Relief Well Discharge: Measured vs. Estimated

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Well discharge can be estimated several ways during design of relief wells for underseepage control along levees. One analytical method is the United States Army Corps of Engineers (USACE) Blanket Theory. This one-dimensional methodology may be used for screening-level analysis, but may suffice for final design in simple geology and geometry. Two-dimensional finite element modeling is a more sophisticated tool for complex stratigraphy and geometry but requires more effort to develop and interpret. A three-dimensional, finite element groundwater model may be used for areas with complex geometry or stratigraphy and to incorporate regional features. Each method, regardless of the methodology used to engineer the relief well system, estimates the volume of water discharged at each relief well. Typically, relief well discharge must be managed and ultimately pumped back over the levee. The pump station engineer(s) relies on the geotechnical design to establish the volume of water from each relief well, and the pump station and conveyance system design are based on those values. The geotechnical design typically includes some uncertainties related to subsurface conditions, and some assumptions about relief well performance. The pump stations may be over- or under-sized if the designer does not understand this. We implemented a flow-monitoring program to measure selected relief well flows and compare against values from multiple underseepage analyses. Relief wells tributary to 3 operating pump stations were monitored in 2019, including during a 100-year Mississippi River flood. Several lessons were learned from the flow monitoring effort that will be useful to others installing new relief wells and estimating flow to pump stations.