Rehabilitating the Hardy Dam for Stability and Seepage Control

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The Hardy Dam, located 5 km (3.10 miles) north of Atikokan, off of Highway 622, in northwestern Ontario, was constructed over Hancock Creek in 1957 as one of the water control structures of the former Steep Rock Mine. Potentially challenging, groundwater-related foundation conditions were identified at the northern third of the site prior to the dam's construction. The risks associated with those groundwater conditions were originally mitigated by installing a perforated pipe underdrain on the downstream side of the dam in the Hancock Creek bed and also by installing an impervious clay blanket on the upstream side of the dam. Investigative studies were completed at the dam in the 1980's as part of a transfer of ownership to the Ontario Ministry of Natural Resources and Forestry (OMNRF) and those studies found that: artesian groundwater conditions were evident along the entire site and that the north slope of the original Hancock Creek channel had become subject to ongoing seepage and blowouts. Several reverse filter granular toe berms had been constructed to remediate the north abutment seepage problems but observations of blow-outs and soil material migration continued. Follow-up studies were completed at the dam between 2007 and 2013 in an effort to develop a more permanent solution to the groundwater problem. It was confirmed that the mechanism driving adverse groundwater conditions at the site differed from the northern third of the site to the southern two-thirds of the site and, therefore, a groundwater depressurization system was installed at the north abutment area in 2013. The efficacy of this depressurization system has since been verified by reduced (and stabilized) porewater pressure measurements in the north abutment area and, more importantly, by a halt to the observations of foundation blowouts and soil material migration. Two dimensional finite element based seepage / slope stability models have also verified that: the north abutment area was analytically unstable prior to implementation of the depressurization system, the north abutment is now stable with its current foundation pressures, and that the main dam structure meets current Dam Safety criteria for seepage and stability.