State of the Infrastructure

A Joint Report by the Bureau of Reclamation and the U.S. Army Corps of Engineers

US Army Corps of Engineers ®

BUREAU OF RECLAMATION

February 2024

On the cover and this page: Joint Federal Lower Yellowstone Intake Diversion Dam Fish Passage Project, Lower Yellowstone Irrigation District (Reclamation, circa 2019-2022).

The U.S. Army Corps of Engineers (Army Corps) and the Bureau of Reclamation (Reclamation) collaborated to complete the Lower Yellowstone Intake Diversion Dam Fish Passage Project near Glendive, Montana, in 2022. Construction, which began in 2019, consisted of an 11,150-foot-long bypass channel for fish passage and a replacement weir for water diversions to the Lower Yellowstone Project. The purpose of the project is to improve passage of pallid sturgeon and other native fish at the intake diversion dam while continuing a viable and effective operation of the Lower Yellowstone Project.

The Lower Yellowstone Project was authorized in 1904 to provide a dependable water supply to irrigate 58,000 acres of land in eastern Montana and western North Dakota. In 1990, the U.S. Fish and Wildlife Service listed pallid sturgeon as endangered under the Endangered Species Act of 1973. Entrainment into the Lower Yellowstone main canal and the Intake Diversion Dam has been shown to impede upstream migration of pallid sturgeon. A new screened headworks (2012) addressed the canal entrainment. The newly constructed weir and bypass channel (2022) provide passage to approximately 165 river miles of habitat in the Yellowstone River and major tributaries such as the Powder River.

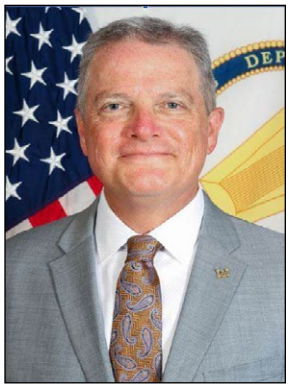
Executive Statement

The Army Corps and Reclamation have a long history of collaboration in evaluating, constructing, operating, and maintaining water infrastructure projects, in addition to sharing management responsibilities at major facilities. Reclamation and the Army Corps Civil Works programs receive funding through annual Energy and Water Development Act appropriations, supplemental appropriations, non-Federal cost-sharing partnerships, and other sources. In an ongoing effort to return the highest overall value to the Nation from available funds, the Army Corps and Reclamation seek opportunities to work with their partners to develop planning study solutions in a timely and cost-effective manner; to manage the cost, schedule, and scope of ongoing construction projects; and to use risk analysis to prioritize capital investment and maintenance needs.

The Army Corps and Reclamation are committed to working with tribal governments, other Federal agencies, states, local governments, the private sector, and the public to manage, maintain, and enhance infrastructure. This report provides a high-level overview of the infrastructure asset portfolio and related asset management practices, collaboration efforts, and future strategies. Recent record investments in these agencies' programs enable critical water resource projects to be constructed and allow both agencies to further develop innovative approaches to address their most pressing challenges.

We are at a critical moment in our history with a once-in-a-generation investment in our nation's Civil Works infrastructure. In the Army Corps alone, 48 construction projects have started and 61 were completed over the last 5 years. As of December 2023, Reclamation has produced three annual Bipartisan Infrastructure Law (Infrastructure Law) spend plans of $1.66 billion each in fiscal years (FY) 2022, 2023, and 2024. Reclamation has allocated $2.9 billion of this funding to 420 individual projects.

Water resources challenges of today are not like those of yesterday. The Army Corps and Reclamation are committed to constructing infrastructure projects that will strengthen the Nation's economy, protect people and property, and restore key ecosystems. Additional details can be found on the respective agency websites. This work is part of the broader effort at all levels of government to manage the Nation's water resources in a responsible manner.



US Army Corps of Engineers ®

Mr. Eddie Belk, Jr.
Director of Civil Works
U.S. Army Corps of Engineers

The mission of the U.S. Army Corps of Engineers is to deliver vital engineering services, in collaboration with our partners, to secure our Nation, energize our economy, and reduce disaster risk.

BUREAU OF RECLAMATION

Ms. Camille Calimlim Touton
Commissioner
Bureau of Reclamation

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.

Water-Related Infrastructure

Decades of Federal investment have yielded a robust national portfolio of water-related infrastructure, which represents a diverse and vast inventory of mission-critical, legacy, and strategically developed assets for the benefit of the American people.

This extensive physical infrastructure is one of our Nation's most valuable assets, providing ongoing power generation, water supply, navigation, flood risk reduction, recreation, and other benefits. The importance, extent, and impacts of water-related infrastructure managed and maintained by the Army Corps and Reclamation are broad and vital, affecting the Nation's economy daily.

The agencies will continue to efficiently manage funds and pursue opportunities to respond to challenges related to water-related infrastructure, including each project's inevitable aging, which results in continuing and increasing needs for project maintenance, repair, and replacement. Many Army Corps and Reclamation dams are more than 50 years old and are reaching the end of the useful life of many features, requiring investment to extend the lifecycle.

The Infrastructure Law provides $17.1 billion for Army Corps Civil Works programs, projects, and activities that will provide a historic opportunity to address the nation's current and future water resources infrastructure needs for the benefit of the American public. When combined with other recent supplemental appropriations, total supplemental funding for the Army Corps Civil Works program is currently approximately $44.9 billion. The Infrastructure Law will improve Federal stewardship of critical infrastructure and significantly increase Reclamation's efforts to support partners, stakeholders, tribal nations, and communities in the 17 western states. This includes an $8.3 billion investment in Reclamation water infrastructure and $2.5 billion to implement the Indian Water Rights Settlement Completion Fund. In addition, the Inflation Reduction Act is providing $4.6 billion to address historic drought in the West.

These substantial investments are being made to extend the useful life of facilities. In doing so, supply chains and the economy are strengthened as capacity is added to waterways and ports. Communities are made more resilient in the face of flood risks. Opportunities to restore the environment, promote equity, and support underserved communities are a part of these improvements.

B.F. Sisk Dam Raise, California. Project will create 130,000 additional acre-feet of water storage at San Luis Reservoir (Reclamation, October 2023).

US Army Corps of Engineers ®

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The U.S. Army Corps of Engineers & the Bureau of Reclamation's Combined

WATER-RELATED INFRASTRUCTURE

Once-in-a-Generation Supplemental Funding
$25.4 Billion - Infrastructure Law
$4.6 Billion - Inflation Reduction Act

1,200+ Dams

5,000+ Recreation Areas

152 Hydroelectric Power Plants

Powering

10 Million Homes

150 Million acre-feet of Water Storage

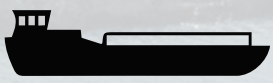
Serves

130 Million People

(Based on average residential gallons per capita per day)

10 Million Agricultural Acres

Tens of Thousands of Miles of Canals



25,000 Miles of Navigable Waterways

Reliable Systems

Dams

Dams are major components of a comprehensive strategy to address water resource challenges posed by drought, flooding, depleted aquifers, environmental needs, energy demands, and population increase and movement in the United States. The Army Corps and Reclamation evaluate the condition of dams, dikes, and levees and monitor the performance of facilities to manage the risks posed to the public. This is done through common Federal public protection guidelines that provide a framework for managing risk for life loss, economic, cultural, and environmental consequences. The guidelines also help maintain the ability of dams and related facilities to provide reliable water, power, and flood risk management benefits.

One of the Army Corps' primary missions is flood risk management. Reclamation's dams also provide flood risk management benefits in many cases, but the agency's mission is focused on water storage to irrigate farms and ranches, supply drinking water, and enhance fish and wildlife habitats. The Army Corps and Reclamation each manage dams that provide water that generates a major portion of the United States' hydroelectric power and creates public recreational opportunities.

Strengths

- The Army Corps and Reclamation conduct regular condition assessments to plan capital investments and assure the continued provision of benefits from the Army Corps' 746 dams and Reclamation's 489 dams.
- State-of-the-art dam safety programs use risk-informed evaluations to identify, analyze, and address hazards. These programs prioritize the safety and welfare of the public and reduce risks to property and the environment.
- The Army Corps Water Infrastructure Financing Program has the capacity to provide $7.5 billion in loans, which will support $15 billion in non-Federal dam infrastructure investments across the United States. The program derived from the Water Infrastructure Finance and Innovation Act of 2014.
- Both the Army Corps and Reclamation have developed programs, at the direction of Congress, to share Federal dam project costs with stakeholders and thus reduce the required Federal investment.
- Reclamation has authority to consider title transfers that can reduce the Federal investment and increase local decision-making.

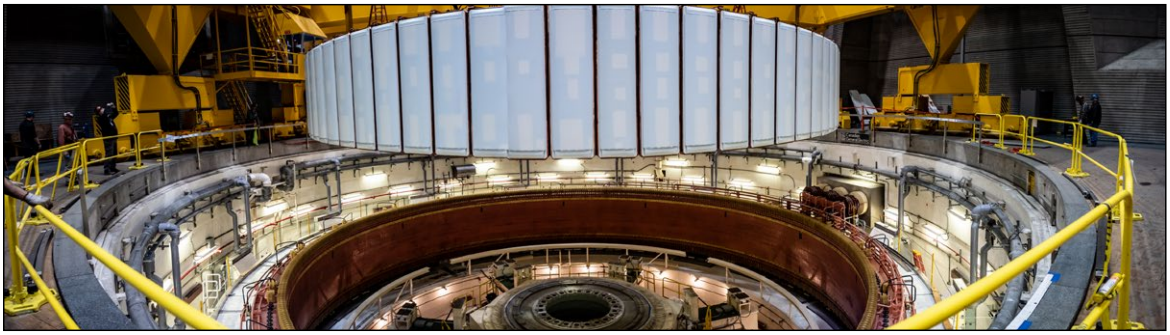
Isabella Auxiliary Dam Safety Modification Project, Lake Isabella, California (Army Corps, June 2020).

Challenges

- Army Corps and Reclamation dams built more than 50 years ago sometimes must operate at reduced capacity for flood storage, water supply, recreation, and other purposes in order to comply with current safety, design, and construction standards.
- Water storage capacity in some reservoirs has decreased due to sediment accumulation and drought, requiring evaluation of sediment removal and management options to reduce risk to water supply, power generation, and other uses.
- Competing infrastructure demands require balancing of water supply, flood risk management, agricultural demand versus municipal and industrial needs, urban encroachment, and storm magnitudes and frequencies.
- Dam safety repair needs sometimes exist in areas of dense population.
- Innovative investments are needed to improve the technical capabilities and financial capacities of non-Federal project sponsors or other entities responsible for operations and maintenance of federally constructed facilities.

Reliable Systems

Hydropower Facilities



Refurbished G23 generator rotor being placed during the G22–G24 Nathaniel "Nat" Washington Power Plant overhaul project, Grand Coulee Dam, Washington (Reclamation, November 2018).

The Army Corps is the largest producer of hydroelectric power in the United States. The Army Corps owns and directly operates and maintains 75 hydropower facilities with a total generating capacity of approximately 24,000 megawatts. Reclamation is the second largest producer of hydroelectric power in the Nation and owns 77 facilities. Reclamation directly operates and maintains 53 of these facilities with a total generating capacity of approximately 15,000 megawatts. Reclamation and Army Corps facilities generate more than 100 million megawatt-hours of electricity each year, the equivalent annual demand of more than 10 million U.S. homes.

As authorized, Federal hydropower generated at Reclamation and Army Corps facilities powers project operations and enables project benefits. Power that is surplus to project requirements is marketed by Department of Energy Power Marketing Administrations. Hydropower revenues have provided a steady source of funding for project repayment and investment. Reliable, low-cost hydropower generated at Reclamation and Army Corps projects has provided tremendous value to the Nation, including spurring local economic development through the provision of reliable electric power to rural communities as well as supporting grid reliability.

Strengths

- Hydropower is a source of clean and renewable energy – providing both firm, dispatchable (available on demand) electric power and ancillary services to support safe, reliable grid operations and integration of intermittent, non-dispatchable renewable resources (e.g., wind and solar).
- Improved turbine reliability has resulted in a 25 percent decrease in unscheduled outages at Army Corps hydropower facilities.
- Systematic Power Review programs provide audit-like evaluations of the status of power programs relative to policy requirements.
- The Army Corps and Reclamation conduct regular condition assessments to strategically plan capital investments at hydropower facilities.
- Army Corps and Reclamation power is generated in a safe, reliable, and cost-effective manner. To that end, both programs seek efficiency while protecting against threats such as cyber attacks.
- Reclamation and Army Corps hydropower programs support the administration's clean energy and climate change initiatives and deliver domestic energy security and economic development benefits.
- Additional hydropower can be developed by non-Federal entities at non-powered Reclamation and Army Corps facilities via Federal Energy Regulatory Commission licensing or Reclamation's Lease of Power Privilege contracting authorization.

Challenges

- Recapitalizing Federal hydropower assets requires an investment strategy that balances trade-offs among performance, reliability, and increased costs.
- Hydrologic variability – notably persistent, long-term drought, has constrained hydropower operations. Both the Army Corps and Reclamation are exploring methods to adapt hydropower operations to ensure continued, long-term benefits.
- Competing water demands require a balance among hydroelectric power generation and flood risk management, water supply, ecosystem restoration, and species enhancement activities.

Reliable Systems

Navigation – Ports, Locks, and Dredging

The Army Corps' primary navigation responsibility is to provide safe, reliable, efficient, effective, and environmentally sustainable waterborne transportation systems for the movement of commerce, national security needs, and recreation. The Army Corps operates and maintains 25,000 miles of navigable waterways, channels, and harbors, including 237 lock chambers at 192 sites and 1,072 coastal, Great Lakes, and inland harbors that directly serve 45 states and territories. Coastal channels and inland and intracoastal waterways maintained by the Army Corps support the Nation's economy and security and contribute to state and local government economic development.

Aerial upstream view of Kentucky Lock Addition Project construction, Nashville District (Army Corps, January 2022).

Strengths

- Since 2010, a 40 percent increase in investment in Army Corps locks and dams has resulted in an 80 percent decrease in unscheduled stoppages, providing more reliable and efficient transportation of goods and services globally.
- The U.S. marine transportation industry supports approximately $2 trillion in commerce annually. Recent navigation investments have improved the resilience of our nation's supply chain to support American jobs and the economy.
- More than 48 percent of consumer goods bought by Americans passes through harbors maintained by the Army Corps. And approximately 743 million tons of cargo or 15 percent of domestic freight is carried by water.
- Infrastructure Law Construction account funding will enable the Army Corps to perform major rehabilitation, construction, and related activities for rivers and harbors, to include work at remote and subsistence harbors, and for work on the inland waterways.
- The potential for more cargo to be transported by larger vessels to improve efficiency has led many ports to pursue harbor deepening or improvement projects. Currently, there are 12 active deepening projects that will allow support of post-Panamax vessels or larger.

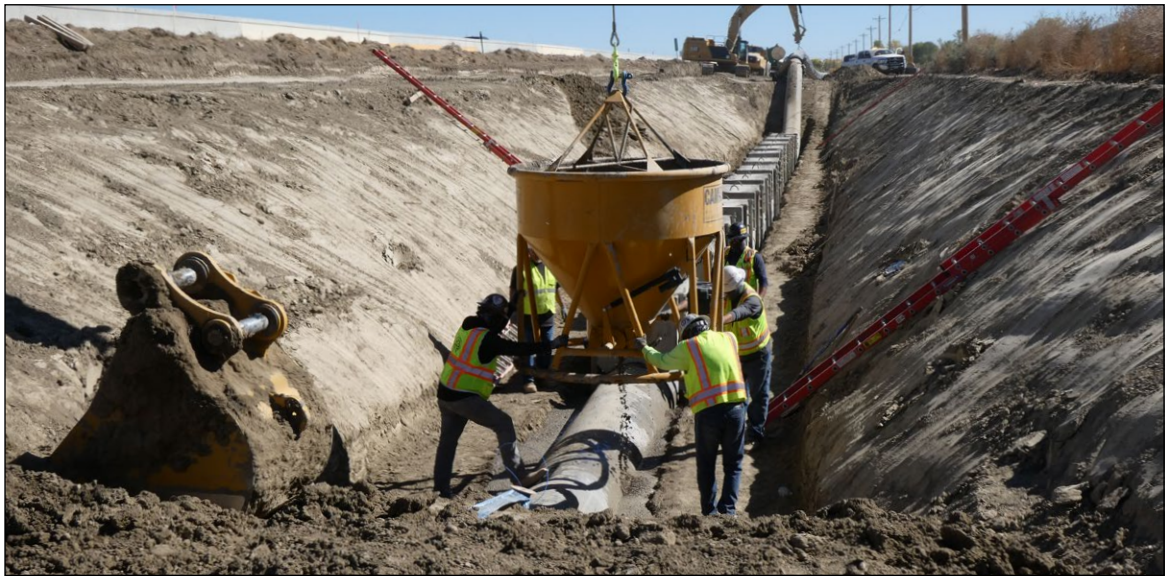
Challenges

- Many inland locks historically lack the capacity or redundancy for optimal industry barge traffic configuration. The Army Corps has been strategically rehabilitating and modernizing inland infrastructure following a Capital Investment Strategy the agency developed for inland and intracoastal waterways.
- The Army Corps conducts regular condition assessments to strategically plan capital investments, and maintains the Nation's harbors, channels, waterways, and infrastructure by using asset management principles that target the greatest economic, environmental, and public safety returns to the Nation, including the reduction of unscheduled lock outages.
- Intermodal transportation using multiple types of transport (e.g., ship, truck, rail) requires extensive coordination with other agencies and entities.
- The Army Corps dredges over 250 million cubic yards of material each year to keep the Nation's channels and waterways navigable. Increased focus is on efficiently managing the dredged material for productive and positive uses including environmental, recreational, coastal storm risk reduction, and economic benefits.

1,200-foot Lock and Dam 25 is located in Calhoun County, Illinois, and Lincoln County, Missouri, at approximately Mile 241.4 on the Upper Mississippi River above the mouth of the Ohio River near Winfield, Missouri (Army Corps, January 2018).

Reliable Systems

Canals and Pipelines



Infrastructure Law construction on the Arkansas Valley Conduit, Colorado (Reclamation, October 2023).

Reclamation's asset inventory includes approximately 12,000 miles of water conveyance features. While primarily main line canals and laterals, this also includes hundreds of miles of pressurized pipelines and siphons. These assets play a critical role in transmission and distribution of water for agricultural as well as municipal and industrial use. Section 40902 of the Infrastructure Law provides $1.05 billion of funding between FYs 2022-2026 for water storage, groundwater storage, and conveyance projects. One project benefiting from this funding is the Arkansas Valley Conduit, a federally owned project in southeastern Colorado that has to date received $160 million in funding under section 40902.

Strengths

- Reclamation conveyance facilities are inspected on a frequent and regular basis, with the more frequent inspections focusing on areas of higher risk. Condition assessments are designed to ensure safe and reliable operation and to maximize cost-effectiveness by identifying priority maintenance and rehabilitation needs.
- Special inspections are performed to examine the condition of assets that are difficult and complicated to inspect, which requires the use of proven and emerging technology and in-depth risk analyses. These actions enable informed decision-making to ensure reliable operations.
- Nearly 90 percent of Reclamation conveyance facilities are transferred works, where operations, maintenance, and replacement are primarily funded and executed by a non-Federal partner. These important relationships bring significant local knowledge and management, while reducing the burden of Federal investment.
- Reclamation continues to exercise its title transfer authority under Public Law 116-9. This enables eligible partners to take ownership of the systems they manage and provides greater flexibility to meet local and regional needs through operational changes and the ability to secure financing for major maintenance and improvement projects.

Challenges

- Reclamation owns 855 miles of canals that have segments in urban areas. To manage the elevated consequences of failure, condition assessments of these segments are more frequent and rigorous. Preventing encroachments and funding risk reduction measures continue to be challenges for our operating partners.
- Reclamation's prestressed concrete cylinder pipe (PCCP) inventory includes more than 50 installations totaling nearly 100 miles. These pipes are prone to sudden failure and have been in service for 25 to 60 years. Reclamation has taken proactive measures to assess the condition of its full inventory of PCCP via electromagnetic inspection.

Reliable Systems

Recreation Facilities

Recreation infrastructure includes boat launches, marinas, campground facilities, roads, parking lots, and buildings and structures that require routine inspection, maintenance, repair, and replacement. Recreation assets provide safe access to recreation for hundreds of millions of visitors without impacting the dynamic multiple missions of the agencies' water-related infrastructure. The Federal Interagency Council on Outdoor Recreation (FICOR) was recently re-launched to create safe, affordable, and equitable opportunities for Americans to get outdoors. The FICOR – which includes leaders from Reclamation and the Army Corps – will focus on improving access to nature, expanding outdoor recreation opportunities, and providing improved and more affordable experiences on America's public lands and waters.

Seven Points Beach, Raystown Lake, Pennsylvania. July 4, 2021 (Army Corps).

The Army Corps is the steward of approximately 12 million acres of land and water at over 400 Civil Works water resources projects located across 43 states. As one of the largest Federal providers of outdoor recreation, the Army Corps hosts approximately 260 million visitors per year at more than 4,800 recreation areas across the Nation. Army Corps lakes and parks include over 94,000 campsites, 7,826 miles of trails, and are home to 14 percent of all freshwater lake fishing in the United States. Reclamation manages almost 8 million acres of land and water, most of which is available for public outdoor recreation. More than 270 recreation areas are managed by Reclamation and Federal and non-Federal partners.

McKay Park/Bend Whitewater Park on the Deschutes River in Bend, Oregon (Reclamation, July 2018).

Strengths

- Recreation at Army Corps lake and river projects is an important part of local and regional economies. Annually, visitors spend approximately $14 billion recreating at Army Corps lakes and waterways, supporting 210,000 jobs. These recreational facilities contribute to local residents' and visitors' quality of life and support state and local governments. $78 million of Infrastructure Law funds has been designated for Army Corps Recreation Program investments in infrastructure that strengthen resilience to climate change while benefiting economically disadvantaged communities. Additionally, $24 million of disaster relief supplemental appropriations (2022) will be utilized by the Recreation Program to repair qualifying flood and storm damages.
- Reclamation's recreation areas evolved from projects that originally focused on single-purpose agricultural objectives to a multipurpose approach that includes recreation as an important benefit. Reclamation's recreational infrastructure plays a major role in meeting the increasing public demands for water-based outdoor recreation facilities and opportunities.
- The Army Corps and Reclamation both work with Recreation.gov to share recreation opportunities.

Challenges

- Recreation facilities (many constructed over 50 years ago) continue to degrade as public demand for recreational opportunities increases.
- The threat of turn-back (transfer of management back to Federal agencies) exists due to limited cost-share funding, inflation, and increased public demands. Reclamation is limited in its ability to provide funding to partners and develop or directly manage recreation areas.
- Maintaining existing Federal property boundaries to protect public lands, natural resources (e.g., timber), and cultural sites can be challenging due to pressure from increased population, development, and private land ownership adjacent to Federal lands.
- Effective management requires balancing accommodating visitors, enabling economic and commercial uses, conserving environmental and cultural resources, planning for natural resources management, performing trespass abatement and law enforcement, and remediating damage to land resources.

Reliable Systems

Bridges and Roads

Army Corps Albuquerque District employees inspect the bridge to the Santa Rosa Dam control tower (Army Corps, May 2022).

Transportation assets are critical for supporting missions associated with water-related infrastructure, including flood risk management, hydropower production, navigation, water supply, recreation, and environmental protection. Public roads and bridges are key to allowing safe public access to Federal lands for recreation and for providing critical transportation corridors across or along projects. Both the Army Corps and Reclamation have a significant quantity of bridge and road assets and participate in the Federal Land Transportation Program under the Office of Federal Lands Highway.

Bridges provide access to project features for maintenance and operations of mission infrastructure, visitation, and general transportation across the projects. Reclamation bridges provide access to high-priority infrastructure, allow for efficient operation and maintenance of Reclamation infrastructure, and provide access to Federal lands. Reclamation has a total of 1,704 bridges, of which 290 are significant public vehicular bridges that are reportable to the National Bridge Inventory (NBI). The average age of Reclamation's NBI bridges is 59 years, 27 percent are over 75 years old, and 3 percent are over 100 years old. In addition, among Reclamation's NBI bridges, 6 percent are in poor or worse condition and 39 percent are in fair condition.

The Army Corps bridge inventory is diverse and serves multiple missions of flood control, emergency management, hydropower production, water supply, navigation, recreation, and environmental protection. Several Army Corps bridges cross state boundaries. The Army Corps has a total of 997 bridges in its inventory; 232 of these bridges are significant public vehicular bridges reportable to NBI. The average age of Army Corps-owned NBI bridges is 61 years. 65 percent of Army Corps bridges are over 50 years old, 22 percent are over 75 years old, and 4 percent are over 100 years old. Bridges in "good or better condition" declined from 78 to 23 percent from 2015-2023. Meanwhile, bridges rated "fair or borderline poor condition" increased from 17 to 68 percent, and bridges rated "poor or worse condition" increased from 5 to 9 percent.

Existing bridge deterioration needs to be prioritized with a focus on preventive maintenance along with formalized efforts to divest, repair, rehabilitate, and replace bridges to meet current and future critical mission requirements.

Reclamation-owned Pit River Bridge carrying Interstate 5 on the top deck and the Union Pacific Railroad/Amtrak on the bottom deck over Shasta Lake, California (Reclamation, April 2019).

In addition to bridges, the Army Corps and Reclamation maintain more than 10,000 miles of paved or unpaved public roads. The Army Corps submits an annual inventory on 7,976 miles of public roads that provide access to nearly 12 million acres of land and water, allowing access to public use areas, project management offices, and crossings over bridges, dams, and levees. Of the Army Corps' paved road inventory, 30 percent is in fair or poor condition and 45 percent of the unpaved road condition is in fair or poor condition. Reclamation submits an annual public road inventory on 3,185 miles of roads. Its roads provide public access to over 7.7 million acres of public land. The Infrastructure Law provides Reclamation and the Army Corps approximately $7 million annually through FY 2026 for each agency in Federal Lands Transportation Program funding.

Strengths

- For bridges, both Reclamation and the Army Corps employ systematic programs that follow Federal Highway Administration and American Association of State Highway Transportation Officials rating methods. Routine inspections are generally completed every 24 months. Certain bridges also receive more advanced inspections such as nonredundant steel tension member or underwater inspections.
- The Army Corps deploys technologies such as infrared thermography, ground-penetrating radar, small unmanned aerial systems, and underwater remotely operated vehicles to assess bridge conditions and to facilitate safer, more efficient engineering decisions. Innovations, technologies, and evaluation methods need to be expanded to allow Army Corps bridge engineers to identify problems earlier, increase bridges' lifespan, stretch limited resources, and prioritize public safety.
- For roads, Reclamation and the Army Corps both use industry standard condition metrics such as Pavement Condition Rating and Pavement Surface Evaluation and Rating for condition assessments, performed on a five-year cycle. For roads within a recreation area, the Army Corps has integrated the manual visual assessment version into operational condition assessments.
- New road design, construction, maintenance, and management technologies and techniques are constantly being developed and incorporated into projects at both agencies. The Federal Highway Administration helps support innovations such as the use of 3D engineered models for more accurate and efficient planning and construction, new methods to determine how to best preserve pavement, and tools to improve efficiency of permit application reviews. New materials and technology, such as increasing the use of permeable paving materials to reduce storm runoff and using recycled materials in pavement, are also helping roads become more reliable and resilient.

Challenges

- Reclamation and the Army Corps own major interstate or highway bridges that require replacement. For Reclamation, it's the Pit River Bridge located on Interstate 5 over Shasta Lake, California, and for the Army Corps, it's the Sagamore and Bourne Bridges that provide the only access to Cape Cod, Massachusetts. Both agencies are pursuing multi-billion-dollar replacement projects with the goal to divest ownership to the respective state Department of Transportation.
- Narrow roadways at project sites do not always safely accommodate recreational vehicles and pedestrians, especially roadways built on structures.
- Both agencies maintain a large inventory of aging bridges that ensure that mission requirements, public traffic requirements, and basic needs for project access are met. Ongoing work also involves the need to fully inventory all bridges (agency-owned or owned by others) that cross project facilities.
- An effort is underway to reduce the number of structurally deficient bridges, as they present higher risk for closure or weight restrictions. However, the rate of deterioration exceeds the rate of repair, rehabilitation, and replacement. Innovative technologies, materials, and construction techniques are required to extend the lives of bridges to ensure they are climate resilient.
- Reclamation completed its first cycle of road condition assessments. The Army Corps is integrating road condition assessments into the Operational Condition Assessment process.

Levees

Successful completion of the first construction contract and first mile of the Sabine Pass to Galveston Bay coastal storm risk management program (Army Corps, 2023).

Scott Mensing, Kansas City's Levees program manager, speaks to new employees on site of the Argentine pump station during a tour of the Kansas City District's local projects (Army Corps, February 2023).

A levee system or "levee" is a human-made barrier along a watercourse with the principal function of excluding flood waters from a limited range of flood events from a portion of the floodplain. Levee features may consist of embankments, floodwalls, pipes and associated drainage features, closures, pumping stations, floodways, and designed channels. The Army Corps Levee Safety Program portfolio is prioritized according to the results of risk assessments. One of the Army Corps' primary missions is flood risk management, and levees have been successful in reducing flooding. The majority of levee systems in the Army Corps Levee Safety Program portfolio are operated and maintained by a local sponsor. The Army Corps provides risk information to local sponsors to inform levee risk management actions, resource prioritization, and technical assistance.

The Army Corps Levee Safety Program portfolio includes 1,599 levee systems totaling 13,323 miles in length. Of these, local sponsors operate and maintain 1,470 levee systems that make up roughly 92 percent of the length in the Army Corps Levee Safety Program portfolio. The remaining 129 systems are operated and maintained by the Army Corps.

Strengths

- The Army Corps Levee Safety Program mirrors its Dam Safety Program, which prioritizes its investments through the results of risk assessments.
- The Army Corps is leading efforts to identify best practices in levee safety to help other agencies develop procedures for levee safety programs and submit information to the National Levee Database.

Challenges

- Changing flood conditions, magnitudes, frequencies, and increased population density can increase risk.
- Resources are increasingly focused on reacting to and recovering from significant natural catastrophic events.
- Effectively communicating risk to the public poses challenges.
- Maintenance and replacement costs are increasing. If unaddressed, deferred maintenance may result in additional levee safety issues.
- A careful balance is required to manage levee safety while minimizing impacts to the environment.

Keeping Communities Safe

Dam Safety Programs

B.F. Sisk Dam Safety of Dams Project construction, approximately 12 miles west of Los Banos, California (Reclamation, January 2023).

Water-related infrastructure and associated facilities produce a wide range of benefits across multiple business areas. For instance, while the original authorization for a given dam may have focused purely on flood risk management, the pool created by that asset may also provide recreation and water supply opportunities that influence other benefits such as economics, environmental conditions, and quality of life.

The condition of Army Corps and Reclamation infrastructure, including a review of operation and maintenance, is regularly evaluated through several programs. The Army Corps and Reclamation use risk-informed evaluations to assess current asset condition and consequences of asset failure. Findings are used to establish a relative risk characterization to estimate failure likelihood and support portfolio investment decisions.

For example, the Army Corps and Reclamation administer similar risk evaluation programs. The detailed evaluations ensure that all dams are operated and maintained properly and effectively, will continue to provide project benefits, and will not pose unacceptable risks to public safety and welfare or to property and the environment.

Reclamation's world-class Dam Safety Program has established a risk-informed framework to meet the program objectives, requirements of the Reclamation Safety of Dams Act, and the Federal Guidelines for Dam Safety. The Infrastructure Law provides a total of $500 million for allocations to the Reclamation Safety of Dams Program for FYs 2022-2026. The entire FY 2022 Infrastructure Law funding for the Safety of Dams Program of $100 million supported the modification of B.F. Sisk Dam Phase 1. Future allocations of Infrastructure Law funding are planned to support subsequent phases of the modification of B.F. Sisk Dam located west of Los Banos, California.

The Infrastructure Law provided Army Corps flood risk management construction funding of $1.334 billion for riverine/inland flood risk management projects in FY 2022. In FY 2021, Army Corps total flood risk management projects prevented $349 billion of damages, and from 2012-2021, they prevented an average of $169.9 billion in damages annually. Army Corps flood damage reduction projects avoid $14 of damages for each $1 invested.

Keeping Communities Safe

Protecting and Restoring the Environment

Water-related infrastructure plays an important role in managing and protecting the Nation's environment and natural resources. Functioning ecosystems serve as "natural infrastructure" that provides many services to our communities. The Army Corps and Reclamation protect and restore this natural infrastructure through several programs.

The Army Corps Regulatory Program evaluates permit applications for construction activities that occur in the Nation's waters, including wetlands. The program is committed to protecting the Nation's aquatic resources and navigation capacity while allowing reasonable development through fair and balanced decisions. The Army Corps Natural Resource Management Program delivers safe public access to Army Corps lands and waters in a manner that protects all project purposes and mission areas through responsible outdoor recreation, environmental conservation, and land use management while partnering with communities to serve the American people. The Army Corps promotes awareness of environmental values and incorporates sustainability into its decision processes and culture.

The Army Corps plays a key role in reducing the negative impacts of invasive species on ecosystems and infrastructure. As the primary Federal agency charged with researching invasive aquatic plants, the Army Corps conducts groundbreaking research to support efficient control while minimizing impacts to natural systems.

Through its Aquatic Ecosystem Restoration Program, the Army Corps works with other Federal, state, tribal, and local partners to improve the structure, function, and processes of degraded ecosystems throughout the Nation. Examples include restoration of America's Everglades, the Upper Mississippi River, Chesapeake Bay, the Columbia River Basin, Puget Sound, and the Gulf Coast. The Army Corps Continuing Authorities Program partners with non-Federal entities on smaller restoration projects, many of which include modifying existing infrastructure for the improvement of the environment. Additionally, the Army Corps partners with The Nature Conservancy through the Sustainable Rivers Program to increase environmental benefits of existing water infrastructure, such as modifying flows downstream of a dam to improve conditions for fish. The program involves 44 rivers nationwide.

Reclamation has significant involvement in the protection of natural resources throughout the western United States. These larger efforts include significant portions of river basins, cover numerous fish and wildlife species and their habitats, and extend over the long term, with planning, implementation, and environmental compliance coverage as much as 50 years into the future. Reclamation's restoration and enhancement activities are aligned with project purposes. Reclamation has numerous major river restoration efforts that are tracked for various reporting requirements. In some cases, Reclamation projects have authorizing legislation that includes benefits to fish and wildlife as one of the project purposes, such as the construction of fish passage facilities, fish barrier removal, or river and stream-bank protection and enhancement.

Supported by Reclamation funding, the Sailor Bar Project enhanced crucial habitat for native fall-run Chinook salmon and steelhead trout by laying clean gravel into the Lower American River (Reclamation, September 2022).

A park ranger from Russell Lake plants water willows as part of a joint effort with the Georgia Department of Natural Resources and the Army Corps. The native plants provide shelter for young bass, feeding areas for fish, and help prevent bank erosion (Army Corps, June 2019).

The Inflation Reduction Act includes $4 billion in funding for water management and conservation efforts in the Colorado River Basin and other areas experiencing similar levels of drought. In Reclamation's Lower Colorado Basin Region, the Conservation and Efficiency Program and a landmark agreement to accelerate California's Salton Sea restoration, both funded by the Inflation Reduction Act, are providing the resources needed to implement actions to manage drought mitigation and conserve precious water.

Strengths

- Restoration activities by the Army Corps and Reclamation support efforts to protect and recover species listed under the Endangered Species Act, such as salmon.
- The Army Corps and Reclamation's restoration, enhancement, and land management activities involve partnerships and cooperation with Federal, state, and local agencies; tribal governments; and various non-profit environmental conservation organizations and stakeholders. Partnerships help ensure successful implementation through cost-sharing efforts that provide hundreds of millions of dollars in funding.
- Reclamation and the Army Corps both support invasive species control across service areas and collaborate with states and other partners to construct watercraft inspection stations to prevent the spread of zebra and quagga mussels, and to prevent infestations that could cause billions of dollars in damage to private and publicly owned infrastructure such as power plants and water intakes. Additionally, the Army Corps constructs barriers to keep invasive Asian Carp out of the Great Lakes.
- The Army Corps attempts to incorporate natural and nature-based features into its projects in all mission areas through its Engineering with Nature Program.

Challenges

- Changing landscapes, competing demands for water, and dynamic environmental conditions (e.g., drought and wildfires) continue to create challenges in designing, prioritizing, and implementing restoration projects nationwide.
- The demand for restoration projects continues to increase and challenges limited Federal resources to complete, maintain, or initiate new projects.
- Invasive species will continue to threaten infrastructure and ecosystems throughout the Nation. Preventing the spread of and early eradication of invasive species are critical to protection of our national infrastructure and economy.

Fish ladder at John Day Lock and Dam, Columbia River near Rufus, Oregon (Army Corps, March 2020).

New pumping station on the shore of the Salton Sea to pump water into newly established deep water habitat. The Inflation Reduction Act provided $22 million in FY 2023 and will provide up to another $228 million over the next four years to support Salton Sea restoration projects (Reclamation, December 2023).

Construction on the first Tributary Habitat Project in the Yankee Fork Basin, Idaho. Side channels and ponds are being dug for juvenile salmonids (Reclamation, February 2021).

Security Response Force members at Hoover Dam, Nevada (Reclamation, 2019).

Keeping Communities Safe

Facility Security

To protect the public and the Nation's investment in critical infrastructure, Reclamation has actively integrated security into its facility management practices. By developing and implementing a comprehensive risk assessment program that encompasses infrastructure, information, and personnel, the Security Program supports Reclamation's mission to deliver water and power. Comprehensive facility assessments provide improvement recommendations that are then prioritized by risk. The program has made significant facility and procedural improvements through the application of fortification funds. By design, these improvements are often invisible to the visiting public. Reclamation actively engages with the Army Corps in a variety of forums to ensure consistent policies and strategies for infrastructure protection. Due to increasing cybersecurity risks to critical infrastructure, Reclamation has also made investments to secure operational technology control systems. These forums help the greater Dams Sector community to facilitate resilience of integrated water systems throughout the United States.

The Army Corps applies an integrated risk management approach to facility security. Risk-informed security strategies that address both physical and cyber security threats ensure the delivery of the Army Corps' mission and secure the Homeland. Due to increasing cyber terrorism, the Army Corps created a Cyber Security Center of Expertise, the U.S. Army Corps of Engineers Critical Infrastructure Cybersecurity Center of Expertise (UCIC), to help identify and combat cyber risk to operational technology control systems. The UCIC and Reclamation collaborate extensively, and with other Federal agencies, on operational technology initiatives to improve threat detection and prevention capabilities. The UCIC partners with the Army Engineer Research and Development Center Advanced Threat Landscape Simulations Team to assist with cyber vulnerability assessments for operational technology. Through an integrated protection program, the Army Corps implements multiple security and mission assurance programs across the agency. This approach and associated Army Corps policies, along with accompanying U.S. Department of Homeland Security and Department of Defense policies, integrate and coordinate security programs and facilitate risk-informed decision-making in an all-hazards environment.

The Army Corps has initiated a pilot program in the Savannah River Basin to perform an all-hazards watershed-wide assessment to determine resilience in watershed communities and impacts on projects. In addition, Reclamation's Truckee Canal Extraordinary Maintenance Project received $35 million in Infrastructure Law funding in FY 2022 for Phase 1 construction to line 3.5 miles of the earthen canal in the most vulnerable stretch in Fernley, Nevada, to support structural integrity and community safety.

All-American Canal desilting facility on Lower Colorado River downstream of Imperial Diversion Dam, California. Imperial Dam is receiving $9.5 million in new funding, part of a $20 million announcement through the Infrastructure Law (Reclamation, April 2023).

Protecting Investments and Planning for the Future

Inspection and Asset Management Programs

Reliable performance of the Nation's water resources infrastructure is essential to these assets' ability to deliver safe and dependable service. The Army Corps and Reclamation combined operate, maintain, and manage more than $340 billion of the Nation's water-related infrastructure assets. From navigation locks and hydropower plants to dams and recreation areas, these assets are a vital part of the Nation's economy, safety, and security and must be managed in an accountable and responsible manner.

Both agencies carry out this responsibility through a "structured asset management system," which is a risk-informed decision-making approach that assesses the lifecycle of projects. In doing so, the Army Corps and Reclamation seek to optimize value derived from the portfolio for the benefit of the agencies, their stakeholders, and the Nation. The application of a performance-based, risk-informed lifecycle approach across all water infrastructure systems allows for prioritization of limited funding to make investment choices at key decision points throughout the complete lifecycle of a project.

Both agencies must balance the competing demands of assets having multiple functions. Risk-informed evaluation methodologies are used to address the multi-purpose character of assets, to include assessing the current condition of an asset and the consequences of its failure to establish a relative risk index supporting portfolio investment decisions within an authorized project. Reclamation utilizes this approach to support reporting major infrastructure needs to Congress biennially.

The Army Corps and Reclamation Asset Management programs use a strategic investment framework to optimize the delivery of benefits to the Nation. This framework and the implementation of asset management within each agency are aligned with the International Standard on Asset Management, ISO 55000. While Reclamation and the Army Corps have successfully managed their assets since inception, adopting a formal asset management approach consistent with modern practices and techniques is necessary to continue that success and meet current challenges:

- Accurate asset information is needed to support budget requests for infrastructure investments.
- Comprehensive, long-term planning strategies are needed to safely extend the useful lives of these assets, invest limited funds wisely, enhance public safety, and reduce or mitigate the consequences of infrastructure failure.
- Resources are limited for managing and maintaining assets that are reaching or exceeding their design lives.

Each agency's asset management approach provides common practices for inventorying, assessing, and categorizing assets to help determine each asset's strengths, weaknesses, and value to the mission in order to:

- Improve reliability, minimize risk, and meet projected infrastructure demands.
- Monitor and maintain asset condition to prevent, or to diminish to an acceptable degree, the consequences of operational (component or system) failure.
- Collect and maintain asset information so that condition, cost, and resource requirements are consistently communicated to stakeholders.
- Strategize operations, maintenance, capital investment, and disposal decision-making.
- "Right-size" the asset inventory and balance benefits, consequences of failure, and risk against lifecycle costs.
- Standardize best practices, promote accountability, and predict work requirements.
- Use a lifecycle approach (planning, design, procurement, construction, operation, maintenance, etc.) to maximize project portfolio benefits and minimize cost.

The Infrastructure Law made $3.2 billion available over a five-year period (FYs 2022-2026) for aging infrastructure-related maintenance projects across the 17 western states. This is the Infrastructure Law's largest program allocation, demonstrating Congress's awareness of the increasing frequency of major maintenance costs on America's vital western water infrastructure as it ages.

Through structured maintenance management, operational condition assessments, risk assessment, and portfolio analytics, the Army Corps and Reclamation develop risk information that improves inputs to investment decisions. This philosophy ensures a uniform, consistent, and repeatable process to support risk-informed budget decisions that comply with law and appropriations.

Friant-Kern Canal Middle Reach Phase 1 Construction, California. The project received $22.2 million in FY 2023 through aging infrastructure-related Infrastructure Law funding (Reclamation, December 2022).

Protecting Investments and Planning for the Future

Water Supply

Addressing future water supply needs will require effective actions for the maintenance, protection, and enhancement of water-related infrastructure. Careful management of the Nation's water supply is critical to limiting water shortages and lessening the impact of droughts.

Army Corps and Reclamation facilities store water to provide municipal and industrial and irrigation water that supports the health of communities, food supplies, and industry. Reclamation supplies water to 10 million acres of farmland and more than 140,000 farmers in the western United States.

The Army Corps has 135 multiple purpose reservoir projects that contain authorized storage space for municipal and industrial water supply uses in 26 states. These projects provide over 10 million acre-feet of dedicated water storage for state and local water supply entities. In addition, 45 Army Corps reservoir projects are authorized for irrigation uses; however, typically the authorization does not specify an amount of storage space, and uses of projects for irrigation are administered through Reclamation facilities.

The Infrastructure Law provided unprecedented support for Reclamation's authorized rural water projects in the form of $1 billion from FYs 2022 to 2026. These projects provide potable water to rural and tribal communities across six states: Iowa, Minnesota, Montana, New Mexico, North Dakota, and South Dakota. Reclamation announced $420 million in Infrastructure Law investments in the authorized projects in FY 2022 and another $278 million in FY 2023.

The Army Corps and Reclamation foresee the following challenges in addressing water supply needs into the future:

- Increasing populations in the western United States have resulted in an increased need to access and use available water supply storage in reservoirs.
- For Reclamation, droughts have made water supply operations and revenues more variable, and resources are required to meet partner needs and maintain public health and safety.
- The availability of water storage can be limited by siltation issues and dam safety restrictions.
- It will be important to continue to expand coordination with partners and stakeholders to balance the costs associated with project rehabilitation and operation and maintenance of facilities.

Before and after picture sent in by a new rural customer of Fort Peck Reservation – Dry Prairie Rural Water System, who received water in 2022 as part of the Scobey-Flaxville Ph2 Branchline Project (Reclamation, 2022).

Through programs such as WaterSMART and the Water Infrastructure Improvements for the Nation Act, Reclamation will continue to work cooperatively with tribal governments, states, and local entities to implement actions to increase water supply by modernizing existing facilities and building out new infrastructure. WaterSMART supports investments in existing infrastructure to increase water supply reliability by leveraging Federal and non-Federal funding. The WaterSMART Program includes funding for cost-shared grants for water management improvement projects; collaborative efforts in the Basin Study Program to address imbalances between supply and demand; Title XVI Water Reclamation and Reuse projects; collaborative watershed projects through the Cooperative Watershed Management Program; planning and design activities through the Water Conservation Field Services Program; and drought planning and implementation actions to proactively address water shortages. The programs included in WaterSMART are collaborative in nature and work is done in partnership and cooperation with non-Federal entities and other Federal agencies to reduce conflict, facilitate solutions to complex water issues, and stretch limited supplies.

Protecting Investments and Planning for the Future

How the Army Corps and Reclamation are Working Together

Lake Mead water level behind Hoover Dam (Reclamation, July 2023).

The Army Corps and Reclamation have a long history of collaborating on the evaluation, construction, and operation and maintenance of water infrastructure projects with a variety of asset types. The agencies have asset management responsibility for a diverse portfolio of water-related constructed assets. With a number of facilities now over 100 years old, both agencies are responsibly managing aging infrastructure issues.

The Army Corps and Reclamation have multi-purpose asset portfolios, which include assets that range in size and complexity, span large geographic areas, and serve a variety of functions. Assets range from simple boat launches to massive dams, extensive levee systems, and locks as long as four football fields. These portfolios include structures for river navigation, hydropower, irrigation, flood risk management, recreation areas, fish ladders, utility systems, and laboratories.

A Federal Asset Management Working Group was established to link asset management professionals from the Army Corps, Reclamation, the Western Area Power Administration, and the Bonneville Power Administration to collaborate on asset management best practices and solutions to asset management challenges, and to provide a forum to expand the group's knowledge in order for all agencies to maximize the value of the Federal assets.

The Army Corps and Reclamation also coordinate on dam safety programs. Dams must be operated and maintained in a safe manner. This is ensured through inspections for safety deficiencies, analyses utilizing current technologies,

and corrective actions as needed based on current engineering practices. The Army Corps and Reclamation Safety of Dams Programs use similar approaches to evaluate and implement actions to resolve safety concerns at dams. Under these programs, the Army Corps and Reclamation complete studies and identify and accomplish needed corrective actions on high- and significant-hazard dams. The selected course of action relies on assessments of risks and liabilities with environmental and public involvement input to the decision-making process.

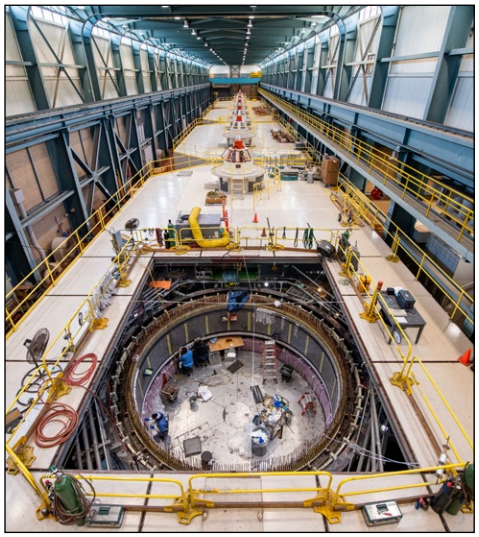
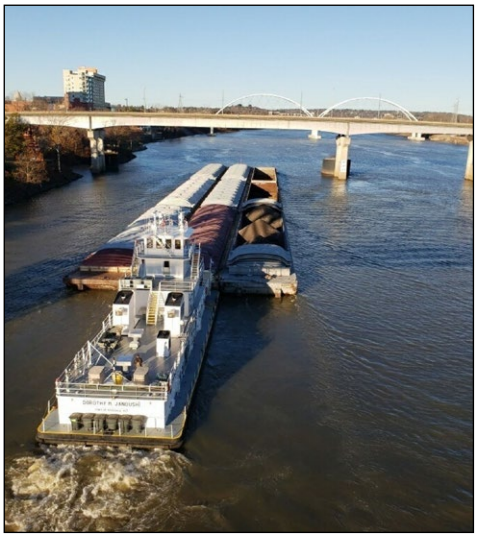
An example of close collaboration on critical infrastructure needs is the Lower Yellowstone Intake Diversion Dam Fish Passage Project (featured on the cover and on page 2).

The Army Corps and Reclamation also collaborate to address reservoir sedimentation issues. Federal reservoirs provide the largest percentage of water storage volumes in the United States. Monitoring sediment accumulation and changes in the rate of accumulation in these reservoirs are essential to understanding the magnitude and geographic extent of reduced storage volume due to sediment accumulation. Evaluating reservoir vulnerabilities to changes in sedimentation rates is critical to the long-term management and reliable performance of reservoirs.

An interdisciplinary and interagency project team was established that utilizes Army Corps regional technical specialists and the Army Corps Committee on Channel Stabilization. The Army Corps developed a baseline report on reservoir sedimentation status, and related efforts leverage existing information and maximize knowledge related to reservoir sedimentation and associated impacts. This work supports further interagency collaboration through the U.S. Geological Survey's interagency Reservoir Sedimentation Database. To help prioritize and plan required reservoir surveying and budgeting, Reclamation is piloting a Reservoir Sedimentation Survey Team. Region-wide strategic plans and an initial reservoir-specific monitoring plan will be formulated by each region as part of the pilot program. Sharing best practices for regular, periodic monitoring will help provide reliable data to predict sedimentation impacts to reservoirs.

Leadership from the Department of the Interior, Army Corps, and Reclamation cut the ribbon during the ribbon-cutting ceremony for the Lower Yellowstone Bypass Channel in Glendive, Montana, July 26, 2022 (Army Corps).

Moving Forward


The three images above - William R. Gianelli Pumping-Generating Plant, McClellan-Kerr Arkansas River Navigation System, and El Vado Dam and Reservoir - represent the inventory of water-related infrastructure managed by the Army Corps and Reclamation, providing mission-critical power generation, navigation, and water supply benefits to the Nation (Reclamation, March 2021, left; Army Corps, December 2018, center; Reclamation, May 2022, right).

Over the Nation's history, investments in water-related infrastructure have resulted in a robust inventory of vital, long-term assets. This infrastructure is one of the Nation's most valuable assets, and the Army Corps and Reclamation are committed to maintaining, protecting, and improving the infrastructure for continued delivery of power generation, water supply, navigation, public safety, recreation, and other benefits. The agencies will continue to use an all-government approach to efficiently manage taxpayer funds and pursue opportunities to respond to challenges related to water-related infrastructure.

Looking ahead, evolving influences on the Nation's infrastructure shall include but are not limited to:

- Continuing to invest once-in-a-generation supplemental appropriations provided through the Infrastructure Law and Inflation Reduction Act to advance resilience of the Nation's critical water-related infrastructure.
- Increases and shifts in population that result in changing water supply and power needs, new demands, changes in potential consequences that affect risk management strategies, and ongoing updates to facility security measures.
- Changes in the magnitudes and frequencies of hydrologic events, resulting in the potential for greater damages to exposed areas and a need for continued and improved monitoring and response capabilities so that water-related infrastructure can provide the Nation with vital benefits long into the future.

List of Acronyms and Abbreviations:

Acronym or Abbreviation	Definition
Army Corps	U.S. Army Corps of Engineers
FICOR	Federal Interagency Council on Outdoor Recreation
FY	Fiscal Year
IAM	Institute of Asset Management
Infrastructure Law	Bipartisan Infrastructure Law
NBI	National Bridge Inventory
PCCP	Prestressed concrete cylinder pipe
Reclamation	Bureau of Reclamation
UCIC	Critical Infrastructure Cybersecurity Center
WaterSMART	Sustain and Manage America's Resources for Tomorrow

Glen Canyon Dam High-Flow Release, Arizona, April 24, 2023 (Reclamation).

State of the Infrastructure

A Joint Report by the Bureau of Reclamation and the U.S. Army Corps of Engineers

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