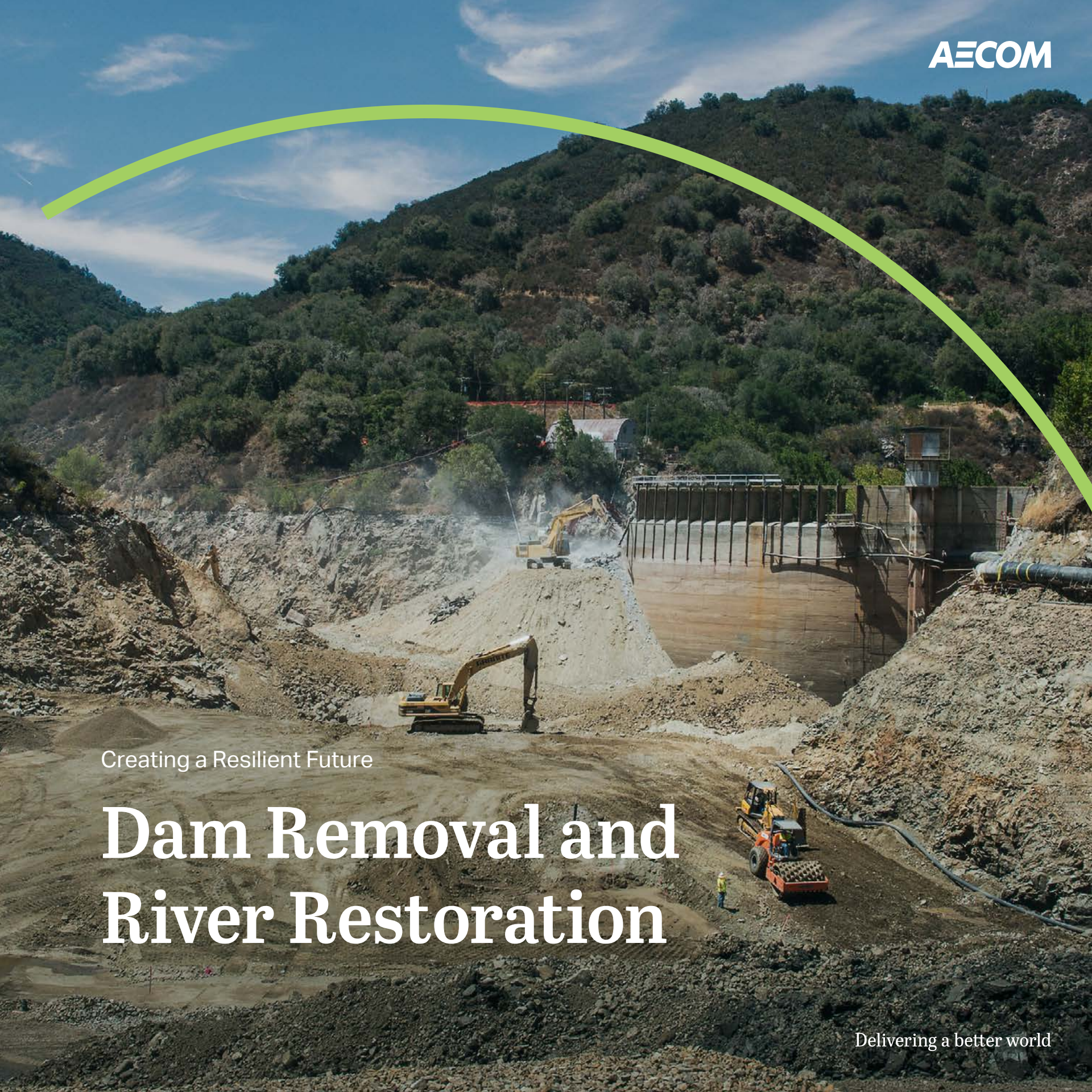


AECOM

Creating a Resilient Future

# Dam Removal and River Restoration

Delivering a better world

AECOM

Creating a Resilient Future

# Dam Removal and River Restoration

Delivering a better world

# Delivering excellence in large dam removal and river restoration

In addition to leading efforts to remove four of the largest dams on the west coast of the United States, AECOM and its legacy firms have been responsible for the design of over 100 dam removal projects throughout the nation, and over 1,000 miles of river and stream restoration.

AECOM is consistently ranked as the #1 Dams and Reservoirs firm by *Engineering News-Record* and proudly maintains the reputation of being the industry's global leader in dam, reservoir, and water projects.

## #1 Dams and Reservoirs

ENR 2021-2023, The Top 500 Design Firms:
The Top Design Firms in Environment

## #2 Design

ENR 2018-2023, The Top 500 Design Firms

## #3 Water

ENR 2022-2023, The Top 500 Design Firms



Front cover and current page: Carmel River Reroute and San Clemente Dam Removal, Monterey County, CA



## Contents

# 01

# Leadership: About AECOM

AECOM is an international leader in the design and construction of dams and reservoirs, as well as the decommissioning and removal of dams. With our comprehensive team of specialists working across the full project lifecycle, we deliver solutions to the world's most complex water resource problems.

AECOM served as the Owner's Representative through planning, design, construction and post-construction monitoring for Carmel River Reroute and San Clemente Dam Removal Project, California's largest dam removal project ever. AECOM also served as construction manager for the largest dam removal in the U.S. at Elwha and Glines Canyon Dams.

Since it was launched as an independent company in 1990, AECOM has become one of the largest providers of professional, technical, and management support services in the world. AECOM is a premier, fully integrated professional services firm positioned to design, build, finance, and operate infrastructure assets for public- and private-sector clients.

AECOM's global staff—including architects, engineers, designers, planners, scientists, and management and construction service professionals—serves clients in over 150 countries around the world. The firm is a leader in all of the key markets that it serves, including water, transportation, facilities, environmental, energy, oil and gas, high-rise buildings, and government. AECOM provides a blend of global reach, local knowledge, innovation, and technical excellence in delivering customized and creative solutions that meet the needs of clients. A *Fortune 500* firm, AECOM and its Professional Services business had revenue of $13.1 billion in fiscal year 2022.

As one of ENR's Top 400 Contractors, AECOM has construction expertise in areas crucial to successful dam removals, including dredging, cofferdam construction and river armoring, levee construction, concrete demolition, and river training.

## 100+

AECOM has completed over 100 dam removal projects in the United States.

## 5,000+

AECOM has worked on over 5,000 dam related projects.


## ACEC

**2021 National Recognition Award**

Boardman River Dams Ecosystem Restoration





### Unleashing the Rivers

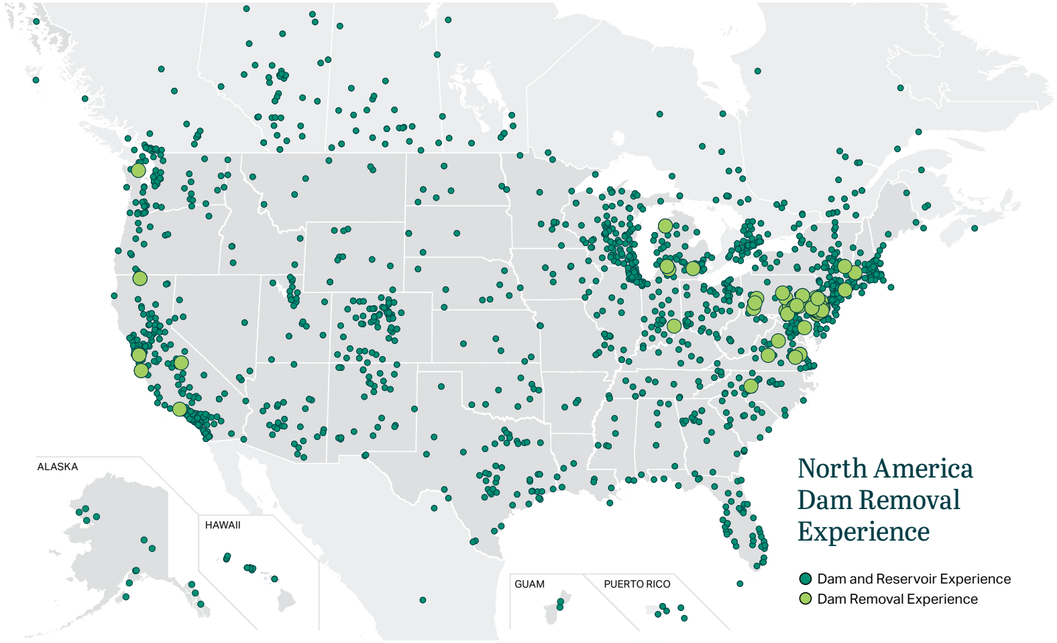
Dam removal is the process of removing dated, dangerous, or ecologically damaging dams from river systems. There are thousands of out-dated dams in the United States that were built in the 18th and 19th centuries, as well as many more recent ones that have either reached their useful lifespan or continue to negatively effect natural sediment transport as well as aquatic and terrestrial wildlife.

There are thousands of dams in the United States, and while many of them provide benefits to their communities, others are currently not serving their intended purpose, such as generating electricity or providing water supply, in need of repair or will require significant improvements to provide fish passage. Numerous studies show that dams can have negative environmental impacts on riverine systems including alteration of sediment transport capability, degradation of water quality, and associated impacts to the aquatic organism and riparian communities. In addition, many dams represent public safety concerns and a significant associated liability to their owners.

Dam rehabilitation and/or fish passage can be very expensive ventures for dam owners, particularly if the dam no longer serves a useful purpose or no longer provides income from the use for which it was designed. Often times, these factors present a decision to dam owners; rehabilitate, provide fish passage, or remove the dam. Removal may be the least expensive option and often can be funded by state, federal, private, or non-profit groups. Dam removal, if conducted thoughtfully and responsibly, creates minimal temporary environmental impact and has numerous long-term environmental benefits, as well as the elimination of owner liability. Finally, once the dam is removed, there is no longer the need for costly future maintenance.

Elwha and Glines Canyon Dam Removal, Port Angeles, WA (Before)

Elwha and Glines Canyon Dam Removal, Port Angeles, WA (After)




## AECOM Dam Removal and Restoration Practice

Our dam removal projects to date have restored nearly 1,000 miles of streams, most on third order streams or larger. Our experienced professionals can address all technical areas required to complete river and stream restoration projects, with particular emphasis on dam removal, natural approaches to the passage of aquatic species, and riverine restoration functionality.

AECOM has been involved in more river restoration and dam removal projects in California than any other firm. Our staff have been directly involved with technical and environmental projects including the Carmel River Reroute and San Clemente Dam Removal; the Matilija Ecosystem Restoration and Dam Removal; the Searsville Dam and Reservoir Alternatives Study; and the Lagunita Diversion Dam Removal, in addition to many other ecosystem restoration projects in California and beyond.

We not only have experience and industry experts in the technical and engineering disciplines required for dam removal, but we have in-depth and proven experience in environmental compliance, permitting and construction management of dam removal projects.

## AECOM Dam and Hydropower Capabilities

With more than 85 years in the industry, AECOM is a recognized leader in dam, reservoir, hydropower and water engineering, having worked on thousands of dams and water resources projects around the world. We offer solutions in almost every facet of dam and hydropower engineering, from performing feasibility studies through design and construction, commissioning, ongoing dam safety monitoring, maintenance, and decommissioning, which gives us intimate knowledge with the infrastructure involved in the removal of large hydropower facilities.

## AECOM Construction Capabilities

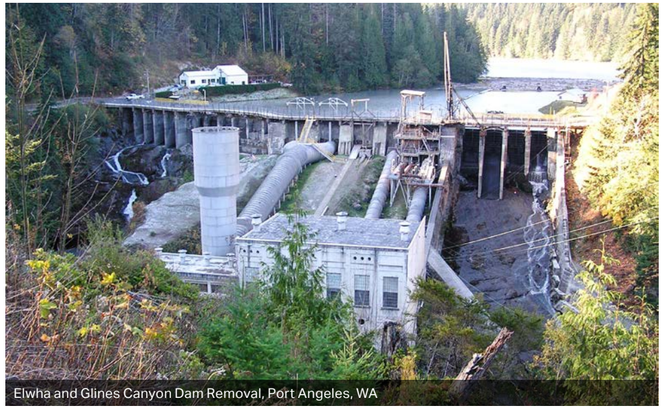
As one of ENR's Top 400 Contractors, AECOM has construction expertise in areas crucial to successful dam removals, including dredging, cofferdam construction and river armoring, levee construction, concrete demolition, and river training.



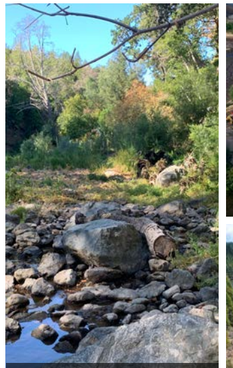


## Highlighted AECOM Dam Removal Projects


Carmel River Reroute and San Clemente Dam Removal, Monterey County, CA

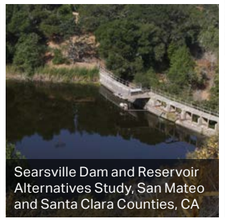

Elwha and Glines Canyon Dam Removal, Port Angeles, WA


College Lake Dam Removal and Blackwater Creek Restoration, Lynchburg, VA


Lagunita Dam Removal and Bank Stabilization Project, San Mateo and Santa Clara Counties, CA


Boardman River Dam Phase 2, Traverse City, MI


Matilija Dam Removal and Ecosystem Restoration Project, Ventura County, CA

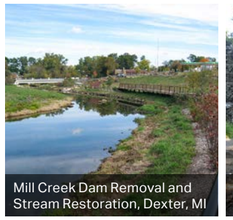

Searsville Dam and Reservoir Alternatives Study, San Mateo and Santa Clara Counties, CA

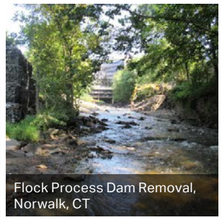

Klamath River Renewal Project, Klamath, OR


Otsego Township and City Contaminated Sediment, Dam Removal and Stream Restoration Project, Otsego, MI


Ecological Restoration of the Little Rapids Area, St. Marys River, Sault Ste. Marie, MI


Marion Dam, Marion, MI


Mill Creek Dam Removal and Stream Restoration, Dexter, MI


Flock Process Dam Removal, Norwalk, CT

# 02

# Talent: Who we are

AECOM's experts have worked on the largest dam removals in California and the U.S., served on review boards for the country's most complex dam design and construction projects, and have received commendations and awards for our work.

"Seth Gentzler has been amazing in his role as project manager and later as Owner's Engineer for CalAm. Throughout the project, I had great confidence that Seth understood all of the project goals, including the fact that they sometimes conflicted with each other, and was always looking for ways to best meet them. His calm demeanor and deep understanding of all aspects of the project have made him an important leader in this collaboration. I've also been very impressed, and appreciative, of his budget management capabilities!"

Trish Chapman, Central Coast Regional Manager, California State Coastal Conservancy (Carmel River Reroute and San Clemente Dam Removal)

## **Seth Gentzler,** PE

**Dam Removal Practice Lead**
Professional Civil Engineer

**Background + education**
Seth Gentzler has more than 28 years' of experience in the field of civil and environmental engineering. He holds an M.S. degree in Environmental Engineering from Georgia Institute of Technology and a B.S. degree in Civil Engineering from Bucknell University.

**Relevant experience**
Seth Gentzler, PE, is a leader in the dam removal industry, managing the technical and environmental compliance work for four of the largest dam removal projects on the West Coast. Seth is a vice president and project manager, and heads up the northern California and Pacific Northwest Hydrology and Hydraulics Practice out of the Oakland AECOM office.

Mr. Gentzler excels at bridging the gap between engineering and habitat restoration, facilitating discussion to find common ground within a wide range of expertise and perspectives, and transforming project concepts into buildable, permittable construction documents. His specific technical expertise includes dam removal, river and wetland restoration design and construction, river and inter-tidal system hydrodynamic modeling, levee and bay trail design, water resource planning, site design, utility coordination, stormwater and non-source point control modeling, flood studies, detention and retention pond design, as well as stormwater management. Current projects include the Matilija Dam Removal Project in Ventura County, California; the Los Padres Dam Alternatives Study in Monterey County, California; and the Matanzas Creek Dam Watershed Plan in Sonoma County, CA.

For nearly all of his projects, Seth has led and facilitated outreach meetings and workshops with local residents, key stakeholders, tribes, agencies representatives, and a variety of technical peer review teams. In addition, he has presented aspects of his dam removal projects and practice at technical conferences, including the Association of State Dam Safety Officials Annual Dam Safety Conference, the Hydrovision Annual Conference, the Salmonid Restoration Federation Annual Conference, and the United States Society on Dams Annual Conference.





## **John Roadifer,** PE

**Geotechnical & Engineering Manager**
Professional Civil Engineer

**Background + education**
John Roadifer has more than 35 years' of experience in civil engineering, construction management, and embankment design. He holds an M.S. degree in Civil Engineering from the University of Utah and a B.S. degree in Geotechnical Engineering from the Colorado School of Mines.

**Relevant experience**
John Roadifer is a registered civil engineer with 35 years' of experience in a wide range of water infrastructure projects. He has worked on some of the largest dam and dam removal projects in California. His responsibilities for these projects have included management or performance of development and evaluation of alternatives, site investigations, laboratory testing programs, conceptual and final engineering, preparation of plans, specifications and other contract documents, construction cost estimation and scheduling, provision of engineering support for (CEQA) and permitting, and coordination with state agencies. Over the last 10 years, John has led geotechnical investigations, geologic assessments, sediment characterization, and geotechnical and dam structural analyses for several large dam removal projects, including San Clemente Dam Removal, Matilija Dam Removal, and Searsville Dam & Reservoir Alternatives Study. His in-depth knowledge of sediment management techniques, construction means and methods, and associated constructability opportunities and constraints makes him an integral part of our dam removal practice.

## **Bill Weihbrecht**

**Senior River Restoration Specialist**

**Background + education**
Bill Weihbrecht is a senior river restoration specialist with more than 38 years' of professional experience related to watershed studies and stream restoration. He has B.S. degree in Environmental Biology from Millersville University.

**Relevant experience**
Bill Weihbrecht has extensive experience in dam removals including feasibility analyses, sediment assessment, staged dam breach sequencing, stream restoration design, and construction oversight. He has completed the design and/or construction management of 51 dam removal and fish passage projects throughout the Mid-Atlantic, New England, and Upper Midwest regions. He has experience in coordinating with state and federal government agencies related to design and permitting issues. His regulatory and construction experience complements the permitting and design tasks. This hands-on experience results in practical, cost-effective designs while minimizing environmental impacts. The majority of his experience includes using a natural channel design approach to restore natural stream functions and quality habitat.

Carmel River Reroute and San Clemente Dam Removal, Monterey County, CA

## Jonathan Stead

**Fisheries/Fish Passage, Habitat Enhancement, Biological Resources, and Permitting**

**Background + education**
Jonathan Stead is a fish and wildlife biologist and senior project manager with 23 years' of experience, with particular expertise in aquatic ecology. He has an M.S. degree in Ecology from the University of California, Davis, and a B.S. degree in Ecology, Behavior, and Evolution from the University of California, San Diego.

**Relevant experience**

Jonathan Stead leads multidisciplinary teams on complex stream restoration, fish passage, water infrastructure, and dam removal projects. Mr. Stead's Fish Passage Facilities in the Alameda Creek Watershed project, a design project he managed from initial technical studies that identified the need to retrofit an existing dam with a fish ladder and fish screens, has been built and was awarded high honors by the Northern California Chapter of the American Public Works Association. He recently completed an evaluation of 30 fish passage impediments for the Santa Clara Valley Water District and currently manages an interdisciplinary team that is helping stakeholders determine the long-term fate of the Los Padres Dam on the Carmel River. In addition to leading biological studies and fluvial design projects, Mr. Stead leads environmental permitting efforts, such as for the San Joaquin River Restoration Program's Mendota Pool Bypass and Reach 2B Improvements Project, which is under construction and will reconfigure and restore a 12-mile reach of river. Mr. Stead was responsible for all biological studies and environmental permitting for this project. He has also been the biology and environmental lead for dam removal and flood control projects, including the Searsville Alternatives Analysis, Lagunita Diversion Dam Removal, Matilija Dam Removal, and the Central Sonoma Watershed Project. Mr. Stead works productively with multi-stakeholder groups to achieve desirable project outcomes for his clients.

## Joe Ehasz, PE

**Program Manager - Water Resources and Hydro**
Professional Civil Engineer

**Background + education**
Joe Ehasz has more than 40 years' of experience in civil engineering, design, and construction of dams and other major civil works. He has B.S. and M.S. degrees in Civil Engineering from Rutgers University.

**Relevant experience**

Joe Ehasz's experience building dams in California includes extensive interaction with the DSOD. He provided on-site construction management for Diamond Valley Reservoir (three embankment dams, Owner MWD) and Olivenhain Dam (RCC dam, Owner SDCWA). He was named one of the Most Influential Dam Engineers in 2011 by Water Power and Dam Construction Magazine.

He also participates on review boards evaluating design and constructability of dams, spillways, and hydraulic structures. Recently, he has served on a review committee reviewing the design and constructability of various options for dikes and dams for separation of the Salton Sea. He also participates on Consulting Boards for the USACE on a large spillway at Folsom Dam in Sacramento, California and Success Dam in Central California. Mr. Ehasz has been on the Board of Consultants at the San Roque Power Project in the Philippines, a large greenfield hydroelectric project that included extensive river training and use of coffer dams during construction.





## Richard Hunn, Jr.

**Senior Water Resources Planner**

**Background + education**
Richard Hunn has 35 years' of experience managing water resource planning and infrastructure development environmental impact studies. He maintains a strong expertise in current federal and state government environmental statutes, including both NEPA and CEQA. He has an M.S. degree in Natural Resource Planning from Humboldt State University and a B.S. degree in Conservation of Natural Resources from the University of California, Berkeley.

**Relevant experience**

Richard Hunn has managed the preparation of numerous planning studies and environmental impact analyses addressing the development of water resource and hydroelectric power generation facilities and infrastructure. This work has included studies in support of Federal Energy Regulatory Commission (FERC) hydroelectric project licensing, (NEPA) documents for the U.S. Bureau of Reclamation, CEQA documents for the California Department of Water Resources and State Water Resources Control Board (SWRCB), and other studies and analyses to comply with federal and state regulations for other regional and local entities. Over the past 15 years, Mr. Hunn managed the preparation of NEPA/CEQA documents for major water storage and conveyance facilities, including the Los Vaqueros Reservoir Expansion Project (275 TAF), Temperance Flat Water Supply Investigation, Bay-Delta Conservation Plan, and the Davis-Woodland Water Supply Project. Richard also managed the preparation of FERC licensing studies for over 25 hydroelectric projects, including recently completed documentation for the Sly Creek Dam Crest Raise and El Dorado Forebay Modification Project. Most recently, Mr. Hunn managed the preparation of the Section 401 Water Quality Certification (EIR) for the Klamath Hydroelectric Project (KHP) for the SWRCB. This work updated past studies to enable removal of the three California KHP dams on the Klamath River.

## Vic Gautam, PE

**Geotechnical/Civil Engineer**
Professional Civil Engineer

**Background + education**
Vic Gautam is a Geotechnical/Civil Engineer with over 20 years' experience specializing in the analysis and detailed design of geotechnical structures, with emphasis on geotechnical engineering for dams and dikes, marine structures, slope stability problems, and industrial and power clients. He has a B.S. degree in Civil Engineering as well as an M.S. degree in Structural Engineering from Case Western Reserve University.

**Relevant experience**

Vic Gautam serves as the Geotechnical Practice Leader in AECOM's Cleveland, Ohio Office, leading a regional team of geotechnical engineers, technicians, and geologists. He specializes in geotechnical modeling, including finite element analyses and slope stability analyses. His vast experience on dams projects, includes design of new dams, upgrades and modifications to existing dams (including spillway modifications and repairs, dam raises, and mitigation of slope instabilities). In recent years he has been deeply involved with dam removal projects, including major projects along the Boardman River near Traverse City, Michigan, and along the Cuyahoga River near Cleveland and Akron, Ohio. He has also led numerous geotechnical site investigations and studies, and has acted as geotechnical and structural designer on a variety of projects.

## Steve McNeely, PE

**Senior Water Resources Engineer and Fluvial Geomorphologist,** Professional Civil Engineer

**Background + education**
Steve McNeely has more than 20 years' experience as a water resources engineer, fluvial geomorphologist and project manager serving as an engineering and environmental consultant. He has a B.S. degree in Earth Systems Science & Policy (Watershed Systems and Ecology), from Cal State University – Monterey Bay as well as a M.S. degree in Civil Engineering (Water resources) from San Jose State University.

**Relevant experience**
Steve McNeely has been involved in the planning, design, permitting and construction supervision of numerous river and stream restoration projects, as well as the design of fish passage improvement projects ranging from culvert replacements to dam removals. He has a wide range of technical expertise, including total station and GPS surveying, digital terrain modeling and remote sensing using Civil3D and ArcGIS software, as well as hydrologic, hydraulic, sediment transport and morphodynamic modeling utilizing a variety of platforms. His experience also includes instream flow assessments, ecohydraulic modeling and assessment of aquatic and riparian habitats. Steve has served as Engineer/Geomorphologist on several dam removal projects in California including the Ventura County Watershed Protection District's - Matilija Dam Removal and Ecosystem Restoration Project; the Stanford University's – Lagunita Dam Removal and Creek Restoration Project; and the California State Coastal Conservancy's – San Clemente Dam Removal Project.

## Jason Plum, PE

**Project Manager**
Professional Civil Engineer

**Background + education**
Jason Plum has more than 20 years' of experience working on and managing water resources engineering projects. He holds a B.S. degree in Mechanical Engineering from Michigan Technological University.

**Relevant experience**
Jason Plum has more than 20 years' of experience and has completed or overseen the civil designs and assessments for over $500M in construction flood mitigation projects, rehabilitation of buildings, structures and facilities; new buildings; infrastructure repairs and improvements, and ecosystem restoration. This includes dams and dam removals, electrical distribution systems, shoreline protection and building renovations. His experience also includes Environment, Great Lakes and Energy permitting, and compliance report writing. He has experience with structure demolition, dewatering and sediment control and overall site grading and restoration, as well as permitting and coordination experience with owners, contractors and other project partners, funding sources and permitting agencies. He has worked with the USACE, Great Lakes Fisheries Commission and many local watershed agencies, municipalities, and private entities.





## Suzanne Huhta, PE

**Fish Passage Specialist**
Professional Civil Engineer

**Background + education**
Suzanne Huhta has more than 25 years' of experience in the field of civil engineering, with a sole focus on fish passage engineering for the past 20 years. She holds an M.S. degree in Structural Engineering from the University of Washington and a B.S. degree in Engineering from Harvey Mudd College.

**Relevant experience**
Suzanne Huhta has extensive experience in all aspects of fish passage engineering, including technical and nature-like fishways, fish bypass channels, constructed riffle design/ rock ramp, rock weirs, fish screening, fish barriers and aquatic organism passage. She understands which fish passage techniques are most appropriate to a given situation, and each of the technique's strengths and limitations.

Suzanne has worked extensively with biologists, state and federal agencies, irrigators, power companies, municipalities, and non-profits. She recognizes the needs and concerns of each stakeholder and works diligently to be sure the solution addresses the complete needs of the project.

## Aaron Humphrey, PE

**Project Manager**
Senior Geotechnical Engineer

**Background + education**
Aaron Humphrey has more than 20 years' of experience working in geotechnical engineering analysis and design, project management, and on dam safety related design, repair, and removal projects. He holds a M.S. and B.S. degree in Civil Engineering from Purdue University.

**Relevant experience**
Aaron Humphrey has served as a geotechnical engineer and project manager for dam and levee related projects across the United States. Aaron is a FERC approved Independent Consultant (IC) for dam safety inspections having served as Independent Consultant for Part 12D dam safety evaluations for the Federal Energy Regulatory Commission (FERC) along with numerous dam and levee designs, inspections, and evaluations for federal, state, municipal, commercial, and private dam owners. As an experienced geotechnical engineer, Aaron is proficient with the technical aspects of dam removals including geotechnical exploration and laboratory testing programs, stability and seepage evaluations, slope stabilization, foundation designs, cofferdam design, and geotechnical performance monitoring. As a project manager, Aaron is experienced with leading multi-disciplinary project teams through the entire life cycle of a dam removal project. Aaron's experience with initial and planning phase activities includes evaluating conditions of dams, understanding and characterizing dam safety risks through PFMA and SQRA activities, and the development of dam removal and river restoration alternatives.

## Brandon Alderman

**Senior Stream Restoration Designer**

**Background + education**
Brandon Alderman has more than 15 years' experience designing, assessing, monitoring, and implementing various stream and wetland establishment, restoration, and enhancement projects. He holds a B.S. degree in Chemistry and a B.S. degree in Biology from Radford University, 2008.

**Relevant experience**
Brandon Alderman leads in stream and wetland design of outfall restoration, mitigation banking and permittee responsible mitigation projects that are used to offset the unavoidable impacts to aquatic resources. He has also provided construction oversite and management of implementation of stream and wetland restoration projects. Brandon has received extensive training in natural stream channel design. Brandon has been involved in the design and construction of over 300,000 linear feet of stream restoration activities and establishment of over 200 acres of wetlands in 9 different states throughout the Eastern United States and Midwest Regions. This knowledge combined with past work experience has allowed Mr. Alderman to provide stream and wetland design expertise that produce an environmentally friendly, stable, low maintenance, and cost-effective solution that generates the necessary mitigation and/or TMDL credits for a project.

## Mario Sebastiani

**Senior Water Resource Engineer**

**Background + education**
Mario Sebastiani has more than 10 years' of experience in civil engineering and water resources and holds a B.Eng and a M.Eng degree in Civil Engineering from University of Louisville.

**Relevant experience**
Mario Sebastiani has played a key role in river restoration, dam removals, floodplain analysis, and stormwater management projects. His hydrologic and hydraulic modeling, design, and construction field experience, paired with strong written and verbal communication skills, provides clients with efficient solutions. He has worked with US Great Lakes Fishery Commission, Michigan Department of Technology, Management & Budget; and Hawaii Department of Agriculture on several dam decommissioning and river restoration projects.

Elwha and Glines Canyon Dam Removal, Port Angeles, WA





# 03

# Passion: What we do

At AECOM, our experts provide a wide range of services related to dams, rivers, and reservoirs throughout North America for local, state, and national government clients.

AECOM is committed to the practice of river and stream restoration, and our experience includes the design and execution of over 100 dam removal projects, and many other river restoration/fish passage projects throughout the United States.

We can provide a full range of services: from initial feasibility assessments and environmental compliance, through detailed design and permitting, to construction management, final completion, and post-construction monitoring. Providing our hands-on aquatic resource restoration design experience with our vast construction experience has allowed us to refine our project delivery approach, and build a trusted network of contractors to provide us with a "design-build" approach, when appropriate. Our team has a vast amount of experience with all applicable construction procurement approaches, including design-bid-build, design-build, progressive design –build, and construction manager at risk, among others. This knowledge and experience allows us to support our clients in making informed decisions concerning procurement, matching project-specific constraints with complementary procurement approaches.

Carmel River Reroute and San Clemente Dam Removal – Channel Inspections, Monterey County, CA

**Key services for dam removal include:**

- Dam decommissioning/removal
- Fluvial geomorphology
- River and riparian restoration design
- Fish passage
- Bathymetry
- Permitting
- Endangered Species
- Cultural Resources
- Feasibility/alternatives analysis
- H&H analysis/modeling
- Sediment transport/modeling
- Sediment characterization
- Sediment management
- Public involvement
- Construction oversight
- Funding and Grant Application
- Topographical, Bathymetric Surveys
- Wetlands Delineations/ Assessments
- Natural Channel Design
- Impounded Sediment Characterization
- Stream Restoration
- Construction Drawings/ Specifications
- Construction Oversight
- Alternatives Analyses
- Cultural and Historical Resources Evaluations
- Hydrology and Hydraulics Analysis
- Dam Inspections/Assessments
- Sediment Transport and Scour Analyses
- Project Permitting
- Construction Cost Estimating
- Post-removal Flood Evaluations
- Feasibility Analyses
- Threatened and Endangered Species
- Mussel Surveys and Relocation
- Geotechnical Investigations
- Fish Passage Design
- Public Involvement/Outreach
- Bidding and Contract Management
- FEMA Flood Plain Mapping
- CEQA/NEPA Compliance


> I just wanted to compliment you on what a great job you did on the Initial Construction Plan. It really helped me to envision how this project can actually happen. Who knew that a construction plan could be exciting reading! Thanks again for your always excellent work.
>
> Trish Chapman, Central Coast Regional Manager, California State Coastal Conservancy (Carmel River Reroute and San Clemente Dam Removal)





# Carmel River Reroute and San Clemente Dam Removal

## Monterey County, California

San Clemente Dam was a 106-foot-high concrete arch dam approximately 18.5 miles from the Pacific Ocean on the Carmel River. California American Water (CAW) owned and operated the dam. When the dam was constructed in 1921, it had reservoir storage of approximately 1,424 acre-feet. Before removal, the reservoir was over 90 percent filled with sediment, leaving a reservoir storage capacity of approximately 125 acre-feet. Over the last few decades of its existence, the dam had lost its usefulness as a water supply source, and posted a significant safety risk to the public due to its compromised structural integrity. Although the dam had a fish ladder, annual fish counts revealed that passage was inconsistent and sub-optimal. With the removal of the dam in 2015, steelhead are now migrating up the river again to 25 miles of pristine main stem river and many miles of tributary habitat.

In the early 1990s, the California Department of Water Resources (DWR), Division of Safety of Dams (DSOD) issued a safety order, determining that the dam structure could potentially fail in the event of either the maximum credible earthquake or probable maximum flood. In response to the safety order, CAW evaluated alternatives that included both dam strengthening and dam removal in a draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS) prepared for DWR and the U.S. Army Corps of Engineers. DWR certified the Final EIR/EIS in December 2007, and DSOD confirmed in February 2008 that the preferred dam removal alternative would alleviate the dam safety deficiencies.

The State Coastal Conservancy (SCC) and CAW led a group of agencies and stakeholders in designing, permitting, and constructing the alternative that removed the San Clemente Dam and restored a naturally-functioning river channel that bypassed much of the accumulated reservoir sediments by rerouting the river into an adjacent tributary canyon.

The removal of San Clemente Dam and the reroute and restoration of the Carmel River is the first of its kind, both in terms size and complexity, and the end results will be instrumental for the planning and implementation of future dam removal and river restoration projects.

In 2008, CAW and SCC hired AECOM (formerly URS) to complete geotechnical investigations and studies, develop a Long-Term Management Plan and Risk Assessment (2009), refine the conceptual design and basis of design (2010), complete detailed flood and sediment transport modeling (2011), conduct biological and archaeological surveys (date), prepare permit applications and provide permitting support (2011), develop a design-build (D-B) Request for Proposal (RFP) (2011), develop and implement a plan for D-B procurement (2011), as well as provide support for public outreach and DSOD coordination, and engineering and environmental compliance support during construction.

In addition to being a complex multi-disciplinary project involving numerous technical and political constraints, there were several unique challenges that needed to be overcome throughout the course of project implementation. A few of these are listed below:

- The lack of geotechnical and topographic data for the pre-dam surface below the reservoir required a certain amount of flexibility to be accommodated in the channel design. A variety of approaches needed to be considered and permitted in certain reaches to allow for this flexibility during construction.
- Design-build was the selected procurement approach for a number of reasons involving site constraints and overall project risk. Because DSOD and many other permitting agencies required significant design detail to approve the project, an "indicative" design, as well as detailed design and performance criteria, needed to be developed prior to submitting permit applications.
- During the design-build contractor selection process, public resistance to the construction access route required a major design change to the access location and alignment. AECOM quickly completed the required feasibility analysis and design to allow for negotiation of the design-build contract, as well as required permit revisions.

AECOM was responsible for preparing a full suite of environmental and local agency permits for the project. The permits included Clean Water Act Section 404 from the U.S. Army Corps of Engineers, which included compliance with Section 106 of the National Historic Preservation Act (NHPA), Clean Water Act (CWA), Section 401 certification from the Regional Water Quality Control Board (RWQCB), formal consultation under Section 7 of the Endangered Species Act for species under the jurisdiction of both the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (NMFS), a Section 1602 Streambed Alteration Agreement with the California Department of Fish and Wildlife, and local use permits from Monterey County. In addition, AECOM, in conjunction with DWR as the Lead Agency, determined that a Supplemental EIR (SEIR) was needed due to project design changes occurring during the final design phase. AECOM prepared and circulated the Draft SEIR, responded to public





comments, and prepared the Final SEIR, which was certified in April 2012.

The project was constructed by a D-B contractor selected based on a competitive D-B procurement process led by CAW. CAW and SCC retained AECOM throughout the construction to be the owner's representative and provide technical oversight and management. The construction took place over 3 years, and now the project is in the warranty period. AECOM continues to support the owner by providing technical reviews and guidance on warranty items and repairs by providing post-construction monitoring and reporting.

Range of Service: 2008–Present
Client: California State Coastal Conservancy and California American Water
Construction Fee: $60 million

**2017 ASCE San Francisco Section Environmental Project of the Year.**





# Boardman River Dam Phase 2

## Traverse City, Michigan

Located in the northern corner of Michigan's Lower Peninsula, the Boardman River is a valued community asset and nationally significant recreational resource noted for its "blue ribbon" trout fishing and "natural rivers" designation. Three dams currently impound water on the main stem of the Boardman River (i.e., Boardman Dam, Sabin Dam, Union Street Dam). The first two of these dams have long been operated by Traverse City Light and Power (TCLP), and licensed by the Federal Energy Regulatory Commission (FERC) for hydropower generation.

Several factors (e.g., FERC requirements, dam safety issues, economics of hydropower production) prompted TCLP to surrender their FERC license. Under a Settlement Agreement between multiple parties, a community- based dams disposition study, spearheaded by a Boardman River Dams Committee (BRDC), was initiated to provide advice to the dam owners (i.e., Traverse City, Grand Traverse County) on the fate of this four-dam system. The results of this process led the dam owners to begin removal of the dams.

**Client Benefits**

- Worked cooperatively with multiple partners
- Experienced staff helped navigate complex permit system with no delays
- Provided guidance on operating and maintaining aging hydropower dams

### Work Performed

The AECOM Team was awarded this project to provide comprehensive engineering and scientific expertise to this project, which is billed as the largest dam removal project in Michigan's history. AECOM is providing:

- Preliminary engineering analysis and engineering studies to provide the data required to complete designs for removal of the dams and restoration of the river's ecosystem. This includes wetland delineations, geotechnical investigations for dam breaching and design of the Cass Road Bridge, depth of refusal measurements for the impoundments, and geomorphic assessment of the river and watershed to aid in design.
- Hydrology and hydraulic analysis to support detailed design, permitting, and development of the Environmental Assessment. A detailed HEC-RAS model was developed to aid in channel design, dam breach analysis, and to assess potential depositional areas. In addition, a hydrologic analysis is being conducted to assess the flood retention of the existing dams.
- River restoration design, using natural design techniques, has been completed for the formerly impounded areas. The goal of the restoration design is to return the river to its pre-dam channel form and function.


- Dam breaching design was developed from geotechnical and structural data related to the concrete and earthen components of the dams. Due to the configuration of Boardman Dam, this structure will be breached through its earthen embankment. A series of pumps and auxiliary channels will be used to provide for a controlled draw down. Sabin Dam will be breached through the existing auxiliary spillway. The concrete walls, foundation, and energy dissipation material will be used to control flow during the breaching operation.
- A new Cass Road Bridge has been designed and constructed to span the relocated river in advance of the scheduled dam removal in 2017.
- A complete NEPA and permit application has been submitted and is currently under review by the regulatory agencies.

Completion: 2015–2020
Client: Grand Traverse County
Project Fee: $15 million

# Matilija Dam Removal and Ecosystem Restoration Project

## Ventura County, California

Matilija Dam is a double-curvature concrete-arch structure constructed in 1947, approximately 16 miles upstream from the Pacific Ocean on Matilija Creek. The 168-foot-high, 620-foot-long crest dam is suffering from an alkali-silica reactivity in the dam's concrete, as well as severely diminished storage capacity due to sediment accumulation behind the dam. The dam crest has been notched twice in the past to shore its stability. It was originally constructed to provide flood control and water supply to the local area, but has not been used for water supply in decades. The original storage capacity was 3,800 acre-feet, but it currently has less than 500 acre-feet remaining, with expected zero capacity by 2020. Furthermore, the dam blocks migration of endangered steelhead to 16 miles of prime spawning habitat.

AECOM (formerly URS) was retained by Ventura County Watershed Protection District (VCWPD) in 2014 to perform an updated structural analysis and stability evaluation for the dam, as well as conduct hydrologic and sediment assessments and modeling, and develop dam removal and water supply mitigation design alternatives and preliminary construction cost estimates. Alternatives were evaluated based on consensus-based evaluation criteria, and presented at numerous design oversight and stakeholder workshops. In 2016, AECOM supported VCWPD and the project funding sub-committee in submitting two large grant applications to support ongoing planning and design work on the dam removal project.

Currently, AECOM is serving as the project design lead for the dam removal project, having completed the 30% design package in 2021 and 65% design package in 2022. AECOM also continues to provide support to VCWPD for downstream river system sediment transport and hydraulic modeling, real estate planning, and alternatives analysis for improvements at the Casitas water diversion structure.

Completion: 2014–Present
Client: Ventura County Watershed Protection District
Project Fee: $1.3 million





# College Lake Dam Removal and Blackwater Creek Restoration

## Lynchburg, Virginia

AECOM has been contracted to provide all phases of engineering and design related services for the removal of College Lake Dam and the ecological restoration of Blackwater Creek using natural channel design.

College Lake Dam was constructed over 80 years ago and due to the urban watershed development, a high sediment supply from degraded upstream reaches has caused reduced ecological function within College Lake. College Lake Dam has been listed as a high-hazard dam threatening the safety of the community during over-topping events. Removing the dam will increase public safety and begin ecosystem recovery. The project's design provides a plan to complete the project goals as well as provides future site planning including trails and amenities for community access. Planning and design for restoration of over 15,000 linear feet of stream and 20 acres of wetlands will provide a living learning laboratory for the City of Lynchburg community and the University of Lynchburg students.

The AECOM team performed a variety of field data collection services including topographic and bathymetric surveys, geotechnical investigation, wetlands delineation, geomorphic assessment, stream and wetland function assessments, vegetation surveys and invasive species surveys, and sediment transport analysis.

AECOM also performed a detailed hydraulic and hydrologic analysis to provide updated high-quality flood zone mapping once the dam is removed. Public meetings and community outreach will continue to occur to collect public feedback on design decisions. AECOM has led and participated in science courses taught at the University to educate students on the principles of stream restoration and field techniques to collect critical data that leads design decisions. Trails and walkways through the areas targeted for natural channel design and wetland restoration will provide community access and education opportunities to ecosystem restoration including areas for bird watching, dam removal education, and flora and fauna identification.

AECOM's design plan utilizes Rosgen natural channel design approach to restoring the incised reach upstream and replacing the lake with a meandering stream through the lakebed. The former lakebed will be graded to provide pocket wetlands for creating varying habitat and plant diversity while also attempting to manage the many invasive species on the list. The reconnection of Blackwater Creek will provide proper floodplain to promote increased flood attenuation leading to stable flood conveyance during large storm events.

Completion: 2019–Present
Client: City of Lynchburg Department of Water Resources
Project Fee: $2.5 million
Estimated Construction Cost: $20 million

# Flock Process Dam Removal

## Norwalk, Connecticut

The City of Norwalk contracted AECOM to provide comprehensive engineering and design services related to the removal of the Flock Process Dam on the Norwalk River. These services included the collection of existing background data, an assessment of existing conditions, additional survey (including bathymetric), sediment characterization, hydrology and hydraulics, dam removal and stream restoration design, permitting and cost estimating.

The Flock Processing Dam is a privately owned stone masonry dam constructed around 1850 to provide power to a local mill. The dam was 70 feet across, 15 feet high and 17 feet thick and is the first blockage on the Norwalk River from the Long Island Sound. The dam is located in a highly developed area which hindered the ability to access the dam for removal. The dam was bound to the west by an active commuter rail line. The Merritt Parkway crosses the Norwalk River near the upper limits of the current impoundment to the north. To the east, Main Avenue parallels the river and several commercial buildings lie between the River and Main Avenue. A large commercial building (Merritt View) is located 400 feet upstream of the dam along the eastern stream bank and a portion of this building extends out into the impoundment area. The left or eastern stream bank downstream of the dam is steeply sloped to near vertical and inhibits construction access. In addition, the AMTRAK rail crosses the Norwalk River approximately 200 feet downstream of the dam where bedrock is exposed.

### Solutions Provided

Access to the dam for construction was obtained between two commercial buildings. During the bathymteric survey, it was discovered that there is an abrupt change in depth to refusal through the dam location suggesting that the dam was constructed in a steep cascade section of the river valley. In order to enhance fish passage, AECOM designed an engineered riffle through the dam breach area.

Three days after the breach, the region received significant rainfall which completely changed the river conditions including channel alignment and severe bank erosion with several tree washouts. AECOM was able to promptly modify the design with the contractor. In coordination with the CT DEEP, the design was modified to eliminate the engineered riffle and add an additional 500' of habitat improvements including the use of root wads, large woody debris and random boulder placement. The dam removal/river restoration portions of the project were completed two weeks ahead of schedule and within the contracted budget and resulted in significantly more habitat improvements than the original design.

Completion: 2020
Client: City of Norwalk
Project Fee: $154,350





# Klamath River Renewal Project – Technical Representative Services

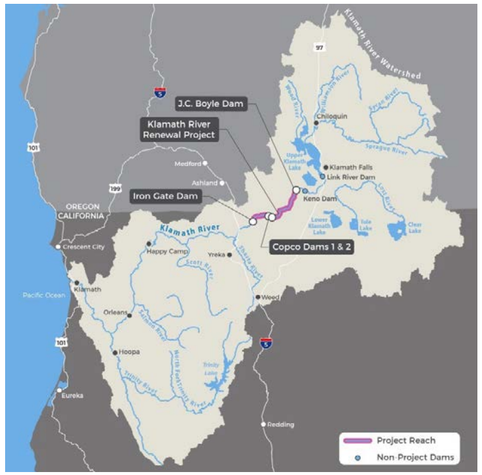
## Klamath, Oregon

The Klamath River Renewal Project represents the largest dam removal project in U.S. history, involving the removal of four large hydropower dams and reservoirs on the Klamath River. Dam removal and related activities will help restore populations of Chinook, Coho, steelhead, and lamprey by providing access to over 400 stream-miles of historic spawning and rearing habitat above the dams.

AECOM was selected as the Technical Representative for the Klamath River Renewal and Dam Removal Project, initiated by the Klamath River Renewal Corporation (KRRC). AECOM provided management, engineering, environmental and construction management services for the US$400 million dam removal project, which stretches along the Klamath River from J.C. Boyle Reservoir in southern Oregon, downstream past Iron Gate Dam in California. To complete the work, AECOM partnered with CDM Smith and River Design Group to provide comprehensive design, permitting and construction management services for the project.

Constructed between 1911 and 1962, the dams were not equipped with adequate fish ladders. As a result, for close to a century, fish species that migrate from the sea and up rivers to spawn, are blocked from accessing more than 400 river miles in the upper Klamath Basin. Under the terms of an agreement signed by Federal officials, the utility PacifiCorp and the states of Oregon and California, the dams will be removed by the KRRC as early as 2023, opening miles of connected fish habitat.

The project includes decommissioning and removal of the Iron Gate Dam, Copco No. 1 Dam and Copco No. 2 Dam in Siskiyou County, California, and the J.C. Boyle Dam in Klamath County, Oregon. Subsequent site remediation and restoration, as well as measures to minimize adverse downstream impacts, will help boost species populations by an estimated 80 percent. The project will significantly increase spawning habitat for salmon, steelhead trout and other species that rely on




uninterrupted river flows. An increase in moving water as a result of dam removal will also improve water quality in the region by mitigating, and in some cases eliminating, toxic blue-green algae found in reservoirs.

Restoration of the river will improve the cultural lives, health, and economic wellbeing of Native American communities in the Klamath Basin. In addition, the project will create jobs, including a few hundred jobs directly related to the project. KRRC's local investments and activities will stimulate over a thousand indirect jobs. Healthy salmon runs are also expected to add nearly five hundred jobs in the commercial and recreational fishing industries in California and Oregon.

J.C.Boyle Dam and Reservoir

## J.C. Boyle Dam & Reservoir

J.C. Boyle Dam is composed of an earthen embankment section, fish ladder, spillway and diversion culverts, intake to the powerhouse, and concrete gravity section (from right abutment to left abutment, looking downstream). The earthfill embankment section is 68 feet tall with a 15-foot wide crest, which a crest length of 430 feet.

## Copco No. 1 Dam & Reservoir

The Copco No. 1 facility consists of a reservoir, concrete dam, gated spillway, diversion tunnel, intake structure, and powerhouse located on the Klamath River. The 133-foot high concrete gravity dam impounds a reservoir of approximately 970 acres.

## Copco No. 2 Dam & Reservoir

The Copco No. 2 facility consists of a small reservoir, concrete diversion dam, embankment section, gated spillway, water conveyance system, and powerhouse located on the Klamath River. The dam is a concrete gravity structure with a gated side intake to a water conveyance tunnel at the left abutment, a central 145 foot-long spillway section with five 26 by 11 foot radial (Tainter) gates, and a 100 foot-long earthen embankment with gunite cutoff wall on the right abutment.

Iron Gate Dam and Spillway

## Iron Gate Dam & Reservoir

The Iron Gate facility consists of a reservoir, embankment dam, side-channel spillway, diversion tunnel, intake structures, and powerhouse located on the Klamath River.

The dam is a zoned earthfill embankment with a current height of 189 feet. The spillway is excavated in rock on the right abutment, and consists of an ungated side-channel spillway crest with a concrete-lined chute.





Copco No. 1 Dam

Vegetation Sampling

Services provided by AECOM include the following:

- **Program Controls:** Budget, Schedule, Change Management, Risk Management and QAQC for the Program.
- **Public Outreach:** Outreach to the public, regulatory agencies, Indian tribes and other key stakeholders within the basin.
- **Preliminary Design:** Develop preliminary design information for use in the CEQA and NEPA processes, permitting and procurement tasks.
- **Permitting:** Pre-consultation with federal, state and local regulatory agencies, and development of permit applications.
- **Procurement:** Progressive Design-Build firms were shortlisted through an RFQ process, and an RFP, bridging documents and draft Agreements were then developed and issued to shortlisted firms. AECOM led the evaluation of proposals and assisted the client and legal team with contract negotiation with the selected Design-Build team.
- **Design Management and Oversight:** AECOM led oversight of the Design-Build team through the 60% design phase.

AECOM continues to provide cultural resource field and tribal coordination support as the project proceeds through the multi-year construction duration.

Completion: 2017–Present
Client: Klamath River Renewal Corporation
Project Fee: $230 million





# Otsego Township and City Contaminated Sediment, Dam Removal and Stream Restoration Project

## Otsego, Michigan

Dam removal, sediment management and river restoration to improve aquatic ecosystems.

AECOM is providing the Michigan Department of Natural Resources with multi-faceted services for two dam removal and stream restoration projects on the Kalamazoo River. These projects draw on AECOM's full service capabilities in aquatic biology, structural engineering, geotechnical engineering, hydraulics, stream restoration, and contaminated sediment management.

Otsego City Dam and Otsego Township Dams are former hydroelectric facilities. Otsego City Dam has a normal head of 9.3 feet and an impoundment area of 73 acres and a 1.2 mile stretch of backwater. Otsego Township dam has a normal head of 9 feet, an impoundment area of 96 acres and a 1.5 mile stretch of backwater. In the mid to late 1950s paper mills along the Kalamazoo River discharged wastes with polychlorinated biphenyl contamination (PCBs). This resulted in PCB contaminated sediments being distributed from Comstock, Michigan to the river's mouth near Saugatuck, Michigan.

### Client Benefits

- Detailed cost estimating to support planning
- Innovative, phase approach to support stakeholder/PRP engagement
- Multiple options for handling contaminated materials

### Work Performed

AECOM's role at this site included providing conceptual level stream restoration and sediment management options for each dam and complete design for water control structures for regulating river level during construction.

- Stream restoration included developing natural stream characteristics (depth, width and floodplain area) for the restoration; developing dam removal and restoration sequencing for both dams; developing a planting plan for exposed bottomlands. Since the impoundments contain large volumes of contaminated sediments and removal of this material largely drives overall project costs three restoration options were evaluated that required different volumes of material to be removed.

- The hydraulic aspects of the water control structure was designed using HEC-RAS. The water control structure is designed to safely pass the dam safety required design storm without raising the upstream or downstream water levels above acceptable levels.
- A sheet pile water control structure was designed for each dam location. The sheet pile wall is designed to be temporary structure designed to manage water level, contain contaminated sediments, stabilize the aging dams, and facilitate sediment removal and dam removal.
- The volume of material requiring removal and approach to removal PCB contaminated sediment was provided for the full river restoration and water control structure design. This included cost estimates, design details and specifications.

Each restoration option included specific streambank/floodplain plantings; bank stabilization measures; and floodplain stabilization measures. The restoration options would provide for removal of contaminated sediments, fish passage and canoe/kayak access, and improving fish and wildlife habitat with varying degrees of long term maintenance and capital costs.

Completion: 2012–2020
Client: Michigan Department of Natural Resources
Project Fee: $400,000 (engineering fee)

# Lagunita Dam Removal and Bank Stabilization Project

## San Mateo and Santa Clara Counties, California

The 70-foot-wide and approximately 8-foot-high concrete run-of-the-river diversion dam was constructed in the late 1800s to provide gravity diversion to an adjacent flume; however, settlement along the flume and canal prevented diversion operation since 1985. The diversion dam also includes a fishway that provides limited passage past the dam. Stanford, environmental groups, and resource agencies concluded that dam removal was the preferred option.

After years of diligent review, alternatives analysis, real estate investigation/negotiations and similar scoping analyses, Stanford selected dam removal as the preferred action for the Lagunita Diversion Dam located on San Francisquito Creek in San Mateo and Santa Clara Counties.

AECOM was retained by Stanford University to provide consulting services for activities associated with the removal of the dam and restoration of the creek and bank. The dam structure included a concrete weir spanning the entire channel width, which was keyed into opposing stream banks via reinforced concrete abutments. The dam was 65 feet wide by approximately 10 feet deep, and enabled gravity diversion to an adjacent flume via slide gates. The diversion dam facility included a Denil-style fishway. The facility had not been used in decades due to a replacement water supply developed by Stanford.

AECOM's services for the first phase of work included a baseline condition assessment, hydraulic and hydrologic modeling, characterization of sediment quality, quantity and mobility, and preparation of 30% design plans and construction cost estimate for the dam removal and bank stabilization. AECOM also coordinated with the various permitting agencies, prepared a project permitting plan, and investigated grant opportunities for project implementation (grant for construction funding was awarded by the California Department of Fish and Wildlife). Follow-up services included completion of final design and bid package, regulatory


permitting, CEQA/NEPA compliance, bid support, and full-time construction management.

AECOM's design utilized a stream simulation approach based on selected reference reaches, in addition to hydrologic and hydraulic modeling of the creek to confirm geomorphic and hydraulic performance. A dam removal and nonstructural bank stabilization design and construction approach was subsequently developed to ensure stable bank conditions and a natural creek channel, as well as optimize biological conditions for habitats and fish passage.

The project design also needed to incorporate construction logistics planning for activities in a difficult to access creek work area to comply with environmental and other applicable permitting laws, to minimize disturbance to immediately adjacent neighboring properties, and for consideration of reuse/recycling of construction materials.

Construction was completed in 2018 and AECOM continues to complete post-construction monitoring

Completion: 2015–Present
Client: Stanford University
Project Fee: $1.4 million
Estimated Construction Cost: $3.5 million

# Ecological Restoration of the Little Rapids Area of the St. Marys River

## Sault Ste. Marie, Michigan

Restoring flow at the St. Marys River will increase fish and aquatic organism foraging, spawning and nursery habitat.

Since the mid-1800s, the St. Marys River has undergone extensive man-made alterations for the purposes of navigation, travel and hydroelectric power. These changes destroyed habitat at the East and West Neebish Rapids, the Little Rapids, and left only remnants of the Main Rapids. Today, the Main Rapids receives less than 10 percent of its historical flow and represents the only remaining rapids habitat of this globally unique river, however, the Little Rapids is a candidate for restoration.

The construction of the causeway, from the ferry dock on Island No. 1 to Sugar Island, destroyed the Little Rapids by diverting flow away from the shallows. Where waters once flowed freely, they now are restricted by two submerged six-foot culverts. These culverts are a safety hazard and result in poor habitat for fish and wildlife due to the restricted flow. With restored flow, however, the area has potential to once again provide foraging, spawning and nursery habitat for a wide variety of sport fish and other aquatic organisms.

Restoration of the Little Rapids will involve reconnecting the upper and lower sections of the river between Island No. 1 and Sugar Island. The project will replace the existing culverts with a series of large box culverts, creating an opening approximately 600 feet wide that will improve water flow, increase velocities and ultimately create conditions that will benefit the aquatic community of the Great Lakes.

### Client Benefits

- Worked cooperatively with local stakeholders and resource agencies to develop consensus around the approach
- Developed detailed hydraulic model to assess impacts to shipping channel
- Guided client through alternative Design-Build contracting process

### Work Performed

AECOM developed a computer model of the system, an Environmental Assessment, and design plans. A key component of this process was the geotechnical evaluation of the subsurface conditions at the causeway. The Little Rapids area is underlain by several hundred feet of lacustrine clay that provides poor conditions for construction of causeway modifications. AECOM oversaw six borings and performed geotechnical analysis in order to design a culvert system that will remain stable while also opening up 600 feet of causeway to flow.

Completion: 2006–2016
Client: Eastern Upper Peninsula Regional Planning & Development Commission
Project Fee: $1.1 million





# Searsville Dam and Reservoir Alternatives Study

## San Mateo and Santa Clara Counties, California

Searsville Dam was originally built in 1892 to provide water to San Francisco. Acquired by Stanford University in 1919, the reservoir is now one of several sources of non-potable water used by Stanford for landscape irrigation, agriculture, and fire protection. The ecosystem that has developed over time throughout the reservoir is also a key aspect of environmental research conducted at the University's Jasper Ridge Biological Preserve (JRBP).

The reservoir's capacity has been severely reduced by over 2.5 million cubic yards of accumulated sediment, and the declining pool volume will eventually impact water supply. In addition, Stanford has been working for more than a decade to improve the habitat for steelhead and other protected species in the San Francisquito Creek watershed, and fish passage past the dam could become a part of those efforts.

The Searsville Steering Committee, composed of Stanford scholars and administrators, many of whom specialize in engineering, environmental science, history, and law, have considered a variety of possible options for the dam, including:

- Continuing to allow the reservoir to fill with sediment and transition to a marsh and forested wetland
- Maintaining the dam and reservoir through sediment removal
- Modifying the dam and reservoir to enable flood mitigation and management, in addition to fish passage to key tributaries
- Removing the dam to allow Corte Madera Creek and other streams to flow downstream unimpeded.

### Engineering and Biological Studies

AECOM was selected by Stanford University to provide an Alternatives Study for the Searsville Dam and Reservoir. The study was driven by Stanford's desire to determine Searsville's role in their long-term sustainable water management planning, its function as a teaching and research facility within JRBP, and particularly recognizing the need to address the increasing siltation condition and its potential impacts on the watershed as a whole. Sedimentation has reduced the reservoir to less than 10 percent of its original water capacity.

AECOM provided the technical support to Stanford's Searsville Study management team and Steering Committee. These technical areas included:

- Dam structure condition assessment and remaining service life, and potential physical modifications
- Existing water diversion assessment, and other potential water supply and storage alternatives
- Potential flooding upstream and downstream of the dam, and downstream flood management opportunities
- Sediment removal/disposal and management
- Fish passage facilities
- Analyses of changes in downstream water flow and sediment load resulting from various dam modification and sediment management alternatives, and the resulting impacts on salmonids and other creek- and wetland-inhabiting species
- Stream and watershed ecology (including habitat and passage of native anadromous fishes), and wetlands delineation and biodiversity impacts and mitigations determination.

AECOM's work included technical sediment and hydrology assessments and analyses, development of alternatives evaluation criteria, concept development of all dam, sediment, water supply, water storage, fish passage, and flood management actions, development of adaptive management strategies, identifying federal and state permitting requirements/processes, identifying grant funding opportunities, preparation of rough order-of-magnitude estimates of costs, and assessment of impacts. AECOM further assisted Stanford with the alternatives evaluation process and presentations to the Steering Committee and outside interest groups.

Completion: 2012–2020
Client: Stanford University
Project Fee: $3.0 million

 Photo Credit: Rossograph, CC BY-SA 4.0



# Marion Dam

## Marion, Michigan

### Cost-effectively improving habitat and increasing recreational appeal.

AECOM (performed as URS Corporation) developed a conceptual and feasibility level design for the ecological restoration of the Middle Branch River of the Muskegon River in Marion, Michigan. Using a reference reach approach, AECOM is leading the stream restoration design with dual aims of improving habitat and increasing recreation for the optimal cost. In addition to channel restoration, AECOM is also investigating the dam removal and staging design process for the potential removal of the Marion Pond Dam as part of this project. The Marion Pond Dam was built back in 1930 to replace a dam built in 1878 that was used to help power a saw, planing, and lathe mill. The Marion Pond is no longer used for logging purposes, but now serves as a small recreational area.

As part of the ecological restoration of the Middle Branch River, a number of different options for the dam are being considered including removing the dam in its entirety or re-routing the river around the dam (keeping the dam in place as a historical marker only). Applicable costs for ongoing structural maintenance and removal are being developed for each option, as appropriate.

### Client Benefits

- Used reference reach approach to develop cost-effective restoration plans
- Developed phased construction approach to reduce costs

Completion: 2010–2013
Client: U.S. Army Corps of Engineers, Detroit District
Project Fee: $100,000



# Mill Creek Dam Removal and Stream Restoration

## Dexter, Michigan

Dam removal and stream restoration integrated with bridge and road replacement work.

This dam is approximately 70 feet wide and approximately eight feet high and is located immediately upstream of the Main Street bridge, and forms a 20 plus acre impoundment. Originally constructed in 1824 as a rock filled timber crib, the dam was reportedly rebuilt in 1910 and 1932. The spillway is approximately two feet wide along the crest and has a concave shape where it is tied into a grouted apron under the Main Street bridge. The base of the dam at the bottom is approximately 8 feet thick. Metal sheet pile was driven along the entire upstream face of the dam and is capped with 8" x 8" x ½ " angle iron.

Mill Creek is located immediately adjacent to the Main Street Bridge. With the long term goal of restoring Mill Creek to free-flowing condition, the Village expressed a desire to have the dam removed concurrently with the bridge replacement. The bridge replacement design maintained the concrete apron under the bridge which was also a barrier to fish movement. The Village was also interested in restoring the stream bank, as well as the former impoundment area, to provide for enhanced recreational opportunities (e.g., nature trails, wildlife observation, fishing, canoeing/kayaking).

### Work Performed

AECOM (performed as URS) successfully completed the bridge replacement, dam removal and stream restoration components on time and on- budget. Services includes sequenced design and construction management to allow for concurrent completion of project components; phased dam breaching; permit development, submittal, negotiation and monitoring; sediment sampling/analysis; sediment management plan development and implementation; aquatic invasive species plan development and implementation; rock structure design and construction oversight (including fish passage features); wetland and floodplain delineation services; parks and recreation planning assistance; intergovernmental coordination; grants acquisition and management; and stakeholder engagement.

Special challenges included project sequencing to meet bridge replacement needs; managing sediment with slightly elevated contaminant levels (Cadmium); designing rock structures to "step down" the former impoundment; negotiating a complex permit process with several dozen conditions; and accessing additional grant funds to facilitate project completions.

Completion: 2007
Client: Village of Dexter
Project Fee: $300,000





# Elwha and Glines Canyon Dam Removal

## Port Angeles, Washington

AECOM provided project and construction management for the National Park Service's simultaneous removal of the Elwha and Glines Canyon dams on the Elwha River. The project was considered the largest dam removal project in the U.S. history at the time, and reopened more than 70 miles of pristine spawning and rearing habitat in the River.

The first step in removing the Elwha Dam was to lower the reservoir's water level approximately 15 feet by using the existing water intakes and spillways. This process began on June 1, 2011, following the closure of the powerhouse. A temporary diversion channel was then excavated and blasted through the left spillway to allow Lake Aldwell to be further drained. Cofferdams, temporary structures acting as dams, were installed to direct reservoir outflow into the temporary diversion channel. This allowed the remaining water immediately behind the concrete dam to be lowered at a controlled rate. The sediment behind the dam was removed simultaneously with the concrete dam removal, and the original river channel was restored. Controlled drawdown of Lake Aldwell was mandated to avoid landslides in the lake and excessive transfer of sediments downstream, which could impact area drinking water supply, and cause lowland flooding. The powerhouse and all other structures were also removed, and the temporary diversion channel refilled. Finally, the site was re-contoured and revegetated to most closely resemble the pre-dam condition. The work was completed in June 2012.

To remove the Glines Canyon Dam, water levels in Lake Mills reservoir were lowered to the bottom of the spillway gates. Using barge-mounted hydraulic hammers, the first 94 feet of the dam were removed down to that waterline. The next 116 feet of the dam were then removed using notched blasting to control lake drawdown and sediment flow down-stream. Concrete debris was mucked out of the lake using backhoes to load into skip pans and move with a 4100 crane to a stock

pile for recycling off-site. The dam was "notched down" on alternating sides, creating temporary spillways used to further drain Lake Mills. The headgate house, penstock, and powerhouse, were removed during windows of halted deconstruction to allow time for sediment loads to decrease downstream. As layers of the dam were removed, the reservoir drained through each new notch. Notches were sized on a case-by-case basis depending on the flows required to maintain or lower the reservoir level. Notching occurred on alternating sides of the dam until the sediments from the upstream delta eroded downstream and were resting against the dam. At this point, the remaining portion of the dam was removed and the river channel was restored.

AECOM was responsible for conducting weekly project review and coordination meetings between participating agencies, generating daily inspection reports, processing requests for information; performing technical inspection of the work for compliance with the contract specifications and drawings; assisting in the preparation of correspondence, estimates, and backup for contract modifications; assisting in identifying and recommending resolution of construction/design issues; monitoring the construction contractor's quality control program; conducting pre-final and final inspections; generating and verifying completion of the punch list; and assisting in the preparation of as-constructed drawings and other documents and activities associated with project closeout.

Range of Service: 2011–2014
Client: National Park Service
Dam Removal Construction Cost: $30 million


# 04

# Proven: Delivering project success

AECOM's ability to deliver successful dam removal projects is proven by the recognition received by the industry and our clients.

AECOM has led the way in the dam removal industry by providing clients with full-service design, permitting, procurement, and construction oversight services. Through our numerous projects, AECOM managers and technical staff have develop strong relationships with federal, state and local agencies, in addition to environmental advocacy groups and local non-profit watershed groups. These relationships create a distinctive capability to help clients identify funding mechanisms to help defray all or some of the costs of dam removal, as well as facilitate and expedite the permitting process. Our experienced team works efficiently within State and Federal guidelines and regulations to limit costs.

AECOM has worked with multiple agencies and project partners on dam removal projects throughout the country. These have included state and federal resource and regulatory agencies, Native American Tribes, municipalities, and not-for-profit conservation organizations. AECOM has completed design and permitting for the removal of dozens of dams of varying size. Designing the removal of a dam involves an in-depth understanding of the dam structure and infrastructure, and often requires collection of recent topographic and bathymetric elevation data for the dam and reservoir. This information facilitates in calculating the volume of impounded sediment, establishing the thalweg through the dam, and stabilizing the streambanks post-removal. Every dam removal is unique in it's approach, addressing the complex issues associated with impounded sediment, dam construction material, erosion and control matters, and occasionally historical and societal issues. AECOM does not take a "cookie cutter" approach to projects, and our goal is to provide cost-effective, innovative project designs and solutions, responsiveness to clients, and to identify and protect water resources.

Carmel River Reroute and San Clemente Dam Removal, Monterey County, CA

**About AECOM**

AECOM is the world's trusted infrastructure consulting firm, delivering professional services throughout the project lifecycle – from advisory, planning, design and engineering to program and construction management. On projects spanning transportation, buildings, water, new energy and the environment, our public- and private-sector clients trust us to solve their most complex challenges. Our teams are driven by a common purpose to deliver a better world through our unrivaled technical and digital expertise, a culture of equity, diversity and inclusion, and a commitment to environmental, social and governance priorities. AECOM is a *Fortune 500* firm and its Professional Services business had revenue of $13.1 billion in fiscal year 2022. See how we are delivering sustainable legacies for generations to come at aecom.com and @AECOM.

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