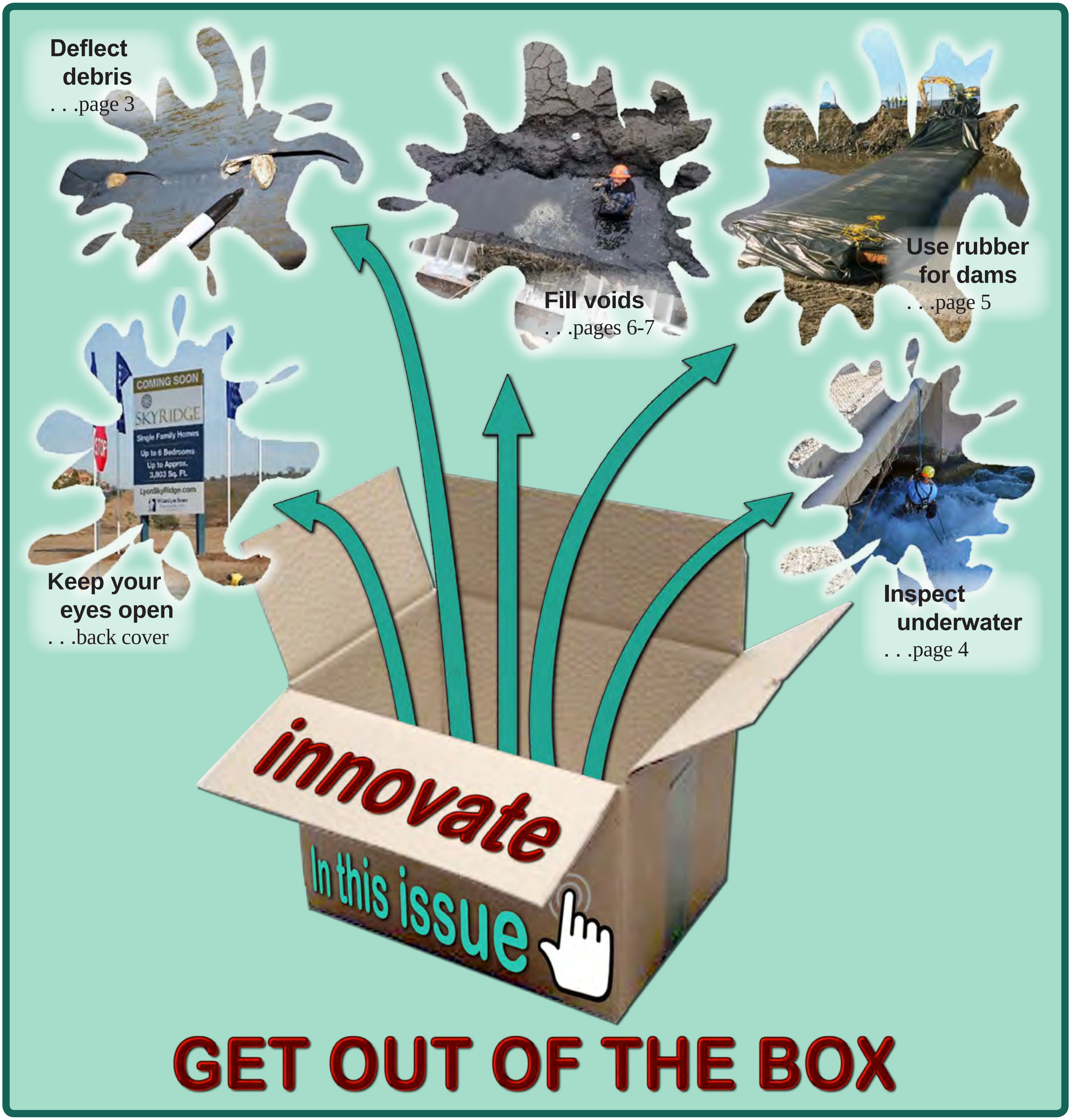
RECLAMATION
Managing Water in the West

Issue No. 243–Fall 2017

Water Operation and Maintenance Bulletin



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Thank you.

On the Covers:

Front: Find innovative solutions in this issue.

Back: Watch for new developments.

CONTENT

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Deflect that Debris—New deflector for intake lines

Debris entering cooling water systems at a pumping plant can create maintenance and operation headaches by reducing the proper water flow and pressure required to keep main unit pumps running. Strainers help minimize these issues, but certain types of debris (rocks, wood, and similar materials) can cause strainers to malfunction and bind-up or experience accelerated wear or damage. These conditions prevent the strainers from being able to properly backwash (self-clean), and the resulting reduction in system pressure or contamination leads to forced outages on pumping units in operation.

The Central Arizona Project (CAP) has historically faced these problems on certain pumping stations, particularly those with elevated sediment levels in the forebay. These plants also share a common design for the cooling water supply consisting of small (8 to 10-inch diameter) branch tees installed in the plant discharge manifolds (54 to 90-inch diameter). On a cross-section, these branch lines are at the side of the pipe (rather than the bottom)—a good design characteristic to minimize heavier debris and sediment loads from system entry. Additionally, flow velocity in the manifold at this area is approximately 10 – 12 feet per second, which also seems reasonable, yet both of these original design features still allow unwanted types of debris to get pulled into the side stream more frequently than desired.

CAP really struggled with this issue and looked at a wide variety of possible solutions, including different strainer designs and dredging options for cleaning forebays. These solutions were not very practical or cost effective due to design constraints (limited available space and piping layout in the case of alternative strainers) or short-lived results (in the case of dredging). The amount of time and resources required to implement these types of solutions was yet another drawback.

Then the CAP Engineering and Asset Management Teams brainstormed a simple "deflector shield" that could be installed inside the manifold. The team believed the shield would deflect the debris and redirect it back into the main flow stream, making it much more difficult to get pulled into the cooling water inlet. The entire design, fabrication, and installation was completed in-house.

Shortly after the first installation, plant teams reported a noticeable reduction in the type of strainer problems that they previously experienced. A slight drop in cooling water pressure was anticipated and confirmed (~ 3 pounds per square inch [psi]), but was more than acceptable due to the design pressures available and the benefits in reliability. Evaluations continued over the next year to ensure all seasonal cycles of debris were tested and a follow-up inspection could be performed on the deflector structure. In the end, overall results were highly favorable and the solution was considered a success.

CAP first installed deflectors as a pilot test at Little Harquahala Pumping Plant. These deflectors have since been installed at two other pumping plants and plans are in place to install them in four remaining plants that have similar issues.

First pilot installation, November 2013.

Seven months after installation. Note that the rocks are caught in the deflector drain ports—and out of the rest of the system.

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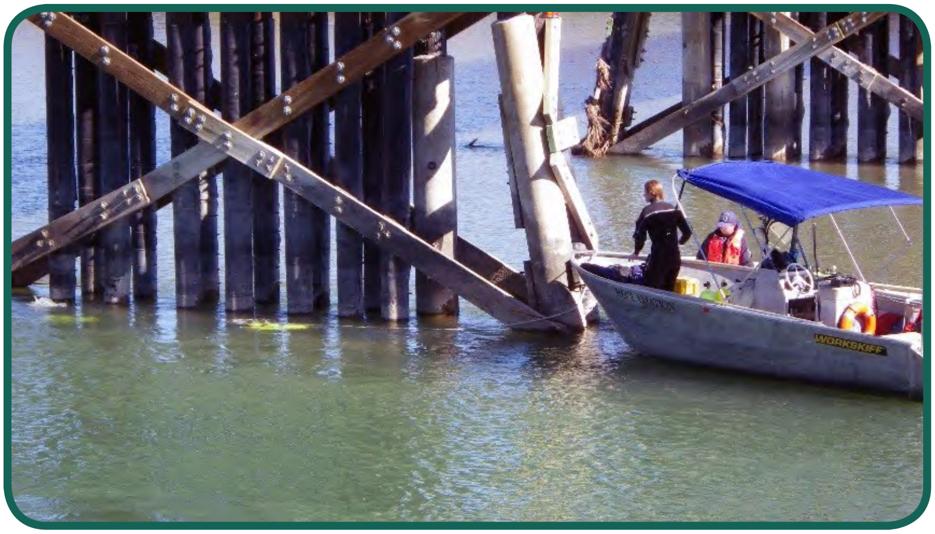
Dive Team: What's underneath the bridge?

In children's stories, there are trolls and monsters under bridges lurking down there to get you. In all of Reclamation's inspections, we've never come across any trolls—not even a miniscule monster. However, we have identified voids, cracks, and erosion problems early enough to address before they weaken and collapse the bridge.

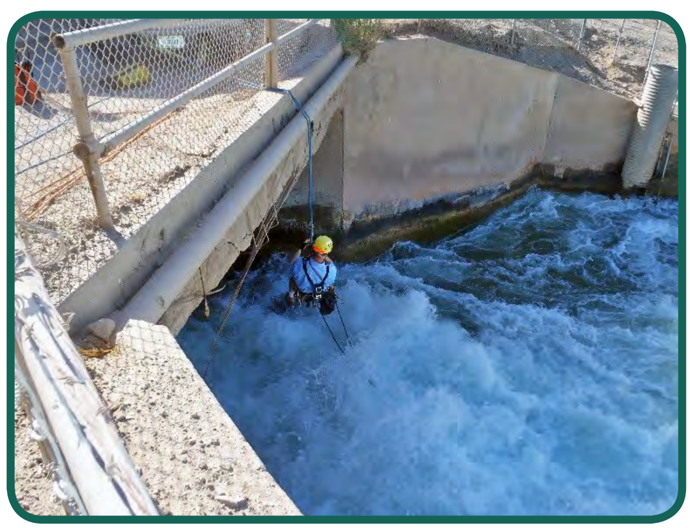


Top: Lower Cibola Bridge, California.

Right: Bridge on Friant-Kern Canal, California.

Reclamation's bridges undergo regular inspections as part of Reclamation's Review of Operations and Maintenance (RO&M) examinations. Most of the bridge structure is underwater—so Reclamation's dive team plunges in to inspect underwater elements. Divers look at and touch elements such as deck slabs, bearing devices, breast walls and columns, bearing seats, abutments, and foundations. They check for erosion and scour, settlement and deflections, obstructions and flow, and channel protection (usually concrete lining or rip rap added to protect the channel).

Each dive is carefully planned out, anticipating and planning for hazards with Dive Hazard and Job Hazard Analyses, which the dive team reviews and updates the day of the dive. All divers are required to be trained with current certifications in Diver First Aid, CPR, and Life Support and Live Saving.



Scott Foster on rope in California Wasteway in Yuma, Arizona.

For more information contact:

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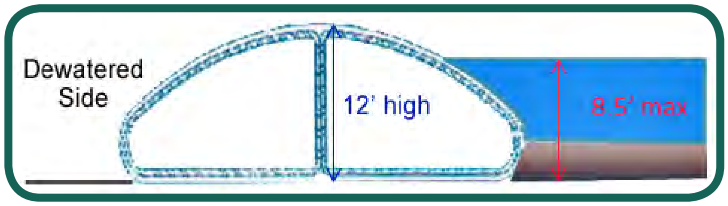
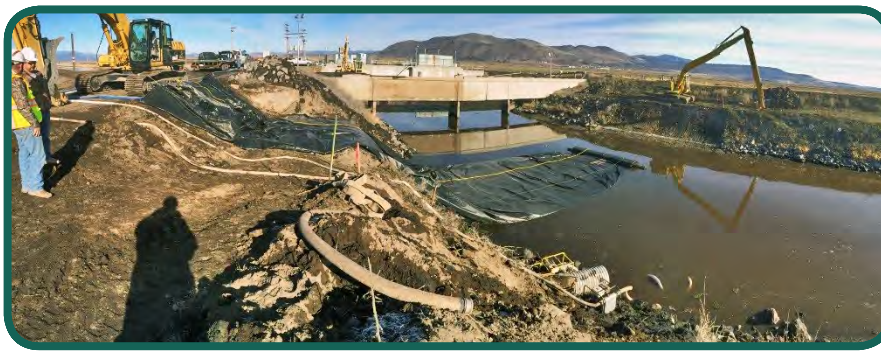
Rubber Dams: Use water instead of earth for cofferdams

When Pumping Plant EE in the Klamath Irrigation District in southern Oregon needed to be dewatered and repaired in 2014, the Klamath Irrigation District (KID) remembered the earthen dam they'd used on its sister pumping plant, E, in 2005 and thought "there must be a better way!" An earthen dam requires full environmental compliance documentation and can cost $20,000 to 30,000 with the compliance costs, haul and removal, etc. This process is also time-consuming as you have to build the dam.



Surely there had to be a better way, other than dumping so much material and then mucking it out again. And Reclamation's Klamath Basin Area Office found it: a water tube that can be used as a cofferdam. AquaDam is a portable, reusable tube, with an outer tube of high density woven geotextile and an inner polyethylene tube that holds water. Portable pumps fill it with water. The dam takes about 140,000 gallons to fill it to full height. This rubber dam can be deployed in hours, depending on how many pumps you can get to fill it. The one time cost was about $55,000 but the dam has been used for many applications, saving more money with each use.



The AquaDam was 143 feet long by 12 feet high and 25 feet across when inflated. It can be used in a straight line or as a "U" shape. It can even be deployed as an arch to seal a canal breach. The AquaDam can hold back 8½ feet of water and mud.

The inflatable cofferdam worked well. "While the dam can be rented, we bought the AquaDam as the number of times we have to use it makes the purchase well worth while," reported James Gale, Chief, Engineering Division, in Reclamation's Klamath Basin Area Office. "Tips we have learned include storing the AquaDam off the ground and protecting it from sun exposure. We also modify the deployment method and no longer allow the dam to freely roll down the bank after deployment. We modified this deployment so that it is safer for our staff."

For more information contact:

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Flowable Fill: A great way to fill trashrack voids

When Pumping Plant EE in the Klamath Project was dewatered in 2014, Reclamation found some rather large voids below the trashrack as well as in the front and back of the trashrack.

To fix the voids, Reclamation's Klamath Basin Area Office used Controlled Low-Strength Material (CLSM) for the repair in February 2014. CLSM, also known as flowable fill, is a mixture of aggregates and water, with just enough cement and fly ash to hold it together. The compressive strength of CLSM is similar to compacted soil. CLSM makes an excellent bedding material for pipe as well, because the mixture easily fills voids beneath the conduit and provides uniform support. This was also used to repair voids along parts on the C Flume, a concrete flume over 4,000 feet long.

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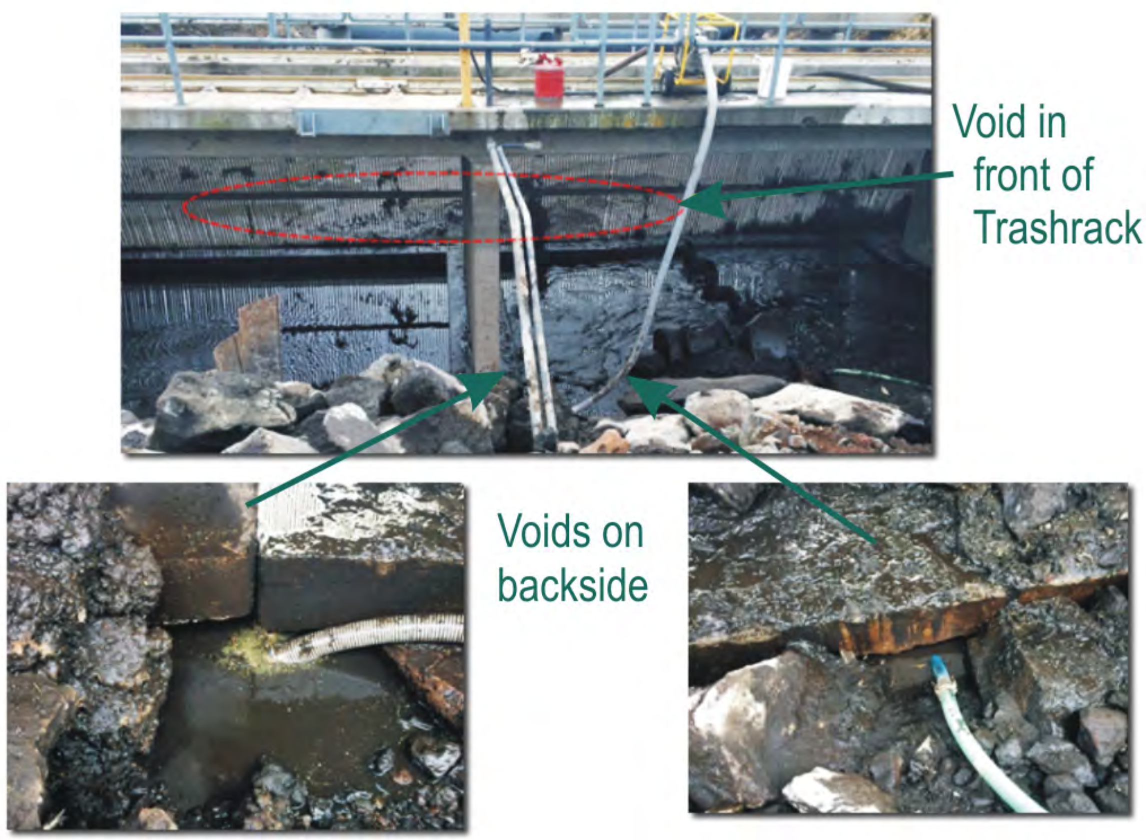

Trashrack void.

For more information contact:

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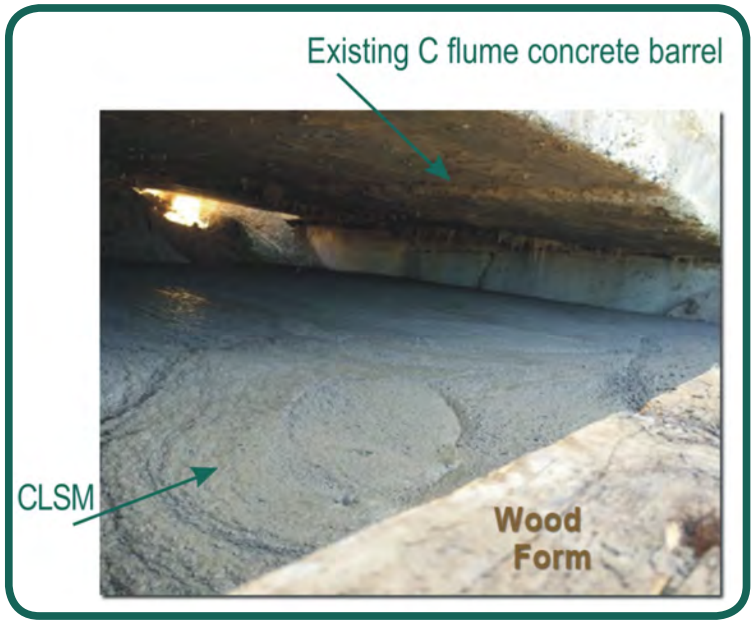
CLSM's advantages include:

- **Easy to place:** no compaction required (unlike soil backfill)
- **Strong and durable:** higher than compacted soil or granular fill, less erodible
- **Versatile:** Adjust mix per requirements
  - ◊ More water: flows better
  - ◊ More cement or fly ash: stronger
  - ◊ Admixtures to adjust cure time and other characteristics
- **Less inspection:** No compaction requirements
- **Won't settle:** Cures in several hours without voids so improper compaction and settlement are not issues

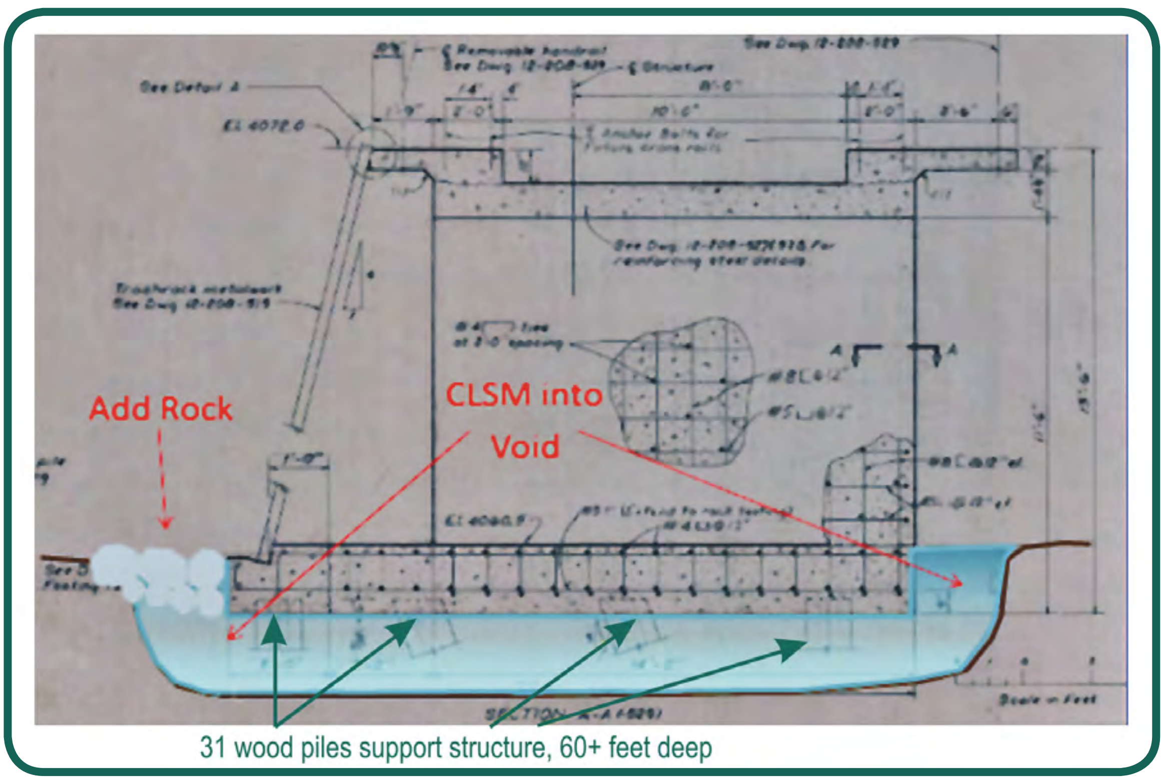


While concrete is stronger, CLSM flows more easily, is less expensive, and can be excavated.

James Gale, Chief, Engineering Division, in Reclamation's Klamath Basin Area Office sums up this experience with CLSM: "CLSM worked to fill the voids. This repair is still going strong after three years, and no more voids have been discovered below this trashrack."

Mix Comparison (3840 lbs total):

	CLSM	Concrete
Cement	150	502
Aggregate	2980	1555
Water	320	267
Sand	0	1516
Fly Ash	390	0
Strength	200 psi	3000 psi



Siphon Success: Installing new siphons at the East Columbia Basin Irrigation District

The East Columbia Basin Irrigation District (ECBID) is expanding to serve water to the higher elevation lands on the east side of the district In a partnership with Reclamation and Washington State's Dept of Ecology. The original canal design envisioned eventual upsizing to ultimate capacity for future development, but construction of the lower portion of the East Low Canal and siphons had originally been built only to a portion of the full capacity to carry initial flows.

Lind Coulee No. 2 showing the original pipe and the new pipe next to it.

Progress to add capacity required additional siphons to carry more water. In the sections of the canal that weren't built to full size, the inlet and outlet works had constructed two openings for anticipated expansion, but only one siphon per segment was built initially.

Reclamation's Technical Service Center (TSC) designed the new pipe for seven siphons. Funding limitations mandated constructing the new siphons separately. To begin efforts in 2010-11, Reclamation built the Weber Siphons with Mowat Construction using funds from the American Recovery and Reinvestment Act of 2009 (ARRA).

ECBID worked with the Washington State Department of Ecology on grants to expand the system. Rather than irrigators relying on irrigation wells in the declining Odessa aquifer, long-term replacement of irrigation water via the East Low Canal was proposed.

Warden Siphon Construction, 2016-17.

In 2012, the State of Washington awarded $26 million for canal expansion work, including canal widening. As a result, ECBID built Lind Coulee No. 1 and No. 2 and Warden Siphons in 2014-17 with several contracts (Rotschy Inc.).

ECBID oversaw the construction and used service agreements with Reclamation for design, construction expertise and review. Reclamation's Pacific Northwest Region construction engineering group provided an on-site engineer, Rusty Gigstead, who monitored progress throughout construction.

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The Lind Coulee No. 1 and No. 2 siphon project cost a total of $14.6 million and was completed on time and under budget. ECBID also contracted with Rotschy to build the Warden Siphon. Collaboration resulted in quality construction on both projects. ECBID staff met with TSC staff to develop lessons learned after each project, which allowed for refinement of the designs and specifications for the remaining siphons. Full expansion will require the final two siphons: Kansas Prairie No. 1 and No. 2, which are contingent upon funding.

On a synchronized path, ECBID widened 46 miles of canal by 12 to 25 feet in width; and removed 2,860,000 cubic yards of soil and rock. Work was performed at a substantial cost savings: $9.34 million actual cost compared to the $34.1 million estimate. Bridge improvements and new radial gates were also included.

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Connections

Problems and Solutions

We would like to hear from you and share information across Reclamation and across water districts: What questions do you want to ask? What answers and tips have you found that other districts could benefit from? Reclamation has technical experts and is working with many partners (including challenge.gov, other Federal agencies such as the U.S. Army Corps of Engineers, universities, state and local governments, and water districts) to address the challenges that water districts face today.

Help your fellow districts out by emailing your favorite tips to:

drowateroandm@usbr.gov.

Let's share information!

Give us your tips!

What are the best sensors and ways to measure water levels within a canal reach and at structures like weirs and flumes? This may depend on your climate (hot/dry vs. cold/humid), water quality, existing infrastructure (presence or lack of stilling wells), accuracy needs, durability requirements, and budget. What is your favorite way to measure water levels?

Research News

Reclamation's Research and Development Office conducts research into areas that can help water districts: addressing pipelines, embankments, corrosion, coatings, and more. See a partial list of research at:

www.usbr.gov/research/projects/categories.cfm.

In 2016, Reclamation conducted two prize competitions on challenge.gov, inviting anyone to help answer: how to detect internal erosion and how to stop burrowing rodents. In each of these competitions, we selected the five top solutions for awards as unique and creative ideas that, with additional development or trials, could enhance or improve current approaches. The next steps are to hold workshops to discuss these solutions and find ways to explore these solutions further (such as field tests and demonstrations). We welcome your participation and input into these workshops—and we are always looking for more solutions to these puzzlers. So please contact if you'd like to hear more about these ideas and if you want to be involved. Thanks!

Irrigation Leader

Mine the Irrigation Leader for some innovative solutions as well. The April 2017 issue brings back new ideas from New Zealand, the May 2017 issue features ideas on using hydropower for irrigation, and the June 2017 features articles on solving problems and modernizing aging infrastructure, including advances in pump technology.

Reclamation's Water O&M Bulletins

Reclamation's Water O&M Bulletins are great places to find innovative ideas and practical advice.

Check out our previous issues stemming back to 1952–or just browse our latest issues from this year:

www.usbr.gov/assetmanagement/WaterBulletins

Issue No. 240–December 2016: Aquatic Weeds, Concrete Cracks, Gates, Grout

Issue No. 242–June 2017: Training, SCADA, Concrete, Water Data, Good Neighbor Brochure.

Issue No. 241–March 2017: Lessons Learned Issue: Breaches and Failures and How to Avoid Them.

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U.S. Department of the Interior
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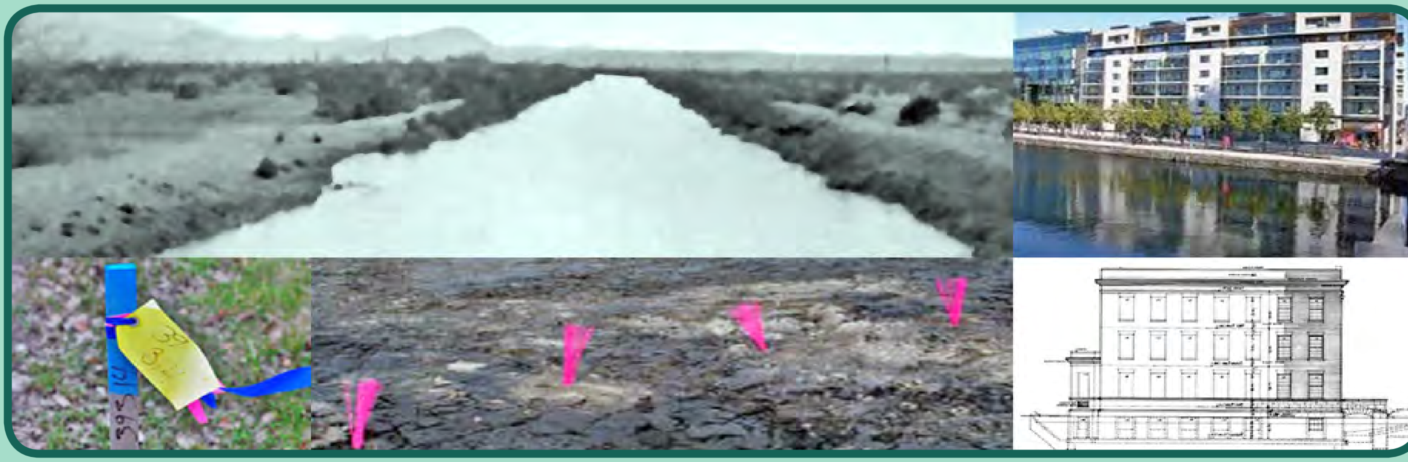
Watch for New Developments!



Development on the canals can lead to:

- **More risk to property and lives**
- **Blocked Operation & Maintenance access**
- **Embankment and material theft**
- **Embankment cut offs, which can cause a breach**

Watch for signs of development:

- **People surveying**
- **Advertisements, billboards, notices**
- **Survey stakes, whiskers, and marks**

What to do if you see signs of development:

- **Take pictures and ask questions**
- **Ask people what they are doing and get contacts**
- **Contact Reclamation**
- **Ensure that your water district and Reclamation coordinate with developers and local government**