

## Research Update

S&T Program Project ID 7688  
Bulletin 2017-10

### Bottom Line

This research project used a laboratory fixture to test different repair methods for sealing leaking contraction joints in dams. These methods included sawdust, chemical grout, and ground-up hydrophilic waterstop.

### Better, Faster, Cheaper

Conventional leaking contraction joint repair methods are either very expensive or do not last long. This research has validated an inexpensive method to deliver repair materials deep underwater.

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## Evaluating Methods to Seal Leaking Contraction Joints in Dams

*Pumping ground-up hydrophilic waterstop and chemical grout down the upstream face of a dam may be a viable solution for repairing leaking contraction joints*

### Problem

Many Reclamation structures in use are past their design life. Waterstops are used between concrete blocks to keep water out of structures, and some of Reclamation's dams have damaged and worn out waterstops. Once waterstops are damaged, water infiltrates the structure, which can lead to corroded metalwork and increase operating costs through increased pumping. Water can also infiltrate lift lines, which can increase uplift pressures and contribute to structural instability. In addition, this water can reduce worker productivity, as work has to be managed around these leaks.

Previous work has attempted to stop these leaks using chemical grouts. Traditional methods require divers and specialized equipment to inject the grout at the correct location. In many cases, these grouts are unsuccessful because water leaking through contraction joints flows at such a high velocity that the grout does not have time to set.

### Solution

From previous research, a novel, inexpensive method was used to deliver a ground-up hydrophilic waterstop in close proximity to a leaking contraction joint. While the leaks were reduced significantly, they eventually increased because the ground-up hydrophilic waterstop was not sticky and fell off, or was sucked into the joint.

This Reclamation Science and Technology Program research project tested and evaluated different repair methods. These methods included sawdust, hydrophilic



*Ground-up hydrophilic waterstop before water was added (left) and after water was added (right). The cups contained the same volume of waterstop prior to activation.*

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waterstop chips, chemical grouts used for sealing water leakage through concrete, and combinations of chips and grouts.

The Concrete, Geotechnical, and Structural Laboratory in Reclamation's Technical Service Center built a fixture to recreate this same type of leaking contraction joint so that the different repair methods could be tested and evaluated. Results from testing indicate that the use of this ground-up hydrophilic waterstop in conjunction with chemical grout completely sealed the leaking contraction joint in the laboratory fixture.

## Application and Results

Testing on the mockup contraction joint in the laboratory fixture and at Grand Coulee Dam, Washington, shows that the use of this ground-up hydrophilic waterstop material is a viable, low-cost repair solution for sealing leaking contraction joints with large flows. The research testing showed:

- The chips lodged in the joint and expanded. This significantly slowed the waterflow.
- The chips alone are incapable of completely stopping the flow of water in a joint.
- The addition of chemical grout can be useful in completely stopping the waterflow.
- The addition of chemical grout is successful in bonding the chips together.
- The addition of chemical grout allows the chips to stay in place once the water pressure is reduced, and it could possibly hold the chips in place in dams that experience vibrations like those from power generation.

## Future Plans

Reclamation researchers recommend a field trial to test this approach on an active leaking contraction joint. However, for a field trial, there are a few additional items to consider:

- Grout that flows through the joint and does not react until it reaches the gutters in the galleries must to be collected.
- Filters will be needed in the drainage gutters to collect this grout once it reacts, and before it reaches sump pumps.
- Some of the grout will not flow into the joint and will instead react in the reservoir. This grout will float to the top of the reservoir and should be collected.

***“Some Reclamation dams have contraction joints that leak large amounts of water. This water can be a pain to deal with. The most commonly used methods for sealing these leaks are not a long-term solution (such as putting sawdust or manure into the reservoir) or are expensive (such as drilling a core hole down the length of the joint and placing expansive hydrophilic cylinders in the hole).***

***We developed an inexpensive way to seal these leaks. This is accomplished by pumping ground-up hydrophilic waterstop and chemical grout down the upstream face of a dam in front of a leaking contraction joint, and letting the flowing water carry the waterstop and grout into the joint.”***

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## Collaborators

**Reclamation:**

- Technical Service Center
- Grand Coulee Dam in Pacific Northwest Region

## More Information

[www.usbr.gov/research/projects/detail.cfm?id=7688](http://www.usbr.gov/research/projects/detail.cfm?id=7688)

[www.usbr.gov/research/projects/researcher.cfm?id=2674](http://www.usbr.gov/research/projects/researcher.cfm?id=2674)