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Instrumentation and Dam Safety

U.S. Department of the Interior

Content

Mission Statement

This *Water Operations and Maintenance Bulletin* is published quarterly through the Asset Management Division of the Dam Safety and Infrastructure Directorate. It serves as a medium to connect personnel who operate and maintain Bureau of Reclamation water supply systems.

History

The *Water Operations and Maintenance Bulletin* has been published quarterly since 1952. Past issues may be read and downloaded at Water Operations and Maintenance Bulletins, where you can also search the entire Bulletin database by subject.

Contact

We welcome suggestions for future issue topics, contributing authors, and comments on the Bulletin. Please direct all inquiries to drowateroandm@usbr.gov.

Cover photo: Lower Yellowstone Intake Diversion Weir, Headworks, and Fish Bypass Channel, Montana, July 2022 (Bureau of Reclamation).

Editor's Note

The Bureau of Reclamation (Reclamation) is perhaps best known for the dams it has built and operates and maintains. Ensuring dam safety is incredibly multi-faceted with work ranging from massive modification projects to extensive comprehensive reviews. This *Bulletin* focuses on monitoring, specifically instrumentation, and technological developments helping to ensure Reclamation's dams equip state-of-the-practice innovations to protect the safety of the public.

This fall issue features two articles from a four-person team of instrumentation subject matter experts. The first article discusses dam safety concerns at Altus Dam identified through visual inspections and instrumentation data, while the second article details automated instruments placed at Altus Dam and how they are being used to gauge the effectiveness of recent dam safety modifications. We are excited to include an overview of the Dam Safety Technology Development Program that also discusses two Technical Service Center projects funded through the program. And our seasonal operations and maintenance (O&M) article discusses fall maintenance best practices to undertake as cooler weather sets in.

For our Q&A, we were fortunate to interview Mark A. Treviño, Area Manager, Oklahoma-Texas Area Office. Treviño is Reclamation's current longest serving area manager, a distinction he'll relinquish when he retires in November. He sat down with us to reflect on his 44 years at Reclamation, area manager responsibilities, communicating with transferred works, and his extraordinary staff.

As always, thank you for reading!

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Around O&M

Asset Management Division O&M Interns

- O&M would like to thank our interns Dakota Gutierrez and Jeremy Huang for their excellent work this summer.
- Gutierrez's summer project documented needed Reclamation-owned bridge information to ensure compliance with new Specifications for the National Bridge Inventory standards, while Huang refactored the Enterprise Asset Registry into a SQL-Server database to make it more accessible, consistent, and efficient in leveraging foundational, high-quality data to other Reclamation asset information systems.

Enterprise Asset Registry

- The Trails Asset Class moved into Active Management on September 9, 2024, and is now available to all employees.
- Water Treatment Asset Class subject matter expert review intends to wrap up by the end of September 2024.
- Pumping Plant Asset Class should move to active management by the end of September 2024.

Field Visit to Columbia Basin Project, August 27–28, 2024

- Dam Safety and Infrastructure (DS&I) toured Grand Coulee Dam, recreation sites, and several water management projects in Washington's Columbia Basin Project in late August. It was an incredible opportunity to see the great work being done in the area and to remind ourselves of how our work impacts the field.
- DS&I wishes to thank the Columbia-Pacific Northwest Region for hosting us. Special thanks as well to the Ephrata Field Office, particularly Office Manager Marc Maynard and his team, for such an informative, well-organized, and lively tour!

DS&I field visit to Warden pumping plant, Columbia Basin Project, Washington, August 28, 2024.

Dam Safety Concerns Identified by Visual Inspections and Instrumentation Data

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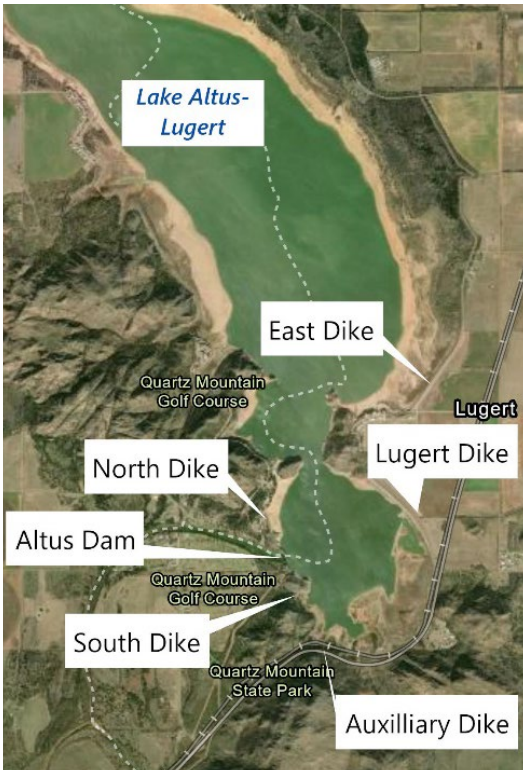


Aerial image of the vicinity of Lake Altus-Lugert, Oklahoma.

A small area of standing water was discovered downstream of Lugert Dike in December 2018 that expanded to 11 acres downstream of the Lugert and East Dikes as the reservoir was filled into the spring. Lugert and East Dikes are two of several earthen embankments, not including the gravity dam, that impound Lake Altus-Lugert, which is an approximately 150,000-acre-foot reservoir within the W.C. Austin Project in the southwestern corner of Oklahoma. The standing water was observed in an area typically covered by dense vegetation. Historically, when moisture was observed in this area, it was believed to be caused by surface runoff. Conditions in December 2018 were unique because the area was cleared of vegetation, the dike had been recently modified, and earthen material within the vicinity had been removed and used to construct dike modifications. Seepage conditions included numerous sand boils and potential sediment transport accompanied by abnormally high piezometer readings. What follows is a discussion of the seepage conditions that developed at Lugert Dike and East Dike. The design of an automatic data acquisition system (ADAS) is discussed in the subsequent article “Automated Instruments at Altus Dam.”

Wet area observed in December 2018 looking upstream toward Lugert Dike.

Safety of Dams (SOD) modifications constructed at Altus Dam and Dikes between the fall of 2016 and December 2018 (SOD 1) included raising the crest of the dikes and filling open trench drains located downstream of the Lugert and East Dikes with filter-protected subdrainage pipe. The reservoir was filled 25 feet between December 2018 and May 2019 to a new historic high level within the surcharge operations pool due to large storm events. Flood control and irrigation releases were able to bring the reservoir level down by mid-July. During this timeframe, performance of the dam and dikes was carefully monitored using first filling criteria published in early 2019. This performance monitoring effort was critical not only because of the abnormal seepage observed at the dikes but also because water-impounding features, like Altus Dam and Dikes, are at increased risk of an internal erosion-related incident when re-filled following modifications.

There are multiple types of instruments at the earthen and concrete impoundments. Additionally, the dam and dikes have a combined crest length of approximately 4 miles. The combination of instruments and crest length makes the facility challenging and time-consuming to monitor. During the 2019 first filling, monitoring efforts at the Lugert and East Dikes – not including the dam and other dikes – included visual observations along 3 miles of dike embankment and readings at 29 piezometers and 3 seepage measurement devices (e.g., weirs, flumes, pipes). Readings were required between once per month and twice per day depending on the reservoir level. In the 211 days between February 5 and September 4, 2019, this amounted to 78 visual inspections, 234 seepage measurements, and 2,262 piezometer readings. The Oklahoma-Texas Area Office (OTAO) and Lugert-Altus Irrigation District performed the surveillance and

Wet area and piezometer in June 2019 looking upstream toward Lugert Dike. The small pink pin flags indicate sand boils.

Both visual observations and piezometer data are important; however, piezometer data are useful because they provide a relatively more consistent means to evaluate if water pressure in the foundation is stable with respect to the reservoir, and they can be used to develop sophisticated models to help engineers understand the potential for internal erosion and design the associated modifications.

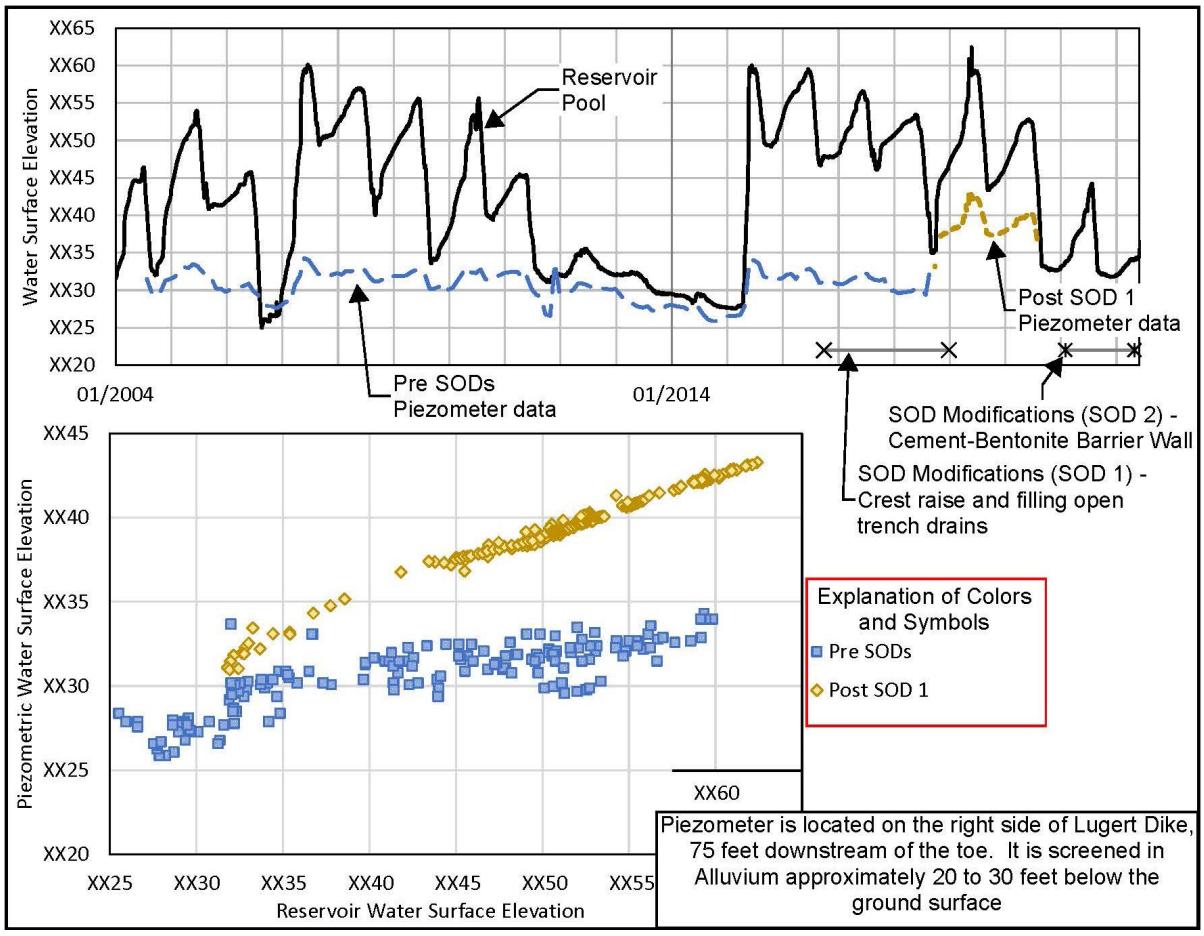
data gathering efforts. During the height of this event, OTAO's facility engineering staff of 6 were making alternating 12-hour tours to collect the instrumentation data and perform visual monitoring. The OTAO Job Hazard Analysis (JHA) required that two staff be present. Monitoring efforts were time consuming and expensive but provided a thorough understanding of site conditions.

Generally speaking, piezometers measure water pressure within subsurface materials. Example data from the project is presented on the following page for a piezometer downstream of the dam with a sensing zone in alluvium. These data are particularly important because data collection began prior to SOD 1 and shows that water pressure in the foundation increased at approximately the same time that the wet area was observed. This change in reservoir response is illustrated by the higher position of the yellow diamonds compared to the blue rectangles at a similar reservoir water surface elevation.

Instrumentation data and visual observations collected during the first filling provided key information for a risk analysis convened in June 2019, which concluded that the risk for internal erosion to occur through the foundation at both Lugert and East Dikes was above the Bureau of Reclamation's Public Protection Guidelines and that additional SOD modifications were necessary. A SOD modification was implemented between February 2021 and May 2022 (SOD 2), which consisted of a cement-bentonite barrier wall installed from the crest of the Lugert and East Dikes into bedrock.

Performance monitoring is a key aspect of dam safety, but it can be challenging to maintain vigilance over the many decades a dam is operated because, much of the time, inspections and data can appear to be benign.

Increased vigilance is necessary when modifications are constructed at an impoundment (dam or dike) or when the impoundment experiences a new or infrequent loading: first-fill reservoir levels, unusually high reservoir levels, earthquakes, etc. First-fill performance monitoring efforts at Altus were successful because they both identified visible adverse conditions and a change in the water pressure within foundation materials – conditions not visible to the naked eye. Furthermore, historic piezometer data were a key factor in understanding what transpired and the decision to construct a cement-bentonite barrier wall. Due to ongoing drought conditions, multi-season first filling was in progress at the time of publication, while performance monitoring has been enhanced with the automated system discussed in the next article.



Piezometer data versus time (top) and versus the reservoir (bottom left). These data illustrate the conditions prior to the SOD modifications and the adverse conditions that developed following SOD 1.

Automated Instruments at Altus Dam

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Automated systems have the potential to provide significant benefit to a monitoring program when the system is carefully designed and implemented by experienced personnel.

An automated system was implemented at Altus Dam in Oklahoma to obtain higher frequency data collection, reallocate staff time from data collection and processing to visual monitoring and other beneficial activities, provide an automatic comparison of readings to expected values (i.e., thresholds) in near-real-time, and provide notifications (call, email, or SMS) when readings are outside of these thresholds. The following discussion focuses on system design and provides a summary of data collected since construction was completed on the cement-barrier wall at Altus Dam in May 2022. Refer to the preceding article, "Dam Safety Concerns Identified by Visual Inspections and Instrumentation Data," for a discussion of the seepage conditions that developed and justified (in part) installation of this automated system.

Instrumentation data and automated systems are a hot topic at trade shows and conferences. There are numerous vendors that offer a range of instrumentation products, many of which are relatively easy to procure. Some of these products are rudimentary and are limited

to a pre-determined set of functions, while others are complex and require careful programming by experienced personnel. In all cases, automated and partially automated systems should involve an instrumentation specialist, a well-defined scope, and operations and maintenance (O&M) personnel. Otherwise, automated systems quickly become a maintenance burden, a data management burden, and worst of all, project staff can lose faith in and grow to despise the system due to a combination of these factors.

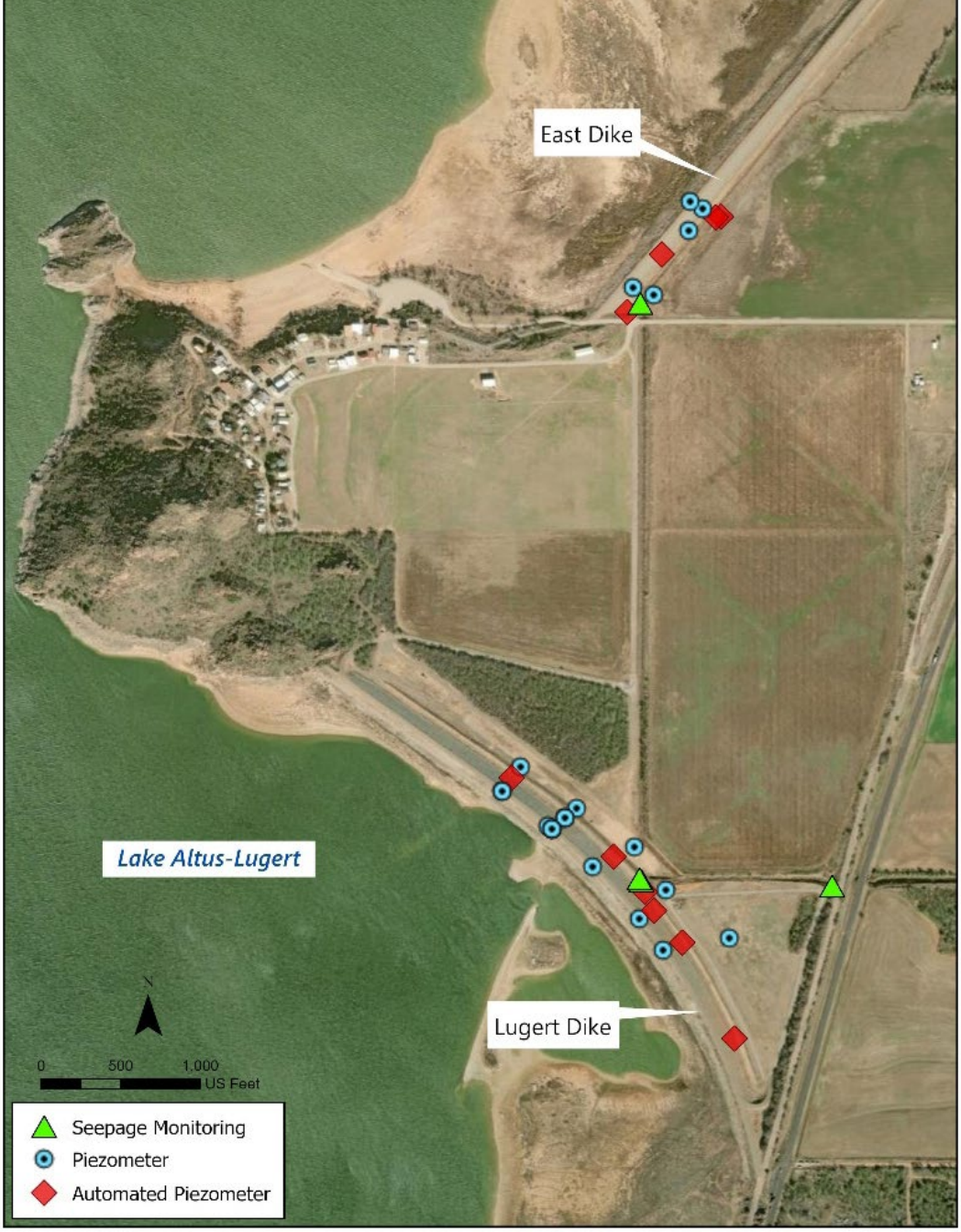
Design and implementation of the automated system at Altus involved the instrumentation specialists from the Technical Service Center (TSC) and the First Filling Team, which included geotechnical engineers from the TSC, the Dam Safety Office, the Oklahoma-Texas Area Office (OTAO), and District personnel. The automated system includes 10 of the 40 piezometers and integrated sensors at three seepage monitoring installations that were already in place. The 2022 first-fill criteria originally designated 29 piezometers to be automated; however, the scope of the automated system was refined by the First Filling Team, and the number of automated piezometers was reduced to provide a more manageable system that targeted key instruments with respect to potential failure modes. Manual readings are required at the 30 piezometers that were not automated because they still provide useful information; however, configuration of the system and ability to coordinate with TSC instrumentation specialists allow for relatively straightforward expansion of the automated system if warranted by observed site conditions.

System life-cycle was a key design consideration. A system designed to be in place for several years should be designed differently than a system expected to be in place for several decades. A short-term system still needs to have durable and reliable equipment, but the implementation will be intentionally impermanent and more adaptable to changing site conditions. This system was designed to include first filling, which was estimated to occur within one to five years after modification. A longer life-cycle was not selected because after the modifications have been tested, the monitoring frequencies will be reduced and it will no longer be economically viable for Reclamation to operate, maintain, and replace (OM&R) the automated system. No system, even a long-term system, is permanent – it will still have associated OM&R costs. Intentional planning of the system life-cycle improves the workability of the system and can reduce the O&M burden.

Key components of this automated system at Altus Dam include sensors, dataloggers, cables and/or radios, a means to collect the data, and a power supply. Dataloggers and radios consist of Campbell Scientific equipment because of its advanced programmability and

System node at a piezometer.

Sensors installed within piezometers are sealed vibrating-wire pressure transducers, which were selected because of their historical durability/reliability, ability for future redeployment, low sensitivity to noise and cable lengths, low maintenance, and compatibility with other system components.



Piezometers and seepage measurement devices at Lugert and East Dikes.

customizable functionality. A distributed network of radio-enabled dataloggers was chosen for this application, rather than cable, because the distance between instruments is significant, the need for rapid system deployment, and the project lifecycle does not justify trenching cables, which would have been necessary due to required mowing at the site. The base station was installed at Lugert Dike, which hosts nearby instruments, aggregates data from the radio network, and operates a cellular gateway to the internet. Solar power is used to supply each of the dataloggers because grid power is unavailable. The base station and each node include a power system comprised of a solar panel, a charge regulator, and one or more batteries. The solar panels and batteries are sized depending on the site-specific sunlight availability and power demanded by the system (number of instruments and rate of data collection and transmission).

Prior to the installation, each radio-enabled datalogger (i.e., node) was pre-configured to communicate with the base station, which was programmed to aggregate the data collected from each node. In addition to forwarding the data at a single point at the site, this strategy allows for optimized radio traffic and reduces potential for interference since various clients are not downloading data directly from the nodes but only from the aggregator. Also, programming techniques were implemented to reduce the cellular gateway's power demands because solar power is limited compared to grid power, and the cellular modem has relatively high power requirements. The automated system was designed to obtain hourly readings and compute reduced readings, which includes converting to engineering units (pressure or gallons per minute) and compensating for barometric and temperature fluctuations using a barometer at the base station and resistance thermometers within each sensor. Raw and reduced readings are available to project staff on demand by cellular internet. Specialized software or subscriptions are not required to access the data, but the data are encrypted and password protected.

The automated system is configured to obtain and store hourly readings from each sensor. The hourly readings are compared to threshold values once per day, and an email is distributed to select project staff if a reading is outside of thresholds. Under normal circumstances (predictable performance) the Reclamation instrumentation database (DAMS) stores one value per day, but the hourly data are available to project staff for additional evaluation as necessary. The system can also notify personnel if a node fails to communicate or if battery voltage is abnormal at a node or the base station. Finally, the program can be adjusted remotely to accommodate changing site conditions since the base station is connected to the internet and it provides a remote route to the nodes.

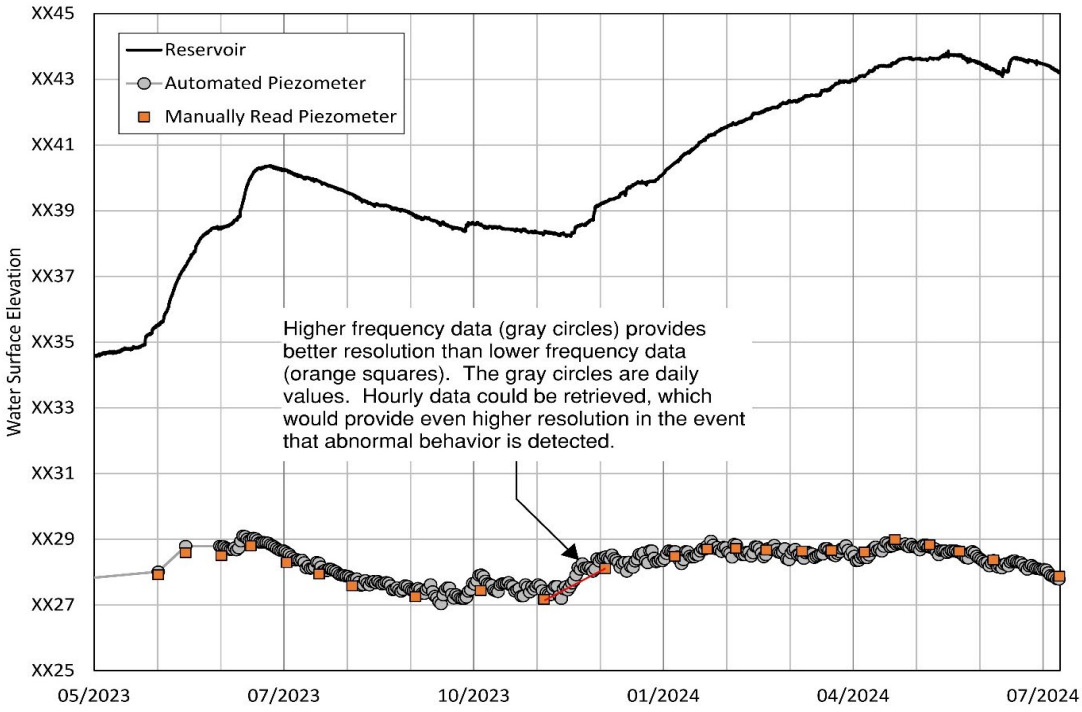
Field work was conducted in June 2023. Installation at each node and the base station included setting a post for equipment mounting, installing the radio-enabled datalogger, radio antenna, power supply, and installing sensors, wiring, and cable protection. OTAO and Lugert-Altus Irrigation District installed posts prior to the automation deployment, which was led by TSC Instrumentation Specialists. The base station, nodes, and sensors were installed in three days. The coordination by and experience of the installation team resulted in an efficient, relatively quick, and successful installation. Additional testing was performed when the installation was complete to confirm

Automated system benefits:

1. **Reallocation of staff time**
2. **Automatic comparisons of data**
3. **Notifications when readings are outside of thresholds**

that the nodes communicated with the base station, sensors were functioning properly, and reduced readings were within expectations.

Labor and travel expenses to prepare for and implement the system were approximately $20,000. The equipment cost approximately $30,000, but the datalogger, nodes, communication components, and sensor components (the majority of the equipment costs) could have an O&M service life of at least 30 years. To provide a rough, approximate comparison, the cost to send two staff members from OTAO to collect and process the data is approximately $1500 per day. The ongoing data maintenance costs are low and can easily



Data for a piezometer read manually and a piezometer read by the automated system.

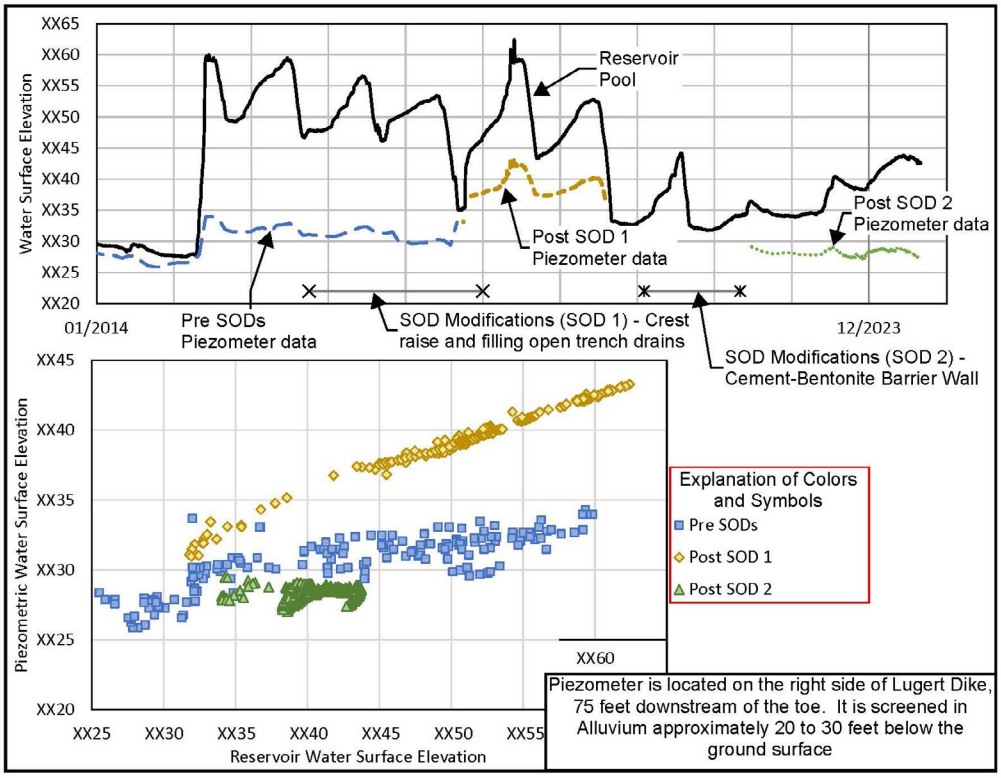
be incorporated into routine data evaluations performed by the TSC. However, if the system were not a coordinated effort, the resulting flow of data could impose unnecessary strain on existing data management efforts, and the cost to maintain the system components in the field could also be higher.

The automated system has been in place and collecting data for over 400 days. During this time, the monitoring schedule has required 2 readings per month and 21 readings have been collected at other nearby piezometers. The additional, higher-frequency data is used by technical staff to assess climatic impacts that can obscure instrument performance and provide additional resolution when evaluating thresholds. For reference, a general discussion of the piezometer data presented in the figure on the next page is provided in the

previous article. The data presented here includes data collected after Safety of Dams (SOD) Modification 2 (SOD 2) and data collected by the automated system. Based on data collected to date, it appears that the cement-bentonite barrier wall (SOD 2) has lowered water pressure in the foundation materials downstream of Lugert Dike to levels lower than those prior to SOD 1. This change in reservoir response is illustrated by the higher position of the yellow diamonds (between SOD 1 and SOD 2) and blue rectangles (prior to SOD 1) compared to the green triangles (post-SOD 2) at a similar reservoir water surface elevation. The reservoir, to date, has been relatively low and definitive conclusions regarding performance of the barrier wall cannot be drawn until the reservoir is higher.

A short-term automated system was installed at Altus Dam following construction of the soil-bentonite barrier wall to provide additional data and notifications of unexpected performance during refilling of the reservoir. Design and implementation of this system involved geotechnical engineers, TSC instrumentation specialists, and field personnel to provide a system that is reasonable to operate and maintain and that provides significant benefit instead of additional burden. To date, the system has operated effectively, and preliminary data suggest that the SOD modifications were successful.

Performance monitoring is a key aspect of the Dam Safety Program, but it can become burdensome during periods when increased vigilance (and higher frequency data collection) is necessary.



Piezometer data versus time (top) and versus the reservoir (bottom left). These data illustrate the conditions prior to the SOD modifications, adverse conditions that developed following SOD 1, and improved conditions (to date) following SOD 2.

Dam Safety Technology Development Program

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The Dam Safety Technology Development (Tech Dev) Program is funded by the Dam Safety Program's Safety Evaluation of Existing Dams fund and sometimes by Department of the Interior funds. The Tech Dev Program provides the Bureau of Reclamation (Reclamation) the opportunity to investigate new methods that will likely reduce project and program costs and facility risk uncertainties.

Per the FGDS, "A strong research and development effort is a necessary element in reducing the uncertainties still present in dam design, hydrology and hydraulics, materials behavior, and construction techniques, equipment, and practices. As part of their dam safety programs, agency management should identify opportunities and needs for research and programs to meet those needs both internally and through other agencies such as the National Science Foundation and the U.S. Geological Survey." DM Chapter 1, Section 1.7.B, states that "Reclamation will administer a program for dam safety research to serve the collective needs of the Department."

Process

A Request for Proposals for the Tech Dev Program is typically sent annually in July for the upcoming fiscal year of funding. The emailed request is sent to four divisions in the Technical Service Center with necessary attachments and instructions on forwarding.

For an in-depth look at the two sets of guidelines that govern the Tech Dev Program: the 2004 Federal Guidelines for Dam Safety (FGDS) and Departmental Manual (DM) Part 753, Chapter 1.

Hydraulic jacking research flume constructed and operated as part of the Technology Development Program.

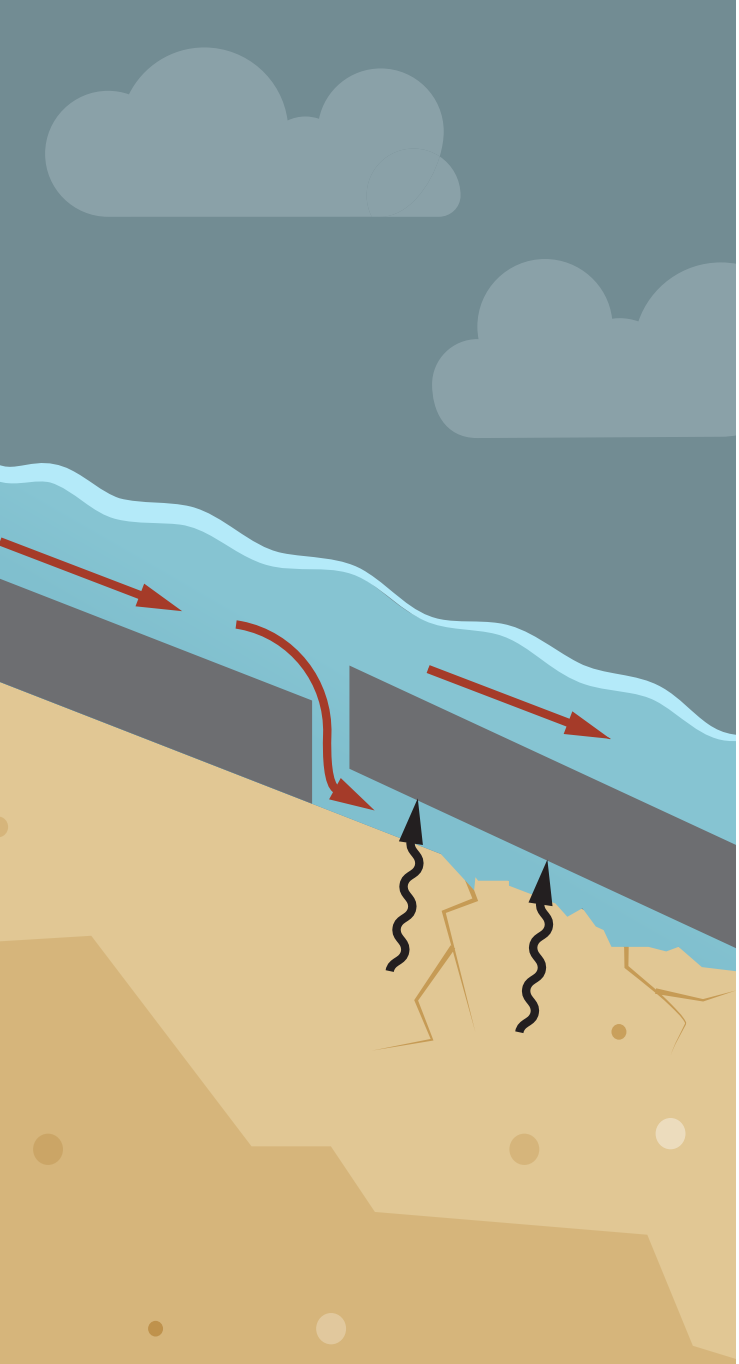
Flow over spillway offsets: (top) attached to floor at a small offset and (bottom) detached from floor at a large offset.

The attachments are also available for Reclamation employees through the Dam Safety Office intranet site. The following information and templates are updated each year or as needed:

1. Dam Safety Program Tech Dev Priorities
2. Instructions for Requests for Proposals
3. Instructions and Guidelines for Proposal Template
4. Proposal Template
5. Budget Estimate Template

The Priority List and Instructions are for reference. For new proposals, the Proposal and Budget Estimate Templates are to be fully completed using the Instructions and information in the templates. The Proposal Template is an all-in-one product, as it is the Project Management Plan required for opening a service agreement, the initial proposal for the research topic, and what will eventually become the final report. For proposals that are continuing projects, the most recent submitted Proposal is updated with accomplishments/issues narratives and with any scope/schedule changes. A new Budget Estimate should be submitted reflecting any changes, such as tasks that were delayed. Continuing projects are typically funded in full after a brief review to ensure the research is not experiencing any significant schedule delays, any scope changes are reasonable, and the requested budget is sound.

New projects are more thoroughly reviewed. During the proposal review meeting, the technical advisor overseeing the proposal's research area will present the proposal to the panel. A discussion covering the proposal's strengths and weaknesses ensues, and the proposal score is developed by all panel members. New projects are



Hydraulic jacking occurs when a joint between two concrete slabs on a spillway chute starts to separate, allowing water to run between the slab and its foundation. Water creates an uplift force, due to buoyancy, counteracting the slab's weight and leading to detachment and foundation erosion.

funded from highest to lowest score until program funds are spent. Proposals with low scores may not receive funding, especially when funding for the program is low.

To access completed research reports, visit https://www.usbr.gov/damsafety/TechDev/index.html. Please contact Lisa Krosley at lkrosley@usbr.gov for further information.

Projects Funded through the Tech Dev Program

Hydraulic Jacking

Hydraulic jacking is a serious threat to concrete spillway chutes, as illustrated by the catastrophic chute failure that occurred in 2017 at Oroville Dam, a California Department of Water Resources facility, and several previous failures on Reclamation projects (e.g., St. Mary Canal Drop #5, 2020; Big Sandy Dam, 1983; Dickinson Dam, 1954). Hydraulic jacking occurs when joints or cracks in a spillway chute experience differential settlement or surface damage that creates offsets into the flow. Stagnation of flow against such offsets converts the flow's kinetic energy into high pressures that can be injected through open joints into the foundation, leading to uplift failure of slabs or foundation erosion followed by slab collapse.

Laboratory experiments in the 1970s and early 2000s associated uplift pressures with chute velocity and joint geometry, but details were still poorly understood at the time of the Oroville failure. To support the efforts of chute designers and risk analysts to mitigate against hydraulic jacking failures, new experimental tests were conducted by Reclamation from 2021 to 2023. New equations were developed for estimating uplift pressure, flow rate through joints and cracks, and the effects of various methods of remediating existing offsets. The new laboratory tests were performed in a supercritical flume furnished with a model joint where the gap width-to-offset height ratio was varied over a 725:1 range. The tests included measurement of boundary layer velocity profiles approaching the joint and uplift pressures associated with unvented (sealed) and vented foundation conditions. A dramatic improvement was made in this study by normalizing uplift pressures specifically to the velocity head near the boundary rather than the simple mean velocity in the chute. This boundary layer velocity head is related to depth-wise velocity profile exponents determined in the experiments and can be estimated in field situations from the chute friction factor. The normalized uplift varies with the joint aspect ratio and

the flow depth-to-offset height ratio. The new relations reduce the uncertainty of modeled uplift pressures by a factor of about three compared to previous methods.

The experimental work has also led to new relations for calculating discharge through open joints, and the results show that extremely large flow rates are possible. Testing of joints and cracks with irregular geometries led to useful relations for estimating uplift at joints that are chamfered, rounded, skewed, beveled, or otherwise relieved to reduce uplift. The products of this research have recently been published in a series of articles in the American Society of Civil Engineers' *Journal of Hydraulic Engineering*, and the new relationships have been incorporated into spillway analysis software tools used at Reclamation. Please contact Tony Wahl at twahl@usbr.gov for more information.

Lake Como, Montana.

Sub-Bottom Profile Survey Imaging

for Void Detection and Seismic Hazard Assessments

Many reservoirs across the Intermountain West were once pre-existing natural lakes. At Lake Como, Montana, local irrigators increased the storage capacity of a lake that was naturally dammed by a glacial moraine from the last ice age, approximately 15,000 years ago. As shown in a sub-bottom profile survey (CHIRP) of the lake in 2021, the old lake preserves a thick package of strata that represents continuous sedimentation into the lake since the glaciers receded. The sedimentary sequence is disrupted and displaced below a layer throughout the lake, which may represent past shaking and displacement from an earthquake on the nearby Bitterroot fault.

In a project funded through the Tech Dev Program, the Seismology and Geomorphology Group is using the stratigraphy preserved at Lake Como to understand the timing of previous earthquakes on the Bitterroot fault, which poses a hazard to Como Dam. In spring 2024, Reclamation geologists, in collaboration with the Montana

Top: Aerial of Como Dam, Montana.

Middle: Analyzing a split core from Lake Como in spring 2024.

Bottom: Core materials including lake sediment, charcoal pieces, and water-lain ash possibly from the Glacier Peak volcanic eruption 13,000 years ago.

Bureau of Mines and Geology, cored Lake Como to target the disturbed layer to constrain the timing of the last earthquake on the fault. The team collected 13 sediment cores and was successful in collecting a maximum of 4.6 meters of sediment in one tube. One of the opened cores revealed white tephra units, which are the ash from ancient volcanic eruptions from Oregon and Washington that settled out in the lake. The next steps for the project are to find and numerically date the disturbed and undisturbed sedimentary layers to bracket the timing of the last earthquake on the Bitterroot fault. There is charcoal preserved in the cores that can be used to date the layers using radiocarbon dating, and there may be other sedimentary features that are evidence of shaking within the reservoir basin preserved in the cores. The cores may also preserve proxy data for past climate in the Intermountain West and sedimentation rates in the reservoir basin. The sediments are nature's time capsule, preserving previous trends in climate and evidence of past natural disasters, frozen in time.

Another component of the project is to use CHIRP to identify voids within embankment structures. During a sub-bottom profile survey in 2021 in collaboration with the U.S. Army Corps of Engineers, the face of Como Dam was surveyed. The method showed a region of low-density material in the left abutment coincident with where the older embankment was constructed. Additional analyses are ongoing to determine whether the sub-bottom profiler can be a non-invasive method of mapping voids in embankment structures and to identify regions of low shear-wave velocity material underneath dams. Please contact Colin Chupik at cchupik@usbr.gov for more information.

Fall Maintenance: Preparing for Cooler Weather

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Asset Management Division

Autumn at Cle Elum Lake, Washington.

While we might not be ready to pack up the picnic blankets and beach attire just yet, winter is right around the corner, and breaking out the ski jackets isn't the only thing we can do to prepare for cooler temperatures. Bureau of Reclamation (Reclamation) facilities, much like our homes and vehicles, require preventative maintenance to be performed ahead of the change in the season. Additionally, the fall season provides opportunities to inspect components typically inaccessible during water operations. Proper maintenance is essential to ensure the reliability and efficiency of water management facilities. The following are strategies and best practices for fall maintenance to help avoid issues and optimize performance.

Dams and Reservoirs

Dams and reservoirs are central to Reclamation's water management infrastructure. As temperatures drop, it is crucial to inspect these structures for signs of significant wear or damage. Key maintenance tasks include:

Caballo Dam, New Mexico, spillway radial gate.

- **Visual Inspections:** Conduct thorough visual inspections of dam spillways, faces, and embankments for signs of cracking, erosion, or displacement. Identify debris accumulation that could impact spillway or gate operations.
- **Mechanical and Electrical Systems:** Ensure all mechanical systems, including gates and valves, are functioning properly. Check operation of electrical systems such as control panels and backup generators. Winter conditions can exacerbate existing issues, making fall maintenance even more critical.
- **Instrumentation:** Review the data from monitoring instruments such as piezometers and flow meters to ensure they are presenting accurate information. Instruments may be more difficult to access during winter months, so ensuring their precision and operability in the fall can prevent lapses in monitoring and accuracy.
- **Manage Water Levels:** Ensure water levels are appropriate for the coming winter season. Facility standard operating procedures (SOPs) dictate the required elevation for reservoirs during seasonal transitions as well as the rate of drawdown. Managing water levels lowers the risk for flood loading and helps prevent issues related to ice formation.

Prepare Irrigation Systems

Irrigation systems require special attention as they transition from summer use to winter dormancy. Proper fall maintenance can help prevent issues such as pipe bursts and system failures during the colder months.

- **Drainage:** Completely drain irrigation lines to prevent water from freezing and causing pipe damage. Ensure that all valves are closed properly after draining and that any residual water is removed from the system.
- **Winterization:** For systems that will not be in use during the winter, winterizing pumps and other equipment can prevent damage during freezing temperatures. This may include using antifreeze or specialized lubricants.
- **Visual Inspections:** Visually inspecting irrigation components likely to be impacted by colder weather in the fall can lead to preventative actions to help ensure the facility will be ready for springtime use.
- **Sediment Management:** Conducting sediment removal operations helps maintain storage capacity, water quality, and system efficiency. Conducting sediment removal in the fall ensures the systems are prepared for spring operation and allows crews to maneuver equipment before access is restricted by snow or ice.

Implementing Infrastructure Repairs

The fall season, with its lower water levels and reduced system demands, presents a prime opportunity for implementing upgrades and improvements to water management infrastructure.

- **Conducting Repairs and Replacements:** Use the fall period to address any maintenance tasks that were deferred during peak season. This could involve replacing worn-out parts, repairing any structural damage or wear, or upgrading obsolete equipment. Timely repairs ensure that infrastructure remains operational and reduces the risk of unexpected failures.
- **Testing and Calibration:** Performing testing and calibration of systems during the fall allows for early detection and correction of any deficiencies in instrumentation and operating equipment.

Sediment buildup at lateral entrance gate.

Anticipate Winter Weather Conditions

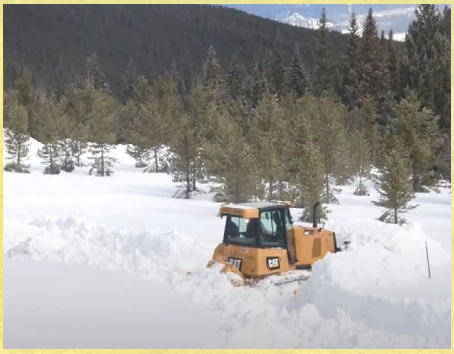
Fall maintenance is also an opportunity to prepare for challenges posed by winter weather.

• **Winterizing Facilities:** Make sure all facilities, including pump stations and control rooms, are winterized to prevent damage from freezing temperatures. This may involve inspecting heating systems, adding insulation, and verifying backup power is operational.

• **Snow and Ice Management:** Develop and implement plans for snow and ice management. This includes preparing snow removal equipment and establishing protocols for clearing access roads and operation areas. Ensure personnel are trained on operating snow and ice clearing equipment.

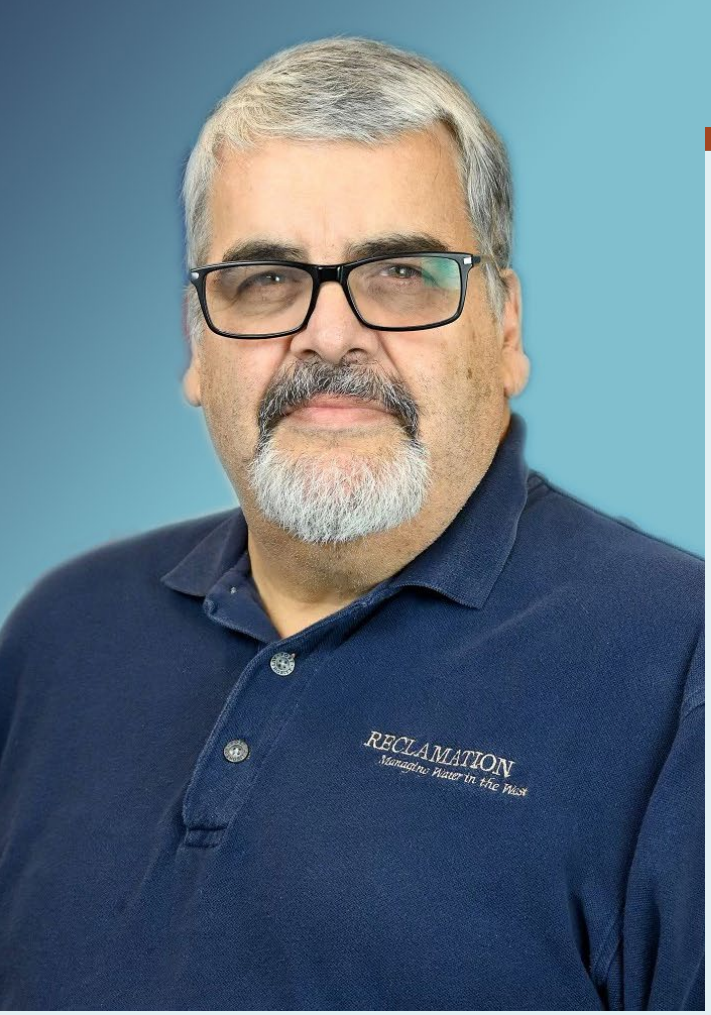
Review and Enhance Operational Procedures

The fall offers a chance to review and refine operational protocols to improve efficiency and performance.



Snow removal at Fryingpan-Arkansas West Slope Collection System.

- **Evaluating Performance:** Assess the performance of systems and infrastructure based on previous seasons' data. Identify issues or areas of improvement and update any operational procedures as necessary.
- **Documentation and Feedback:** Documenting all maintenance activities and collecting feedback from staff on any issues encountered allows managers throughout the organization to make informed decisions on the operations and maintenance (O&M) of facilities in the future.
- **Review SOPs:** Using data from previous seasons and feedback on O&M from staff, SOPs can be refined to encompass any changes in operations due to system upgrades, recent repairs, or identified areas of interest.
- **Emergency Preparedness:** Review and update emergency action plans to ensure they are accurate ahead of any severe winter weather. This includes ensuring communication systems are functional and that personnel are trained in winter-specific emergency response procedures.



Q&A Mark A. Treviño

Area Manager, Oklahoma-Texas Area Office, Missouri Basin and Arkansas-Rio Grande-Texas Gulf Regions

Mark A. Treviño joined the Bureau of Reclamation (Reclamation) in September 1980. After working on projects in Texas and Oklahoma for nearly a decade, 14 years at the Technical Service Center (TSC) in Denver, and two years at the Oklahoma-Texas Area Office (OTAO), he was named OTAO Area Manager in September 2005 and has held the position since. Reclamation's current longest serving area manager, Treviño is retiring this November. We met with him in August to talk about his career path, responsibilities as area manager, communicating with transferred works operators, and empowering his staff.

How did you get interested in water management?

One of my first mentors, Bob Lopez, suggested I apply in the Water Operations Branch at the Rio Grande Project in El Paso as construction at Reclamation's McGee Creek Project was winding down. I gained experience in water operations and provided support for existing computer programs and developing new applications as needed in support of the Rio Grande Project. Personal computers had just come on the market, and shortly after my arrival, the project received its own VAX mini-computer, which I also managed. After completing a temporary detail in what is now TSC's Sedimentation Group, I applied and got a job in TSC's Water Management Group. While in Denver, I was able to take advantage of opportunities working on water issues throughout Reclamation. The experience and exposure provided opportunities to work with professionals with differing opinions and methodologies.

I started with the Water Management Group in 1989. I spent a lot of time working with regional offices to help with their computer-run systems, in addition to working internationally with professionals in Spain, Mexico, Cyprus, and Egypt. My expertise allowed me many opportunities in implementing and applying developing technologies to improve water management decisions. These early experiences inspired my interest in water management.

Can you provide a high-level summary of your different roles at Reclamation?

Once I was at the TSC, a major issue was deciding which computer systems and available software were best suited for a particular problem. As new technologies evolved, I provided training in the implementation of these technologies. I completed Reclamation's Leadership Development Program in 1999. This program provided great insight into how I saw myself and more importantly how others viewed my abilities. I believe this program, along with my previous work

experience, has contributed greatly to my management style. I left Denver for Alamosa, Colorado, to manage the Closed Basin Project in 2000. The project consists of approximately 170 wells that are used to pump water from the upper unconfined aquifer to supplement water deliveries to New Mexico as part of the Rio Grande Compact.

After three years as manager of the Closed Basin Project, I came to Austin as a special projects coordinator in 2003. In 2005, I had the opportunity to apply and was selected as the OTAO Area Manager and stationed in Austin. OTAO is responsible for 11 Reclamation projects located in Texas, Oklahoma, and southern Kansas. These projects are considered transferred works, which means they are operated and maintained by local entities as Reclamation's partners. OTAO staff offer assistance and oversight as needed to ensure that our projects are managed in a safe and sound manner. OTAO staff are some of the most dedicated in Reclamation. Their efforts and engagement with operating partners, other Federal agencies, and local stakeholders have led to excellent working relationships and accomplishment of OTAO's mission.

As a manager, I learned the importance of inclusion and learning from everyone involved in an issue.

Inlet wall concrete placement (1982).

Who have been your mentors?

Throughout my time with Reclamation, I have gained valuable insight from various supervisors and leaders who have always been approachable, offered their advice, and encouraged me. My path beyond construction began with advice from Bob Lopez who suggested I apply for the opportunity in El Paso to broaden my work experience. At first, I was hesitant about going from construction into a project office. Bob's advice about this particular opportunity was, "I'm not asking you to go there and die; see where the experience leads you." After four years in El Paso working in Water Operations, I got the job in the Water Management Group in Denver. My supervisor, Wayne Cheney, encouraged me to take on projects that would expand my skill set. Wayne would always say, "Mark, its nothing you can't learn," which gave me the confidence to pursue new issues related to water management. Many people have served as informal mentors and coaches. They've given me feedback, and they've always been open to hearing my feedback. I always encourage new staff to engage when asked about a particular issue.

You've been OTAO Area Manager for 19 years. How do you describe your role?

Our office is a little different in that all of our projects are transferred works. Where the typical area office might have 100 employees, we hover between 25 and 30. Our projects are managed by our operating partners that we have under contract. With transferred works projects, communication and relationships become critical, and I rely on my staff to build those relationships. The district managers know who I am and that I am here to help where I can, but they deal with my staff daily because they're closer to the projects. My role as area manager is to make sure employees have the resources and support they need for success. I also look for projects that are often outside of what OTAO staff do every day. This keeps them engaged and exposes them to other parts of the agency which is good professional development.

Choke Canyon Reservoir outlet works (1982).

Choke Canyon Reservoir upstream view (1982).

What are the greatest challenges and opportunities affecting OTAO?

Infrastructure throughout Reclamation is getting older. Our last major construction project was during the 80s. We work closely with our operating partners to ensure that our projects are maintained to ensure they remain viable and are able to provide water for their users. We provide information to municipalities and districts throughout the Oklahoma-Texas area on grant programs available through Reclamation. Our efforts aid municipalities in increasing water efficiency and reliability during times of drought and increasing demand. By engaging with local stakeholders and operating partners, we can highlight the many successes resulting from Reclamation programs. Our main focus is ensuring that our Reclamation projects are maintained and managed accordingly to continue to deliver water well into the future.

How is your day-to-day work as area manager involved in facilities' operations and maintenance?

The day-to-day work is about being vigilant as to conditions at our respective projects. It is not uncommon in this part of the country for thunderstorms to drop four or five inches of rain in 24 or 48 hours, and as such, reservoir levels go up quickly. Communication and good working relationships with our operating partners and other Federal agencies become critical during severe rain events.

What is extraordinary about your staff?

Their dedication and professionalism. Our leadership team puts a lot of trust in our staff to take the lead on issues when they arise. Staff have developed relationships within Reclamation, other Federal agencies, our operating partners, and local stakeholders, which contributes greatly to our accomplishment as an area office. When an issue arises, supervisors will assign it to the appropriate staff member and provide guidance as needed. Our partners do not hesitate to call our office with questions or when they need help. I often hear from our partners and stakeholders about how a staff member went the extra mile to develop a solution. Trust in our staff is critical to their professional development. Mistakes are learning opportunities that can guide the employee in their development when they encounter similar issues in the future.

See where the experience leads you.

You may not know everything at first, but that's an opportunity to work with and learn from other people.

Can you share a success story about a project?

It's hard to name one specific project, as the nature of my career has always been to work on several projects at once, often providing technical support or finding new ways to accomplish a specific task. As an area manager, my duties revolve around ensuring that staff have the necessary resources and adequate timelines to provide the best solution possible. I look for opportunities to give our staff both exposure and experience in different parts of Reclamation, which increases employee engagement and professional development. Working throughout Reclamation, I have gained an appreciation of the various issues and problems related to water management in the West.

What advice can you share for those just starting careers in Reclamation?

Don't limit yourself to a specific area. There's great value in working with people from different parts of the agency and different parts of the country to fully understand how water issues vary across the West. While on a temporary detail to the Regional Office in Sacramento, I learned how the irrigation districts were working with their customers to encourage operating efficiency. Some of the districts found that by posting actual water usage by different irrigators, farmers were able to learn from each other and develop more efficient practices and increase production as part of a "friendly competition."

What are you most looking forward to with your retirement?

My wife retired from teaching last year after 41 years, so we'll have more free time together. Being able to do what we want, visit friends, and travel. I enjoy bicycling in my spare time when the temperatures aren't triple digits and being able to visit different parts of the country. I have had a great career with Reclamation and intend to share my experiences through contacts at the University of Texas, advocating for programs like the Pathways Program, careers in Reclamation and Federal service, and further stressing how competitive the job search has become. For the folks in OTAO, I have every confidence in their abilities to provide the type of commitment and customer service that they have become known for.

Updates & Due Dates

Upcoming Enterprise Asset Registry Activities

- The Buildings Asset Class Subject Matter Expert (SME) review period ends on October 11, 2024.
- The Prestressed Concrete Cylinder Pipe SME review is wrapping up and will finish before October 2024.
- The Fish Structures Asset Class SME review will begin in October or November 2024.
- Recreation Phase II, Conveyance Points, Land Management, and Wells are all in development.
- The Enterprise Asset Registry Project is scheduled for completion in August 2025.

Fall and Winter Trainings

2024 Bridge Training

October 22–24, 2024

Helena, Montana

The Bureau of Reclamation's (Reclamation) Bridge Training is an annual, in-person training for regional bridge program managers, bridge inspectors, and other personnel involved with the bridge program. This training provides updates on the Reclamation Bridge Inventory, inspection report templates, scour screenings, load ratings, common bridge deficiencies, updates to Directives and Standards, and other bridge-related topics. Please email Dan Staton at dstaton@usbr.gov for additional information.

Fall and Winter Trainings continued:

2024 Land Resources – Recreation Training

October 29–31, 2024

Sacramento State Aquatic Center, Gold River, California

The Recreation Training is the next installment of the Land Resources series of training opportunities. It will focus on common Recreation components such as accessibility, concessions, contracts and agreements, Enterprise Asset Registry, and asset management tools. This training will feature a field visit to the Auburn State Recreation Area. There is no cost for this training. Reclamation employees must register in DOI Talent. Please direct questions to Courtney Cobb at (303) 445-3273 or ccobb@usbr.gov.

2024 Building Inspection Training

November 5–8, 2024

Denver, Colorado

This course is administered by professional staff from the Certified Commercial Property Inspector Association and prepares students to confidently perform Reclamation building inspections. Students become familiar with inspecting a variety of Reclamation building types and systems. Students learn about the site, structure, roofing, building envelope, interior, plumbing, HVAC, and life safety/fire protection components of buildings and how to inspect them and identify deficiencies. Students have the opportunity to participate in a mock inspection field day at the class's end. Please contact Mike Studiner at mstudiner@usbr.gov for more information.

2025 Water Management Workshop (WMW)

February 11–13, 2025

Denver, Colorado

The WMW is for supervisors, managers, water masters, and others responsible for or associated with the operations and maintenance of water systems. The Reclamation-sponsored workshop has been held since 1961. Participants spend their time attending multiple educational sessions with opportunities for discussion and collaboration. The objective of the WMW is the self-improvement of personnel who are directly responsible for the technical details of operating and maintaining water systems. This workshop counts for annual training requirements for Reclamation employees. Please contact Dave Folsom at dfolsom@usbr.gov for additional information.