

# Recovering water resources

Enduring, innovative  
infrastructure for  
tomorrow







# Protecting our earth's waters

Wastewater collection and treatment facilities have saved millions of lives since the industrial revolution. These systems are continuously being updated to achieve modern goals: swimmable and fishable water bodies.

What if you could rely upon experts who understand how to navigate complex regulations and optimize your facilities to meet these goals? With Mott MacDonald you can.

Today's society requires resilient and operationally efficient facilities. Innovative solutions are needed to reimagine their net environmental benefits. If your project depends on a strategic partnership, Mott MacDonald is your solution.

Construction of the new Stoney Creek Pump Station increased capacity to handle peak flows during storm events, up to 45 million gallons per day (MGD) or 170 million liters per day (MLD).

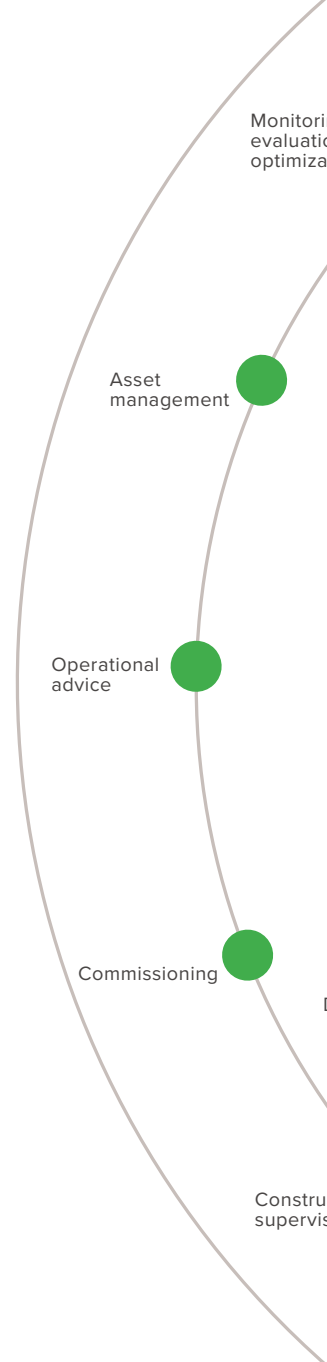


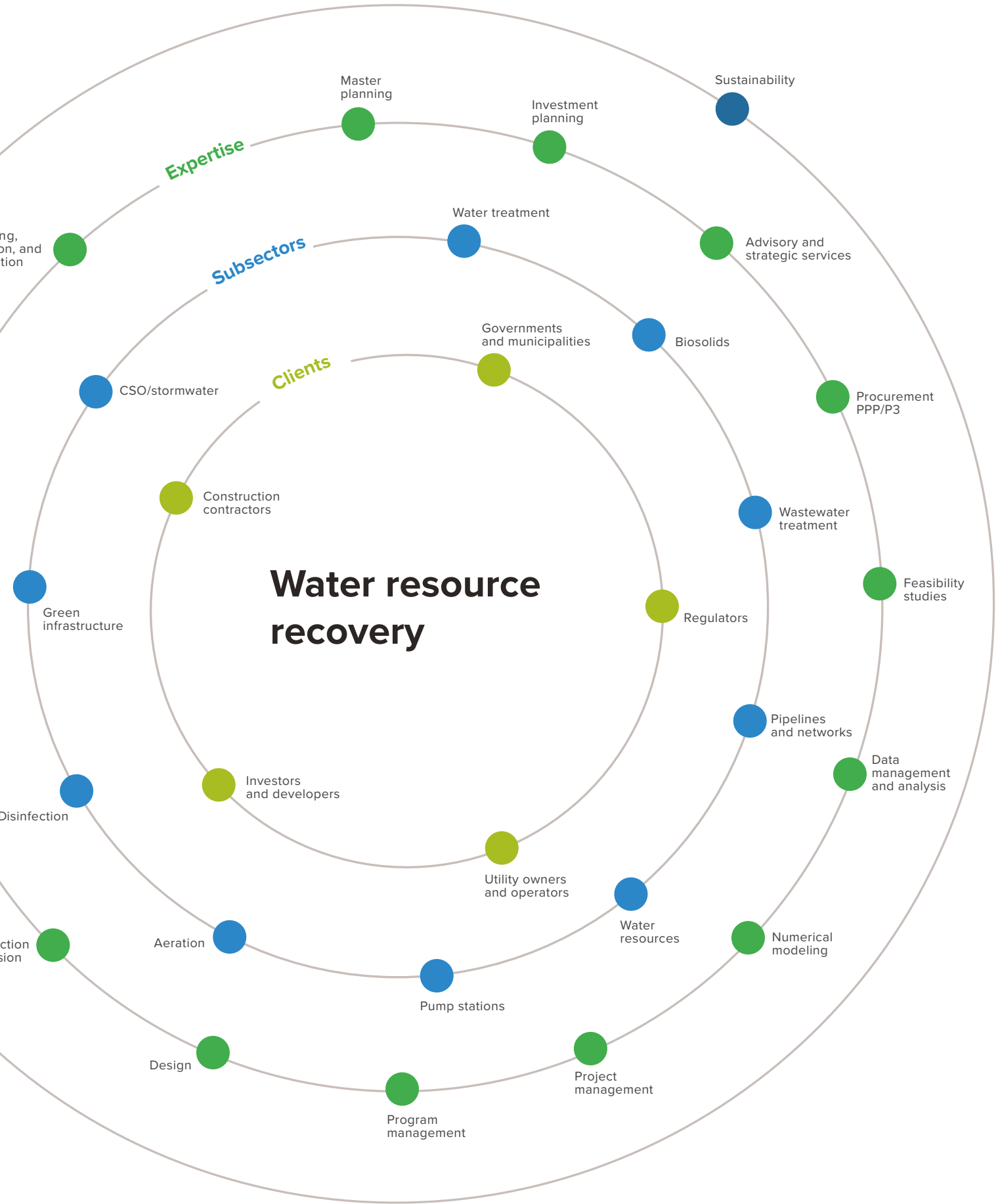
In the fast-changing world of wastewater collection and treatment, you need advisors who can think laterally and search out the connections that others fail to make. You need pioneers with a thirst for innovation, who will look at challenges from a fresh angle and turn obstacles into sustainable solutions for your organization and for the lives you touch every day.

That's why you need Mott MacDonald. Our global network of experts never stops asking "what if?"

We constantly stretch our thinking, imagining elegant solutions for the most complex wastewater challenges. Yet in our drive for progress, we never lose sight of the human impact of our actions.

Our restless curiosity propels you forward, to achieve appropriate balance between the multifaceted interactions of civilization and nature. Mott MacDonald will take your potential into a new opportunity space. Together, we will find clarity from uncertainty, one question at a time.





## Water resource recovery facilities

# A fast-track upgrade in Florida

### Opportunity

To improve the effluent quality of treated wastewater and reclaimed water in Ponte Vedra, FL, the St. Johns County Utilities Department wanted to consolidate wastewater flows from the Players Club, Innlet Beach, and Sawgrass Wastewater Treatment Plants. The expansion of the Players Club facility will be the largest capital project undertaken by the Department over the next three years.

### Solution

Mott MacDonald designed a new 2.4 MGD (9 MLD) water reclamation facility with headworks equipped with a fine screen, and a vortex grit removal system, biotrickling filter odor control and carbon polisher, a four-stage Bardenpho treatment process, secondary clarifiers, tertiary disk filters, and ultraviolet disinfection to public access reuse standards.

Other components include an energy-efficient aeration system using turbo blowers and fine bubble diffusers, reclamation and reject ponds and pumping, chemical feed systems, sludge storage, and dewatering facilities.

### Outcome

To meet the requirements of the State Revolving Fund low interest rate loan, the project followed an accelerated design schedule and was completed in eight months. When construction is completed, the new Players Club Water Reclamation Facility will provide high-level advanced wastewater treatment reliably and cost-effectively. Treated water will most times be 100% recycled and can be used to irrigate adjacent golf courses.



The new facility will be able to treat a peak flow of 6.5 MGD (24 MLD).

---

### Project

Players Club Water  
Reclamation Facility

---

### Location

Ponte Vedra Beach, Florida

---

### Client

St. Johns County Utilities  
Department

---

### Expertise

Design, permitting, bidding,  
funding, and construction  
administration and  
observation services

## Water resource recovery facilities

# Extending the life of critical systems

---

### Project

Phase IV modifications  
to final clarifiers

---

### Location

Newark, New Jersey

---

### Client

Passaic Valley Sewerage  
Commission

---

### Expertise

Detailed design

With a capacity of 330 MGD (1,200 MLD), the water resource recovery facility serves approximately 1.3 million people in 48 municipalities.

### Opportunity

The Passaic Valley Sewerage Commission owns and operates an activated-sludge secondary water resource recovery facility in Newark. With a capacity of 330 MGD (1,200 MLD), the plant serves approximately 1.3 million people in 48 municipalities.

The plant includes 12 rectangular final clarifiers, each with three circular sludge collection mechanisms 120 feet (36 meters) in diameter. All required rehabilitation, as well as an extensive scum removal system.

### Solution

We conducted a thorough inspection and recommended a comprehensive repair program. Submerged and exposed steel surfaces were cleaned with abrasive blasting and repainted. Sludge collector squeegees, sludge collection boxes, clevis rods, and hardware were replaced.

### Outcome

The rehabilitation of the final clarifiers and upgrade of the scum removal system will serve the treatment plant well for many years to come.



## Effluent disposal, reclamation, and reuse

# A sustainable upgrade with UV disinfection



### Opportunity

Created in 1971, the Two Bridges Sewerage Authority provides wastewater services to an area of 56 square miles (145 square kilometers) with about 40,000 residents. The Authority's wastewater treatment plant, which began operating in 1979, was designed for an average capacity of 7.5 MGD (28 MLD) and a peak daily capacity of 13.5 MGD (51 MLD).

Studies indicated that the plant's chlorination/dechlorination system could not meet current design criteria and future limits for chlorination byproducts. Ultraviolet disinfection was recommended, but it was essential to avoid disrupting the treatment process and impacting local wetlands while installing a new system.

### Solution

Mott MacDonald designed a two-channel UV system with low-pressure self-cleaning lamps installed in a pile-supported masonry building. Vertical turbine pumps were installed in the existing post-aeration tanks, for use when the Pompton River flooded.

### Project

Two Bridges UV disinfection

### Location

Lincoln Park, New Jersey

### Client

Two Bridges Sewerage Authority

### Expertise

Design, permitting, funding assistance, construction management, and mechanical, electrical, structural, and architectural engineering

The new treatment system includes a range of sustainable features.

### Outcome

The new system can handle a peak flow of 25 MGD (95 MLD), and is expandable. It includes sustainable features such as natural lighting, light pollution reduction, minimization of heat island effects, and compliance with ASHRAE ventilation standards.

The use of a gravity flow bypass system reduced energy usage and the cost of construction materials. An accelerated schedule allowed the Authority to take advantage of funding under the American Recovery and Reinvestment Act (ARRA).



## Pump stations and hydraulic structures

# Protecting a lift station from extreme weather

### Opportunity

Built in the 1980s, the Shadowbrook Lift Station pumps wastewater under Dry Creek near the center of Roseville to a large-diameter trunk line. Located approximately two feet below the 100-year flood elevation, the lift station was vulnerable to flooding and could be inaccessible during severe rainfall. Lacking a standby generator, it would have to be connected to a portable generator during an emergency.

### Solution

We determined that the grade elevation of the lift station should be at least 3.7 feet (1.1 meters) above the existing grade. To increase emergency storage, a pipe segment five feet (1.5 meters) in diameter and six feet (1.8 meters) long was constructed upstream. A permanent generator was added with an automatic transfer switch to improve reliability during a power outage.

We oversaw environmental documentation and coordinated with agencies including the US Army Corps of Engineers, US Fish & Wildlife Service, Regional Water Quality Control Board, and Central Valley Flood Protection Board.

### Outcome

The project increased the resilience of the wastewater pumping system, reduced the potential for malfunctions to cause overflows, and provided adequate time for operations and maintenance staff to respond to occasional high-water alarms.



### Project

Shadowbrook Lift Station and Force Main

### Location

Roseville, California

### Client

City of Roseville, Environmental Utilities Department

### Expertise

Field surveying, geotechnical and environmental services, detailed design of construction documents and construction support

Upgrades to the Shadowbrook Lift Station and Force Main increased its resilience to severe rainfall events.

## Piping and collection systems

# Preparing for a 10-year storm



Approximately 200 feet (61 meters) of interceptor was rehabilitated using cured-in-place pipe.

### Project

New Industrial Road Parallel Sanitary Sewer

### Location

San Carlos, California

### Client

City of San Carlos

### Expertise

Alternatives analysis, pipeline design, tunnel design, construction support

### Opportunity

A small residential suburb on the San Francisco Peninsula, the City of San Carlos borders San Francisco Bay. Deficiencies in the sewer collection system caused the City to identify projects that would eliminate sanitary sewer overflows in the event of a ten-year storm.

Projects included the Industrial Road Parallel Sanitary Sewer Project, which aimed to improve approximately 5,500 feet (1.7 kilometers) of sanitary sewer pipe ranging from 24 to 33 inches (60 to 80 cm) in diameter. The City proposed replacing the existing pipe with 33-inch pipe.

### Solution

We developed two alternative alignments for the pipe, which were compared with the City's concept alignment by considering cost, permitting requirements, impact on cultural resources, constructability, and potential for hazardous waste.

### Outcome

Our evaluation found that upsizing the sewer would be more economical, more reliable, and less disruptive to the community than a pump station upgrade recommended in the master plan.

To avoid a lengthy permitting process and an expensive crossing with major box culverts, approximately 200 feet (61 meters) of interceptor was rehabilitated using cured-in-place pipe. This also avoided the need to trench across an environmentally sensitive creek and to obtain permits from the US Fish and Wildlife Service and the Regional Water Quality Control Board.

## Piping and transmission systems

# Moving wastewater under the river

### Opportunity

Servicing Jacksonville and the surrounding community, JEA provides electric, water and sewer services in parts of Clay, Duval, Nassau, and St. Johns counties. To provide redundancy for an aging existing wastewater main, a new force main had to be constructed 50 feet (15 meters) below the bed of the St. Johns River.

### Solution

Mott MacDonald served as the owner's representative for the \$14 million design-build project to construct 4,200 linear feet (1.3 kilometers) of 36-inch (0.9-meter) force main by horizontal directional drilling beneath the St. Johns River. The high-density polyethylene pipe was 36 inches in diameter, within a 42-inch (1.1-meter) steel casing.



The new force main is expected to be in service for 40 to 50 years.

### Outcome

The aging existing wastewater force main transported over 10 MGD (38 MLD). The two force mains will now be able handle a peak flow of 16.7 MGD (63 MLD), serving more than 50,000 customers. The new main is expected to be in service for 40 to 50 years and will allow JEA to perform necessary repairs on the existing force main for true redundancy of the system.

The project was named Project of the Year at the 11th annual statewide conference of the Florida Region of the Design-Build Institute of America.

### Project

South Shores Second Subaqueous Force Main Crossing

### Location

Jacksonville, Florida

### Client

JEA

### Expertise

Owner's representative during construction

## Wet weather and stormwater facilities

# Cleaner water, cleaner air, fewer floods

### Opportunity

Like many older US cities, more than half of Philadelphia is served by “combined” sewers that carry both sewage and stormwater. Heavy rain or snow can cause combined sewer overflows (CSOs) that discharge into local rivers through the city’s 164 outfalls.

In the 19th century, as the Northern Liberties and South Kensington neighborhoods were developed, the Cohocksink Creek was encapsulated in an arch-shaped brick sewer approximately 16 feet (4.9 meters) wide. Properties were developed along what would have been the banks of the Cohocksink Creek. Heavy rains sometimes overwhelmed the sewer, causing catastrophic pipe failures and flooding.

Eventually the original sewer was reinforced with gunite to maintain pipe integrity, but it was still undersized. To minimize the effects of flooding of the now developed area, the sewer system is being expanded to increase conveyance capacity.

### Solution

The Philadelphia Water Department launched the Cohocksink Storm Flood Relief project, a six-phase effort for which Mott MacDonald provided services for Phases II, IV, V, and VI.

The project includes more than one mile (1.6 kilometers) of new sewers, ranging from pipes 12 inches (0.3 meters) in diameter to box culverts as large as 10 by 15 feet (3 by 4.6 meters). Upon completion, the capacity of the sewer system would increase from approximately 2,000 to 4,000 cubic feet per second (56 to 113 cubic meters per second). The project also included recessed planter beds and other green infrastructure, and new ADA-compliant ramps and pavements.

### Outcome

The flood relief program has increased the reliability of sewer service in the area, and reduced the risk of flooding and the pollution of waterways. Improvements to ramps and pavements improved the appearance of the streets. Ongoing coordination with public services, agencies, and utilities minimized disruption to residents and businesses.



Excavation for proposed regulating chamber in the Northern Liberties section of Philadelphia. The regulating chamber is equipped with three 6- by 15-foot (1.8- by 4.6-meter) pontoon gates.

### Project

Cohocksink Storm Flood Relief Project

### Location

Philadelphia, Pennsylvania

### Client

Philadelphia Water Department

### Expertise

Investigations, surveying, design (geotechnical, structural, civil, environmental, electrical), streetscape improvements, landscape design, construction management



## Wet weather and stormwater facilities

# Managing stormwater with green infrastructure



### Opportunity

The drainage area of Bowery Bay, just west of LaGuardia International Airport in Queens, is densely developed, with very few unpaved or green areas. This causes stormwater runoff and CSOs.

### Solution

As part of a larger green infrastructure initiative, we were assigned approximately 600 acres (242 hectares) within the Bowery Bay drainage area and tasked with site selection and design.

This included developing a drainage area analysis, selecting and surveying preliminary sites, making a final selection, and developing plans and bidding documents for right-of-way bioswales and stormwater green streets.

### Outcome

Green infrastructure reduces demand on sewer systems, improves air quality, and creates a cleaner, more attractive urban environment. The Bowery Bay project will reduce the flow load to the Bowery Bay Water Pollution Control Plant and help protect local waterways.

### Project

Bowery Bay green infrastructure

### Location

New York, New York

### Client

New York City Department of Environmental Protection

### Expertise

Project management, geotechnical, surveying, engineering design services

Bioswales and stormwater green streets will reduce CSOs in the Bowery Bay area of Queens.

## Biosolids management

# Powering a treatment plant with its own methane gas

### Opportunity

Created in 1956, the Hanover Sewerage Authority provides service to the township and adjoining residential areas of Morris Plains, Morris Township, Parsippany-Troy Hills, and to industries in East Hanover. In 1961, the Authority completed construction on its original wastewater treatment plant. The facility was expanded in the 1970s and upgraded to achieve a higher level of treatment in 1992. Over time, the plant's anaerobic digester system reached the end of its useful life. Primary Digester No. 1 had been out of service for many years, and the performance of Primary Digester No. 2, in continuous service for 30 years, was degrading.

### Solution

We provided all necessary design services for improvements to the plant's digesters. Upgrades to Primary Digester No. 1 required retrofitting new piping and valves in areas of limited space, and achieving a high degree of gas pressure containment by reconditioning the existing concrete tanks. Gas generated in the digesters was used to fuel the plant's boiler system.

Primary Digester No. 2 was fitted with a two-layer membrane cover that increased gas storage capacity from about 8,400 to 39,500 cubic feet (238 to 1,119 cubic meters). A new sludge mixing system requires less horsepower than traditional mixing systems. Hot-water jackets on the mixing tubes eliminate the need for heat exchangers and circulating pumps, warming the sludge to enable anaerobic digestion.

### Outcome

Our design brought one digester back into service and extended the useful life of two others. Excess methane, formerly flared off, is now being recovered to generate heat and electric power. Digester gas generates enough electricity run more than half the plant, and hot water helps heat the plant's buildings.

### Project

Digester upgrades

### Location

Morris County, New Jersey

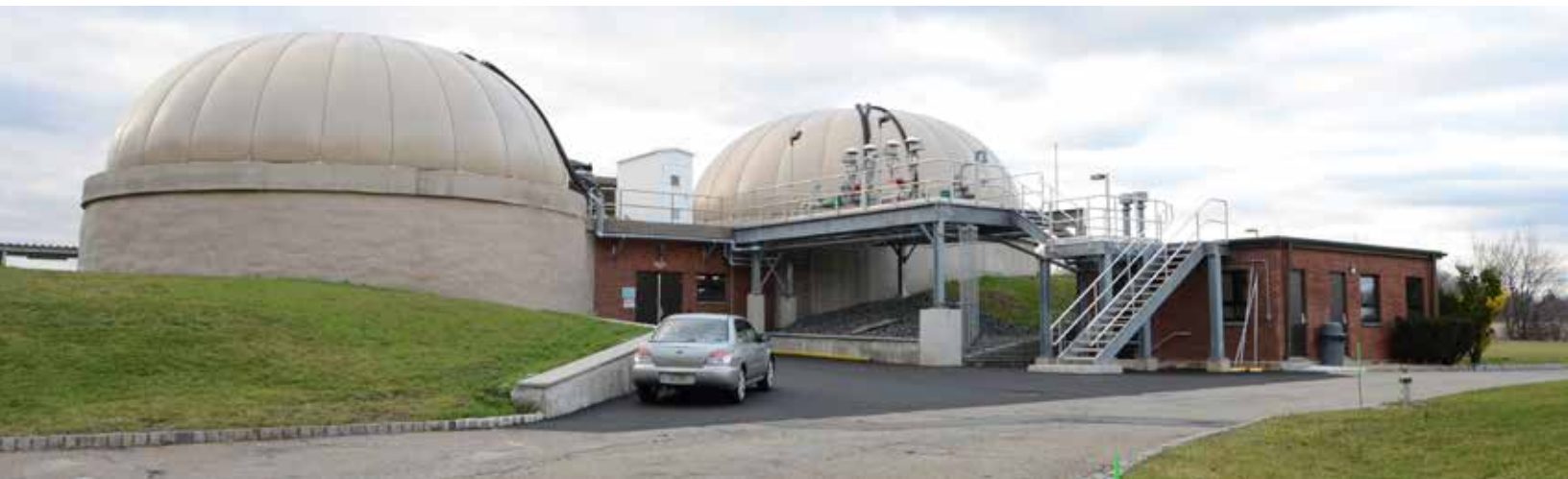
### Client

Hanover Sewerage Authority

### Expertise

Instrumentation and controls, bid services, construction services, and structural, architectural, electrical, and mechanical process design

Upgrades to digesters extended their useful life and enabled excess methane to be used for cogeneration.





Improvements in treatment reduced the volume of biosolids by 40%.

## Biosolids management

# Turning biosolids into energy and savings

---

### Project

AMP4 and AMP5 biosolids program

---

### Location

Cambridgeshire, UK

---

### Client

Anglian Water

---

### Expertise

Inspection, feasibility study, program management

### Opportunity

With 4,000 employees operating in the east of England, Anglian Water serves more than six million domestic and commercial customers. Like other British water and wastewater utilities, it is regulated by Ofwat according to five-year cycles called Asset Management Plan (AMP) periods.

As part of its goals for AMP4 and AMP5, Anglian Water set out to improve the biological quality of the 573,000 tons (520,000 metric tons) of treated wet sludge that it was producing each year.

### Solution

As part of a team, Mott MacDonald conducted an inspection and feasibility study at the Great Billing Sludge Treatment Center, which was designed to process up to 42,660 tons (38,700 metric tons) of dry solids per year. We recommended upgrades including relining the tanks, checking the internal pressure capacity of the roof, and repairing concrete structures.

We also developed two enhanced digestion techniques, implemented at four treatment facilities, to improve the conversion of organic matter to water and biogas.

### Outcome

Operating costs at the four facilities were reduced by \$4 million (£3 million) per year, and they became self-sufficient in renewable energy. Enhanced digestion allowed Anglian Water to consolidate its sludge treatment, taking advantage of spare capacity at existing sites. Treatment capacity was increased 30% from the baseline target.

Converting more solids to gas reduced the total volume of biosolids leaving Anglian Water's sludge treatment plants by 40%. Program-wide savings totaled \$12 million (£9 million) on a projected capital cost of \$131 million (£100 million).



## Industrial wastewater treatment

# Ensuring the future of deicing at Denver's airport

### Opportunity

In recent years, Denver International Airport has received more than 54 inches (1.4 meters) of snow each winter. Deicing aircraft wings and rear tail components is essential for safe travel.

The Denver International Airport uses five centralized deice pads, with a total of 27 deicing spaces, to deice planes using propylene glycol mixed with water and additives. Thanks to its advanced deicing management system, the overall average time to deice a plane is less than 16 minutes, with an average queue time of 5-7 minutes.

In the 2016-2017 snow season, the airport applied 192,035 gallons (726,932 liters) of airside deicing chemical, plus 72,631 gallons (274,938 liters) of pavement deicing chemical. Used chemical drains into ponds and tanks, and about 70% is recycled into windshield washer fluid and other products.

### Solution

Using comprehensive modeling, we analyzed the ability of the airport's deicing and industrial wastewater system to store, recycle, and process wastewater. We provided all services needed to develop hydraulic models, run numerous routing scenarios, and document the findings.

### Outcome

Our work will help ensure that Denver International Airport's cutting-edge deicing system is not constrained by limited storage or processing capacity.



Denver International Airport applied 192,035 gallons (726,932 liters) of airside deicing chemical during the 2016-2017 snow season.

---

### Project

Deicing and industrial wastewater system capacity analysis

---

### Location

Denver International Airport

---

### Client

City and County of Denver, Department of Aviation

---

### Expertise

Hydraulic modeling, system capacity analysis



## Condition assessment and asset management

# Protecting the waters of Charm City



### Opportunity

According to the US EPA, “Baltimore-area waters have long been contaminated with untreated discharges from sewer overflows of bacteria, pathogens and other harmful pollutants which can seriously degrade water quality, kill aquatic life and threaten public health.”

Under the terms of a consent decree, the EPA required the City to perform a comprehensive evaluation of the Low Level Sewershed, including the central business district, Inner Harbor, and an industrial and port area.

### Solution

As part of a joint venture, we performed an extensive inspection and collected survey data for a large portion of the collection system. We developed a calibrated and validated collection system model and applied it to data from a year-long effort to collect data on rainfall and flow. GIS-based data was collected in an ArcSDE geodatabase that could be synced periodically with the City’s master geodatabase.

### Outcome

Based on the data collected and analyzed, we simulated various alternatives to find the optimal suite of improvements that would minimize costs and meet the City’s performance criteria for the collection system.

---

### Project

Low Level Sewershed study

---

### Location

Baltimore, Maryland

---

### Client

City of Baltimore, Bureau of Water and Wastewater

---

### Expertise

Inspection, data surveying and evaluation, modeling

A comprehensive evaluation helped identify the optimal suite of improvements for the collection system.

## Integrated watershed management

# A green and gray solution for a flood-prone neighborhood

### Opportunity

Several times a year, if you lived near Hayson Avenue and Red Oak Boulevard in the Banksville neighborhood of Pittsburgh, your basement would be flooded after moderate to severe rain.

### Solution

We evaluated seven alternatives to address the problem, ranking them by cost (to homeowners and the Pittsburgh Water and Sewer Authority), pollutant reduction, and CSO benefits. The locations of residential backups were introduced into the Authority's model.

We agreed with the Authority on a two-phase gray and green solution. A large-diameter combined sewer would provide storage capacity during peak rainfall, while green infrastructure at key locations would reduce stormwater runoff. A 200-foot (61-meter) segment of reinforced concrete pipe 72 inches (1.8 meters) in diameter was installed parallel to the existing sewer.

### Outcome

Modeling showed that the project will result in a CSO reduction of approximately 800,000 gallons (3,028 cubic meters) at the downstream overflow location. Local residents supported the solution, which avoids the cost of requiring them to separate their sanitary and storm sewer lateral pipelines.

### Project

Hayson Avenue storage sewer and green infrastructure

### Location

Pittsburgh, Pennsylvania

### Client

Pittsburgh Water and Sewer Authority

### Expertise

Integrated watershed management

A two-phase green and gray solution helped correct flooding in the Banksville neighborhood.







The Region of Halton's expanded Mid-Halton water resource recovery facility will save energy with an efficient biological treatment process that preserves alkalinity and a hydraulic turbine on its outfall. HMM, a joint venture of Mott MacDonald and Hatch, was the prime design consultant for the project in Oakville, Ontario.

Opening opportunities with connected thinking.

For more information, write to  
[americas@mottmac.com](mailto:americas@mottmac.com) or call 800.832.3272.

[mottmac.com](http://mottmac.com)