

[FLOOD CONTROL]

Pump It Up & Out

A Maryland county utilizes three Archimedes screw pumps to solve severe flooding problems

By Mike Rossi



Elevated retention pond levels trigger the operation of Archimedes screw pumps.

The Edmonston Storm Water Pump Station is located in the town of Edmonston, Md., in Prince George's County. For years, the existing pump station had been unable to keep up with high-intensity storm flows reaching the station's retention pond and transfer them to the Anacostia River. As a result, nearby homes and properties had been subjected to flooding caused by pond overflow.

Following severe flooding in 2004, the Prince George's County Department of Public Works and Transportation (DPW&T) commenced the Edmonston Storm Water Pump Station improvements project. The station upgrade included three new Archimedes screw pumps, each 46 ft long and 10 ft in diameter and capable of pumping 133 cu ft of water per second.

Watershed Characteristics

The Washington, D.C., metropolitan area is subject to more than 40 in. of rainfall per year. The *Maryland Stormwater Design Manual* tabulates the 24-hour rainfall depths associated with the one-, two-, 10- and 100-year storm events as 2.7, 3.3, 5.3 and 7.4 in., respectively, for Prince George's County. Rainfall intensities are relatively high. For example, intensity duration frequency curves for Arlington County, Va., just across the Potomac River from Prince George's County, show that a 10-year storm event has an

intensity of 5 in. per hour for a duration of 15 minutes.

The Edmonston Storm Water Pump Station is located on the northwest side of the northeast branch of the Anacostia River and serves a drainage area of 0.72 sq miles. The drainage area is essentially built out with commercial, industrial and urban single-family residences. The river has a drainage area of approximately 175 sq miles, though much of this is located downstream of the pump station.

The pump station has a 52,000-sq-ft retention pond which provides approximately 365,000 cu ft of storage. Influent culverts include 66- and 27-in.-diameter circular culverts, a 5-by-11-ft box culvert and a 4-ft-9-in.-by-10-ft box culvert. There are two 5-by-8-ft effluent box culverts with an invert out elevation of 6.8 ft.

The original pump station, built in the late 1950s by the U.S. Army Corps of Engineers, has two 75-hp pumps, each capable of pumping 50 cu ft per second through the levee to the Anacostia River. These pumps are set to turn on when the water in the retention pond is at an elevation of 12 ft, when the pond is approximately two-thirds full.

Station Design & Pump Selection

In 2005, the DPW&T retained Waste Water Management Inc., Falls Church, Va., to design the upgrade. Working closely with the DPW&T, the company determined that Archimedes screw pumps would be ideal. Advantages of Archimedes screw pumps include capability of pumping debris, relatively slow speed and thus less wear and abrasion, no net positive suction head required (NPSHreq)—providing a capability of running dry—and the cost savings associated with not having piping and valving.

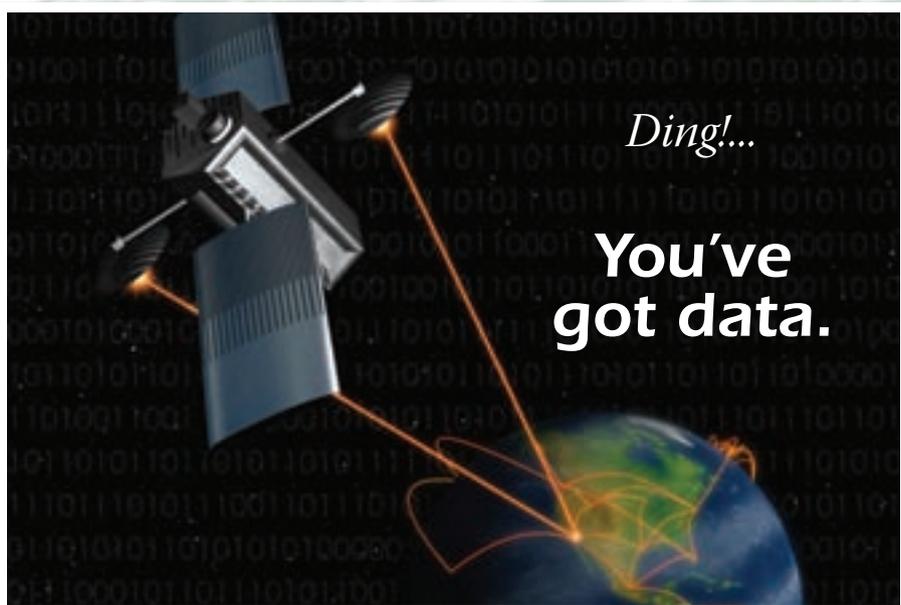
On this project, the fact that the pumps could run dry was the most important consideration; it allows the pumps to turn on when the retention pond water surface elevation (adjustable setpoint) is only inches above the box culvert invert elevation, rather than 5 ft above it as was required by the original axial flow pumps due to their NPSHreq. While other types of

pumps could have been used, a deep wet well would have been required, which would have been problematic due to the proximity of the levee, the presence of groundwater and low-quality subsurface materials. The “touch point” of each screw pump is at an elevation below the effluent culvert invert elevation, allowing the pumps to drain the pond completely.

Older screw pumps utilize grease pumps and piping systems to lubricate

the lower bearings, which are often submerged. The Edmonston screw pumps, manufactured by Spaans Babcock, are equipped with lifetime-lubricated lower bearings. This feature eliminates the possibility of grease entering the Anacostia River due to grease piping failure and the problem of spent grease disposal.

The project also incorporated an automatically cleaned bar screen system that reduces the amount of



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trash and debris passing through the pump station. The pump station has a system of well-lit catwalks and platforms, allowing personnel to visually assess the operation of all components.

The DPW&T worked closely with the town in the selection of the facade and roofing materials, and more than 120 new trees and shrubs were added to the site for aesthetic value.

Operation

The retention pond and the Anacostia River are essentially decoupled systems—that is, storm events causing high stage in the Anacostia River are not necessarily the same events that would cause inflow to the retention pond. Under low river conditions, runoff in the watershed passes through the retention pond and out to the river through an existing box culvert passing through the levee.



The new pump station has kept Edmonston dry, even as neighboring communities experienced flooding.

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On a rise in river stage above the invert elevation of the effluent box culvert, gravity flap gates and electrically actuated sluice gates close to keep river water out of the retention pond. Should the retention pond rise due to storm events in its watershed, the screw pumps will turn on, pumping water up to an elevation above the top of the levee. The water discharges to an effluent channel which drops into the existing box culvert on the pond side of the levee, downstream of the sluice gates. This design allowed the levee and associated top-of-levee trail to remain undisturbed.

The project was substantially completed in December 2007. Installation of the emergency generator, which had an 18-month lead time due to Hurricane Katrina backlog, is still pending as this issue goes to print. On Feb. 1, 2008, the region received 2.05 in. of rain, and on May 11 the region received 2.63 in. of rain; while flooding was severe throughout the Washington, D.C., metropolitan region and in Prince George's County, the Edmonston Storm Water Pump Station performed as designed, and the town and its residents stayed dry. **[SWS]**

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