



---

# Pump Station Expertise

Proven pump station experience  
for water resources management.



BLACK & VEATCH

# Solutions for Efficient, Reliable and Long-Life Pump Station Development and Operations

**Black & Veatch** evaluates, designs, commissions and value-engineers solutions for new, rehabilitation and upgrade pump station projects.

Our experience encompasses pump stations ranging from 5 to 13,000 CFS for stormwater, raw water, treated water and wastewater facilities. It includes surge control systems, compressed air systems, valves, piping and vibration control. In fact, our projects involve practically all types of pumping conditions, pumping equipment, piping size and material, control schemes and power sources.

We see pump stations as whole systems. Combining mechanical specifications, controls logic, and hydraulic and transient analyses, our system-wide approach focuses on achieving reliable, efficient, long-life and easy-to-maintain operation.

Industry leader in **safety and health performance**

Portfolio spanning **water, power and telecommunications**



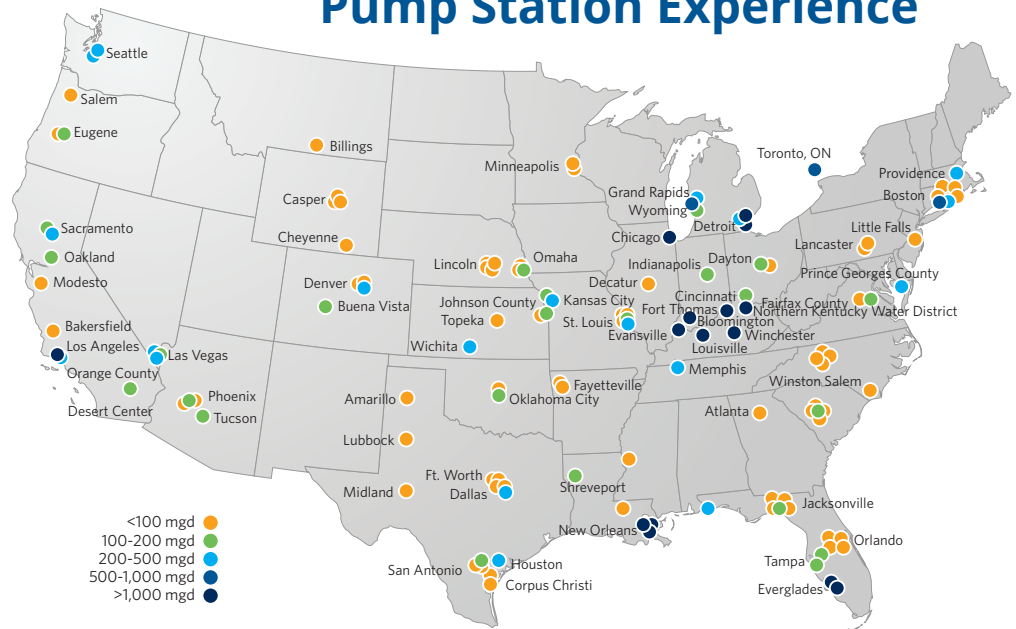
Completed projects in more than

**100+** countries and on **6 continents**

**7,000** Active Global Projects

**100+** Years in Business

## North American Pump Station Experience



A world-class, comprehensive water solutions firm, **Black & Veatch** has supported the planning, design and construction management of more than 4,000 water facility pump stations with capacities up to 13,000 CFS.



# Proven Pump Station Experience for Water Resources Management



## All-Encompassing Expertise:

- **Site inspections and condition assessments**
- **System modeling, design, specifications**
- **Piping and instrumentation drawings**
- **Hydraulic and transient analyses**
- **Pump selection and technical specifications to meet or exceed Hydraulic Institute standards**

Black & Veatch is a contributing member of the Hydraulic Institute, serving on technical committees related to the design of intake systems, pump testing standards and pump vibration, among others.

## Pump Selection

We evaluate and design facilities using any type of pumping: horizontal end suction and horizontal split-case; vertical centrifugal, vertical diffusion vane, submersible vertical turbine, and inclined submersible turbines; and submersible sewage pumps. Our expertise includes all pump layout and selection factors: net positive suction head available; operating head range versus rated capacity; variable and/or constant speed pumps; footprint/space restrictions; site layout; and transient controls.

## Transient Analysis Evaluation

Using modeling to evaluate and implement mitigation measures, we know how to relieve undesirable stress on pumping and piping systems. Our expertise includes automatic pump bypass facilities, control valves, surge anticipation/relief valves and hydropneumatic surge tanks.

## Intake and Suction Side Hydraulic Design

To ensure best suction side hydraulics, we design per Hydraulic Institute (HI) standards and perform thorough

analysis through CFD modeling and/or physical modeling to confirm flow into each pump is uniform and free of vortices.

## Vibration Analysis and Machine Condition Evaluation

Using state-of-the-art tools, we provide condition assessments of existing equipment by evaluating machine vibration at various pumping conditions, and provide detailed technical recommendations to improve pump station reliability. Our expertise includes evaluating pumping systems for hydraulic performance with in-situ testing of the units in the field and preparing detailed reports for reliability-centered maintenance.

## System Controls

Providing expertise in the planning and design of complex water distribution control systems, we help clients select the best alternative for real-time monitoring, communications, security and issue mitigation.

## Pump Control Valves

We select control valves to ease pump operation, lower costs, and provide high-confidence reliability based on owner objectives.

## Power Supply and Electrical Design

Supporting continuous pumping operation, we deliver power system reliability and redundancy. Our experience includes pumping units powered by engine drives and electrical motors using across-the-line starters, soft-starters and adjustable frequency drives. We successfully designed and commissioned several types of pump speed controls using liquid rheostats, adjustable frequency drives, electromagnetic eddy current drives, etc. based on owner's choice.

## Life Cycle Analysis

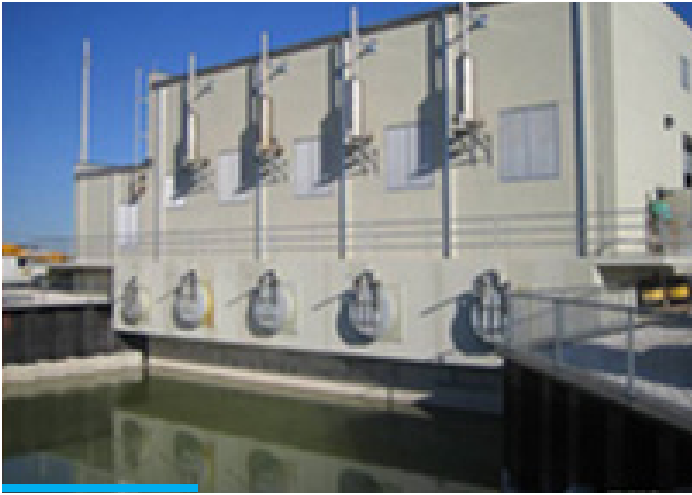
Following Hydraulic Institute guidelines while drawing on our extensive pump station experience, we analyze each component of the system. Built on operations, energy, maintenance and asset-replacement data, our analysis provides accurate cost-estimates and minimizes life-cycle costs.

# Large-Capacity Pump Stations

**Black & Veatch** has worked on many of the world's largest pump stations, among them the most technically challenging and sensitive projects in the country.

## U.S. Army Corps of Engineers

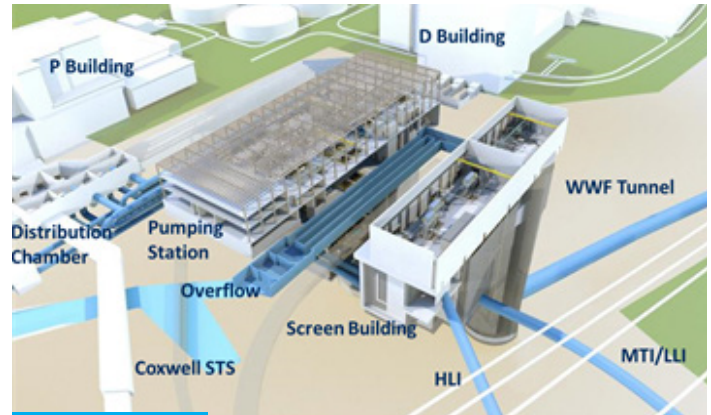
### 8.5 Square Mile Area Flood Damage Reduction, Everglades Restoration



**Black & Veatch** provided engineering services to support hurricane hardening of existing pump station infrastructure under a fast track schedule. The purpose of this project is to protect a multi-use land mass area in Miami-Dade County from increased water elevations that will result from the Everglades National Park Water Deliveries and Restoration Project. The pump station removes seepage water and storm water from the protected area with a capacity of 500 CFS (325 MGD) with both diesel driven and electric driven pumps.

## City of Toronto

### Ashbridges Bay Integrated Pump Station (IPS)



**Black & Veatch** is leading the design of Ashbridges Bay IPS, the largest deep pumping facility in North America with 1,500 CFS (970 MGD) capacity. The integrated pump station is linked to 16 miles of gravity tunnel network and three tunnel suction headers. Black & Veatch is providing detailed design, construction contract administration and post-construction services. The IPS provides an opportunity to integrate city infrastructure, optimize capital and operational costs, and improve efficiency of operation. Upon completion, it will be the most environmentally beneficial project in the city's infrastructure system.

## Coastal Water Authority

### Capers Ridge Pump Station & Raw Water Intake; Houston, TX



Work included final design of a 775 CFS (500 MGD) river intake structure and pump station as part of the Luce Bayou Interbasin Transfer Project. The scope included planning and final design of a new raw water river-intake and pump station, which is designed for eight 120 CFS (78 MGD) vertical pumps, each pump equipped with a synchronous motor. Other onsite improvements include, dual 96-inch transmission mains, pipeline pigging station, sediment flushing system, and river bank protection system. The project is initially equipped with four of the eight pumps installed for an operational capacity of 360 CFS (230 MGD).

# U.S. Army Corps of Engineers, New Orleans District

## Outfalls Canals, Permanent Flood Gates, Pump Stations and Outfall Canal Feasibility Study; New Orleans, LA



Three main canals drain stormwater from New Orleans. The emergency response following Hurricane Katrina installed interim control structures to protect the drainage system from future storm surge and flooding. Serving the U.S. Army Corps of Engineers (USACE) New Orleans District and State of Louisiana, Black & Veatch evaluated the system and provided solutions to strengthen the resilience of the pumping stations, surge gates, floodwall, levees and other components.

Black & Veatch performed a complete condition assessment of the interim control structures, including site assessments. Based on the results, three new pump stations and surge gates were selected to replace the interim control structures. Pump station capacities are 12,500 CFS (8,080 MGD), 3,390 CFS (2,190 MGD) and 8,980 CFS (5,805 MGD), respectively. Black & Veatch provided the conceptual design of new pump station and gate structures to increase surge protection and reduce the potential of hurricane-driven flooding in the Orleans and Jefferson parishes.

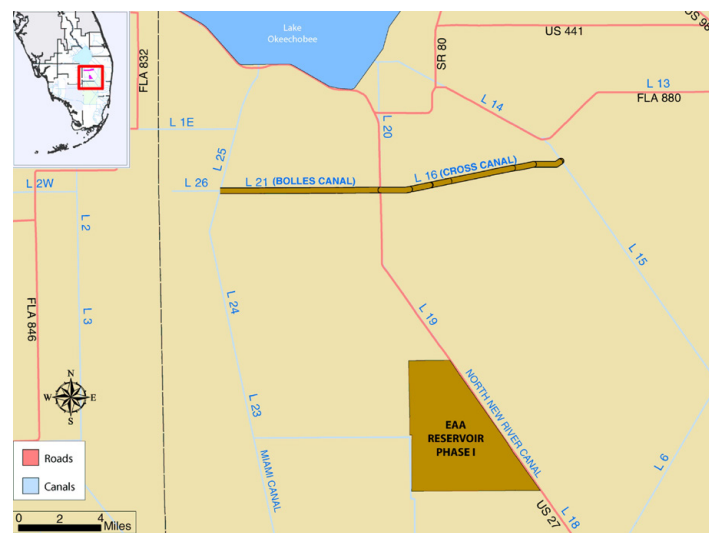
At the completion of conceptual design, Black & Veatch moved into a management role overseeing the work on behalf of the State of Louisiana. The work covered 14 miles of levees and floodwalls, hydraulic analysis of 7 miles of canals, and hydrologic modeling of the total drainage system during wet weather events. It documented the layout of 18 pump stations of various configurations at multiple sites. It encompassed flood and erosion control, wave breaks and jetty systems. It considered utility design and relocation, electric power systems and fuel storage, and roadways and bridges.

# South Florida Water Management District, Everglades, Florida

## Everglades Agricultural Reservoir, Phase 1



**Black & Veatch** provided design and construction oversight services for an above-ground water-storage reservoir with a capacity of 190,000 acre-feet and maximum depth of 12 feet. The project included the design of a new pump station with a capacity of up to 3,000 CFS (1,940 MGD) and of modifications to existing pump stations and canals. Completed as the first phase of the Everglades Agricultural Area (EAA) reservoir project, the work supported flood control and water quality protection in the Everglades and coastal estuaries while also creating a supply to meet agricultural demands and lessen the area's dependence on water from Lake Okeechobee.





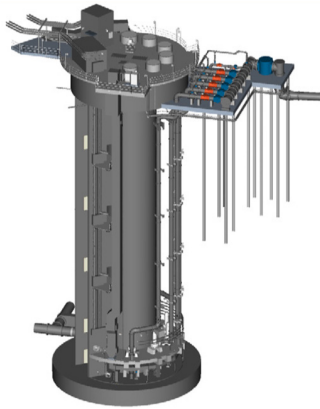
# Large-Capacity Pump Stations (cont.)

Our **experience** includes water, wastewater conveyance and storage pump stations.

## Charleston (SC) Water System

### West Ashley Influent Pump Station

The new station is a unique, dry-pit/wetwell pump station that is contained within a 50-foot-diameter, 145-foot-deep shaft and contains five, 23 CFS (15 MGD) dry-pit submersible pumps for a total capacity of 116 CFS (75 MGD). Several key operational and maintenance features were incorporated to reduce maintenance staff O&M. Backup generation capacity was added to support the new pump station and integrated with existing power and controls equipment. The station was hydraulically modeled for self-cleansing characteristics to ensure grit, rags and trash would not settle in the wetwell. Located in a VE Flood Zone, the station is situated above the 100-year flood elevation and designed to withstand inundation and wave action.



## City of Charleston Water, SC

### US 17 Spring/Fishburne Drainage Improvement Project



The Spring and Fishburne drainage basins incorporate approximately 20 percent of the land mass on the historic Charleston peninsula and are habitually flooded with a combination of storm and tidal waters. Black & Veatch was contracted by the City of Charleston to design and provide construction management of the deep 12-foot diameter tunnel conveyance system (9,300 linear feet) with nine associated drop shafts, river outfall and pump station expertise for the approximately \$200M project (the city's largest infrastructure project ever undertaken). The system was designed to transport stormwater via drop shafts and underground tunnels to a pump station along the banks of the Ashley River. The tunnel was designed to a depth of 120 to 140 feet below the ground. The 800 CFS (520 MGD) pump station includes three axial flow pumps each equipped with an 800-horsepower diesel drive.



# Matrix of Large Pump Stations Experience

Stormwater, Raw Water,  
Treated Water and Wastewater

Client	Pump Station	City/ State	Total Pumping Capacity CFS (MGD)	Service				Project Type		Scope of Services			Details									
				Stormwater	Raw Water	Treated Water	Wastewater	New	Upgrade / Retrofit	Concept / Prelim Design	Final Design	Construction Phase Services	Split-Case Centrifugal	Horizontal	Vertical	Vertical Turbine	Submersible	Variable Frequency Drive	Raw Water Intake	Low Service	High Service	Booster
USACE New Orleans District	17th St. Canal PS	New Orleans, LA	12,602 (8,144)	■				■		■					■						■	
USACE New Orleans District	London Avenue Canal PS	New Orleans, LA	9,001 (5,817)	■				■		■					■						■	
South Florida Water Management District	EAA Reservoir Stormwater PS	Everglades, FL	5,001 (3,232)	■				■		■	■					■						
USACE New Orleans District	Orleans Avenue Canal PS	New Orleans, LA	2,700 (1,745)	■				■		■												
Metropolitan Water District of Southern California	Hiram W. Wadsworth PS (Diamond Valley Reservoir)	Los Angeles, CA	2,089 (1,350)		■			■		■	■	■				■		■	■			
Grand Rapids, City of	West Side CSO Stormwater PS	Grand Rapids, MI	1,895 (1,225)	■				■		■	■	■					■			■		
Grand Rapids, City of	Wealthy St. Stormwater PS	Grand Rapids, MI	1,184 (765)	■					■	■	■	■					■					
Southern Nevada Water Authority	Alfred Merit Smith WTP Intake PS No. 1	Las Vegas, NV	928 (600)		■			■		■	■	■				■			■			
Southern Nevada Water Authority	Alfred Merit Smith WTP Low Lift PS	Las Vegas, NV	928 (600)			■		■		■	■	■				■						
New York City Department of Environmental Protection	Newtown Creek Brooklyn/Queens Main Sewage PS	New York City, NY	828 (535)				■		■	■	■							■				
Coastal Water Authority	Capers Ridge Intake and PS	Houston, TX	774 (500)		■			■			■	■				■						
Sandy Creek Energy Services	Sandy Creek Station Unit 1, Cooling Water PS	Riesel, TX	761 (492)			■		■		■	■	■				■						
Grand Rapids, City of	Scribner Stormwater PS	Grand Rapids, MI	712 (460)	■					■	■	■	■					■					
Kansas City, City of	KCMO WTP Intake PS	Kansas City, MO	619 (400)		■				■	■	■	■						■	■			
Detroit Water & Sewage Department	Northeast Sewage PS	Detroit, MI	603 (390)				■		■	■	■	■	■			■		■				
Metropolitan St. Louis Sewer District	Bissell Point PS	St. Louis, MO	557 (360)	■					■	■	■	■						■				
Orange County Sanitation District	Effluent PS Annex - dry pit vertical non-clog pumps	Fountain Valley, CA	557 (360)				■	■	■	■	■	■						■				
Metropolitan St. Louis Sewer District	Lemay WWTP Raw Wastewater PS Expansion	St. Louis, MO	542 (350)				■		■	■	■	■										
Metropolitan St. Louis Sewer District	Lemay PS No. 1	St. Louis, MO	446 (288)				■		■	■	■							■				
San Diego County Water Authority	San Vicente PS	San Diego, CA	444 (287)		■			■		■	■	■	■	■	■			■			■	
Dupage County	Elmhurst Quarry Stormwater Transfer PS	Dupage, IL	410 (265)	■				■		■	■	■										
Toledo, City of	Bay View WWTP Effluent PS	Toledo, OH	410 (265)				■	■		■	■	■	■			■		■				■
Tampa Bay Water	Bypass Canal PS	Clearwater, FL	387 (250)		■				■			■				■		■	■			
King County Dept of Natural Resources	Denny Way/Elliott West CSO Control Facility PS	Seattle, WA	387 (250)	■				■		■	■	■				■		■				
Metropolitan St. Louis Sewer District	Baumgartner WWTP PS	St. Louis, MO	376 (243)				■	■			■											
Detroit Water & Sewage Department	Detroit Water Works Park II Low Lift PS	Detroit, MI	371 (240)			■		■		■	■	■								■		
Kansas City, City of	Turkey Creek PS	Kansas City, MO	371 (240)			■			■	■	■	■						■				
East Bay Municipal Utility District	E.A. Fairbairn PS	Sacramento, CA	351 (227)		■			■	■	■	■	■							■			
Metro Wastewater Reclamation District	Robert W Hite WWTP Primary Effluent PS	Denver, CO	347 (224)				■		■	■	■	■										
Phoenix, City of	Val Vista WTP GAC Contractors PS	Mesa, AZ	340 (220)			■		■		■	■	■				■		■				■
San Bernardino Valley Municipal Water District	Central Feeder PS	San Bernardino, CA	333 (215)			■		■		■	■	■				■			■			
Southern Nevada Water Authority	Hacienda PS	Las Vegas, NV	320 (207)			■			■	■	■	■	■	■								■
North Texas Municipal Water District	Panther Creek Regional WWTP Influent PS	Frisco, TX	316 (204)			■				■	■	■	■	■							■	

# Black & Veatch Has Considerable Large Capacity Pump Station Experience

Large Black & Veatch Pump Station Projects	Pump Station Capacity, CFS (MGD)	Project Highlights
<b>Flood Protection PSs</b> New Orleans, LA	3,404 CFS (2,200 MGD)	Planning & preliminary design for large wet weather pump stations. Development of RFP for design/build project. Critical flood control infrastructure. Significant public/political interest.
<b>Everglades Restoration</b> South Florida Water Resources Authority	3,714 CFS (2,400 MGD)	Six, 400 mgd pumps equipped with 2000 hp engine driven motors. Significant public/political interest.
<b>Sanitation Districts of Los Angeles County</b>	1,547 CFS (1,000 MGD)	Large, critical infrastructure project
<b>North Main PS &amp; South PS</b> Boston, MA	1,408 CFS & 557 CFS (910 & 360 MGD)	Black & Veatch operated & prepared O&M manuals for the two main influent pump stations to the Deer Island WWTP prior to takeover of the new facilities by MWRA
<b>Wealthy Street PS &amp; Front Scribner PS</b> Grand Rapids, MI	1,137 CFS & 712 CFS (735 & 460 MGD)	Large wet weather pump stations. Significant public/political interest.
<b>Four PSs</b> Izmir, Turkey	232 CFS to 1,060 CFS (150 to 685 MGD)	Large, critical infrastructure project
<b>Ameria PS</b> Cairo, Egypt	1,015 CFS (656 MGD)	Eight 82 mgd wastewater pumps for 200 ft deep pump station
<b>91st Ave. Unified PS</b> Phoenix, AZ	928 CFS (600 MGD)	Large wastewater influent pump station
<b>Riva PS</b> Istanbul, Turkey	792 CFS (512 MGD)	Deep wastewater pump station with ten 64 mgd pumps (8 duty, 2 standby)
<b>Lemay PS</b> St Louis, MO	603 CFS (390 MGD)	Deep wastewater pump station
<b>Southside Influent PS</b> Dallas, TX	603 CFS (390 MGD)	Six 66 mgd raw wastewater pumps and two 30 mgd pumps
<b>Potomac Sewage PS</b> Washington DC	712 CFS (460 MGD)	Large influent pump station
<b>San Vicente PS</b> San Diego Water Authority	441 CFS (285 MGD)	High head up to 390 psi, large 7000 hp motors with air brakes to prevent backspin
<b>Elmhurst Quarry</b> Chicago, IL	410 CFS (265 MGD)	Wet weather pump station, high head pumping from deep stormwater detention reservoir
<b>Denny Way Tunnel PS</b> Seattle, WA	387 CFS (250 MGD)	Wet weather tunnel dewatering pump station. Critical CSO infrastructure.
<b>Missouri River Intake</b> Kansas City, MO	371 CFS (240 MGD)	Replacement of 700 hp wound rotor motors & liquid rheostat drives with induction motors & VFDs
<b>Ohio River Intake PSs</b> Cincinnati, OH/Northern Kentucky	348 CFS & 93 CFS (225 & 60 MGD)	Large, high head pumps (200 ft & 350 ft)
<b>Baumgartner PS</b> St Louis, MO	376 CFS (243 MGD)	Deep tunnel wastewater pump station
<b>Overflow Relief System PSs</b> St Louis, MO	340 CFS (220 MGD)	Wet weather pump station
<b>Maxon WWTP Effluent PS</b> Memphis, TN	309 CFS (200 MGD)	Replacement of 2500 hp wound rotor motors & liquid rheostat drives to induction motors & VFDs
<b>87th St PS</b> Kansas City, MO	248 CFS (160 MGD)	Large, critical infrastructure project
<b>Otero PS</b> Buena Vista, CO	186 CFS (120 MGD)	Eight new 2250 hp split case pumps
<b>Fields Point Tunnel PS</b> Providence, RI	77 CFS (50 MGD)	Deep tunnel (300 ft) wastewater pump station

