

Lotsberg Salt Formation – Solution-mined Cavern for SAGD Solid Waste disposal, Cold Lake, Alberta.

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Summary

Osum Oil Sands Corp. proposed Taiga Project near Cold Lake, Alberta (Figure 1) will produce oil from the Lower Grand Rapids and Clearwater formations using steam to mobilize the bitumen. Although the project will incorporate a brackish water source and water recycling, solid and liquid waste disposal will be required throughout the life of the project. Liquid waste will be disposed of to the Granite Wash, and solid waste (also called irreducible waste) will be disposed of in a series of solution-mined salt caverns near the plant-site (Figure 2). The caverns will be hosted in the Lotsberg Formation, an Early Devonian Elk Point Group evaporite which measures up to 200 m in thickness at a depth of 900m in the project area. Composed mainly of halite, with some minor anhydrite and dolomite beds, and disseminated red and green shales, the Lotsberg is ideal for cavern creation. A 150 m core was acquired at the 100/09-06-066-01W4/00 well location through the Lotsberg and overlying formations of the Contact Rapids, Cold Lake, and Ernestina Lake, in order to model and evaluate the rock for solution mining. Geomechanical testing was completed on the overlying strata for structural stability, surface subsidence, tensile and hydraulic fracturing, salt creep and potential dilation during mining and operation of the salt cavern. In addition, detailed core description (Figure 3) and leaching rate testing were undertaken.

The proposed salt cavern(s) will be developed over many years. A washing program to continuously inject brackish water will be implemented prior to production operations to create the cavern. Wash pumps will be used to inject warm brackish water into the salt cavern to dissolve the salt and form the desired cavern size prior to injection of waste material. It is estimated that 1 m³ of salt will be washed away with every 8 m³ of brackish water injected. From geomechanical modeling, it's possible to create the cavern with a maximum radius of approximately 70 meters, to a depth of 110 meters, and a design volume of up to 600,000 cubic meters.

Cavern development can be hindered by the insoluble materials found interbedded within the halite. The following factors are relevant to the leaching process:

- 1) Volume of solids. A mineral content of 20 % by volume is accepted as a limiting value. Higher solid content and the nature of its dispersal can significantly inhibit the leaching process and limit cavern volume;
- 2) Mineralogical composition. Variations in physical and chemical properties such as water absorption, decomposition, and hardness, can affect changes in volume and integrity of the cavern; and
- 3) Continuity of insoluble horizons. Shale and anhydrite layers that are thicker than 5 cm can have a negative influence on cavern shape and can cause irregular, unleached collars within the cavern.

Osum has determined through detailed core analysis that the Lotsberg Salt Formation at this location provides an excellent host for salt cavern development. The Lotsberg is almost entirely composed of pure soluble halite, with thin beds green and red shale, and some minor disseminated shales (Figure 4). Geomechanical testing and modeling has determined that excellent conditions exist regarding cavern stability, unlikely tensile fracturing and planar discontinuities, and little to no subsidence and creep closure rates.

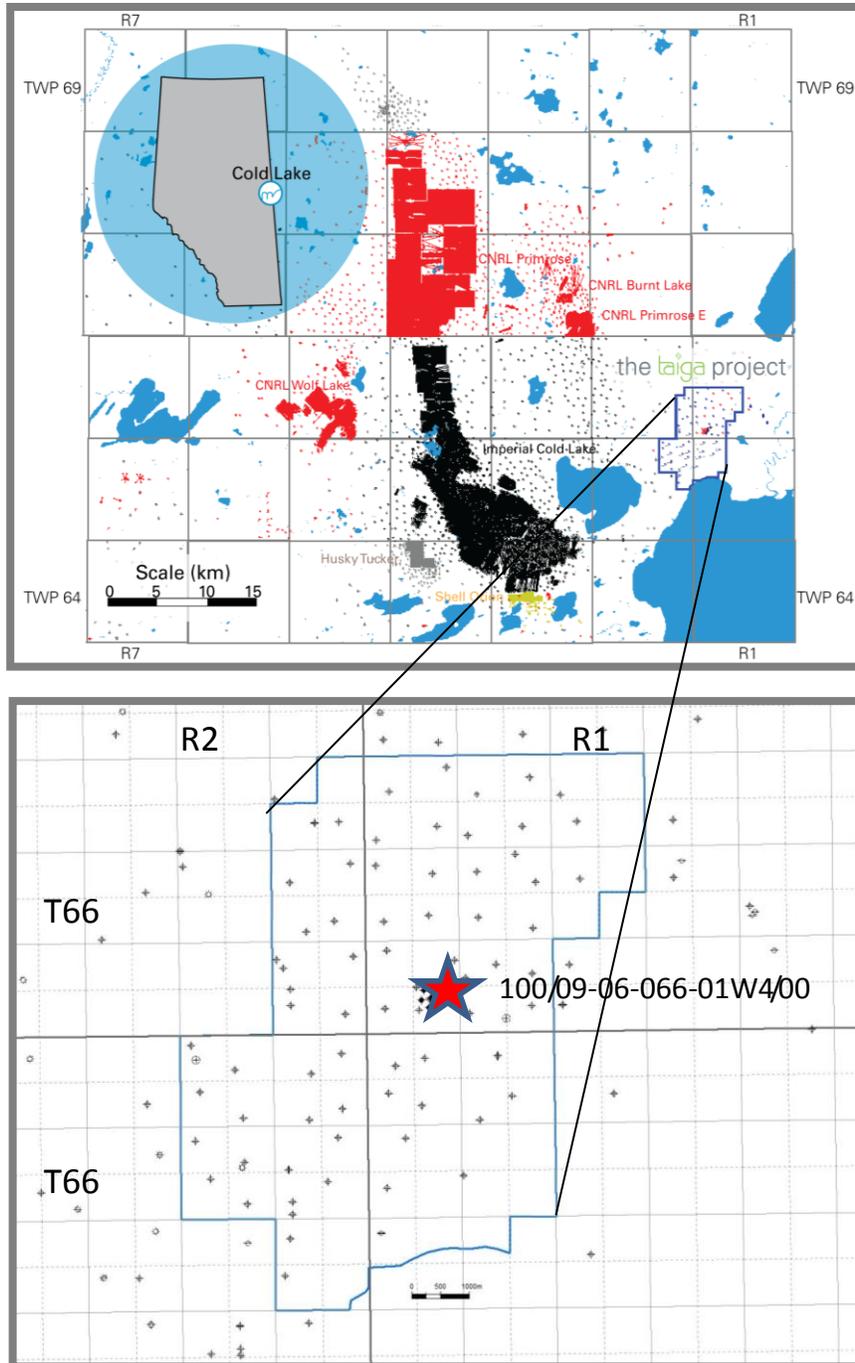


Figure 1: Location map of Osum's Taiga Project near Cold Lake, Alberta.

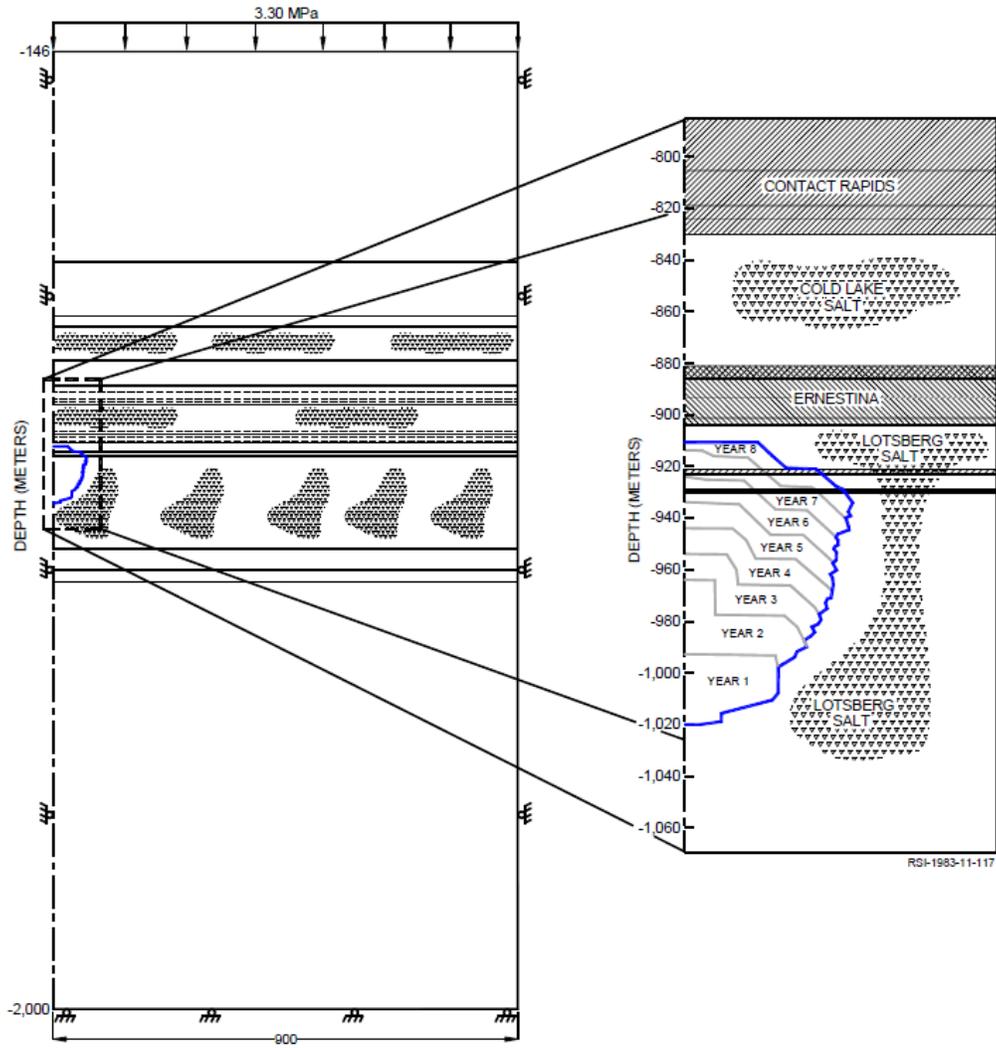


Figure 2: Schematic of the Osum Solution-Mined Disposal Cavern Design.

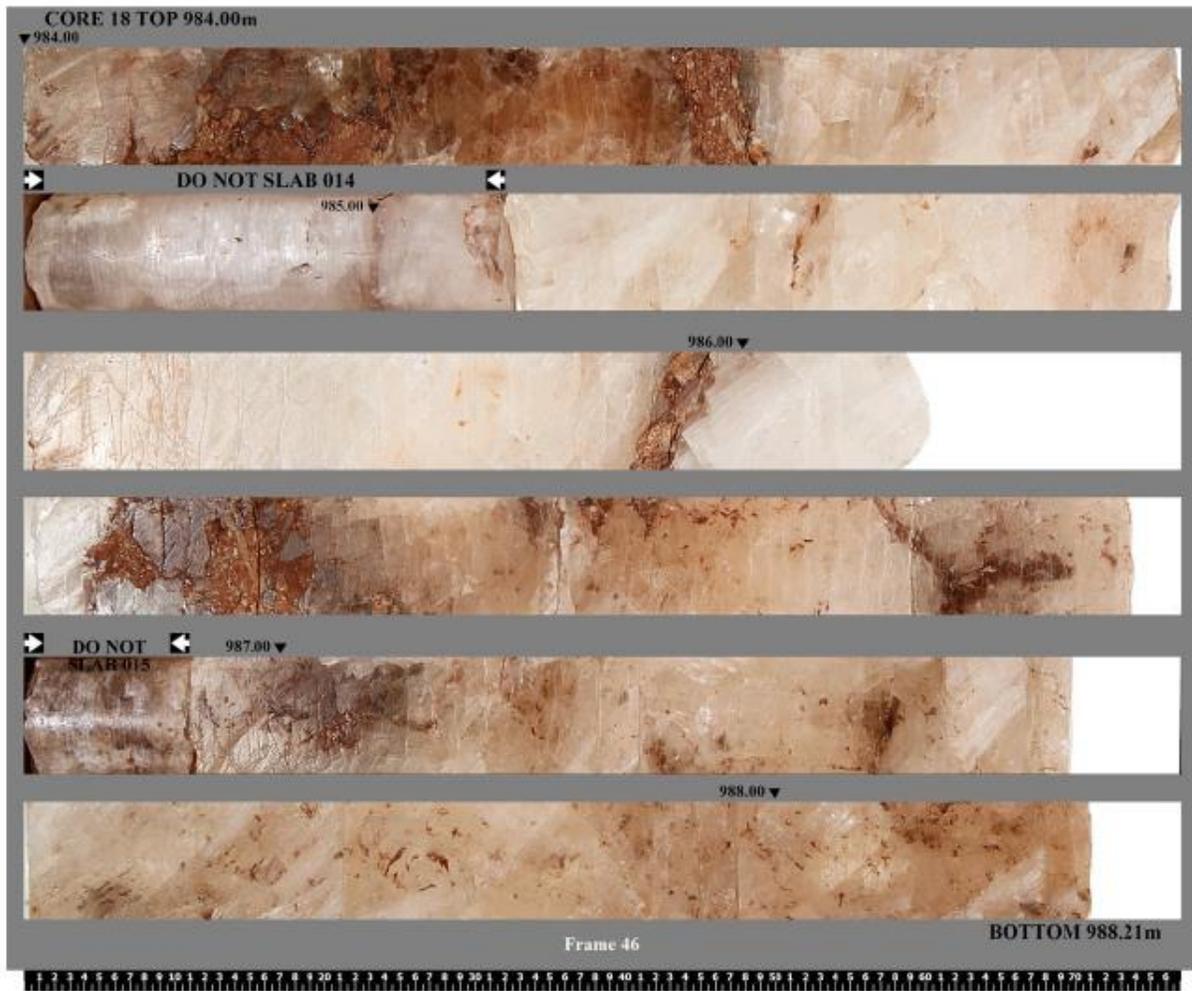


Figure 4: Slabbed Core Image Lotsberg Salt Formation, pure halite crystals with specks of disseminated red shale, location 100/09-06-066-01W4/00.