

RECLAMATION

Managing Water in the West

Proposed Experiment in Evaluating Filter Material and Water Chemistry for Potential of Promoting Bacterial Growth Resulting in Clogged Drains

Research and Development Office
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Final Report ST-2015-7101-1



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Mission Statements

The U.S. Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our future.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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EXECUTIVE SUMMARY

The goal of this S&T project was to develop recommendations for future studies into the conditions that promote bacterial growth in toe drains. An experiment was outlined to test how various filter materials and water chemistry conditions result in bacteria growth. The experimental methods were outlined and submitted to the Research and Development office for funding during FY2016 (Project ID: 3125). The research proposal was not funded. This report is a summary of that proposal and experiment.

Research Question

Bacterial grown in the drainage systems of embankment dams can clog drains resulting in costly repairs. What conditions promote this bacterial growth in drainage systems of embankment dams and how can we modify our evaluation of filter material to reduce the chance of bacterial growth and promote infrastructure reliability?

Mission Responsibility

Because there is no standard for evaluating gravel and sand for use as filter material, the current policy is to follow ASTM C295 (Standard Guide for Petrographic Examination of Aggregates for Concrete). There are special concerns for filter materials; therefore, C295 may be inadequate for this purpose. During 2013, several samples from clogged dam drains were submitted to the MERL Petrography Lab to determine the cause of the clogging. In most cases, the problem turned out to be sludge and mineral precipitates from iron and sulfur bacteria which thrive under certain conditions.

Research Strategy

The proposed experiment involves building ten toe drain models and testing five types of filter material. These proposed materials include quartz sand, sand samples used in two embankment dams with a history of drain clogging from bacterial growth (Los Banos and Mt. Elbert/Twin Lakes), and two sand sources proposed for use in the Lake Isabella dam. Each sand sample will be autoclaved before being placed in two toe drain models, one control and one treatment. Each of the five control toe drains will include tap water, while a sample of bacteria-bearing water from an acid-mine drainage in Idaho Springs will be introduced to the five treatment models. Bacterial growth will be monitored for six months to one

year. Results will be documented with photos, graphs, and tables and a final report.

In addition to the proposed experiment, a literature review should be conducted to determine levels of iron sulfide and other iron- and sulfur-bearing minerals that would induce bacterial growth and set a standard for acceptable levels of these minerals, as well as the water chemistry necessary for their growth. The ultimate goal would be to incorporate these results into a new standard for the petrographic evaluation of gravel and sand for use as filter material.

Need and Benefit

In the past several years, many samples from clogged dam drains were submitted to the MERL Petrography Lab to determine the cause of the clogging. In most cases, the problem turned out to be sludge and mineral precipitates from iron and sulfur bacteria which thrive under certain conditions. There is currently no ASTM standard for the petrographic evaluation of sand as filter material in embankment dams. The proposed experiment was designed to determine what types of rocks and minerals promote the growth of bacteria that clog drains.