# Indian Lake Dam Rehabilitation - Strengthening Aged Concrete and Stone Masonry for Post-Tension Anchoring

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Between 2012 and 2023 Engineering Assessments and Rehabilitation Design was completed for this large, high hazard dam that was originally built in 1898. The gravity dam structure has a cyclopean mass concrete core within a stone masonry exterior surface and is founded on rock. Evaluations concluded that the dam embankment crest level needed to be increased, and that the gravity concrete section required anchoring to meet regulatory requirements for safe performance. With the increase in embankment height, the supporting downstream side retaining wall also needed to be extended and strengthened to support the larger embankment. Major challenges included existing leakage through the dam that complicated consolidation grouting for post-tensioned anchor installations. Interior conditions of the dam concrete varied widely in integrity with extensive amounts of grout take, grout washout due to leakage, and wider-than-anticipated grout migration. The use of targeted tertiary holes was used to achieve confidence in the consolidation prior to post-tensioned anchor installation. The efforts of performing grouting extended past the designed restrictions on work window based on concurrent reservoir levels; this resulted in implementing additional monitoring controls to check against excess movement during grouting operations. For the support of the extended embankment retaining wall, inclined post-tensioned bar anchors were installed with steel casings extending between rock and the newly strengthened retaining wall to avoid damaging the existing wall. One installation challenge for the inclined P-T anchors was multiple anchors exhibiting creep beyond the PTI recommended allowable during performance and proof tests. These were reviewed for multiple considerations of issues and subsequently verified for acceptability with supplemental lift-off tests. An additional challenge encountered was having wires break during lift-off testing in one strand of an 8-strand 280kip (design load) post-tensioned anchor. Contractors engineer, the design engineer, and William's personnel were involved in allowing adjustment to acceptance criteria.