

## **Are Your Drains Tip-Top or Just Getting By? Guidance for the Evaluation and Maintenance of Dam and Levee Drains, Relief Wells and Instrumentation.**

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All dams and levees hold back water, and so it follows that all dams and levees will experience some seepage. To control the dangers associated with seepage, dam designers incorporate water collection and pore water pressure relief elements in the design of earthen embankments and gravity structures. These include embankment drains, structure underdrains, and relief wells, as well as open-riser piezometers, weirs and flumes that allow for monitoring pore pressure conditions and measuring seepage discharge. These elements are at the heart of dam and levee safety and allow for safe operation through filtration, pressure relief, the controlled collection the safe disposal of the seepage. Since these elements are buried, it is all too easy to fall victim to an “out-of-sight, out-of-mind” mentality when it comes to their maintenance. Additionally, dam and levee owners, managers, and maintenance staff may be uncertain about the function of these elements and what level of maintenance is required. This presentation will remedy that with a summary of seepage principles and terminology, and describe the purposes and function of relief wells, drains, and piezometers. The discussion will then move on to common maintenance issues that can plague drains, well and piezometers and reduce their effectiveness. This will include examples of the types of deterioration and damage that can occur. Procedures for evaluating monitoring data and inspecting, testing, and repairing drainage features and piezometers will be discussed. Examples of equipment and procedures to evaluate and rehabilitate drainage features and instruments will be shown. The involvement of experienced professional guidance is always needed to avoid damage to these features, but much of the work can be performed by the local maintenance personnel using common equipment and even home-made tools. Examples and general guidance for developing a maintenance approach will be presented. This presentation is ideal for dam owners and their maintenance personnel but will also provide valuable insight for consulting engineers and scientists, and those focused on dam safety issues.