by Jeff Griffin, Senior Editor

Not Your Common Sliplining

Unusual Project Requires Creative Solutions

It could be said that no underground construction project is "routine." Even what may appear to be a simple installation often has unexpected challenges.

Of course, there are projects with numerous complications that set them apart from others and which require project owners, engineers and contractors to think outside the box if they are to be successfully completed.

Site conditions often limit how a project is approached. That was the case in 2006 when planning began to rehabilitate an approximately 35-year-old, 90-inch corrugated metal pipe (CMP) that conveys stormwater through a portion of the site occupied by Plant Jack McDonough, a coal-fired electric power generating plant in Smyrna, GA, owned and operated by Georgia Power, a Southern Company.

The 1,630-foot-long pipeline had been built to convey creek water running through the site in order to use this portion of the site for an ash pond.

"The old CMP passes beneath earthen dams and the ash pond," explained Gregory L. Hebeler, Ph.D., geotechnical engineer with Golder Associates Inc., the consulting engineering firm for the project. "The inlet and outlet portions of the culvert lie beneath the earthen dams, and the remainder is beneath the impoundment area. A concrete headwall is located at the upstream end of the culvert and the downstream end flows into twin concrete box culverts underneath an adjacent railway. The culvert is concrete encased beneath the ash pond and extending approximately 125 feet into the earthen embankments, but is not encased over the remaining portions. The culvert is a bitumastic coated, asbestos-bonded CMP with 3-inch wide by 1-inch deep corrugations."

The maximum height of the earthen dams above the crown of the culvert is approximately 68 feet and 84 feet, respectively under the inlet and outlet side embankment crests.

Trenchless best option

With the aging pipe inaccessible for replacement by conventional cut-and-cover construction, the only option was to use a method of trenchless rehabilitation.

Southern Company and Golder Associates ultimately made the decision that sliplining was the best trenchless option for the project. However, bends in the stormwater line's route, and the deformed shape of the old pipe posed several problems.

Explained Hebeler: "There are two bends along the pipe alignment: a 9-degree bend at approximately Station 04+90 and a 30-degree bend at approximate Station 15+25. Negotiating those bends with new pipe sections required careful planning and execution."

In addition, the old pipe had corroded locally and had deflected to varying degrees in the sections not encased in concrete. The pipe was deflected enough in multiple locations to limit the size of the new pipes that could pass through.

Pipe for the project was Hobas centrifugally cast fiberglass reinforced polymer mortar (CCFRPM) pipe in diameters from 72 to 84 inches. Different pipe diameters were used for a combination of flow capacity and clearance considerations. The liner pipe's bends, reducers and diameter changes were modified throughout the line to achieve the best and tightest fit to provide the highest possible flow recovery.

"Benefits to using the Hobas product are high-strength pipe wall with an efficient cross section and a smooth interior which allows for superior flow recovery," said Kimberly Paggioli, P.E., Hobas marketing manager. "Hydraulic capacity was definitely one of the deciding factors for using this pipe on the project."

Contractor for the project was Garney Construction with work managed and performed by personnel from the company's Atlanta division.

Plan B

The original plan was to winch pipe sections through the old pipe from equipment mounted on the surface at the downstream end, but access was very limited and after pulling through two short joints of pipe, the procedure was determined to be too slow, said Jeff Seal, Garney project manager.

Because of the double box culverts at the downstream end and restricted access, the other option – and best access point – was the upstream end at the headwall.

"Sliplining," Seal continued, "was initiated from where a creek flowed into the head-

Pipe & Fittings

The line began with a 110-inch by 84-inch reducer at the headwall. There was 39 feet of 84-inch diameter pipe, then an 84- by 78-inch reducer followed by 429 feet of 78-inch pipe in 19.5 foot sections, and 702 feet of 9.75 foot sections and 11.58 feet of 5.79 foot sections. Next was a 78- by 72-inch reducer and 320 feet of 72-inch 20 foot sections, 84.5 feet of 6.5 foot sections and one 6.17 footer. The elbows were 78 and 72 inches in diameter.

wall from which the CMP proceeded under the ash pond. The opening was at ground level eliminating the need to excavate a starting pit."

Before beginning the sliplining, the maximum joint lengths that would go through the bends were calculated and wood templates were made and tested to confirm the calculations were accurate.

"We custom-fabricated pipe dollies to carry sections of CCFRPM through the old pipe," Seal continued. "Two dollies were used for each pipe section. They rode on air-filled tires with the front end steerable and guided by a worker inside the pipe. Using a one-ton mini-excavator, we pushed each section of pipe into the tunnel guiding it through areas where the fit was tight with only a few inches of play. We then used air bags to lift the pipe and pull the dollies from under it."

During rains, water was allowed to flow through the tunnel, said Seal, so a custom inflatable plug was made to seal between the new and old pipe to prevent sand and debris from entering the annular space.

Grouting

Pipe joints were blocked with pressure-treated lumber to keep them from moving during grouting which was done inside the pipe by subcontractor Uretek ICR, Mid-Atlantic, Kernersville, NC.

Maximum grouting pressure for the new pipe was approximately 12 psi which meant the pressure on the outside of the pipe could not exceed that pressure, said Seal.

"While pipe was being installed, grout ports were left open so water did not 'build up' and create head pressure which could have buckled the pipe," he explained. "First, grout was pumped in between the new and old pipes. Once this grout cured enough to provide support, we came back a second time, increasing the grouting pressure to overcome the outside hydrostatic pressure."

Grouting was divided into four sections as pipe was installed with brick and mortar bulkheads constructed to separate the sections and hold the cellular grout which was pumped through two-inch threaded ports in the pipe located every 10 feet and alternating in a spiral from 12, 3, 6 and 9 o'clock.

After annular grouting was completed, an inspection with ground penetrating radar (GPR) was made to locate any potential problems.

"GPR inspections were made every five feet making a loop around the pipe," said Seal. "More grout was pumped into any voids that were located."

Pipe installation took approximately three months. Seal said work proceeded slowly at first because pipe had to travel the longest distance and pass through the two bends. The pace increased as longer sections of pipe were put in place and the distance they had to travel decreased.

Working together

"Successful completion of this project required the collaboration of the owner's engineer, the owner's construction personnel, the owner's consultant (Golder Associates), the contractor (Garney) and Garney's grouting subcontractor (Uretek)," commented Joel Galt, hydro services supervisor, Southern Company Generation.

In cooperation with Southern Company staff, Golder Associates conducted culvert assessment and developed a retrofit design providing flow equal to or greater than the existing stormwater line.

Hobas provided pipe appropriate for the application with custom pieces needed to fit existing mitered bends and other requirements unique to the project.

"Garney Construction completed the project efficiently providing quality construction with a perfect safety record while overcoming significant engineering and environmental challenges. The project management team identified issues and used technology and teamwork to solve complex problems." he continued.

Southern Company is a leading U.S. producer of electricity, owning electric utilities in four states providing more than 42,000 megawatts of generating capacity to serve 4.4 million customers.

Golder Associates is an international group of companies with more than 150 offices worldwide that provide ground engineering and environmental consulting services for civil engineering, industrial, environmental, natural resources, and health projects. Golder is involved with more than 12,000 projects annually.

Hobas Pipe USA manufactures centrifugally cast fiber reinforced polymer mortar pipe at its facility in Houston, TX, and has been supplying large diameter pipe in the U.S. for more than 20 years. CCFRPM pipe offers a combination of benefits that include corrosion resistance, high strength and leak-free service.

Garney Construction is one of America's largest and most-respected contractors and is a single-source contractor for water and wastewater projects with 45 years experience providing conventional and trenchless pipeline contracting and water treatment facility construction for municipal and industrial projects. The company is 100-percent employee owned.

FOR MORE INFORMATION
Contractor: Garney Construction, (816) 741-4600, www.garney.com
Pipe and fittings: Hobas Pipe USA, (800) 856-7473, (281) 821-2200, www.hobaspipe.com
Engineering: Golder Associates, (336) 852- 4903, (919) 462 6491, www.golder.com
Grout: Uretek USA, (28) 351-7800, www.uretekusa.com

Ash Ponds

One of the important elements in operating a coal-fired generating plant is controlling byproducts of the coal burned to generate electrical power. Fly ash usually is collected by electrostatic precipitators so it is not released into the air through the plant's stacks. Bottom ash falls to the bottom of the boiler where it is ground up. Both types of ash are sluiced to ash ponds.