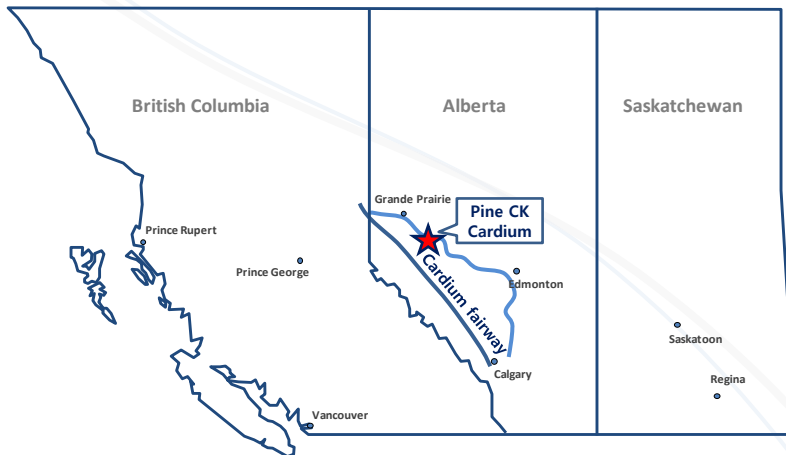


# Pine Creek Cardium Light Oil Project

[ MKS INVESTMENTS LTD. ]

November 2021



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# I. Overview

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## ■ Geology of Pembina Cardium

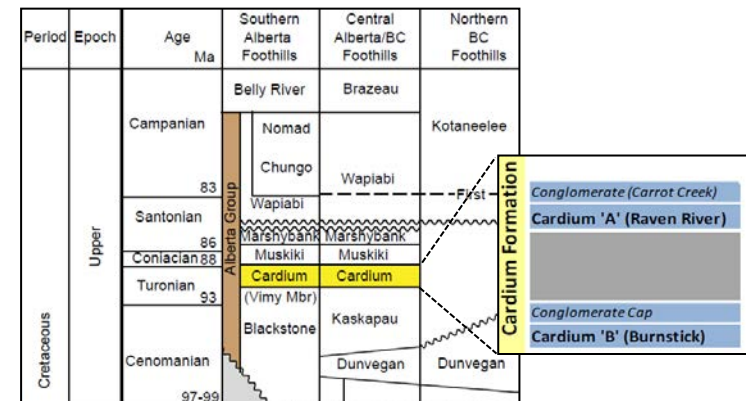
The Cardium is a Late Cretaceous age formation comprising of a wedge of clastic sediments (primarily sandstone) laid down ~88 mln years ago. The formation thins from a total gross thickness of ~150 m in the foothills (on the west side) to ~50 m in the central Alberta plains until it disappears into the large mudstone formations. The environment that the formation was laid down in varies from shallow marine shelf, shoreface complexes, and tidal environments to estuarine and fluvial coastal plains. As a result of these diverse conditions, the Cardium is quite complicated and the rock character varies from mudstone and siltstone to sandstone and small intervals of conglomerate.

In terms of a hydrocarbon system, trapping in the Cardium is primarily stratigraphic in nature. This allows for the collection of vast pools, such as those at Pembina, as well as blanketing layers with resource style rock more amenable to horizontal development. The source for the oil and gas is thought to be the underlying shale members that neighbor the Cardium within the Cretaceous Colorado group. Notably, the Cardium system has conspicuously low in-situ water, which effectively increases the oil in place through higher oil saturations, and reduces risks associated with fracturing into mobile aquifers. It also removes water as a potential drive mechanism (or moving force) for the oil. Offsetting this, however, is a significant amount of associated gas in Cardium reservoirs. This provides a main source of reservoir drive energy, but requires some additional infrastructure for gas conservation when production is originally being ramped up. Generally speaking, gas content increases toward the western margin of the play, as the formation is deeper and more thermally mature.

## Cardium Paleogeography and Facies Map



## Cardium stratigraphy

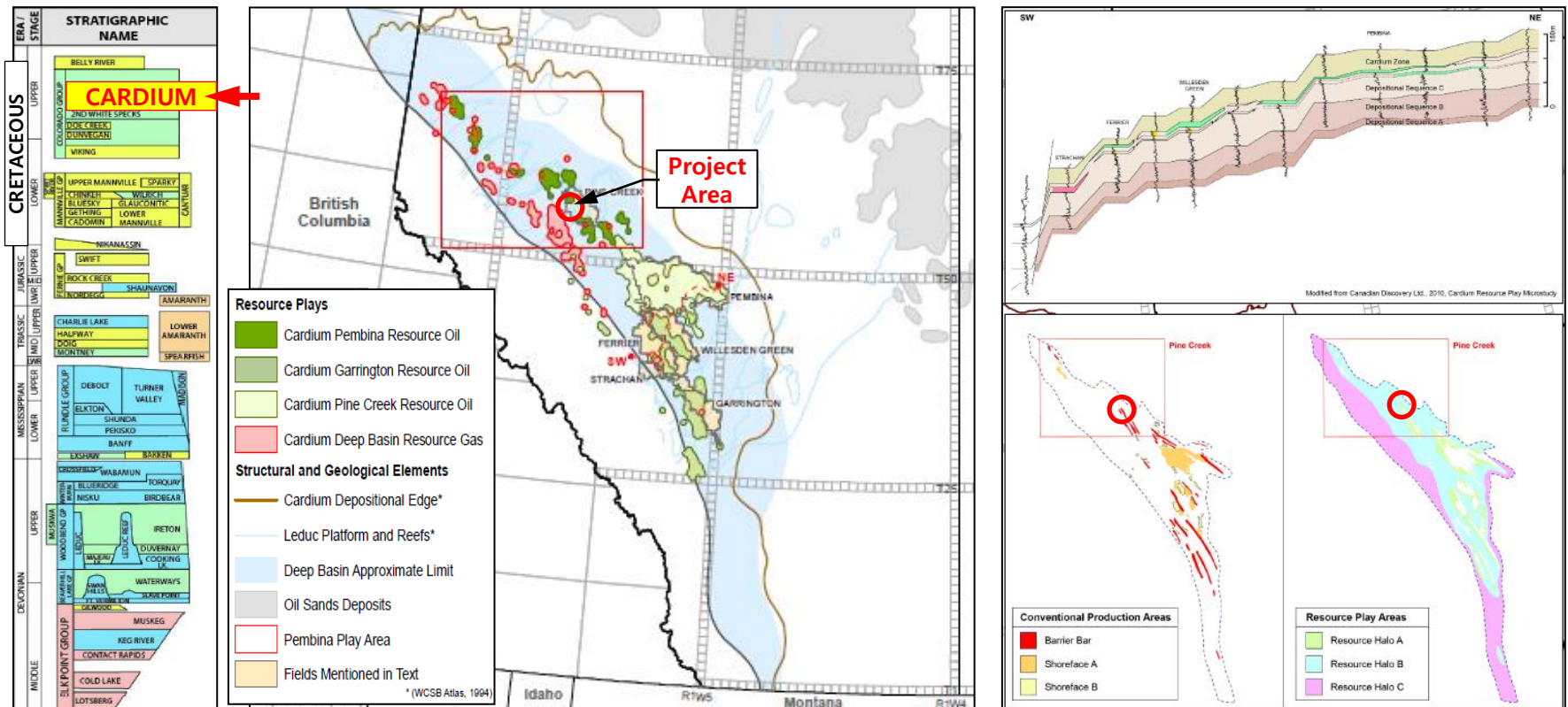


\* Canada research, Raymond James (Jun, 2012)

# I. Overview

## ■ Cardium Pine Creek Resource Play

Cretaceous Cardium comprises a muddy, sandy and conglomeratic clastic wedge that was deposited in a dominantly shoreface to shallow marine environment along a northwest-southeast-trending shoreline. The conventional trapping mechanism is stratigraphic transition of porous sandstones or conglomerates into shales. The Cardium resource plays focus more on the halo of siltier rock surrounding the cleaner and coarser barrier island and shoreface sands. Production in the Pine Creek area is relatively poor compared to the other Cardium resource plays, as there is generally less of the coarser-grained facies in that area.



\* source : modified from Canadian Discovery

# I. Overview

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## ■ Target Land and Cardium producers

- Pine Creek target open crown lands and offsetting Cardium producers with Cardium A HZ development trend

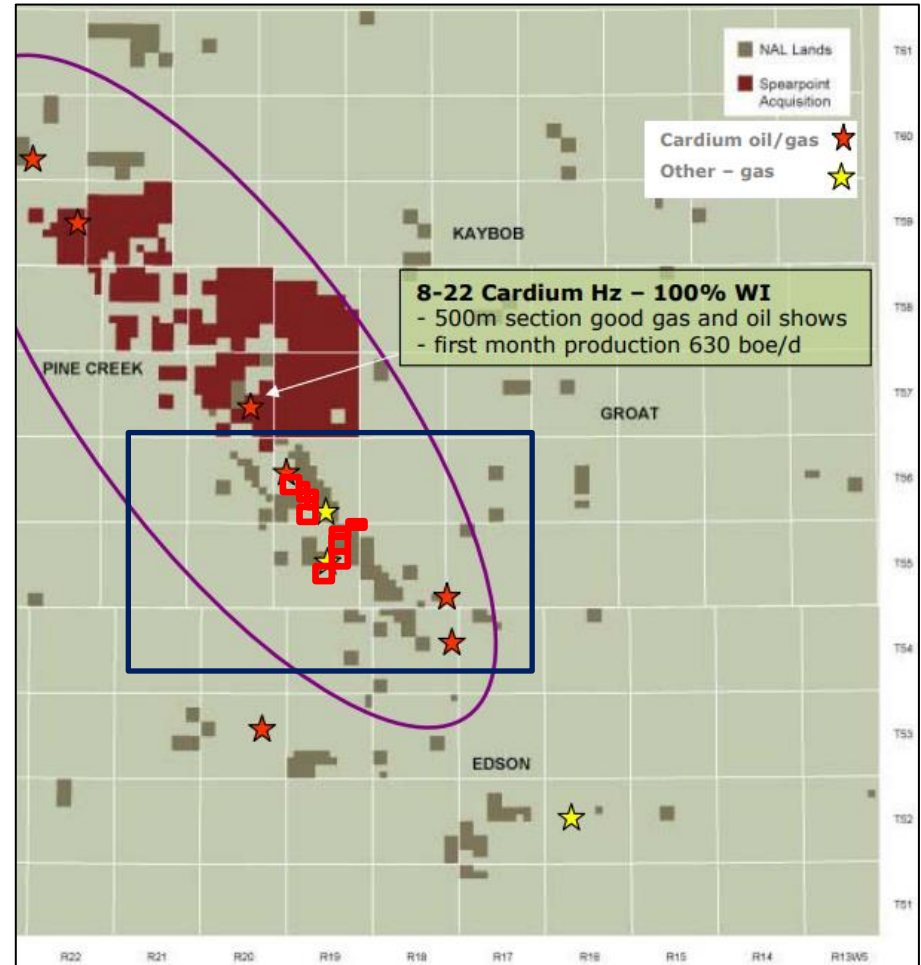
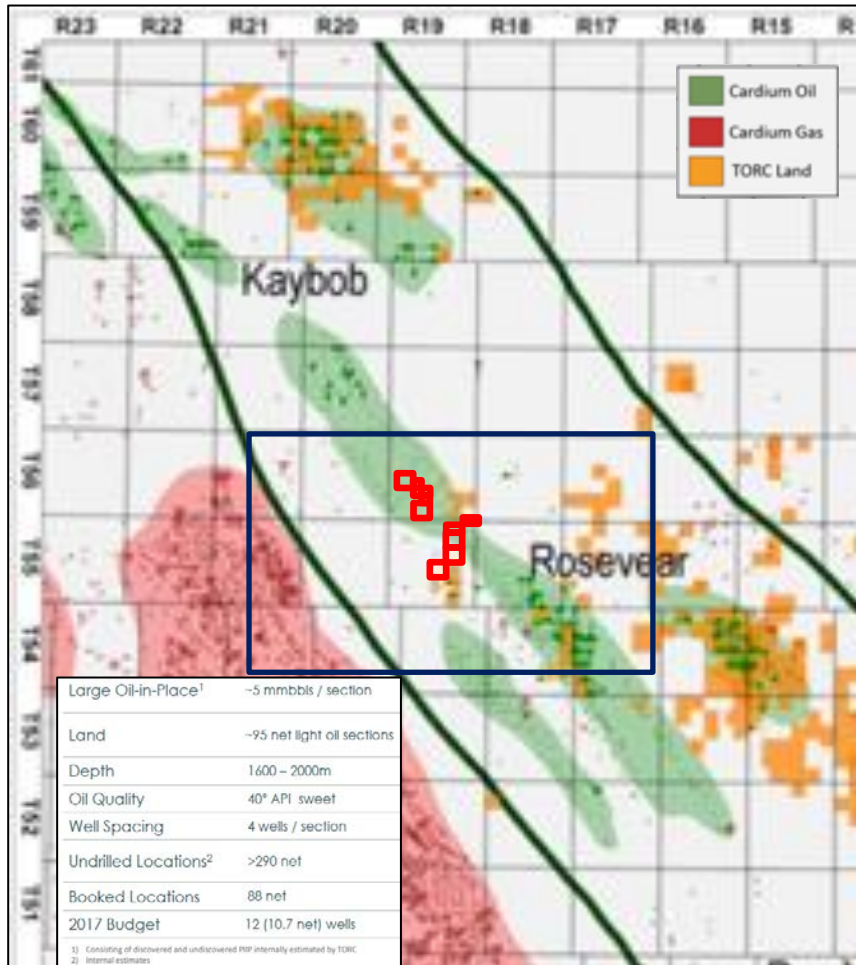




# I. Overview

## ■ Pine Creek Cardium Development – TORC & NAL

- Regional shoreface, stratigraphic trap, low permeability halo and discrete pools
- HZ in upper porosity and geosteer in best quality rock & 25 stage liner, 20 ton/stage, frac'd with slickwater - 1 mile HZ



\* source : TORC Oil, Gas (2017) & NAL Resources (2009)

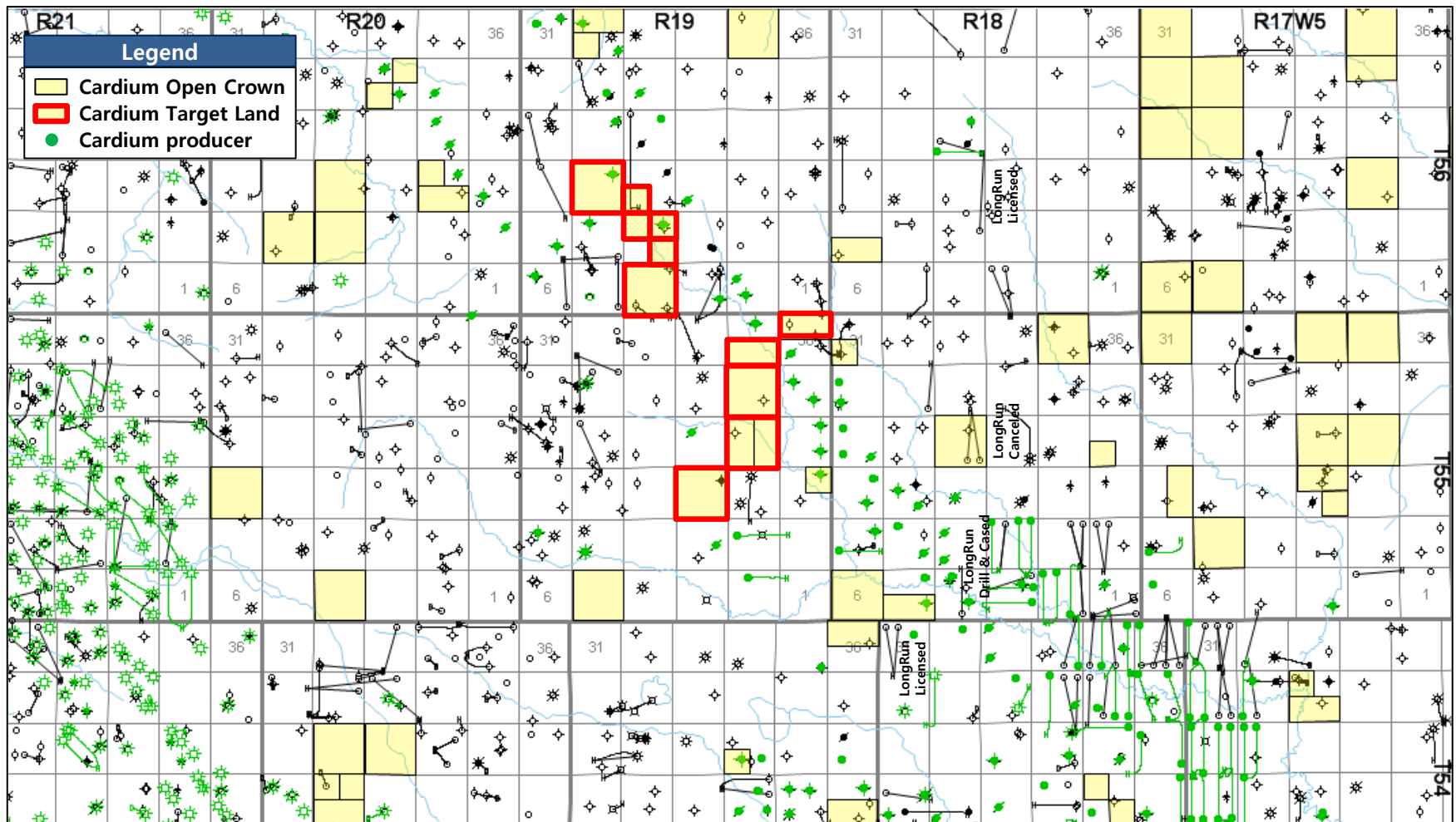
## II. Target Land

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### ■ Target Project Area

- Located between Cardium sand and Halo edge with offsetting horizontal drilling activities from Southeast



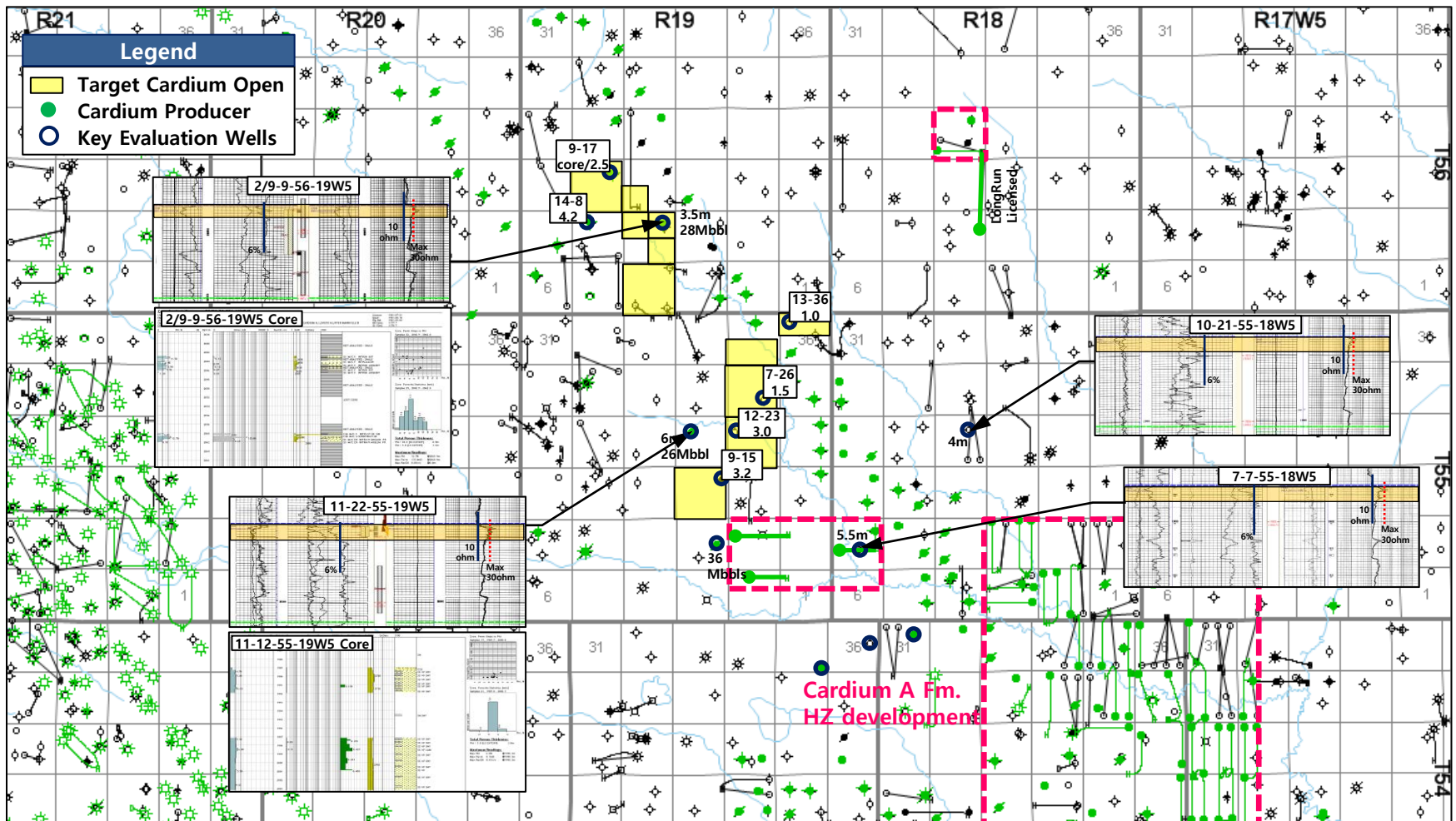
# III. Technical Evaluation

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## Cardium Well Analysis

- Multi production from 3 Cardium zone and horizontal drilling in Cardium A zone





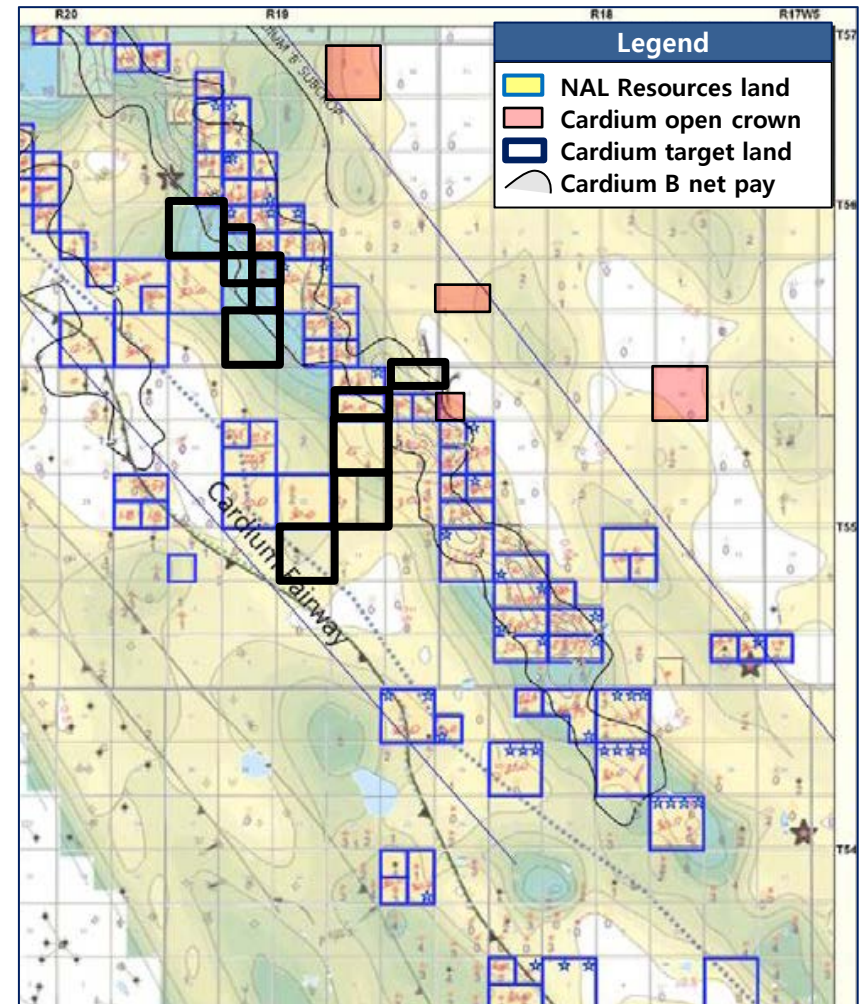
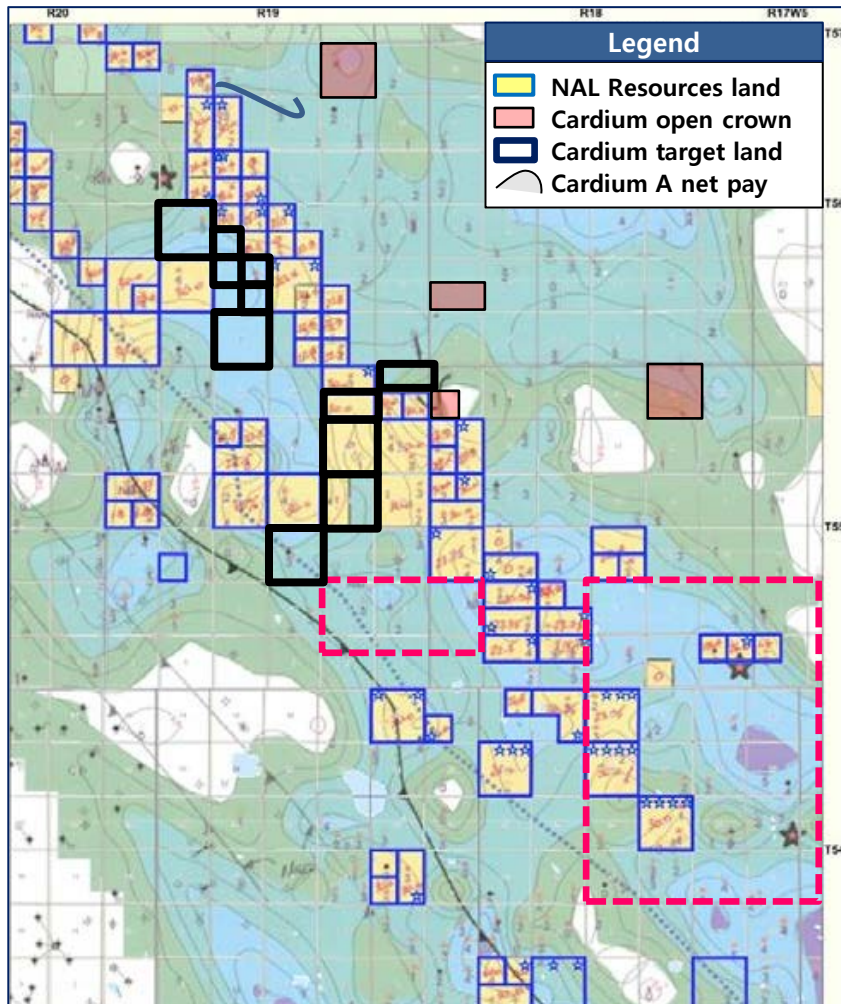
# III. Technical Evaluation

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## ■ Cardium Net Pay Analysis

- NAL Resources Cardium A and Cardium B net pay contour based on the 6 % porosity cut





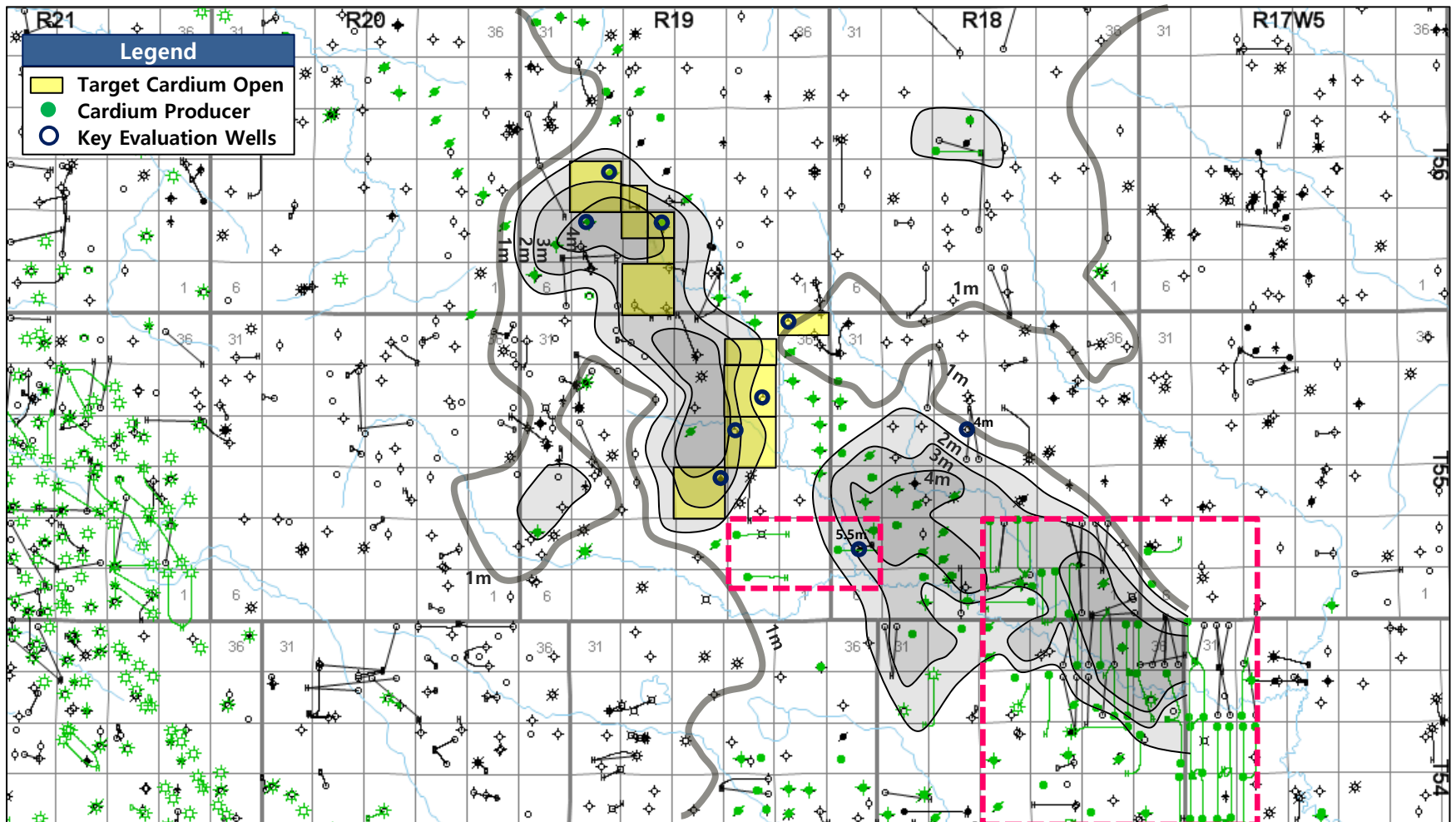
# III. Technical Evaluation

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## ■ Cardium Net Pay

- Cardium A formation contour based on the net pay with 6 % porosity cut



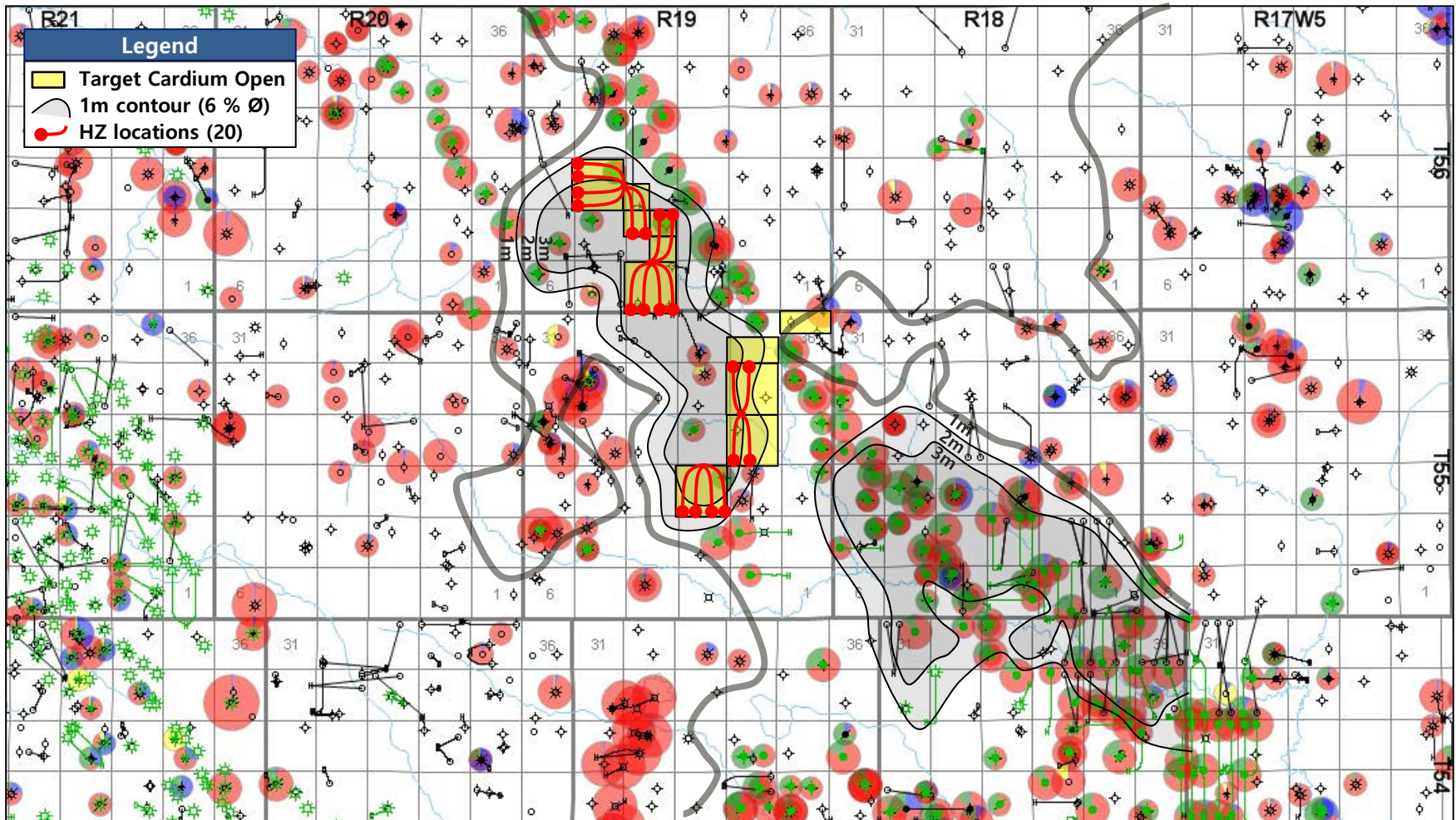
# IV. Development

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## Cardium HZ Drilling Plan

- 9.5 sections land with 20 HZ drilling plan over 2 m net pay (6 % porosity) zone





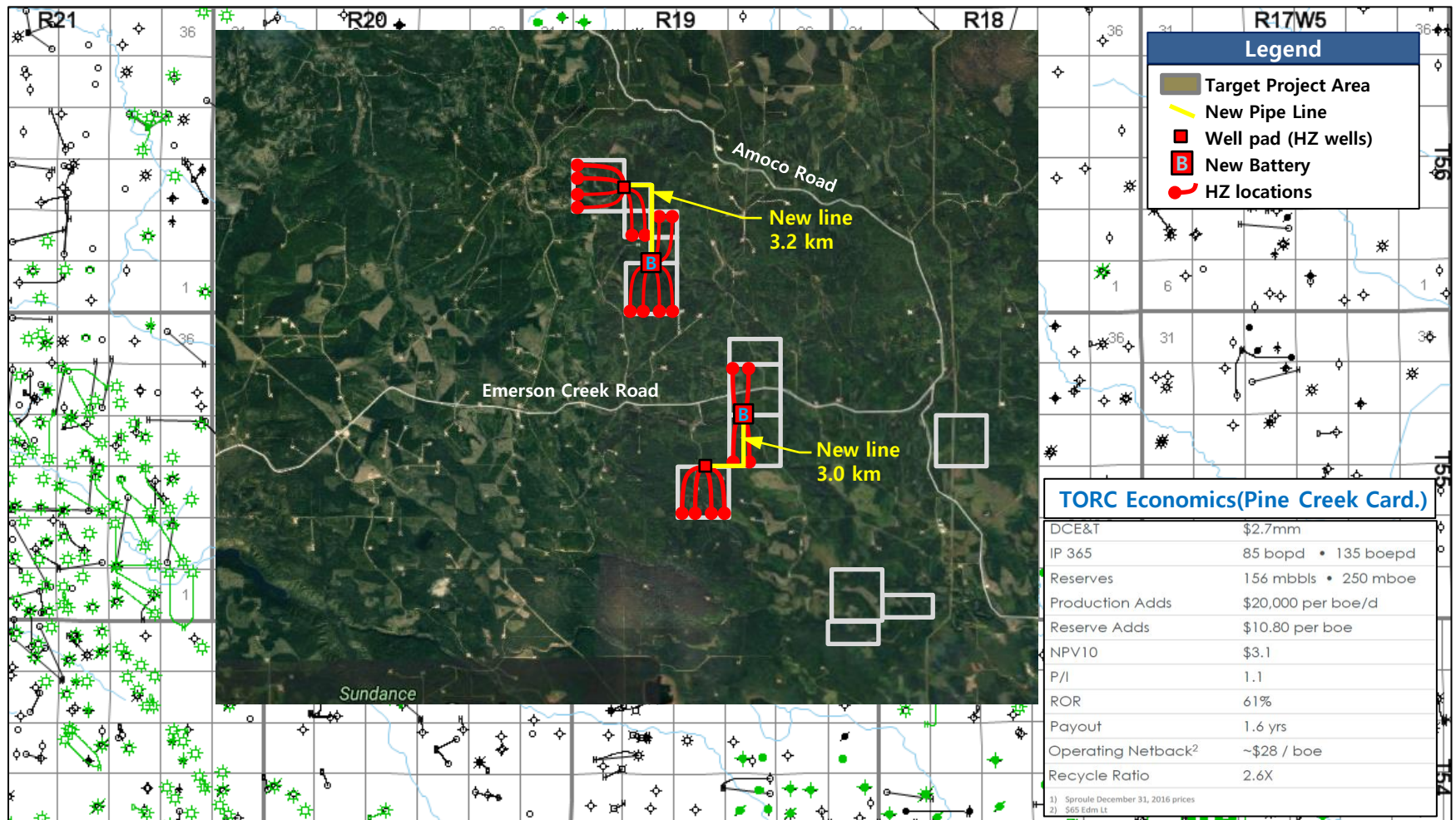
# IV. Development

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## Cardium Development Plan

- Access from the Amoco Rd. and Emerson CK Rd. drill 20 HZ wells, install 2 oil battery and 6.2 km of pipeline



\* source : TORC Oil & Gas (Oct., 2017)



The background features several thin, wavy lines in shades of blue and grey. Scattered across the upper half are several small squares, some solid blue and others outlined in blue.

End of Documents

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