The Upper Devonian Grosmont Formation in northeast Alberta contains a giant heavy-oil (bitumen) reservoir that is juxtaposed against the Athabasca tar sand deposit. Most Grosmont reservoir rocks are heterogeneous dolostones that contain significant primary and various types of secondary porosity. In a study area between Townships 80 to 95 and Ranges 16W4 to 25W4 (Figure 1), logs from about 200 wells and cores from about 50 wells have been studied with the objective to identify favourable sites for the thermal recovery of bitumen.

Facies analysis identified seven lithofacies types that range from basinal mudstone/shale facies to peritidal carbonates. Thin mudstone beds [so-called 'shale breaks'] subdivide the Grosmont reservoir into four intervals, i.e., Lower Grosmont [LGM] and Upper Grosmont 1, 2, and 3 [UGM1, UGM2, UGM3] (Figure 2). The primary porosity and permeability distributions were significantly modified by diagenesis, particularly by dolomitization and karstification. The reservoir now consists of three major ‘diagenetic’ zones (Figure 2). Zone I, encompassing most of the LGM and much of the UGM1, is dominated by limestones that have low average porosities [1 to 5 %] and low permeabilities [commonly 1 to 100 md]. Zone II, encompassing much of the UGM2 and parts of the UGM3, is dominated by dolostones with enhanced porosity [average of 10 to 20%, in places up to 45%] and higher permeabilities [commonly 1 to 1000 md]. Zone III is the karstified, upper part of the reservoir that contains meter-sized caverns and channels. The best pay generally is in Zone II.

Computerized well log analysis was used to generate a suite of structure, isopach, cave, porosity, net pay, isoporosity, and hydrocarbon pore volume maps. As a result, 'recommendation maps' which identify locations favorable for steam injection have been constructed for the Grosmont Formation, as well as for the overlying Upper Ireton and Nisku Formation. Generally, steam stimulation sites should be placed in locations where (i) there are no thief zones, (ii) the hydrocarbon pore volume (HPV = product of net pay, porosity, and bitumen saturation) is greater than 2 m, and (iii) there is no gas. Accordingly, one of the most promising zones is the UGM2 (Figure 3) for which shale break 3 [SB-3] is expected to act as a top seal that contains the injected steam energy. However, injected steam is likely to escape upwards via fractures in SB-3 [SB-3 thief zones].