

# ERCB LASER Review

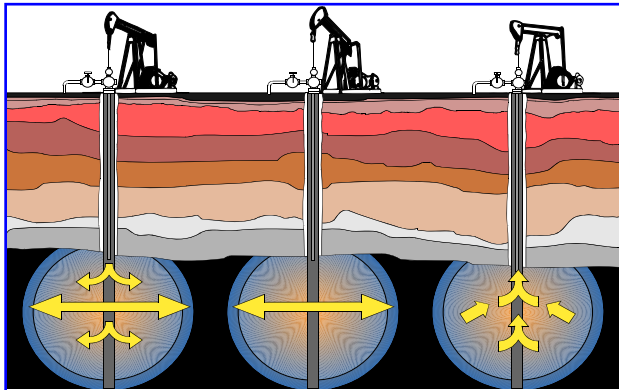
Follow-up to 2009 Annual Review

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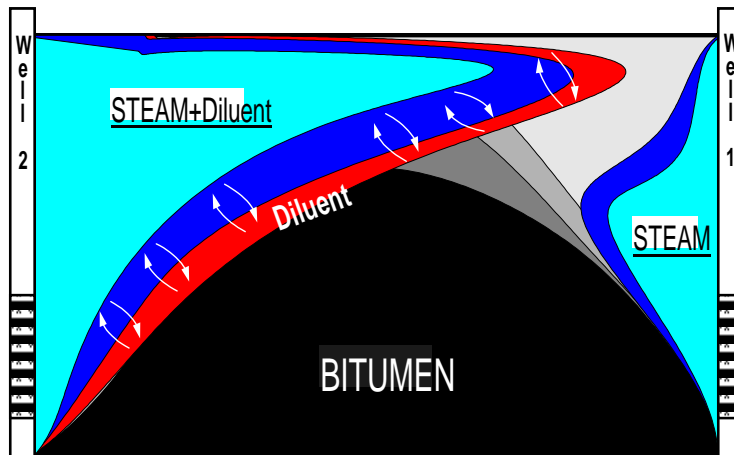
- LASER – Process Overview
- Pad Location Map
- LASER Geoscience Overview
  - Reservoir Properties and OBIP
  - Pad by Pad Summary
  - Representative Type Log
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  - Resource Quality (core pictures)
- Casing Integrity
- LASER Summary
  - Background/ Diluent Injection
  - LASER Process Phase Behavior
  - Injection Pressures
  - Production Performance (area/ pad)
  - Measurement Methodology

# LASER - Process Overview

## Liquid Addition to Steam for Enhanced Recovery

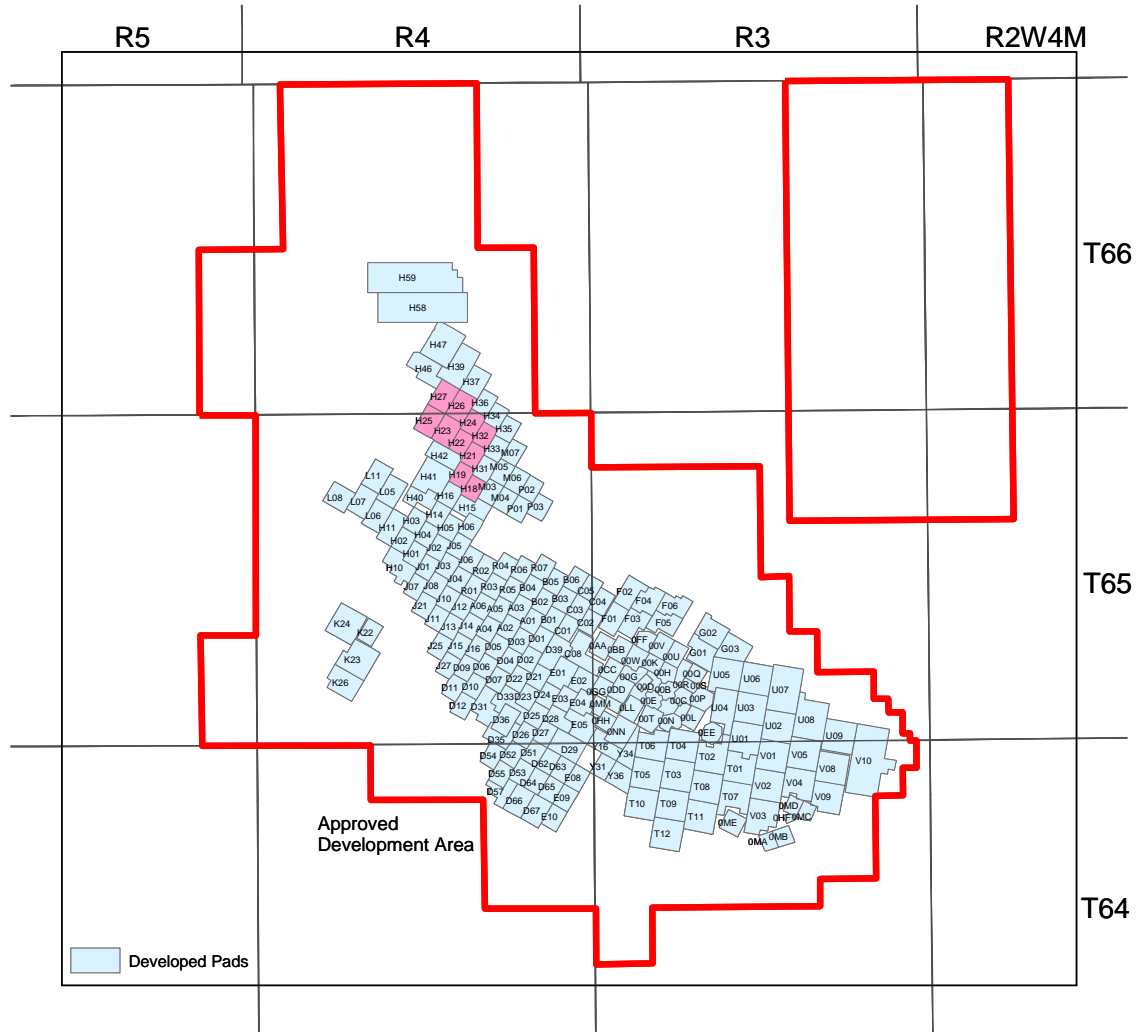


CSS Stimulation Process



- LASER is a late-life technology
  - Follow-up process for CSS
  - Implemented with 2-3 cyclic cycles remaining
  - Alternative to purely thermal processes
- LASER is a cyclic steam process with the addition of a C5+ condensate to the steam during injection
  - Enhances gravity drainage efficiency by reducing in-situ viscosity beyond thermal limit
  - Potentially increases the recovery by >5% of EBIP
- Key pilot performance indicators:
  - Incremental OSR over a purely thermal baseline
  - Fractional recovery of injected solvent

# Pad Location Map



# Cold Lake Reservoir Properties and OBIP

## Reservoir and Fluid Properties

Depth	Clearwater @ 400m
Depositional Facies	Incised Valley Fill, Tidal / Estuarine
Sands	Unconsolidated, reactive, clay clasts
Diagenetic Cements	Mixed-layer clays
Bitumen API Gravity	10.2
Bitumen Viscosity	100,000 cp @ 13°C 8 cp @ 200°C

Bitumen Saturation      Average      70%

	<u>Range</u>	<u>Average</u>
Porosity	27 - 35%	32%
Permeability	1 - 4 Darcies	1.5 Darcies
Bitumen Wt %	11.1 - 11.8%	11.5%
Total Net Pay	28 - 35m	31m

### Original-Bitumen-in-Place (OBIP)

<i>Clearwater Fm</i>	<u>8 Wt %</u>	
	<i>(E6m3)</i>	<i>(MBO)</i>
LASER Area	35	221

# LASER Pad by Pad

- The LASER pads have pay mostly in tidal bar and flat facies with minor amounts of pay in estuarine delta and fluvial facies.
  - These facies are bitumen-saturated, fine- to medium-grained sandstones that contain thin mud-beds and clasts
  - The southern part of the area (pads H18,19,21,22,32) has variable amounts of clay coatings on the sand grains

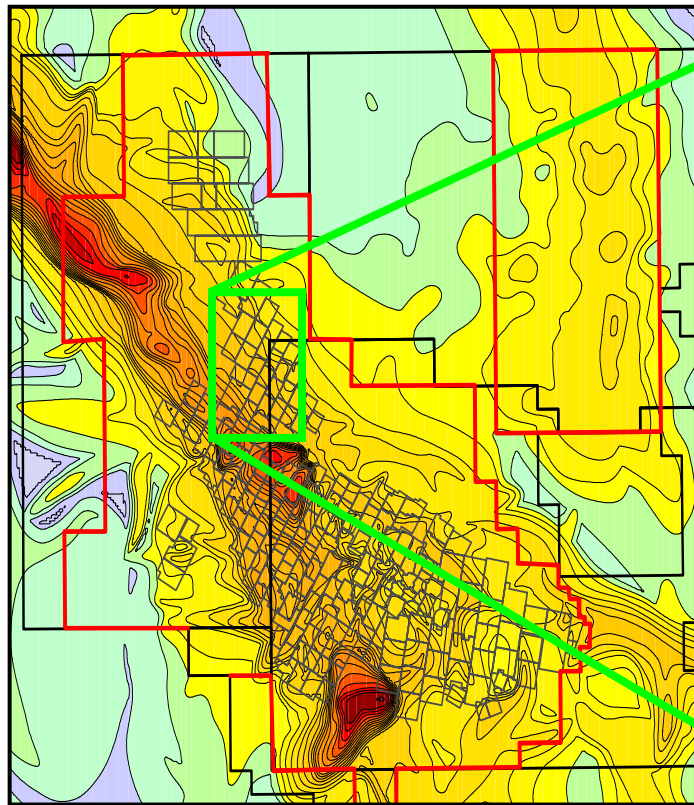
<b>Pad</b>	<b>Net Pay (m)</b>	<b>Wt%</b>	<b>OBIP (e3m3)</b>	<b>EBIP (e3m3)</b>
H18	30.7	11.5	3245	2422
H19	26.4	11.1	3212	2034
H21	34.0	11.6	3091	2719
H22	35.2	11.6	3198	2805
H23	33.1	11.6	4617	3972
H24	27.9	11.4	2586	2213
H25	31.9	11.4	4503	3719
H26	32.5	11.4	3997	3878
H27	33.0	11.8	4131	3998
H32	28.8	11.5	2534	2244

# Clearwater Fm – Paleogeography

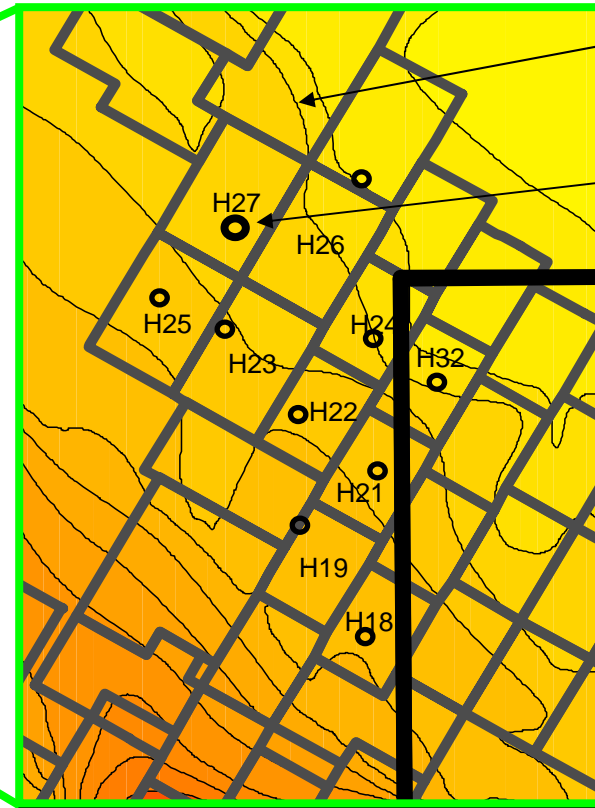
- Regional sediment transport of quartzose/feldspathic sands from southwestern fold/thrust belts during Cretaceous time
- Deposition of Clearwater reservoirs in large NW-SE oriented incised valley complexes (up to 50-60m incision)
- Predominantly sandy, tide-dominated facies form the reservoir at Cold Lake

**Clearwater Reservoir Isopach (C30-90 – Incised Valley Fill)**

5 m contours



**LASER area detail**



30m isopach

LASER type log

OV AA/3-3-66-4W4

○ Annotated pad wells seen on a later slide





























