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ERCB Progress Presentation – 2010 Update

Commercial Scheme Approval # 11341

September 29, 2010

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1) Sawn Lake Background

2) Subsurface Overview

- **Geology / Geosciences**
- **Subsurface Future Plans**

3) Surface Operations

- **Current Status**
- **Facilities Design**
- **Water Source**
- **Water Disposal**
- **Future Plans**

4) Environmental Aspects

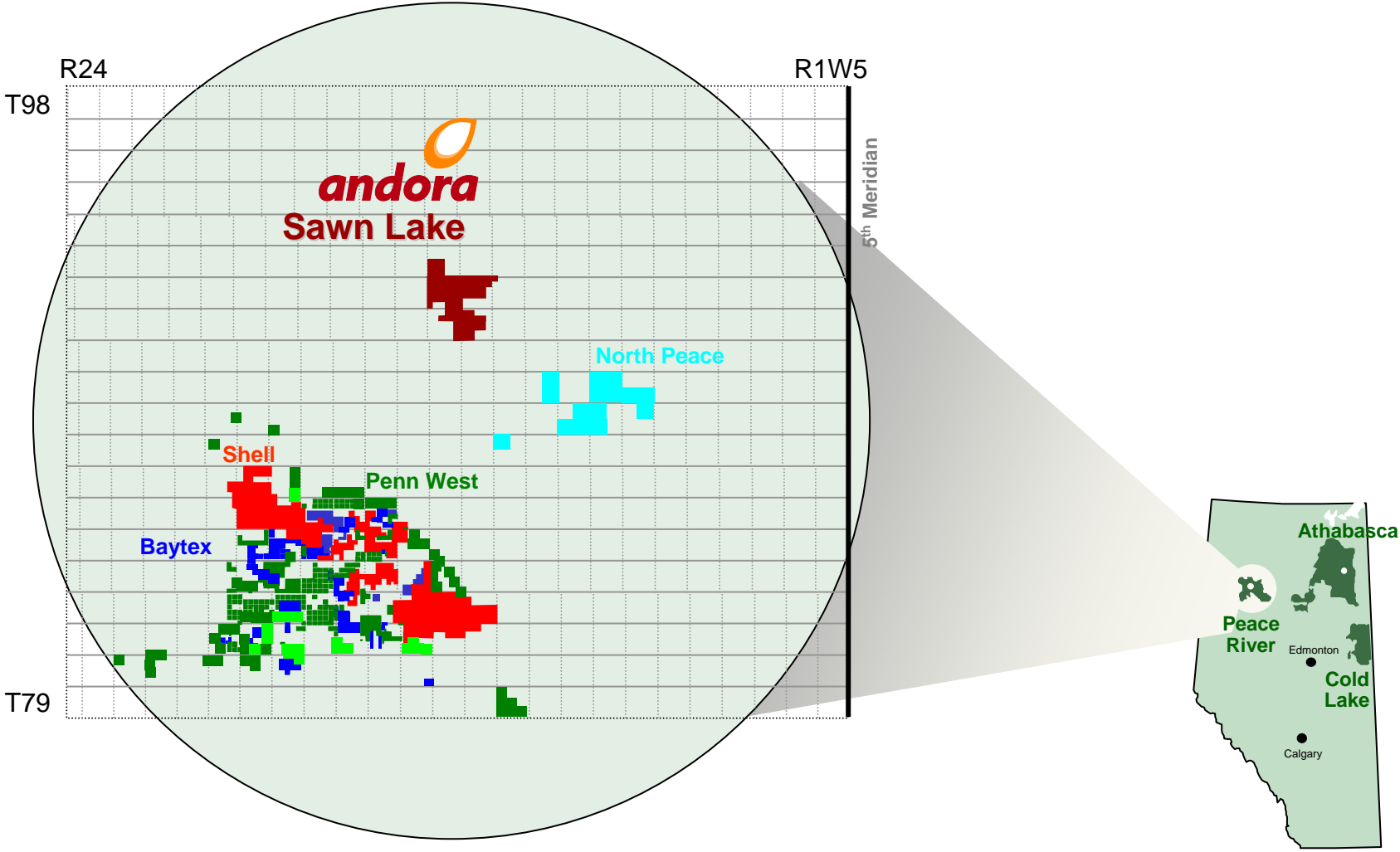


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Sawn Lake Background

Sawn Lake Location Map

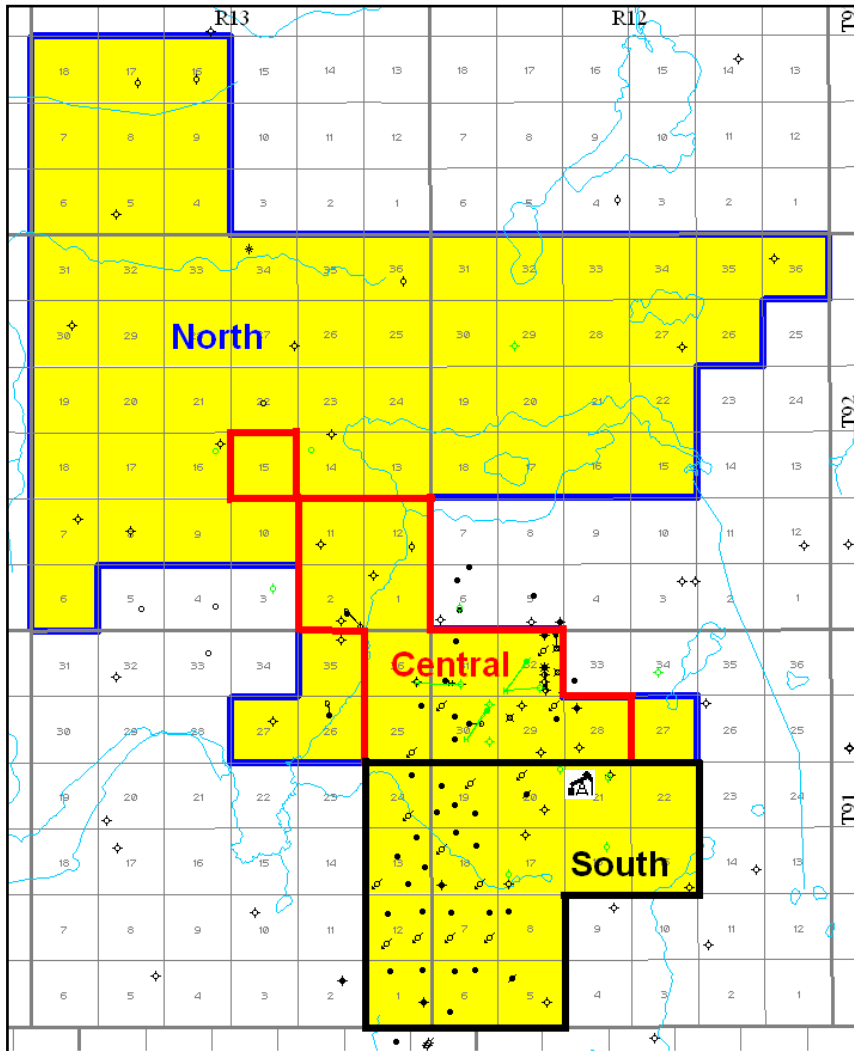


Sawn Lake Project Background



- **Andora has working interests in 88 sections of Oil Sands Leases - all in primary term**
- **Andora's Focus - Operated Leases 740307A365, 7403070363 & 7408030779**
- **2005 – 2007 Resource Evaluation and Asset Consolidation**
 - **> 100 Legacy wells, Sawn Lake Slave Point Exploration & Development**
 - **3 Andora (Signet) Horizontal Wells**
 - **9 Andora (Signet) Vertical Wells**
 - **~ 200km 2D seismic**
 - **Andora Acquired 18km² 3D Seismic over SAGD Project Location**
- **2008 – 2009 Application to ERCB for SAGD Demonstration in Sawn Lake**
- **August 2009, ERCB Commercial Scheme Approval for SAGD demonstration project in South Sawn Lake**
- **2009 – 2010 build all season access road and pipeline right of way into facility site**
- **2010 Optimize Facility Design, prepare Water Source & Disposal Well Applications**

Sawn Lake - Land



Andora - Working Interest in 88 sections

- **Sawn Lake North**
 - 10% of 51 sections (non-operated)
 - 100% of 9 sections
- **Sawn Lake Central**
 - 50% of 12 sections
 - Designated Operator
- **Sawn Lake South**
 - 100% of 16 sections
 - Approved Commercial SAGD Site

 **SAGD Project Location**

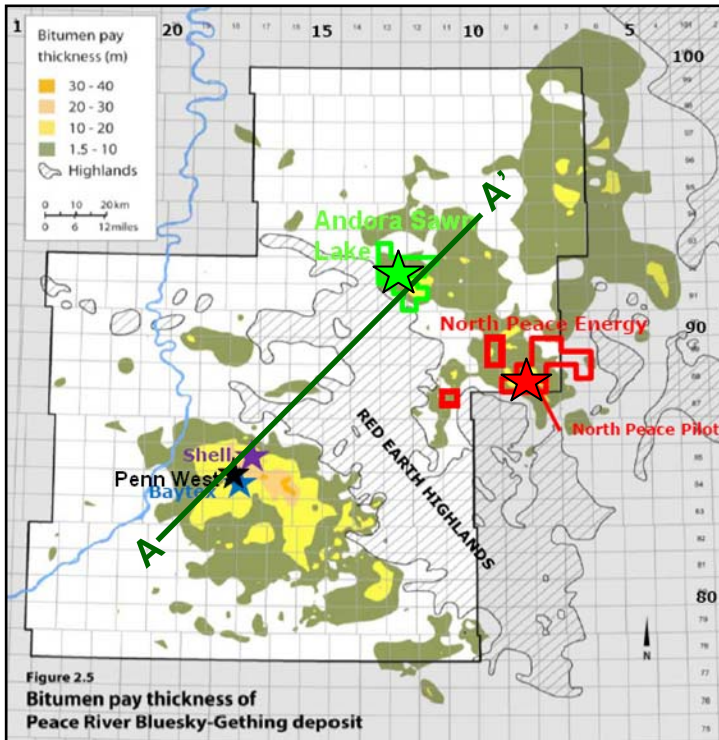


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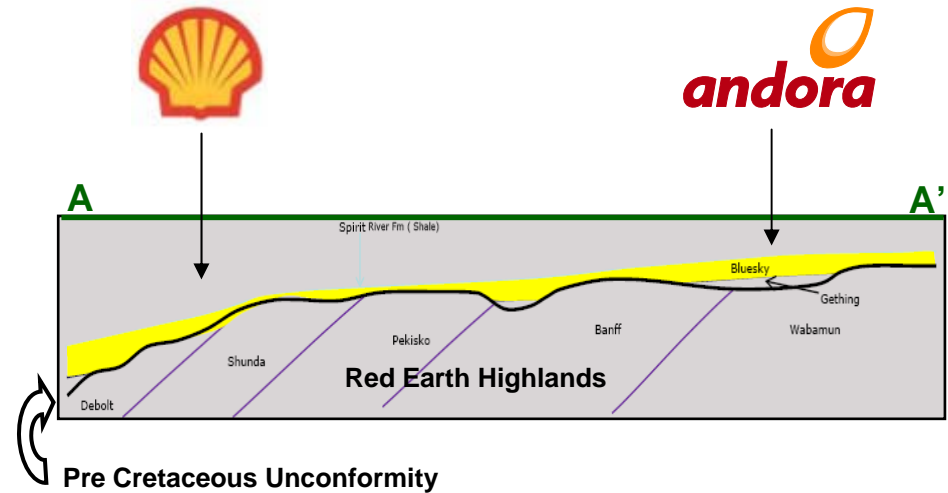
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Sawn Lake Subsurface Overview

Sawn Lake – Geological Setting

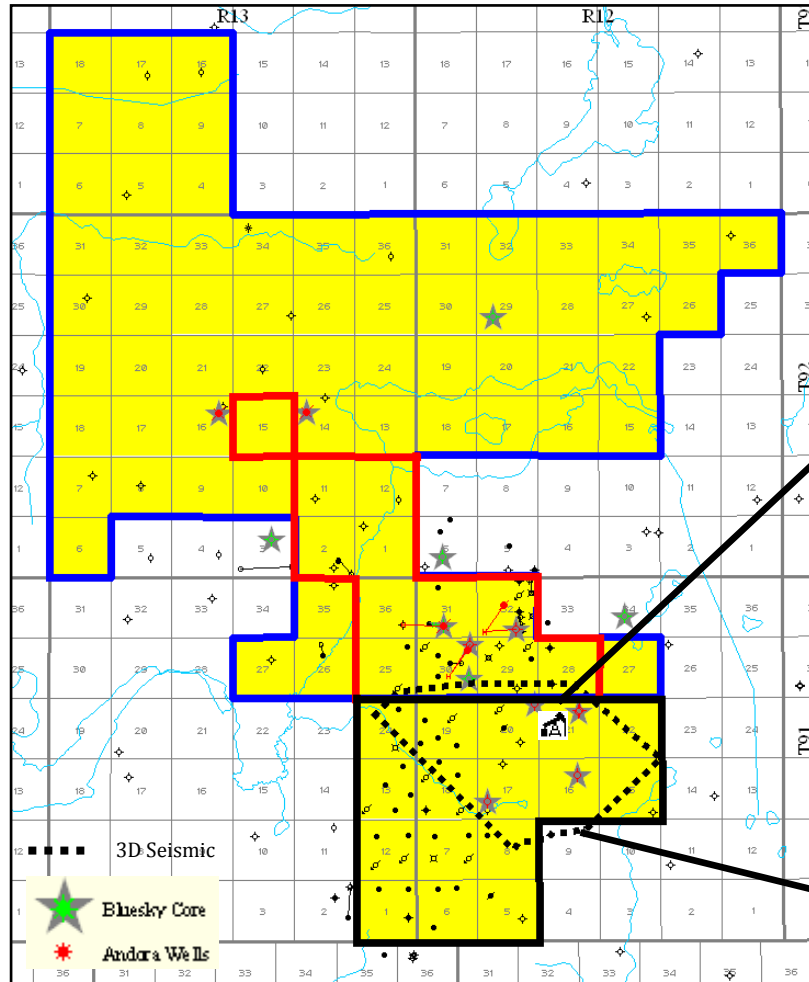


Peace River Region – Oil Sands Geological Schematic Cross Section

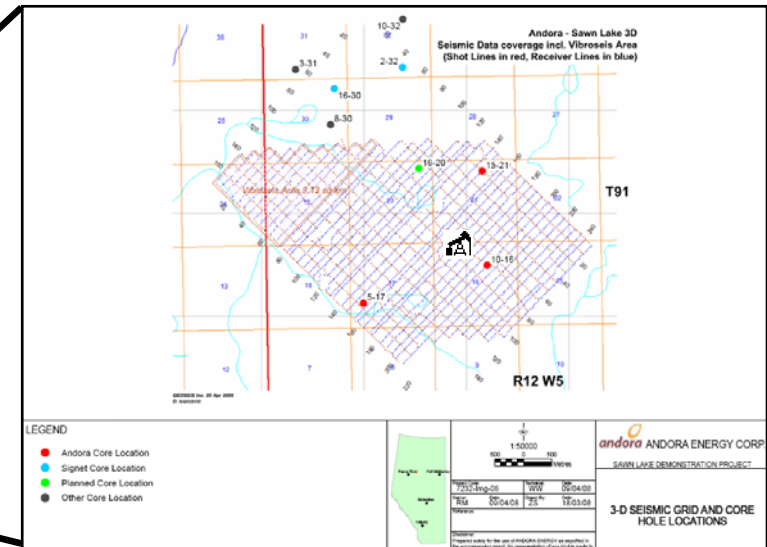


Peace River Region – Oil Sands Deposits & Major Projects

Sawn Lake – Core & 3D Seismic Data

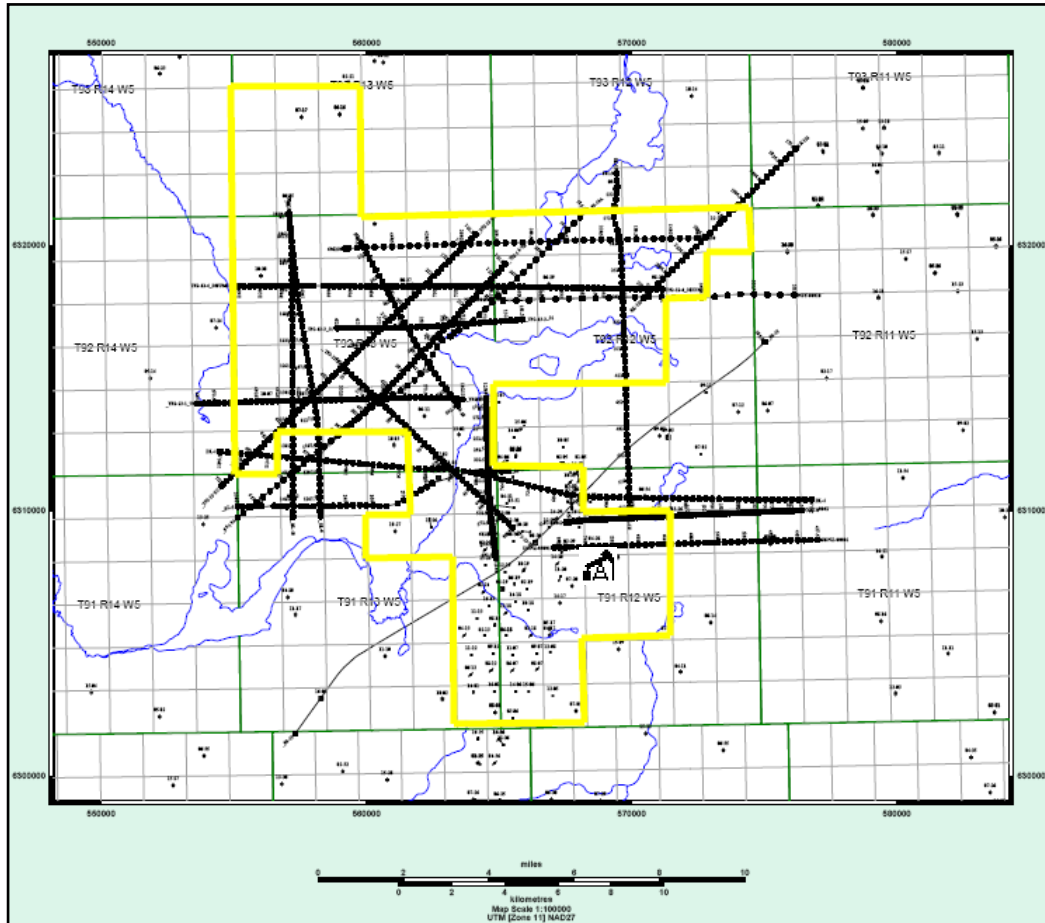


- Average of 2.8 wells per section on South & Central
- 18km² of 3D Seismic coverage over SAGD Demonstration
- 14 Bluesky Core



SAGD Project Location

Sawn Lake – 2D Seismic Data



➤ +200 km 2D seismic data

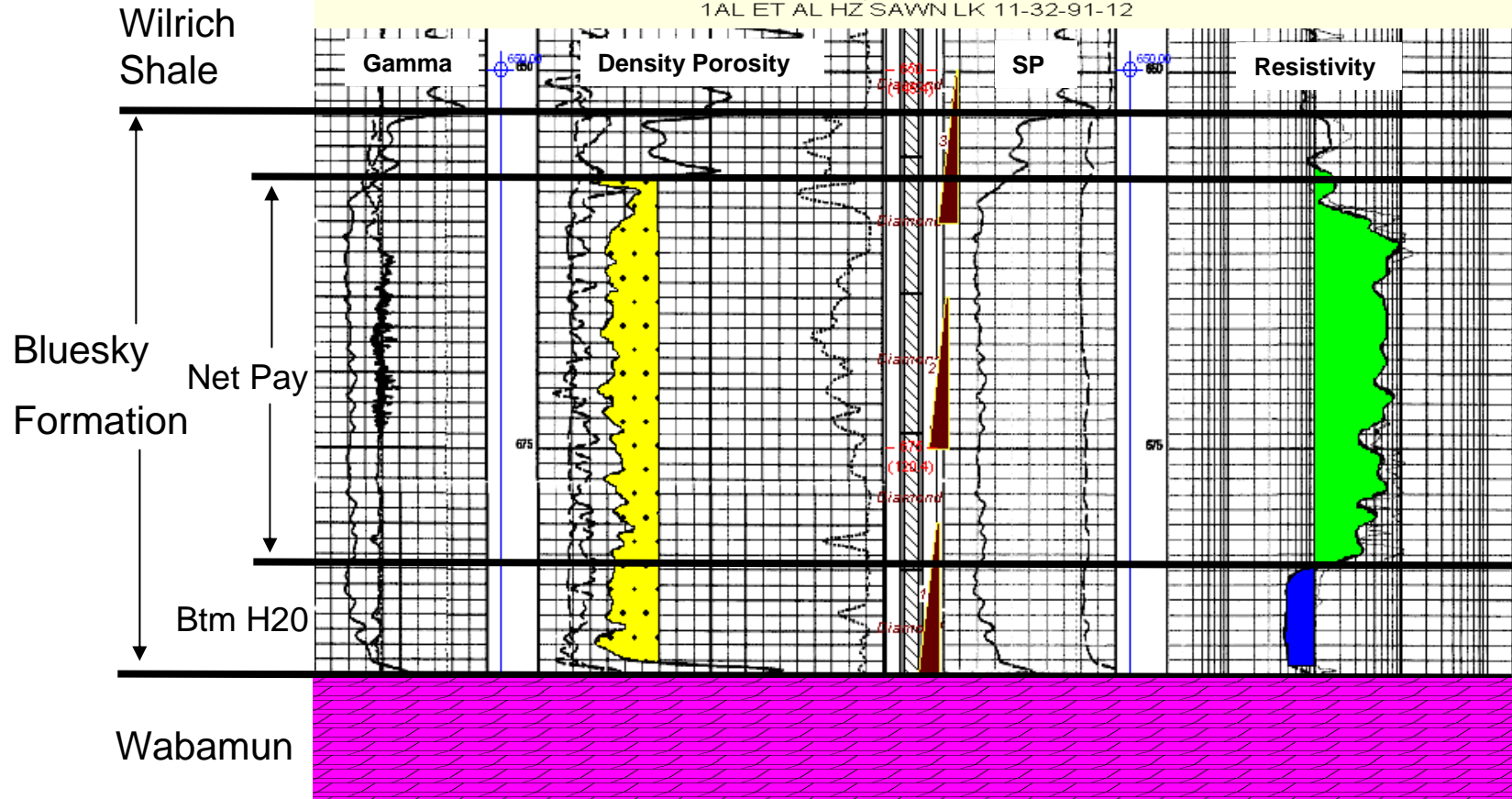
▲ SAGD Project Location

Sawn Lake – Type Well

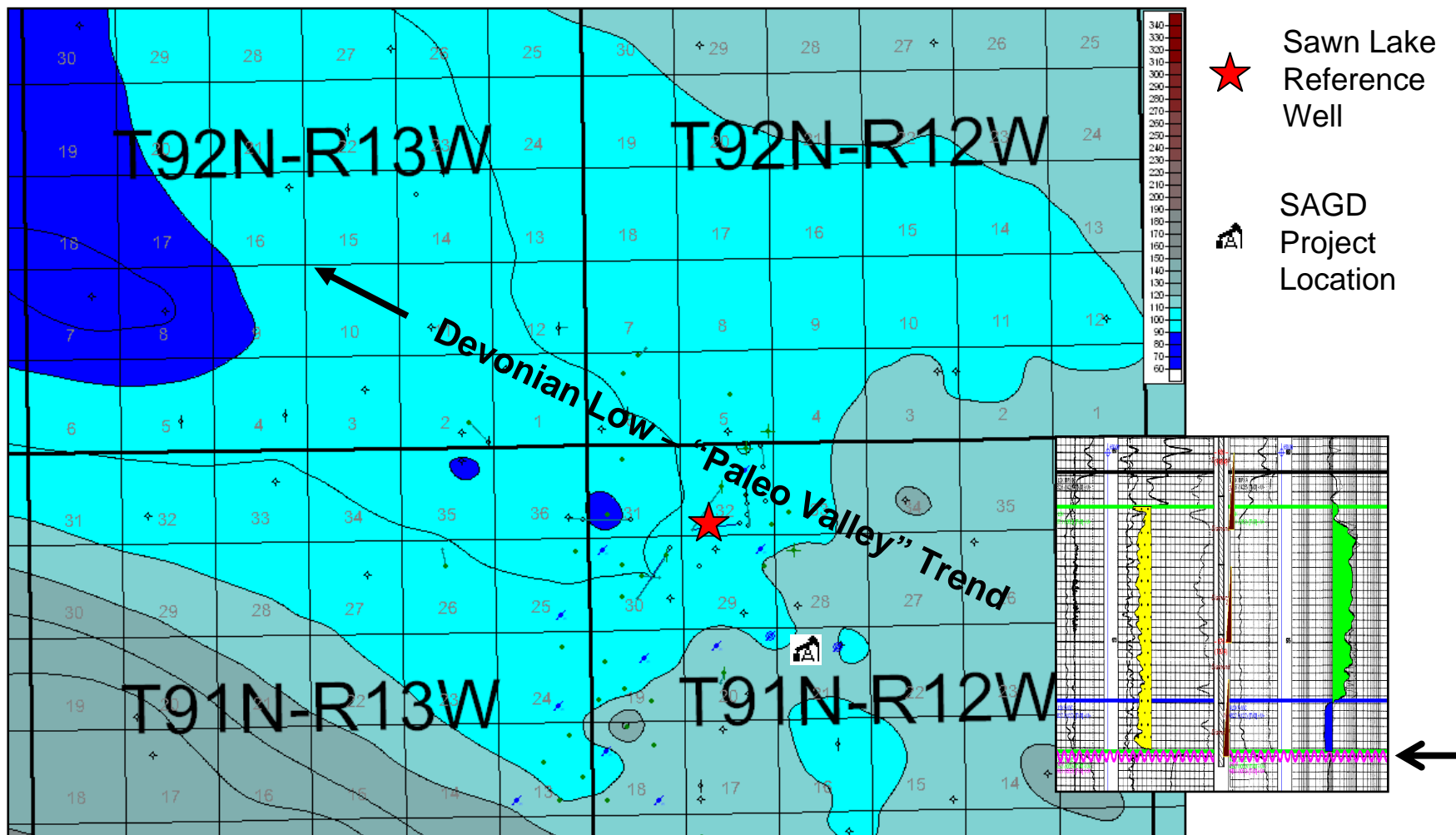


02/02-32-091-12W5/0

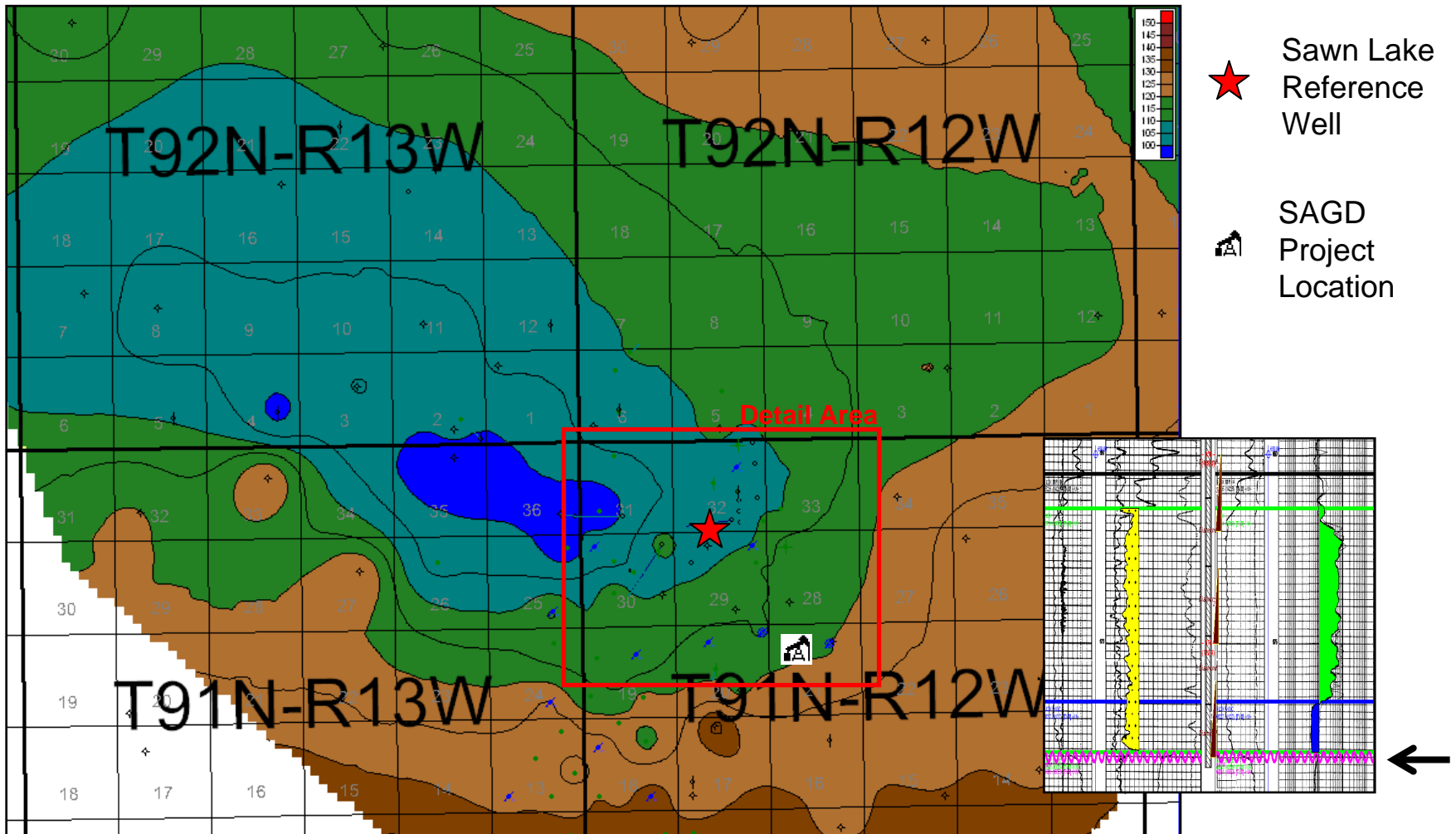
KB: 795.4 m RR: 2006-08-30
TD: 743.0 m [TVD] FormTD: WBMN
Mode: Abd Whip Fluid: N/A
1AL ET AL HZ SAWN LK 11-32-91-12



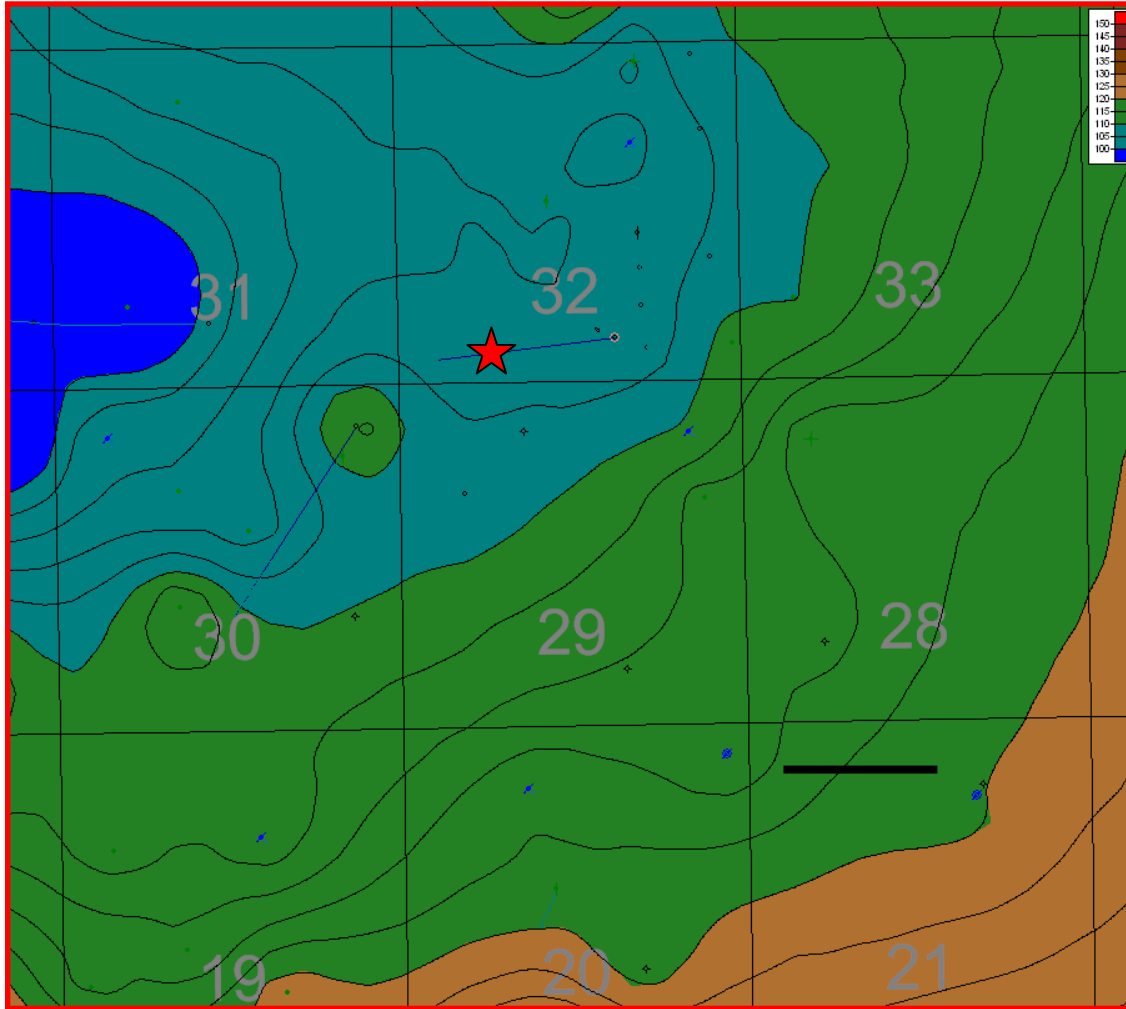
Sawn Lake – Devonian Structure



Sawn Lake – Base Bluesky Structure

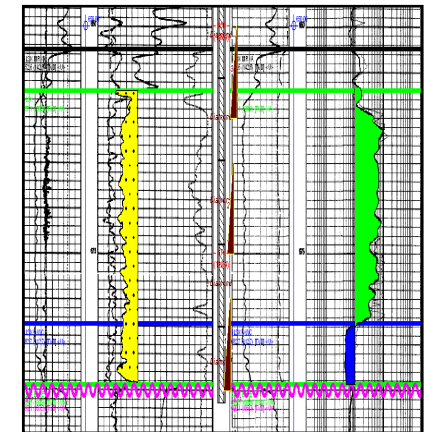


Sawn Lake – Base Bluesky Structure (Detail)

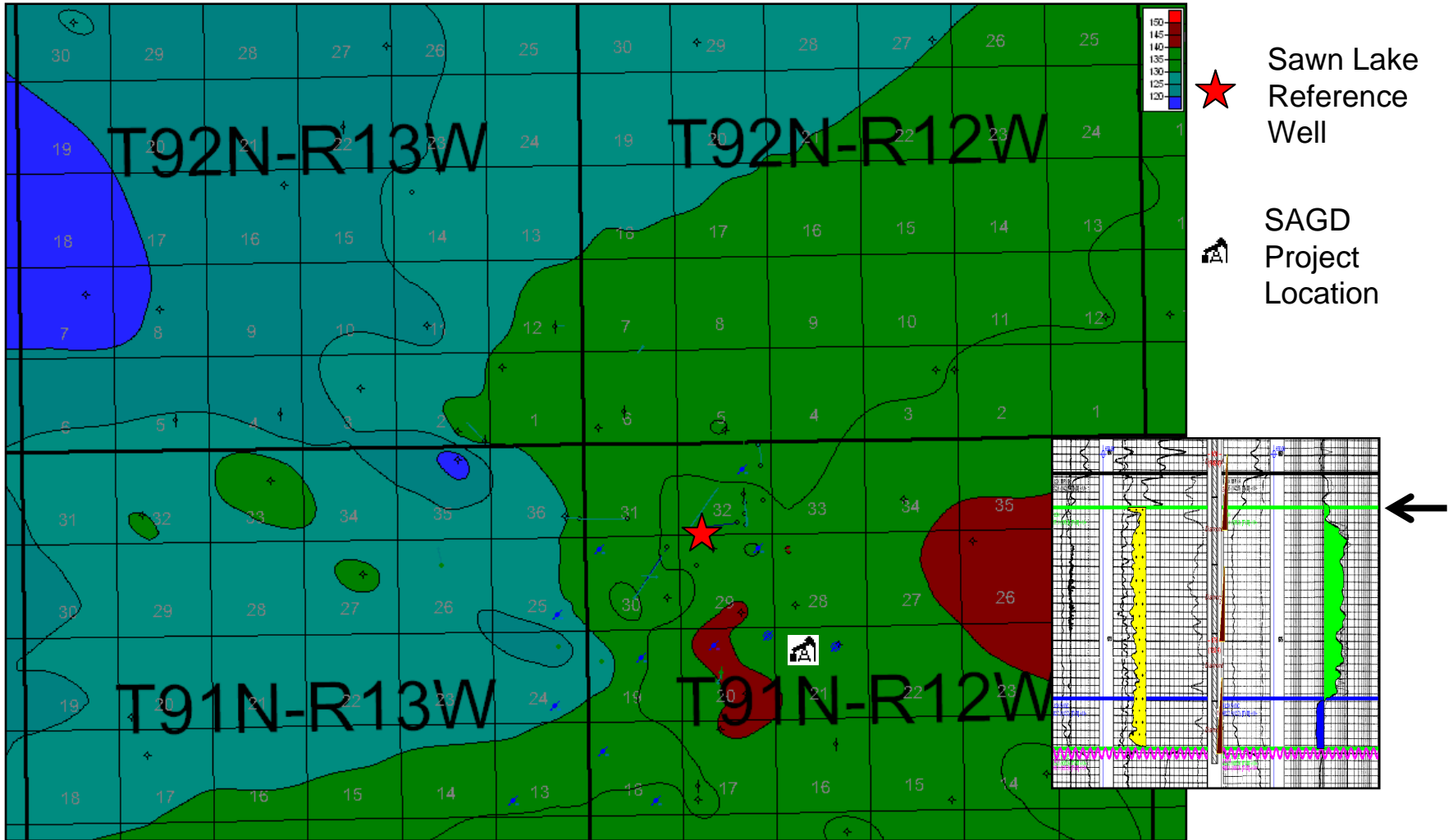


— Proposed SAGD Well Pair Path

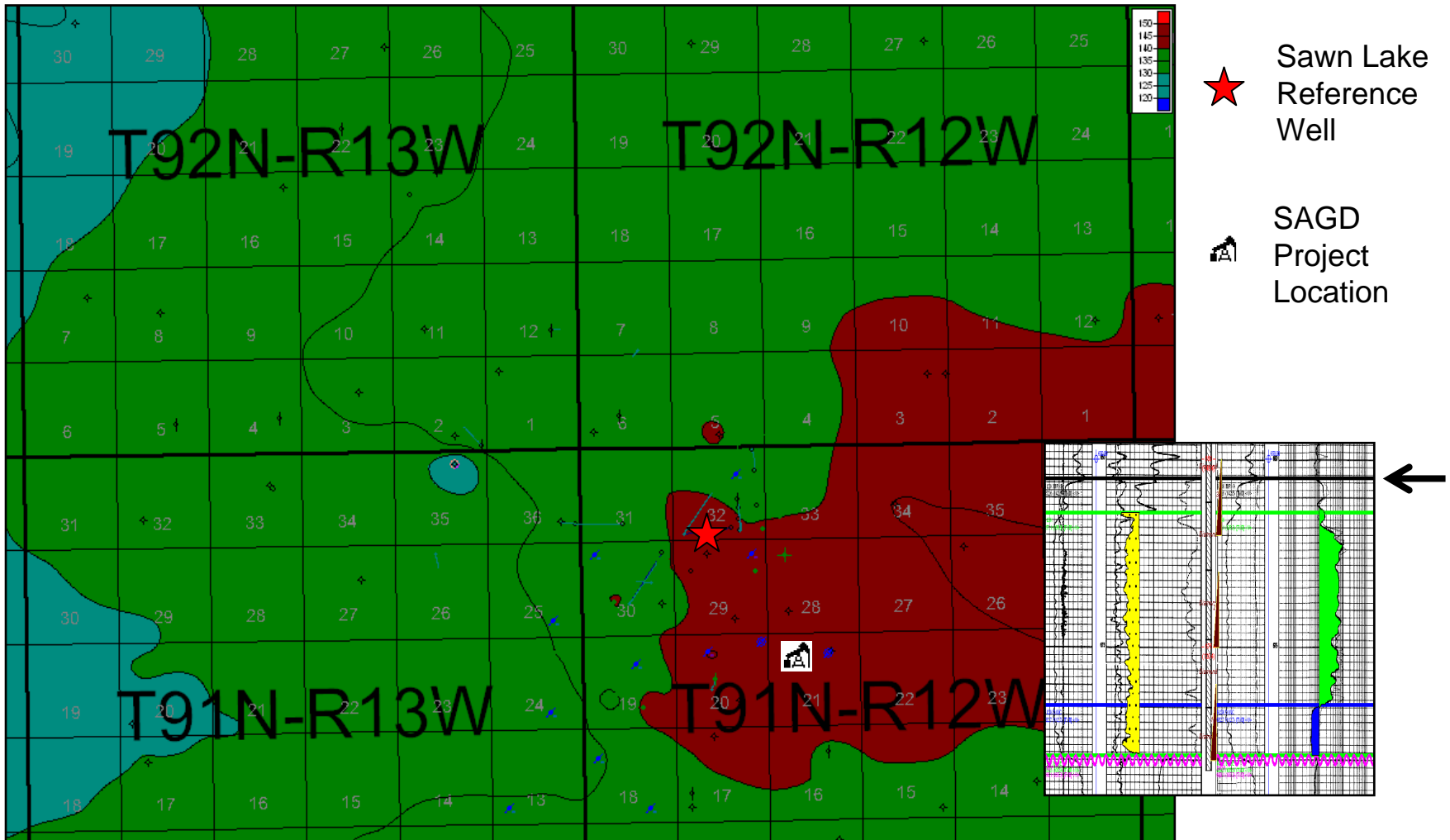
★ Sawn Lake Reference Well



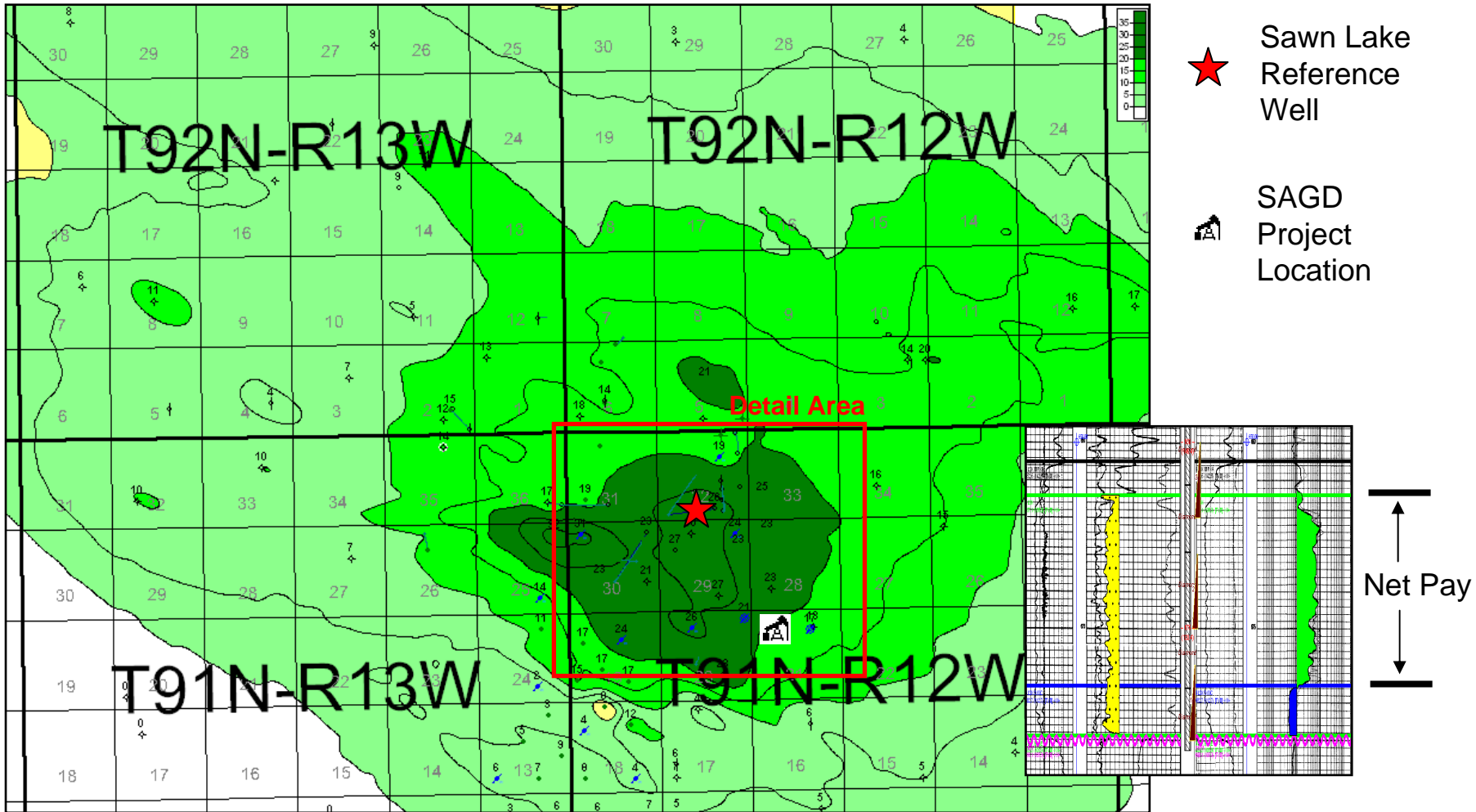
Sawn Lake – Top Bluesky Pay Structure



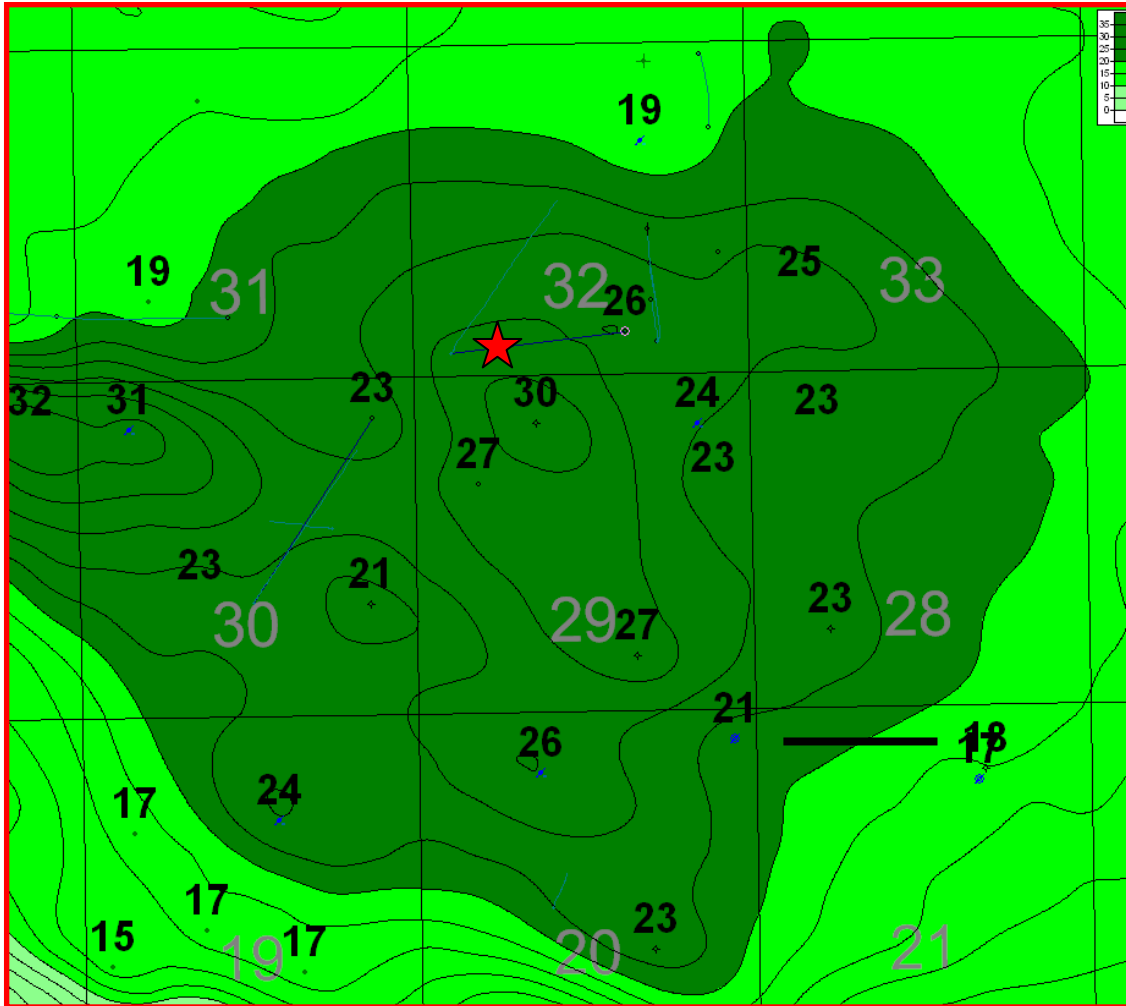
Sawn Lake – Top Bluesky Structure



Sawn Lake - Bluesky Net Pay

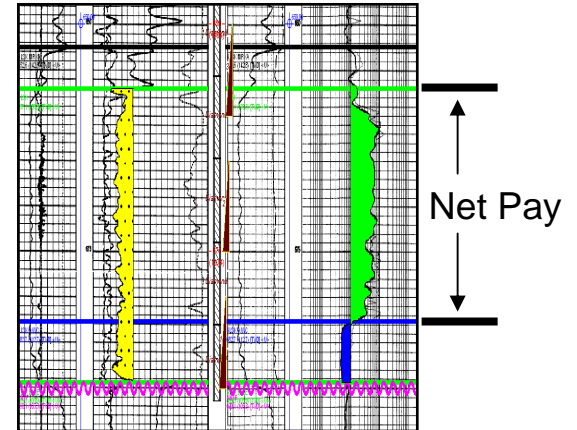


Sawn Lake - Bluesky Net Pay (Detail)



— Proposed SAGD Well Pair Path

★ Sawn Lake Reference Well



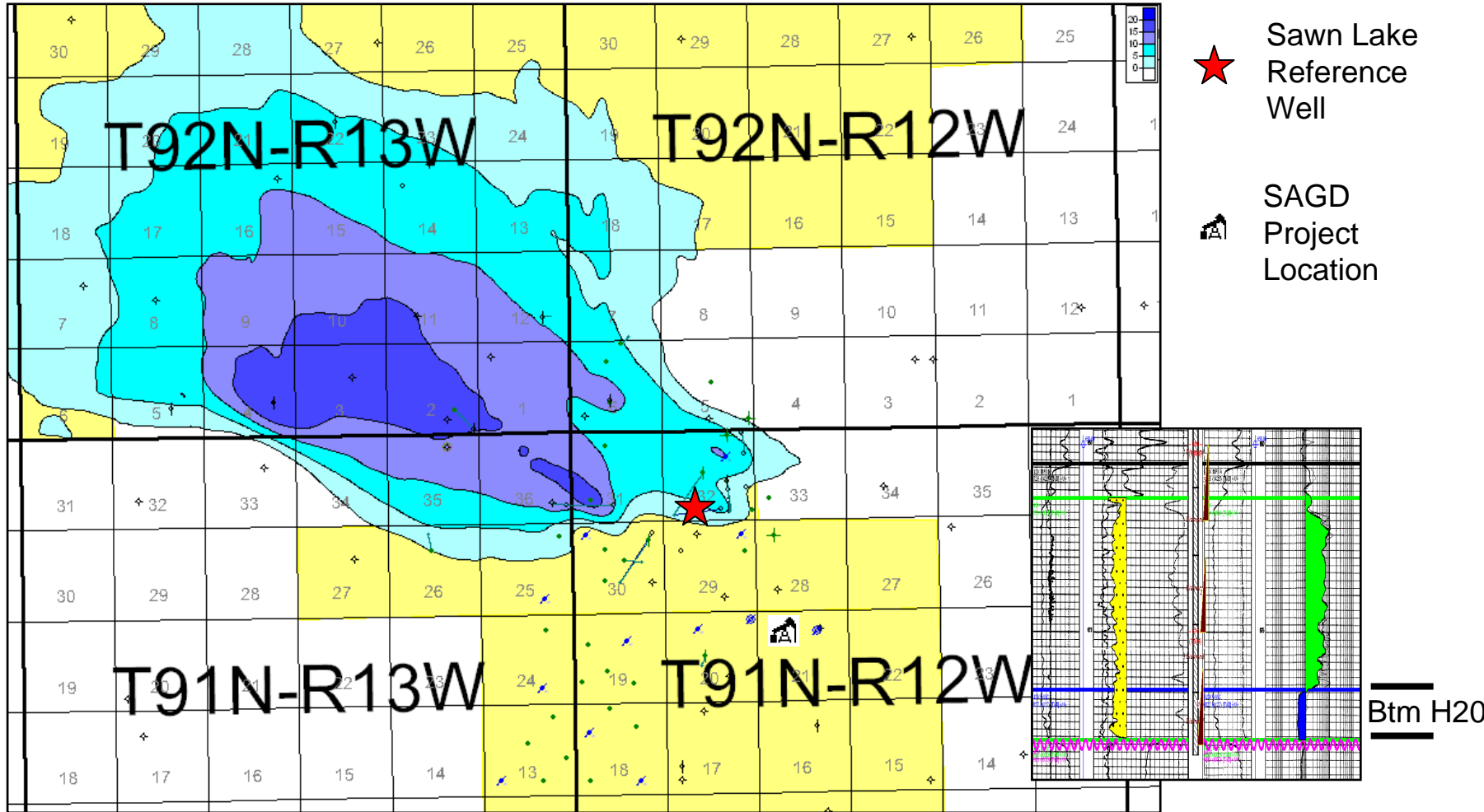
➤ Sawn Lake Field

- **39 contiguous sections with > 10 meters of pay and excess of 2 Billion Gross Barrels of Bitumen in Place**
- **6.5 sections with > 20 meters of pay and ~ 0.5 Billion Gross Barrels of Bitumen in Place**
 - **30% Porosity**
 - **70% Oil Saturation**

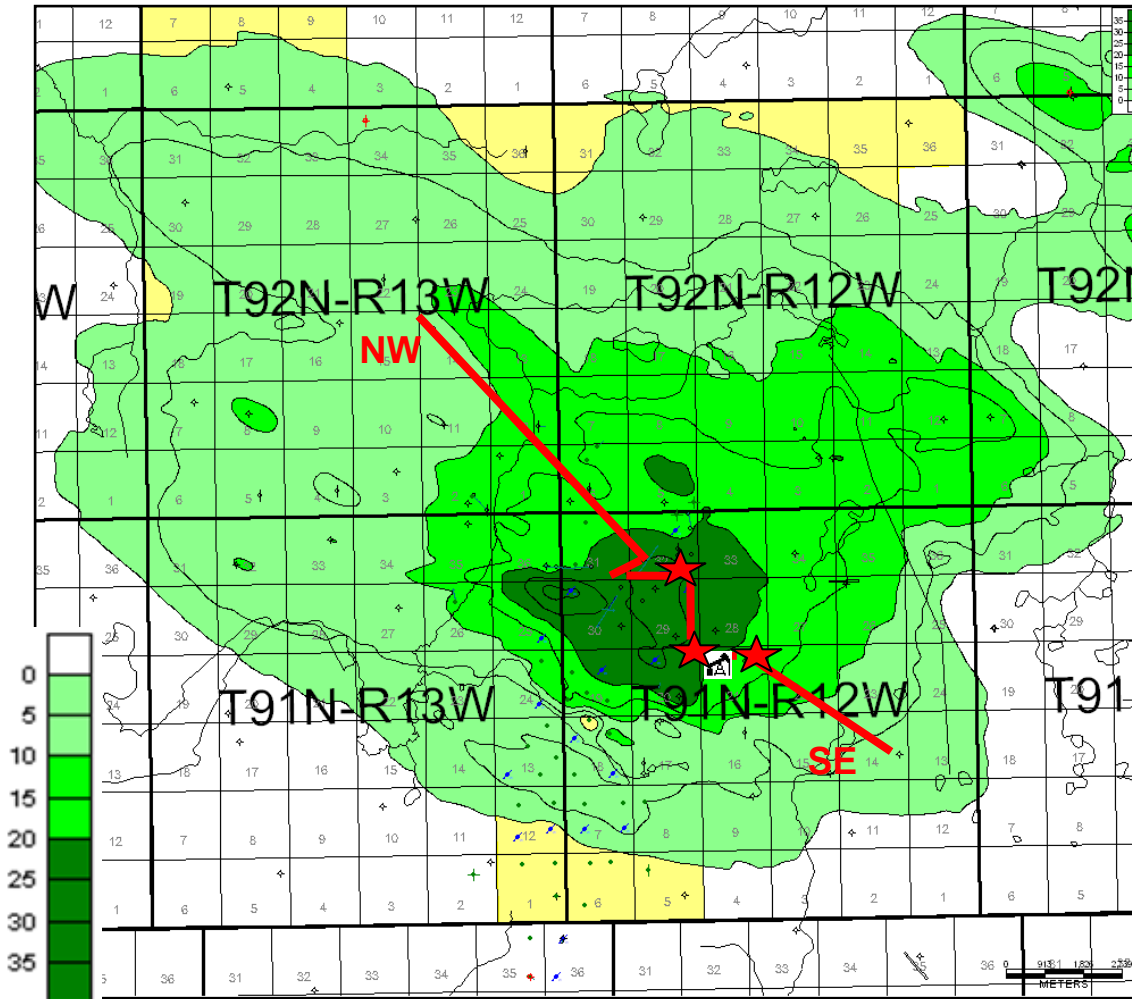
➤ SAGD Single Well Pair project located at 15-21-91-12W5

- **750 – 900 m proposed well length with 10.8 ha assumed development area**
- **3 Million Gross Barrels of Bitumen in Place (482,500 m³) assuming:**
 - **20m Net Pay**
 - **30% Porosity**
 - **65% Oil Saturation**

Sawn Lake – Bottom Water



Sawn Lake - Regional Cross Section

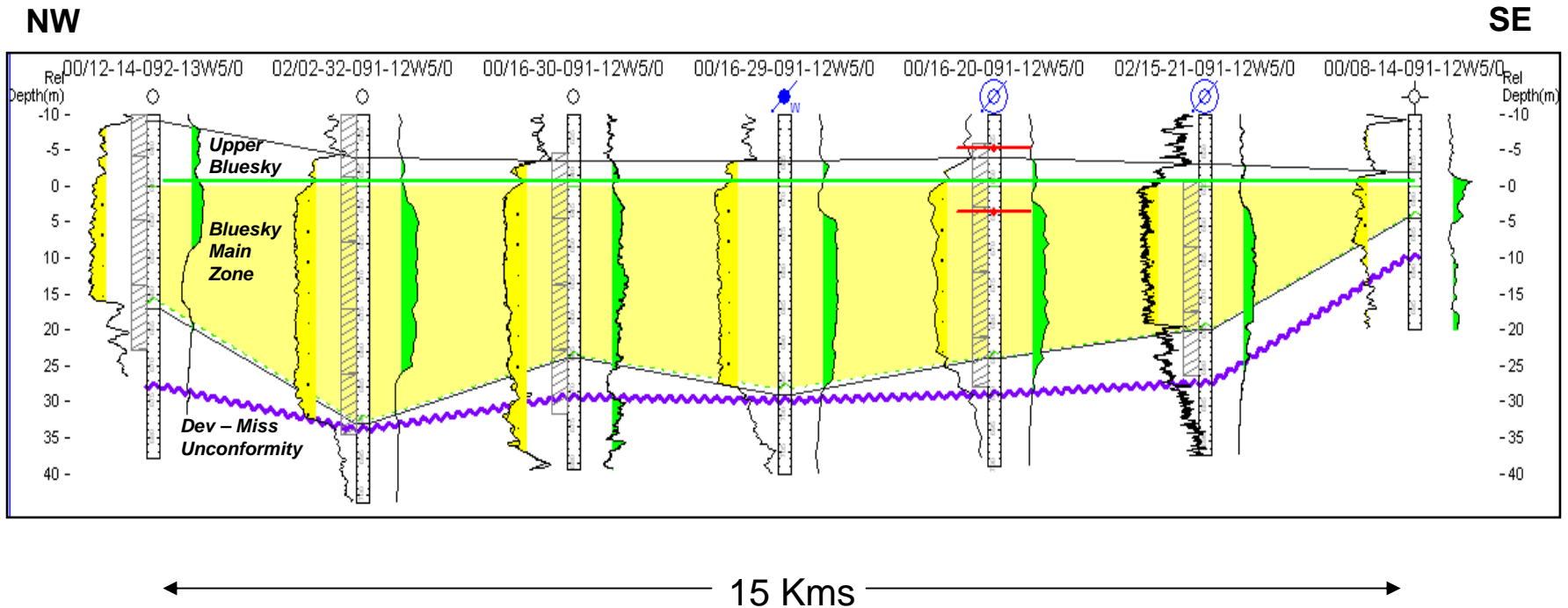


➤ Regional Cross Section
NW – SE through the
“Tide Dominated Delta”



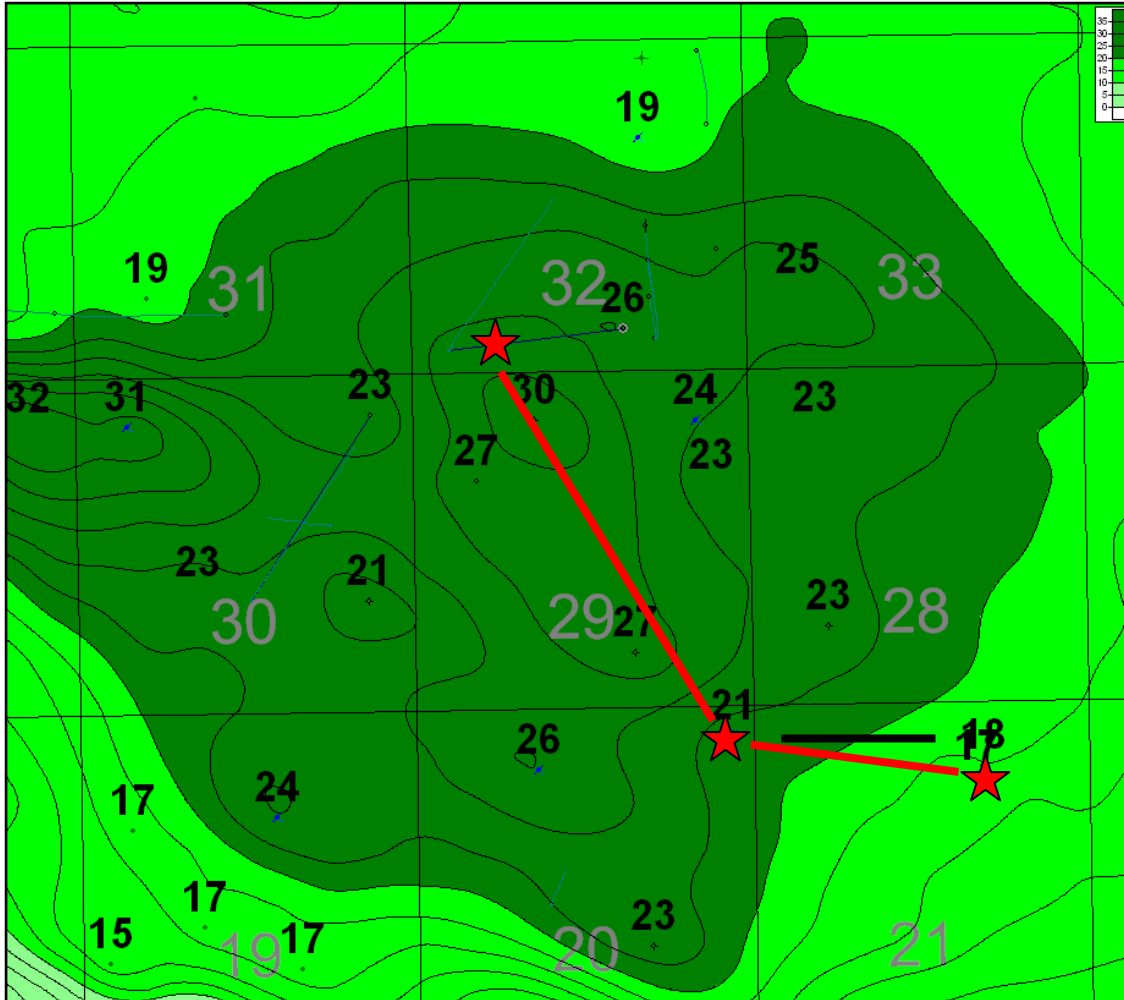
**SAGD Demonstration
Site**

Sawn Lake – Regional Cross Section NW-SE

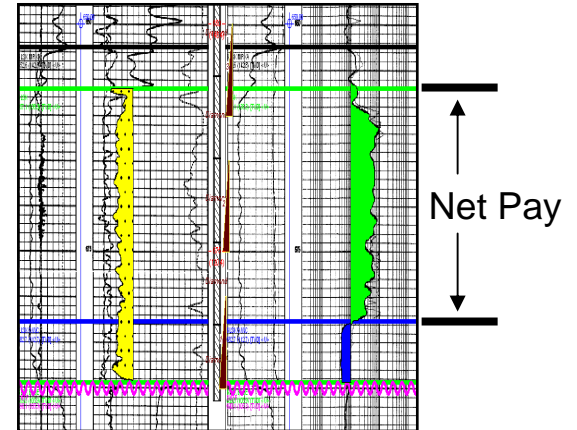


➤ Thick continuous Oil Sands Reservoir within the “Paleo Valley”

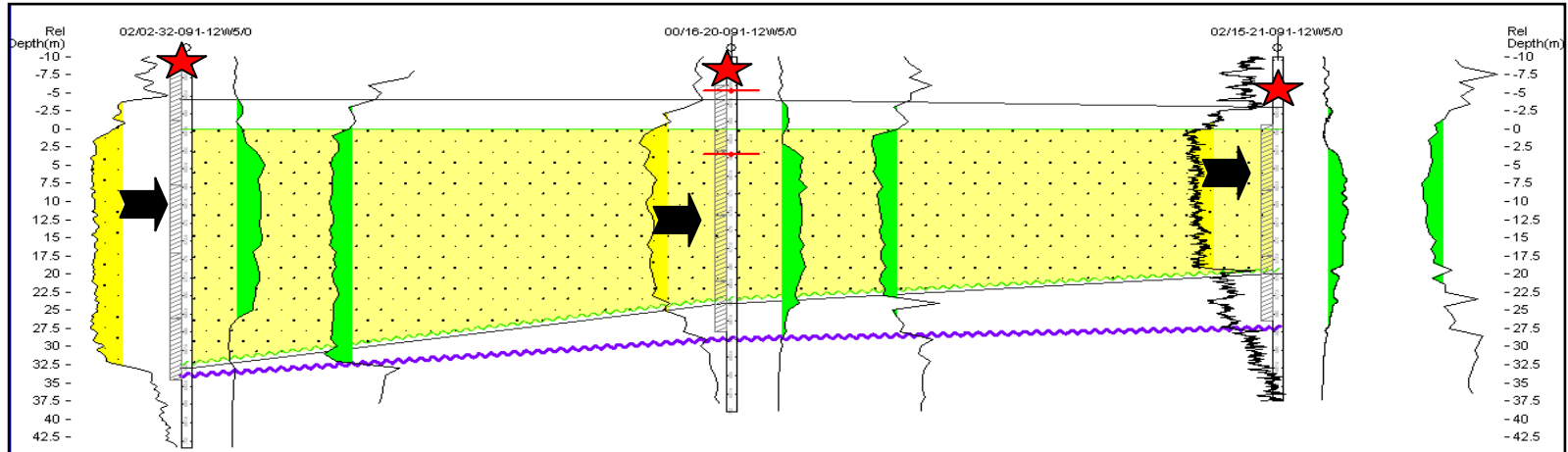
Sawn Lake - Bluesky Net Pay



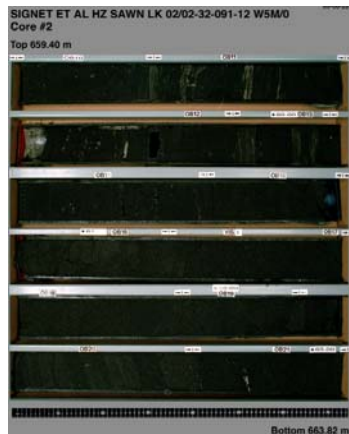
- Proposed SAGD Well Pair Path
- ★ — Sawn Lake SAGD Project Cross Section



Sawn Lake – SAGD Test Key Zones

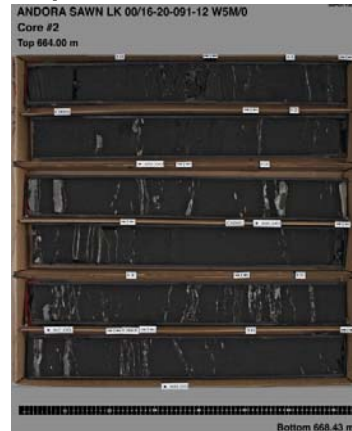


Thick Clean Heavily Oil Saturated



* Dominant Zone Type

Dispersed Shale Inter-beds



Top Lean Zone

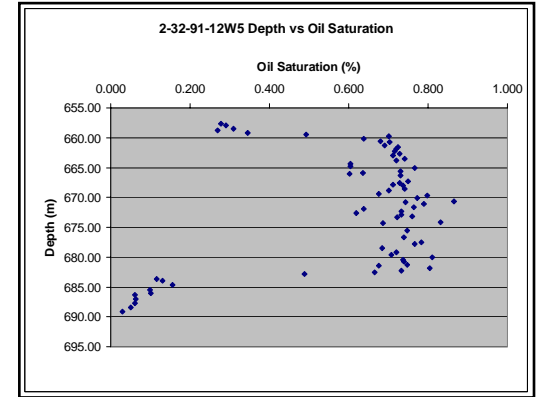
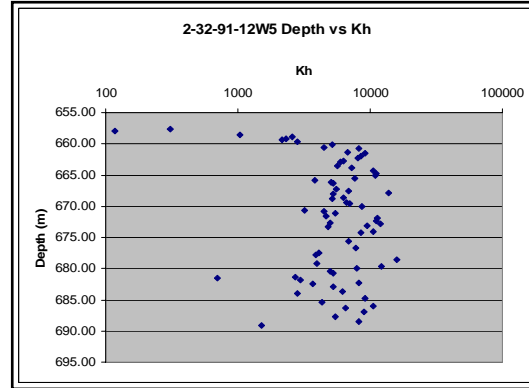
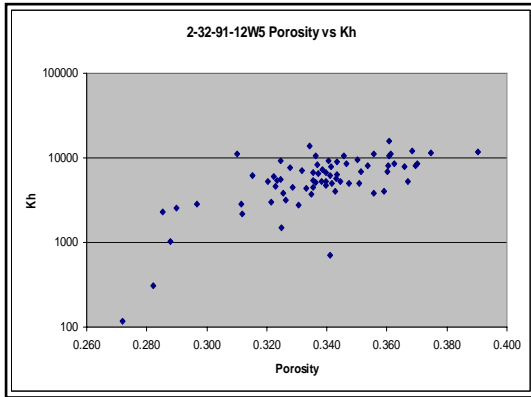


* Thin & aerally constrained Zone Type

Sawn Lake – 2-32-91-12W5 Core



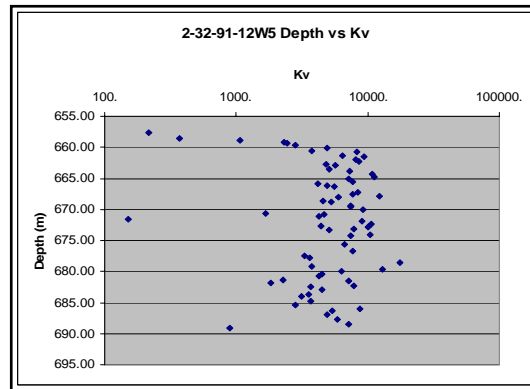
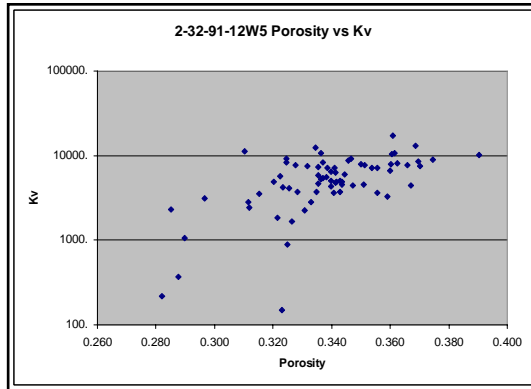
➤ 2-32-91-12W5



Porosity vs. Permeability

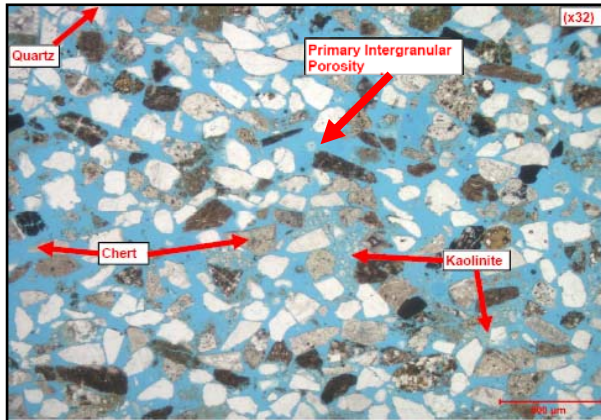
Depth vs. Permeability

Depth vs. Oil Saturation

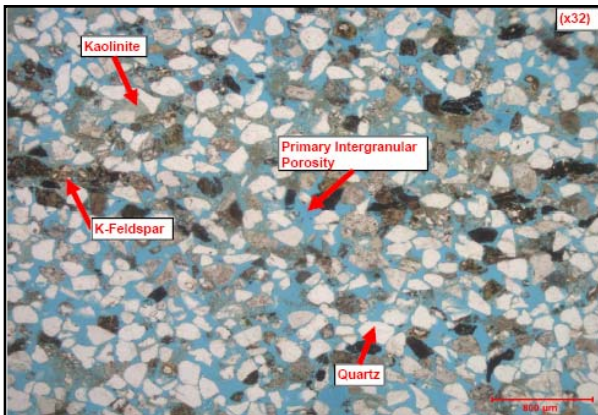


Sawn Lake – Petrography

➤ 2-32-91-12W5 (677.75 m)



➤ 16-20-91-12W5 (673.5 m)






➤ XRD Analysis

Depth Interval (m)	2-32-91-12W5	16-20-91-12W5
	677.5	673.5
Mineral	Whole Rock Weight %	
Quartz	91	80
K-Feldspar	1	2
Plagioclase	0	0
Anhydrite	0	0
Calcite	0	0
Dolomite	Trace	3
Halite	0	0
Siderite	0	0
Pyrite	Trace	Trace
Total Clay	8	15
Total	100	100

Clay Mineral	Relative Clay %	
Smectite	0	0
Illite / Smectite	0	0
Illite / Mica	14	14
Kaolinite	86	86
Chlorite	0	0
Total	100	100

Sawn Lake - Reservoir Comparison



			
Project	Sawn Lake	Red Earth	Carmon Creek
Region	Peace River	Peace River	Peace River
Formation	Bluesky	Bluesky	Bluesky
Depth (m)	650 - 700	400	500 - 600
Net Pay (m)	5 - 30	10 - 16	5 - +30
Porosity Avg. (%)	30	30	29
Permeability (darcies)	1 - 8	1 - 3	0.5 - 4
Oil Saturation (%)	65 - 80	60	70 - 80
Oil Gravity (API)	8	10	8
Reservoir Temp. (C)	17	16	17
Thermal Process	SAGD	Hz. Well CSS	Multiple

Sawn Lake – Subsurface Future Plans



- 1) **Wabamun Test for Waste Water Disposal**
- 2) **Drill, Core & Instrument 2 Observation Wells**
- 3) **Drill SAGD Single Well Pair**
- 4) **Additional Reservoir Modelling and Simulation**
- 5) **Timing**



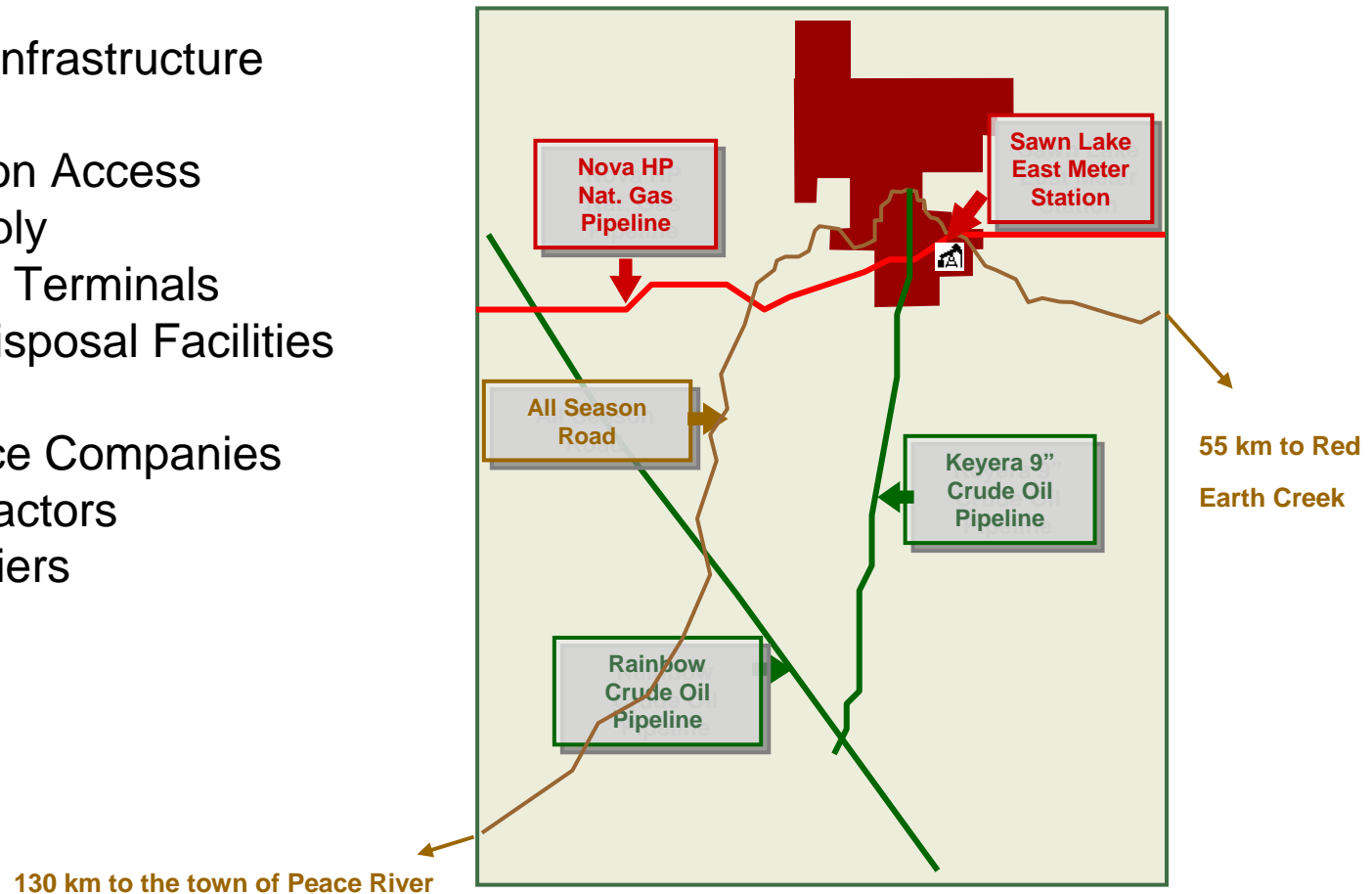
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Sawn Lake Surface Operations

Utilize Existing Infrastructure

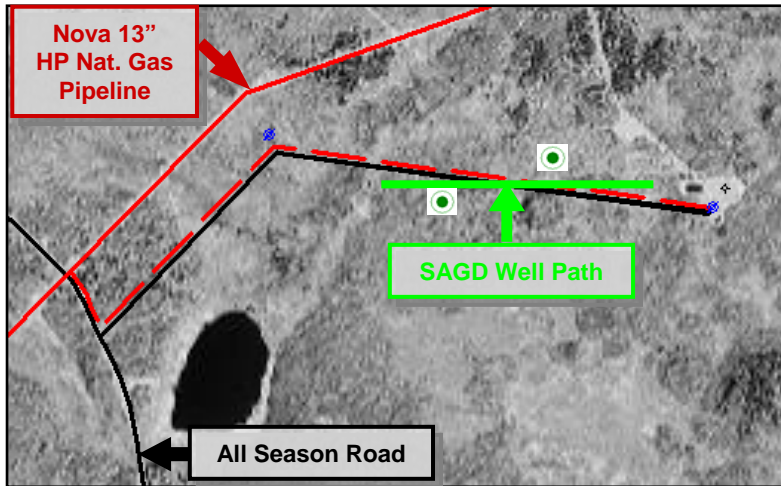
- ✓ All Season Access
- ✓ Gas supply
- ✓ Oil Sales Terminals
- ✓ Waste Disposal Facilities
- ✓ Local
 - ...Service Companies
 - ...Contractors
 - ...Suppliers



Sawn Lake – Road to Sawn Lake Development



Sawn Lake - All Season Access & Infrastructure



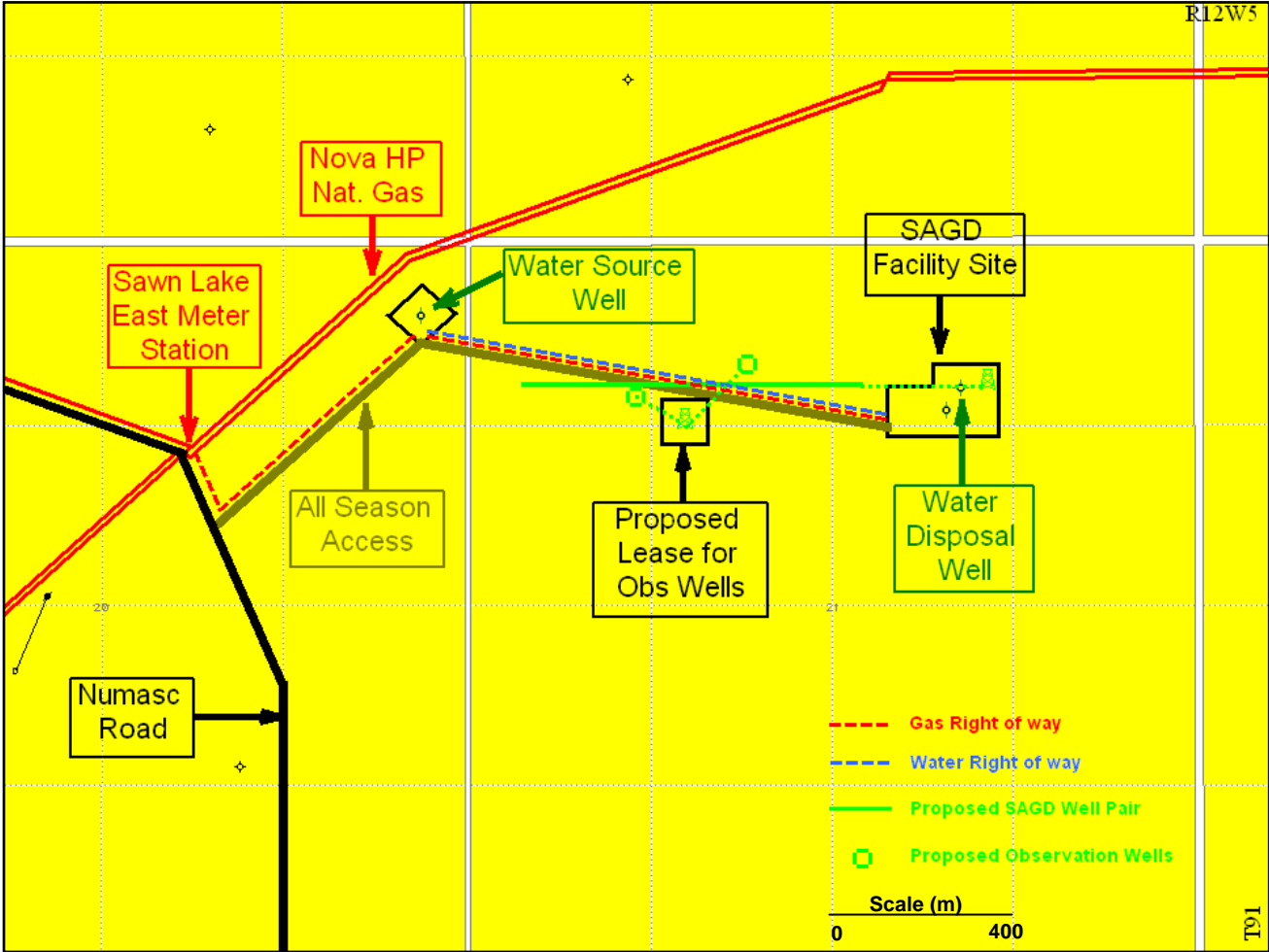
➤ Existing...

- ✓ All Season Roads
- 🏠 ✓ Facility Site
- ✓ Gas Supply
- ⊕ ✓ Water Source & Disposal Wells

➤ Proposed...

- ⊙ ✓ Obs. / Inj. Wells
- ✓ SAGD Well Pair

Sawn Lake – Surface Plan



➤ SAGD Facility

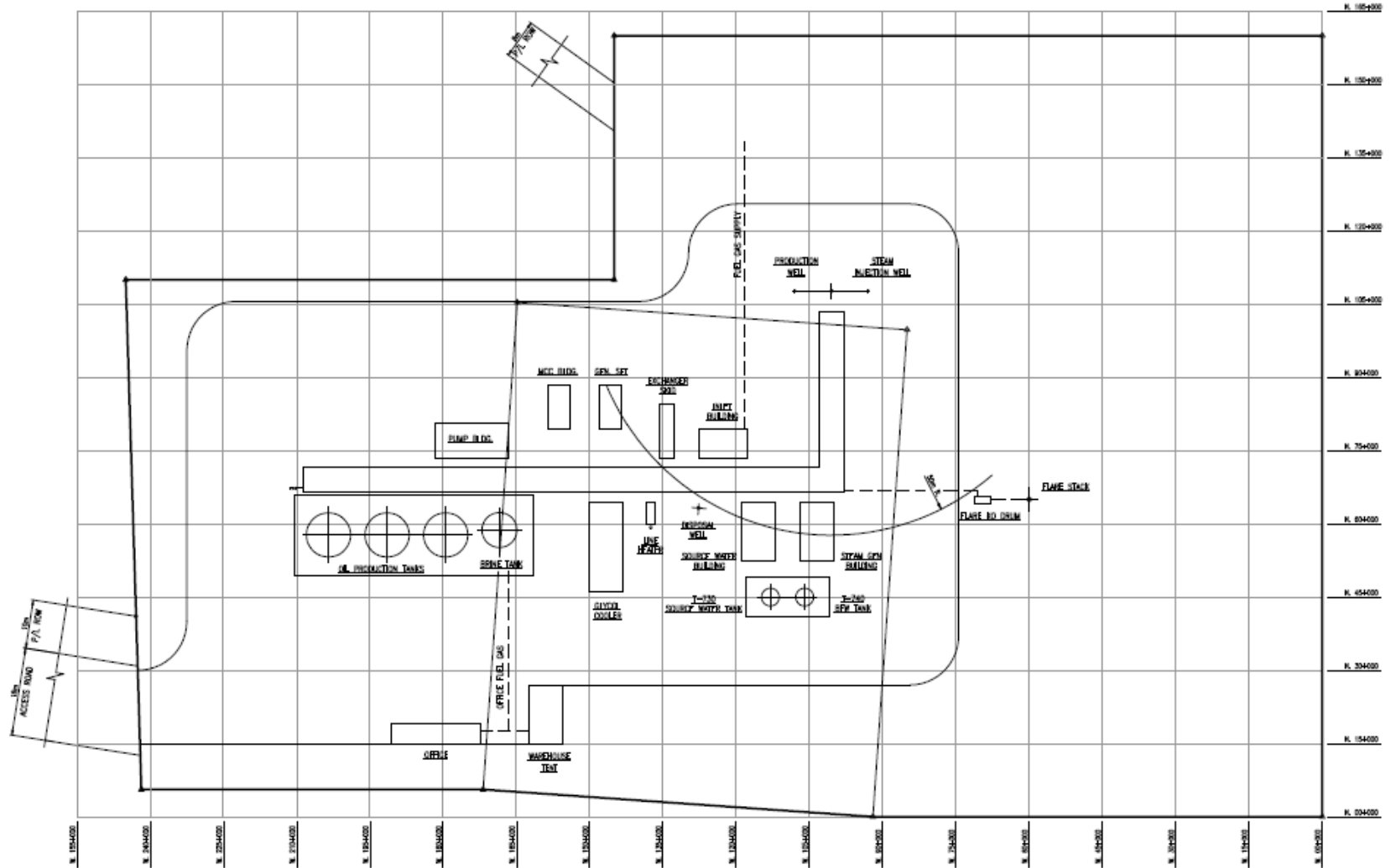
- All Season Access completed Q2 2010
- Revised Facility Design...
 - Remove Free Water Knock Out
 - Additional Tank for “Tank Treating”
 - On site Power Generation, 350KW
- Currently working on revised MARP
- No Facility work has commenced

- Solid wastes to be trucked out to third party disposal site
- Potable Water will be trucked in from third party
- Sewage will be trucked out to third party

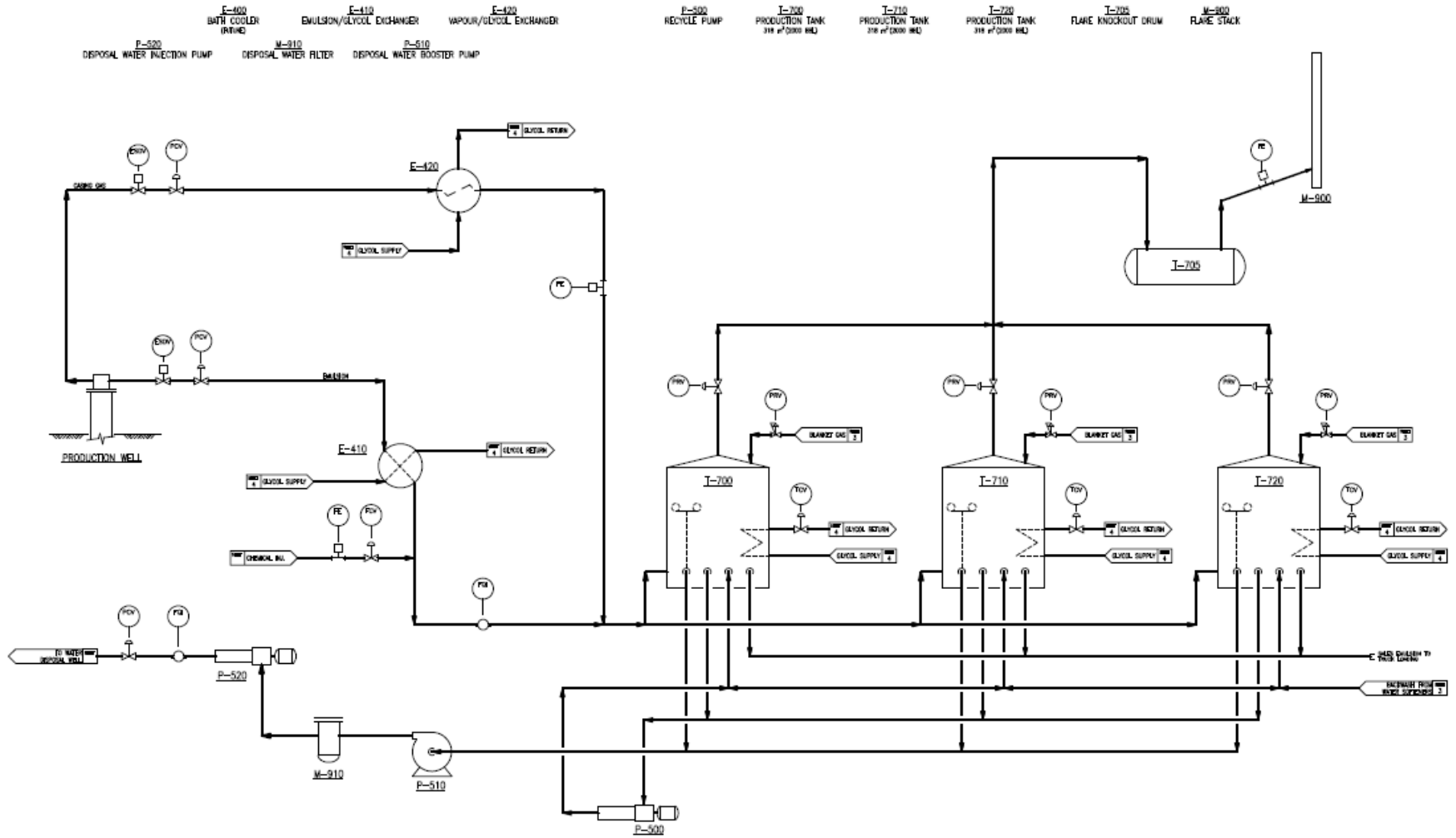
➤ Anticipated Fluid Quality

- 8° API
- 100,000 – 500,000 cps @ 17° C
- Very low sediment production
- Low GOR's ~ 10 m³/m³ with low quality gas to be sent to flare
- Low H₂S ~ 100's ppm

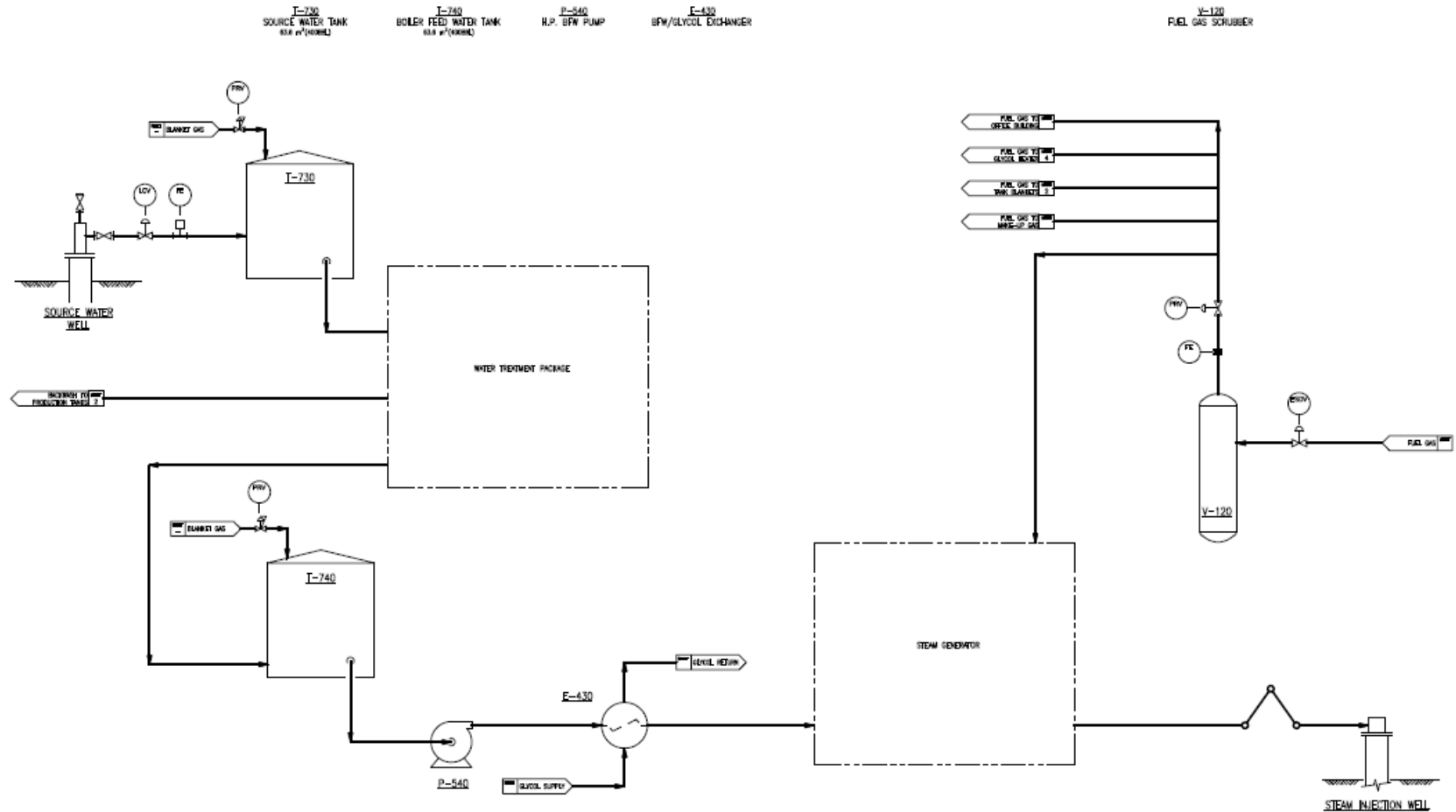
Sawn Lake – SAGD Facility Plot Plan



Sawn Lake – Oil Emulsion Flow Sheet



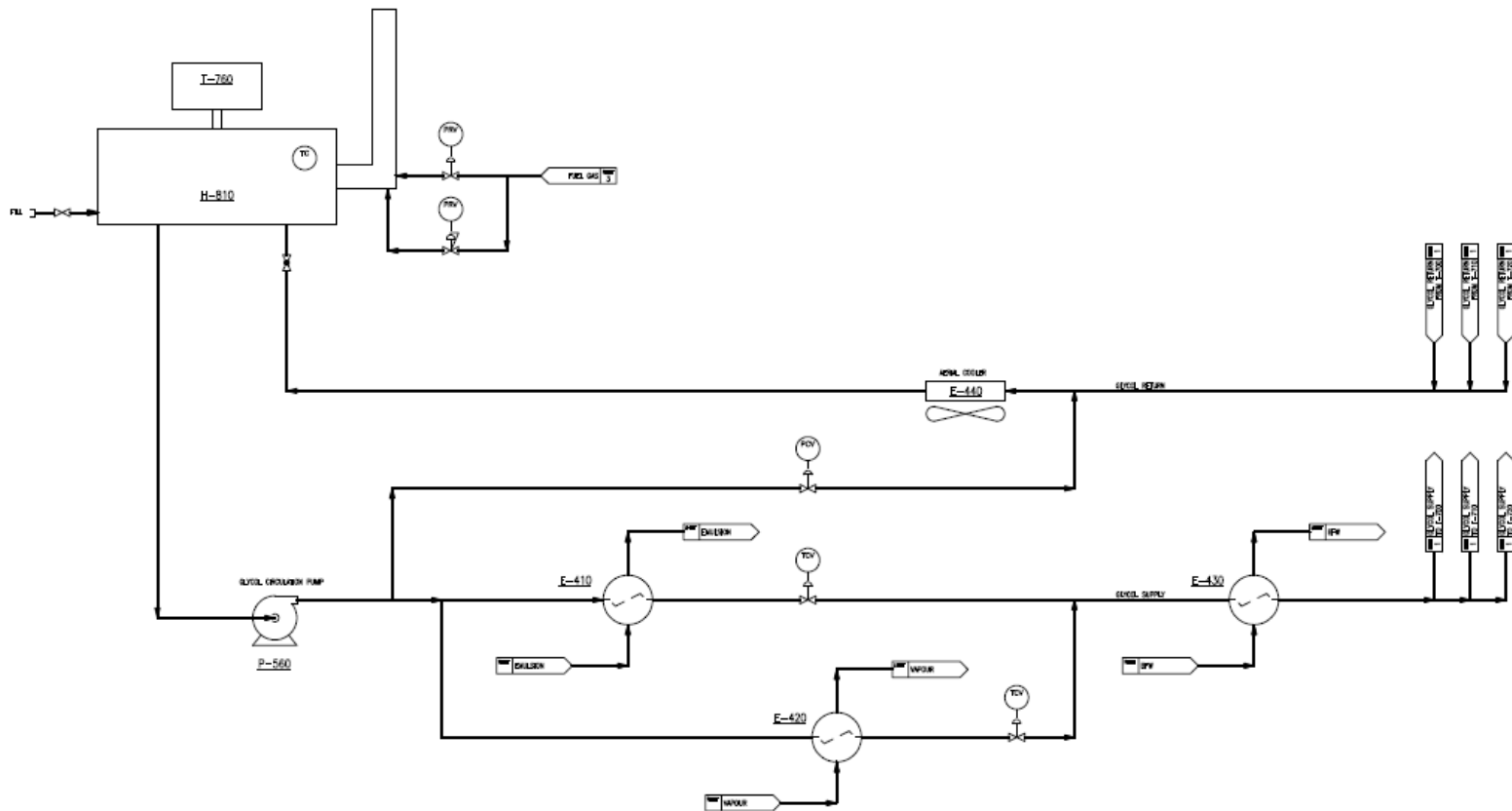
Sawn Lake – Water Treating / Steam Flow Sheet



Sawn Lake – Utility Heating / Cooling Flow Sheet



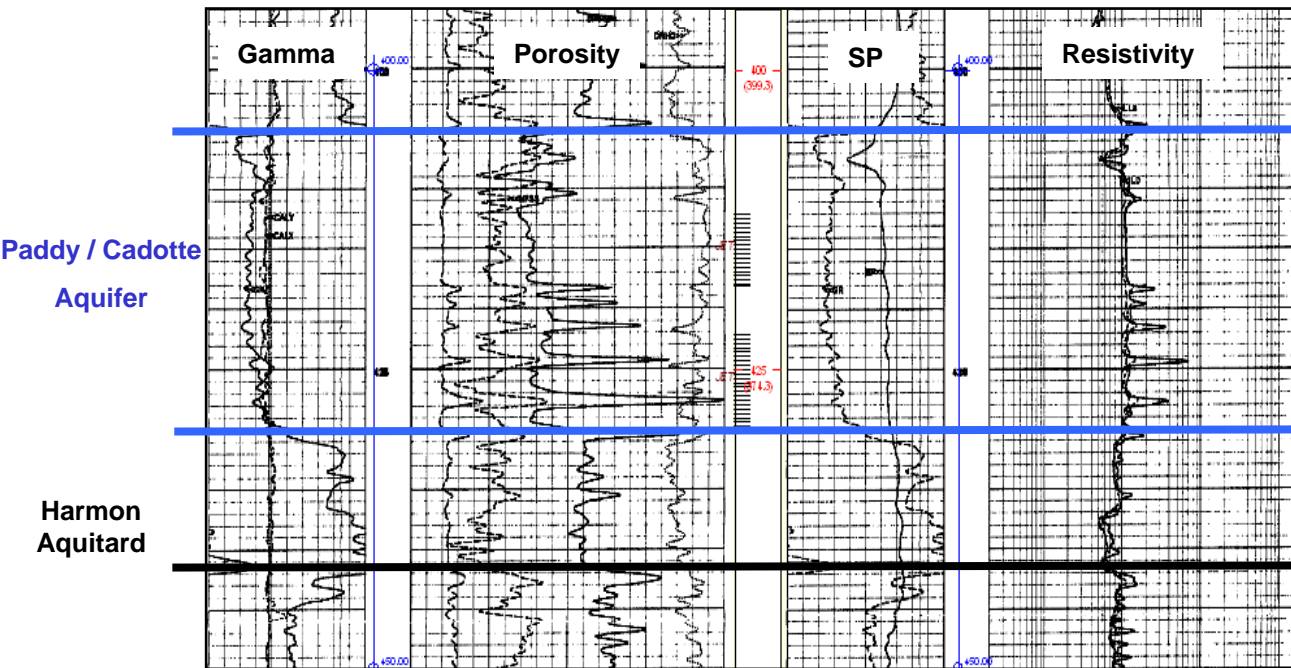
H-810 LINE HEATER I-760 GLYCOL SURGE TANK P-560 GLYCOL CIRCULATION PUMP E-410 EMULSION/GLYCOL EXCHANGER E-420 VAPOUR/GLYCOL EXCHANGER E-440 GLYCOL ADRIAL COOLER E-430 BPM/GLYCOL EXCHANGER



Sawn Lake – Surface Operations



Water Source Well 00/16-20-91-12W5



- Paddy / Cadotte Aquifer, 420 mKb
- Fresh Water, ~ 3600 ppm
- Currently working on Temporary Water Diversion License under the Water Act
- Pipeline Right of Way acquired and cleared adjacent to facility road access

- **00/15-21-91-12W5 Cement Remediation as per approval condition;
i.e. well originally completed with non-thermal cement**
 - **Well located on facility site**
 - **Well Remediation was initiated June 2010**
 - **Cement Top unexpectedly found at 1000 mKb, base of Wabamun / Winterburn**
 - **Currently working on revised remediation plan to ensure Thermal Cement Isolation**
 - **Remediation design in an effort to provide use as Disposal or Observation Well?**

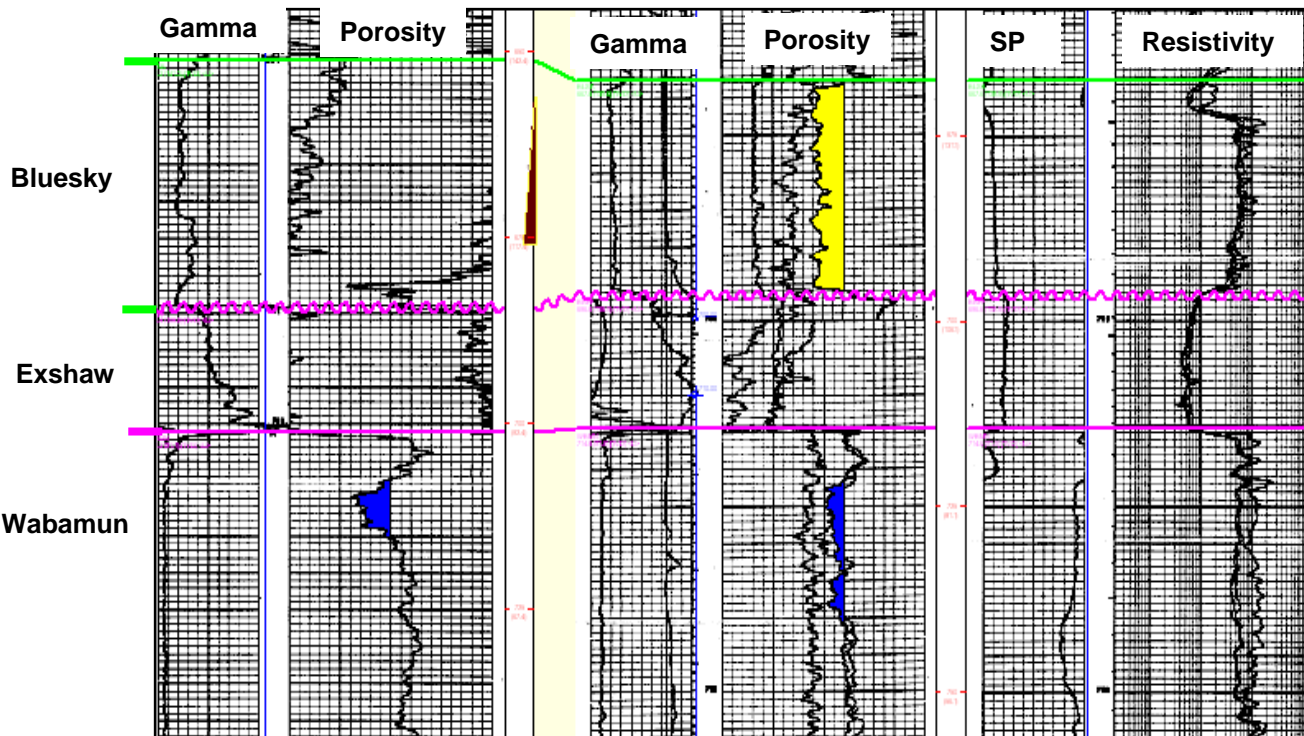
Sawn Lake – Surface Operations



➤ Water Disposal Well 15-21-91-12W5

00/15-21-91-12W5

00/16-29-91-12W5



- Disposal Well located on facility site
- Wabamun test yet to be completed
- Anticipate Zone to take up to 300 m³/d with no pumping required
- Produced water will not be recycled

1) Approvals & Licenses For:

- Water Source Well
- Water Disposal Well
- Observation Wells
- SAGD Well Pair
- Facilities

2) Timing



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Sawn Lake Environmental Aspects

- **No Environmental issues**
- **AENV, minor amendment pending;**
 - **as per the removal of the Free Water Knock Out**
 - **on site power**
- **Monitoring has yet to be initiated;**
 - **Groundwater Monitoring proposal pending**
- **Future Plans;**
 - **Air monitoring**
 - **Industrial Run Off**

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