

## Petro-Canada's Mackay River *In-Situ* Oil Sands Project: Current Scope and Status

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### ABSTRACT

Petro-Canada has been a leader in *in-situ* oil sands research and development since its inception over a quarter century ago. Today this investment is paying off with the commercial development of the Mackay River Oil Sands lease, northwest of Ft. McMurray, Alberta. This project will build on Petro-Canada's investment in SAGD technology, developed through membership in the former UTF consortium (now known as the Dover Project), along with various other SAGD projects. The fact that the Dover project area sits immediately adjacent to the Mackay River site is viewed as a distinct advantage in understanding the eventual performance of the Mackay River reservoir, since Dover has the longest history of application of SAGD technology of any oilsands or heavy oil project anywhere in the world. Currently, Mackay River is one of several SAGD projects within the general area of the Athabasca Oil Sands which have either been announced as being under consideration for development or have actually been granted approval for development by the AEUB (Fig. 1).

The resource base at Mackay River was discovered nearly 40 years ago by one of Petro-Canada's predecessor companies, Arco Canada. It was not until 1997, however, that full-scale evaluation of the property was undertaken. Since that time, over 200 delineation core holes have been drilled and evaluated, and over 150km of seismic coverage has been shot. Two main pools have been identified, which Petro-Canada refers to as Mackay River North and Mackay River South (Fig. 2). Both reservoirs have been extensively drilled, with up to 16 delineation wells per section. At this time Petro-Canada is only choosing to develop the Mackay River North reservoir, which will alone support a 30,000 bbl/d development for the next 25 years.

Reservoir characteristics of the McMurray Formation at Mackay River are excellent, with up to 34 m net pay, porosities averaging 33%, permeabilities of as much as 10D, and oil saturations in excess of 80% (Figs. 3 and 4). The reservoir at Mackay River is quite shallow, with depths to the top of the McMurray Formation averaging only 115m TVD. Because of this last fact, horizontal SAGD

wells are being spudded at a angle of 45 degrees in order to build angle fast enough to achieve horizontal trajectories at these shallow depths.

Prior to proceeding with commercial development of this project, extensive studies were undertaken in order to determine expected reservoir characteristics and performance once production was initiated. A 3-D geostatistical model was developed for the MacKay River North reservoir based on log and core data from over 150 wells (Fig. 5). This model was used to develop both thermal models of reservoir performance (steam chamber growth and reservoir depletion, production rates, steam-oil ratios), as well as aiding in the planning of horizontal wellbores (Fig. 6).

Initial development plans call for the drilling of 25 horizontal pairs in order to meet the planned production volumes. These wells are being drilled from pads, and have been planned in such a way as to minimize surface land use. Over 200 SAGD well pairs will have to be drilled over the 25-year life of the project in order to fully exploit the reservoir (Fig. 7). Current plans call for first oil to be produced in the fall of 2002.

Mackay River Project Fig. 1

## Athabasca Oil Sands Area: Current In-situ Projects

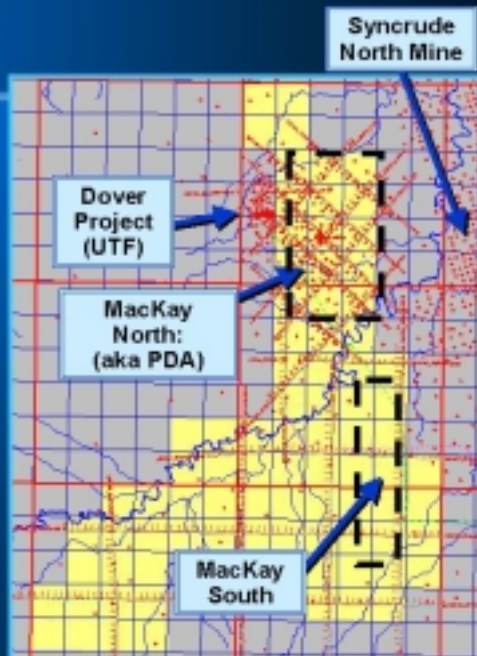
- Approved Commercial Projects
  - AEC Foster Creek
  - PanCanadian Christina Lake
  - Suncor Firebag
  - Petro-Canada MacKay River
- Current SAGD Pilots
  - Gulf Surmont
  - Jacos Hangingstone
  - UTF (Northstar et al. Dover)
- Other Projects in Development
  - CNRL Mic Mac
  - Opti Long Lake
  - Husky Kearl Lake
  - Deer Creek Lease 24
  - PC Lewis
  - PC/Nexen Meadow Creek



Mackay River Project Fig. 2

## Mackay River: FAQ

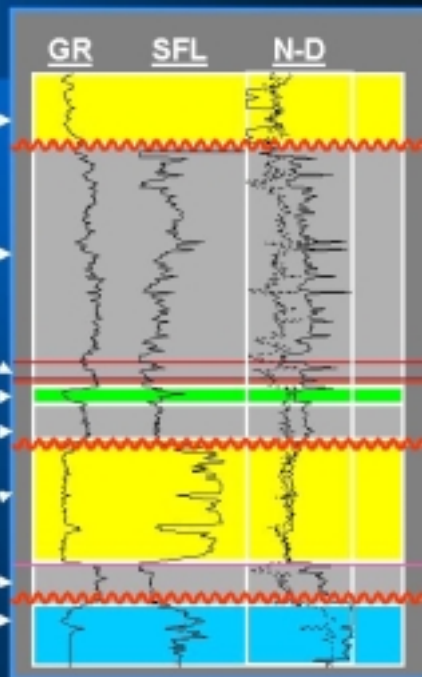
- ◆ **HISTORY:** Discovery wells drilled in '59-60; Minor drilling programs '78 and '81; Major delineation drilling programs '97-2000
- ◆ **CURRENTLY:** 200 strat. test wells and 150 km of 2-D seismic delineate two reservoirs (N. MacKay & S. MacKay)
- ◆ **MacKay North**
  - ◆ Prime Development Area
  - ◆ 50 km of 2-D coverage
  - ◆ 150 delineation wells
- ◆ **MacKay South**
  - ◆ 100 km of 2-D coverage
  - ◆ 50 delineation wells



MacKay River Project Fig. 3

## MacKay Stratigraphy

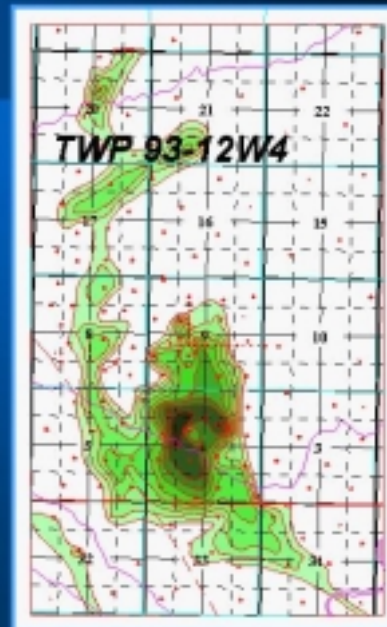
- ◆ Pleistocene: glacial drift
- ◆ Lower Cretaceous
  - Clearwater Fm. (marine shales)
  - Wabiskaw Mbr.
    - Marine shoreface/shoals
    - Wabiskaw C sand
    - Wabiskaw C shale
  - McMurray Fm.
    - Middle Mbr. (reservoir)
    - Lower Mbr. (paludal muds)
- ◆ Devonian
  - Beaverhill Lake Limestones



MacKay River Project Fig. 4

## MacKay North Reservoir

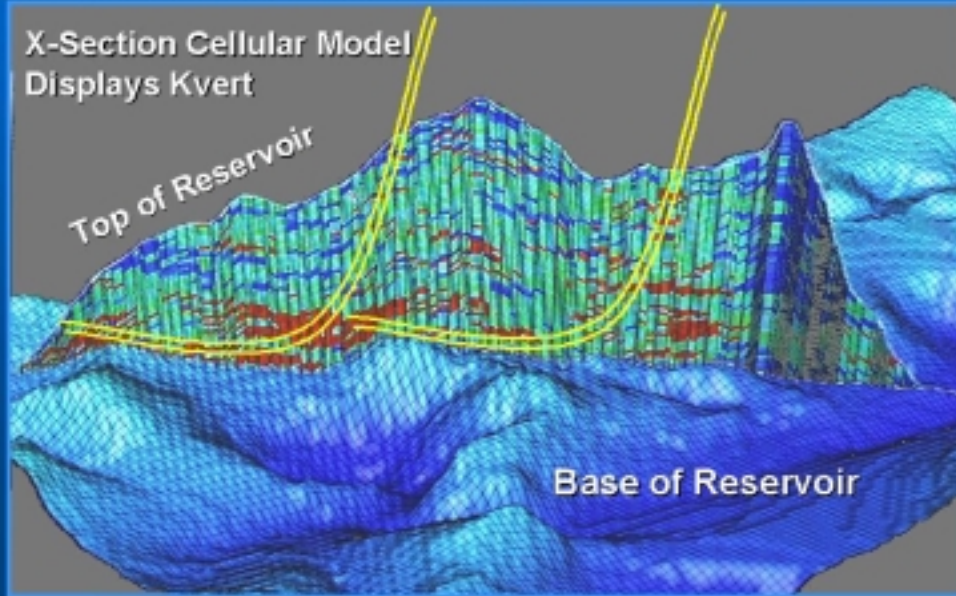
- ◆ Reservoir quality:
  - ◆ Net pay: < 34 m (15 m cutoff)
  - ◆  $\phi$ : up to 33%
  - ◆ k: up to 10 D
  - ◆ So: > 80%
  - ◆ Oil gravity: ~10° API
  - ◆ Depth to top of reservoir: 90-135 m



McMurray Fm.  
Net Continuous Pay  
with 15 m cutoff (5m c.i.)

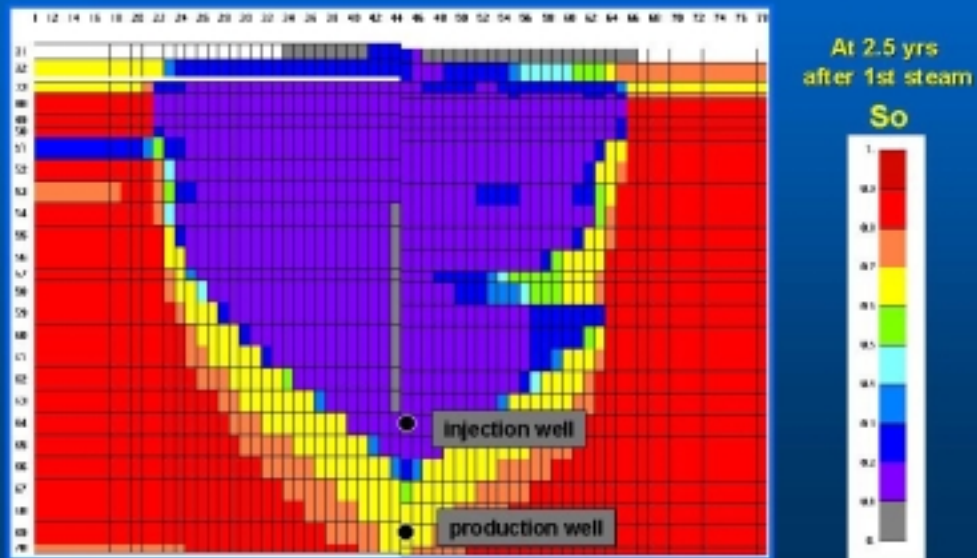
MacKay River Project Fig. 5

Vertical section through geostatistical model showing Kvert distribution along with sample horizontal well pairs



MacKay River Project Fig. 6

Sample Exotherm Model Run: Vertical Section Illustrating Steam Chamber Growth



MacKay River Project Fig. 7

## Development Planning

- ◆ **Development plan:**  
calls for approximately 200 horizontal well pairs to be drilled over the 25 year life of the project
- ◆ **Current Status:**  
25 well pairs drilled off of two pads have been planned in the initial development area (highlighted) in order to meet the target startup production rate of 30Mbbls/d

