

**Facies Architecture of Lowstand, Transgressive, and Highstand Systems Tracts in the Upper Devonian Lock Haven Formation, Council Run Field, North-Central Pennsylvania**

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The Council Run Field of north-central Pennsylvania is one of the most productive natural gas fields in the central Appalachian basin. Reservoir sandstones at Council Run belong to the Upper Devonian Catskill and Lock Haven Formations. The principal reservoirs are informally named the Fifth Elk, Fourth Elk, basal Bradford, and Third Bradford sandstones. The first three of these sandstones occur within a distinct fourth-order type 1 stratigraphic sequence that begins at the base of the Fifth Elk sandstone and ends at the base of the Third Bradford sandstone. The stacking pattern of sandstones within this sequence defines lowstand, transgressive, and highstand systems tracts. Systems tracts recognized in the subsurface at Council Run field can be correlated to outcrops along the Allegheny structural front southeast of the field.

The discovery well at Council Run field produced solely from the Fifth Elk sandstone and this interval has remained among the most prolific reservoir horizons in portions of the field. Core and FMS data, in conjunction with well log and map interpretations, reveal that the Fifth Elk interval consists of multiple coarsening upward parasequences deposited in deltaic and near shore environments of the lowstand systems tract during a forced regression. Specifically, the Fifth Elk sandstone in the field mostly consists of two distinct upward coarsening facies associations capped by marine flooding surfaces. Limited fining upward parasequences within a restricted portion of Council Run field might represent remnants of the original distributary channel fill.

Strata equivalent to the Fifth Elk sandstone crop out along the Allegheny front southeast, or landward, of the Council Run field. The exposed strata were deposited in strictly marine to beach environments. There is no evidence for coeval delta plain facies. Drilling and seismic exploration have not yielded any evidence of Fifth Elk distributary channels or any other significant sandy facies between Council Run and the front. Coeval alluvial plain deposits landward of the lowstand shorelines may have been thin due to sedimentary bypass or removed through ravinement erosion during a subsequent transgression.