A River Process and Risk Based Framework for Sediment Management at Dam Removal Projects in New York State

Foster Valle and Tim Koch, NY State Department of Environmental Conservation

A State Regulator's Perspective: Chasing the RIDM Principle

Andrea Henry, P.E., Virginia Department of Conservation and Recreation

How can state programs revise regulations to incorporate risk informed decision-making while:

- Overcoming anecdotal evidence
- Lowering costs for dam owners
- Managing a large dam portfolio across a diverse state, and
- Battling the "unknowns"

The Commonwealth of Virginia's Dam Safety Program is fortunate to have a growing number of staff dedicated to bringing an inventory of 2500 dams into regulatory compliance. Current regulations reflect prescriptive standards and a uniform hazard classification methodology. If almost 60% of dams within the State's inventory are currently considered non-compliant, how do we justify added regulatory complexity? This presentation will reflect efforts to set the stage for the future of risk informed decision making in Virginia including the development of comprehensive guidance documents, a revised IDA process, reducing requirements for low hazard dam owners, and identifying significant and high hazard potential dams throughout the entire portfolio.

Armoring Spillways and Embankments with Articulating Concrete Blocks

Paul Schweiger, P.E., CFM, GFT

Over the past 36 years numerous embankment dams and earth-cut spillways in the United States have been armored using Articulating Concrete Blocks (ACBs) to provide erosion protection. Several dams and spillways armored with ACBs have been overtopped and performed satisfactorily with overtopping flow depths and velocities exceeding 4 feet and 30 feet per second, respectively. Much has been learned about what works and what does not work. Of the ACB installations that have failed or experienced damage, the underlying issues have been attributed to one of several possible failure modes that were not understood or adequately addressed during the design. This presentation will share information on several recent ACB embankment armoring projects completed in the Northeastern region of the United States. ACB spillway armoring failures will be discussed that have been attributed to one of several potential failure modes that may not have been understood or adequately addressed during design. State of the practice design features to address these potential failure modes will be presented. This information is important for engineers to consider during their designs, and for regulators reviewing ACB armoring designs, so that future failures and unnecessary damage resulting in costly maintenance can be prevented.

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Back in my day...How historical data can help your project of today

Nathan Clymer, PE, Hazen and Sawyer

We live in a world where large amounts of historical data are increasingly available. Dam engineers have the difficult task of compiling, categorizing, and selecting what to use. During this process questions inevitably arise about the data source, precision and accuracy, and usefulness. A dam engineer conducting a rehabilitation of a dam may have hundreds or thousands of pages of design reports, design drawings, and as-built drawings to comb through. This leaves the engineer with many decisions to make about what task they are trying to accomplish and then what data is usable as-is, where that data needs to be verified prior to using, what supplemental data is needed, and what data to discard. Lessons learned from several example dam rehabilitation projects will be presented, including historical data that were available, how they have been mis-used, methods for correcting those issues, and how to avoid those mistakes in the future. Specific types of data to be discussed include Historical Design drawings, As-built drawings, reports, and geotechnical boring logs will be among topics discussed.

Considerations for dam safety risk in capital planning

Rachel Barrows and Rachael Bisnett, Stantec

Municipal dam owners are increasingly recognizing the risk to water supply from aging dam infrastructure and increased frequency of extreme loading events. Within an asset management context, reservoirs and their associated dams are often considered “static” features of municipal water treatment and distribution systems while system components like pipelines and plant equipment are integrated into asset management systems and subsequent capital improvement planning. Asset management practices typically emphasize potential service impacts, replacement costs, and service life for individual assets wherein industry or owner-specific data on reliability is readily available. This approach works well for the traditional components for which anticipated consequences of failure may include loss of service, reputational impacts, and/or environmental damages. Consequences of failure for dams are significantly different and may include long-term supply loss, regional economic impacts, and life loss consequences. Because of these inherent differences in risk type and scale, additional considerations are required to incorporate dams into utility-wide asset management and capital improvement planning. Risk-Informed Decision Making (RIDM) is the standard of practice for managing dam safety. RIDM leverages dam failure risk to prioritize projects and funding within an individual dam or a portfolio of dams. Likelihood of potential hazards, dam performance, and consequences of potential failure are considered within the RIDM framework to estimate the risk. Municipal dam owners also have a need to incorporate unique water supply and operational consequences, which are specific to each owner, system, and facility. Integrating dams into existing asset management and planning practices requires collaborative development between dam owners and dam safety practitioners to understand existing systems and support the organization’s long-term needs. Springfield Water and Sewer Commission (SWSC) and Stantec performed a Portfolio Screening Risk Assessment (PSRA) for nine of SWSC's dams. The PSRA leveraged established RIDM practices, SWSC’s existing capital planning framework, and information on SWSC’s operations and distribution system to develop a relative estimate of the overall portfolio and dam-specific risk profiles. The results from the PSRA were used to define and prioritize future capital expenditures for SWSC’s dams. This presentation will cover the approach that was developed and implemented with the goal of outlining a simplified framework that could be referenced by other dam owners.

Cuba Lake Dam Low Level Outlet Replacement

N. Johan Anestad, P.E., and Hannah R. Williams, EI, Ramboll

Cuba Lake Dam is a High Hazard structure located in Cuba, NY. The dam was originally constructed in 1852 - 1858 to impound the largest and most important feeder reservoir to the Genesee Valley Canal. It currently serves to retain Cuba Lake, a popular recreation destination in Western New York. The New York State Office of General Services (NYSOGS) retained Ramboll Americas Engineering Solutions, Inc. in 2014 (Ramboll) to prepare an Engineering Assessment Report for Cuba Lake Dam. The dam was found to be in generally good condition and capable of passing its Spillway Design Flood (SDF). The existing twin 18-inch ductile iron pipe low-level outlet, however, was found to be in a deteriorated condition with inoperable control valves. Additionally, the outlet controls were located on the downstream end of the pipes, leaving the system fully charged under approximately 55 feet of head. The NYSOGS tasked Ramboll with developing alternatives for a replacement of the non-functioning low-level outlet system. Following review of the presented alternatives, a value-engineered option of installing three siphons installed across the dam in lieu of outlet pipes through the dam was chosen as the preferred design approach. Design and permitting of the proposed replacement involved coordination between multiple agencies and stakeholders, including the NYSOGS, NYSDEC, US Army Corps of Engineers and the Cuba Lake District, the caretakers of the dam and representative of the many homeowners along the perimeter of Cuba Lake. Construction of the new low-level outlet commenced in November 2024 and reached Substantial Completion in September 2025. This presentation will provide a brief history of the evaluation, design and permitting of the siphon system and look at the dam during the construction phase, culminating with successful operation of the system.

Design and Construction for the Loughberry Lake Dam Rehabilitation

Zachary King, P.E., Schnabel Engineering; James Salaway, P.E., City of Saratoga Springs – DPW

The City of Saratoga Springs, NY is completing construction on the rehabilitation of Loughberry Lake Dam, which is an earthen embankment dam 1,000 feet long and 40 feet high that impounds the primary water source for the city. Raw water is drawn from Loughberry Lake, conveyed beneath Route 50 and treated at the Saratoga Springs Water Plant located south of the dam. Spillway flows are conveyed separately and discharged beyond the toe of the dam. The rehabilitation, projected for completion in December 2025, included slip-lining the existing principal spillway tunnel and relocating the principal spillway weir downstream. The new spillway location allows the slip-lined principal spillway tunnel to serve as a secondary water supply for the water treatment facility, thus allowing for inspection and repair of the existing 90-year-old intake piping. The rehabilitation also involved constructing an upstream stability berm, replacing the principal spillway conduits to alleviate hydraulic constrictions, centrifugally casting the auxiliary spillway conduits with concrete, and placing an energy dissipation structure for combined spillway conduit discharges. Key design constraints included the maintenance of Loughberry Lake during construction and coordination with adjacent projects and regulatory entities. The water treatment plant was required to remain operational throughout construction, resulting in specific project phasing and strict limitations on the lake drawdown and allowable turbidity. Siphons and bypass piping were installed through the primary and auxiliary spillway systems during different construction phases to prevent overtopping the upstream cofferdam. Turbidity levels were measured hourly by City staff, and the City held the authority to temporarily cease construction activities at any point should turbidity surpass specified limits. Intake and overflow pipes were incorporated to connect the new principal spillway chamber and the recently constructed water intake structure (designed and constructed by others), matching existing grades and elevations. Portions of the project were constructed within an easement on the adjacent property which is concurrently undergoing independent development, requiring coordination on manhole grades, construction traffic, staging areas, and restoration responsibilities. Since Route 50 spans the dam crest, construction required receipt of a NYS DOT Highway Work Permit to coordinate work within the NYS DOT right of way. To mitigate impacts to traffic during the Saratoga Race Course Season, no lane adjustments on Route 50 were allowed between May 30th, 2025 and September 2nd, 2025.

Enhancing Waterway Management and Decision-Making through System-Wide Hydrologic and Hydraulic Modeling of the Erie Canal

Allan Estivalet, P.E., CFM, Schnabel Engineering; Barry Anctil, P.E., MBA, New York Power Authority

The Erie Canal is a historic waterway extending approximately 360 miles across upstate New York, connecting the Great Lakes to the Hudson River and ultimately the Atlantic Ocean. There are over 150 miles of earthen embankments impounding the Canal, which present a potential hazard to public safety in the event of failure. To date, no comprehensive breach modeling or consequences evaluation has been completed to help the Canal Corporation understand their risks associated with failure of these embankments. To address this gap, system-wide hydrologic and hydraulic (H&H) modeling, including breach analysis, is being performed.

Comprehensive hydrologic and hydraulic models are in development for the Erie Canal system in western New York, focusing on the 17- and 60 Mile Pool reaches between Lockport and Macedon. These areas were selected due to their likely highest consequences in case of structure failures. HEC-RAS 2D rain-on-grid models were developed to simulate rainfall, infiltration, and runoff directly on the 2D mesh, providing a fully coupled representation of overland flow, channel routing, and spatially variable rainfall. This approach eliminates the need for separate hydrologic inputs from external models and allows rainfall to be applied directly across the terrain. As a result, it more accurately captures localized runoff generation, flow connectivity, and dynamic interactions between surface water and hydraulic structures than traditional deterministic models. Extensive data was collected to inform and develop the model, including high-resolution terrain and bathymetric surveys, aerial imagery, and detailed structure inventories. The models capture the complex interdependencies among the system's major components such as locks, gate systems, waste weirs, dive culverts, and water impounding embankments across a range of flood and operational scenarios. The resulting simulations provide quantitative insights into canal storage dynamics, water-surface levels, asset performance, and downstream consequences associated with potential embankment breaches.

This presentation will provide participants with valuable insights into the fascinating Erie Canal system and show how the integration of modern engineering, data solutions, and advanced technologies enables the Canal Corporation to better understand, assess, and manage the risks associated with its Canal embankments and other assets. The outcomes of this work enhance canal operations, strengthen emergency preparedness, and support long-term capital planning across the Canal system.

Finding ‘New’ Dams on the Erie Canal

Kevin O’Malley, PE, New York Power Authority

Problem Statement – Multiple significant dams, in-place for 100+ years, were absent from the regulators inventory: NYSCC, a subsidiary corporation of NYPA since 2017 owns over 140 dams integral to operation of the current and former NYS Canal System. Some of these dams were not identified in the NYSDEC inventory until 2019. Thirteen of these dams were located on the 17- & 60-mile pools in the Western Region of the Erie Barge Canal. Baseline documents needed for compliance including Emergency Action Plans (EAP’s), Safety Inspections, Engineering Assessment (EA’s), and Inspection & Maintenance (I&M) Plans had to be created for multiple dams on a similar timeline while overcoming the logistical challenge of working around a fully operational canal focused on supporting navigation and recreational activities while also relying on design and construction record documents typically more than 100 years old.

Method/Approach – Contract with expert Consultants utilizing a multi-year approach to scoping work with regional and hazard-based prioritization to complete the necessary field work and analyses for compliance with NYSDEC regulations while also embracing the use of RIDM based risk assessment methods to rank the dams based on impacts to the public paired with Potential Failure Modes (PFM’s) for each site.

Findings – Significant budget utilization required. Multiple internal staff working with acquisition teams, Consultant PM’s, etc. to maintain progress. Identified deficiencies at each dam in stability and structural analyses to inform soundness of structures, consequences of failure, risk analysis and risk prioritization. Identified system lack of overflow capacity, and lack of downstream hydraulic capacity in existing stream channels.

Implications- Identified deficiencies in condition at all structures, completed stability and structural analyses to inform soundness of structures, evaluation of risk to help focus and prioritize structures for maintenance, repair and rehabilitation. Developed a new appreciation among the Canals and NYPA teams for the significance of the structures they work with each day.

Fission Chips and Train Trips: Adventures in Dam Safety

James R Guistina, PE, Colliers Engineering and Design

Our team of professionals undertook the repair of an earthen auxiliary spillway used to discharge overflow from two embankment dams in Ashford, NY (30 miles south of Buffalo, NY). The dams are under the jurisdiction of the Department of Energy (DOE) and New York State Energy Research and Development Authority (NYSERDA). Development Dam #1 (Lake 1 Dam) and New York State Atomic Development Dam #2 (Lake 2 Dam) are both Class A or Low Hazard Dams and were initially built to supply water to the West Valley Demonstration Project (an abandoned nuclear waste recycling plant). The dams drain a total watershed of just under 5 square miles and consist of two separate earthen embankments that run in a series from northwest to southeast. The spillway for Lake 2 Dam is a 36" Reinforced Concrete Pipe (RCP). Lake 1 Dam has a 150' +/- wide grass lined spillway (which is the subject spillway) that discharges into Buttermilk Creek. The 2000' long canal connecting the lakes has a history of sedimentation from landslides and is the only hydraulic connection between the separate reservoirs. The project was necessitated by overtopping events that have caused significant erosion to Lake 1 Dam's earthen spillway and the eastern edge of the lake's shoreline. These incidents resulted in damage to the rail line that run over the top of each embankment by washing out the track ballast and posed a serious risk of catastrophic dam failure and loss of the reservoir. We formulated comprehensive plans and specifications to address the erosion of the dam's spillway with challenges including: Complex 2D and 3D hydraulic modeling of the unique reservoir system; extremely poor glacial soils on which to found a new structure; limited staging area and an outlet stream that is perpendicular to the proposed spillway which has a long history of flooding and lateral migration. The discharge creek also progressed through a culvert immediately downstream of the spillway discharge that was well undersized for design storms. The solution included replacing the turf-reinforced earthen spillway with a reinforced concrete structure, thereby enhancing the spillway's capacity to prevent overtopping and safeguarding the railroad situated atop the dam. The project provided morphologic improvements to the downstream, while creatively handling the high velocities (25-30 ft/sec) discharging into the highly erosive creek bed. The project was designed from 2020 to 2024 with construction completed in 2025.

Gate House Repairs Under Pressure (Literally)

Gregory Johnson, P.E., PMP, and Rex Powell, P.E., Colliers Engineering & Design

Indian Lake dam is a cyclopean concrete and masonry dam constructed circa 1898. During rehabilitation to address stability, seepage, and general upgrades, a dive inspection into the gatehouse revealed extensive damage. Although minor repairs were always expected, the condition was much worse than anticipated and long-term performance of the structure was in question. The gatehouse is roughly 40 ft below water and the structure's issues complicated the repair solution. The challenges included 5-foot-diameter low level outlet conduits that would not shut completely making access dangerous/difficult, masonry construction with severe mortar loss that rendered the structural capacity extremely limited, and some portions of the support walls that were completely inaccessible making them very difficult to address. Because the condition was discovered during construction, developing a repair solution was a priority. Different alternatives were brainstormed and evaluated, and an independent structural facing placed outside of the existing walls was ultimately chosen as the preferred alternative. There was no cofferdam included in the rehabilitation project prior to discovery of the gatehouse issues and cost estimates of the planned work for the gatehouse indicated that the cofferdam option would add significant cost. The design team developed plans to repair the structure using a three-sided reinforced concrete facing constructed with tremie concrete & divers. An early design modification was to use precast concrete panels in lieu of conventional formwork which had several benefits. First, the thimbles for exterior sluice gates could be cast into the precast allowing the divers to more easily align the thimble with the existing opening. The exterior layer of reinforcing could be cast within the panel and formwork for the corners and vertical joints between the panel could be easily placed against the panels. The design team worked through the details which included room for lap lengths at vertical panel joints, room for standard hooks at the corners, and tolerance to allow for dimensional variations in the bedrock and existing dam. The structural design and construction of the improvements were complicated by several factors which required creative thinking as each challenge presented itself. The resulting design incorporated the external panels, internal bracing, several lifts of tremie concrete with cleaning between each lift, a grouting program to seal inaccessible areas and several innovative details relating to bracing anchorage & support, formwork support & placement of reinforcement. This is a story of engineers meeting each challenge of a complex design.

Indian Lake Dam Rehabilitation - Strengthening Aged Concrete and Stone Masonry for Post-Tension Anchoring

Todd Mueller, PE, Colliers Engineering & Design

Between 2012 and 2023 Engineering Assessments and Rehabilitation Design was completed for this large, high hazard dam that was originally built in 1898. The gravity dam structure has a cyclopean mass concrete core within a stone masonry exterior surface and is founded on rock. Evaluations concluded that the dam embankment crest level needed to be increased, and that the gravity concrete section required anchoring to meet regulatory requirements for safe performance. With the increase in embankment height, the supporting downstream side retaining wall also needed to be extended and strengthened to support the larger embankment. Major challenges included existing leakage through the dam that complicated consolidation grouting for post-tensioned anchor installations. Interior conditions of the dam concrete varied widely in integrity with extensive amounts of grout take, grout washout due to leakage, and wider-than-anticipated grout migration. The use of targeted tertiary holes was used to achieve confidence in the consolidation prior to post-tensioned anchor installation. The efforts of performing grouting extended past the designed restrictions on work window based on concurrent reservoir levels; this resulted in implementing additional monitoring controls to check against excess movement during grouting operations. For the support of the extended embankment retaining wall, inclined post-tensioned bar anchors were installed with steel casings extending between rock and the newly strengthened retaining wall to avoid damaging the existing wall. One installation challenge for the inclined P-T anchors was multiple anchors exhibiting creep beyond the PTI recommended allowable during performance and proof tests. These were reviewed for multiple considerations of issues and subsequently verified for acceptability with supplemental lift-off tests. An additional challenge encountered was having wires break during lift-off testing in one strand of an 8-strand 280kip (design load) post-tensioned anchor. Contractors engineer, the design engineer, and William's personnel were involved in allowing adjustment to acceptance criteria.

Inspection of underground intake conduits at Niagara power Project: Operational insights and future monitoring strategies

Ketan Ragalwar, P.E., Ph.D., New York Power Authority

New York Power Authority conducted a remotely operated vehicle (ROV) inspection in 2019 for the general condition assessment of the two underground conduits that extend from the Niagara Power Project's river intakes (located on the upper Niagara River) northerly to the eastern end of an open forebay, adjacent to the Lewiston Pump Generating Plant. The objective of these inspections was to obtain detailed visual and sonar imagery data to assess the internal condition and structural integrity of the conduits. These conduits, critical to the project's water system, are located below grade and are not accessible through conventional inspection methods, necessitating the use of advanced underwater robotic technology. The ROV-based survey enabled comprehensive documentation of the conduits' geometry, alignment, and internal surface conditions. High-resolution sonar and optical cameras were used to capture continuous imagery at 0.5-foot intervals, allowing for the creation of a complete 3D cloud imagery dataset. This data set provides a permanent digital record of the conduit interiors, which can be used as a baseline for future condition assessments and structural change detection. We will present an overview of the conduit system's construction and structural configuration, including the design layout, access constraints, and hydraulic operating conditions that influenced the inspection approach. It will also describe the logistical and technical planning required to deploy the ROV in a confined, submerged environment—covering equipment selection, navigation methods, data acquisition parameters, and safety considerations. The results from the 2019 inspection revealed several noteworthy features, including minor surface irregularities, sediment deposition zones, and joint interface conditions. The discussion will highlight how the integration of sonar and optical data enhanced the accuracy of defect identification in water conditions. We will conclude by outlining recommended next steps for long-term monitoring and asset management. In particular, it will discuss the potential for integrating above-ground drone-based photogrammetry and thermal imaging to complement future subsurface inspections. Such an integrated approach—combining aerial and underwater imaging—can provide early indicators of structural movement or seepage patterns visible at the surface that may correlate with subsurface changes detected in the conduits. This case study demonstrates how ROV technology can be effectively applied to inspect critical, inaccessible hydraulic structures and how combining it with emerging drone technologies can significantly enhance monitoring and maintenance strategies for underground infrastructure systems.

Is it worthwhile to update old inundation maps with new modeling software?

Christine Suhonen P.E., GZA

Of the thousands of High Hazard and Significant Hazard potential dams in the USA, many likely have Emergency Action Plan inundation maps from software of the 1990's and early 2000's – DMBRK, as well as HECRAS 1-dimensional. When is it time to update maps with modern software, such as HEC-RAS 2-dimensional? Is it worth the time and money? This presentation is about a project GZA performed for a dam owner in New England who owns multiple dams as part of a water supply system. While GZA assisted this dam owner with EAP tabletop exercises, local police and fire emergency responders asked for inundation maps that show depth as well as the inundation area. GZA and the dam owner considered creating depth maps from the old modeling results, however, it was ultimately decided to perform updated modeling using 2-dimensional modeling. This presentation will include an overview of the project background, the hydraulic modeling methodology, the depth maps, as well as cross sections which the towns requested to help with visualizing the depths. In addition, GZA will present a comparison of the new maps with the prior maps, commenting on the cost of the project versus the benefits.

Linking Foundation Conditions to Operational Risk: A Case Study on Youghiogheny Dam Spillway

Cheyne Aiken, R.G., and Nicole Brennan, P.G., GEI Consultants, Inc; Justin Pearce, CEG, Sharon Schulz, P.E., and Carolyn Wehner, US Army Corps of Engineers

Partial spillway failures at Oroville and Guajataca Dams in 2017 resulted in large-scale evacuations, caused over $1 billion in damages, and prompted congressional mandates for federal agencies to assess spillway vulnerabilities. In response, the U.S. Army Corps of Engineers (USACE) initiated portfolio-wide screenings of concrete-lined chute spillways to identify structures susceptible to operational damage and inform risk-based safety improvements. This case study highlights the need for targeted spillway analyses and establishes a technical foundation for long-term risk-informed asset management. In 2023, USACE Risk Management Center's (RMC) screening of lined spillways identified critical deficiencies in the Youghiogheny Dam spillway in Confluence, Pennsylvania. The concrete-lined spillway was constructed under two contracts; the original construction, which consisted of the upper channel lining and ogee weir monoliths, was completed in 1943, and the second contract for the lower portion of the chute was completed in 1946-1947. The spillway has never been activated. The RMC screening and a subsequent spillway-focused semi-quantitative risk assessment (SQRA) identified the absence of critical defensive measures such as dowels, joint reinforcement, water stops, slab turndown keys, and inconsistent anchoring. The foundation beneath the spillway slabs is composed of Pennsylvanian-epoch Glenshaw Formation rocks: a series of nearly horizontal cyclic sedimentary units - sandstone, siltstone, shale, limestone and indurated clay - which have variable strength and resistance to erosion. The indurated clay layer is prone to slaking and may be present between the sandstone and siltstone units that support much of the spillway weir structure. Where slab anchoring is present, foundation preparation was conducted using pneumatic drilling methods that may have exacerbated fractures within weak foundation materials. The hillslope above the right spillway channel exposes these weak materials, where shallow sloughing and surficial slides are common. These sloughs and slides accumulate at the base of the spillway channel and block the downstream outlets of the drainage galleries, reducing their effectiveness in dissipating pressures beneath spillway slabs during a flow event. Erodibility estimates conducted with RMC toolboxes show that the probability of erosion of the sandstone beneath the spillway weir is risk-neutral to unlikely if exposed to flow. However, moderate erosion of the underlying carbonaceous silt-shale and silt and clay shale is also likely. While life-safety-based investments were not warranted, the team recognized the potential for significant damage if spillway flow occurs. As part of this risk assessment, the team evaluated operational potential failure modes associated with spillway activation that could result in major structural repair costs, spillway outage, and possible impacts on hydropower generation.

Losing Your Grip? Liftoff Testing of 41-year-old Post-tensioned Rock Anchors

Nathaniel W. Martin, PE, AECOM

The age of dams in the US is increasing with the average age close to 60 years. The northeast region hosts the highest percentage (71%) of dams over 50 years old. Many of these dams have been retrofitted in the distant past. As a result, the adequacy and longevity of these past repairs is coming into question by both Dam owners and consulting professionals. Delta Reservoir Dam is a 106-foot-high cyclopean concrete gravity dam located in Rome, NY that was originally constructed in 1912 to supply water to the summit section of the Erie Canal. The dam has undergone numerous rehabilitations including a project in 1984 that included installation of post-tensioned anchors (PTAs) extending through the dam 100+ feet to bedrock. Past research on 1980's era PTAs has shown that some anchors as young as 28-years old have lost significant amounts of pretension due to stress relaxation or completely failed due to corrosion (John Day Dam).When the Delta Reservoir Dam was anchored, three of the 93 anchor heads were constructed with access manholes and tensometers to periodically check the tension in the anchor cables. Use of the tensometers was not successful a few years following the anchoring. Ascertaining the performance of the anchors was identified as a follow-up from a potential failure modes analysis (PFMA) performed in 2023. A liftoff procedure to test the anchors was developed and test apparatuses were designed and fabricated, including a custom stressing head and lift chair. The liftoff testing was successfully performed in October of 2025 on the three accessible anchors. Liftoff testing results show that the tested anchors are within the expected range of tension, ranging from 70-74% of ultimate tensile strength. The results show that properly installed anchors are likely to survive more than 40 years, and potentially well beyond that. PTAs with modern corrosion protection systems should have an enduring useful life. The anchor information will be utilized to reassess structural performance of the dam and help better inform risk assessments of the dam in the future through a program to periodically retest the anchors.

Massachusetts Department of Conservation and Recreation Abandoned Dams Program Update

Jennifer Doyle-Breen, PWS, and Doug Gove, Jr. , P.E., AECOM; William Salomaa, MA Department of Conservation and Recreation

The Massachusetts Department of Conservation and Recreation Office of Dam Safety (MassDCR ODS) has jurisdiction over 1300 dams in Massachusetts. Dozens of those dams have been abandoned by their owners,requiring MassDCR ODS to use valuable resources to inspect, prepare reports for, and maintain these dams. In 2019, MassDCR ODS launched a pilot program to address six abandoned dams that were classified as significant to high hazard and in poor to unsafe condition. AECOM was retained to conduct a detailed investigation of each of the six dams, which are spread across Massachusetts, and to evaluate options for rehabilitating or removing each of the dams, with the ultimate goal of turning the property over to the local municipality and eliminating a public hazard. The goal of the pilot program is to not only address these six dams, but also to develop a standard approach and toolkit that MassDCR ODS can apply to other abandoned dams in the Commonwealth which pose a safety risk to the community and a burden to the Commonwealth of Massachusetts. At the 2023 ASDSO conference, AECOM and MassDCR presented the progress made since 2019 regarding the program and the range of challenges encountered. This abstract proposes an update presentation regarding solutions identified at two of the six dams that are currently under construction – one of which was selected for dam removal and one of which was identified for dam repair. The presentation will also identify both the variety of challenges faced by different communities and settings as well as common themes that have been encountered and solutions implemented by the AECOM/MassDCR Team. Lessons learned that will inform MassDCR ODS's approach to the remaining four dams in the program as well as the other abandoned dams in the state will also be presented.

Multi-Regulatory Agency Involvement To Remove Amboy Dam

Brandon George, EIT, Claire Brady, P.E., and Kenneth Avery, P.E., CFM, D.WRE, Colliers Engineering & Design

Amboy Dam is a run of river low head dam located on Nine Mile Creek just upstream of NYS Route 173 in the Hamlet of Amboy, NY. Built in 1905 to provide water during low flow periods, the dam was incorporated into a USACE clearing and snagging project in 1979 that's now operated and maintained by NYSDEC and was partially removed by NYSDEC after a 2019 flood, increasing the hazards for paddlers and anglers. Nine Mile Creek is tributary to Onondaga Lake, a CERCLA (Superfund) site and as part of the settlement was eligible for funding to improve the creek's aquatic habitat through removal of stream obstructions, an effort stewarded by USFWS. The dam's incorporation into a USACE local flood protection project and NYSDECs own regulatory requirements covering dam safety, sediment removal, wetlands, stream disturbance and floodplain management required regulatory approvals from both agencies to clear the project for construction. Colliers Engineering & Design (CED) worked with USFWS to design the dam removal 300 ft of stream improvements, including a cross-vane, grade control, bank protection and floodplain bench plantings and provided oversight during construction which was completed during Fall 2025. As a result, a human safety hazard has been removed, aquatic connection has been improved, upstream flooding and NFIP Special Flood Hazard Area has been diminished and the integrity of the local flood protection project maintained.

Navigating the Shift to a Dam Safety Culture at the NYS Canal System

Thomas McDonald, PE, New York Power Authority

The NYS Canal System was originally constructed in 1825, and has undergone several enlargements and expansions over time, culminating with the Barge Canal in the 1910's. The Canal Corporation currently owns and manages over 3,000 civil infrastructure assets, including over 1,000 water impounding structures such as dams, spillways, embankments, culverts, gates and other water control and conveyance infrastructure. Most of these structures were built over 100 years ago before modern dam safety standards. Dam Safety regulations were promulgated in NYS in 2012, and the Canal Corporation (Canals) was transferred from the NYS Thruway Authority to NYS Power Authority (NYPA) in 2017. NYPA and Canals were challenged with how to develop a dam safety program and instill a dam safety focused culture in a historic canal navigation organization. Focus on a graduated plan to identify and understand imminent risks, push forward with meeting compliance with NYS Dam Safety regulations, while establishing best practices, dam and public safety training, incorporating risk analysis and risk informed decision making. While establishing the program, offer technical support to juggle day to day emergent and urgent issues, as the organization continues growing and evolving to meet the challenge of maintaining a safe and navigable Canal system. Partnering with regulators, expert Consultants and the community to provide a diversity of voices supporting Canals while embracing a dam and public safety mindset. Teamwork and relationship management are critically important to foster organizational change. As the dam safety engineer, your approach must necessarily evolve over time as the organization embraces the principles of dam and public safety. As training, guidance and experience take effect, it is important to provide the space and support needed for personnel to own and grow into fully embracing dam safety as a way of thinking and practicing their work. Listening, maintaining flexibility where possible and providing sound advice and judgment is essential to developing trust, which is foundational to good communication. The Canal Corporation has embraced a dam and public safety aware culture, with a focus on risk management, utilizing information derived from engineering and risk analyses to inform prioritization of maintenance, repair and rehabilitation work, and has brought focus to issues like public safety at dams, emergency action planning exercises, and risk informed decision making and prioritization. This work continues across the Canal system to ensure all Canal users are invited to recreate safely on the Canal and live safely near the Canal.

New Heights and Unknown Depths: Anchoring a 150-year-old Wall for Modern Floods

Jeff Wackowski, PE, LaBella Associates

The Kents Falls Dam was originally constructed to power a sawmill, and some of its components are estimated to date back to the mid-1800s, though very little documentation from its early history remains. Massive reconstruction projects were completed from the 1940s through the 1990s to convert the facility into the current FERC-regulated hydropower generation station. A moderate flood event overtopped the right abutment in 2015 causing significant scouring downstream of the intake structure and under the penstock. The owner and regulator concluded that the walls protecting the right side of the site needed to be raised to at least contain the 100-yr flood within the channel. The left abutment had been reconstructed in previous efforts, requiring only a doweled concrete cap to retain the 100-year flood. The 450-foot-long right approach wall was still stone masonry with a concrete cap and facing, with varying widths and depths along its length. To come up with a comprehensive design solution, the owner leveraged the structural design capabilities of LaBella, while also bringing Colliers Engineering & Design (CED) onto the team. CED provided expertise in hydrology and hydraulics, FERC compliance guidance, and experience in specialized design elements. Borings and test pits dug during the design phase found large variations in bedrock elevation and wall geometry. Inferences in the design of the wall had to be made from the available field information and the limited drawings and history of the structure. Design would need to be amended where possible while core rock anchor drilling ultimately verified bedrock depth and wall construction. The tallest portion of the existing wall was approximately 32 feet tall near the intake. Further upstream, the wall met bedrock only a few feet below its cap. A new concrete cap was placed along the top of the wall, varying in width and depth to reach the height and geometry required with contain the 100-year flood with a nominal foot of freeboard and to remain stable up to the PMF even with scour of the downstream grade. This concrete cap would act as a beam distributing the loads from 34 new post-tensioned permanent rock anchors along the length of the wall.

No Way In, No Way Out: The Realities of Small-Reservoir Dredging

James R Guistina, P.E., CED, Colliers Engineering & Design

Dredging small dam reservoirs can be deceptively complex, particularly when site access and water control options are limited. The 4 subject NRCS designed earthen dams from this CED designed project serve as flood control as well as habitat for wildlife in rural Chautauqua County (1 hour south of Buffalo, NY). Over the past 50 to 75 years the four individual dams accumulated sediment from the contributing watershed (enhanced by farming operations) that have built up to the point of reducing effectiveness of the dams as flood control devices. Typically, and in the case with these four dams, small earthen dams have a lack of infrastructure or flexibility found in larger reservoirs to handle the sediment effectively. When maintenance dredging is finally required, engineers and managers face a unique set of challenges—balancing the technical, environmental, and logistical constraints of confined, difficult-to-reach sites. The sponsor, Chautauqua County, requested CED to provide design services for the four dams to dredge and dispose of the accumulated sediment. The project challenges included limited access for equipment and property owner involvement (the dams sit on easements and are not public property). Additionally, environmental considerations for work periods and sediment contaminations were included in design. Limited water control options constrained the design operations as the dams lacked functional low-level outlets and/or valves to draw down the reservoir safely. Without the ability to lower water levels or isolate work zones, sediment removal must occur under wet conditions, which increases turbidity, complicates sediment containment, and limits visibility and control. For this reason, it was decided to repair and clear the low-level outlets and gates as part of this project to complete the sediment removal in relatively dry conditions. Successful dredging in such constrained settings depends on integrating geotechnical, hydrological, and operational perspectives early in project planning. Approaches such as phased dredging, geotextile dewatering systems, and partial drawdown methods can reduce risk and improve efficiency. Collaboration among dam owners, engineers, regulators, and contractors is essential to develop feasible, site-specific solutions. This presentation offers lessons learned from the four small reservoir dredging projects where access, environmental, social, and water control were extremely limited. It highlights strategies for balancing technical feasibility, dam safety, and environmental performance—offering practical insights for practitioners tasked with maintaining the capacity and functionality of small but vital flood prevention infrastructure. Construction was completed in 2025.

Non-ecological Co-Benefits of Dam Removal

Christiana Pollack, CERP, GISP, CFM, Princeton Hydro, LLC; Beth Styler Barry, The Nature Conservancy

Dam removal projects are increasingly evaluated not only for habitat restoration but also for their contributions to community resilience and safety. In this presentation we discuss methods used to explore flood reduction opportunities, and subsequent reduction in repetitive losses, due to drop in water surface level using tools such as FEMA Flood Insurance Studies. Benefits of Dam Removal discussed include Public Safety, Economic ROI, Recreation, and Water Quality. Several real-world case studies will be used to illustrate how to use these tools to communicate the benefits of dam removal and add the benefits of resiliency and sustainability to funding/grant opportunities.

One Dam, Two Spillways: Comparative Armoring Approaches at Crosley Lake Dam

Randy Thompson, PE, WatershedGeo

The Indiana Department of Natural Resources (IDNR) undertook the Crosley Lake Dam rehabilitation to upgrade to current dam safety standards for safely conveying the design storm. Initial designs proposed articulated concrete block (ACB) armoring for both the principal and emergency spillways on this significant hazard classified dam; however, escalating construction costs led IDNR to consider a more economical alternative. The final design incorporated two spillways engaging at the same discharge elevation: one armored with ACBs and the other with an impermeable engineered synthetic turf revetment (ESTR). This configuration provided a unique opportunity to directly compare two systems designed for similar hydraulic performance within the same project site and under identical flow conditions. Both spillways were designed for velocities approaching 27 ft/s. The ACB spillway design followed a Factor of Safety based method, evaluating shear stress, velocity, uplift resistance, and product specific parameters. The impermeable ESTR design also employed a Factor of Safety analysis, but with velocity as the governing design parameter. The ESTR's impervious geomembrane distinguishes it from the open-jointed ACB system by eliminating subgrade infiltration and potential internal erosion. Both systems were keyed at the toe, and the ESTR was used in combination with concrete A-Jacks® for energy dissipation before discharging into the natural waterway. The presentation will examine the dual-spillway design process, focusing on hydraulic performance, constructability, and cost. Bid records indicate that incorporating the ESTR spillway provided measurable cost savings while maintaining hydraulic resilience. Lessons learned from subgrade preparation, traffic-bearing requirements, and installation logistics will be presented, offering insight into how two armoring systems achieved the same regulatory goal by different means-one through material impermeability, and the other through a permeable, interlocked concrete armor that stabilizes the surface by countering uplift forces and protecting the underlying geotextile and subgrade.

Piano Key Weir Considerations in Northern Climates

Kevin Ruswick, P.E., CFM, and Jack Gergel, P.E., Schnabel Engineering; William Simcoe, P.E., City of Albany Department of Water & Water Supply

The City of Albany, NY was first settled in 1614 and the first water supply system was built in 1678. As the city's population increased, the water supply system was expanded and now includes a portfolio of six dams constructed between 1850 and 1928. The primary water supply reservoirs are Alcove Reservoir and Basic Creek Reservoir located 16 miles southwest of the City. Schnabel was retained by the City in 2015 to perform engineering assessments for the City's portfolio of dams. Basic Creek Reservoir is a high hazard earthen embankment with a height of approximately 25 feet, approximately 870 feet in length and impounds a maximum of 3920 ac-ft water. Detailed hydrologic and hydraulic analyses were performed to assess the dam's compliance with spillway capacity requirements. A comprehensive geotechnical exploration program, laboratory testing and seismic and slope stability analyses were performed on the embankment and foundation materials. The results of the engineering assessment concluded that the dam had significant deficiencies in spillway capacity, and the foundation were susceptible to significant seismic deformation. Schnabel performed detailed alternatives analyses to identify cost-effective remedial measures to bring the dam into regulatory compliance. Spillway alternatives evaluated included: a labyrinth weir, a new auxiliary spillway, incremental design flood study, raising the embankments, lowering the pool/hazard classification, an Obermeyer pneumatically actuated gate, and a staged piano key (PK) weir constructed on top of the existing concrete spillway. The PK weir was ultimately selected for detailed design due to its functionality and limited long-term maintenance required. The structural design of the PK weir was complicated by the cold weather climate and involved developing a three-dimensional (3-D) finite element model to estimate the various stress distributions in the piano key divider walls and ramps. A unique consideration for the design was predicting stresses caused by outward thermal expansion of ice contained within the inlet keys as thermal ice expansion was found to control over other evaluated load cases for the structural design of the divider walls. This led to a complex reinforcement layout for resisting anticipated stresses. Detailed 3-D computational fluid dynamics modeling was performed to refine the performance of the PK weir. Geotechnical design improvements include installation of deep soil-cement mixed panels within the foundation soils to improve foundation performance during seismic loading conditions. This presentation will highlight the unique challenges of the remedial design including for the northernmost PK weirs subject to significant ice loading.

Rebuilding a Waterfall

Joseph Troxell, Michael Baker International, Inc.

Hinckley Lake Dam is a Class I (high hazard) Dam in Medina County, Ohio, that is the center of the Cleveland Metropark's Hinckley Reservation. The dam was originally constructed in 1928, and it did not meet current dam safety guidelines. Deficencies included: the existing lake drain was not functional; the dam did not pass/store the design storm; and the existing concrete principal spillway weir did not meet current stability criteria. The project was delivered by Construction Manager at Risk delivery method, with The Great Lakes Construction Company. This delivery method provided the Owner with benefits during construction, allowing for easier changes in the work when issues were encountered, and also to make aesthetic changes at the Metroparks request. Michael Baker evaluated multiple alternatives to bring the dam into compliance with current dam safety standards. The selected alternative was to raise the embankment (with a downstream raising and the use of non-overflow walls near the spillway) and to rehabilitate the existing principal spillway. The primary feature of the original spillway was an aesthetic "waterfall" in the center of the weir, and the improvements needed to maintain this feature. Artesian groundwater conditions were encountered during the subsurface exploration, which impacted both the design of the spillway rehabilitation and the control of water during construction.

Challenges of the project included:

- Existing drawings were limited, leading to changes during construction as features were exposed.
- Difficulty maintaining a drained pool due to heavy precipitation.
- Construction with mass concrete which required monitoring of concrete temperatures during curing;
- Use of new concrete mix designs featuring Type 1L Cement;
- Encountering seepage in the excavations, despite having no pool in the reservoir, which required modifying the seepage collection system;
- Raising of the existing embankment using off-site soils. The borrow pit was then backfilled with dredge spoils later in the project;
- Redesigning new non-overflow walls when excavation encountered a concrete core wall, which was not depicted on the original plans.
- Settlement of a new non-overflow wall soon after construction was completed. Additionally, when the spillway was first engaged, nappe oscillation was observed. Michael Baker and Metroparks are currently evaluating options to address this, and the Contractor has installed three test sections to evaluate the benefits.

Reducing the Risk Footprint of Onondaga Dam

Brandon George, EIT, and Kenneth Avery, P.E., CFM, D.WRE, Colliers Engineering & Design

Onondaga Dam is a high hazard flood retention dam constructed by USACE in 1949, to provide flood protection for the City of Syracuse, NY by controlling runoff from 68 mi2 of the Onondaga Creek watershed. The dam is 67 ft high, 1800 ft long, with a maximum storage pool of 48,000 AF. Colliers Engineering & Design (CED) under contract with NYS Office of General Services (NYSOGS) and NYS Department of Environmental Conservation (NYSDEC) completed the Second Engineering Assessment in 2025, following NYSDEC regulations and guidelines that resulted in reductions in the Spillway Design Flood (SDF) and the dam breach inundation limits from revisions to both the hydrologic and hydraulic analyses. From review of available historical data, the predicted SDF peak inflow at Onondaga Dam varied significantly between studies and was ultimately doubled from that of the original design. As part of the assessment, several methodologies were evaluated to update the design storm hydrograph, leading to selection of a Snyder unit hydrograph. This update was informed by methodology developed by Taylor and Schwarz using mean basin slope, to develop new synthetic hydrographs for six subbasins, and that used routing parameters informed by current DEMs and land cover data. This resulted in a reduction in peak SDF flow to 52,900 cfs, which was in line with prior SDF estimates used in the design of the dam and the Phase I Dam Inspection Program. Review of guidance on selection of dam breach parameters resulted in modification to the anticipated breach formation time to 1.6 hours and a peak breach flow of 222,000 cfs. The presence of significant watersheds downstream of the dam complicate the hydraulics of the inundation extents. By extending the downstream limits of the hydraulic model from Onondaga Lake to Lock O-1 on the Oswego River, including the sizeable contributing drainage areas downstream of the dam, and employing a hybrid 1D/2D hydraulic model provided a significant reduction in the inundation limits. All of these refinements will help to better guide the planning and response effectiveness of emergency responders.

Reeling in the Leaks: Adaptive Engineering Solutions for a Historic Dam Rehabilitation

Marc Chmura, P.E., and Gillian Wiliams, P.E., GEI Consultants, Inc; Richard Parker, Maine Dept of Inland Fisheries & Wildlife

Built in 1925, the Panther Pond Dam in Raymond, Maine has long served as both a recreational resource and a critical fishery management structure for the Maine Department of Inland Fisheries and Wildlife (IFW). The dam regulates flows from Panther Pond into Sebago Lake and is used to attract spawning landlocked salmon from downstream waters. During peak spawning season, hundreds of salmon can be seen ascending the dam's fish ladder, an iconic scene for local residents and biologists alike. The dam consists of two concrete ogee spillways, a sluice gate, earthen embankments, a fish ladder, and a fish hatchery building along the downstream riverbank. After nearly a century of service and numerous patch repairs, the dam was showing its age, including a persistent leak at the right embankment adjacent to the downstream spillway retaining wall, an issue documented as far back as the 1980s. Over the years, multiple failed attempts had been made to address the leak and the sinkholes that developed as a result. Recognizing the need for major rehabilitation, IFW partnered with GEI Consultants to design improvements that would ensure long-term reliability, address the persistent leak, and improve flow control for salmon management. The plan included driving new 35-foot-long sheet piles upstream of the spillway, as well as demolishing and reconstructing the spillway and sluice gate structure for improved flow management. After the new sheet piles and spillway were in place, the upstream cofferdam was removed, and almost instantly the downstream leak reappeared. However, this time it was pouring into an open excavation where the new downstream retaining wall was to be rebuilt. With dye testing inconclusive and the salmon spawning season quickly approaching, GEI, IFW, and the contractor collaborated to implement a solution involving well point dewatering and design adjustments to capture the leak within a filtered seepage collection system. The system worked, allowing construction to continue, and when all was backfilled, the leak was fully controlled. This presentation will explore the century-long struggle with this stubborn leak, the adaptive engineering decisions made in the field, and how innovative design and collaboration restored the dam's safety, reliability, and ecological function—just in time for the salmon run.

Rehab of a 1830s Canal Dam

Joe, Michael Baker International, Inc.

40 Acre Dam is a 2.1-mile long Class III Dam in Auglaize County, Ohio that impounds a section of the historic Miami and Erie Canal; it is owned by the Ohio Department of Natural Resources (ODNR). The dam features a 35' principal spillway that is in-line with the canal. There is an auxiliary spillway that's 9.5' wide that discharges into the St. Mary's River, which meanders along the downstream side of the dam. The dam was constructed as part of the Canal in the early 1800's. The concrete auxiliary spillway was severely deteriorated and the embankment was in poor condition with steep slopes, tree growth, an uneven crest, and animal burrows. A Hydrologic and Hydraulic study indicated that the dam was not capable of safely passing the design flood event. In 2023, emergency repairs were made at several locations on the upstream slope of the embankment. This project involved the evaluation of interim risk reduction measures (IRRMs) to address the immediate issues, with future plans to bring the dam into compliance with current standards.

Challenges for this project include:

- Developing a prioritization plan, considering that 40 Acre is a Class III (low hazard) dam, and is part of the 50-mile long Miami and Erie Canal system.
- Developing a bid package that would draw interest from mid-size Contractors.
- Logistics for access, with repairs being completed over a 2-mile long embankment that was barely one lane over most of the length.
- The historic nature of the Canal System and the dam itself. This increased the unknowns and potential construction issues while requiring additional permitting efforts.

Small scale projects like 40 Acre Dam are not necessarily easy. They have a different array of problems such as budget constraints, less attention from regulators that have to prioritize the work throughout the state, and less interest from contractors when projects go out to bid. The designer needs to think outside the box with innovative designs and creative bid techniques that make valued improvements for the clients and appealing projects for contractors.

Risk-Driven Decisions for Cost-Effective Dam Rehabilitation in New Jersey

Kyle Taylor, PE, French and Parrello Associates

Screening-level breach analyses and hazard classification at large portfolio scales

Jonathan Quebbeman, PhD, PE, PH, Hazen and Sawyer

For State dam safety agencies, it is critical to understand the potential impacts from a dam breach analysis, which ultimately informs the hazard classification of the dam. Tools such as FEMA's DSSWise are aimed at streamlining this analysis through efficient online data processing and hydraulic breach analysis. Another tool has been developed by the USACE Risk Management Center (RMC) called the Dam Screening Tool (DST), which is a cloud-based system used to rapidly create a HEC-RAS model, perform a breach, and conduct a simplified LifeSim approach for life-loss and economic damage estimation. Both of these systems are efficient, but each dam is still evaluated individually. Many states have portfolios with thousands of dams, where using either DSSWise or DST would still require extensive resources. Further, dams that have been previously categorized may be subject to 'hazard creep' from downstream development, potentially elevating previously determined hazard classifications. This presentation introduces an automated approach to screening-level dam breach analyses, where hundreds or thousands of dams may be assessed quickly. The approach automates the process of HEC-RAS model creation for each dam, conducts each unique breach analyses, and then evaluates downstream consequences. Consequences include impacts to structures and estimates of the population at risk. The process results in a collection of dam breach HEC-RAS models that could be further refined if needed, and generates a summary table of dams and results across the portfolio (e.g., PAR, structure impacts, depth-velocity data, or other output variables of interest). Further, by updating the structures inventory accounting for new development downstream, the breaches can be quickly rechecked for changes to impacts or potential hazard classifications. This presentation will review this automated approach, examine example results, and discuss potential applications at broader scales with challenges when operating at the portfolio scale.

Seepage Solutions: Engineering Excellence on the Erie Canal

Wesley Hollenbach, P.E., AECOM; and Joseph Dodd, New York Power Authority

The Erie Canal began operating in 1825 after eight years of construction. Today, the New York State Canal Corporation, a subsidiary of the New York Power Authority, is responsible for maintaining, improving, and promoting the Canal system's 524-mile waterway network. In the western region, water levels have been lowered due to concerns over embankment integrity, with seepage as a common issue. After nearly 200 years of continuous operation, the aging infrastructure of the Canal presents significant maintenance challenges.

Embankment failures could have serious consequences for nearby communities and downstream areas, including loss of life, property damage, or harm to essential infrastructure. This presentation will be of particular interest to those dealing with active seepage through an earthen embankments and aging infrastructure requiring rehabilitation.

We will detail an innovative construction method known as one-pass trenching technology, which is revolutionizing the engineering and installation of underground systems. The project aimed to extend the service life of the embankment by over 50 years and allow for a higher normal operating pool. Instrumentation was installed to monitor construction safety and assess post-construction performance.

A 1.3-mile soil bentonite cutoff wall was designed and installed along the Canal embankment. The design was completed in under two months, and the construction was finished in just 40 working days, thanks to the one-pass trenching technology. This method mixes low-permeability bentonite into the existing soil matrix to create a barrier without the need for an open trench excavation, reducing site disturbance, cost, material use, and installation time, plus enormous construction and dam safety benefits.

During construction, QA/QC testing ensured the hydraulic conductivity stayed below the maximum allowable value, and 22 active seeps were monitored. Only one active seep was detected in the first watered-up season after installation, showcasing the project's success. Instrumentation data indicated a significant lowering of the phreatic surface on the downstream (outboard) side of the Canal by up to14 feet in some locations. Visual observations and data confirmed that the cutoff wall has substantially reduced or eliminated seepage issues at the Royalton embankment section.

The findings from this project will be inform future rehabilitation efforts along the Erie Canal, ensuring the waterway's safe operation of infrastructure for generations to come. This presentation will share insights with the audience, providing valuable information for similar embankment rehabilitation projects worldwide.

Seismic Results of Comprehensive Risk Assessments: What Are We Doing Here?

Jake Dafni, Ph.D., P.E., Matt Farren, and Heidi Pence, P.E., GEI Consultants, Inc.

Dams are typically designed for earthquake return periods ranging from 2,475 to 10,000 years. The recently imposed Federal Energy Regulatory Commission (FERC) comprehensive assessment (CA) guidelines require assessing the risk impacts of up to 1,000,000-year earthquake events. Given the lack of defined faults and source zones in the northeastern United States, we often rely on the United States Geological Survey (USGS) hazard tools to develop seismic hazard curves for the risk assessment portion of dam CAs. The USGS National Seismic Hazard Model (NSHM) used to develop the seismic hazard curves only recommends use of accelerations for earthquake return periods between 475 years and 10,000 years and relies on gridded background seismicity and extrapolation for earthquake return periods beyond 10,000 years. The non-linear seismic hazard curves predict peak ground accelerations (PGAs) significantly greater than the 10,000-year event, often more than 10 times greater than PGAs historically recorded at the dam sites. The predicted PGAs have also increased with release of the 2023 NSHM. This confluence of factors results in seismic risk driver potential failure modes for dams in the northeast, an area with low seismicity, and leaves consultants and owners unsure of what action, if any, to take. This paper shows the semi-quantitative relative risk results from more than ten CAs in the northeast, compares the risk results to areas with greater seismicity in the United States, and discusses these results within the context of case studies of seismic dam failures. We find that there are a disproportionate number of seismic risk drivers (higher likelihood of failure and consequences) for dams in the northeast despite the lack of historical seismic dam failures and recommend that the discrepancy between seismic design and the FERC CA process be reconciled.

Stability Analysis of an Historic Dry Stack Masonry Dam in New Hampshire

Mark DiLullo, PE, AECOM

The authors have performed a stability evaluation of a dry stack (no mortar or grout) masonry dam using a modified two-dimensional gravity analysis method. Since the masonry is ungrouted, the authors concluded a traditional two-dimensional gravity analysis would not accurately assess the behavior of the dry masonry wall. Research was conducted on current literature regarding the analysis of dry stack masonry walls, and a modified gravity analysis was identified and applied. Four load cases were considered, including flood and seismic. The assessment concluded that parameters such as wall unit weight and vertical wall batter angle had significant effects on the analysis results and that additional information to better define these critical parameters was necessary to more accurately assess the dam's stability. Preliminary findings showed acceptable stability results for certain combinations of wall unit weight and vertical wall batter angle; however, many likely wall batter angles produced marginal-to-unacceptable stability results for flood and seismic load cases.

The Engineering Geologist's Critical Role in FERC Part 12D Comprehensive Assessments: Lessons Learned from Diverse Physiographic Provinces

Todd G. Bown, P.G., GZA GeoEnvironmental

The Federal Energy Regulatory Commission (FERC) Part 12D Comprehensive Assessment (CA) mandates a rigorous, independent evaluation of dam safety, a requirement significantly amplified by lessons learned from the Oroville Dam incident. Within the Independent Consultant (IC) team, the engineering geologist serves a critical function by identifying and assessing geological hazards—including foundation instability, internal erosion, landslides, and seismic risks—that threaten the structural integrity and long-term performance of dam infrastructure. The geologist's expertise is central to the CA process. They conduct a detailed review of site geology, construction records, and historical performance data to assess foundation conditions and surrounding terrain. Particular attention is given to identifying potential failure modes (PFMs) linked to geological hazards such as differential settlement, seepage, karst activity, seismicity, faulting, weathered rock zones, and mass movement of soil and rock. These findings directly inform the Potential Failure Modes Analysis (PFMA) and the subsequent Level 2 Risk Analysis (L2RA), ensuring that subsurface conditions and geohazards are accurately characterized and prioritized within the dam safety framework. This presentation focuses on the experience of an engineering geologist Subject Matter Expert (SME) who participated in four CAs across diverse physiographic provinces: the Adirondacks in New York, the Appalachian Plateau in Pennsylvania, and the Blue Ridge Mountains of Virginia and Tennessee. By highlighting these varied case studies, the presentation will distill key lessons learned and establish best practices for evaluating dam-related geological hazards. Ultimately, integrating this specialized geological analysis enhances the resilience of dam infrastructure and allows the IC team to assist the dam owner in developing targeted mitigation strategies and prioritizing risk.

The Fall Protection Cable that Changed a Dam: How a Simple Safety Upgrade Sparked Major Improvements

Jeff Wackowski, P.E., LaBella Associates; Todd Mueller, P.E., Colliers Engineering & Design

The Cadyville hydroelectric plant is a FERC-regulated development located on the Saranac River a few miles west of Plattsburgh, NY. The concrete gravity dam is about 47 feet tall and includes a 237-foot-long concrete spillway, cast between the exposed bedrock of river. The dam owner initiated a project to upgrade the fall protection cable across the crest of the dam to allow for safe installation of seasonal flashboards. Field investigations and a growing to-do list of small items led to a multi-year dam improvement project. Construction efforts unearthed additional issues that had been buried for decades. A fall projection cable anchor foundation design evolved into an abutment upgrade, designed to withstand PMF hydraulic conditions. Excavation for the new foundation block led to partial replacement and structural upgrading of the existing abutment. Both sections included post-tensioned rock anchors – a first time for design and installation by the Engineer and requiring input from the owner's Dam Safety Engineer. This prompted the addition of Colliers Engineering & Design (CED) to the engineering team, to lend their expertise and guidance as the Owner's Engineer. Large cellular cofferdams were placed to facilitate the excavation and then moved to accommodate the expanded scope. Continual collaboration throughout the 2-year construction period between the engineering team, owner, contractors, and the field construction managers was necessary to adapt to the unknown field conditions. The technical teamwork between LaBella and CED resulted in a successful engineering solution for the Owner and improved both dam safety and personnel safety. To capitalize on the construction efforts of the fall protection project, the owner initiated additional concrete improvements at other parts of the dam. Multiple dives were conducted to configure the design and seating of 30-foot-tall steel cofferdams required to complete concrete repairs on the upstream face of the intake below the water level. The divers discovered unknown structures, which required further collaboration between all parties to adjust the repair scope and design a 3-sided custom steel box cofferdam. Ultimately, the team ended up completing the fall protection system, headwall improvements, the new cutoff wall, a new splash-wall to prevent soil erosion beneath the penstock, concrete surface repairs to the intake below water, intake deck crack repairs, concrete reconstruction of the intake vent, spillway surface repairs, and infilling two abandoned low-level release portals at the base of the dam.

TNC Free Rivers Accelerator and Massachusetts Acceleration Programs with Case Study

Marea Gabriel, The Nature Conservancy

The Nature Conservancy is working with state and local partners through the Free Rivers Accelerator to remove aging or unsafe dams. This initiative supports dam safety objectives by addressing high-liability structures while restoring natural flow and resilience. Key strategies include: (1) building a vetted project pipeline through engineering assessments and partnerships with dam owners; and (2) improving efficiency via permitting streamlining, sustainable funding, and inter-agency coordination. A Massachusetts case study will demonstrate how state dam safety programs and watershed partnerships are accelerating safe, science-based removals under new restoration-friendly regulatory frameworks.

Using Prioritization Tools in Dam Removal Decision Making

Charles DeCurtis, Ph.D., The Nature Conservancy; Shawna Fix, Southeast Aquatic Resources Partnership

The National Aquatic Connectivity Collaborative and Southeast Aquatic Resources Partnership have created prioritization tools that allow for dam assessments based on dam safety, the dam's intended use, and benefits for nature and humans. This presentation demonstrates how the tools support transparent, defensible decision-making that balances safety considerations with environmental and community outcomes. Participants will explore example dams and discuss how prioritization frameworks can complement existing dam safety assessments and planning.

Visualizing Risk Pathways: Event Tree Analysis for Dam and Levee Safety

Daniel A. Vellone, M.S., P.G., CPG, U.S. Army Corps of Engineers

In recent years, federal dam owners have increasingly adopted risk-informed decision making (RIDM) practices to characterize, evaluate, and mitigate dam and levee safety risks. Likewise, many state and private dam owners are following suit, recognizing the importance of these methodologies. The U.S. Army Corps of Engineers (USACE), in collaboration with other federal agencies and industry partners, has developed and refined methods for evaluating these risks, establishing industry standards for risk assessment practices. USACE employs Semi-Quantitative Risk Analysis (SQRA) and Quantitative Risk Analysis (QRA) to assess Potential Failure Modes (PFMs), assigning likelihoods and consequences to guide risk prioritization. These methodologies have become foundational in dam and levee safety, ensuring comprehensive risk evaluations. One of the most effective tools in this process is event tree analysis—a graphical technique used to trace the sequence of events leading to dam or levee failure. Event trees provide visual models to decompose PFMs through systematic progression, starting from an initiating event (e.g., flood or earthquake loading), and mapping the potential pathways to failure or non-failure. This approach applies a Boolean logic to visualize complex risk scenarios, assessing both success and failure outcomes. Event tree analysis is especially effective in evaluating interdependent failure modes and understanding the progression of failure to support informed, data-driven decision-making in high-risk systems. This presentation will introduce best practices for dam and levee safety professionals involved in risk assessments, providing valuable insights into event tree analysis and updated tools such as the USACE Risk Management Center's Event Tree Toolbox and Database. Attendees will gain essential knowledge to effectively contribute to team-based risk analyses and enhance their decision-making capabilities for improved safety management.