Central Alabama's Valley Creek Wastewater Treatment Plant Rebuilt

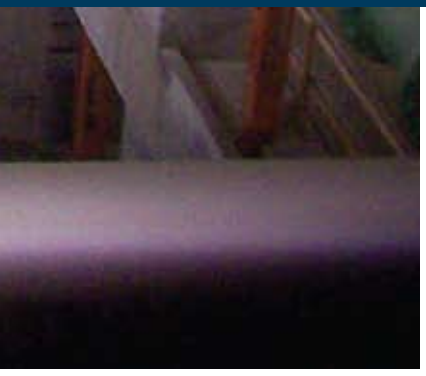
The pump station cracked like the spine of a book.

When Central Alabama received an unexpected deluge in the Spring of 2005–10 inches of rain fell within a 24-hour period–it caused massive flooding and significantly raised the ground water table around the Valley Creek Wastewater Treatment Plant in Bessemer, which had been completed three weeks earlier.

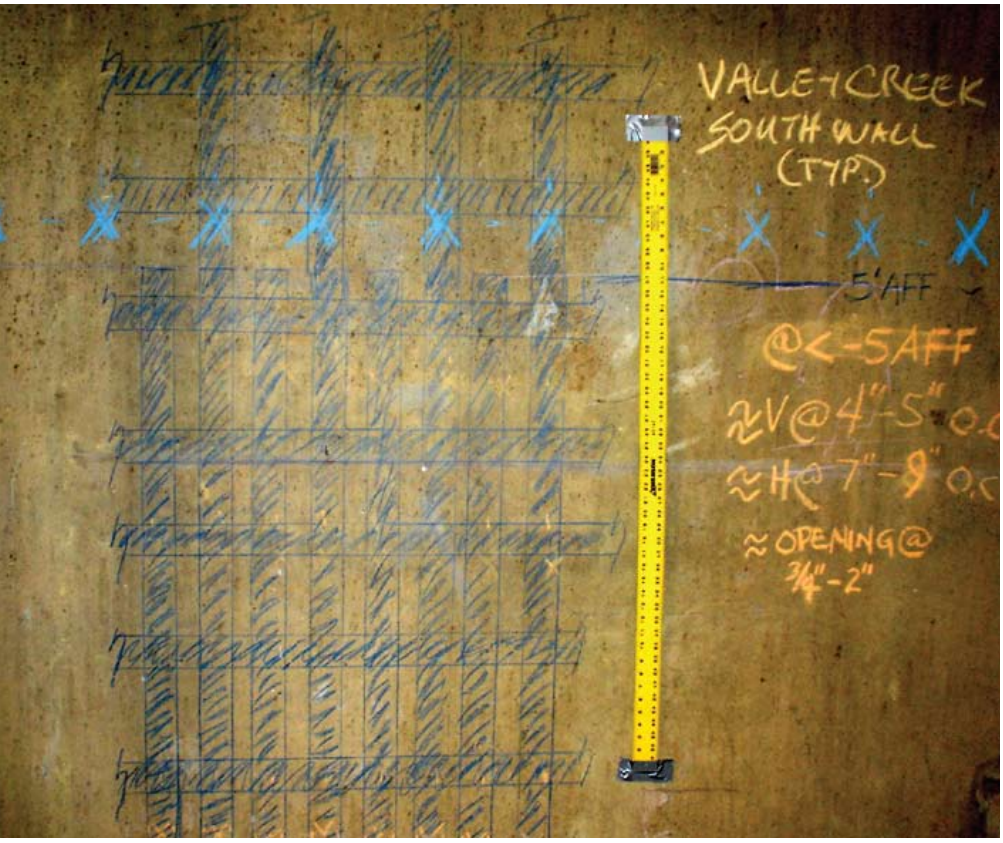
This rapid rise in the amount of ground water caused the 5-foot-thick floor of the plant to shift upward 2 ½ inches. Under this tremendous hydrostatic pressure, the walls, beams and piping structure of the massive building suffered extensive damage.

The influent pump station had floated upward 2 ½ inches cracking concrete columns and beams, along with pipe supports. The hydrostatic pressure that was exerted on the walls and floors caused 1-inch-thick steel pipes and 1 ½-inch diameter flange bolts to pop and stretch. The pump station cracked like the spine of a book, down the length of the wall between the wet well and the dry well. The fact that the wet well and the upper wet well were full of water kept the upward movement limited to 2 ½ inches and prevented further damage.

CSDA Contractor Wins Award for Its Work



This building, approximately 360 feet long, 216 feet wide and 100 feet deep into the ground, was an integral part of a $328 million dollar facility designed to serve the Jefferson County area of Alabama. Capable of handling 300 million gallons of wastewater per day, the Valley Creek Wastewater Treatment Plant plays a big part in the future growth of Birmingham and Jefferson counties. The leaders of Jefferson County did a global search to find an engineering firm that would take on the task of designing the repairs for this at-risk structure. No one wanted to put their company's fortunes at risk on this one-of-a-kind project that had many eyes watching.



Hole and rebar placement were identified on face of walls to avoid confusion.

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After 15 months of forensic engineering by Walter P. Moore of Houston, Texas, a plan was presented and accepted by Jefferson County to repair the pump station. The general plan was to add bulk to the structure by adding 2 to 5 feet of concrete thickness to the walls. This would require the drilling of approximately 25,000 holes for steel reinforcement bars. In addition, approximately 696 holes would be drilled through the 5-foot-thick concrete floor to place rock anchors 25 to 30 feet down into the bedrock. Concrete beams and a whaler beam in the wet well and the upper wet well and massive steel beams in the dry well were also needed to keep the walls from moving inward.

Brasfield & Gorrie of Birmingham, Alabama, was selected to be the General Contractor of this project. In April of 2006, Mark Westhoven with Brasfield & Gorrie contacted ABC Cutting Contractors of Bessemer, Alabama, for help in estimating and engineering the dowel holes and general demolition on the project. The work was slated to start in August 2006.

One of the greatest problems faced by workers was that the work site was a confined space below the ground. Proper ventilation was a major concern. The dry well in the center of the structure had space for airflow but the wet and upper wet wells did not. Since airflow, down in the wells, was almost nonexistent, special care had to be taken to eliminate the generation of any kind of dust. For this reason, no gasoline or diesel engines were allowed to operate in the work area. "This was the most 'safety-conscious job' I've ever worked on. We had people working in areas where there was little to no oxygen and we had to stay on top of safety at all times," said ABC project manager, James Hudgins.

James Hudgins supervised three to four different crews, with foremen P. J. Beavers and A. E. Solomon, while working for Brasfield & Gorrie and sub-contractors Hayward Baker, Griffin Electric and Superior Rigging. Keeping priorities straight was a challenge since they could change in the middle of the day. Mike Clowdus (project superintendent) and Dewayne Oliver (mechanical supervisor) of Brasfield & Gorrie coordinated with ABC and all subcontractors since engineering was constantly inspecting the site and work assignments had to be flexible.

The first order of business was to start drilling the dowel holes in the dry well. The walls were laid out for rebar by Bhate Engineering using ground penetration radar (GPR) technology. At first, Bhate was marking every bar, horizontally and vertically. After some discussion, ABC recommended only laying a small "window" of bars around the dowel hole locations. It was determined by Walter P. Moore that some bars were in compression while others were in tension, so it was important that in certain areas only air drilling would be allowed. The lower 14 feet of the dry well could be air drilled, the least costly way, or core drilled if the first two attempts by air drilling did not work. The next

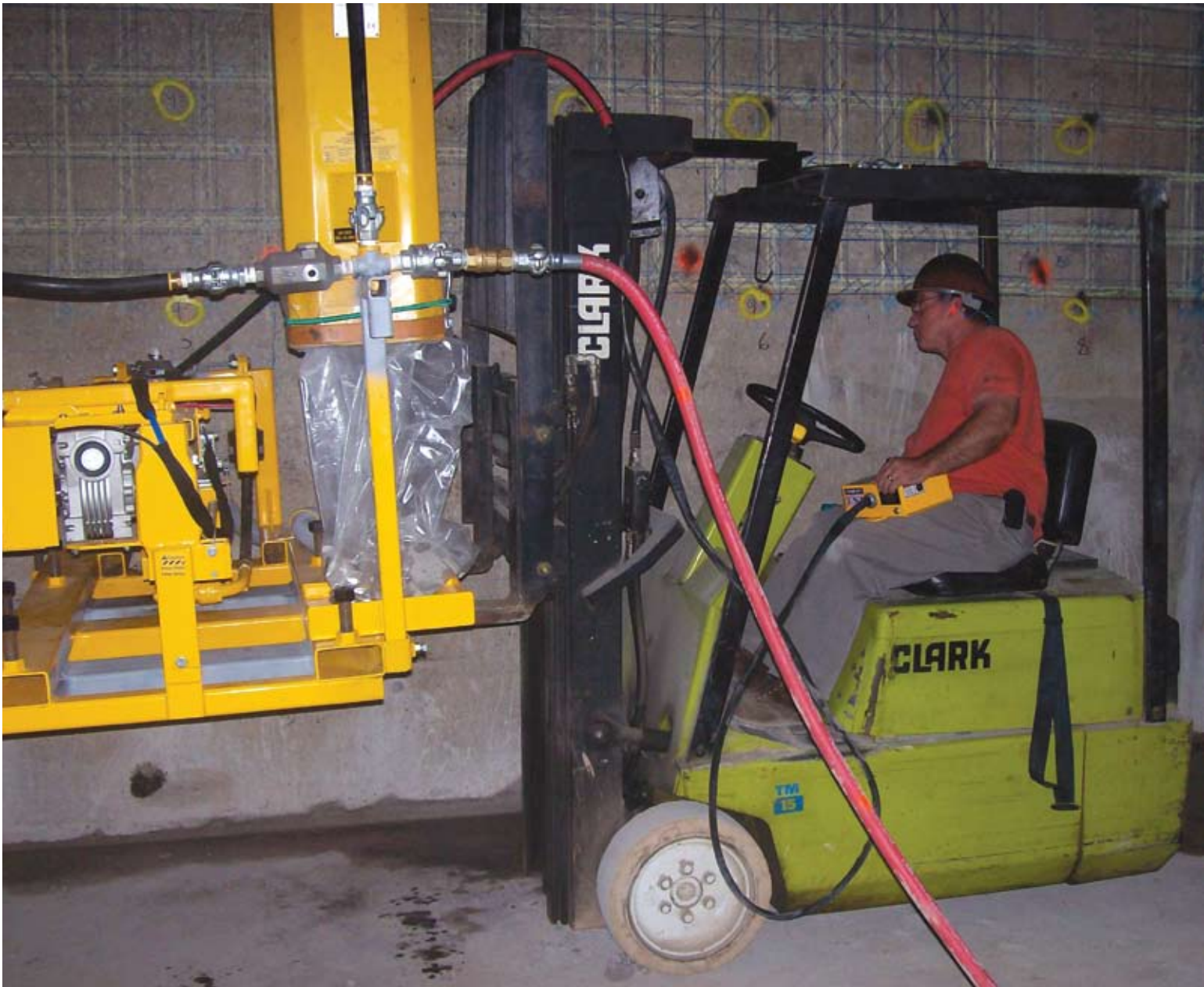
14 feet, located above a 3-foot-thick walkway, could only be air drilled because the rebar could not be cut. Dowel bar holes varied in size from 1 3/8-inches diameter and 19-inches deep, (lower walls & floor) to ½-inch diameter by 6 inches (upper 14 feet of wall). In general, dowels were to be on a 2-foot by 2-foot grid on the walls and an 18-inch by 18-inch grid on the floor.

The new walls were 5 feet thick and contained four mats of #11 rebar. The walls above the walkway were 2 feet thick with two mats of rebar. These mats were to go through the 3-foot-thick walkway between floors, which had to be core drilled because of the heavy concentration of rebar in this concrete. This became typical for the rest of the walls around the inside of the dry well.

More than 9,900 dowel holes were air drilled and 4,500 holes were core drilled in the dry well area. Most of the concrete cores contained four to six pieces of #11 rebar. Brasfield & Gorrie assigned a man to count, measure, and document the dowel holes. Everyday, ABC & Brasfield & Gorrie would agree to the quantity, size and depth of the completed hole. Based on the quantity of holes, Brasfield & Gorrie made it clear that hole tolerance was important, not only for the integrity of the newly poured concrete walls, but also because extra deep holes would require a considerable increase in epoxy on the dowels and result in increased costs.

Hayward Baker, the rock anchor sub-contractor, discovered that the floor was reinforced with four mats of #11 rebar. ABC assured Hayward Baker and the Brasfield & Gorrie personnel that they were capable of drilling their 696 holes without interfering with the dowel hole production. These holes were 6 inches in diameter and 61 inches deep. Each anchor hole would require six hold-down bolts, for a total of 4,100 more air drilled holes. Bhate used GPR to find the location of the top steel mat for each hole. Walter P. Moore wanted to save the integrity of the top mat so the holes were positioned in such a way that the bars were "mooned" in lieu of fully cutting a complete bar. Each core was catalogued and inspected by an engineering firm to record which bar was cut and the direction of each bar in the core. James Hudgins used a roll-around-fork lift to pull each core out of the hole and then place the core for viewing by the inspectors.

ABC personnel designed a way to mount an air drill on a platform that was then mounted to an electric forklift.



Core drilling floor holes for anchors.

Water and slurry were captured in different ways and disposed of by leeching out the water and then shoveling the solids into skip pans. Cores, dust and debris were cleaned up each day and placed in a skip pan. Wet vacuums picked up the slurry water and dumped it into a hopper with a 4-inch-diameter hose to the lower sump area. This skip pan had a filter bag to leech out water and retain the solids.

Conventional core drilling with water and air drilling were considered for this project. Overall cost was an issue and the difference between air drilling and core drilling 25,000 holes was estimated to be $1 million. ABC air drilled many of the holes, only core drilling when steel presented itself in a manner that precluded the faster, less costly approach. Decisions by the engineering firm Brasfield & Gorrie and ABC were sometimes made daily as to which holes would be drilled by one method or the other.

Air drilling holes into the walls with no water presented challenges to ABC since they were down 100 feet below ground level in a confined space. If any dust were generated, all personnel would be in full respirators and the constant maintenance of each person's respirator would prove time consuming. This would add tremendous cost to the overall project since productivity would be diminished considerably.

The fact that many of the holes were located as high as 14 feet off the floor required creative thinking in how to get the equipment to the correct height and keep it drilling level, as well. Standard lift equipment was slow to position and would add additional costs.

Hudgins and the ABC maintenance shop personnel designed a way to mount an air drill on a platform that was then mounted to an electric forklift. The air drill was outfitted with a remote control and special dust collection system that amazed the safety and air quality personnel – no one would have to wear respirators since the concrete drilling dust was totally contained.

In order to facilitate the pouring of the 2-foot-thick floor and the reinforcing walls, it was necessary for ABC to remove existing stairs, beams, fan pads and concrete filets. Primarily using its Brokk 180, ABC with help from a CSDA member, Ron Dailey of True-Line Coring & Cutting, attacked the concrete demolition and removal. The first items to go were four 2-foot by 12-foot by 12-foot fan pads, which were found to have been filled with a heavy concentration of scrap steel. The smaller stairs proved to be easy work for the Brokk.

The overhead beams were cracked and the plan was to wire saw them out. ABC presented the idea that the Brokk could be used to remove only the concrete, leaving the rebar in place. This would make the repair much less costly, safer and greatly increase the integrity of the repair. A Brokk 90 was brought in from True-Line and walked out on a shored-up walkway to remove the concrete from one of the beams that was 65 feet off the floor. In the wet well, a 3-foot by 3-foot concrete section along the three outside walls was removed by using the Brokk. Dust control was a simple matter of adding a water mister.

The most challenging demolition was the two flights of stairs, 4-foot wide by 65-foot long and 52-foot high, in the wet well along the walls. Conventional cut and pick techniques could not be used due to the limited access caused by the roof. The Brokk 180 was walked up the long stairs and began removing the concrete and steel rebar as it backed down. The operator was able to be safely removed from the machine by using the remote control from a lift. The first stairway proved to be the learning curve taking three days and the second was done in 1½ days.

W. P. Moore wanted a ¼-inch amplitude of roughening along the floor and 10 feet up the walls to bond the new concrete to the old. This required using the Brokk 180 again to scarify some 15,400 square feet using a roto-mill head. The dust control issue was again handled by the ABC shop personnel as they designed and added a water mist manifold to the front of the cutting head.

As the dry well work progressed toward its conclusion, the wet well and its many problems came to the forefront. The wet well was treated as a confined space and was off limits until ABC opened the roof to this well. The first three openings were 6 feet wide by 20 feet long through 10 inches of concrete and 10 inches of hollow core. The openings were adjusted to match the spacing of the hollow core panels. The three 20-foot lines were wall sawed and corner cut. The 6-foot ends were wire sawed to avoid any over cuts that might weaken the roof. Prior to this, Brasfield & Gorrie had ABC scarify the 10,000 square feet of the wet well roof and then 18 inches of reinforced concrete was poured around the openings to cap the wet well roof. The concrete cured to its maximum strength. ABC proceeded to the next set of openings and the process was repeated again. The first openings were for ventilation. The next three were for a buck hoist and a set of stairs.

After the installation of the buck hoist, the safety monitor needed to clear ABC for entry each day before they were allowed to enter the north section of the wet well. This well was divided by two baffle walls with two openings in each.

The completion of the last six openings allowed for ventilation fans to be installed that would change the atmosphere in the wet well 12 times per hour and therefore lessen the danger of methane gas and decreases in breathable oxygen. It also made the well an "ice box."

There were no walkways in the well so the dowels went from the floor to a height of 32 feet. The dowels were similar to the dry well except for the ones penetrating the baffle walls & sump walls. ABC preceded to air drill 5,870 holes and core drill another 1,920 holes in the wet well walls and floor.

The 6-inch by 61-inch anchor holes in the south side of the wet well were saved for last. Because of the water table and underground streams, Hayward Baker had ABC drill an experimental hole on this side to see if the ground water would present a problem. As the driller broke through the 5-foot floor, a 10-foot column of water pushed the concrete core, the bit and the drill out of the hole. In 15 minutes, the entire southern wet well had 6 inches of flowing water across the floor. After plugging the hole, Brasfield & Gorrie began the task of lowering the water table by placing eight well point pumps on the outside of the plant and pumping it down. As work moved into the lower sump and the southern end, water, while still an issue, could be controlled by various pumps and stand pipes.

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From the left: James Hudgins, Project Manager on the Valley Creek project, and Jeff Marshall, ABC Branch Manager, accept the award from AGC Alabama.

The inside walls were braced by new and larger beams through the baffle walls and a whaler beam that was 8 feet wide by 5 feet high along the 360-foot east wall, at a height of 52 feet. Dowel holes were necessary in the outside walls and through any interior walls for the whaler beam.

The complexity of the job required ABC to use all of its various concrete cutting equipment as well as adapt this equipment to the unique circumstances of this particular project. ABC used operators from its other branches in Montgomery, Mobile and Huntsville. "It was also one of the smoothest jobs we've had in years. With all the different teams working hand-in-hand and the organization of everything involved. It was an excellent team effort," said Hudgins. All totaled, ABC air drilled 18,770 holes, core drilled 7,120 holes, removed some 150 tons of concrete, prepared surfaces for bonding and did it all without a lost time incident.

Mike Clowdus of Brasfield & Gorrie stated in the beginning that ABC was the critical path and that it was paramount for them to get out in front and stay there for the duration of the project. Mike later commented, "Throughout this entire project, ABC stayed on track and ahead of schedule. With a lot of hard work, creative thinking and good old-fashioned ingenuity, ABC did their part to make sure that the Valley Creek Wastewater Plant was back online in short order."

For its outstanding work on this unique project, ABC Cutting Contractors was awarded the Specialty Subcontractor Build Alabama Award for 2008 by the Associated General Contractors Association of Alabama. The ceremony was held on January 4, 2008, in Birmingham, Alabama.

COMPANY PROFILE

ABC Cutting Contractors of Alabama is headquartered in Bessemer, Alabama, and has offices in Huntsville, Montgomery and Mobile. Established in 1986, ABC serves Alabama, Mississippi, and the panhandle of Florida with 45 trucks. The company offers services in core drilling, slab sawing, hand sawing, wall sawing, wire sawing, road and bridge grinding and grooving and Brokk demolition. The company focuses on customer service and safety is their top priority. All the offices joined CSDA in 2004.

RESOURCES

General Contractor:
Prime: Brasfield and Gorrie
Birmingham, Alabama
Subcontractors: Hayward Baker, Superior Rigging and Griffin Electric
Sawing and Drilling Contractor:
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Bessemer, Alabama
Tel: 205-425-7711
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Methods Used: Core Drilling, Wall Sawing, Wire Sawing, Hand Sawing, Air Drilling