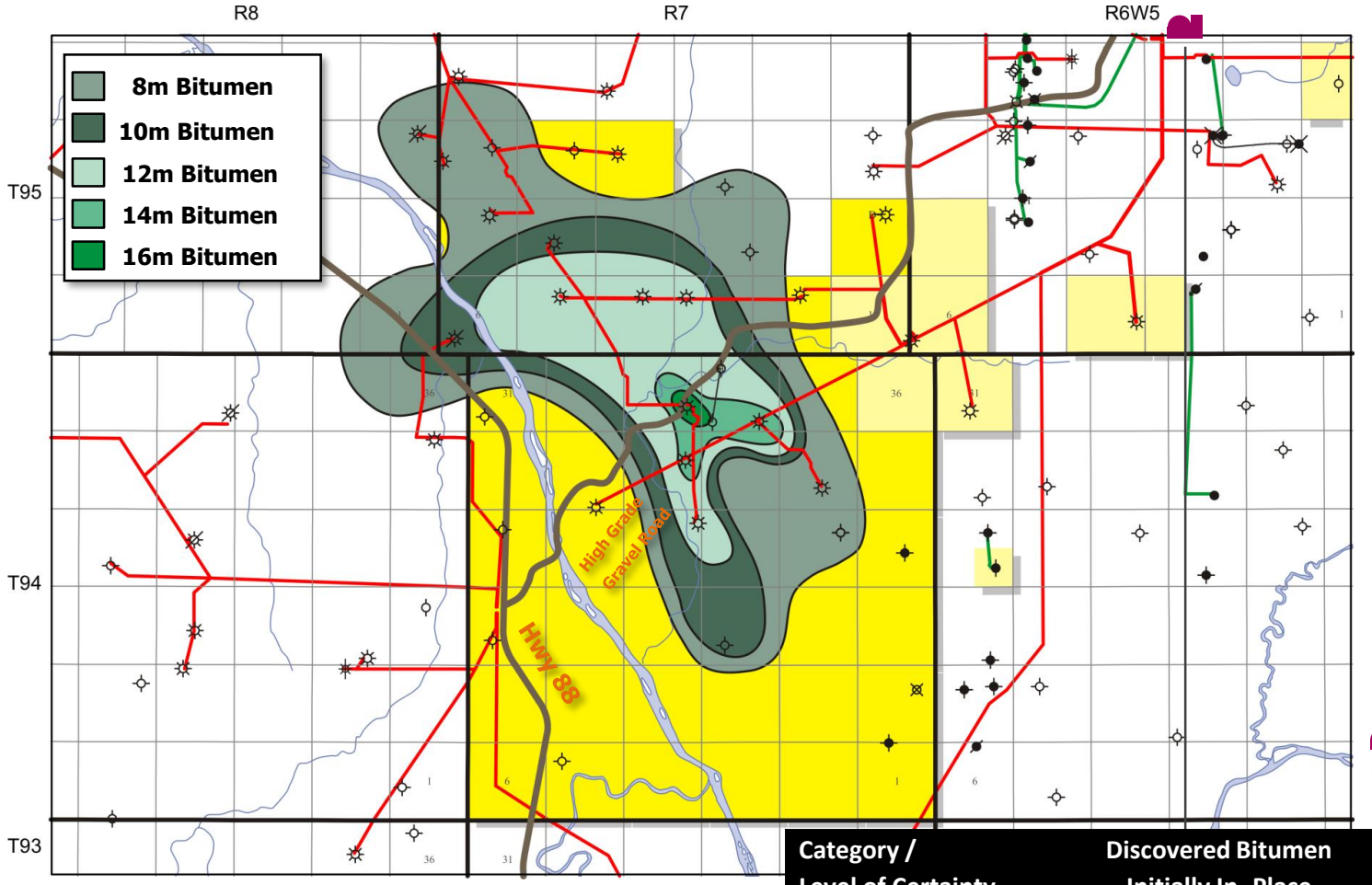
Regulatory Work

- Experimental Recovery Scheme Approval
  - July 24, 2014: Obtained Experimental Scheme Approval No. 12283
    - Full LEAD Pilot design
  - November 13, 2014: Experimental Scheme Amendment Submitted for LEAD Pilot Stage 1
    - Updated to included Stage 1 and Stage 2 LEAD Pilot designs
  - September 28, 2016: Experimental Scheme Approval 12283B
    - Approval to inject C5+ solvent
  - May 26, 20117: Experimental Scheme Approval 12283C
    - Extended confidentiality and validity to July 24, 2019

- EPEA
  - June 2, 2014: Obtained AER EPEA Approval No. 299681-00-00
  - September 29, 2014: Received a 'No Objection Letter' from the AER for LEAD Pilot Stage 1 design
  - February 2, 2015: Groundwater Monitoring Program Proposal approved by AER
- Facility Licence
  - Facility considered a Single Well Bitumen Battery, and therefore required no facility licence
- Injection Well Approval
  - August 5, 2015: Obtained D51 Class IV Injection Well Approval for 100/04-34-094-07W5 horizontal well (a condition of the Experimental Scheme Approval for heater operation) Approval No. 12283
  - September 21, 2016: Obtained D51 Class III & IV Injection Well Approval for 100/04-34-094-07W5 horizontal well (a condition of the Experimental Scheme Approval for heater operation) Approval No. 12283B (as amended)

Geoscience

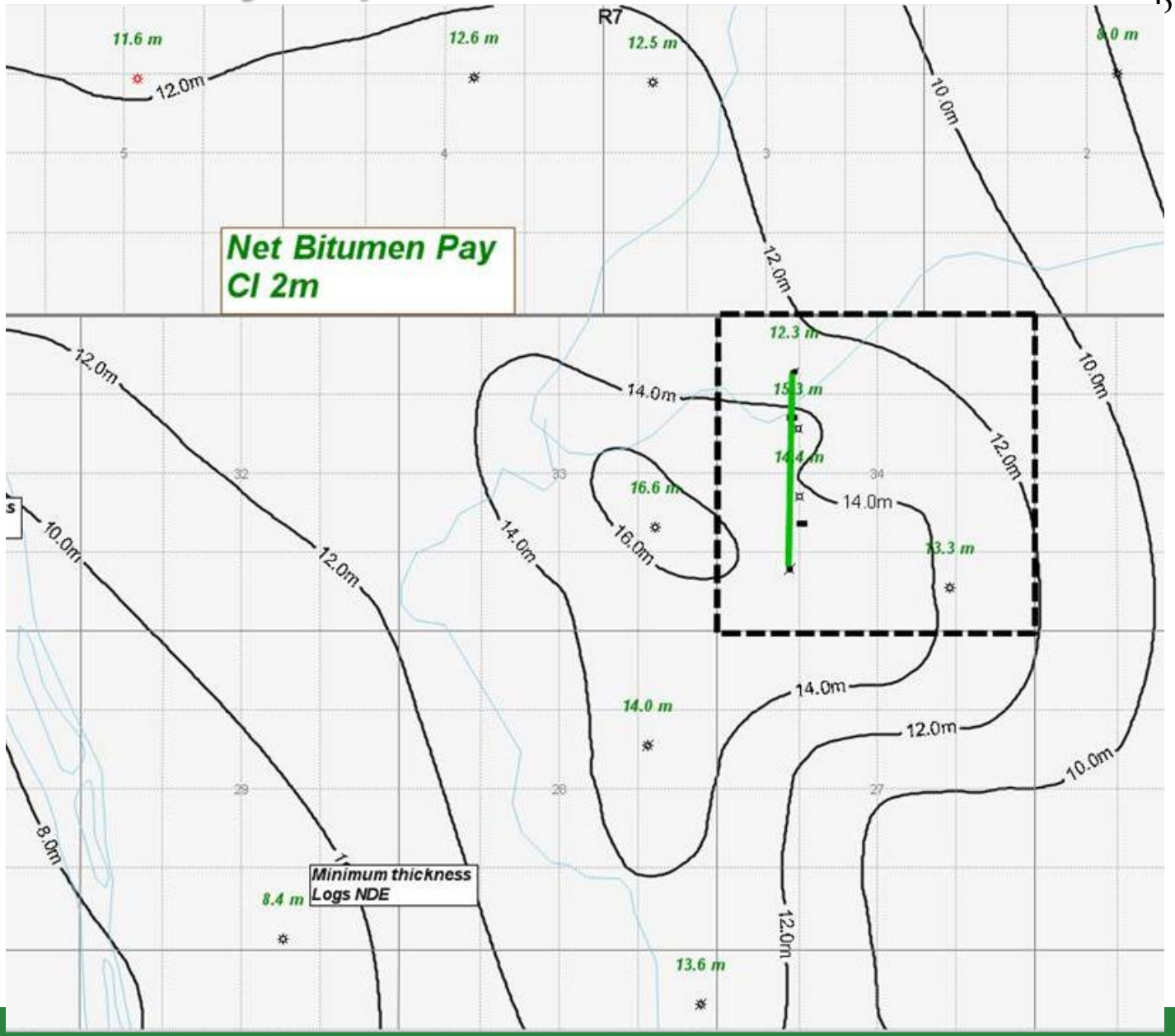
Panny Resource



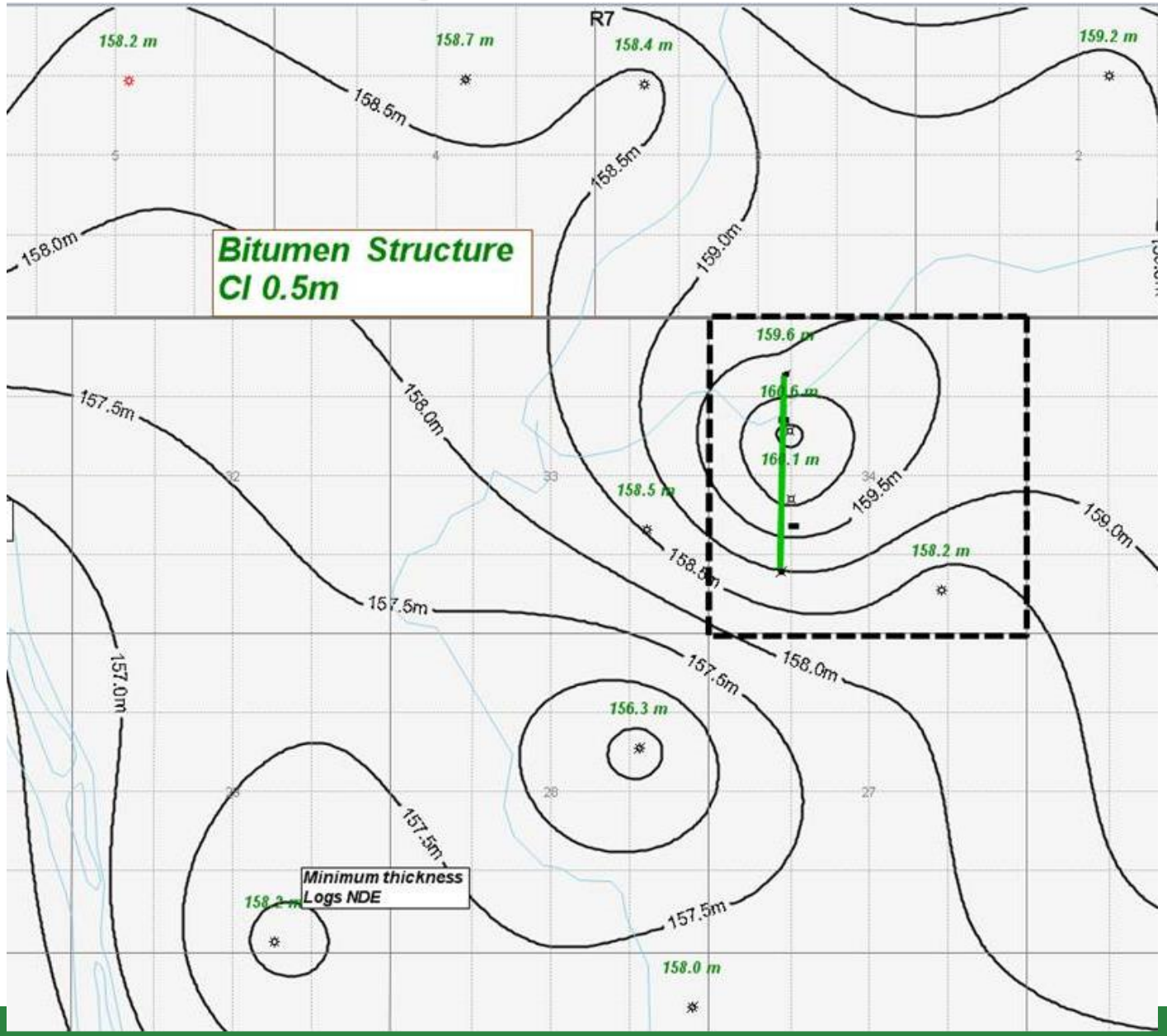
- McDaniel & Associates conducted an independent resource assessment as of December 31, 2011
- Resources assigned based on CSS recovery process

Category / Level of Certainty	Discovered Bitumen Initially In- Place (MMbbl)	Assigned Recovery Factor	Contingent Resource (MMbbl)
Low Estimate	509.2	10.0%	50.9
Best Estimate	755.0	17.5%	132.1
High Estimate	983.0	25.0%	245.8

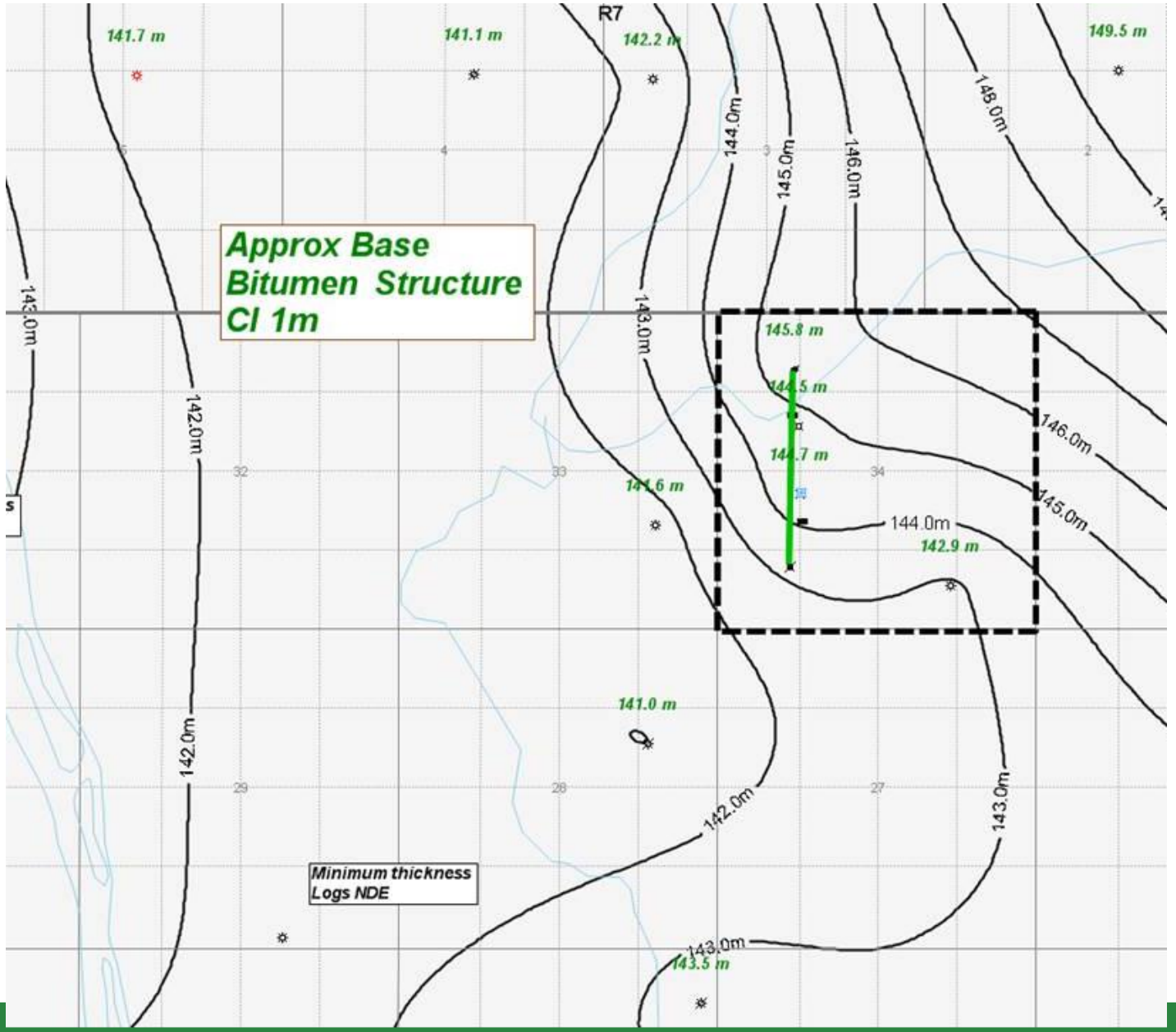
Net Bitumen Pay Map



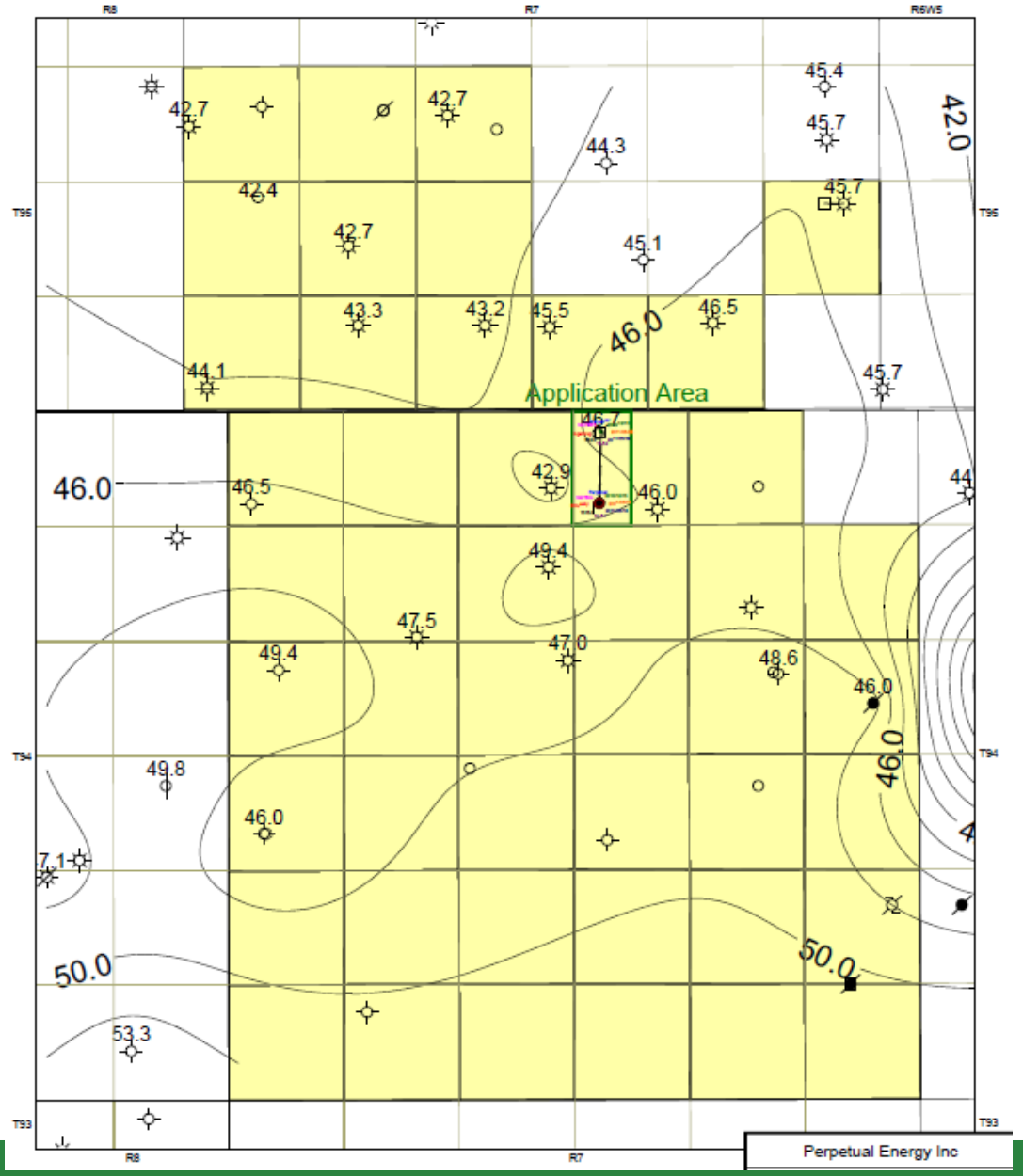
Bitumen Structure Map



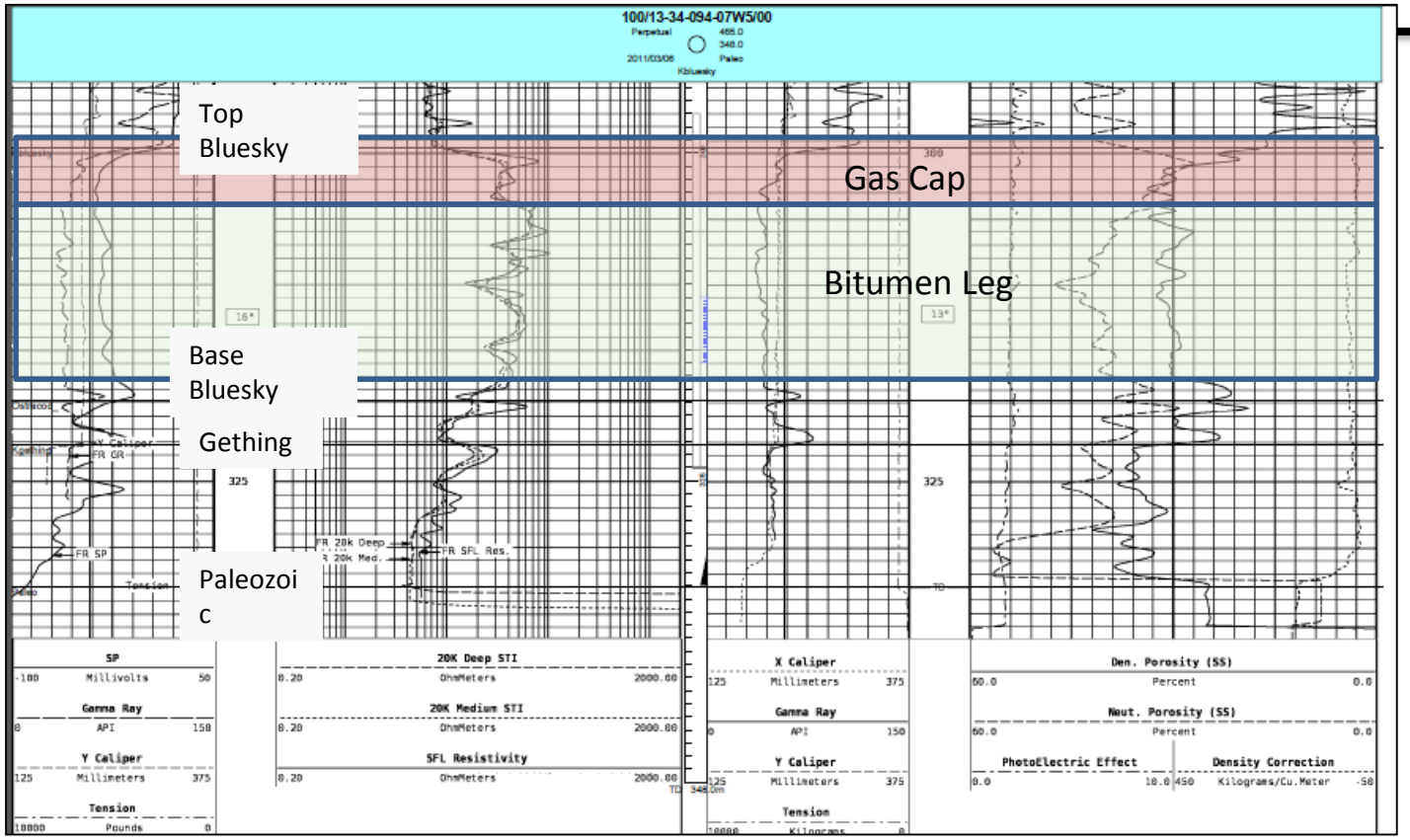
Base Bitumen Structure Map

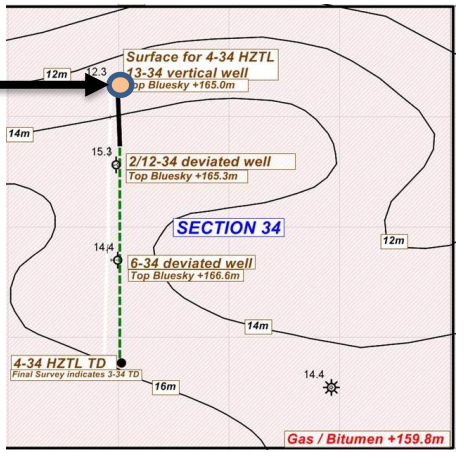


Wilrich Isopach – Top of Bluesky

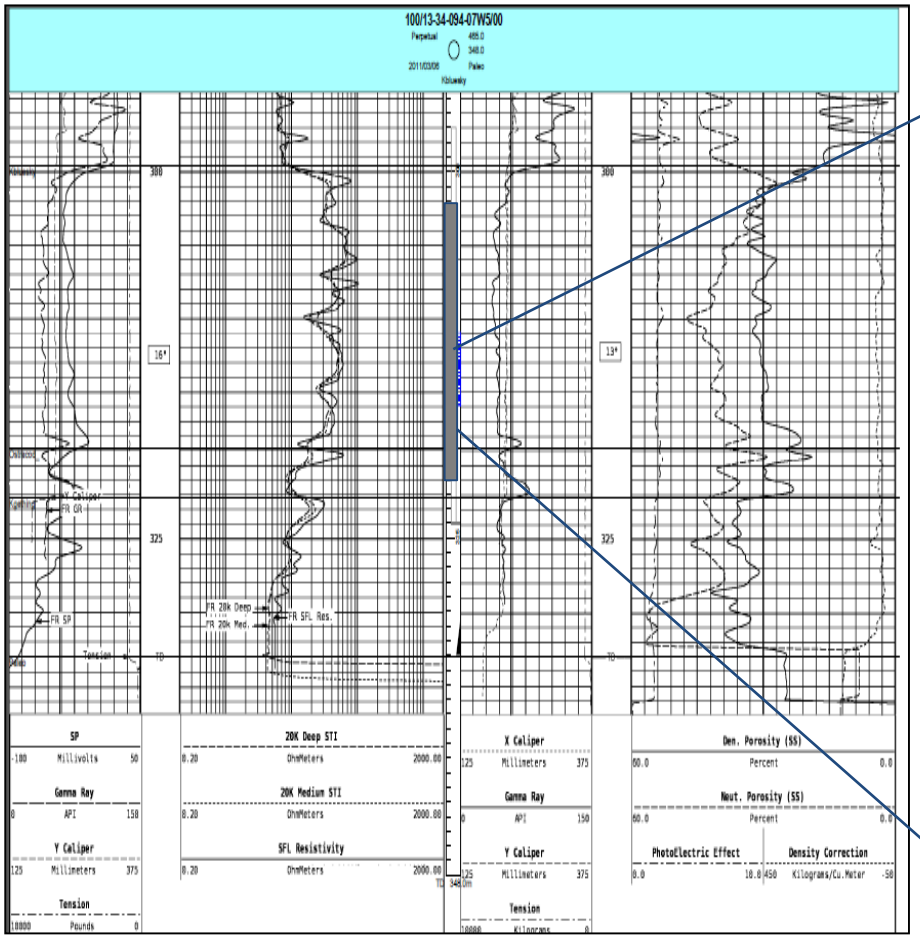


100/13-34-094-07W5/00 - Type Well





100/13-34-094-07W5/00 - Type Well/Core

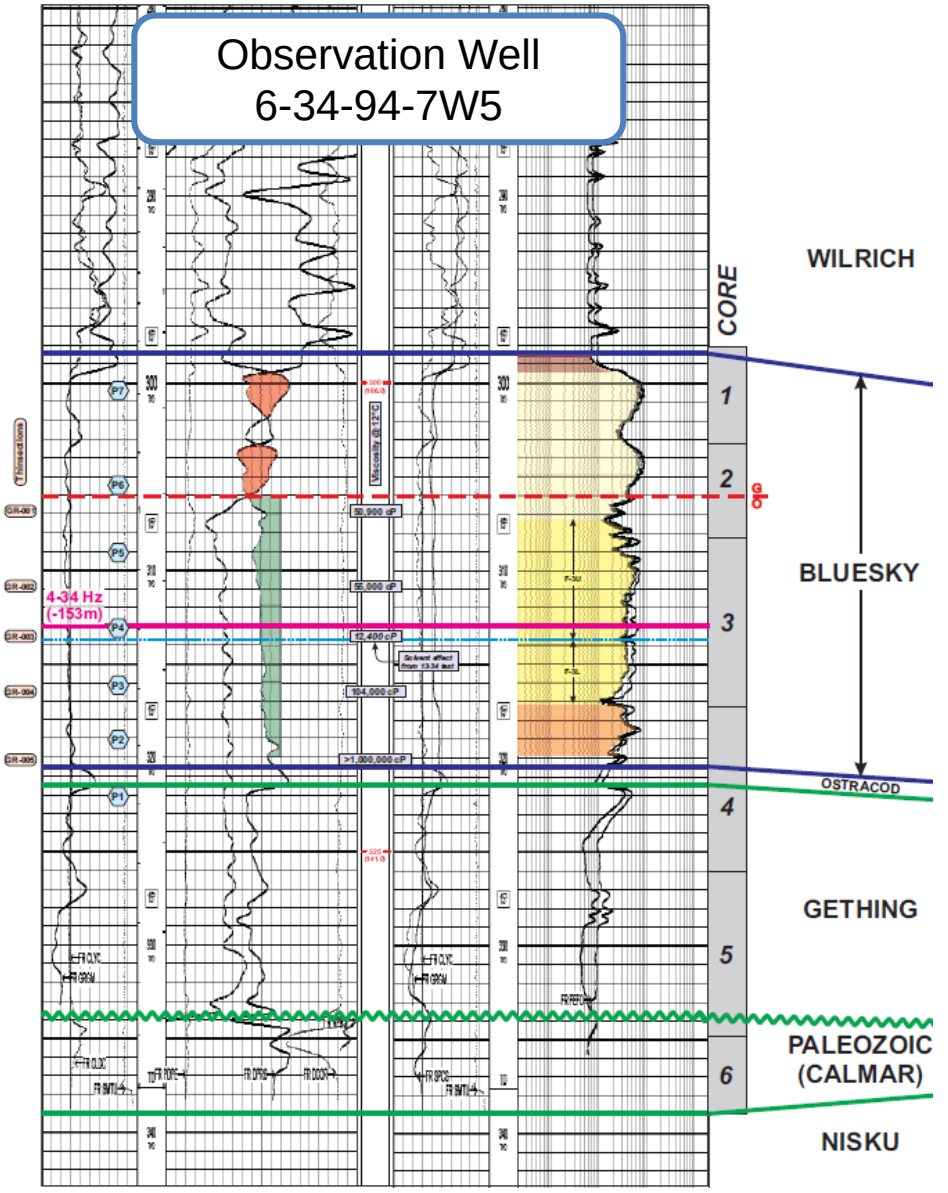


309.38 – 313.82 m

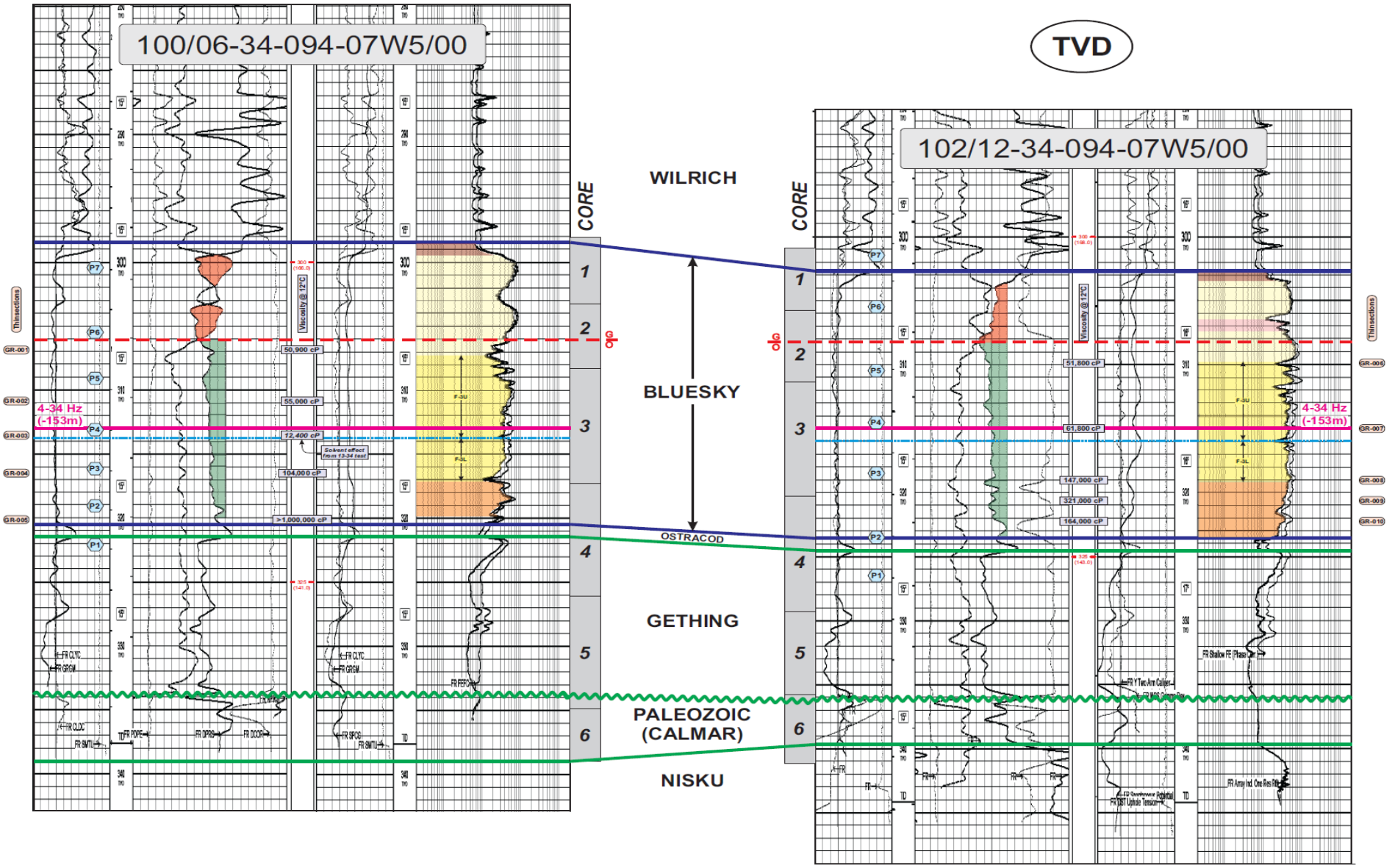
Overall rare to moderate low angle, planar to wavy mud laminations.

Panny Bluesky Reservoir Overview

Depth =	315 mTVD
Porosity =	27%
Oil saturation =	67%
Temperature =	11°C
Density =	11° API
Viscosity =	50,000 cP at 11°C average
Horizontal permeability =	1,400 mD
Vertical permeability =	900 mD
Gas cap =	Avg 3m, up to 6m
Bitumen pay =	Avg 12m, up to 16m
Gas cap pressure =	500 kPaa
Bitumen pressure =	~1,200 kPaa (gradient exists)



Observation Wells



Bitumen leg divided into 2 gross reservoir quality facies: F1 and F3 (F3U and F3L).

Core Analysis Summary – Reservoir Facies

100/06-34-094-07W5/00	Facies	Calc So	Calc Sw	Pore Vol So	Pore Vol Sw	Kh Air mD	Kv Air mD	Kv Harm Ave.	Kv/Kh	Porosity Measured	Porosity Calc	Thin Section	Grain Size
BLUESKY													
	F-5												
BLUESKY GAS	F-2	0.08	0.62	0.11	0.89	1076	774	699	0.72	0.30	0.23		
	F-2A	0.25	0.52	0.32	0.68	47	20	20	0.42	0.26	0.21		
	F-2	0.16	0.55	0.22	0.78	1852	1224	773	0.66	0.31	0.24		
BLUESKY OIL	F-3U	0.52	0.27	0.66	0.34	1692	1130	894	0.67	0.31	0.26	0.19	Mf+L-Mf
	F-3L	0.56	0.26	0.68	0.32	1091	654	515	0.60	0.31	0.27	0.21	L-Mf
	F-1	0.49	0.33	0.60	0.40	710	440	76	0.62	0.30	0.26	0.18	Uvfs

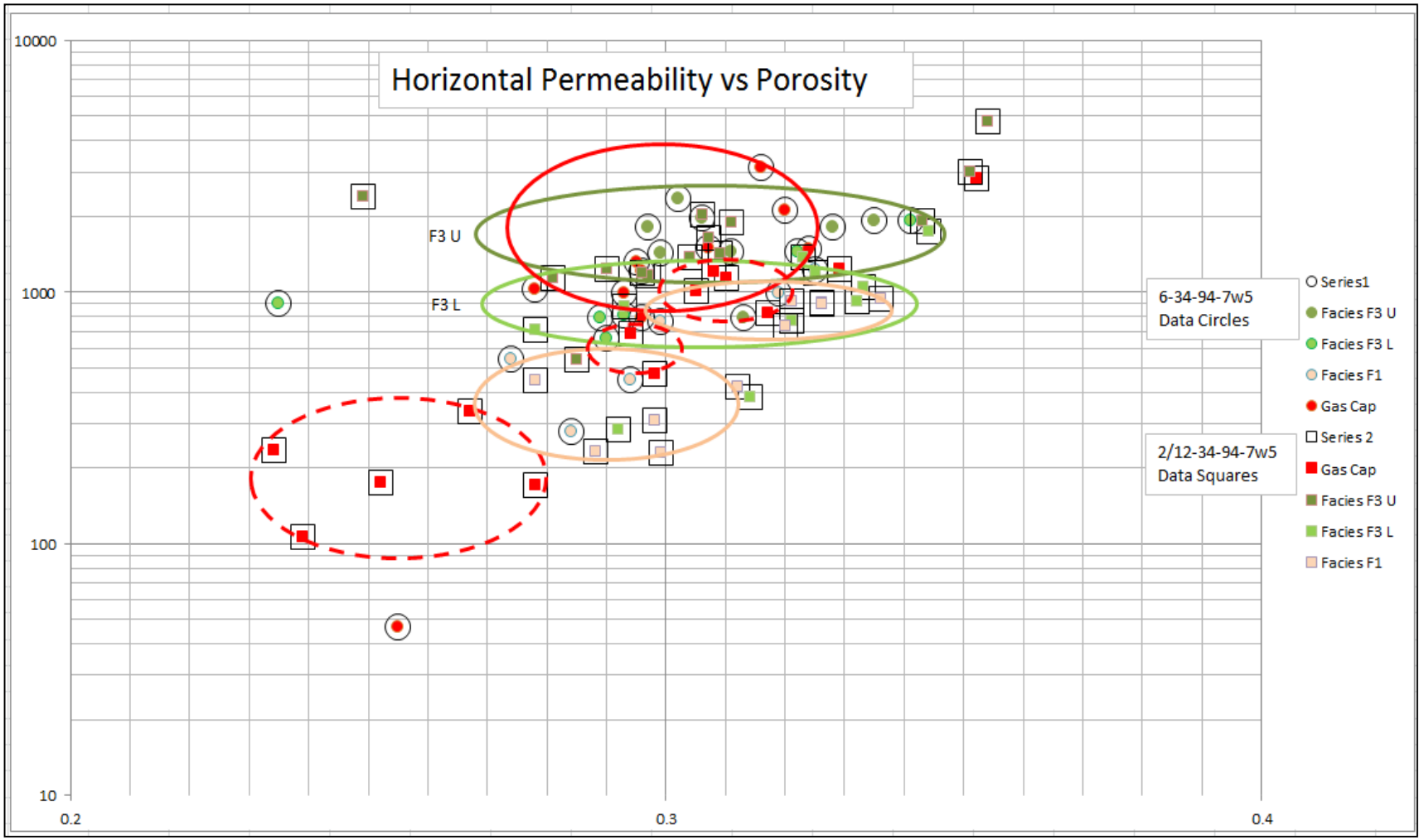
102/12-34-094-07W5/00	Facies	Calc So	Calc Sw	Pore Vol So	Pore Vol Sw	Kh Air mD	Kv Air mD	Kv Harm Ave.	Kv/Kh	Porosity Measured	Porosity Calc	Thin Section	Grain Size
BLUESKY	F-5	0.00	0.92	0.00	1.00	0	0	0	0.40	0.19	0.18		
	F-5A	0.01	0.88	0.02	0.98	7	4	4	0.53	0.19	0.17		
BLUESKY GAS	F-2	0.19	0.57	0.25	0.75	275	148	109	0.54	0.26	0.21		
	F-4	0.24	0.51	0.31	0.69	584	407	135	0.70	0.29	0.23		
	F-2	0.22	0.51	0.30	0.70	1327	851	363	0.64	0.32	0.25		
BLUESKY OIL	F-3U	0.55	0.27	0.66	0.34	1850	1074	506	0.58	0.31	0.27	0.24	Mf+L-Mf
	F-3L	0.54	0.28	0.66	0.34	937	555	233	0.59	0.32	0.28	0.19	L-Mf
	F-1	0.53	0.30	0.64	0.36	608	282	186	0.46	0.31	0.27	0.19	Lf

F- 5	Transgressive sand; greenish glauconitic
F- 5A	Sand, sshy; interbedded sands/shales
F- 4	f gr sandstone, abundant aggregated carbonaceous, muddy laminae; some high angle cross beds
F- 3U	medium grained sandstone, thin (cm) clay laminae or banded layers of large clay clasts, siderite, chert, bi-directional structures
F- 3L	lower medium grained sandstone, thin (cm) clay laminations or banded layers of large clay clasts, slight increase of detrital clay, siderite, chert
F-2	Massive fg sandstone w/ rare clay laminates; may be burrowed (F-2A: mottled, burrowed, distorted)
F-1	Sandstone w/ common linclined clay laminations, minor late stage patchy Ferroan Dolomite

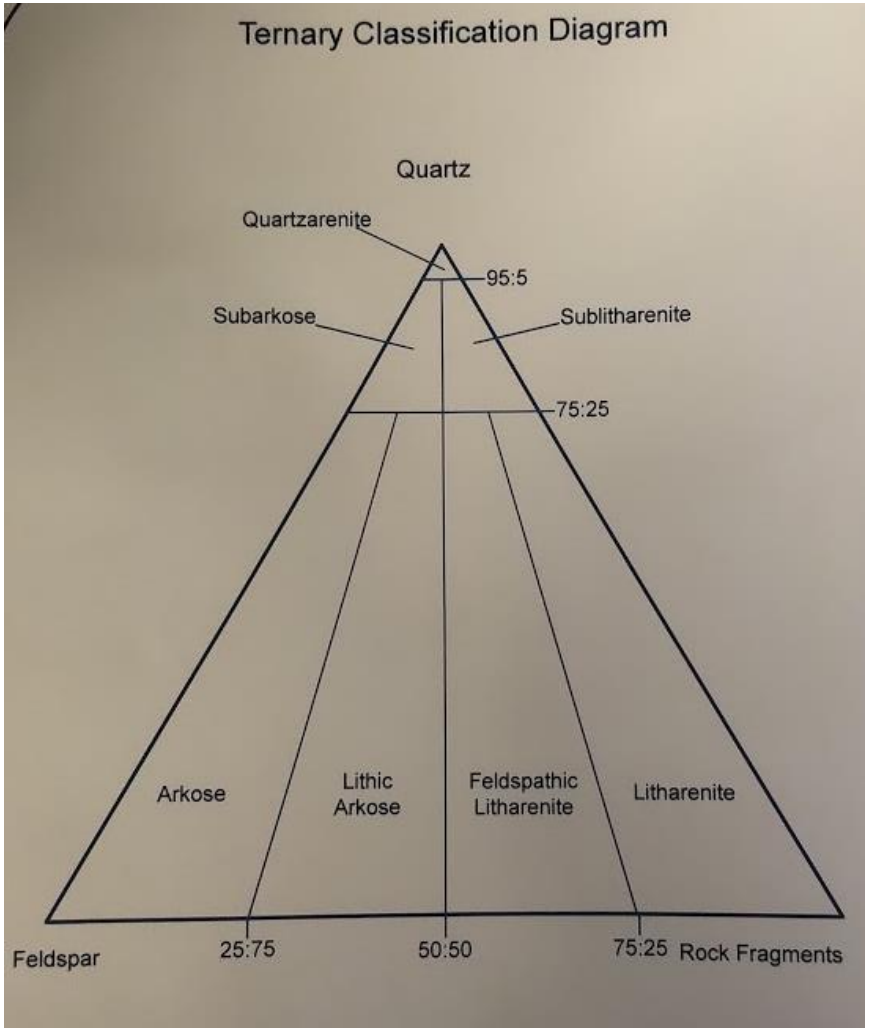
- Bluesky oil F-3 facies (primary bitumen target) Averages:
  - Porosity = 27%
  - Horizontal permeability = 1,400 mD
  - Vertical permeability = 900 mD
  - Oil saturation = 67%

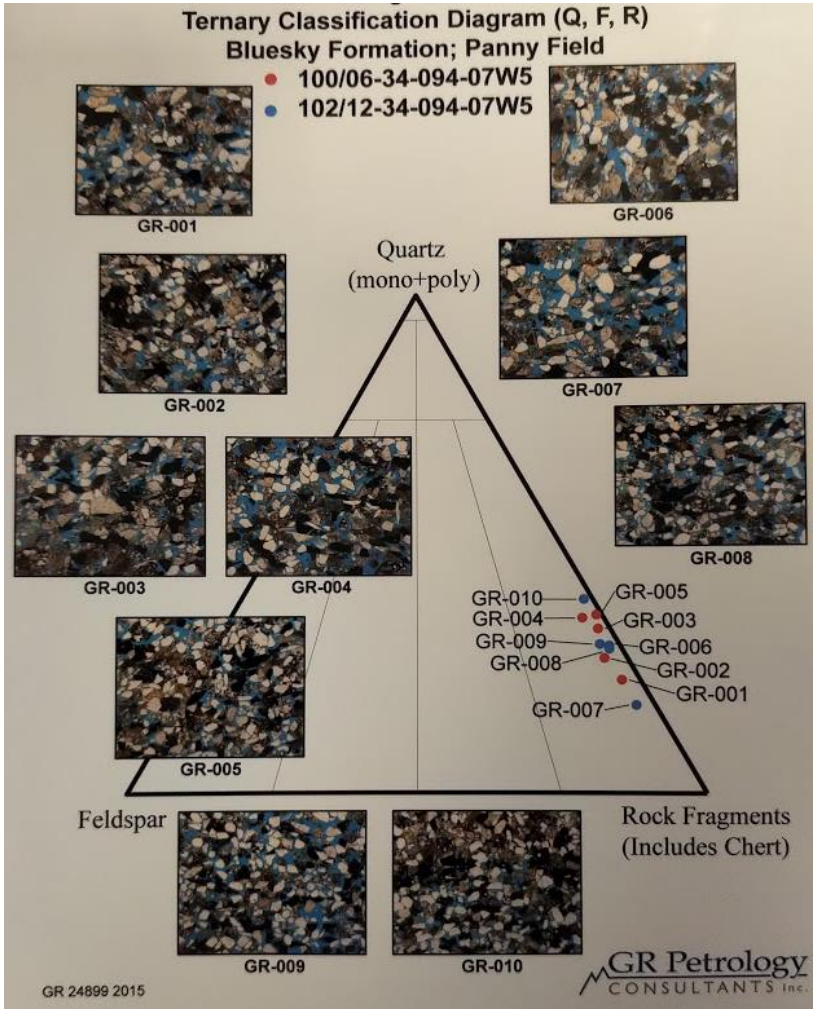
- Bluesky facies based on petrographic and core data
- Chert Arenite Lithology – excellent reservoir rock. Minor, localized, non extensive shale partings and laminae seen near base of Bluesky sand. Localized minor shale clast blebs.
- Slight coarsening upward sequence observed. Grain size range:
  V Fine - Fine at base (facies F1)
  Fine- Lower Medium (facies F3, targeted bitumen leg)
- Best reservoir permeability / porosity relationship in facies F3.

Core Analysis Summary – Porosity vs Permeability

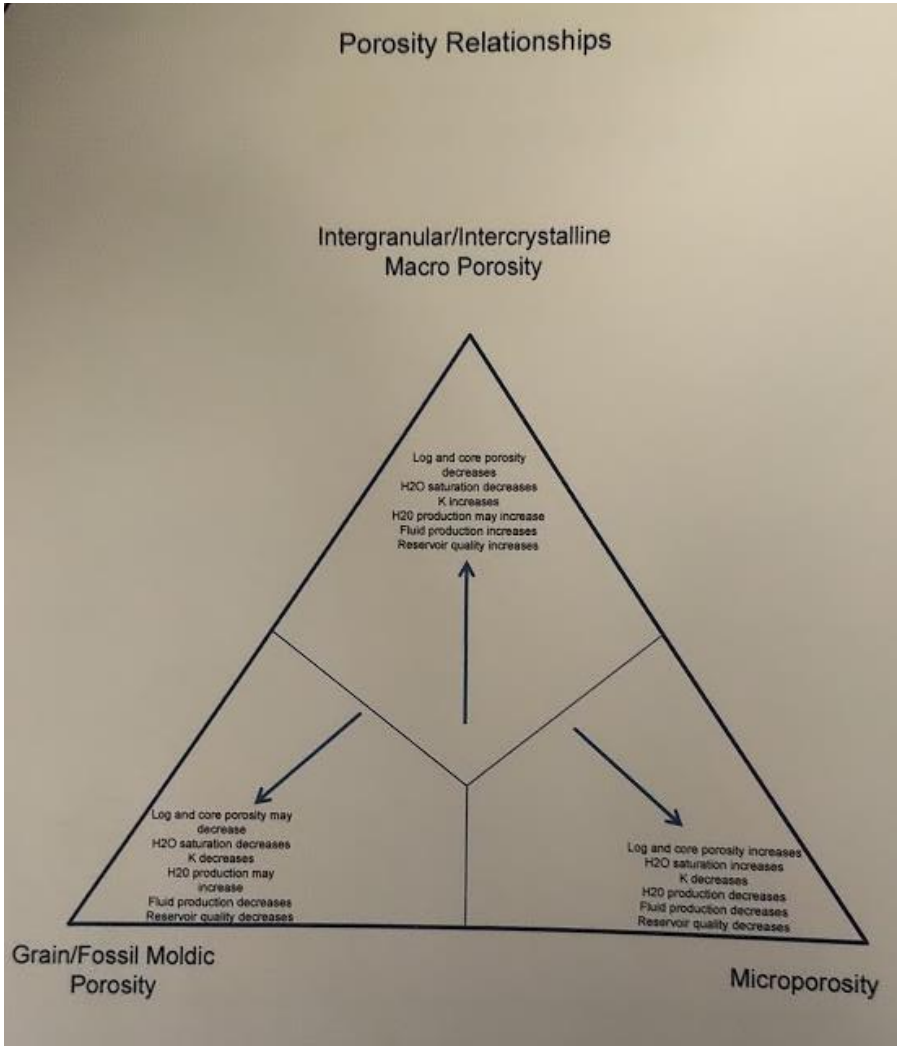


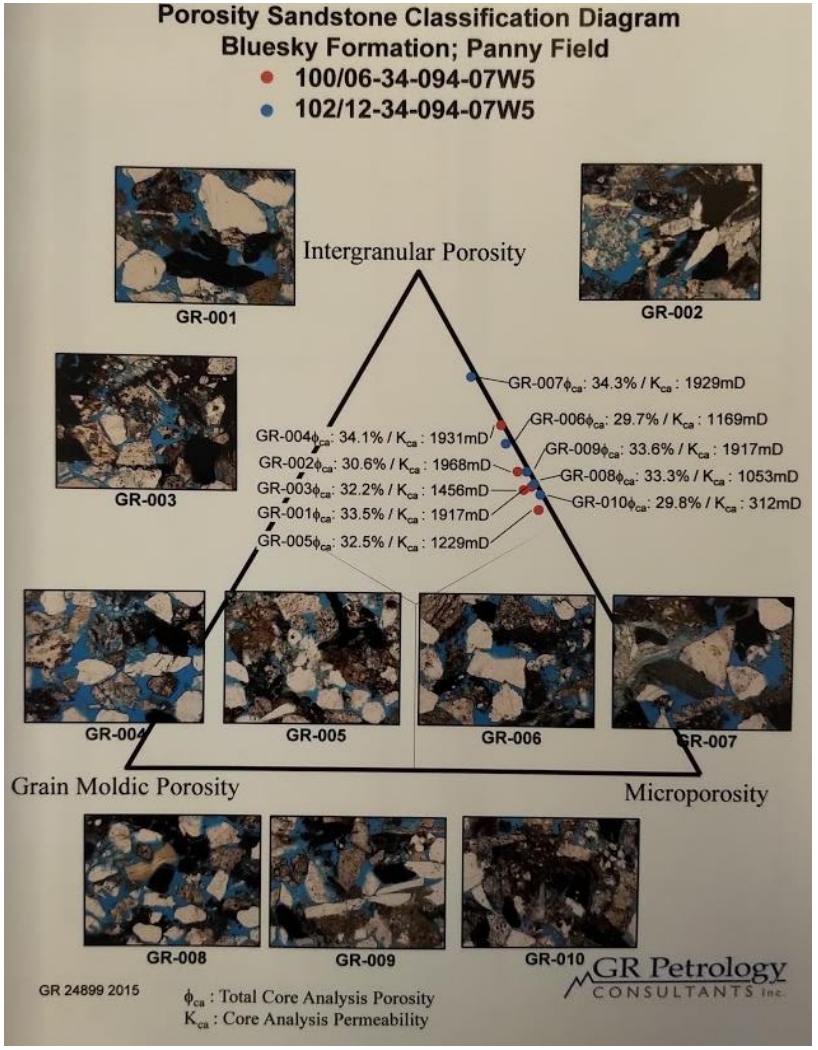
Rock Classification





Porosity Relationships





Mineralogy

PERPETUAL ENERGY

COMPANY: Perpetual Energy Inc.
WELLS: 100/06-34-094-07W4 & 102/12-34-094-07W5M

FILE: GR 24899 2015
FORMATION: Bluesky
FIELD: Panny

TABLE 4
Mineralogy Calculated from Thin Section Modal Analysis

GR Sample #	Quartz (%)	Feldspar (%)	Dolomite (%)	Calcite (%)	Siderite (%)	Pyrite (%)	Clay (%)	Glauc (%)	Phos (%)	CD (%)	HM (%)	Grain Density Calculated (kg/m3)
GR-001	71.6	4.4	2.3	0.3	1.3	0.3	15.6	3.3	tr	0.3	-	2676
GR-002	64.0	5.5	3.7	0.7	1.3	-	21.8	1.7	-	1.3	-	2675
GR-003	73.9	2.9	2.7	tr	0.3	-	17.3	2.0	-	1.0	-	2660
GR-004	68.8	4.8	4.3	0.7	0.3	-	20.1	1.0	-	-0.0	tr	2672
GR-005	61.9	2.6	7.7	4.0	0.3	-	22.2	1.0	-	-0.0	-	2672
GR-006	70.9	3.4	7.0	0.7	-	-	16.4	1.0	-	0.3	tr	2661
GR-007	67.4	6.2	1.3	0.7	0.3	tr	20.8	3.3	0.3	0.3	-	2682
GR-008	58.7	4.5	4.3	0.7	-0.0	tr	22.8	0.3	-	8.7	tr	2612
GR-009	65.4	4.9	5.7	0.7	0.3	tr	21.7	1.3	tr	tr	tr	2675
GR-010	63.4	4.1	12.3	2.0	-	0.3	16.5	0.3	-	1.0	-	2686

Glauc (%) - Glauconite
Phos (%) - Phosphate
CD (%) - Carbonaceous Detritus
HM (%) - Heavy Minerals
tr - trace

Reservoir Sensitivity

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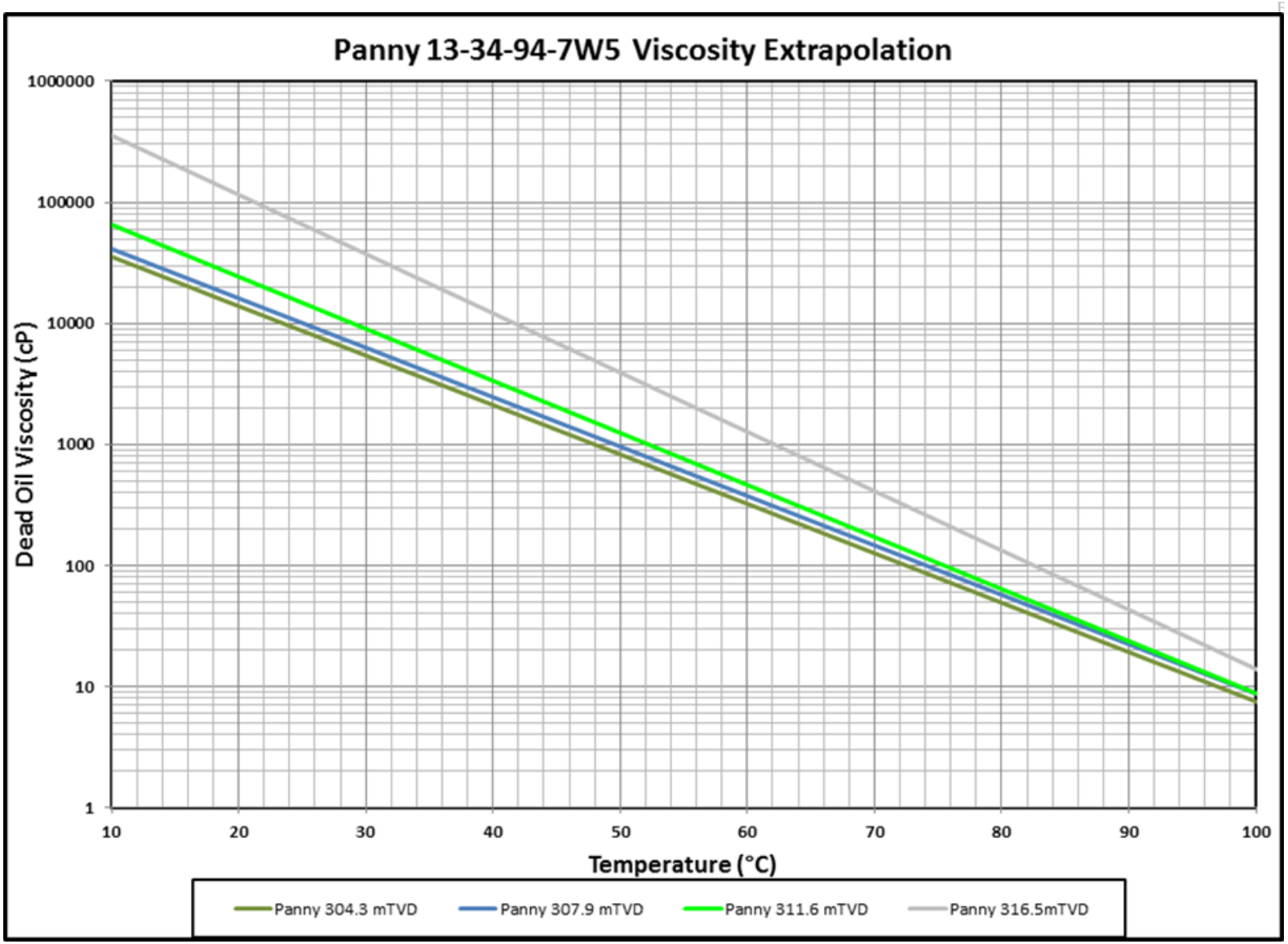
Reservoir Sensitivity

- High sensitivity and incompatibility with HCL, HF acid systems.
- Slight to moderate sensitivity to water based fluids – clay sloughing and fines migration.
- Slight to moderate potential for permeability reduction related to fines migration.
- Moderate potential for scale formation with water production.
- Moderate potential for clay expansion.
- Potential for sand migration and production.

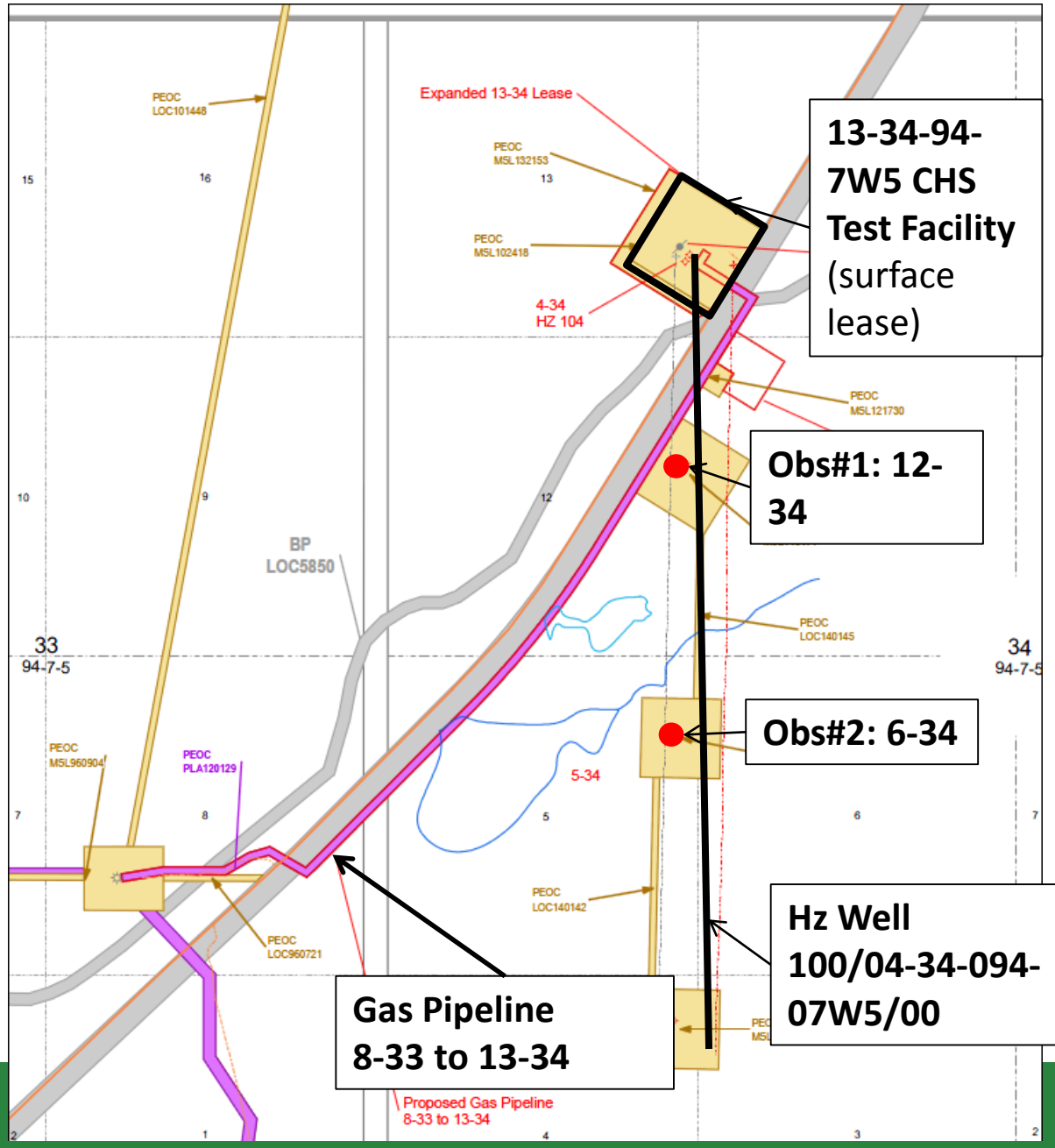
Viscosity



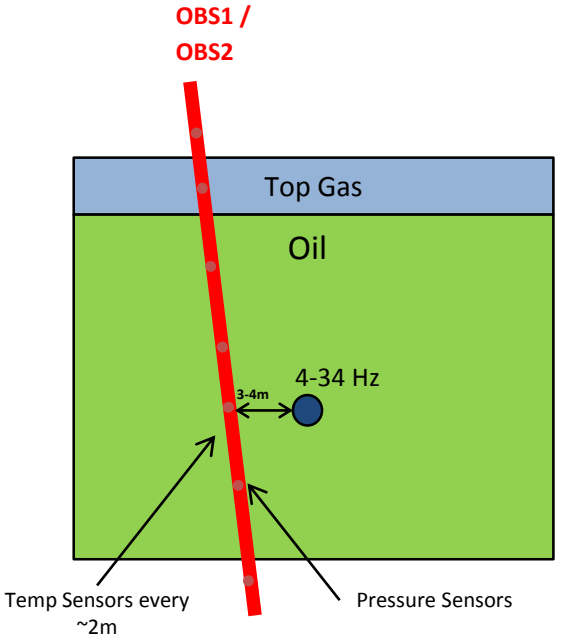
Viscosity gradation observed.

Drilling and Completions

Stage 1 CHS Test Layout



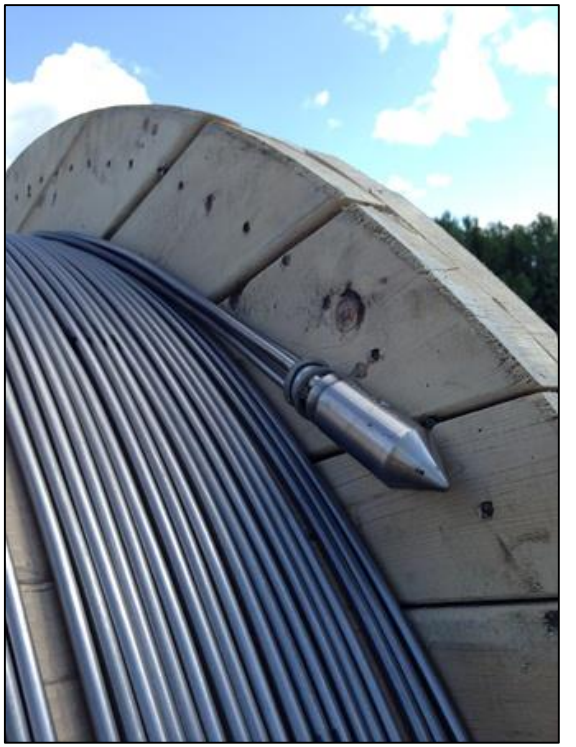
- CHS Test:
  - Used existing Hz 4-34
  - Drilled 2 Obs wells
    - Drilled, cored, logged, cased with instrumentation
      - ~7 pressure sensors
      - ~19 temp sensors



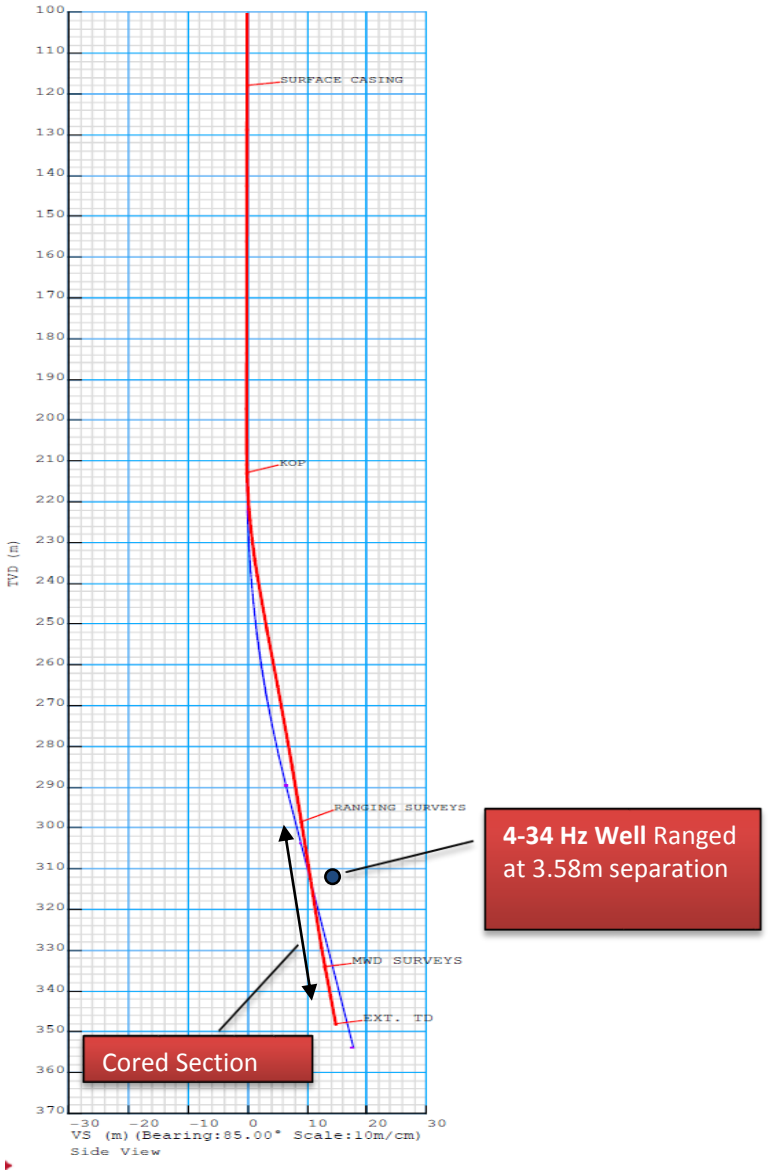
Horizontal Well Completion

Electrical Heaters

- 2 x MI (Mineral Insulated) Electric Downhole Heater Systems
- A/C 3 phase (3 cables each), wye-spliced at ends
- **~600 W/m total nominal output** (~300 W/m each x 2)
- Configuration:
  - **ESP cables,** spliced to
  - **Cold Lead MI cables,** spliced to
  - **Hot Lead MI cables**
  - Splices offset from each other
- Control: Temperature or kW set points



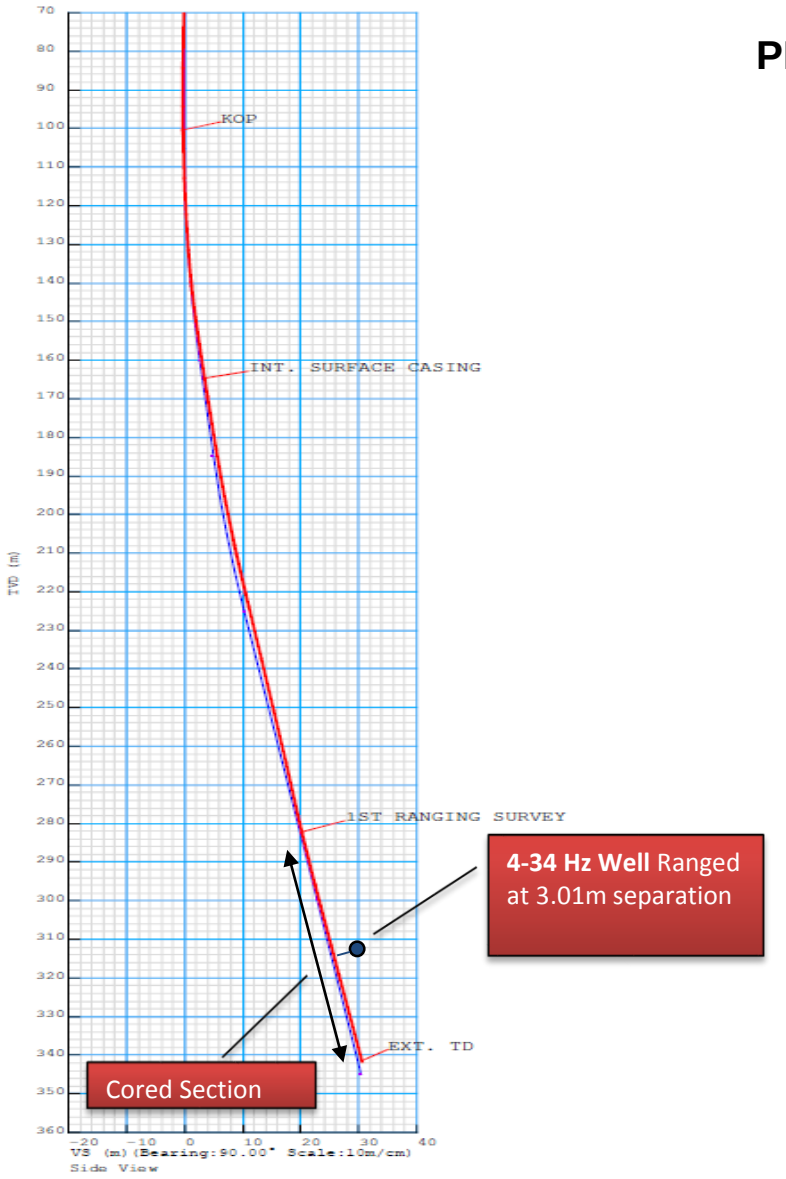
Observation Well Drilling – 12-34-94-7W5



PEOC Panny 12-34-94-7W5

- Spudded Feb 18, 2015; Rig released Feb 24, 2015.
- Drilled surface, ran 219.1mm (9 5/8”) J-55 ST&C surface casing set at 118m.
- Drilled out with directional tools, KOP at 213m, build hole angle to 7° to core point at 301.4m
- **Cored** from 301.4m to 342m and had **99.6% core recovery** :
  - Cut core #1 and then RIH with survey tools to take ranging shot
  - Cut core #2 and then RIH with survey tools to take ranging shot
  - Cut cores #3-6, RIH with directional drilling BHA and Range to 4-34
- Drilled to 348.5m (0.5m from TD) when well **lost mud circulation, cured losses**:
  - Bit was 8.5m into the Paleozoic, 0.5m away from planned TD
- Open hole logged.
- Ran 114.3mm (4.5”) L-80 SLHT casing with sensors, cemented with Thermal-40 cement with 4.0 m3 returns.
- **Final ranging shows 3.58m separation.**

Observation Well Drilling – 6-34-94-7W5



PEOC Panny 6-34-94-7W5

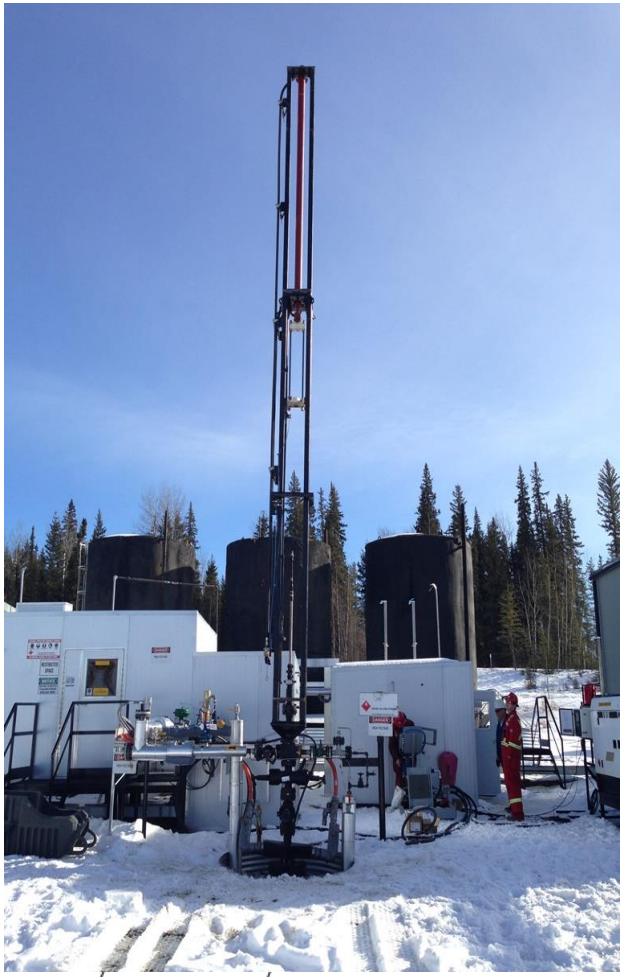
- Originally licenced as 5-34-94-7W5.
- Spudded Feb 25, 2015; rig released Mar 3, 2015.
- Drilled surface hole and kicked-off directional at 100mMD; landed surface casing at 165mMD.
- Drilled out with directional tools and build hole angle to 9° by core point at 299.7m
- **Cored** from 299.7m to 341.2m and had **99.4% core recovery**:
  - Cut core #1 and then RIH with survey tools to take ranging shot
  - Cut core #2 and then RIH with survey tools to take ranging shot
  - Cut cores #3-6, RIH with directional drilling BHA and Range to 4-34
- Lost mud circulation in Paleozoic, cured losses.
- Open hole logged.
- Ran 114.3mm (4.5”) L-80 SLHT casing with sensors, cemented with Thermal-40 cement.
- Cement briefly lost circulation, top filled cement ~50m
- Ran cement bond long – good cement.
- TD crossed into LSD 6-34; well license amended.
- **Final ranging shows 3.01m separation.**

Artificial Lift

Horizontal Well Completion

Artificial Lift

- Pump Seating Nipple for Insert Rod Pump
  - 30-250-RWAFR-20-3
  - Sucker rods w/ sinker bars
  - Landed at 60° inclination in intermediate casing tangent section
  - Wellhead mounted hydraulic stroking unit

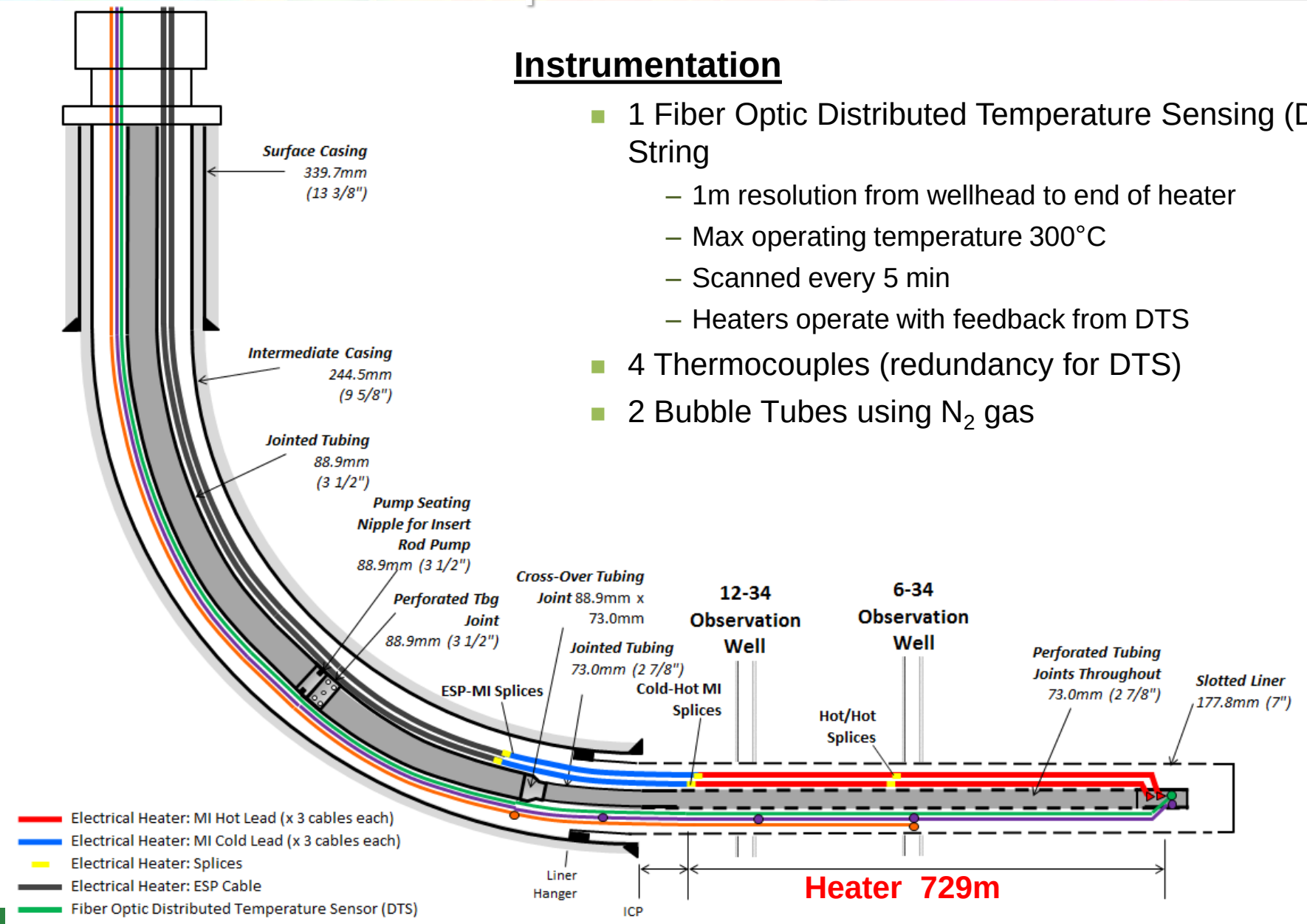


Artificial Lift

Reciprocating pump utilized.
No issues experienced with artificial lift system.
38 m3/d peak rates @ 350 kPaa sandface pressure.

Instrumentation

Horizontal Well Completion

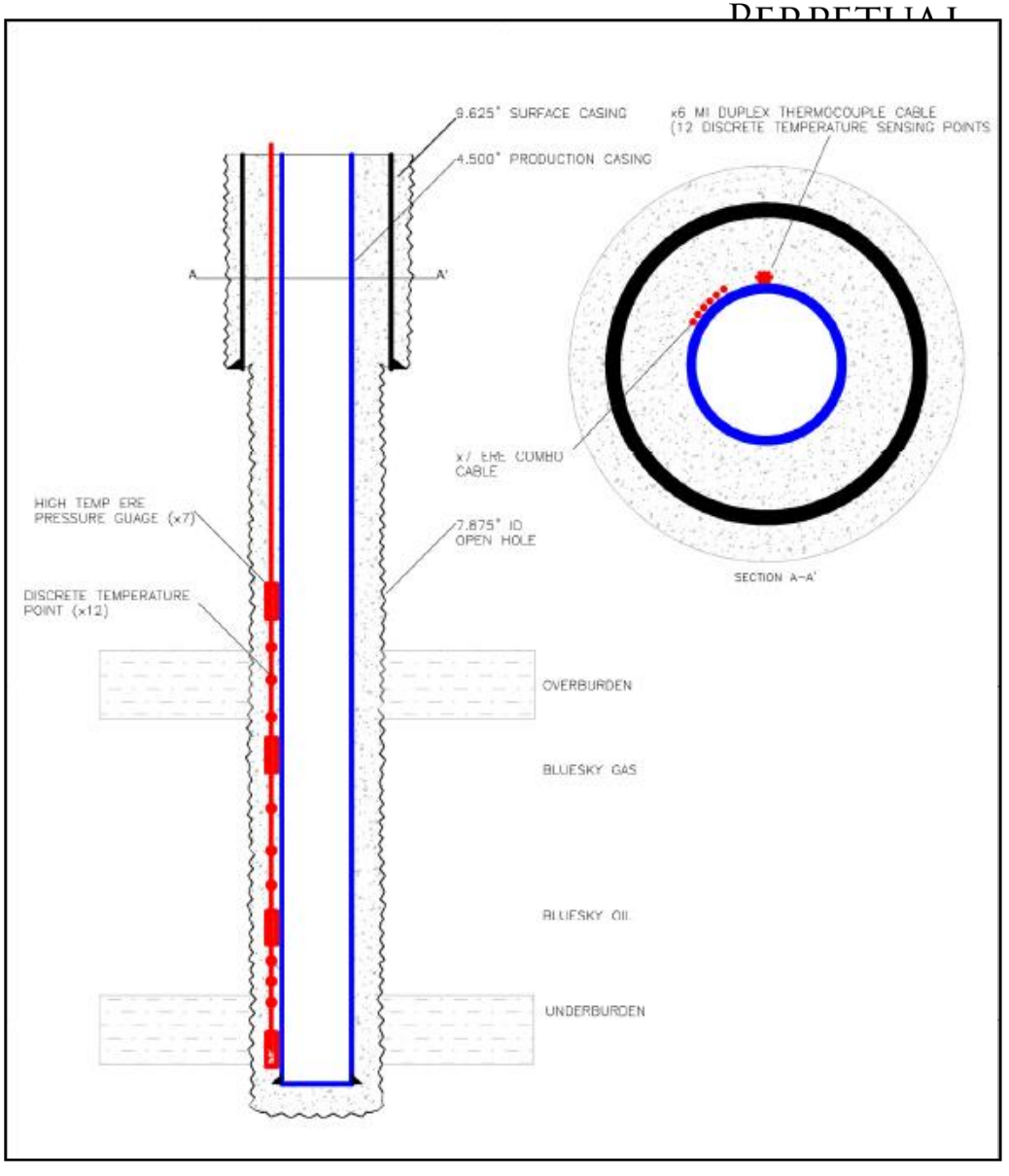


Instrumentation

- 1 Fiber Optic Distributed Temperature Sensing (DTS) String
  - 1m resolution from wellhead to end of heater
  - Max operating temperature 300°C
  - Scanned every 5 min
  - Heaters operate with feedback from DTS
- 4 Thermocouples (redundancy for DTS)
- 2 Bubble Tubes using N_2 gas

Observation Wells

- 9 5/8” surface, 4 1/2” production casing
- Ranged wells to land close to horizontal well
  - Obs 6-34: **3.01m** separation
  - Obs 12-34: **3.58m** separation
- Cored entire Bluesky/Gething formation
  - Avg 100 core sample points per well
  - Petrology lab work
- Log with typical log suite plus CMI log on one well
- All instrumentation clamped to outside of production casing and cemented-in-place
- **7 pressure and 19 temperature points per well**
- Solar powered RTU for data recording, download with USB stick weekly



4-D Seismic

No 4-D Seismic

No seismic / microseismic utilized directly for this project.

Scheme Performance

CHS Pilot Summary

- LEAD Pilot Stage 1: Cyclic Heating Stimulation (CHS) Test -
  - First heat on Oct 14, 2015
  - First production on Mar 1, 2016
  - Cycle 1 - Produced for 6 weeks , followed by 2 week temperature falloff
  - Cycle 2 - Heated for 6 weeks, then produced
  - Cycle 2 - Produced while heating.
  - Cycle 3 - Solvent injection; aborted due to asphaltene deposition.
  - Toluene soak and clean out
  - Cycle 4- Produced while heating
  - Heater off May 06, 2017
  - Excellent data collected during heating phase, production phase and shut-in
  - Positive production results
  - Incorporate data into refined reservoir model to evaluate additional pilot work and commercial designs

Operations Overview – Observation Wells

PERPETUAL ENERGY

- Observation wells
  - Drilled March 2015
  - 100% of sensors are working (52 total)
  - Measurements recorded hourly
  - Thermocouples have allowed accurate reservoir thermal conductivity tuning in the model
  - Reservoir thermal conductivity higher than previously assumed
  - Pressure gauges have provided important insight into vertical and horizontal permeabilities
  - Reservoir pressures took ~3 months post-drilling to equalize

Lessons Learned

PERPETUAL ENERGY

- Reservoir
  - Seven pressure sensors per observation well have provided necessary insight into the non-linear bitumen pressure gradient
  - Pressure response during heating has been less than expected, and pressure depletion during production has also been less than expected
    - significant upside which has contributed to production outperforming expectations
  - Observation well thermocouples have allowed improved thermal conductivity estimates
  - Heater operation during production (“flow assurance”) appears to increase production rates significantly, and enables continued heating of the reservoir during production cycle
    - shortens heating cycle since continue to heat the reservoir during production

Future Plans

Pilot was terminated May 06, 2017 after failure of the second heater. Perpetual continuing to gather pressure and temperature data at the observation wells. No further production is anticipated.

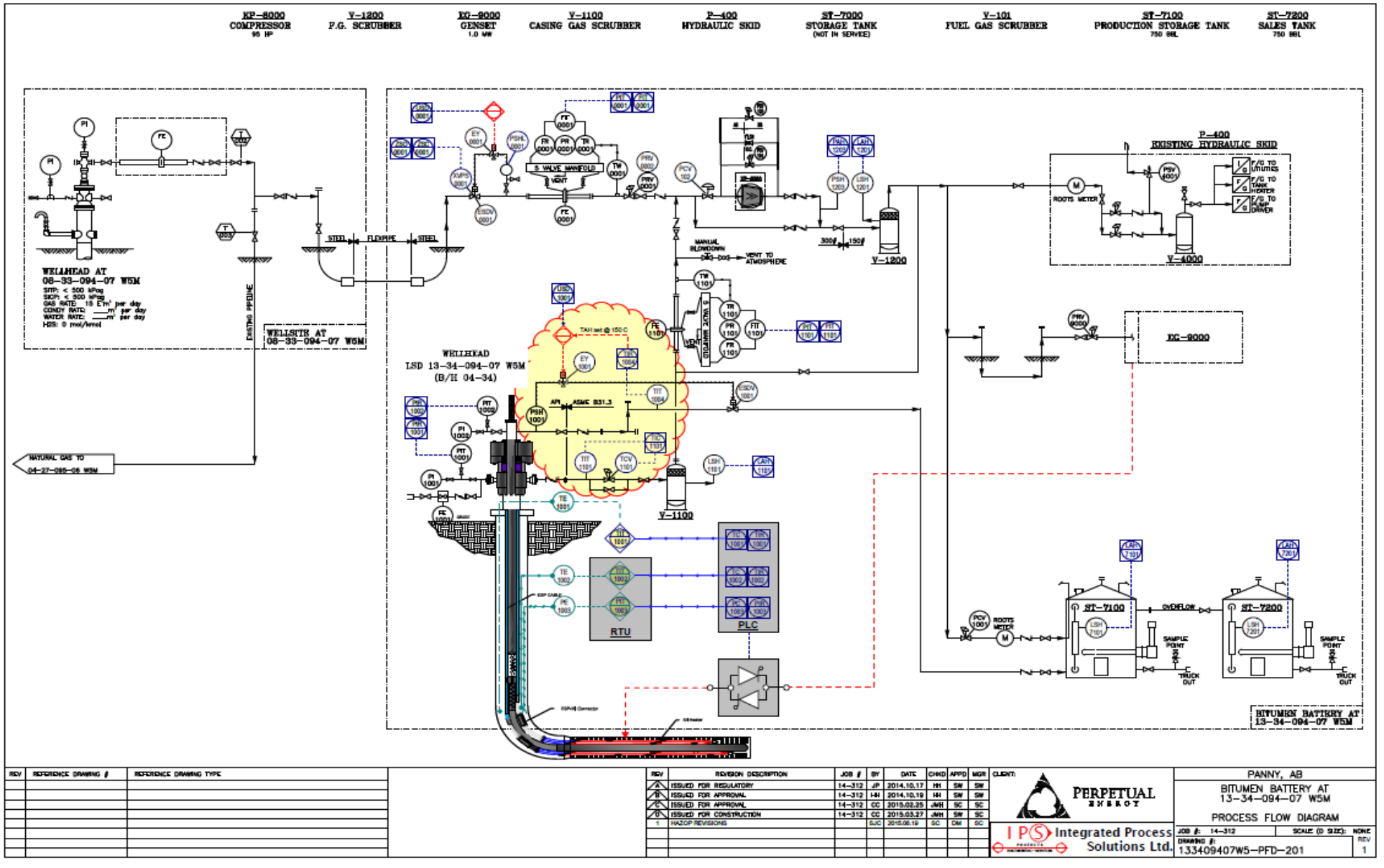
This is the final presentation for this pilot.

Surface

Facility

13-34-094-07W5

Facility Process Flow Diagram



REV	REFERENCE DRAWING #	REFERENCE DRAWING TYPE

REV	REVISION DESCRIPTION	JOB #	BY	DATE	CHKD	APPD	MGR
A	ISSUED FOR REGULATORY	14-312	JP	2014.10.17	HH	SW	SW
B	ISSUED FOR APPROVAL	14-312	HH	2014.10.19	HH	SW	SW
C	ISSUED FOR APPROVAL	14-312	CC	2015.02.25	JHH	SC	SC
D	ISSUED FOR CONSTRUCTION	14-312	CC	2015.03.27	JHH	SW	SC
1	HAZOP REVISIONS		SJC	2015.06.19	SC	DM	SC

CLIENT: PERPETUAL ENERGY

Integrated Process Solutions Ltd.

PANNY, AB

BITUMEN BATTERY AT 13-34-094-07 W5M

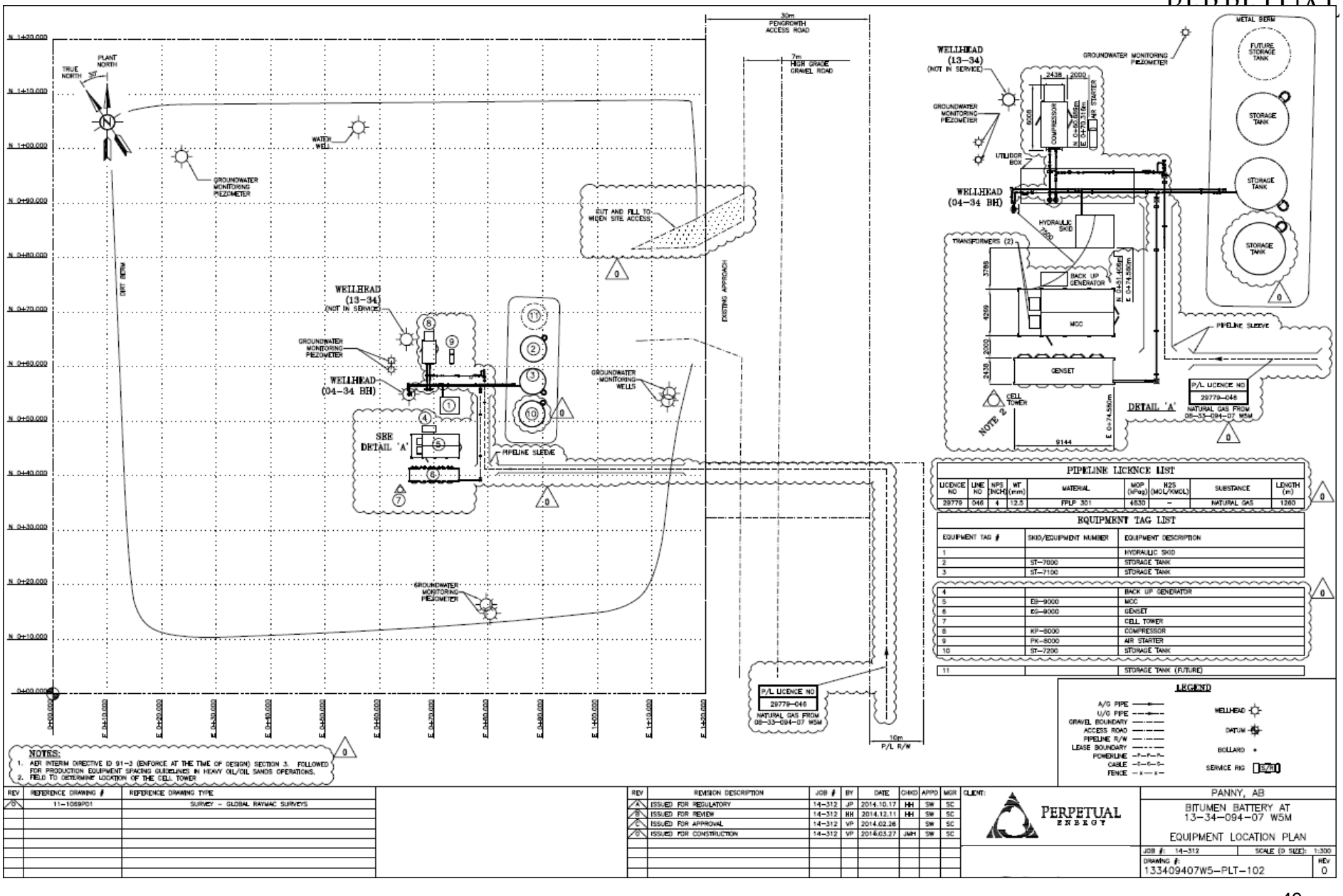
PROCESS FLOW DIAGRAM

JOB #: 14-312 SCALE (D SIZE): NONE

DRAWING #: 133409407W5-PFD-201 REV 1

- Emulsion goes directly to 750 bbl production and sales tanks
- Treating of oil to pipeline spec (<0.5% BS&W) is achieved through demulsifier injection near the wellhead and tank heating to temperatures of 60-80°C

Facility Site Plan



PIPELINE LICENCE LIST

LICENCE NO	LINE NO	NPS (INCH)	WT (mm)	MATERIAL	MOP (kPag)	H2S (MOL/KMOL)	SUBSTANCE	LENGTH (m)
29779	046	4	12.5	FPLP 301	4830	–	NATURAL GAS	1260

EQUIPMENT TAG LIST

EQUIPMENT TAG #	SKID/EQUIPMENT NUMBER	EQUIPMENT DESCRIPTION
1		HYDRAULIC SKID
2	ST-7000	STORAGE TANK
3	ST-7100	STORAGE TANK
4		BACK UP GENERATOR
5	EB-9000	MCC
6	EG-9000	GENSET
7		CELL TOWER
8	KP-8000	COMPRESSOR
9	PK-8000	AIR STARTER
10	ST-7200	STORAGE TANK
11		STORAGE TANK (FUTURE)

LEGEND

A/G PIPE
U/G PIPE
GRAVEL BOUNDARY
ACCESS ROAD
PIPELINE R/W
LEASE BOUNDARY
POWERLINE
CABLE
FENCE
WELLHEAD
DATUM
BOLLARD
SERVICE RIG

NOTES:
1. AER INTERIM DIRECTIVE ID 91-3 (ENFORCE AT THE TIME OF DESIGN) SECTION 3. FOLLOWED FOR PRODUCTION EQUIPMENT SPACING GUIDELINES IN HEAVY OIL/OIL SANDS OPERATIONS.
2. FIELD TO DETERMINE LOCATION OF THE CELL TOWER

REV	REFERENCE DRAWING #	REFERENCE DRAWING TYPE
0	11-1089P01	SURVEY - GLOBAL RAYMAC SURVEYS

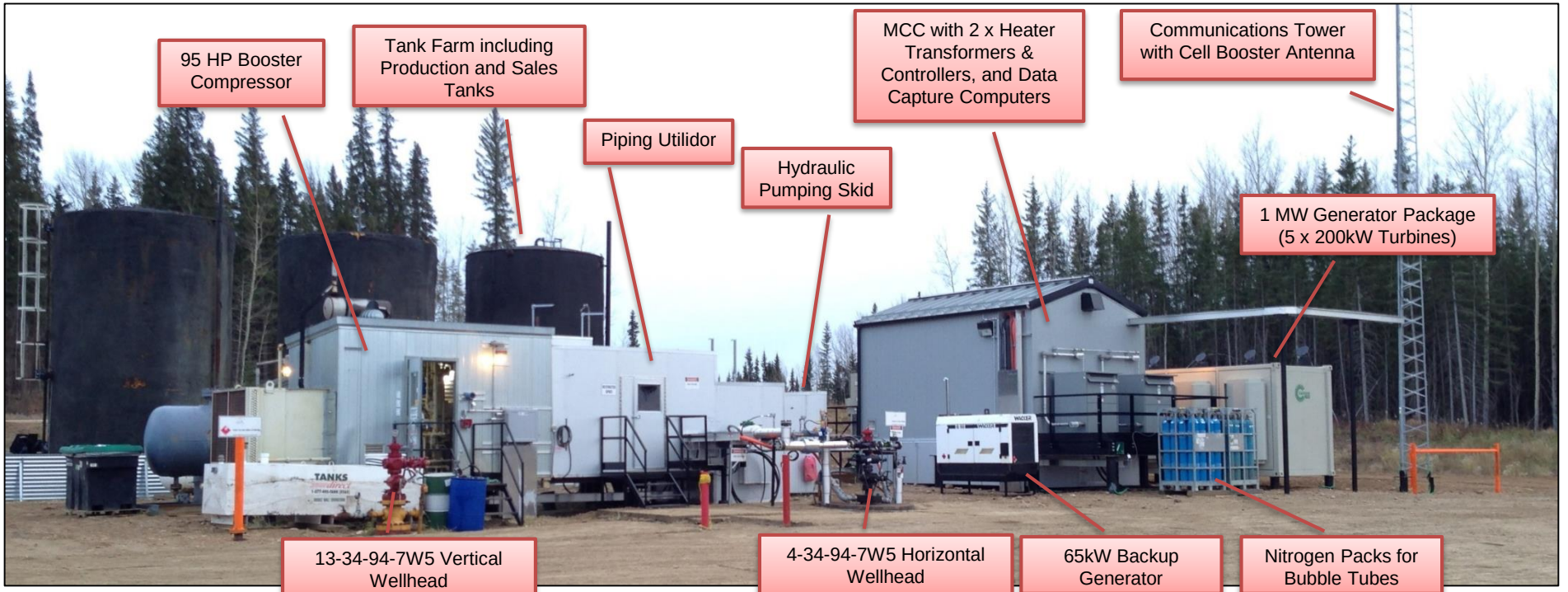
REV	REVISION DESCRIPTION	JOB #	BY	DATE	CHKD	APPD	MGR
A	ISSUED FOR REGULATORY	14-312	JP	2014.10.17	HH	SW	SC
B	ISSUED FOR REVIEW	14-312	HH	2014.12.11	HH	SW	SC
C	ISSUED FOR APPROVAL	14-312	VP	2014.02.26		SW	SC
0	ISSUED FOR CONSTRUCTION	14-312	VP	2014.03.27	JMH	SW	SC

CLIENT: PERPETUAL ENERGY

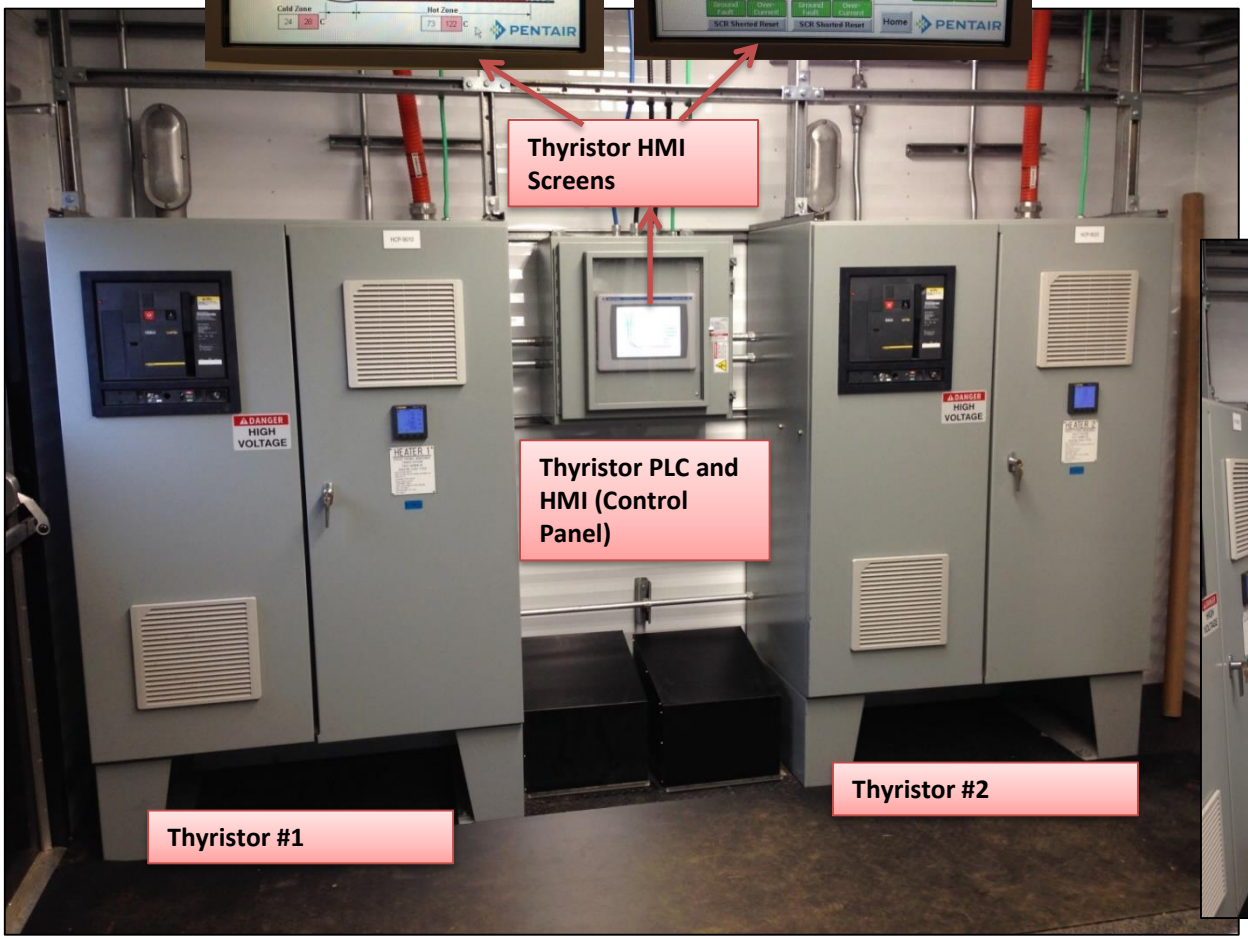
PANNY, AB
BITUMEN BATTERY AT
13-34-094-07 W5M
EQUIPMENT LOCATION PLAN

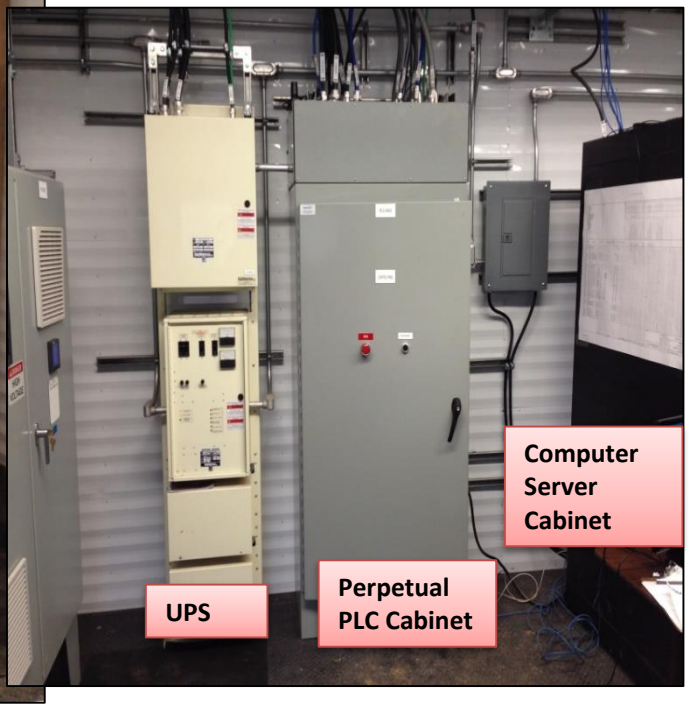
JOB #: 14-312 SCALE (D SIZE): 1:300
DRAWING #: 133409407W5-PLT-102 REV 0

Facility Photos



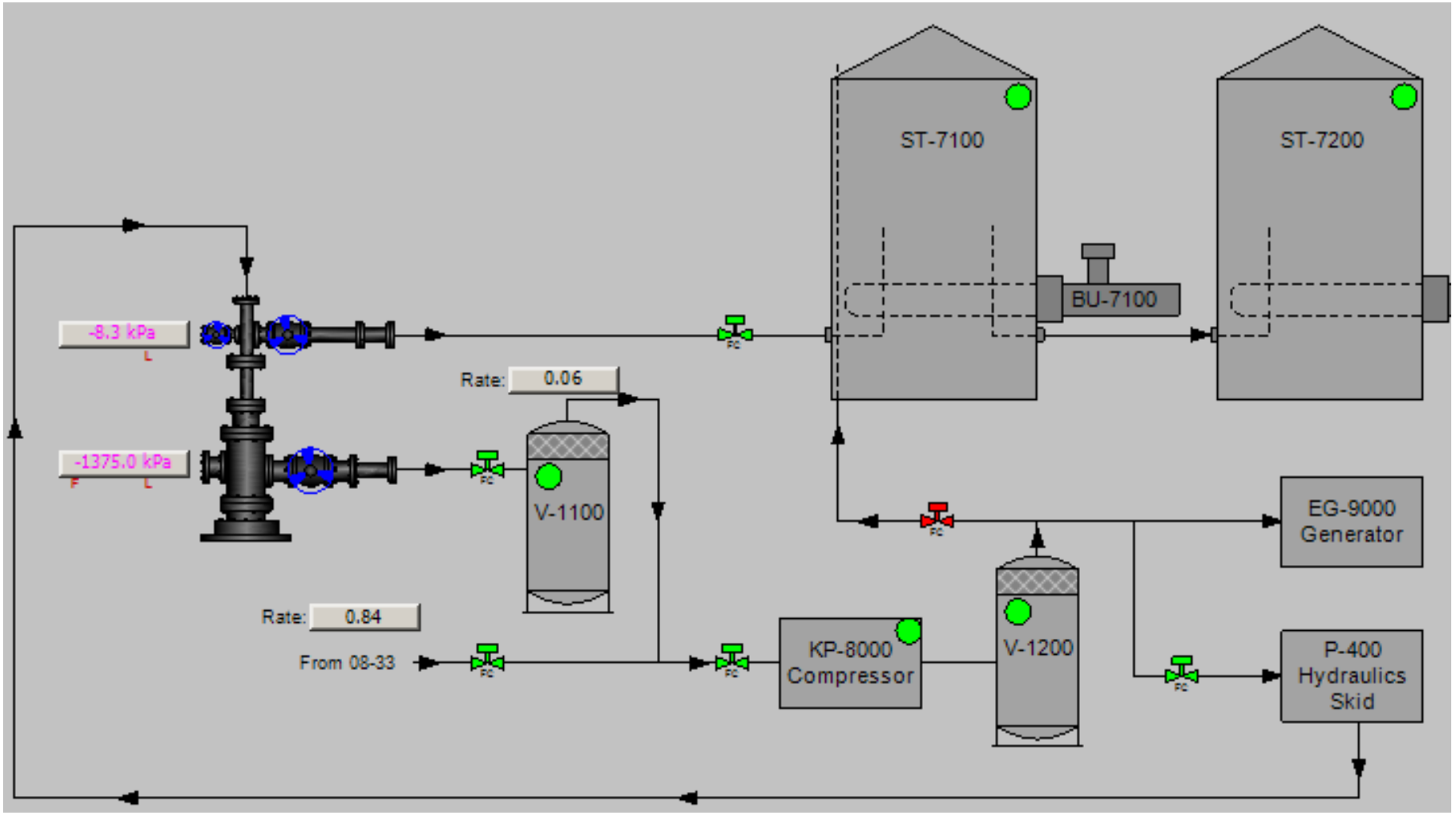
Facility – MCC Building





Measurement and Reporting

Measurements



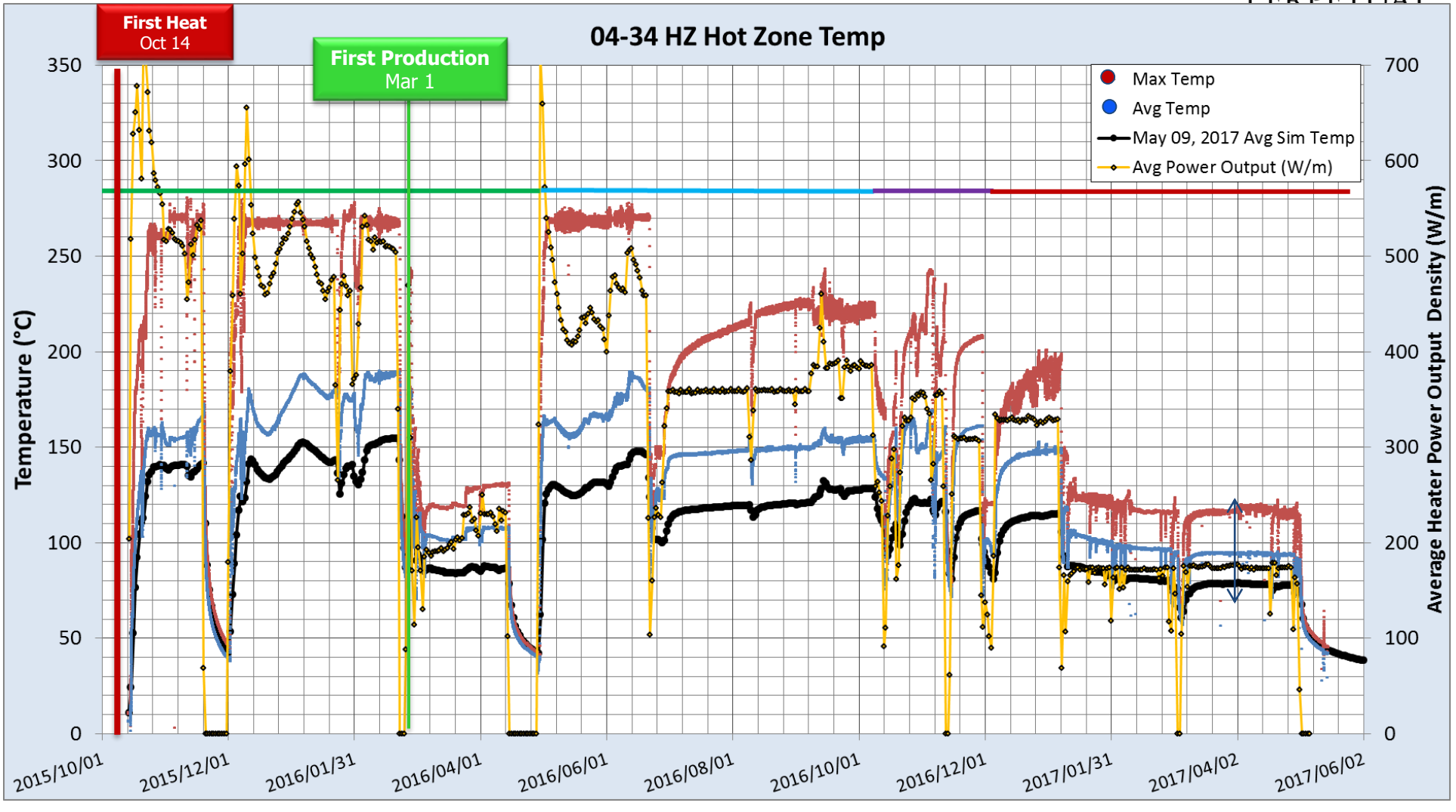
Measured Data – Production and Observation wells

100/04-34-094-7W5	
Casing pressure	kPaa
Tubing pressure	kPaa
Sandface pressure	kPaa, bubble tube
Liquid rate	Tank height, m
Oil Rate	Prorated from spin cut
Produced gas rates	Meter, m3/d
Reservoir Temperature	Thermocouples, DTS – Deg C
100/13-34-094-7W5 - Surface	Location
Fuel gas rate	Meter, m3/d
Three Phase Currents	Meter, A
Three Phase Voltages	Meter, V
Power	Calculated, W
Generator data	Measured

All acquired data were stored in the ClearScada

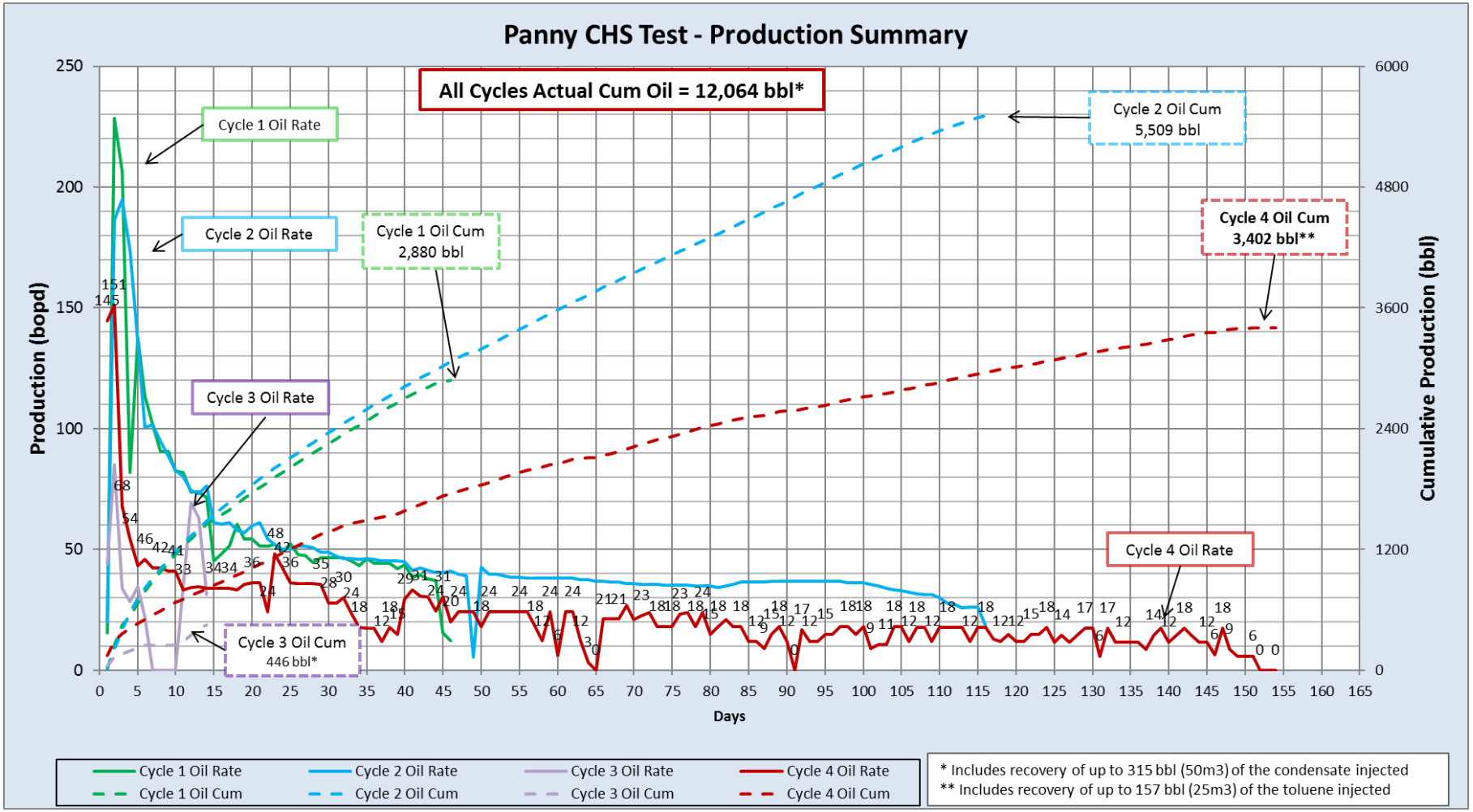
100/12-34-094-07W5 & 100/06-34-094-07W5 – Observation Wells	
Reservoir Pressure	ERE, kPaa
Reservoir Temperatures	ERE and Thermocouples – Deg C

4-34 Hz Response – Heater Section Temperatures



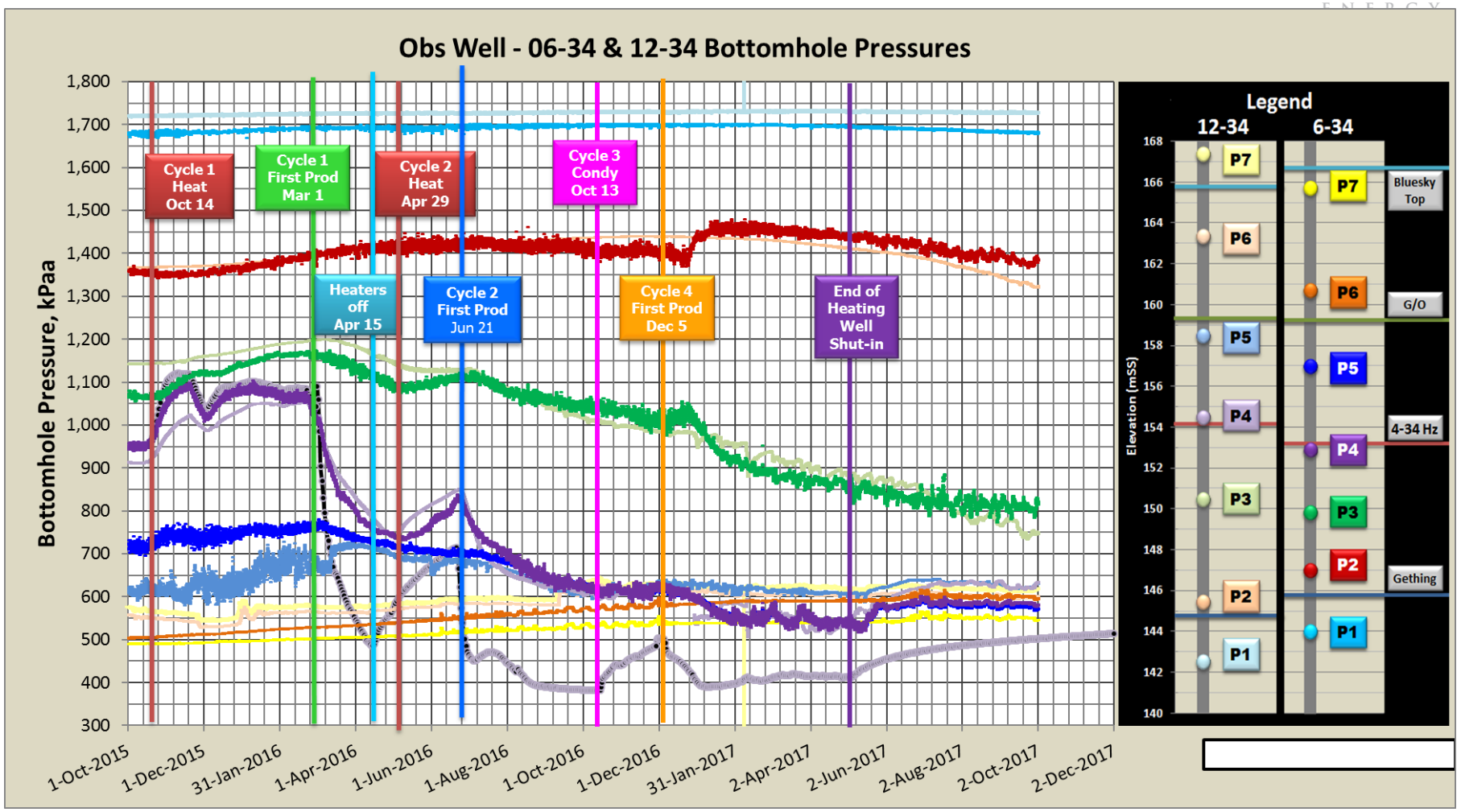
- The primary operating constraint was the fiber optic DTS temperature limitation – 300°C maximum
- Secondary operating constraint was intermediate casing temperature - 140°C maximum during production
- Even with active hot spots, average temperatures increased slowly over time
- The DTS measured heater temperature with heaters on, and sandface temperature with heaters off. Simulation assumes sandface temp; difference between the two is primarily the fluid in the wellbore acting as an insulator

Production Summary



- Water cuts obtained from spin cut averaged ~5% BS&W with only trace sand
- Running the heaters at maximum power within constraints during production contributed to increased performance
- The majority of the trucked-out oil met pipeline specifications without the need for diluent

Obs Well Pressure Response – Since First Heat



- P4 sensors horizontally across from the 4-34 Hz well showed good response to heating and production but higher than modelled pressures after the first cycle of heating.
- Sensors above and below showed pressure responses that suggest baffling or compartmentalization
- Slow pressure decline deemed related to stronger production performance than originally expected

Bitumen Treatment

Successfully produced sales spec oil with existing facility process

Water Treatment

No water injection or water treatment required for CHS test Phase 1

Gas Conservation

Power generation utilized natural gas from the Panny gas field

Measurement and Reporting

PERPETUAL ENERGY

Production Volume:

Fluid rate measured daily based on tank levels.
Oil and Water prorated from spin cut of well sample.

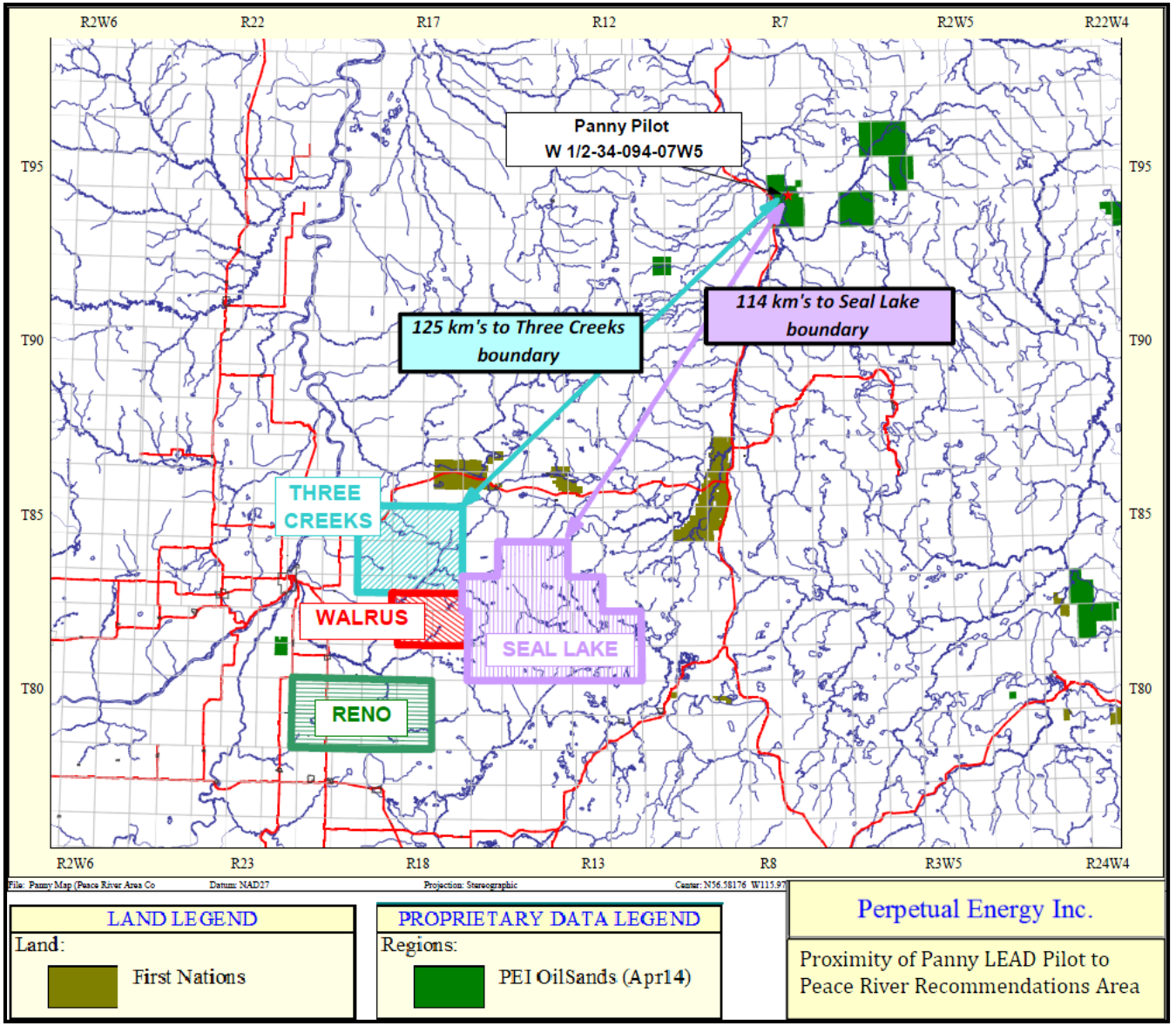
Injected volume:

Volume of injected fluid measured using supply tank meter.

Environmental

Proximity to Peace River

PERPETUAL ENERGY



Obtained and complied with EPEA approvals.

Compliance

Regulatory Update

- Experimental Recovery Scheme Approval
  - July 24, 2014: Obtained Experimental Scheme Approval No. 12283
    - Full LEAD Pilot design
  - November 13, 2014: Experimental Scheme Amendment Submitted for LEAD Pilot Stage 1
    - Updated to included Stage 1 and Stage 2 LEAD Pilot designs
  - September 28, 2016: Experimental Scheme Approval 12283B
    - Approval to inject C5+ solvent
  - May 26, 20117: Experimental Scheme Approval 12283C
    - Extended confidentiality and validity to July 24, 2019

- EPEA
  - June 2, 2014: Obtained AER EPEA Approval No. 299681-00-00
  - September 29, 2014: Received a 'No Objection Letter' from the AER for LEAD Pilot Stage 1 design
  - February 2, 2015: Groundwater Monitoring Program Proposal approved by AER
- Facility Licence
  - Facility considered a Single Well Bitumen Battery, and therefore required no facility licence
- Injection Well Approval
  - August 5, 2015: Obtained D51 Class IV Injection Well Approval for 100/04-34-094-07W5 horizontal well (a condition of the Experimental Scheme Approval for heater operation) Approval No. 12283
  - September 21, 2016: Obtained D51 Class III & IV Injection Well Approval for 100/04-34-094-07W5 horizontal well (a condition of the Experimental Scheme Approval for heater operation) Approval No. 12283B (as amended)

Compliance

- The Panny CHS Pilot Project was conducted in compliance with all conditions of approvals and associated regulatory requirements.

Future Plans

Future Plans

Pilot was terminated May 06, 2017 after failure of the second heater. Perpetual continuing to gather pressure and temperature data at the observation wells. No further production is anticipated.

This is the final presentation for this pilot.