

Rebuilding After the Storm

Flood Protection, Levee and Dam Services





Cover Image:
Buffalo Bayou Flood Damage Reduction and Bank Stabilization
Houston, Texas, USA

This page:
East of Harvey Canal Floodwall Design Services
Algiers, Louisiana, USA

Our commitment to rebuild stronger

The ecological health, economic vitality and quality of life in floodprone regions are defined by the people who live there.

Invaluable assets — such as wetlands and waterways — contribute to the regions' economy, tourism trade, recreational opportunities and culture. For decades, destructive storm events and many other ecosystem stressors have compromised the current status and future potential of these areas.

Today, AECOM is building more resilient and sustainable communities by helping our clients restore and protect communities throughout the United States.

Our professionals have national and global stature with a strong local and regional presence. And, like these impacted regions, AECOM has many dimensions: our local experience, multidisciplinary expertise and extensive resources.

We are in a unique position to design, build, operate, maintain and finance projects throughout these regions — and can address virtually any problem or opportunity associated with how we restore, protect and use these natural resources. Our clients benefit from our in-depth understanding of the regions' characteristics, stakeholders, challenges, opportunities, governance systems, regulatory environment and funding opportunities.

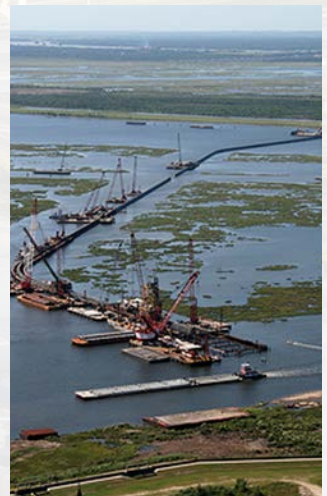
Restoration



Protection



Sustainable Use



Levee Systems Management Reduces Flood Risk



Hurricane Storm Damage Risk Reduction System IDIQ 2008-2016 — LPV Reach 111
New Orleans, Louisiana, USA

Innovative levee engineering to protect our communities and infrastructure assets.

Reducing risks to our communities from rising water levels is critical in coastal and flatland areas. These regions are often subject to emergency flood events and need proven solutions for recovery.

For more than 60 years, AECOM has been involved with all aspects of flood management levee systems, including field inspections, flood damage emergency response, storm damage assessment, risk assessment, feasibility studies, engineering and design, geotechnical evaluations and construction services. Our professionals are familiar with the stringent U.S. Army Corps of Engineers (USACE) post Hurricane Katrina criteria as well as industry standards.

AECOM has developed a global perspective assisting national and international clients, including federal and local governments, to inspect,

assess and design and construct a variety of levee and flood management systems. Included are floodwalls, floodgates and the structural features of the flood protection system.

We address challenges by creatively evaluating the situation, developing the right approach and delivering projects to benefit our clients' vision.

Understanding the risks associated with levee systems. AECOM provided designs for levee and floodwall improvement projects and construction oversight throughout the New Orleans area in the post-Katrina recovery. Noteworthy were the designs of Lake Ponchartrain and Vicinity (LPV) 109 and LPV 111, 7 and 5 miles of levee protection respectively. Unique to LPV 109 was the effective use of wick drains to reduce settlement and increase soil shear strengths. LPV 111 levee sections were supported on deep soil mixing columns.

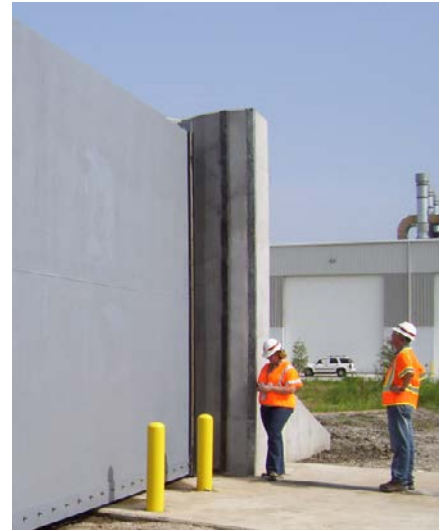
Our construction arm built LPV146 in St. Bernard Parish. The project added 39,965 feet of H-pile supported concrete T-walls constructed atop existing levees and raised the level of protection from elevation of 20 to 29 feet. This reduced the vulnerability of potential surge elevations and wave heights.

In 2014, AECOM completed an award winning risk evaluation of 3,000 miles of urban and non-urban levees for the California Department of Water Resources (DWR). The study enables DWR to achieve 200-year protection in the urbanized portion of the Central Valley, thus preventing catastrophic flood damage.

Technology provides quantifiable data to aid in project prioritization. AECOM used electromagnetic survey on hundreds of miles of the Urban Levee Investigation Program for California DWR to identify anomalies and buried or abandoned pipelines under the levees. LiDAR survey was used to quickly obtain topographic mapping of the levees and surrounding terrain to support future analyses and design efforts.

Areas of Expertise

Full Planning, Design, and Construction Life Cycle. AECOM is a global network of experts working with clients, communities and colleagues to develop and implement innovative solutions to the world's most complex challenges. Worldwide, we design, build, finance, operate and manage projects and programs that unlock opportunities, protect our environment and improve people's lives.



Risk Assessment and Management.

AECOM offers a range of analytical tools and toolboxes developed in-house and with input from various clients' dam and levee safety boards. We provide risk and uncertainty analysis associated with levee integrity and consequence assessment including economic and ecosystem impacts, probable life loss and environmental and cost benefit analysis.

Perform Evaluation Studies.

The nature of safety issues and the urgent need for action requires a comprehensive approach. We have led varied evaluation studies, ranging from small and simple to large and complex, for various federal and private entities. These issue evaluation studies have included risk assessments, field investigations, and material characterizations as well as engineering analysis such as seepage and filter evaluations, stability, liquefaction, dynamic deformation, structural response and hydrology and hydraulic analyses.

System Integrity. To protect our resources—including citizens, infrastructure, land, water supply and agriculture—against long-term impacts, our engineers analyze levee and flood wall integrity. A thorough understanding of the system resiliency is an essential

factor in assessments. AECOM's engineering staff includes experts able to analyze a variety of components integral to levee/flood protection systems such as: levees, T-Walls, I-Walls, gates and other flood control structures.

Inspections and Field Investigations.

AECOM provides inspections related to: levees, floodwalls, gates and structures, pumping station systems, locks and dams and emergency response and storm damage assessments. We also offer extensive capabilities completing geophysical surveys and remote sensing, electromagnetic surveys and LiDAR, geology and geomorphic studies and field investigations and in situ testing.

Levee Certification and Accreditation.


AECOM assists levee owners in the levee certification and accreditation process. We have a deep expertise in implementing FEMA levee policy for levees and floodwalls across the U.S., including fluvial and coastal situations, for accredited and non-accredited systems. For example, we had a principal role in assisting FEMA in the development of the Levee Analysis and Mapping Procedures (LAMP) for non-accredited levees. We were the technical leader for all the coastal LAMP pilot projects nationwide, including those conducted in Texas.

Above left and right:
**Mississippi River-Gulf Outlet (MRGO)
 Floodwall and Gate**
 New Orleans, Louisiana, USA

Levee and Flood Control Structure Design and Construction.

Expertise combined with a proven quality process ensures systems perform as designed AECOM has decades of experience in the design of floodwalls, levees and structures including floodgates, pump stations, diversion channels, weirs and flood detention basins. Expertise includes:

- Instrumentation installation and studies
- Data management and GIS
- Integrated GIS and CADD platforms
- Web-based monitoring systems
- Project websites
- Early warning system inspections and designs
- Repair under PL84-99 for federal flood control projects
- Cybersecurity
- Construction
- Operation and maintenance support
- Engineering, analyses and modelling



We successfully deliver flood protection engineering services that are innovative and cost-effective by applying best practices from across the United States.

Geotechnical Engineering: Field Investigation and Analysis



Feather River West Levee

Yuba City, California, USA
Thirty-five miles of 80- to 120-foot deep open trench and deep mixing method cutoff walls were installed along the Feather River West Levee

AECOM has the understanding, experience and specialized knowledge from useful and effective geotechnical investigations and complicated analyses to deliver unique and cost-effective solutions to the most complex problems.

Areas of Expertise

- High plastic clays
- Karstic foundation
- Soft soils
- Sand foundations
- Site investigations
- Flood control embankment drilling Regulations
- Laboratory testing
- Dye tracer testing
- Surface and downhole geophysics
- 2-D and 3-D seepage steady state and transient analysis
- Slope stability analysis
- Seepage control measures
- Slope stabilization techniques
- Settlement analysis
- Foundation strengthening techniques
- Seismic hazard evaluation and rehabilitation

- Retaining walls
- Surcharge analysis
- Cutoff walls

Types of Projects

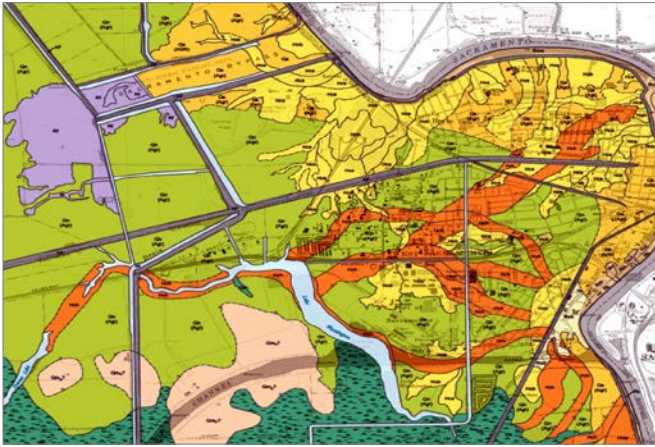
- Flood management
- Floodwalls, levee and dam design
- Industrial sites
- Hazardous waste sites
- Landfills
- Building foundations
- Project sites in floodplains
- Bridges
- Marine
- Highways
- Transit
- Detention ponds
- Setting basins

Representative Projects

- Amistad Dam Geotechnical Investigation and Inspection and Assessment of Penstock, Del Rio, Texas
- Paisano Levee, El Paso, Texas
- Design of Rehabilitation of American Canal, El Paso, Texas
- Field Investigation and Design for Rehabilitation of North Floodway Levee, Harlingen, Texas
- New Lamar Street Levee Site Investigation and Design, Dallas, Texas
- Investigation and Design of Rehabilitation of Rochester Levee, Dallas, Texas

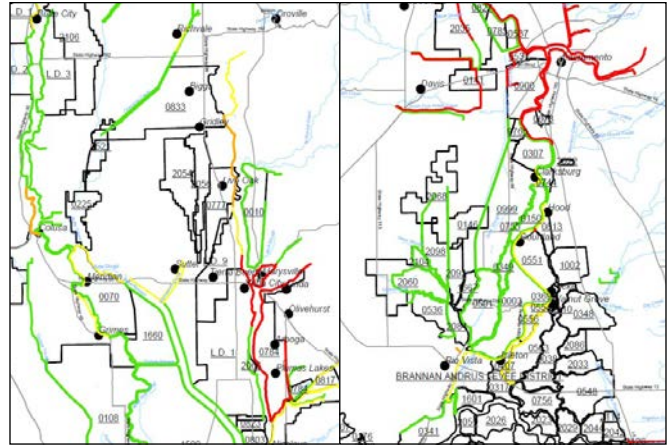
- Field Investigation and Design, Courchesne/Nemexas Levee Reaches, El Paso, Texas
- Assessment of Tainter Gates and Surcharge Analysis, Oklahoma
- Raise and Rehabilitation of New Orleans East Levees, New Orleans, Louisiana
- Trig Lake Dam, Dallas, Texas
- Urban and Non-urban Levee Assessment (2,000 miles), Sacramento, California
- Field Investigation and Foundation Design of Confidential Data Center Projects, Fort Worth and McKinney, Texas
- Non-Hazardous Landfill Feasibility Study, Freeport, Texas
- Field Investigation and Foundation Design for Proposed Maintenance, Office and Central Stores Building of Lubrizol Facility, Deer Park, Texas
- Rehabilitation for Levees at Edinburg Pump Station — Lower Rio Grande Flood Control Project, Penitas, Texas
- Geotechnical Assessment on Existing McDavid Plano Lincoln, Plano, Texas
- Landslide Investigation Consultancy, Hong Kong, China
- Santiago Creek Dam, California (160-foot exploratory fault trench to investigate the Terrace Fault)
- Lake Isabella Dam, California (seismic hazard evaluation)

Inspections and Analysis



Understanding the geomorphology

As part of the investigation and assessment of over 1,500 miles of California levees, AECOM conducted detailed geomorphic characterization of the flood plains to understand the history of the river dynamics and the presence of buried channel and ox bows which can be under-seepage paths.



Mapping field observations

For any given levee system, we typically undertake a thorough program of levee inspection and field mapping. This data is combined with historical records, and past exploration data into a fully integrated data base/GIS/CADD system. This becomes the foundation of the data collection process supporting future evaluations, engineering and designs. AECOM has accomplished this on hundreds of miles of levees.

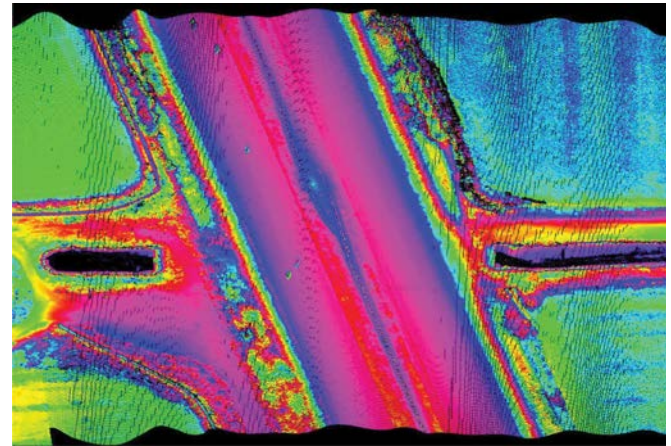


Field investigation teams

Our field investigation teams can be multidisciplinary.

We have combined engineers, surveyors, biologists and geologists to conduct levee field inspection and data collection during the levee field investigation for the CA-DWR emergency erosion repair project, Task Force Guardian repairs and many other levee programs.

AECOM has similarly conducted post storm damage field investigation for the USACE in support of the PL84-99 Federal emergency repair program.



Designs that mitigate problems

AECOM has an extensive arsenal of field investigation techniques including Electromagnetic Survey and LiDAR Survey. Various investigation techniques have been used on the hundreds of miles of levees for the USACE, California-DWR, and the Local Reclamation Districts, for soil sampling and in situ testing.

Flood Management: Dams and Levees



Geotechnical Investigation and Final Design for Rochester Levee Rehabilitation

Dallas, Texas, USA

The project required an extensive testing program to determine the correct lime admix to stabilize the high plastic clays prevalent at the site.

Geotechnical Investigation and Final Design for the Rehabilitation of LPV 109 Levee

New Orleans, Louisiana, USA

This Hurricane Katrina-damaged levee was founded on extremely soft clay, requiring foundation strengthening techniques. AECOM developed a design using wick drains to quickly and successfully consolidate and strengthen the foundation. This unique and cost-effective design won an award with Engineering News-Record magazine as one of the Top 25 Newsmakers of 2010.

AECOM is an international leader in dams and reservoirs. We have a comprehensive, global team of specialists who work across the full project life cycle — delivering solutions to the world’s most complex problems.

We have served some of the largest dam and levee owners and operators in the country:

- U.S. Army Corps of Engineers (USACE): Hundreds of dam and levee task orders
- International Boundary and Water Commission (IBWC): Amistad Dam and 100 miles of levees
- U.S. Bureau of Reclamation (USBR): Over 200 dams
- U.S. Fish and Wildlife Service (USFWS): More than 70 dams
- Natural Resources Conservation Service (NRCS): More than 25 dams

- Federal Energy Regulatory Commission (FERC): More than 100 projects
- State of California: 7 dams and 2,000 miles of levees
- U.S. Army Engineer Research & Development Center (ERDC): Over 30 local dams

Representative Projects

AECOM has worked with local and federal agencies to pioneer and improve the methods used for the assessment, design, and construction of flood management systems.

- Amistad Dam Geotechnical Investigation, Inspection, and Assessment of Penstock, Del Rio, Texas
- The Raise and Rehabilitation of Levee LPV 109, New Orleans, Louisiana
- Seepage Analyses for New Orleans East Levees, New Orleans, Louisiana
- Levee Screenings to Assess LSAC Rating, Sacramento, California
- Assessment of Tainter Gates and Surcharge Analysis for 10 Dams, Oklahoma

- Investigation and Design for Rehabilitation of North Floodway Levee, Harlingen, Texas
- Field Investigation and Design Courchesne/Nemexas Levee Reaches, El Paso, Texas
- New Lamar Street Levee Site Investigation and Design, Dallas, Texas
- Investigation and Design of Rehabilitation of Rochester Levee, Dallas, Texas
- Design of Rehabilitation of American Canal, El Paso, Texas
- Periodic Inspections of Federal Dams on Military Bases, Nationwide — Includes Repair Cost Estimates, Emergency Action Plans (EAPs) and Standard Operating Procedures (SOPs)
- Lewis Lake Dam Emergency Repairs, Houston, Texas
- Trig Lake Dam, Dallas, Texas

Dam and Levee Safety



Eufaula Dam
Eufaula Lake, Oklahoma, USA

AECOM has the understanding, experience and specialized knowledge to deliver state-of-the-art dam safety risk analysis and prioritized risk management strategies — to preserve and enhance the safe, cost-effective management of dams worldwide.

AECOM is providing engineering support services, including the participation of nationally recognized geotechnical and dam design, construction, and operation risk experts, for projects within USACE's Tulsa, Huntington, Jacksonville, Omaha, Sacramento, and Rock Island Districts. The projects require dam and levee expertise, coordination with subcontractors, understanding of client requirements, and disciplined focus on schedule and budget.

The project team has excelled on all aspects of the jobs and delivered projects to the complete satisfaction of the client. The high quality of the work is attested by the 13 ACASS ratings received to date. Five of the ratings are "Exceptional" and seven "Very Good."

**Representative Projects:
USACE Tulsa District**

- Quality control and consistency reviews of Issue Evaluation Studies, Safety Modification Studies, USACE Risk Analysis Results, Major Rehabilitation Evaluation Reports and Baseline Risk Assessments for Addicks and Barker, Rough River, Isabella, Center Hill, Green River Lake, Brookville Lake, Nolin Lake, Bluestone, Howard Levee, Martis Creek, Zoar Levee and Diversion, Clearwater, Zoar Levee; Union Village, Dover, Howard A. Hanson, L-40 and North Kansas City Levee, Moose Creek, Terminus, Canton, Success, and Lewisville Lake Dams.
- Herbert Hoover Dike Potential Failure Mode Analysis (PFMA) and Risk Assessment (RA) on each of the failure modes. Engineering support services and participation

in the PFMA, RA Risk Reduction Assessment (RRA), and supporting report preparation to the Dam Safety Modification Report (DSMR) for the 143-mile Herbert Hoover Dike.

- Constructability Review, DSMR for Isabella Dam.
- Risk Analysis Facilitation and Participation for Success Dam DSMR.
- Review of RA and RRA DSMS for Addicks and Barker Dams. Independent technical review of 35 percent design.
- Constructability Review of proposed remediation of alternatives for the Addicks and Barker DSMR.
- Design modification Support for the Dahla Dam Project Outlet Works and Spillways.
- Development of Guidance Document for Performing Constructability Reviews for USACE Dam and Levee Safety Program.
- Support and Course Preparation for Embankment Dam Design Considerations for Risk Analysis Training. Developed a 32-hour course for Risk Management Center and USACE personnel on embankment dam design training.

Monitoring and Instrumentation



Hoover Dam, Las Vegas

Nevada, USA

Installing an automated system of vibration monitors to measure ground velocities associated with blasting for bridge piers near Hoover Dam. AECOM legacy firm, Morrison-Knudsen, was one of the consortium of firms that built the Hoover Dam. More than 200 Morrison-Knudsen engineers worked to design the dam that would be constructed in Black Canyon. It is the highest concrete arch dam in the United States and the largest building project that the federal government had ever undertaken.

Our engineers are experienced in producing dam safety management plans for the ongoing safety management of dams or during specific times such as construction staging, first filling, or prolonged drawdowns. A key goal of our management plans is to provide early detection of potential dam safety issues so corrective actions can be implemented, if required, and dam safety is not compromised.

Areas of Expertise

- Engineered risk assessments
- Automatic Data Acquisition System
 - Final designs/software integration
 - Installation/construction management
 - Training, O&M support
- Web-based information portals
- Web-based cameras and video surveillance
- Siren warning systems
- Evacuation plans/studies
- Community outreach/public education
- Instrumentation data management
 - WinIDP/WebIDP Software
 - Used for long-term performance monitoring of dams, levees, tunnels, and other civil infrastructure
 - Supports data collection, reduction, reporting, and plotting for multiple projects
 - Desktop and web-based versions provide access on stand-alone PCs, local area networks, intranet, or secure Internet project portals.

Representative Projects

Dam Safety Monitoring:

- Amistad Dam, Texas and Mexico
- Canton Dam, Keystone Dam, and Hulah Dam, Oklahoma
- Medina Dam, Texas
- Wolf Creek Dam, Kentucky
- USACE Projects, Nationwide
- Merrill Creek Reservoir, New Jersey
- Kennecott Copper Mine, Utah
- Bonneville Lock and Dam, Oregon

Early Warning Systems/

Evacuation Plans:

- Lake Murray Dam, South Carolina
- Seattle Public Utilities, Washington
- Puerto Rico Electric Power Authority

Wireless Video Surveillance:

- Bluestone Dam, West Virginia
- Tuttle Creek Dam, Kansas
- Hoover Dam Bypass Project, Nevada

Dam Safety State Regulations:

- Updated and Revised TCEQ Dam Safety Manual – Instrumentation Guidance, Texas

Cybersecurity for Industrial Control Systems/SCADA



Chicago Department of Water Management
Chicago, Illinois, USA

AECOM worked with the utility to develop a security and preparedness capital improvement plan to improve the security and resilience of supervisory control and data acquisition systems and critical infrastructure for the two largest capacity conventional water treatment plants in the world.

Customers from multiple industry sectors engage AECOM to conduct comprehensive reviews, studies and assessments of their industrial control system (ICS) and supervisory control and data acquisition (SCADA) network infrastructure, operations, facilities and other operational technology assets. The objective of these services is to protect vital systems. We seek to understand the current security posture of the operational systems that are installed, identify and correct weaknesses that could potentially be exploited, and improve the overall resilience of the system to current and future threats.

Threats to critical infrastructure are increasing at an alarming rate. Many of these environments are based on outdated industrial automation

equipment that must be assessed and strengthened to prevent unauthorized access by adversaries with potential for significant negative consequences. Water and dam systems are no exception.

AECOM approaches cybersecurity risk assessments through an integrated service offering encompassing cyber, wireless and physical domains. Our experts search for vulnerabilities and weaknesses within each domain and focus in on the gaps and seams between those three domains, aligning critical processes with critical technologies to ensure business continuity and resilience.

Businesses rely on information and operational data for mission success that must be prepared to tolerate disruptions, natural disasters and other anomalies. Protecting that control and information delivery chain requires a robust enterprise solution addressing governance across local, state and federal agencies, policy, standards, a concept of operation, and a view of current and future technology states.

AECOM considers business information and operational command and control requirements and processes, potential risks and threats, operational systems and technologies, as well as the future vision of a particular installation to develop sound strategies focused on operational resilience and business continuity.

Ultimately, our experts will conduct an objective analysis of the effectiveness of the current security controls that protect vital operational assets with a determination of the probability of losses to those assets. New project builds will incorporate these cybersecurity practices as the foundation of the design activities.

AECOM's threat, vulnerability and risk assessment approach focuses on revealing and remediating flaws. This aligns critical processes and business technologies to improve resilience, preparedness, detection and response.

Mechanical and Electrical



Above left and right:
Dwyer Road Pump Station
New Orleans, Louisiana, USA

Our team has a wealth of experience in design, specifications, investigation, and inspection of mechanical and electrical elements associated with dam appurtenant works. We have led development of new dam facilities and upgrades of existing facilities.

Our team of mechanical and electrical engineers has considerable experience in the works associated with dams.

This experience includes the mechanical and electrical aspects of comprehensive inspections of large dams consistent with international dam safety guidelines. We have carried out detailed analysis and condition reporting on critical mechanical

systems, such as guard valves, scour piping, and spillway gate hoisting systems. We have also undertaken upgrades to outlet and intake pipework and worked with our structural team to assess potential seismic issues.

We have experience in the preparation and review of detailed O&M manuals and SOPs, with a focus on the safety and longevity of the asset.

Typical assets we have worked on include spillway gates, gate locking systems, gate hoisting, intake and outlet pipework, large-diameter valves, raw water pump stations, toe drains, maintenance cranes, personnel lifts, ventilation and transient analysis, high-voltage and low-voltage power distribution and backup systems, electrical drives, instrumentation, control systems and communications.

Areas of Expertise

- Outlet works mechanical design
- Pipe stress analysis
- Design and specification of spillway and fish passage gates
- Design, troubleshooting, and specification of pump stations
- Hoist drive train analysis
- Speciation of cranes and lifts
- Drainage pumping
- Condition assessment and reporting
- Gate electrical and control system design
- Electrical services design
- Instrumentation, control and communications
- Development of O&M manuals and SOPs

Seismic Hazard Analysis



From left:
Lake Isabella Dam
 California, USA
Performed seismic hazard evaluation for two embankment dams at Lake Isabella Reservoir.
Santiago Creek Dam
 California, USA
160-ft exploratory fault trench to investigate the Terrace Fault.

AECOM has considerable experience in the field of seismic evaluation of dams, levees, slopes, and foundations in areas of high seismicity around the world.

AECOM is a world leader in the field of seismic hazards evaluation, which requires an integrated approach in the disciplines of geology, seismology, geophysics, and earthquake engineering. Seismic hazards include ground shaking and fault rupture, which are directly caused by earthquakes, and their secondary effects such as liquefaction, landsliding and tsunamis. A seismic hazards analysis attempts to assess the level of hazards by:

- Identifying the active faults that can cause earthquakes
- Assessing the maximum earthquakes and the rate of earthquakes for each fault

- Characterizing the ground motions that can be generated by each seismic source through ground motion prediction models or numerical ground motion modeling
- Quantifying the hazard using the approaches of probabilistic seismic hazard analysis or deterministic seismic hazard analysis

Our seismic hazards staff have evaluated seismic safety or developed seismic design ground motions for more dams than any other firm in the world. We have worked on some of the most significant and largest dams in the world, including Aswan Dam in Egypt, and Shasta and Auburn Dams in the United States. Our seismic hazards staff has pioneered the development of many of the field techniques, analytical procedures, and computer models that are widely used by the geological, seismological, and engineering professions. Our staff has developed advanced methods for the computer modeling of seismic source characteristics and seismic wave propagation and uses these

capabilities to estimate the strong ground shaking in locations where suitably recorded data are sparse.

AECOM has contributed to the rigorous development of methods for analysis of site response. In addition, we have an extensive library of computer programs for static and dynamic soil-structure interaction and foundation analysis, including SHAKE, QUAD4M, SAP-2000, NONSAP, Q-FLUSH, FLAC7, and PLAXIS.

Areas of Expertise

- Development of procedures for seismic analyses
- Liquefaction potential evaluations
- Site response analyses
- Dynamic slope stability analyses
- Soil structure interaction
- Deformation analyses

Rebuilding stronger after the storm

Hurricane Katrina made landfall August 29, 2005 due east of New Orleans. After evacuation, employees of AECOM's Metairie and New Orleans offices took refuge in the Baton Rouge office and immediately began the process of recovery.



Lake Pontchartrain and Vicinity (LPV) Reach 110
CSX Railroad Flood Gate two days after Hurricane Katrina
Orleans Parish, Louisiana, USA



Lake Pontchartrain and Vicinity (LPV) Reach 110
CSX Railroad Flood Gate after repairs
Orleans Parish, Louisiana, USA



Elmwood Pump Station
Jefferson Parish, Louisiana, USA

Pump Stations



From top left:
Charlie Pump Station
 Dallas, Texas, USA
Dwyer Road Pump Station
 New Orleans, Louisiana, USA
Estelle Basin Pumping Station
 Jefferson Parish, Louisiana, USA

We have led development of new drainage pumping stations and upgrades to existing facilities.

Types of Projects

- Condition assessment and reporting
- Development of O&M manuals and SOPs
- System inspections
- Rehabilitation design
- New pump station design
- Pumping capacities up to 460 million gallons per day
- Storm water pump stations
- Wastewater pump stations

Areas of Expertise

- Condition assessment and reporting
- Outlet works mechanical design
- Pipe stress analysis
- Design and specification of spillway and fish passage gates
- Design, troubleshooting, and specification of pump stations
- Hoist drive train analysis
- Specification of cranes and lifts
- Drainage pumping
- Gate electrical and control system design
- Electrical services design
- Instrumentation, control and communications

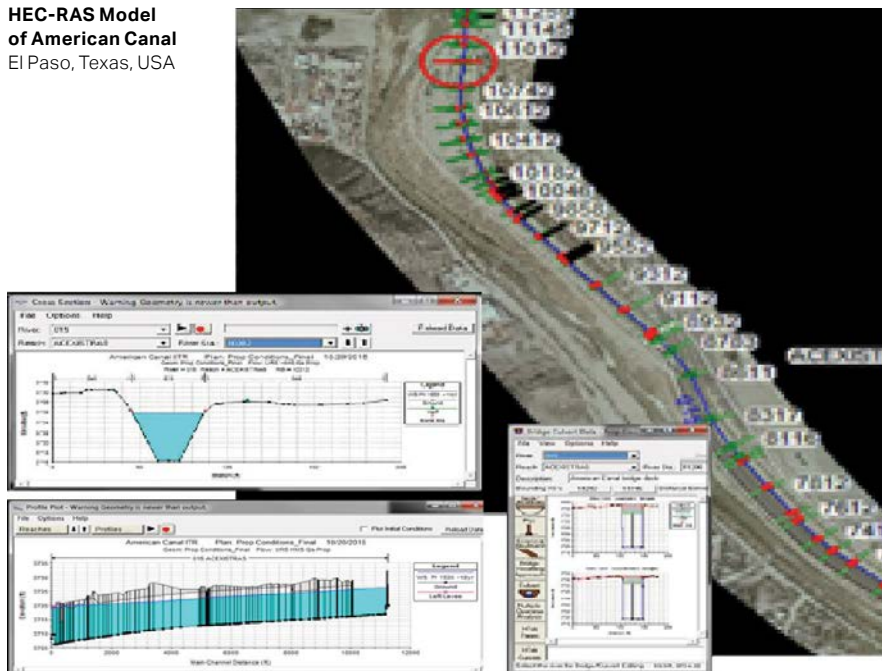
Representative Projects

- 35 percent Design of New and Rehabilitation of Existing Pump Stations, Dallas, Texas:
 - New and Existing Hampton Pump Station
 - Existing Delta Pump Station
 - New Charlie Pump Station
 - New Trinity Pump Station
 - Existing Nobles Branch Pump Station

- Rochester Pump Station — 35 percent Design Rehabilitation, Dallas, Texas
- 17th Street Canal, Orleans Ave Canal, and London Avenue Canal, New Orleans, Louisiana
- Estelle Basin Drainage Plan, Jefferson Parish, Louisiana
- Hurricane Protection Office (HPO) LPV 105-11, New Orleans, Louisiana
- Main and O Street Pumping Station Rehabilitation, Washington, D.C.
- Potomac Pumping Station Rehabilitation, Washington, D.C.
- Chattahoochee Raw Water Pumping Station and Transmission Main Water, Georgia
- Elmwood Pump Station No. 1 and Fronting Protection, Jefferson Parish, Louisiana

H&H Modeling and Interior Drainage

HEC-RAS Model of American Canal
El Paso, Texas, USA



Water is central to human life and development. Balancing the world's need for safe, reliable water with protecting this critical natural resource for the future requires a deep understanding of interconnected systems. From flood protection to water quality control to desalination, our goal is to do more with less, ensuring that our clients have access to globally sustainable technologies, locally delivered.

Areas of Expertise

- 1D, 2D and 3D modeling
- Mapping
- Engineering
- Flood protection
- Dams, levees and reservoirs
- Hydropower
- Scientific investigation
- Hydrological and qualitative studies for streams, groundwater, lakes, bays, estuaries and oceans
- FEMA CLOMR/LOMR application
- Floodplain analysis/delineation
- Floodplain development permitting
- Dam and irrigation operation

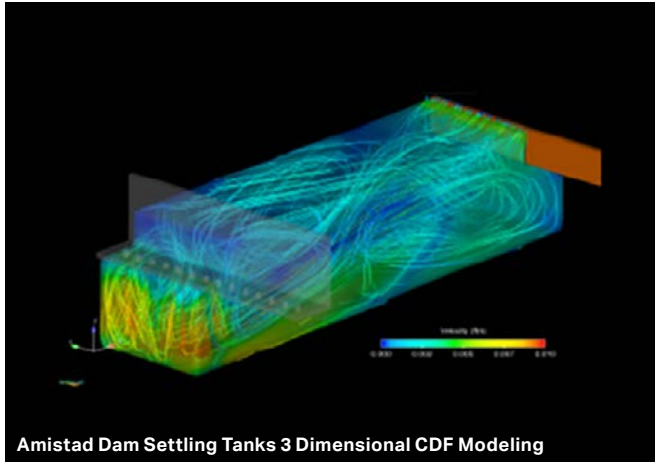
Types of Projects

- Hydrologic and hydraulic modeling study and floodplain management study
- Levee interior drainage analysis
- Dam and reservoir regulation manuals
- Highway drainage design
- Municipal storm drainage system design
- Dam breach analysis and stability evaluation

Representative Projects

- Water control manuals for the following; USACE Fort Worth District (SWF) Dams and Reservoirs:
 - Town Bluff
 - Belton
 - Stillhouse Hollow
 - Whitney
 - Granger
 - Wright Patman
 - Sam Rayburn
 - Georgetown
 - Proctor
 - Lake O' the Pines
 - Lewisville
- USACE SWF West Fort Hood and Fort Hood Main Cantonment Drainage Analysis, Fort Hood, Texas
- TxDOT IH 30/SH 360 Johnson Creek Hydraulics Study, Tarrant County, Texas
- Sabine River Authority Flood Litigation and Mineola Reservoir Study, Texas
- USACE SWF REGI
- Final Design and Relining of the IBWC American Canal, El Paso, Texas
- Final Design IBWC Courchesne El Paso, Texas: River FLO-2D modeling and interior drainage
- City of Dallas, Mockingbird Maple Flood Control Project, Dallas, Texas: CLOMR and LOMR
- City of Fort Worth:
 - Leslie Creek Open Channel Study
 - Glenwood Creek Open Channel Study
 - Modeling for Big Fossil
 - Flood Warning System
 - Como Creek Master Plan
- Rush Creek Watershed Study, Arlington, Texas
- Sublett Creek Neighborhood Improvements 2D Study, Arlington, Texas

Sediment Transport and Sediment Control



AECOM is an expert in providing detailed sediment transport analysis and designing remediation measures and preventative measures for national and international projects.

Areas of Expertise

- Watershed soil erosion and yield
- Channel geomorphology assessment
- Scour and erosion analysis
- Channel and reservoir sediment transport modeling
- Stream rehabilitation and stabilization
- Hydraulic structure design and evaluation
- 1D, 2D and 3D hydrology/hydraulic analysis and modeling
- Irrigation canal sedimentation and equilibrium channel design
- Sediment sampling and monitoring
- HEC-6, HEC-6T, and HEC-RAS sediment transport modeling
- RMA2 and FLO-2D
- FLOW-3D

Types of Projects

- Reservoir sediment control and operation
- Tailing dam breach and mud/debris flow inundation
- Watershed soil yield and surface flow erosion study
- Channel geomorphology and sediment transport analysis
- Post-fire watershed hydrology and sediment erosion analysis

Representative Projects

- IBWC Amistad Dam Modeling and Design of Settling Tanks and sediment monitoring system
- USACE SWT Flow Distribution 3D Modeling of Debris and Sediment, Webbers Falls Lock and Dam, Oklahoma
- IBWC American Canal, Final Design of Sedimentation Basin and Trash Rack Structures, El Paso, Texas
- Waterman Wash, Rainbow Valley, Arizona
- Little Thompson Creek Geomorphology Assessment and Channel Rehabilitation Design, Colorado
- Tailing Dam Breach Analysis, TVA Colbert Fossil Plant Pond 4, Colbert County, Alabama
- City of Albuquerque Rio Grande Surface Water Diversion Project, Albuquerque, New Mexico
- Dredging Feasibility Study for Main Mill Dam, New York
- Kettle Creek Dam Post-Fire Sedimentation, Colorado Springs, Colorado
- Aspen Mudflow Modeling, Aspen, Colorado

Construction



Carter Lake Outlet Works Colorado, USA

AECOM completed design and construction phase engineering support for a new outlet works addition at Carter Lake Reservoir. The new outlet works is on the right abutment of the dam and parallels the existing outlet. The new outlet has a design capacity of 250 cubic feet per second (cfs) and consists of 1) a multiple-level, gated intake tower that is approximately 107-foot high; 2) a 6-foot diameter tunnel that is steel-lined, concrete encased, and 800-foot-long; 3) a 300-foot connecting steel penstock; and 4) a reinforced concrete valve structure housing a 42-inch sleeve valve and energy dissipation structure.

AECOM plays an active role in implementing a broad range of significant dam and reservoir projects—from preparing contract documentation, assisting clients with the tendering process, and providing design support, to performing the management, monitoring, and quality assurance role on-site during construction and completing construction.

At AECOM, we know the accurate translation of detailed designs into industry standard specifications and drawings is important to avoid errors on-site and potential contract claims. For major dam projects, we use a specification format based on the Construction Specifications Institute (CSI) standard specifications. Alternatively, where clients have a standard format for specifications, we customize our specifications to suit.

Maintaining design intent throughout construction is important to AECOM and our clients to give the best possible chance that the works will operate as designed and achieve the required design life. Our site personnel have a strong understanding of design intent and construction practicalities to provide continuity from design through construction. Our designers also remain an integral part of the team throughout construction so that design changes or unforeseen conditions can be addressed quickly and efficiently with minimum effect on the project.

AECOM has operated within a number of different types of project delivery systems, including traditional

design-bid-build, design-construct, direct forces construction, target cost contracts, alliances, and early contractor involvement. In all types of delivery systems, we have had active involvement during construction, working closely with the clients and contractors.

AECOM is unique in that we also provide full construction of dams and related structures. Our perspective as a builder is reflected in our designs as we focus on constructability.

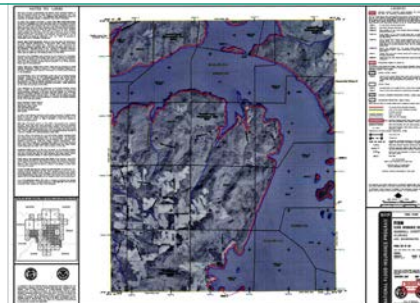
Areas of Expertise

- Constructability assessments
- Construction risk assessments, including construction flood risk
- A strong understanding of contract documents, specifications, and measurement and payment provisions
- Tender processes, including tender evaluation
- Cost estimating and programming
- Construction supervision and contract management
- Construction
- Design-build

Representative Projects

ADECA-OWR Map Mod Program/DFIRM Studies and Upgrade, Mobile, Alabama

The Federal Emergency Management Agency's (FEMA) Mitigation Directorate maintains and updates the National Flood Insurance Program maps. The Map Mod program transforms the nation's flood maps into more reliable, easier-to-use and readily available maps. Flood Map Modernization uses state-of-the-art technology to increase the quality, reliability and availability of flood hazard maps and data. Flood maps are delivered in an industry-standard geographic information system format, which allows users to view information in a graphical format and add or remove layers of data according to their needs. FEMA partners with state, regional and local stakeholders and allows partners to choose their level of involvement in mapping tasks such as collecting, updating and adopting flood data.



West of Algiers Canal Levee Enlargement, New Orleans, Louisiana

The 25,000-foot levee reach included the civil and geotechnical design involving complicated technical challenges. The main challenge was the nature of the levee reach itself and its location as the Algiers Canal is part of the Gulf Intracoastal Waterway and had over 50 separate lots with access to the canal for various operations ranging from small scale to heavy industrial activity. Many of these operations used large cranes to traverse the levee, and this had to be accounted for in designing access ramps as well as providing continuous access to the canal during construction operations. Environmental impact was another technical challenge, as buried debris and sand were encountered in the levee during construction.



Drainage Pump Station, Dallas, Texas

AECOM provided 35 percent architectural and engineering conceptual designs for three new pump stations on the Trinity River in Dallas, Texas. Our experts also provided design documents for two existing pump stations along the levee system to address usability and maintenance issues at these sites. The pump stations will provide improved flood relief for the downtown district and the surrounding residential communities. Each station will have the ability to transfer excess water from the surrounding neighborhoods over the levee and into the river. The pump stations to be renovated include the Delta and New Hampton stations. The new pumps stations are the Trinity-Portland, Charlie and Hampton III developments.



East of Harvey Canal Floodwall, New Orleans, Louisiana

This project is an essential component of the West of Algiers Hurricane Flood Protection as administered by the US Army Corps of Engineers (USACE). It is comprised of an 8,000-foot-long, pile-supported, reinforced concrete inverted T (type) floodwall. The floodwall will connect to the Harvey Canal Sector Gate at its north end and will tie into another concrete floodwall near the Boomtown Casino. The height of the floodwall is between 10- to 16-feet. The project area is an industrial district with fabrication yards and other industrial related businesses located along Peters Road and includes 21 floodgates, typically 30 feet in width, to allow for facility access.



Elmwood Pump Station and Fronting Protection, New Orleans, Louisiana

AECOM provided engineering and design of a 2,400-cubic-feet-per-second (cfs) drainage pump station addition to an existing 3,400 cfs pump station for a federal client. The project included the addition of two 1,200 cfs, 11 foot diameter horizontal propeller pumps and hurricane protection structures at Pumping Station No. 3, the Elmwood pumping station. The project also included a pile-supported reinforced concrete intake structure, building structure, concrete discharge tubes and discharge structure. The improvements also included a pile supported concrete 25-foot T-wall, I-walls varying in height from 3- to 10-feet above the ground surface with steel sheeting 25 feet below the surface for structural stability and seepage control, new levee sections, utility relocations and roadway improvements.



LPV Reaches 105-111 Levee Improvements, New Orleans, Louisiana

In a follow-up contract to the federal client’s Task Force Guardian Program, an emergency program to restore the levees damaged by Hurricane Katrina, AECOM was awarded multiple task orders to assist the client with improvements to the levee system in New Orleans. The project encompasses about 30 miles of the levee/flood protection system and consists of seven major reaches of work. The project includes the design and construction of floodwalls, levees and floodgates, and requires utility relocation, pump station remediation and real estate coordination.



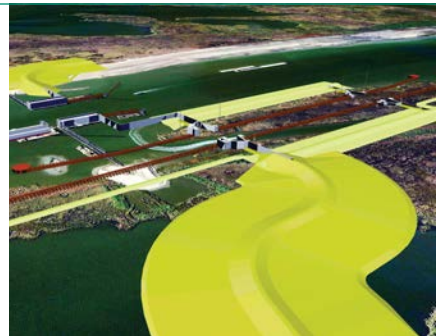
LPV 146 Levee Improvements and Floodwall Construction, St. Bernard Parish, Louisiana

Our professionals provided levee improvements and floodwall construction on the levee section Lake Pontchartrain and Vicinity (LPV) 146 in St. Bernard Parish. This time-sensitive and mission-critical project improved hurricane safeguards in an effort to better protect the Greater New Orleans area. Construction is complete having driven 10,000 sheet pile and 27,000 H-pile working two shifts per day on three headings. This project added 39,965 feet of sheet/H-pile supported concrete T-wall atop existing levees and raised the level of protection from approximately an elevation of 20 to 29 feet. The new height reduces the vulnerability of potential surge elevations and wave heights and materially adds to the 100-year storm protection system in the New Orleans area.



Houma Navigation Canal Lock, Houma, Louisiana

The Lock will be located in the Houma Navigation Canal which is a man-made channel constructed in 1961 that provides direct access to the Gulf of Mexico from the Gulf Intracoastal Waterway at Houma, Louisiana. AECOM provided engineering services, from the design memorandum through construction administration, for this federal client. The project consists of a lock with two sets of sector gates and possibly a separate 200-foot flood gate, each with up to a maximum 200-foot-wide gate opening, mounted in a pile founded concrete gate monolith. The center-to-center distance between the two gate monolith structures could be up to 1,200 feet. The chamber walls will be earthen and the gate monoliths will be concrete.





Local presence, global reach

From restoring shorelines and building protective barriers along the Gulf Coast of the United States, to restoring rivers in Italy and fragile coral reefs off the coast of Australia, AECOM is entrusted with the most sensitive and vulnerable ecosystems of our world.

We recognize the ecological, economic and quality of life benefits of restoring degraded ecosystems.

We develop and protect the natural systems and shared resources that cities, regions and people depend on to grow and thrive.

We offer lifecycle capabilities from conception to delivery, including financing.

We are planners, scientists, researchers, engineers, designers, architects and project managers with global reach.

Hurricane Storm Damage Risk Reduction System
IDIQ 2008-2016 — LPV Reach 111
New Orleans, Louisiana, USA

About AECOM

AECOM is the world's trusted infrastructure consulting firm, delivering professional services throughout the project lifecycle – from 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 expertise and innovation, 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 \$13.3 billion in fiscal year 2021. See how we are delivering sustainable legacies for generations to come at aecom.com and [@AECOM](https://twitter.com/AECOM).

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