

INTRODUCTION

In the fall of 2004, Eastern States Construction Service, Inc. began work on what was to become a two-year endeavor of constructing a new, upgraded, sanitary sewer interceptor for New Castle County along the Red Clay Creek.

Encountering numerous changes in site conditions, difficult obstacles and challenges to normal construction techniques, the final 11,015 feet of sewer pipeline was put into New Castle County use in the fall of 2006.

It is my hope this narrative explains some of the unique challenges Eastern States Construction experienced during this project and the satisfaction of working together with the owner to find innovative and creative techniques needed to meet them. The fact the project met the owners financial and time constraints is also a testament of the cooperative effort of all those involved.



Installation of new sewer across the Red Clay Creek looking down from Kirkwood Highway.

DESIGN AND CRAFTSMANSHIP

The Red Clay Interceptor is New Castle County's main sewer conduit servicing the communities of Newport, Stanton and Marshallton. As the flow in this line increased over the past decade to 3.5 million gallons a day, the existing 18" and 24" lines were rapidly approaching failure during peak flows and storm events.

As early as 2001, New Castle County began releasing contracts for bid and began improvements on the lower portions of the Red Clay line (in the Glenville area). By 2004, the engineering and approvals were complete to release two major portions of the line for bid and construction: Red Clay Interceptor, Sections 2B and 3, an 11,000 foot stretch from Newport to Glenville (see enclosed map). Eastern States Construction was the successful low bidder on both projects for a combined contract value of \$5,101,596.00.

The engineering and design of the improvements varied in difficulty. In some areas, the undeveloped floodplain along the banks of the Red Clay Creek allowed ample room to design a parallel sewer line as a method of increasing service capacity. And while the parallel sewer line avoided costly bypass costs, this did present a problem in design at several road and railroad crossings. New tunnels or "bores" would be needed at seven different locations along the new sewer path.

The one section of pipe that could not be designed parallel is the approximate 1000 foot stretch of pipe along the Ametek Industrial site. This section of sewer needed to be designed as a complete removal and replacement with a larger 30" diameter pipe. Due to the path of the sewer, the use of unique ductile iron pipe capable of being deflected into a curved path to follow the stream bank and maintain a watertight seal was needed. The ductile iron pipe also needed to remain corrosive resistant and hold up to harsh conditions along the stream bank.

To further complicate the design process, over 25 different property owners needed to be approached by New Castle County for easement, access and work zone agreements (including Delaware Department of Transportation, CSX Railroad and the aforementioned Ametek, Inc.). Much of the work also was required to follow strict DNREC and U.S. Army Corps of Engineers wetlands guidelines.

To top off the design constraints already mentioned, there are numerous historical sites along the banks of the Red Clay Creek (one of the earliest developed areas in Delaware). The primary sites of interest included mill races in Kiamensi, Marshallton (now the Ametek Industrial Site) and Greenbank. These areas required the project to have close involvement with the Delaware Historic Society and Preservation as they sampled and recorded excavations.



Installation of sewer casing under DELDOT's Newport Road Bridge and existing storm and gas utilities

MEETING THE CHALLENGES OF A DIFFICULT JOB

The project management team at Eastern States Construction decided the best course of action was to attempt the most difficult portions of the work first. In particular, the seven proposed tunnel "bores" located throughout the project (varying from 36" to 42" in diameter). It was believed once the tunnels were complete, connecting the pipe from tunnel to tunnel would be the quickest and easiest method of construction. This was also an advised course of action due to the unknown nature of tunnel work.

Boring techniques and the time taken to complete them vary greatly depending on the nature of the soil encountered. Our experience working in the Red Clay Creek valley led us to suspect rock, boulders, groundwater and a variety of soil conditions could be encountered in a number of the proposed bore areas. Boring in solid rock is a tedious and long process and boring in "boulders" almost impossible. While bores under Kiamensi Road, Old Capitol Trail and Newport-Gap Pike went smoothly, other areas presented problems. Solid rock was discovered in the proposed 160' bore under the CSX Railroad in Kiamensi and boulder type soil was encountered under Newport Road and the Wilmington & Western Railroad.

Fortunately, Delaware Department of Transportation was in the process of working on the bridge in Marshallton on Newport Road. Cooperating quickly with DELDOT, New Castle County and the Department's contractor, Eastern States' took the opportunity to offer a value-engineering proposal (both in time and money) by coordinating the possibility of doing the Newport Road work by open cut method within the work zone of the bridge. Time was of the essence as the DELDOT contract was coming to a close, but by aggressively planning the work, the casing pipe was installed in one week with minimal disturbance to their contract and completion date.

Similarly, when boulder conditions were discovered under the Wilmington & Western Railroad, Eastern States Construction and New Castle County cooperated in approaching the railroad owner to discuss open cutting the railroad. A suitable schedule was discussed that avoided peak use of the historic and scenic railroad and Eastern States quickly completed the open excavation, saving the owner costly rock boring expenses and added time to the contract.

While changing bores to open cuts was an obvious choice when available in rocky conditions, the CSX Crossing did not present this as an option. Being over 50' below the elevated railroad meant the only method of construction was tunneling. Our bore subcontractor, John Fithian Contracting Company, from Youngstown, Ohio took the lead on the solid rock bore under the CSX railroad. Full analysis of the rock encountered indicated the presence of Delaware Blue Granite, one of the strongest rock formations in the United States. Fithian coordinated with drill manufacturers in Germany to determine the best and most efficient model of drill to best work in this extremely strong rock. Even with this analysis, numerous failures of the gearing, drill head and bit design caused numerous shut-downs and problems. On some days, production would be limited to completing just 2-3 feet of tunneling. Through numerous trials and errors, a method of operation was developed which improved productivity and in early 2006 the bore was finally completed, after almost three months of work.



Boring drill head needed for Delaware Blue Granite

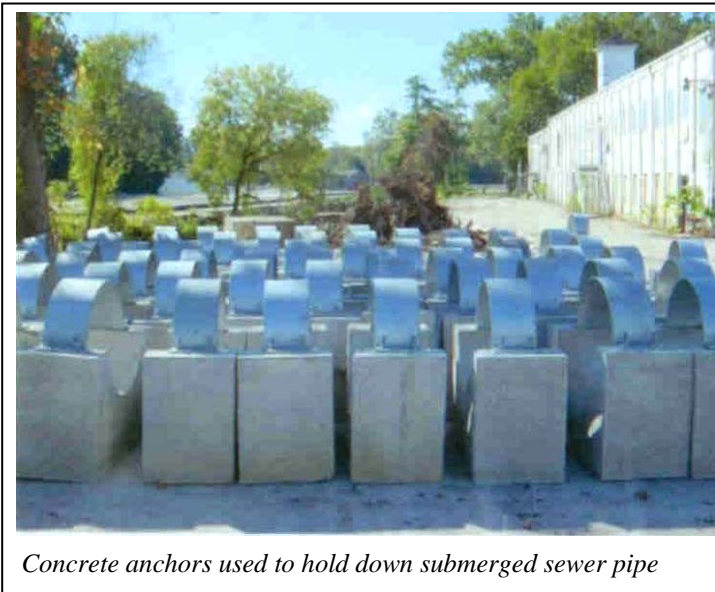
While much of the tunnel work was proceeding, Eastern States decided to tackle the second major obstacle of the project: the work within the Red Clay Creek itself, the removal and replacement of the submerged sewer along the Ametek property.

INNOVATION IN CONSTRUCTION TECHNIQUES AND MATERIALS

The work along the Ametek Industrial site presented a number of interesting and challenging issues, both in design and execution.

The first involved the curved path of the existing and future sewer line. This prohibited normal straight line design from manhole to manhole and required the use of ductile iron pipe that allowed bending of the joints while maintaining a watertight seal. TR Flex Ductile Iron Pipe as manufactured by US Pipe, Inc. met the requirements needed. With the use of a special restraining gasket, TR Flex pipe is almost impossible to pull apart and allows safe deflection up to two degrees. Deflecting gravity sewer pipe also presents problems during installation as traditional laser techniques used to ensure line and grade do not work. Each pipe as it was installed needed to be checked for elevation and alignment to guarantee proper installation.

Another difficult aspect of installing pipe in submerged conditions was ensuring the pipe did not “float” during installation or in its final use. The engineers designed the use of concrete anchors to be connected to each length of pipe using a galvanized metal band and bolts. Eastern States made the proactive decision to mass produce these weights ahead of time to ensure no delays during construction. But connecting two weights to each pipe length further complicated and slowed pipe installation.



Finally, the most difficult challenge of the work along Ametek involved the final method to divert the stream, access the work area with proper equipment, and complete the final bank restoration in an environmentally sensitive way. After much discussion and analysis, the final method was quite a creative and successful one.

It was decided to turn the pipe installation and restoration into a three-step process. The first was to create an access way and temporary stream diversion using 42” high concrete highway barriers, plastic sheeting and

a combination of soil, stone and existing rock. This created a flat surface as a work zone to ensure proper installation of the pipe to the degree of accuracy necessary. Although water remained an issue during construction the concrete barrier and plastic assisted greatly in creating a workable environment for the pipe installation.

At the conclusion of pipe work, backhoes and trucks slowly removed the temporary stream diversion while simultaneously installing the designed bank stabilization of riprap rocks. By completing this activity from the downstream end of the project first, it also ensured little disturbance to the natural stream environment.



Steps used to replace sewer in the Red Clay Creek (from upper left). 1) Diversion of the stream and creation of a work zone using concrete barriers. 2) Installation of the new pipe with concrete anchors. 3) Removal of the diversion barrier and installation of permanent stone bank. 4) Completed work zone.

EXCELLENCE IN PROJECT TEAMWORK

It can not be underestimated that cooperation between New Castle County and Eastern States Construction greatly assisted every aspect of this project. The allowance of work to be started in different areas at different times, while complicated easement issues persisted well past our start date, greatly saved overall time on the project schedule.

Similarly, the cooperation of DELDOT and Wilmington & Western Railroads to allow changes in their easement agreements saved both time and money for the owner.

In many ways the traditional thinking of starting a sewer project at the low end and working “upstream” would have led to costly work stoppages and a much greater time for completion. It was everyone’s cooperative effort to “think outside the box” that led to numerous cost and time saving measures.

There were plenty of other entities that also assisted in the project. The Delaware Historic Preservation's active participation in our daily routine while digging in potentially sensitive areas caused minimal impact to our work while allowing them adequate time and access to collect valuable information about our State's historic past.

The cooperation of CSX railroad during the lengthy rock bore and many property owners along the sewer's path should also be recognized.

And as with most projects, the quality work done by our subcontractors should not go unmentioned.

CONCLUSION

In conclusion, the Red Clay Sewer projects presented the type of unique challenges that makes working in construction so satisfying. The fact Eastern States Construction worked with such a cooperative owner and design team further led to our great sense of accomplishment at its completion.

Eastern States Construction is proud to be a continuing contributor to New Castle County's improvements to the infrastructure in Delaware.