

Civil Works Services

Our leadership in civil works and water infrastructure delivers environmentally sustainable, economically viable and technically sound solutions to all levels of government.



We Know Civil Works and Water Resource Infrastructure

Black & Veatch understands the critical infrastructure needs of our nation. We are a leader in civil works and water infrastructure, and we pride ourselves in providing environmentally sustainable, economically viable, and technically sound solutions. We focus on risk informed decision making as related to public safety, environmental stewardship and protection of critical facilities. Our solutions provide quality and responsive aid throughout the nation to meet flood risk management, resiliency, hardening of assets, climate change, navigable transportation, coastal defenses, hydropower, environmental and water quality, water supply, recreation, and restoration needs.

We Understand Your Challenges

The importance of effectively and efficiently managing our nation's resources has never been greater. Management of these resources is dependent on providing sustainable, economical and environmentally safe civil works solutions. We understand the needs and missions of the federal and state governments, municipalities, private owners and other clients. We are committed to providing essential resources to critical Government agencies such as U.S. Army Corps of Engineer (USACE) Districts, U.S. Bureau of Reclamation, Federal Emergency Management Agency (FEMA), U.S. Fish & Wildlife Service, U.S. National Park Service, U.S. Coast Guard, Tennessee Valley Authority, the Nature Conservancy, local ports and harbors, as well as bordering waterways at our military installations.

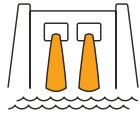
A Rich History Improving Civil Works

Our distributed office network results in our ability to provide local teams, backed by the entire capability of our Company to nearly all of USACE Divisions and District offices. We can offer cost-effective access to deep multidisciplinary resources, ranging from basic civil works infrastructure services to complex water resource engineering and emergency response and recovery assistance. We have served U.S. government missions at every stage, and span from preliminary studies and planning to complete program management services.

Full Suite of Civil Works Services

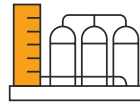
As one of the world's most successful large engineering firms, Black & Veatch has assembled a team of exemplary and widely recognized experts to undertake any civil works project, regardless of size, scope or complexity. Black & Veatch is a leader in the implementation of civil works and water programs that involve a wide variety of multifaceted needs and stakeholders, offering planning, engineering, construction, O&M services that touch all aspects of the Civil Works Programs.





500+ Major Dams and Reservoirs

portfolio including the most recent and largest dam modifications completed in North America



4,000+ Pump Station

and hydraulic structure (spillways & gates) projects

\$16
BILLION+

Civil Works

projects portfolio within the last 10 years

Flood Risk Management

Black & Veatch provides all facets of planning, design, procurement and construction management for levees, floodwalls, gated structures, pump stations, pipelines, tunnels and all other coastal and inland storm damage risk reduction measures, while incorporating natural and nature-based features (NNBF) for ecosystem restoration and protection, as well as socio-economic, community and recreational amenities.

Levees & Floodwalls

- 80 + miles of inland and coastal levee/floodwall design and modifications

Pump Stations

- 4,000+ projects with all types of pumping schemes, alignments and configurations
- Largest pump station in North America 7,800 MGD (12500 CFS)

Flood/Diversion Tunnels & Pipelines

- 200+ projects with over 300+ miles of tunnels
- Industry leader in tunnel conveyance and storage systems as well as integrated raw water, treated water, stormwater and wastewater
- 9300+ miles of pipelines in the U.S. up to 108-inch diameter and 450 psi
- Open cut, tunnel boring machines, trenchless/microtunnel technology

Dams, Levees & Reservoirs

Black & Veatch is a premier dam and levee/floodwall design and construction management firm. We provide risk assessment analysis, risk reduction strategies, instrumentation and monitoring plans and data reviews for dams and levees, as well as repair, replacement and maintenance these of aging key facilities.

- 500+ major dams and reservoirs
- Specialists in dam raisings, seismic analysis and seepage studies for project modifications
- Owner's engineer, designer and construction manager of most recent major dam modifications in North America

Hydropower

Black & Veatch provides hydropower solutions for run-of-river projects and at multipurpose reservoirs. We're committed to finding clean, green power alternatives and have successfully worked on hydropower design at nearly 500 projects producing more than 50,000 megawatts.

- 40+ years of service
- 37,700+ MW of hydropower
- 14,400+ MW of pumped storage
- 100+ FERC permitted projects
- ENR ranks us 4th among hydropower plant design firms



Navigation

Black & Veatch provides solutions for repair, replacement and maintenance of aging infrastructure including inland waterways, locks and dams, and erosion protection for projects of all sizes. Under the Federal Civil Works Program, we support USACE in their mission to provide safe, reliable, efficient, and environmentally sustainable waterborne transportation systems for the movement of commerce, national security needs and recreation purposes.

Water Supply

Black & Veatch provides water supply solutions for rivers and multipurpose reservoirs. We study potential sources, including the traditional supplies but also consider newer options. Surface waters and groundwater are typically the traditional sources, but in today's world, conservation, water reuse and desalination are more commonly becoming part of a water supplier's portfolio. Water supply planning must be based on a sound understanding of the hydrologic cycle. In fact, it's more than that, as water supply must consider environmental and public interest concerns. It requires a strategic vision (short and long term), while at the same time, callings for prudence, as economic realities can't be discounted or ignored.

Recreation

Black & Veatch provides solutions for multipurpose reservoirs and USACE recreational areas. USACE is one of our nation's leading federal providers of outdoor recreation with more than 400 lake and river projects situated in 43 states. We fully understand the need to support USACE with this mission and will work closely with the Corps in seeking methods to provide outdoor recreational activities designed to enhance the experience for both daytime and overnight visitors, thus enriching people's lives.

Coastal Resiliency

Black & Veatch provides global solutions to help coastal and waterfront communities prepare for, repond to, and recover from hazardous/catastrophic events. Our coastal and hydraulics experts effectively address climate change, storms and hurricane risks for resiliency.

Our Civil Works Capabilities Include:

- Planning
- Flood Risk Management
- Dams
- Levees/Floodwalls/Closure Facilities
- Gates
- Locks and Dams
- Water Control Structures
- Diversion Tunnels & Pipelines
- Pump Stations
- Hydropower and Hydraulic Structures
- Water Supply Development
- Navigation Dredging
- Coastal Protection
- Beach Renourishment
- Asset Management
- Recreational Facilities
- Climate Preparedness/Resilience
- Emergency Response/Recovery Assistance
- Transportation
(Roads/Bridges/Railroads/ Ports)

Example Projects - Prior Experience

Elmwood Pump Station and Fronting Protection, Jefferson Parish, New Orleans, Louisiana

Black & Veatch was the Owner's Engineer for construction of three new pump stations, gated structures and fronting project that protects the drainage system for the three main canals that drain portions of Jefferson Parish and downtown New Orleans. The project includes design and construction of surge gates and new pump stations at the mouth of the 17th Street Canal, Orleans Avenue Canal, and London Avenue Canal (pump station capacities are: 12,500 cfs, 3,390 cfs, and 8,980 cfs respectively). The project included geotechnical analysis of levees and floodwalls surrounding the canals, hydraulic modeling, and hydrologic modeling of the total drainage system. Key efforts included:

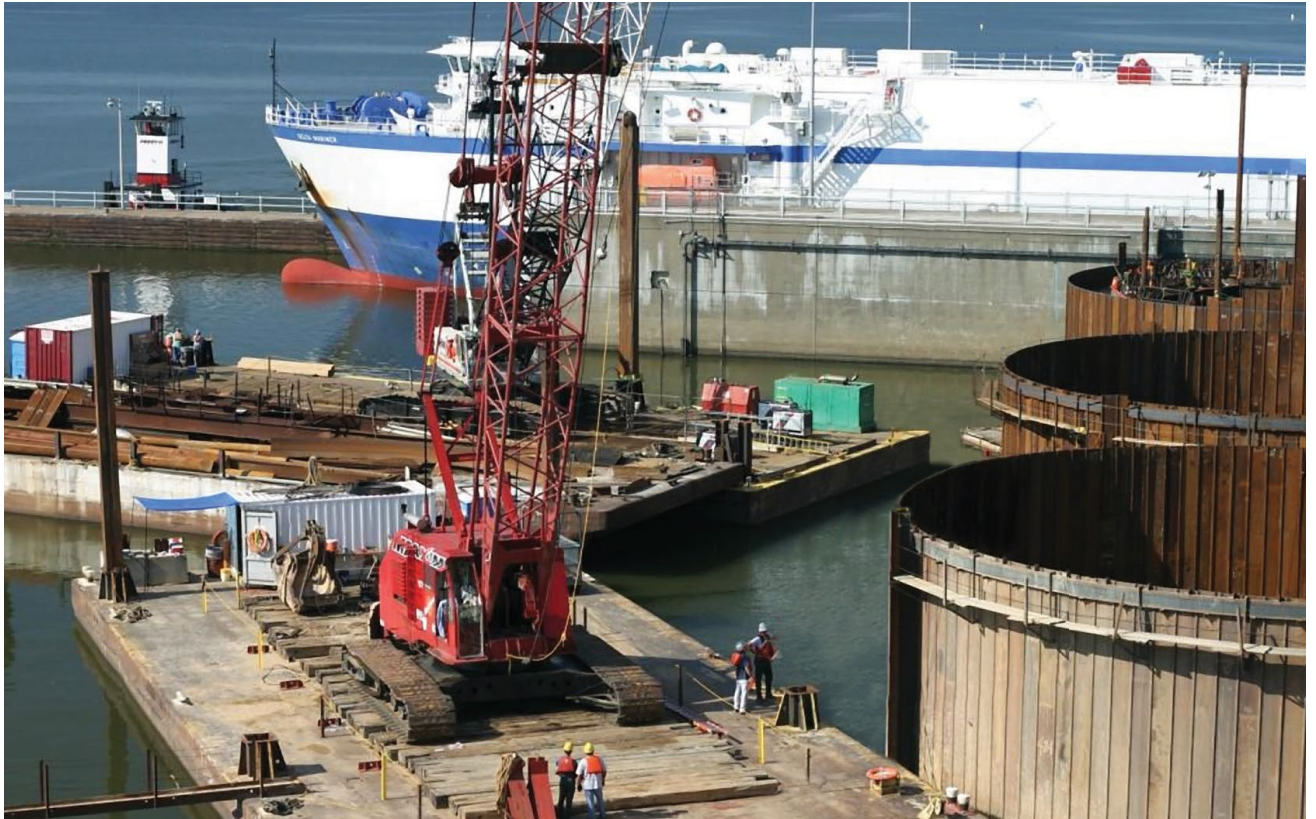
- Development of multiple design report, engineering studies and construction cost estimating and scheduling
- Preparation of an RFQ and RFP to facilitate construction of the three pump stations and canals improvements
- Evaluation and analysis of flood control and erosion control to include wave breaks and jetty systems
- Site investigations, planning and design including utility design/relocations
- Evaluation of roadways/bridges that span the canals, allowing access to the pump stations
- Electric power and backup power systems including fuel storage
- Drainage analysis and design
- Evaluation of 14 miles of levees/floodwalls; hydraulic analysis of 7 miles of canal

The execution of this project involved preparation of a feasibility study that involved a tremendous amount of public interaction and report development. The project then moved through design, development of plans and specifications and then to construction.



McCook Reservoir Tunnel and Gates P&S

The USACE Chicago District is providing design and construction services to the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) on the McCook Main Tunnel System (MTS). This project connects the existing Mainstream Tunnel with the McCook Reservoir which is currently being excavated. Black & Veatch is performing the detailed design for the MTS project on behalf of USACE. The facilities design and construction has been divided into several design and construction packages. Black & Veatch responsibilities include: geotechnical engineering, preliminary and final design for reservoir and tunnel connection facilities, shafts, and gates for the Mainstream tunnel connection to McCook Reservoir and Thorn Creek diversion tunnel to Thornton Composite Reservoir. Black & Veatch led the evaluation and screening of alignments alternatives and connections to surface facilities.



Kentucky Lock and Dam Upstream Monoliths P&S

Black & Veatch has participated on a team with USACE Nashville District (LRN) and the Tennessee Valley Authority (TVA) on multiple projects, including the analysis and design of the Large Upstream Concrete Lock Monoliths. Black & Veatch designed two U-Shaped concrete monoliths (one included the miter gates), the culvert valve monoliths and transition monoliths to the chamber monoliths. We performed a stability analysis of these monoliths that included: overturning, sliding, and potential for flotation. We also performed a Static and Dynamic 3-D Finite Element Analysis to evaluate the seismic effects. Quest performed a soil-structure-interaction analysis that Black & Veatch used to develop the 3-D finite element ANSYS model that incorporated the SSI output.

Chickamauga Lock & Dam, Electrical Mechanical P&S

Black & Veatch has participated on a team with USACE Nashville District (LRN) and the Tennessee Valley Authority (TVA). The contract consisted of multiple projects, with scopes varied. This contract required participation from virtually all of Black & Veatch's civil works and lock and dam specialists. Seamless coordination was efforts were performed by our experienced Task Order managers. Key project elements/efforts included:

- Design of a 2400 Ft Cofferdam
- New Lock Construction
- Plans and Specifications
- Engineering Services
- Sensitivity Analysis
- Parametric Studies
- Cofferdam Height Optimization Study
- Economic Plan
- Risk Analysis Models
- Monte Carlo Simulations
- Engineering During Construction (EDC)
- Shop Drawings
- Design Documentation Reports
- Piping Systems
- Heating and Ventilation Systems

Black & Veatch received two (2) 'Exceptional' performance ratings on the project: (1) engineering services for the Chickamauga Lock Replacement, Cofferdam Construction P&S project, and (2) for the Chickamauga Lock Replacement, Electrical/Mechanical Design P&S project.

Boone Dam Modifications, Chattanooga, TN

Black & Veatch was selected for the design, field engineering, and quality assurance of this fast-track project to reduce seepage through Boone Dam's karstic foundation. Black & Veatch is designing a composite seepage barrier consisting of multiple components, while performing field engineering and quality assurance (QA) for the concurrent displacement and bedrock grouting. Black & Veatch is working with Tennessee Valley Authority (TVA) to develop the final remediation strategy through a risk informed decision process to assure that it meets or exceeds TVA's guidelines. Black & Veatch is overseeing dam safety, full-time monitoring of the automated instrumentation to ensure the dam's integrity while drilling and grouting are performed, QA of materials testing, and full-time inspection of construction. Black & Veatch has led alternative analysis evaluations for this project to determine the best solution, as well as participating in potential failure mode analysis and risk workshops.



8.5 Square Mile Area Everglades Flood Damage Reduction, Jacksonville, Florida

This project is intended to protect a residential area in Miami-Dade County from increased water elevations that will result from the Everglades National Park Water Deliveries and Restoration Project. The project also involves a fresh water diversion into a storm water treatment area. The main protection system will be a perimeter levee. Significant seepage is expected to occur through the bedrock and exit into the protected area. An interior canal will collect the seepage and a 500 cfs pump will transfer the water into a storm water treatment area, ultimately returning to the everglades. Black & Veatch produced 203 construction drawings for this project.

Charleston Sewer Tunnel Replacement Program, Charleston, South Carolina

Black & Veatch was contracted to provide an overall Master Plan to determine the appropriate rehabilitation/replacement options. The Master Plan evaluated rehabilitation, open cut, wastewater storage, conventional tunneling and trenchless pipeline technologies such as microtunneling, horizontal

directional drilling, pipe bursting, and sliplining. Replacement tunnels were ultimately recommended. Following the Master Plan, CWS contracted with Black & Veatch (B&V) for an accelerated design and construction management of the Ashley River, Cooper River, West Ashley and Daniel Island Extension Tunnels. The \$26.5M Ashley River Tunnel consisted of approximately 12,000 feet of tunnel (120 feet below historic, downtown Charleston), 1500 feet of near surface microtunnel, and 1150 feet of open cut connections. The \$39.6M Cooper River Tunnel consisted of 18,100 feet of tunnel (120 feet below historic, downtown Charleston), 1200 feet of near surface microtunnel, and 1400 feet of open cut connections. In addition to the replacement tunnels, the \$24.4M Daniel Island Extension Tunnel consisted of 18,800 feet of tunnel that crossed under a major shipping channel of the Cooper River. Construction is currently underway on the final phase, \$51M West Ashley Sewer Tunnel and Influent Pump Station, consisting of 9300 feet of tunnel, a 60 foot dry pit with a 20 foot wet well pump station (140 feet deep) with a pumping capacity of 75 MGD and numerous near surface force main and gravity sewer line modifications.

Fargo-Moorhead Metro Diversion Flood Protection, Fargo, North Dakota

The Fargo-Moorhead (FM) Area Diversion Project established permanent flood protection measures for the region. The plan included the design and construction of a, 20,000 cubic feet per second, 35-mile long, 1,500 foot-wide, diversion channel with 32,500 acres of upstream staging. The plan also included the diversion channel, 23 bridges (19 highways and 4 railroads), two gated control structures, two aqueduct structures and recreational facilities. This plan was chosen after years of diligent study, public input and joint cooperation between the City of Fargo; the City of Moorhead; Cass County, North Dakota; Clay County, Minnesota; the Joint Cass Water Resource District; and the Buffalo-Red River Watershed District. The FM Diversion would reduce a 100-year flood event from 42.4 feet to 35 feet at the Fargo gage. For reference, the 2009 flood of record peaked at 40.8 feet. Though not designed to prevent a 500-year flood event, the FM Diversion would give the area a chance by reducing the river level in Fargo from 46.7 feet to 40 feet during a 500-year event. The plan included 200,000 acre-feet of upstream staging. The staging area would only be used for flood events exceeding a 10-year event, or a 35-foot event in Fargo. During a 100-year flood, the staging area would add five days to the duration of existing flooding.

Black & Veatch provided the engineering reviews and program management support for: North Region USACE-led Elements oversight, Project Specific LERRDs Packages oversight, System Wide WIK Studies general oversight, System Wide LERRDs Studies general oversight, South Region LERRDs Package oversight, South Region WIK Package oversight, Package-Specific Public Outreach oversight, and Package-Specific Permitting oversight. Support activities included: OWNER representation at meetings with stakeholders, technical reviews and meetings with designers, coordination between

federal and non-federal activities, work product and deliverable specific reviews, support for multiple project work packages, on-call senior consulting services, and other program management support activities as needed.

Trident South Process Alliance, Thames Water Area, UK

Black & Veatch was awarded a five-year contract to provide engineering services associated with the capital programme of Thames Water. As one of three Trident with Thames Water staff and in alliance with the contractor, Costain.

The alliance serves the London water supply area comprising surface water and groundwater treatment works and the South East Provinces plus Long Reach STW for wastewater treatment.

By working strategically and through challenge and innovation, the alliance team worked to out-perform the capital programme and achieve savings. Water supply projects undertaken comprised:

- Schemes to achieve improved water quality standards for nitrates (Southfleet 4.1 MI/d) and plumbosolvency (at 27 sites up to 890 MI/d);
- Disinfection schemes at Coppermills WTW (690 MI/d), Ashford (690 MI/d) and Walton (135 MI/d);
- New treatment works at Brixton (13.7 MI/d) and Bell Green (27 MI/d);
- Construction of new slow sand filters at Hornsey (50 MI/d);
- Other serviceability driven schemes and studies.

