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CMC Research Institutes, Inc.

Containment and Monitoring Institute (CaMI) Field Research Station (FRS)

Don Lawton (CMCRI+UofC), Kirk Osadetz (CMCRI)
Richard Adamson (CMCRI)

General FRS overview

December, 2014

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Canada's CO_2 emissions

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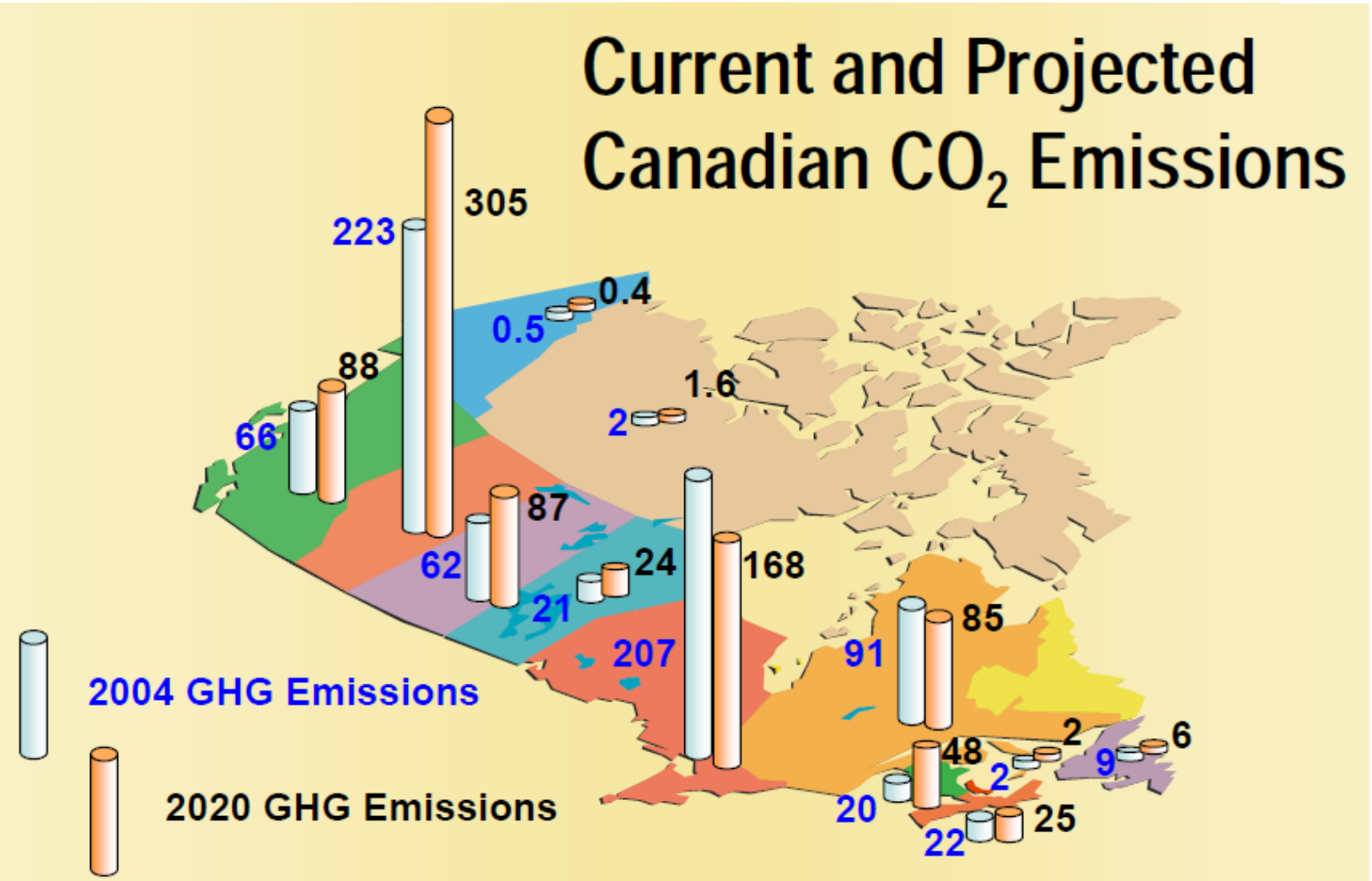

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ALBERTA RESEARCH COUNCIL

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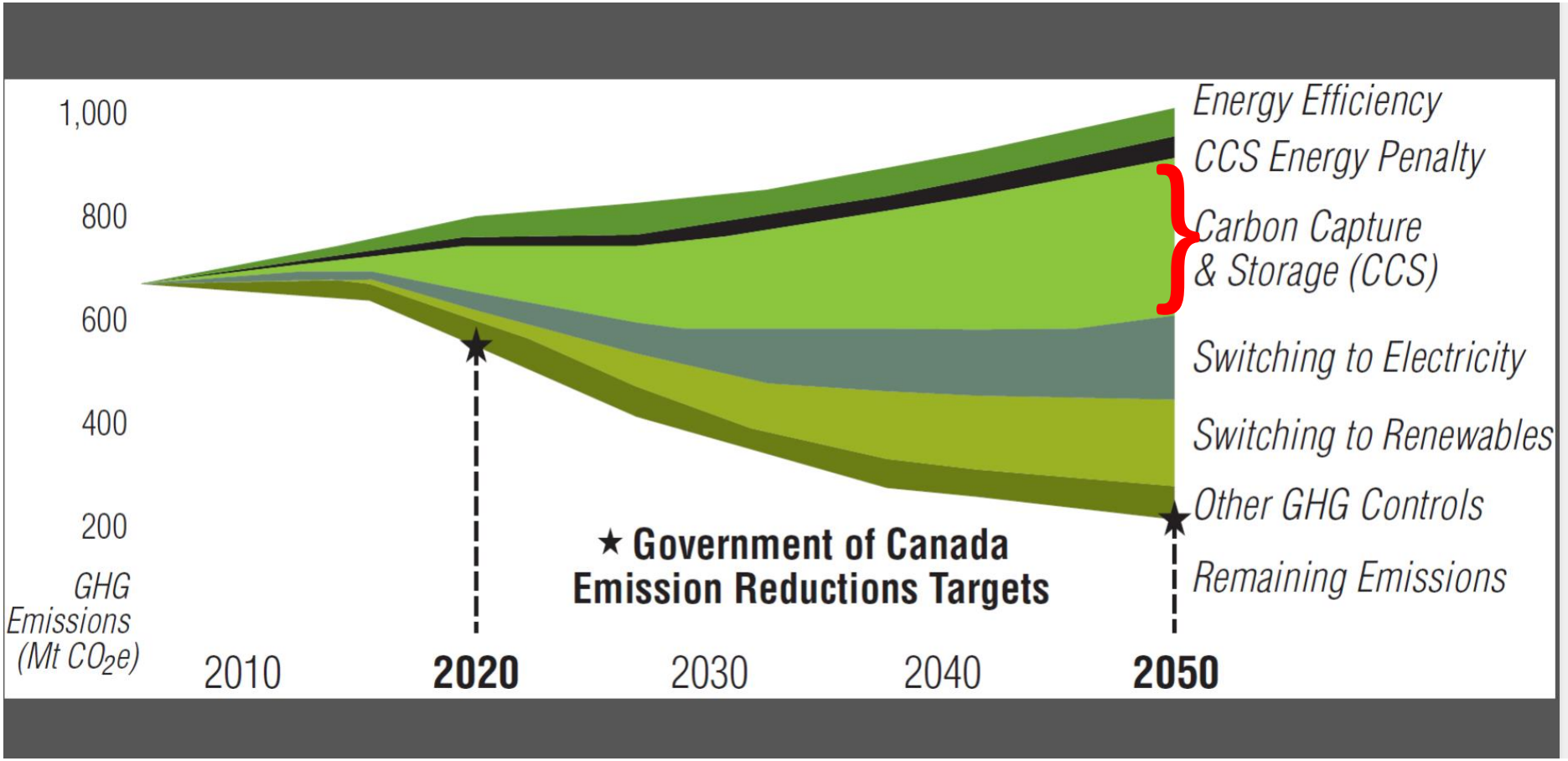
Canada's emissions reduction wedges



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44 research projects
155 researchers at 27 universities
Govt of Canada
Govt of Alberta

= $22M

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Containment and Monitoring Institute (CaMI)

Field Research Station (FRS)

- Containment assurance is critical
- There is a need to better characterize containment risks
- FRS is a unique benchmarking and evaluation program for monitoring subsurface fluids.
- FRS is relevant to many aspects of the petroleum industry as well as regulators.
- FRS is being developed by CMCRI in collaboration with the University of Calgary, with an emphasis on HQP development

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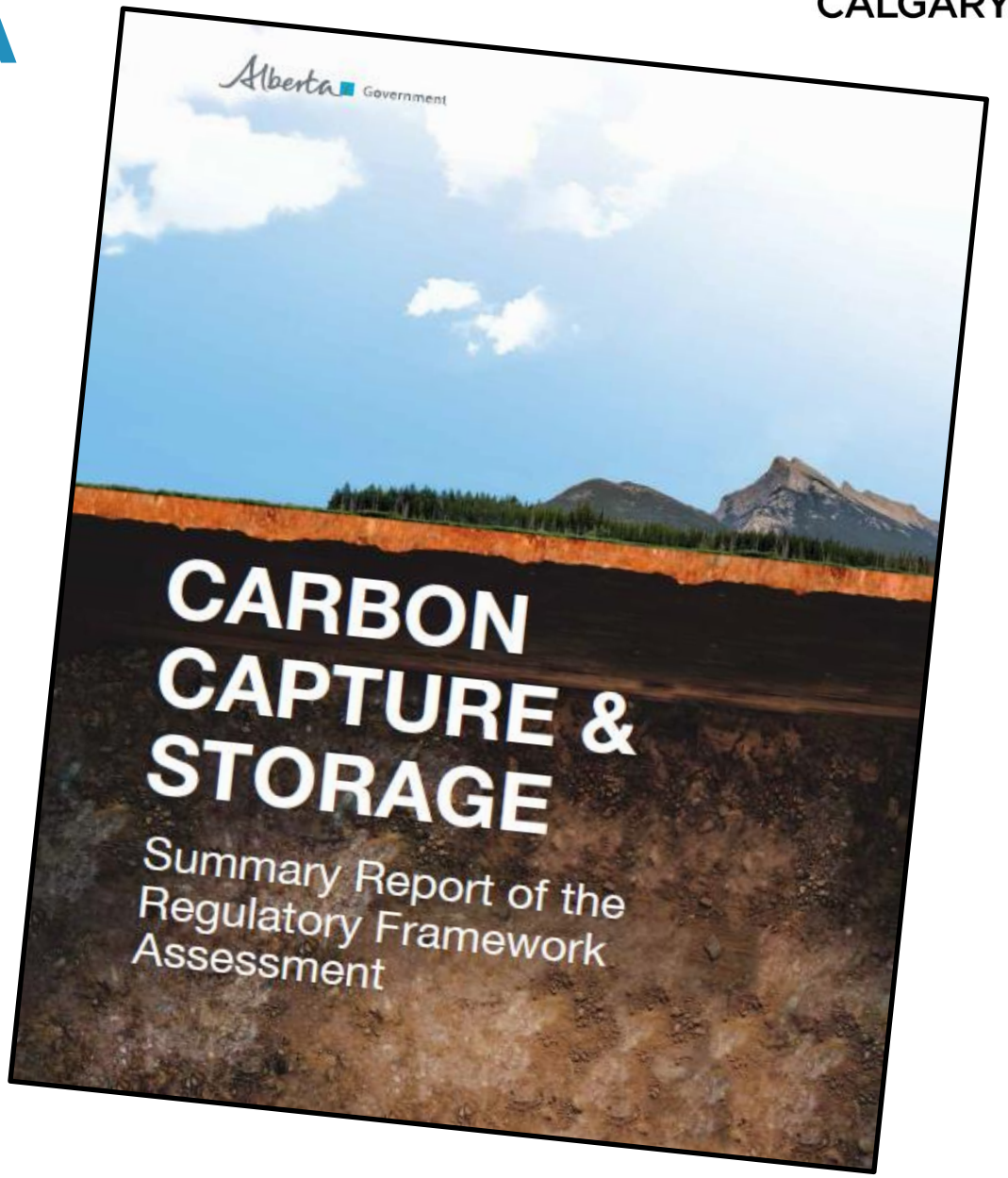
CCS RFA

Government of Alberta Regulatory Framework Assessment

(August 2013)



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RFA recommendation

Risk Assessment, Monitoring, and Technical Requirements

"Require MMV and closure plans to be based on a project-specific risk assessment, and include the use of best available technologies to monitor the atmosphere, surface, ground and surface water, and subsurface."

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CaMI Field Research Station

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- Undertake controlled CO_2 release at 300 m & 500 m depth; ~1000 t/yr.
- Develop improved monitoring technologies.
- Determine CO_2 detection thresholds.
- Enable university & industry training & research.
- Understand fate of methane in aquifers.
- Provide quantitative monitoring protocols to regulators and industry.
- Accelerate public outreach & education.
- Provide on-site fuel cell for CO_2 source and natural gas utilization; energy storage.

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Monitoring and containment needs/applications

- Secure carbon storage
- Steam chamber containment and conformance
- Tertiary/enhanced petroleum recovery
- Shale gas and tight oil (fracking)
- New well construction or legacy wells
- Well abandonment issues and fugitive emissions
- Acid gas or produced water disposal
- Induced seismicity risk analysis and mitigation

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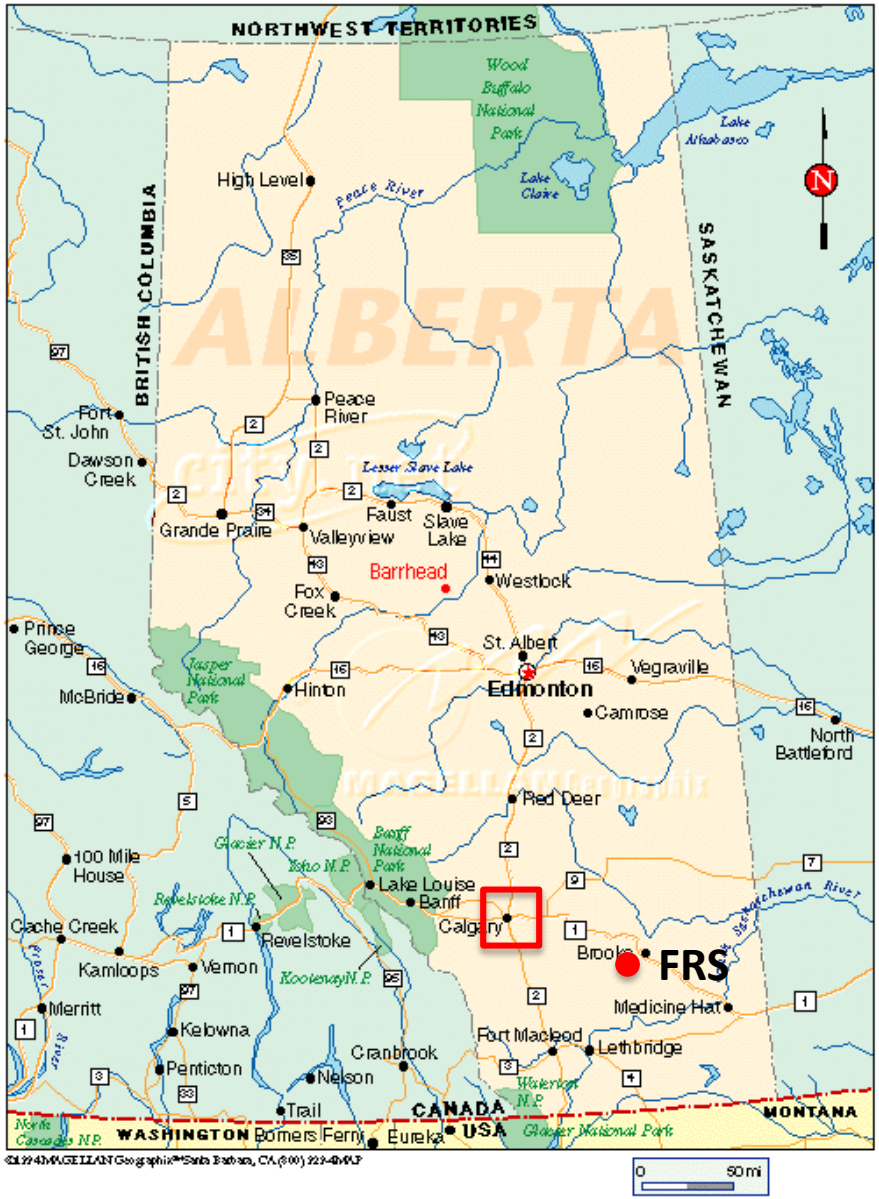
Location of the FRS



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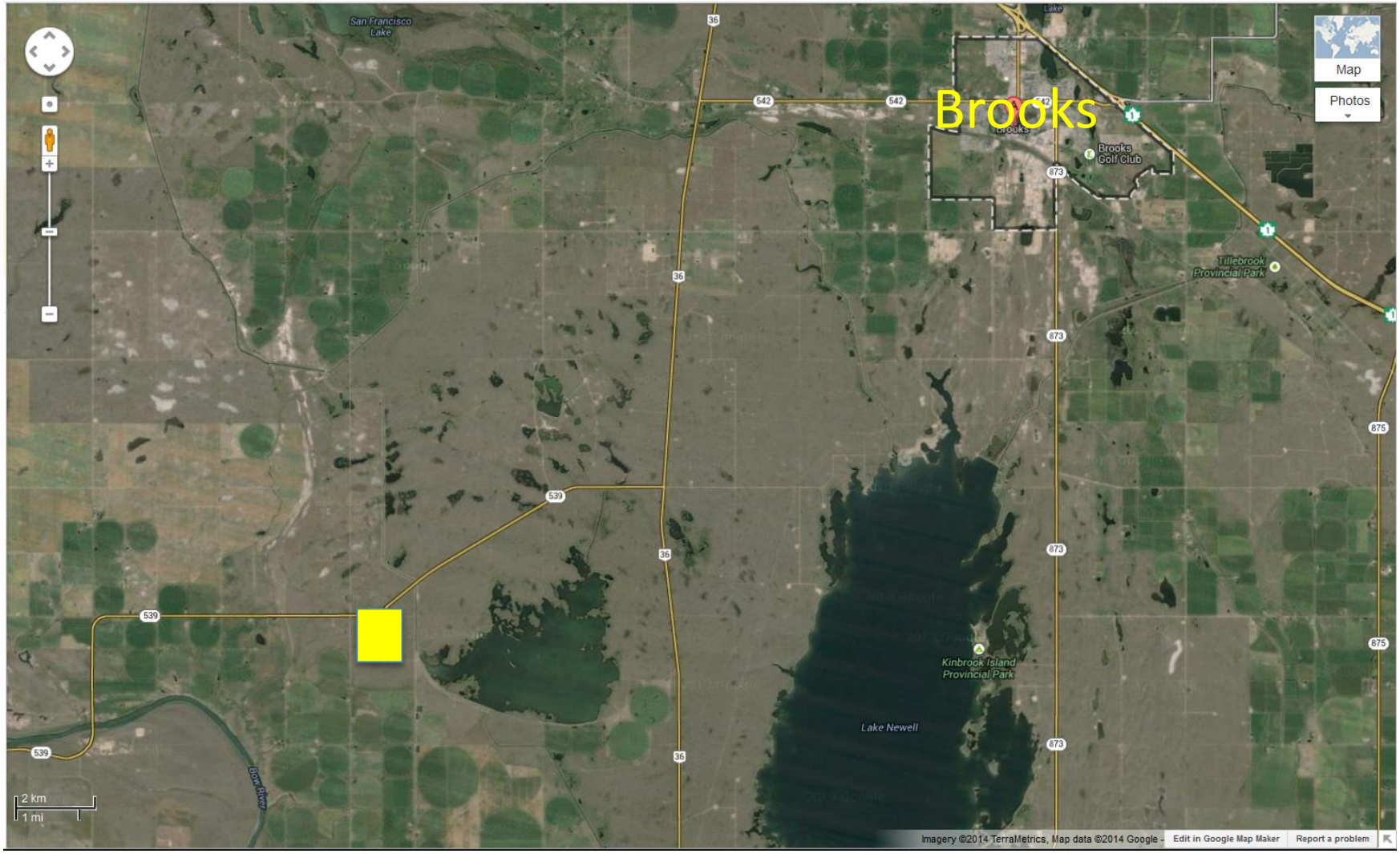
FRS location



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FRS site – courtesy Cenovus

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Bedrock geology Newell County

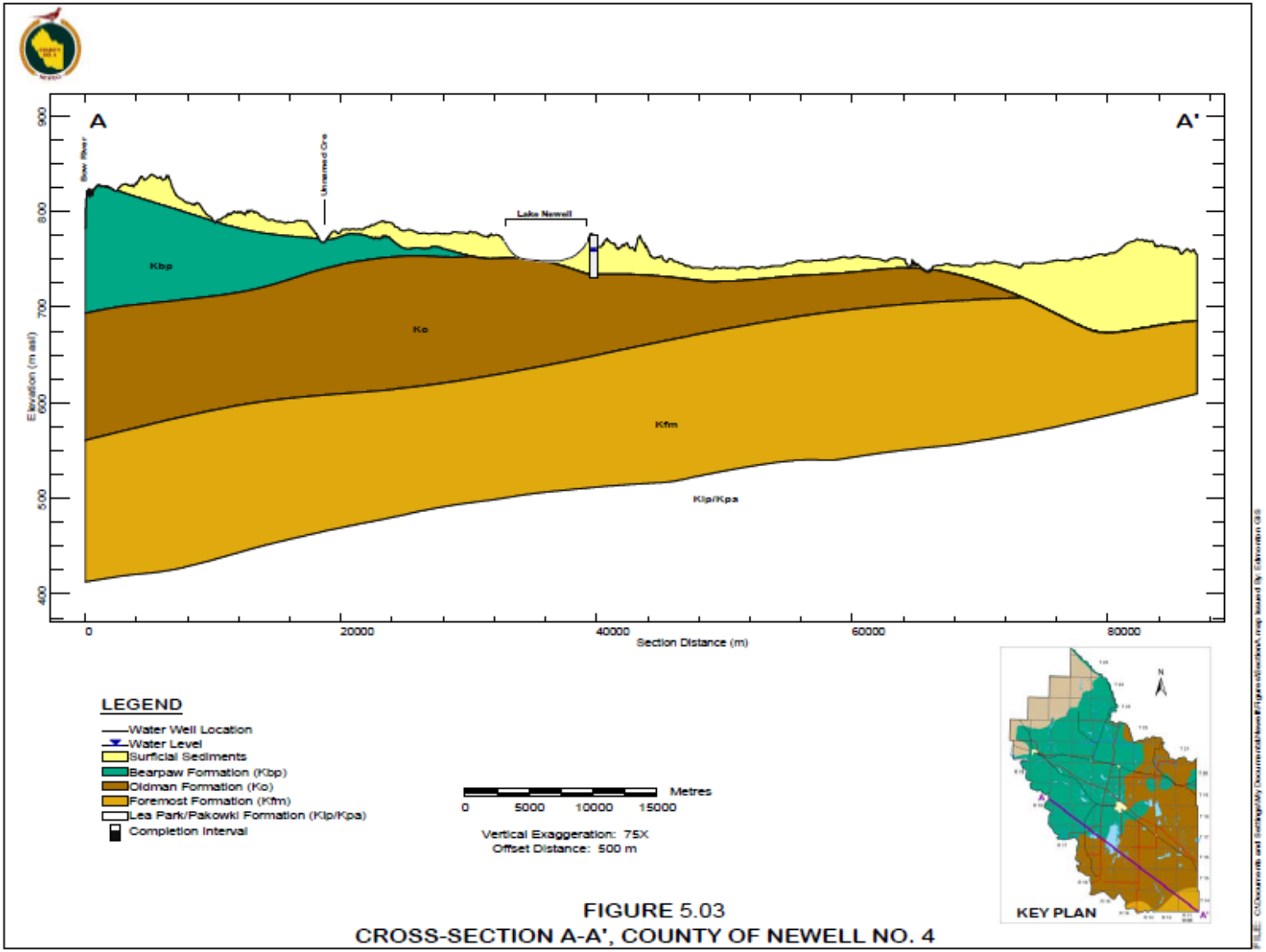

FIGURE 5.03
CROSS-SECTION A-A', COUNTY OF NEWELL NO. 4

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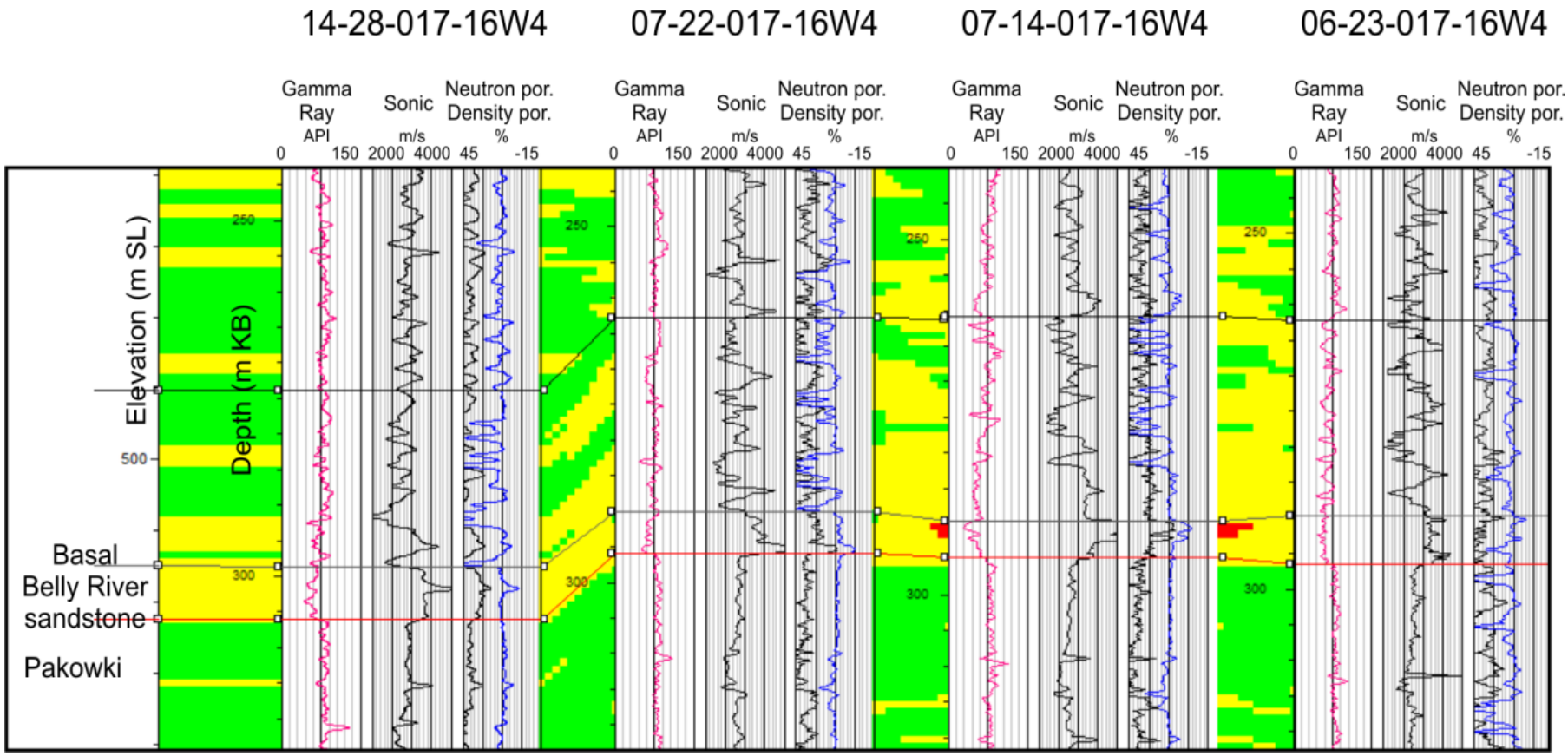
Basal Belly River, Newell County



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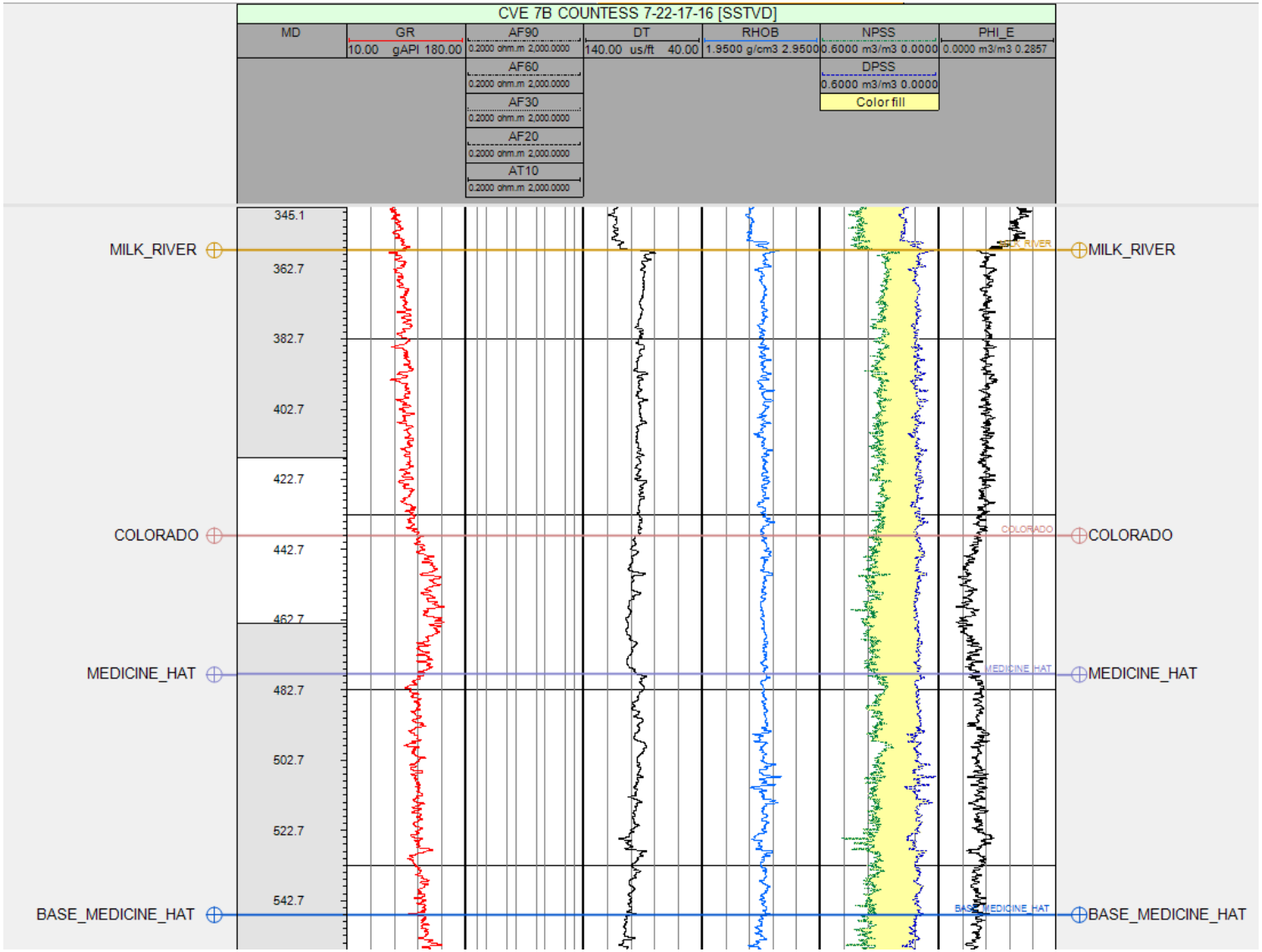
Medicine Hat Sand, Newell County



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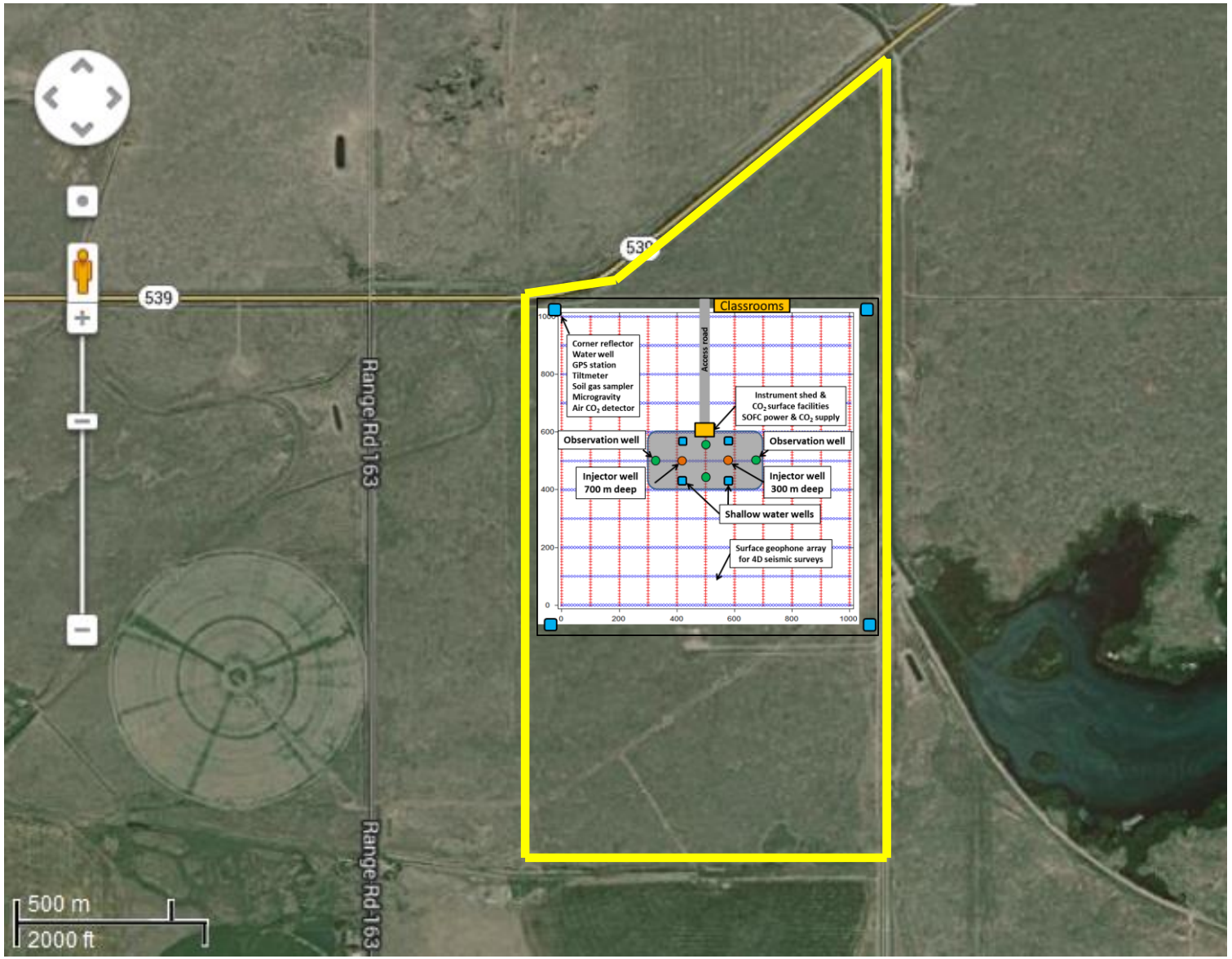
CaMI Field Research Station



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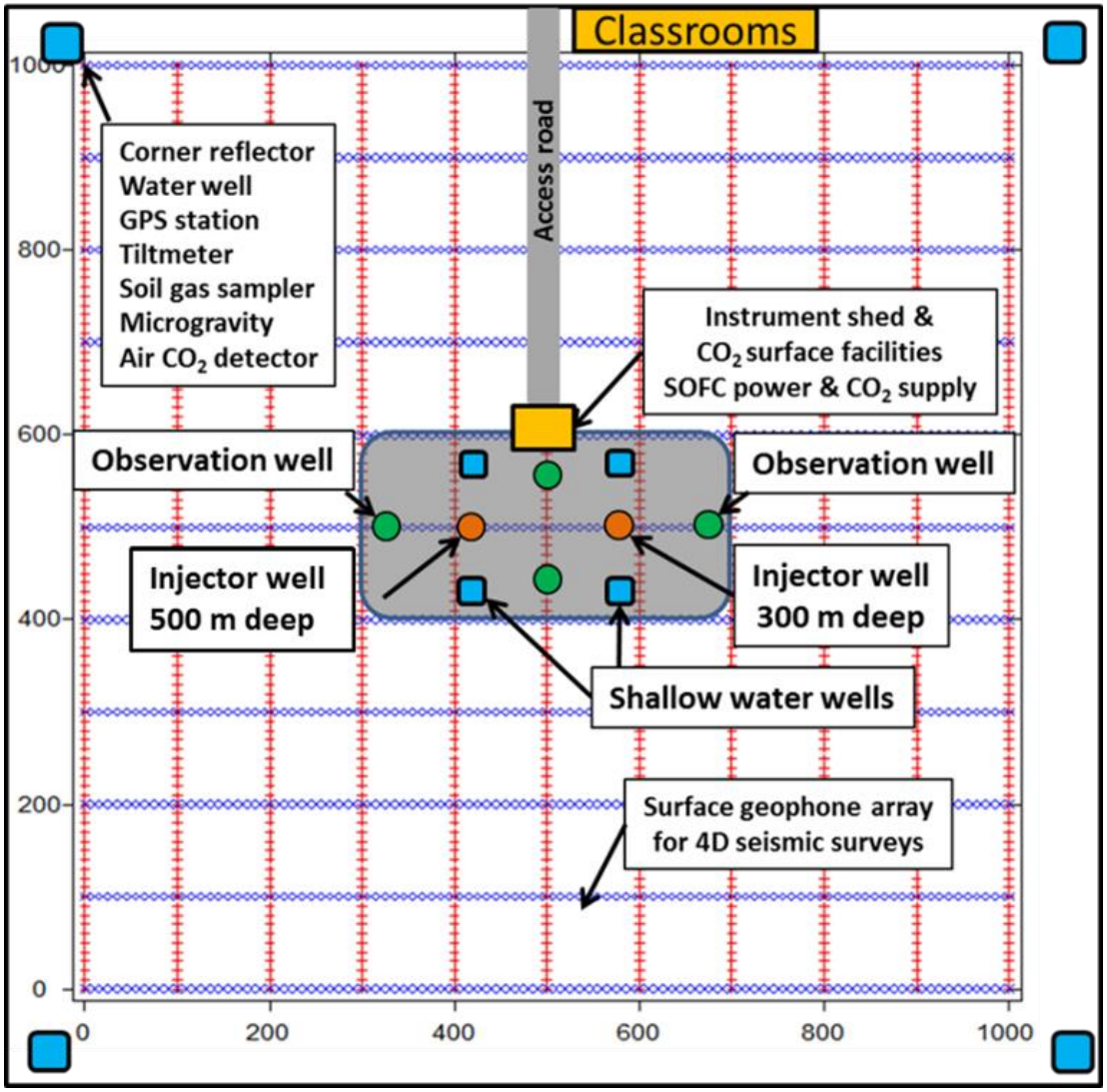
CaMI FRS surface layout



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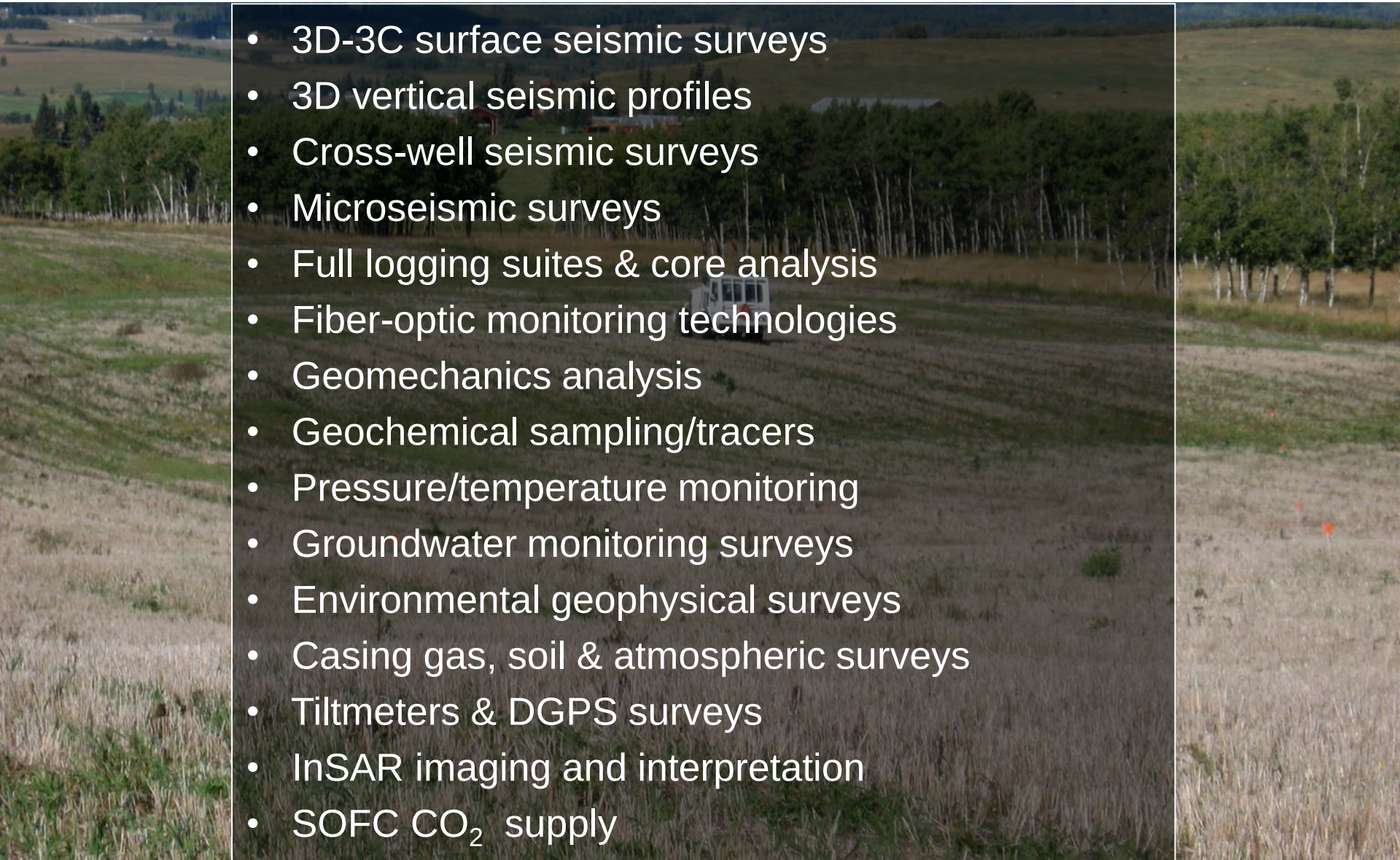
CaMI FRS technologies



- 3D-3C surface seismic surveys
- 3D vertical seismic profiles
- Cross-well seismic surveys
- Microseismic surveys
- Full logging suites & core analysis
- Fiber-optic monitoring technologies
- Geomechanics analysis
- Geochemical sampling/tracers
- Pressure/temperature monitoring
- Groundwater monitoring surveys
- Environmental geophysical surveys
- Casing gas, soil & atmospheric surveys
- Tiltmeters & DGPS surveys
- InSAR imaging and interpretation
- SOFC CO_2 supply

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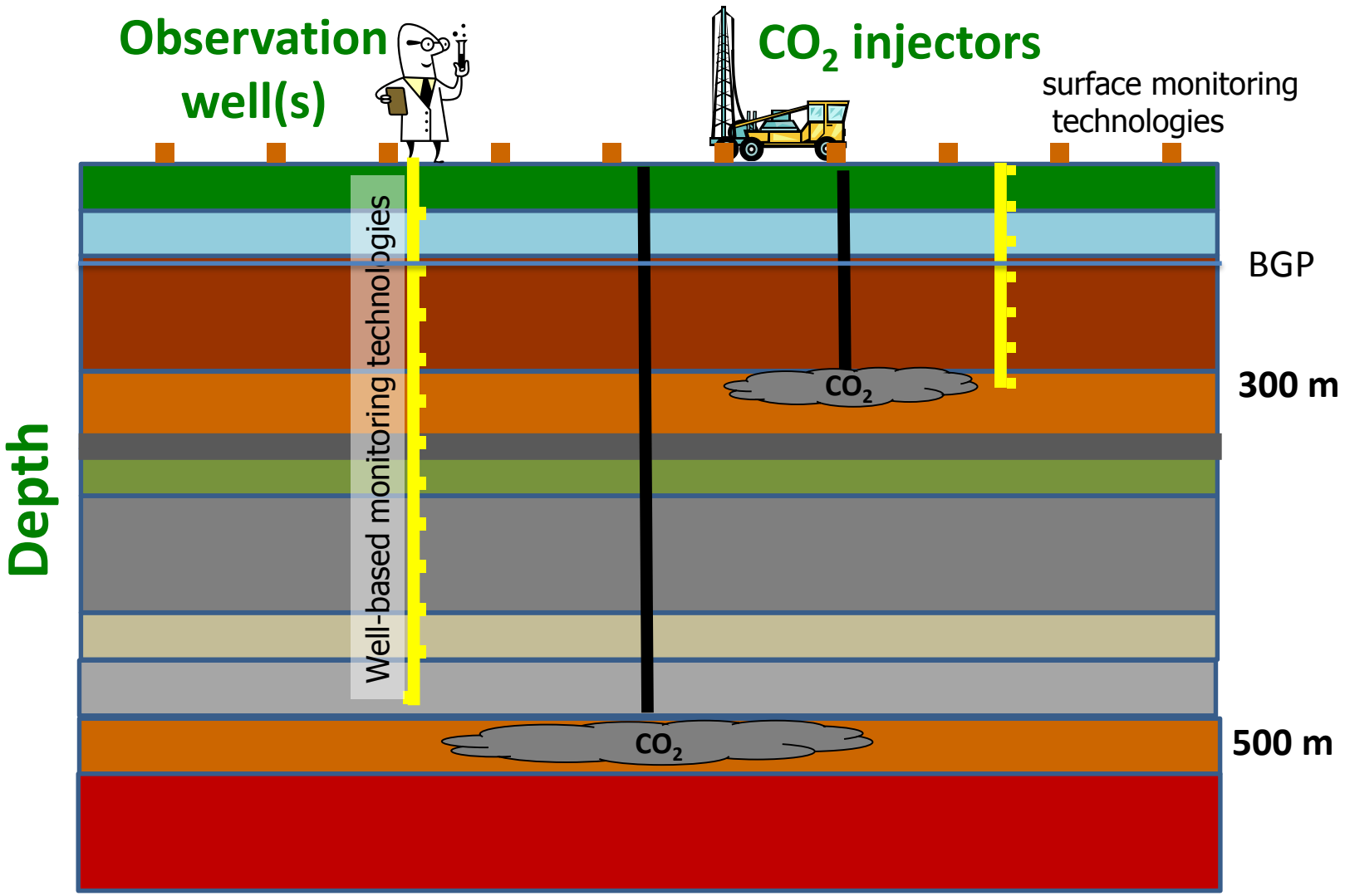
CaMI FRS project



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Monitoring wells

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CaMI FRS project

Data Suite (IHS Data)

- Study region 5km by 5km = 75 wells
- 198 wells with digital LAS files (>10km radius)
- Limited core data
- Deviation surveys and locations
- Well tops
- Static water levels – 3m below ground level

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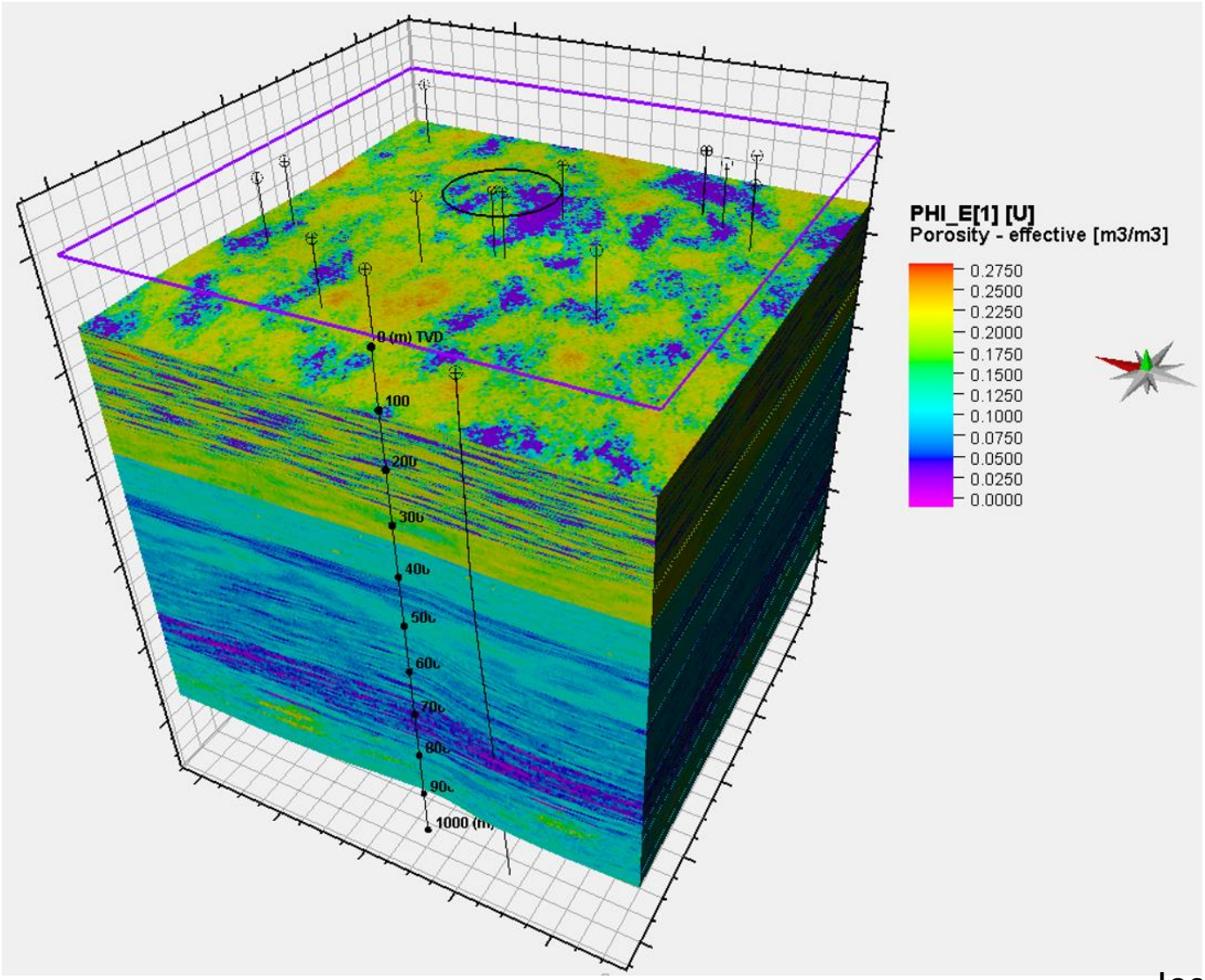
CaMI FRS geostatic model



Jessica Dongas

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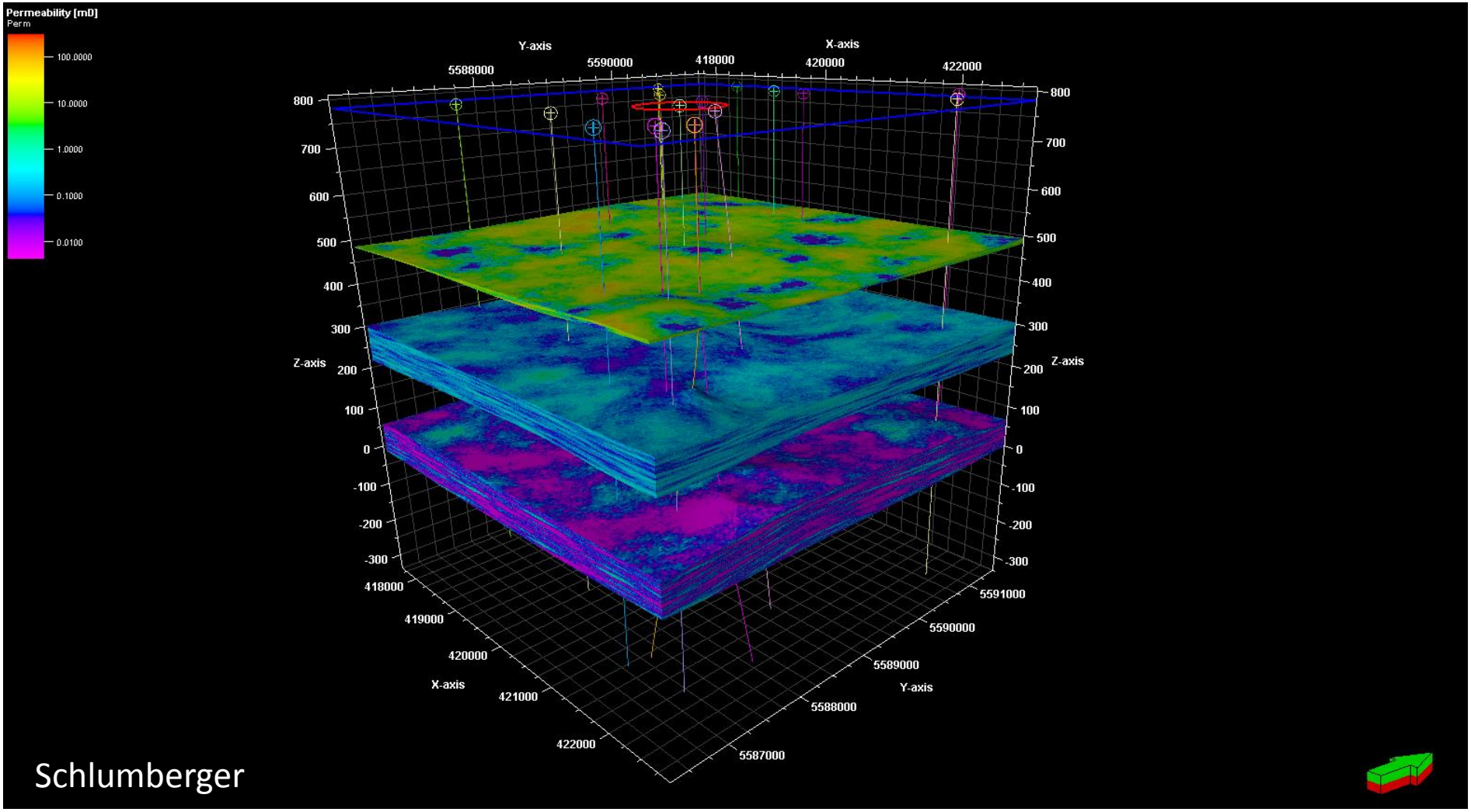
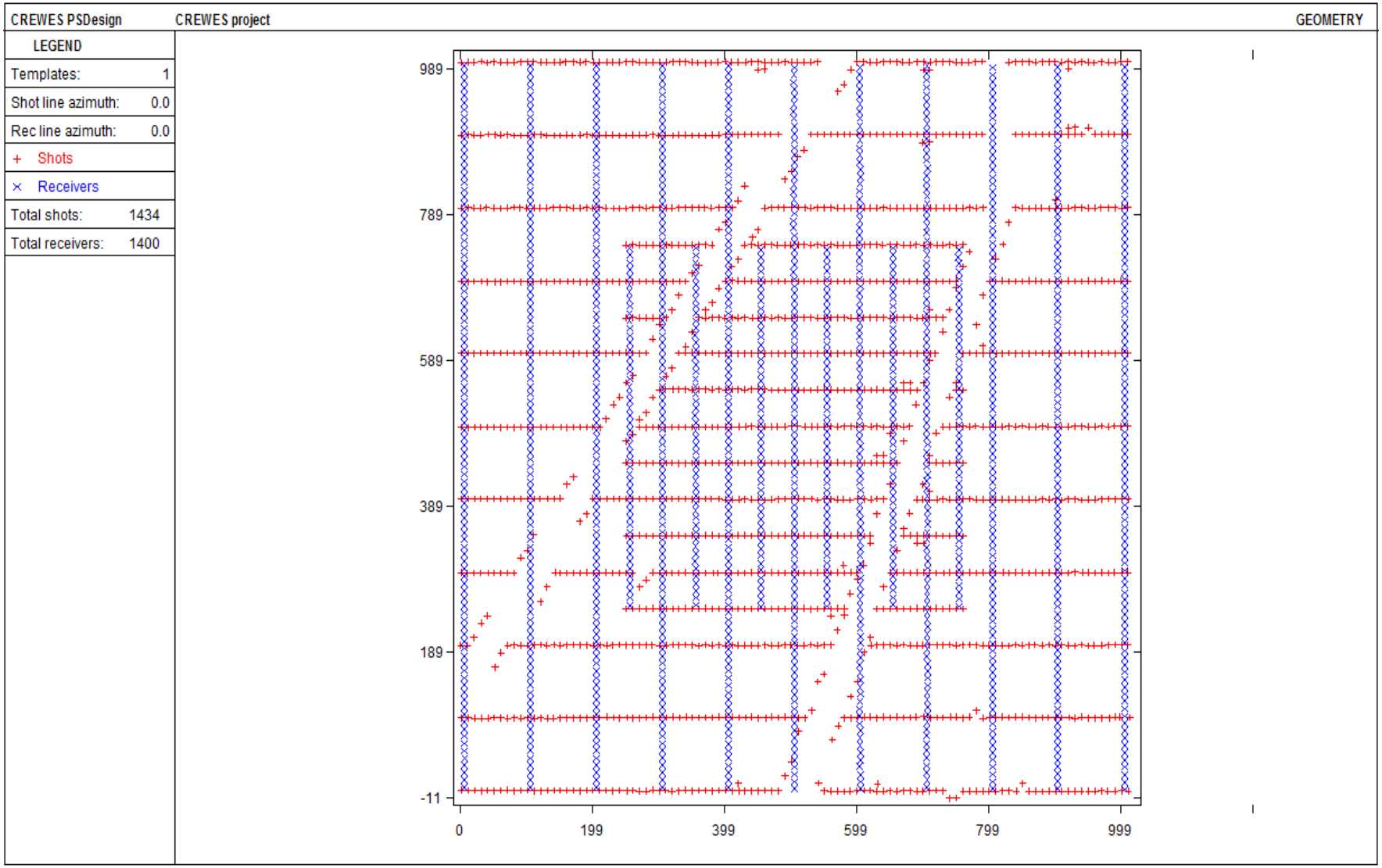
CaMI FRS project



Schlumberger

FRS baseline seismic program



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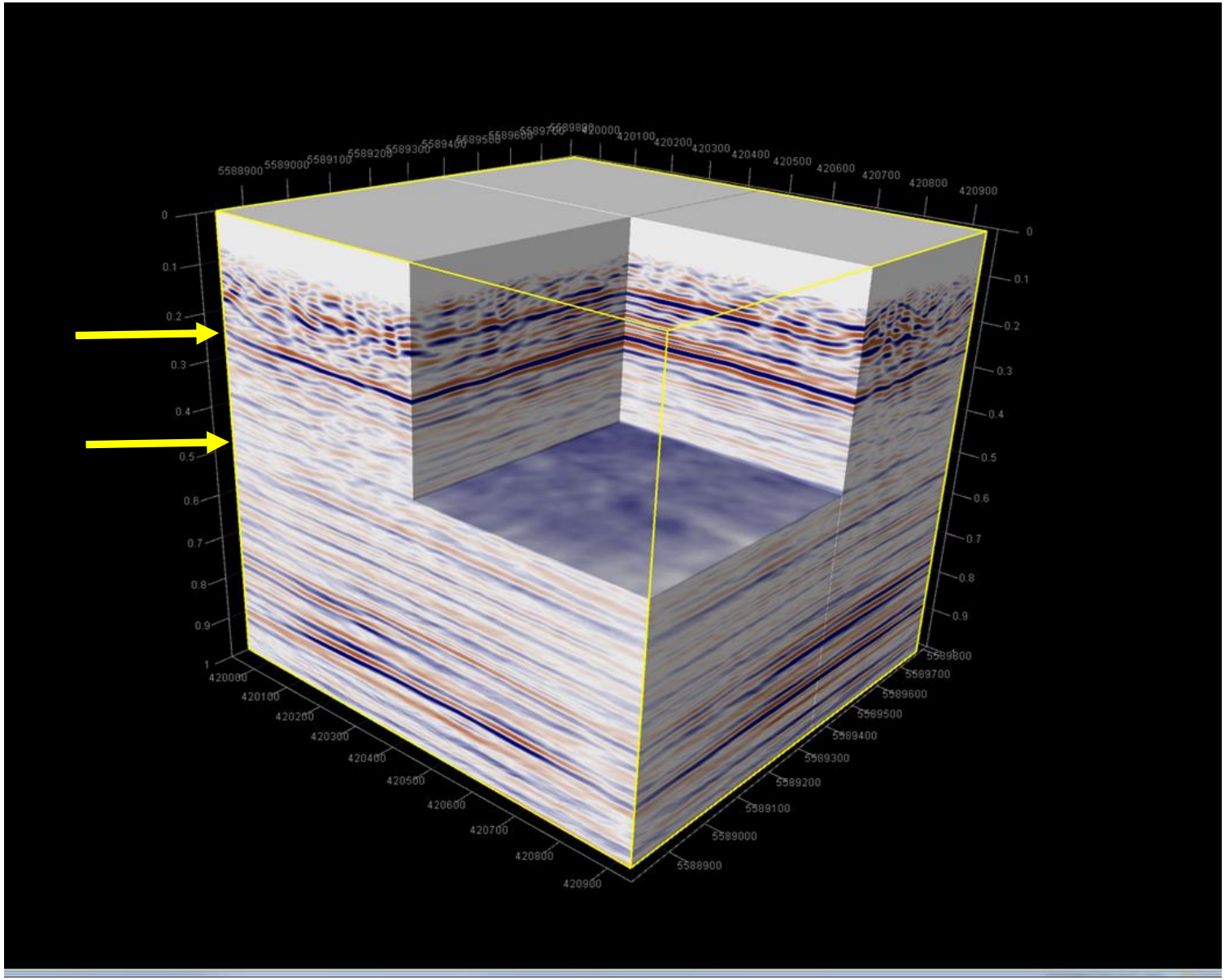
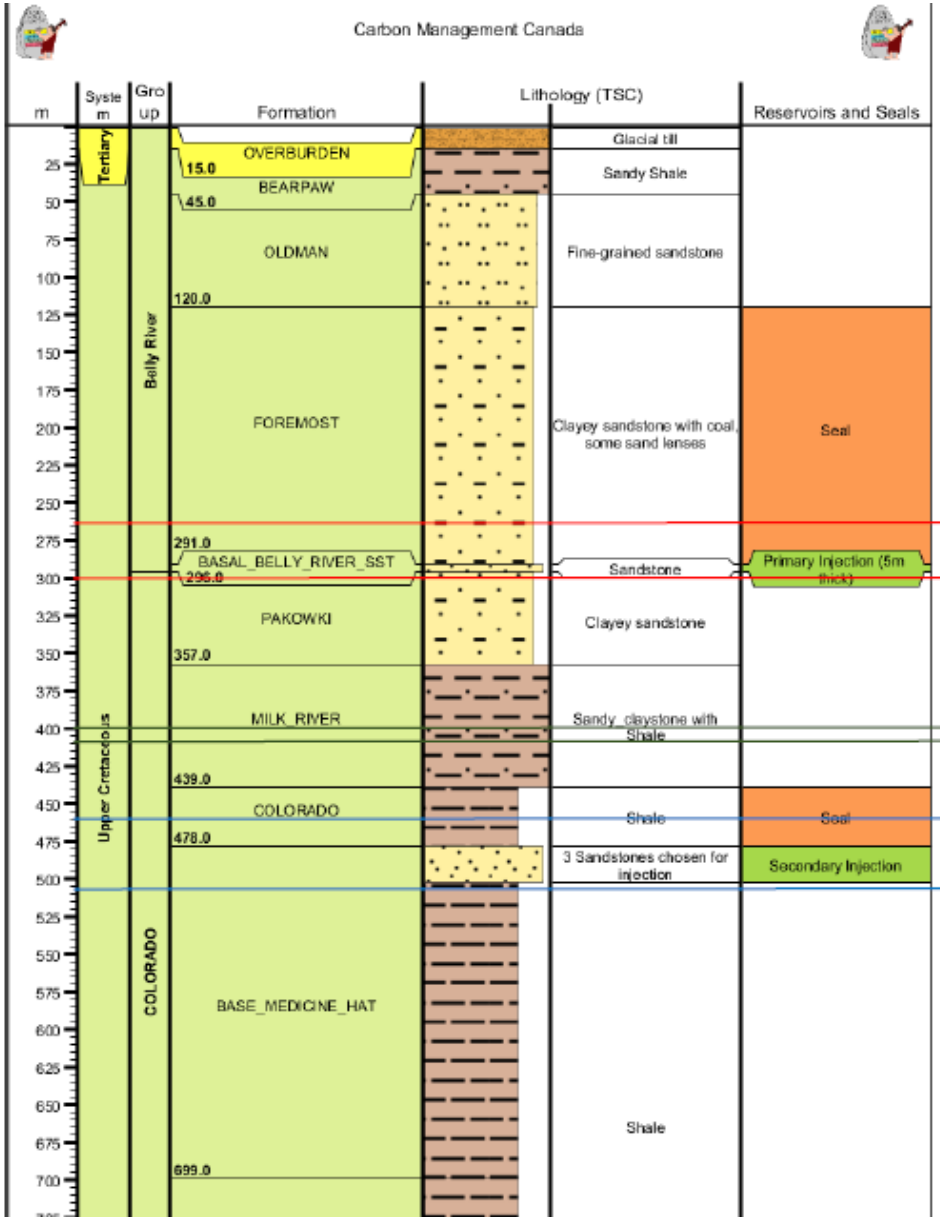
FRS baseline seismic program



FRS proposed cores well#1



CaMI.FRS
Proposed core intervals
Sept 11, 2014

Core zone 1: 264 – 300 m

Core zone 2: 400 – 409 m

Core zone 3: 462 – 507 m

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Schedule

- Q1 2014: Consult with AER on regulatory requirements.
- Q1 2014: Public outreach and consultation program.
- Q2 2014: Completion of reprocessing and assessment of existing seismic data.
- Q2 2014: Planning of baseline water well sampling program.
- Q2 2014: Completion of pre-drilling geostatic model #1 and simulation.
- Q2 2014: Completion of well design.
- Q2 2014: Execution of new baseline seismic program.
- Q2-Q3 2014: Completion of baseline water well review program.
- Q4 2014: Completion of the drilling application.
- Q4 2014: Drilling program – well #1
- Q1 2015: Geostatic model #2.
- Q1 2015: Injection permitting.
- Q2-Q3 2015: Completion of injection and observation wells.

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Summary

- Field site selected, east-central Alberta
- CaMI Field Research Site Capex $9 million CDN
- FRS design plan developed with Schlumberger Carbon Services
- Outreach program in progress – completed in 2014
- Well #1 permitting in progress – completion imminent
- Well drilling and infrastructure emplaced: 2015
- Other field sites proposed - network

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