HIGH FALLS LANDSLIDE: A FAILURE IN LOW ACTIVITY CLAYS FROM THE NORTHERN ONTARIO CLAY BELT

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Abstract

Heavy and prolonged rainfall during the spring of 1995, combined with an unusually rapid snowmelt, is strongly implicated as a triggering mechanism for a large failure at the High Falls water control dam, on the Frederick House River, northeast of Timmins. The failure produced approximately 8,000 to 10,000 cubic metres of clayey silt debris. Since the initial failure, the exposed slope is very unstable and continues to fail on a yearly basis.

There are several contributing factors attributing to instability. The perched water table that overlies the impermeable clayey Quaternary sediments affects the natural pore pressure and induces changes in shear strength, especially during abnormally wet seasons. The famous “Timmins Flood of ‘96” caused additional failure on the exposed and oversteepened slope. Weathering of intact clayey sediments occurs not only at the top of the sediment pile but at the exposed face as well. This causes the drying and jointing of the scarp resulting in the desiccation and exfoliation of the till, and subsequently oversteepening of the upper slope. A concave slope profile forms with colluvium build-up greatest at the base of the concavity. The colluvial drape effectively limits seepage, thereby further elevating the pore water pressure in the upper sediment profile. This repeating cycle of rapid weathering, consequent development of a colluvium layer and subsequent failure are inferred as the mechanism for the instability.

The Quaternary stratigraphy exposed at High Falls comprises a silty-sand compact basal till (Matheson Till) overlain by several metres of varved glaciolacustrine sediments (Lake Ojibway sediments). This is subsequently overlain by clay-rich, clast-poor till (Cochrane Till) which incorporated much of the underlying glaciolacustrine sediments. The glaciolacustrine clays and overlying till average more than 40% clay. Based on laboratory observations, the glaciolacustrine sediments and Cochrane Till are low expansion plastic clays with activity values < 0.5. Locally, relatively higher values (plasticity index) occur near the top of each stratigraphic unit. Moderate and high expansion clays (activity values > 0.5) are usually the culprits in slope failure so other aspects at this site are closely examined.