Walking through the jobsite trailer at the Yellow River Water Reclamation Facility was enough to tell me things were different from other treatment plant projects I have visited. In the short time I was on site, I had the opportunity to talk with the major players associated with this project. The true reason for the success of the project, however, was clearly demonstrated during a short break about halfway through my day of scheduled interviews. I was amazed just watching the team, in casual discussion over lunch, toss out suggestions and issues being faced on the job. The engineer asking input from the contractor, the plant operator offering suggested modifications to increase efficiency of plant operations, and the contractor proposing a change in design to reduce costs and shave time from the schedule.

That easy, everyday conversation which netted tangible results truly represents the strength of this construction project—the collaboration, the sharing of knowledge, the integration of the incredible power and expertise in one room dedicated to a common goal.

This project is unique when combining its sheer size with a design and construction model not commonly used in the water and wastewater treatment industry. We knew from the start this project would be different from most others we had been involved with, and we were right. Along the way the collective team learned lessons, celebrated accomplishments, and worked through setbacks, but the key is they did it together—and they surfaced at the end triumphant because of it.

The story that unfolds in the following pages represents the backbone of this project—the mechanics of what made it work, the stumbling blocks along the way, and the great people who made it all possible.

CRYSTAL DELLECHIAIE
PC Construction Company
Gwinnett County Department of Water Resources’ objective was fairly straightforward: upgrade the existing Yellow River Water Reclamation Facility (WRF) to replace the wastewater treatment process, increase plant capacity from 14.5 MGD to 22 MGD, and improve the effluent quality. While this project could be viewed as just another major treatment plant renovation on the surface, the path taken to achieve that goal was anything but ordinary.

The Georgia-based facility, which was originally constructed in 1979, needed substantial structure and equipment upgrades and replacements. The scope of the $250 million construction project also included high-level, advanced treatment methods to meet the stringent discharge limits required in Georgia. Major facilities for construction included a preliminary treatment building for screenings/grit removal, primary clarifiers, equalization tanks, fine screens, biological reactor basins, a membrane facility, U.V. disinfection, chemical feed systems, a plant odor control building, a sludge pump station, an operations building, and a maintenance building. All work had to be completed without operational disruption and required phased decommissioning followed by new construction.

When Gwinnett County originally began plans to move forward with this project, they took a look at all construction options. They had previously utilized the construction management-at-risk (CMR) delivery method on other construction projects and recognized the significant advantages this integrated delivery method could have for the Yellow River WRF project. Hiring CMR partners would increase Gwinnett County’s control over the design phase, as well as the construction of the project, and allow the project to be completed quicker while taking advantage of cost savings along the way. They specifically wanted a fully integrated project team that would work together to manage the implementation of multiple design and construction phased packages through a rolling Guaranteed Maximum Price (GMP) procurement process. By utilizing multiple GMPs, Gwinnett County recognized they would be able to better coordinate available funds with the design effort to ensure certain areas were constructed based on the priority of plant needs.

Those advantages tipped the scales. Rather than a traditional design-bid-build or integrated design-build arrangement, the County elected to move forward with a modified CMR delivery method and contracted separately for design and construction services. This decision turned out to be the defining element in the project’s overall success.
Although Gwinnett County had utilized the construction management model previously, the request for proposal for the Yellow River WRF project was unique. Gwinnett County understood that a complex project like this would bring in a variety of designs from the competing firms, making comparison and the ultimate selection difficult. As a result, they hired Hazen and Sawyer to create a basis of design report for the competing designers to use as a guideline. Eighteen months later, the design proposal was solicited and the engineers, Jacobs (formerly Jordon, Jones and Goulding, Inc.)—the engineer of record—in collaboration with CH2M Hill and Precision Planning, Inc. (PPI), were selected through a qualifications-based process in 2006. An independent law firm was then brought on board to help provide a clearer picture of the contracting methodology and the risks Gwinnett County would assume as the owner under this contract model. Within the next year, the project team was finalized with selection of PC Construction Company (PC) as the contractor.

The basic functional structure was formed early. The contract incorporated a rolling GMP that grew as the design progressed and project scope was added, allowing for increased flexibility in joint decision-making and, ultimately, the execution of work. As the scope was determined, the County Administrator issued task authorizations to fund multiple phases of the work and the related GMPs. As the project continued and the County was satisfied with the project’s progress, the task authorizations increased. This process allowed Gwinnett County greater flexibility to work directly with the engineers and the contractor to coordinate the necessary plan for designing and constructing the project.

From the start, the size of the project and the proposed delivery method caused concern for bonding companies. Gwinnett County's desire to secure a bond for the full $250 million, coupled with the loosely defined project scope, led to a delay in contract execution. While those details were ironed out over the course of the next six months, Gwinnett County moved forward with the creation of the Design Development Report with Jacobs/CH2M Hill/PPI.

That action would turn out to be the first lesson learned for this team. The early wastewater treatment process decisions and related conceptual designs were made without the benefit of PC’s input on cost and constructability. As the project moved forward, the team realized the impact on the design process was greatly influenced by the involvement of a collaborative team—owner, engineer, and contractor—as early as possible.
RELATIONSHIPS AND PERSONALITIES GROW TOGETHER

Anyone who has worked on an integrated delivery project knows the importance of relationships. The strength of the team’s interpersonal relationships and the overall collaborative environment can make or break a construction project. In this case, the major players on the team had recently completed a large design-bid-build project in the area. Those well-established relationships immediately carried over to the Yellow River project, allowing the team to start off with key players already in sync and ready to dive into another project together.

But along with that synergy came bumps in the road. The project team was made up of many people who brought different skills to the project and the delivery process. As work progressed, identifying those individuals who were best-suited for this type of delivery was critical.

“The specific people on the project really make a difference,” said Mike Joseph, PC Project Manager. “If you throw a few of the wrong personality types in there, it just doesn’t work.”

Everyone had to be able to set aside their way of doing things and commit to building the best possible project for the owner. People who found it difficult to work in this delivery approach moved on to other opportunities. Extra effort was taken to make adjustments to the teams and eliminate those who could hinder the collaborative mentality of the project. Once the team was in place and working well together, the project experienced a rapid increase in team effectiveness.

“You could have the same delivery method and a different team and we wouldn’t have had the same product,” commented Adam Minchey, Gwinnett County Department of Water Resources Special Projects Manager. “You could have the same team with a different delivery method and it wouldn’t have turned out the same. The delivery method was the tool we needed to get the job done, but it really took the team to make it successful.”

Getting the project under way was certainly an adjustment for many team members. Three diverse groups—the contractor, the designers, and the owner—came together with preconceived notions about the contract and how the process would flow. Perceptions were different from the start and required a conscious effort to break down the normal barriers that exist on a traditional design-bid-build project.

Members of the Yellow River team discuss challenges and opportunities
“On a typical competitive bid project, the construction and engineering teams charge ahead in their own territories,” explained Jim Grum, Jacobs Senior Project Manager. “If an engineer is scratching his head trying to decide between two different methods of doing something, he might just pick one. But here, we had an incredible amount of knowledge available to us through PC. There was definitely a learning curve on the project just to get people really thinking about how to act like a team and to use all the resources they had available to them.”

In addition, although PC was ready to start building a $250 million project from day one, Gwinnett County, wanted to slow down the process and have the entire team work for six months on planning, designing, and scheduling before beginning major construction elements. So when PC stepped foot on site with only a $4 million pump station to build, it was an eye-opening experience. Imagine a room full of eager construction guys ready to start moving dirt instead spending their days poring over plans and outlining, with the owner and design teams, the details they would later build.

Although there was an effort to help all team members understand the difference between this project and a typical design-bid-build project, more time spent on ground rules could have benefited the early stages of design and construction. Jacobs/CH2M Hill/PPI tended to feel pushed with limited resources and time to complete the design work. At the same time, PC’s resources were split between working with the designer and executing work required for construction. More attention to the intended processes established for the project may have fostered a consistent understanding from the beginning. An executive-level review of project requirements and processes between all parties may have also helped eliminate some of the initial confusion.

However difficult it was to switch gears, the combined knowledge of Gwinnett County, the Yellow River WRF plant personnel, Jacobs/CH2M Hill/PPI, and PC working in an integrated format early in the process allowed for many successes before construction even started.

- The plant personnel provided insight on plant maintenance and operation while helping PC identify existing utilities and determine how the plant utilized those pipelines. That information aided in the design of plant facilities and helped plan the various construction sequences. Issues and problems were considered early and overcome before they could impact the design and construction work.
- There were many times during the project’s design phase when PC’s constructability suggestions moved the design for a particular building in a direction that benefited both the cost and schedule.
- PC’s estimating group was able to work directly with Jacobs/CH2M Hill/PPI and Gwinnett County to gain knowledge of the design at various stages. This interaction and the resulting cost information associated with project elements further enhanced the decision-making process as the design moved forward in multiple areas of the project.
- PC’s early knowledge and understanding of the intended scope allowed their office and field personnel to participate in procurement, planning, and scheduling, and resulted in a more efficient construction effort and reduced project cost.
The first order of priority for Gwinnett County was to get the teams truly working together as a unit. One of the first steps in obtaining that goal was to break down the barriers by combining the teams under one roof. Every trailer housed a mix of Gwinnett County, Jacobs, CH2M Hill, PPI, and PC people.

Contracting issues typically place restrictions on housing construction personnel in the same trailer with the owner and engineer. Without those limitations, managers from the project team sat in offices side by side. Information concerning the project was open to use by all parties. Communication, which is often one of the greatest challenges on large construction projects, was made easier by housing all related parties together.

“The goal was that if someone walked through the door, they wouldn’t know who you worked for,” recalled Kristin Wilson, PC Field Office Manager. “What they would see was everyone working together to make this project a success. I’d say that goal was achieved—you can definitely see the difference it made.”

Field personnel also started seeing the signs that things truly were different on this project. The normal barriers separating the team members no longer existed and they were expected to function as one team under one roof.

“It took a while for us to figure out that the normal line wasn’t there,” said Rick Fisher, PC Project Executive. “We had people sitting next to people they normally wouldn’t work with. For example, quality control people were placed in our superintendent’s trailer. That was unheard of! That was the enemy in the old days. Normally we are in the role of protecting that line but here, steps were taken specifically to blur it.”
“I don’t know how many construction jobs you go to where you will see the owner, the contractor, and the engineer sitting literally next to each other in the same trailer complex,” said Adam Minchey, Gwinnett County Department of Water Resources Special Projects Manager. “We are a truly integrated team here and it didn’t happen overnight. It took some time to get the mind-set wrapped around the fact that we aren’t adversaries; we are actually all working toward the same goals.”

This joining of resources was viewed in many different ways. Some questioned if it would work and others embraced the idea. Regardless of those perceptions, what actually happened speaks loudly about the process. The Yellow River WRF plant personnel and the engineer’s field group worked closely with PC supervision, sharing information valuable to the construction effort. In turn, PC people brought a wealth of construction knowledge and ideas on how to accomplish the work.

“Everyone acted as a single team whereas with a competitive bid job, everyone is on a different side of the fence,” said Fisher. “On most jobs, everyone has their individual agenda but here we have one collective goal.”

By physically working together every day, the teams began to understand what it took for the others to do their jobs. That understanding fostered a more open environment for the team to collaborate and learn from one another to provide the best possible project outcome for the owner.
With the fundamentals of the project situated, attention turned to the core components supporting the actual execution of construction: planning and scheduling, estimating and GMP development, procurement, and accounting and administration.

Planning and Scheduling

Following PC’s selection and prior to receiving a contract, the team began sharing information informally. During that time, PC visited the site on numerous occasions to review plant functions with the engineers and facility staff. It became obvious that there were key people who understood the plant operations, knew where underground utilities were located, and were aware of how the plant was using those facilities. From these early interactions, PC was able to determine what portions of the plant were in service and why and what areas were not required for plant operation. This early information was crucial to the planning and scheduling effort.

The project team decided to put together a comprehensive, summary-level schedule for the proposed project’s scope based on the Design Development Report (DDR). While PC’s estimators were working on a conceptual estimate for the project, the project team was developing a coordinated plan and schedule.

Once the plan was decided by the project team, the design development was further expanded. This expansion of the schedule was critical to ensuring the design work coordinated with the construction plan—not an easy task and certainly one that took time and involvement from the entire project team. There were missteps along the way, but the team gradually became more accustomed to the needs and concerns associated with each firm’s role in the project.

As design development progressed, PC expanded the schedule detail to evaluate the impact the design effort was having on the original scope of the summary schedule. Many decisions were made during this time concerning how to best facilitate procurement and construction work while coordinating those efforts with plant operations. As the detail and complexity of the schedule grew, the interrelationships of work in the various areas of the plant became more evident and the project team was able to adjust the plan to meet the challenges. Critical to the success of this process was having that solid, comprehensive summary schedule at the start of the project. Because adequate time and resources were committed to this effort, the plan proved to be effective.

Project scheduling had to be communicated to all involved parties on a continual basis. The project team met twice each week to review schedule updates and discuss what was actually occurring on the job compared to what the schedule indicated for progress. This meeting became a way to share ideas, discuss changes, review big-picture issues, and address other project concerns. At times, PC’s corporate scheduling group assisted in reworking and expanding the schedule and plan for the job.
Planning and scheduling on this project was an ongoing, continuous process involving every member of the Yellow River WRF project team.

**Estimating and GMP Development**

Initially, PC worked with Gwinnett County and Jacobs/CH2M Hill/PPI to develop a detailed conceptual estimate for the scope of work included in the Design Development Report. These documents became critical to Gwinnett County’s ability to determine the ultimate project scope and plan execution in various construction phases. During this time, Gwinnett County decided to eliminate the solids handling process from the project’s scope—a particularly important decision that had a substantial impact on the planning, design, estimating, and scheduling for the job and eliminated potential budgetary issues.

PC continued to provide certain preconstruction services as the design progressed and Jacobs/CH2M Hill/PPI were responsible for developing multiple design packages consistent with the schedule for construction phasing. At designated times during the design process, PC provided a GMP for work related to the construction of particular project phases under design. All aspects of these services were handled with an open book mentality, allowing Gwinnett County and the engineers access to all information at any given time.

Concurrent with the estimating process was the commencement of construction activities to prepare the plant site. This initial construction effort produced valuable information that was analyzed and incorporated into the estimates, planning, and scheduling for the overall project.

Once agreement for a particular GMP was reached, PC developed budgets and schedules to manage the work. PC was often able to proceed with work related to that GMP before formal agreement was reached, creating significant flexibility for the project team. This estimating/GMP process involved multiple design packages occurring simultaneously and spanning two years.

As each design package reached the stage of 60-90% completion, PC moved forward with the associated estimate. Leading up to that point, PC worked with subcontractors and vendors assisting Jacobs/CH2M Hill/PPI with the design to ultimately secure competitive pricing for the GMP. There was continuity among the various phases of design, estimating, procurement, and ultimately construction.

Although estimating and GMP development went well, the team identified some points that could have increased the efficiency of the process, including:

- Assigning PC estimators to the project full-time and locating them on-site during the project’s preconstruction phase would have allowed for more day-to-day interaction with the designers and eliminated some of the time constraints resulting from PC’s bid schedule.
- More consideration should have been given to the division of work packages. With a total of 12 GMPs over the course of the project, it was difficult for everyone to understand how the scope was divided. It was confusing divvying up the reporting, phasing, and logistical components of the job, especially with some work overlapping several GMPs.
- Site work and yard pipe should have been combined into one GMP, but packaging the two was difficult because of changing project concepts and designs.
In addition, the value engineering process could have been approached differently with more involvement from the estimating group. Estimating proposed a lot of ideas once the initial design was created that resulted in unexpected redesign costs not originally included in the contract.

**Procurement**

Procurement for the Yellow River WRF project occurred in multiple phases as the design effort progressed and a GMP was determined for the respective work. PC developed a procurement strategy that considered project components common to every GMP, such as concrete, rebar, piping, and valves, and also outlined measures to develop competition for the materials and services.

Some major purchases had to be made using estimated quantities and sizes at the time of the initial conceptual estimate. Information for equipment and systems was also required early in the design effort, requiring PC to identify long-lead items for each GMP package and work with Gwinnett County and Jacobs/CH2M Hill/PPI to select equipment and systems for the best value. This allowed Gwinnett County to get the items they wanted at a time when the project could benefit the most.

Two of the most significant procurement decisions were made early on. An electrical subcontractor, Cleveland Electric, and instrumentation and controls subcontractor, Invensys, were contracted by PC with contracts that included a fixed fee, both similar to PC’s contract with Gwinnett County. As such, these two key subcontractors became fully integrated into the Yellow River team and provided significant contributions to the project’s success.

Although several subcontractors were brought on board for their specific expertise, PC’s proven self-performance experience provided incredible flexibility as the project advanced with significant site, concrete, and mechanical work. At the project’s peak, as many as 250 skilled PC tradespeople were on site, and changes were incorporated on the fly with minimal disruption to the flow of construction operations.

“Our people were on site from start to finish,” commented Rick Fisher, PC Project Executive. “We were able to move our crews around to perform work as needed rather than having multiple subcontractors come and go based on demand. This flexibility allowed us to better control safety, schedule, and quality.”

**Accounting and Administration**

The project’s accounting functions were also integrated from the onset. The contract required PC to maintain an open book for all aspects of the project. The team evaluated the methods Jacobs/CH2M Hill/PPI used to approve documents and account for costs. The team maintained joint records in one place to avoid duplication of effort and provided all project team members with access to the information. This document control system proved to be effective throughout the duration of the project.

Set procedures for accounting and administrative tasks were defined by the team. The accounting of costs generally followed the procedures used by PC with additional processes folded in as required by the multiple GMP structure. It was determined that separating the cost for work by GMP was essential to monitoring and estimating accurate work completion costs. The project utilized multiple budgets to cover work in different areas throughout the project. Working with multiple budgets was a learning process for everyone, involved additional work for the accounting group, and created confusion at times. To complicate matters, PC converted to a new Enterprise Resource Planning module that required extensive training and the adoption of new accounting procedures. As the project progressed, everyone adjusted to the processes and adapted to challenges encountered along the way.
THE GREEN LIGHT ON CONSTRUCTION

The significant time invested in design, scheduling, and estimating helped shape the project's construction phase. The give and take continued as the team worked through the process of actively constructing the scope of certain GMPs while continuing design for future work.

“The biggest challenge for us was to take care of business with the owner, gain consensus, and collaborate while maintaining a sufficiently fast pace to keep up with the constructors,” said Chuck Crandall, CH2M Hill Design Manager. “The engineering and construction team members worked together to identify the design work elements required to most efficiently advance construction progress. With priorities established and agreed, the design approach and sequencing was adjusted to match field needs.”

Challenges arose as PC wanted to keep chugging along the construction train yet needed answers and support from the design team who were, at the same time, aggressively designing other aspects of the project.

“Once we were able to get the design and got under way with construction, we just had to keep going,” said Bob Huie, PC Senior Project Manager. “The engineers were constantly getting barraged with questions regarding the information they supplied and that bogged down their ability to move forward with the next phase. Sometimes we just had to back up and slow down. That’s all part of us understanding better what the engineer needs to do their work so that later, when we are doing our thing, it is right.”

As the teams in the trailers got accustomed to the give and take of working together, the crews in the field also got their first taste of completing construction operations under a CMR model. Perceptions were quickly formed as some of the tradespeople associated the contract model with a reason to make changes. Just as they would gain momentum on construction activities, someone would point them in a new direction. The continuous change is often difficult for the long-term field workers because they take such immense pride in their work. Frustration can set in when they constantly face having to undo what they spent days constructing.

On the other side, some of the barriers that typically exist in the field were lifted. The crews were able to concentrate more on working together as one team and less like individual trades.

“Normally on a hard bid job, you do what your job is and nothing else,” said Hector Ortiz-Macias, PC Foreman. “It’s not like that here. If you ask for help, other trades will come right away. The electrical guys aren’t trying to back charge the concrete guys; everyone is just helping everyone out. It is more of a team effort, which helps increase productivity and quality.”
Productivity all around increased as a result of the more streamlined RFI and change order processes allowed by the contract. The team was able to efficiently incorporate value enhancements and make changes to the project without the typical holdups. As potential design issues surfaced, the project team jointly brainstormed solutions, allowing implementation of the necessary revisions almost immediately. Once an agreement was reached by the group, an RFI was issued confirming the final decisions.

“Because everyone was in the office, we were able to discuss details and then put them on paper rather than passing the paper back and forth,” said Jeff Maxcy, CH2M Hill Construction Manager. “By the time the RFI was written, the answer was already there.”

“It was interesting to see a discussion start between two people who happened to refill their coffee mug at the same time,” said Jennifer Damico, PC Field Office Secretary. “Before you knew it, there would be eight people gathered around throwing out ideas and working out issues. A lot of decisions were made casually like that around here.”

The advantage of this process included less impact on construction while allowing the owner and engineer to get what they wanted faster. That same approach occurred with construction issues. Rather than placing blame and struggling to overcome problems, the team worked together to come up with solutions that worked best for the owner without compromising quality or schedule. This mentality eliminated the typical drawn-out, back-and-forth process associated with most construction projects and made the incorporation of changes seamless.

With the open book mentality fully achieved on the project and the sharing of resources embraced, submittals were also handled differently. PC worked directly in the engineers’ 3D models to develop shop drawings and other project documents, and had immediate access to submittal reviewers in the trailer complex to clarify details. Once the engineers received submittals, they reflected the details discussed previously by the group and were usually reviewed, approved, and returned to the vendor within days.

Construction quickly ramped up to full swing with the teams celebrating many accomplishments yet continuing to face challenges and learn lessons along the way. The lessons helped paved the way for the team’s growth and further understanding of the critical need to work together to achieve success. On the other hand, the accomplishments clearly demonstrated just how successful the delivery method, combined with a true team mentality, can be on complex projects such as this.
Challenges and Lessons Learned

While the positive outcomes associated with the actual construction of this project outweighed the lessons learned, the team did face a few challenges.

**Community Impact:** The perceived impact to the neighbors surrounding the facility was an ongoing issue during construction resulting in multiple changes to the design of the plant and rework in the field. Increased effort to involve the community initially may have eliminated some of these issues.

**Influent Pump Station:** PC recognized early in the planning stage that rebuilding the Influent Pump Station (IPS) was going to be difficult and would require the work to be completed in phases. The IPS work was viewed as secondary to the other early front-end facilities—Preliminary/Primary Treatment and Plant Odor Control. Efforts were focused on those areas rather than coordinating the three in tandem. The nature of the IPS work also created a significant amount of change that PC had to accommodate for while executing the originally planned work. In the end, the schedule for the IPS took much longer than originally allotted.

**Preliminary Treatment Facility:** The work required to install equipment, piping, and ductwork in the Preliminary Treatment Facility ended up being more expensive and time consuming than planned due to space constraints. A slightly larger building space would have eliminated this problem. This is an example of how the design could have been changed to more effectively impact the construction work.

**Plant Odor Control Facility:** The installation of under-slab and in-slab utilities, as well as the required coordination with concrete work, was a significant effort. This work could have been planned better and earlier to improve the schedule and costs associated with this part of the project. In addition, PC chose to field-apply the final coats of paint for the building, which took several extra weeks to complete and impacted the other trades working in the building. This decision was reconsidered when it came time to apply the final coats of paint to the Membrane Biological Reactor (MBR) Facility. Instead, the paint for the structural steel was shop-applied and the issues seen with the Plant Odor Control Facility were eliminated.

Team Successes

Successes, now that’s what everyone really enjoyed talking about on this project—and there were so many of them! Summarized below are a few stories, ones that the individuals I interviewed just couldn’t tell without big grins on their faces. Each one can be attributed to the flexibility allowed by the construction contract and the continuous team approach to problem solving, innovation, and collaboration.

**The Flood:** It was September 21, 2009 and work was nearing completion on the new IPS facilities. The plan for that day included testing the new influent pumps in anticipation of start-up in the next few weeks. However, Mother Nature had her own plan. With rain having fallen steadily for several days and more forecasted, Atlanta was hit by what many considered to be the worst rainstorm in nearly 300 years for the area. The resulting flooding exceeded the 500-year flood limits at and around the project site. As water seeped in, the existing pump station was damaged and no longer operable, and the electrical equipment associated with the new pumps had been compromised. With the pump station out of commission, wastewater wasn’t able to flow into the plant. Discussion of the situation led to one solution that
would minimize community impact and avoid more complicated problems for Gwinnett County—the team had to work fast to get the new pumps into service.

This, of course, wasn’t as easy as flipping a switch. Over the next two days, Gwinnett County, facility operators, Jacobs/CH2M Hill/PPi, PC, and Cleveland Electric came together with one goal—repair the new electrical equipment that had been damaged and accelerate the start-up of the pumps.

“When the existing Influent Pump Station flooded, everybody pitched in,” said Hector Ortiz-Macias, PC Foreman. “All hands were on brooms and mops and pumps. We turned those new pumps on and hit the go switch. It was the only way we could clean up the site.”

Working around the clock, crews had the new pumps in service within three days. What could have been a disaster turned out to be a tremendous success story and a great example of how the contract arrangement made the effort easier to execute. Under other circumstances, the owner would be on their own to solve the problem. On this project, all the resources brainstormed the best plan together—and got it done.

“Even though there was a flood and even though the plant was being impacted, a straight contract would have required us to complete the start-up by the books, going through all the steps while the plant was down,” said Rick Fisher, PC Project Executive. “Here it was as simple as Gwinnett County saying ‘put the pumps online guys.’ So we fired the pumps up. Of course there was risk associated with that decision but when you weigh those risks against unprocessed sewage contaminating the river, there was only one choice.”

Summing it all up, Adam Minchey of Gwinnett County proudly stated, “We were probably the hardest hit and the quickest to recover, and we did it together.”

**Electrical Planning:** When a plant such as this is built, the main power goes to the electrical building for distribution to the remainder of the plant. Under a typical approach, the entire project is designed and becomes the basis for the electrical building design before the project is constructed in its entirety. On this project, decisions had to be made up front about the power needed for both the existing and new facilities and, in order to take advantage of the phased construction, the building had to be designed and constructed early. As this effort unfolded, it became obvious that the project team had to work closely with Walton EMC, the local utility, to bring significantly more power to the plant. This power had to be redundant and brought in from two separate substations in the area of the plant. All parties were closely involved in the process to ensure the treatment plant had sufficient power as new facilities were brought online. The design and upgrade of the power grids spanned more than two years and, as a result of the careful planning, the work was completed early for use by the plant.
3,400 Cubic-Yard Concrete Placement: When it came time to place concrete for the 18-inch thick structural floor associated with the first of two 20-million-gallon water equalization tanks, the team spent a lot of time orchestrating the details and setting the stage for success. One of the biggest concerns for this work, which included the largest single concrete placement for Gwinnett County, was the timely delivery and placement of the concrete. With two ready-mix plants located in a very congested area of Atlanta, accidents, traffic, and road work could delay the trucks' arrival on site. To lessen the impact of road conditions, the team started the placement at 1:00 a.m. on a Saturday. For 14 straight hours, one ready-mix truck arrived every two minutes. Portable lighted signs were set up on the side of the road and the police department directed traffic to ensure the trucks arrived without holdup.

"The base slabs at the Crom tanks were placed really early in the job and we orchestrated really well as a team," said Ron Ellison, PC Field Engineer. "It says a lot when you can pull off something like that early in the job without incident. That really set the stage for the team's future."

There are many reasons why this placement was a success. The early morning start was certainly one, but it began even earlier with the pre-placement planning meetings and collaboration between Gwinnett County, Jacobs, CH2M Hill, Precision Planning, Crom Corporation, USA Readymix, Pioneer Concrete Pumping, ECS Southeast, LLC, and PC. During the pre-planning process, it was decided to use two 63Z-meter Putzmeister truck-mounted boom pumps to complete the placement. The versatility of the pumps and their approximately 204-foot reach capability allowed the large amount of concrete to be placed quickly within the expansive location without the need to relocate the pumps during the process.

Maintenance Facility: An excellent example of the teamwork on this project revolved around the Maintenance Facility. The team needed a warehouse to store construction equipment and tools. When they discussed the options as a team, it was suggested that—rather than building a temporary, makeshift building—they construct a metal building that could be converted to the Maintenance Facility at the project's completion simply by incorporating masonry to match the existing architecture.
“We ended up with twice the size of a Maintenance Facility and eliminated a metal building we would have basically just thrown away,” said Adam Minchey, Gwinnett County Department of Water Resources Special Projects Manager.

“That was a simple value-added component, but it really showed how we approached the greater project. That is just one example of hundreds if not thousands of ideas the team came up with—and that is essentially part of the delivery method—collaborating up front.”

**Fine Screen and Lime Facility:** This structure was located at a critical intersection of many pipelines and was in the middle of the new flow stream for the plant process. With this information available early in the project, it was clear that starting the work on this facility was critical to the phased start up and use of the new Preliminary Treatment Facility and Equalization Tank Facilities. A portion of the fine screen area was used to coordinate the transfer of flow to the existing plant facilities. This eliminated the installation of additional temporary piping and accelerated the completion of work for the structure.

The early start up of the Lime System for use with the existing plant facilities allowed Gwinnett County to use the system for a lengthy period of time and PC to proceed with the demolition of a portion of the existing Chemical/Maintenance Building. The additional time meant that Gwinnett County could work out any issues associated with the system and PC could use the space to complete new underground utility work.

**Effluent Control Facility:** Initially, the timing of construction for this structure was not considered a priority. As it turned out, the design location of the structure was close to the new electrical building that was needed for power use early in the project. Adjustments were made to increase the urgency associated with this work. The early installation of the underground piping connected to both ends of this structure allowed more effective completion of other utilities nearby, as well as better power distribution throughout the plant by the utility company.

A detailed underground survey performed by PC’s field forces also made the passive nature of the cascade aeration design for this structure possible. This led to the elimination of mechanical aeration and will result in future operating cost savings for Gwinnett County.

**Biological Reactor Basins (BRB) and Membrane Biological Reactor Facilities (MBR):** The success surrounding the BRB and MBR work clearly illustrated the ingenuity and continuous innovation at play on this project. Examples of this include:

> The foundation piling installed at the MBR portion of this structure posed significant layout and installation concerns requiring coordination with excavation and underground utilities. PC prepared a
A detailed plan to maximize the resources needed to perform the work and minimize impacts and delays as each trade executed their work.

- Excavated rock was crushed, screened, and reused as a stone base for the BRB structure. The timely processing of this material was crucial to the start of concrete foundations for this area of the structure. To increase efficiency and ensure the timely start to concrete work, the material processing was outsourced.

- Rather than utilizing the traditional Doka system to place the 32-foot-high walls, PC opted to use a lighter forming system. The reduced weight decreased the load on PC’s cranes and resulted in reduced labor costs.

- An elevated rolling-table system was used to form and place the structural decks covering the BRB. This unique system, which is often used in building construction but not in the construction of treatment plants, saved a significant amount of time associated with setting up and dismantling a conventional shoring system.

Involvement of Plant Personnel: The contract for this project encouraged a close working relationship between the plant personnel, Jacobs/CH2M Hill/PPI, and PC. Because of the interaction among the groups, the testing and start-up of the facilities was executed very effectively. The plant personnel, as end users, had an active role in planning all project phases. They were also involved with the design work, observed construction, and made suggestions and changes along the way.

“We knew we had to tear down half of the plant and build a new one,” said Ben Bagwell, Plant Supervisor at the Yellow River Water Reclamation Facility. “As much as we needed it, I was kind of reluctant for it to start because I knew it was a very complex project. A lot of the choreography had to happen through the entire project—to think about having to do that with a regular design-bid-build project where you may have to make a change on the fly—I was very apprehensive. Going with a construction management-at-risk contract gave us a peace of mind from day one. I didn’t know who worked for whom, and the fact that we were all in the same room talking the same talk from the very beginning increased my comfort with jumping right in the middle of things. The process was so much more efficient without the typical change order restraints. The project has gone as smooth as I could have ever dreamed and I think it is because of the method we chose and the people involved—it couldn’t have been any better.”

Plant personnel were also provided with hands-on training throughout the testing and start-up phases. As issues came up, the project team would step in and address them immediately. This process made the transition from commissioning to Gwinnett County’s acceptance of operations much easier.
Cost Savings: One of the keys to any construction project is budget. Keeping on budget is good. Coming in under budget is better. But delivering a high-quality project at the best value for the owner while using on-site knowledge and experience to reduce costs—you can't get any better than that. And that is exactly what happened at the Yellow River WRF project.

A few examples of more than $10 million worth of cost-saving efforts associated with this project include:

> The salvage and resale of existing plant materials and equipment provided approximately $1 million in savings.

> The project team decided during the design phase that the Plant Odor Control and MBR facilities would be constructed using structural steel versus cast-in-place concrete. This decision saved the project significant time, perhaps as much as four months in each area, and resulted in savings over $100,000.

> During concrete construction of the BRB basins, PC suggested adding doorway openings in the baffle walls separating the various process zones in each basin to improve access for PC’s workforce at the bottom of the 35-foot tank structure. This decision vastly improved access, made the work in these deep basins more efficient and safer, and resulted in a $30,000 cost savings. Upon completion of the work, stop logs were added to each opening to allow access to plant personnel for any future maintenance work.

> On typical design-bid-build projects, the designer and contractor do not typically collaborate on the procurement process. The flexibility of this contract allowed PC and Jacobs/CH2M Hill/PPI to work together to procure the specified process equipment. By combining forces in this way, the project saved $500,000 on the purchase of the Return Activated Sludge Pumps, and $180,000 on the purchase of the mixers for the BRB Basins.

> Existing valves and pipe were reused for new construction and temporarily during construction of the new plant facilities. The team recognized the value in using the pipe and was not influenced by the typical contract barriers created by perceptions of liability. Rather, the team used good engineering judgment and saved the project $40,000.

> Jacobs/CH2M Hill/PPI originally included stainless steel pipe in the GE/Zenon package for the MBR facility. Since PC planned to procure a large amount of stainless steel pipe for other portions of the project, they included the MBR facility piping into the scope of their overall package. By eliminating GE/Zenon from the mix and having PC lead the charge on buyout, the project saved over $200,000.

> Typical construction management contracts require the engineer to carry quality control personnel on their staff. On this project, Gwinnett County opted for PC to carry the quality control personnel at half the cost, which saved approximately $1 million. The contract also required PC to hire an overall quality control manager who would be overseen by the engineer's quality assurance manager. Early in the project, PC suggested eliminating the quality control manager position and relying solely on the engineers’ quality assurance manager to oversee the entire QA/QC process. This decision eliminated redundancy and saved Gwinnett County an additional $600,000. This is an excellent example of the flexibility allowed by the CMR contract.

> Because of the how the contract was set up, changes and plant improvements were incorporated into the project on a daily basis with minimal impact to the schedule. It was not necessary to identify engineer and owner-initiated changes and agree on cost prior to performing the work. This saved untold time on the schedule, which directly related to tens of thousands of dollars of owner savings. And because the project moved along so quickly, there was time available to invest some of these savings into further plant improvements.
Construction is now slowing down and the landscape at the Yellow River Water Reclamation Facility has changed drastically. It is astounding when you look at what has been accomplished on this project. Nearly 500 workers covered this congested 128-acre site during peak work periods. Together, they moved 350,000 cubic yards of soil materials, placed over 65,000 cubic yards of concrete, laid 63,000 linear feet of underground piping, placed 15 new facilities into service, and brought in a complete new power service from off site. These are just a few of the highlights that have taken place with minimal disruption to the existing plant facilities.

Many might think that Gwinnett County, or any other owner, would add project risk by opting to move forward with a CMR model with only a conceptual design in place. In reality, it has turned out to be just the opposite. Gwinnett County maintained more control over both the design and construction phases while enjoying incredible flexibility to ensure desired project outcomes. In addition, the new plant was put online one year earlier than would have been possible utilizing a design-bid-build process and the multiple GMP structure set for this project allowed the team to utilize the job history to reduce costs.

“The way this project was contracted has a lot to do with the success,” said Wayne DeLong, PC Senior Superintendent. “The owner wasn’t worried about time. They had a budget and wanted the job done right. Factoring in the size of the project, the type of contract, and the outcome—it would be awfully difficult to duplicate what went on here.”

The team unanimously agreed that although this project was challenging, even difficult at times, it was a tremendous experience to have all parties committed to a team effort.

“When you are able to put all of your energy toward building the best plant possible with the trust of the engineer and the owner behind you, it definitely makes it much more pleasant to come to work,” said Mike Joseph, PC Project Manager. “On many design-bid-build projects, everyone has their own agenda, which leaves less time for just getting the job done. At Yellow River, it didn’t matter if it was a design problem or a construction problem; everyone just got together and solved it like a team.”

The CMR approach lends itself to finding the best way to complete the work, which was evident in the daily decisions and creative measures associated with this project. At the end of the day, the plant operations staff got exactly what they wanted with unlimited input into the process and Gwinnett County was able to realize the invaluable and positive impacts to cost and schedule.
“If we had done this project the traditional design-bid-build, we would have had two choices,” said Adam Minchey, Gwinnett County Department of Water Resources Special Projects Manager. “We could have up to five contractors out here with different electricians, all pointing their fingers and stepping over each other. Or we could have waited until the design was complete, but then we wouldn’t be anywhere close to where we are today. I have 22 years and $1.5 billion worth of construction projects that I’ve overseen and I’ve never worked on a project that was anywhere close to this successful.”

In 2007, Gwinnett County, Jacobs, CH2M Hill, PPI, and PC came together with a goal of executing the project in a manner that made the experience a positive and memorable one for all. Nearly six years later, that goal has been checked off as one of the many achievements on this project. Though some team members have already vacated the site and others hold on to the last few months completing the final details, they all unanimously agree on one thing—this has been their most successful and rewarding project experience, and they wouldn’t trade it for the world.
YELLOW RIVER WRF IMPROVEMENTS PROJECT

OWNER | Gwinnett County Department of Water Resources
CONTRACTOR | PC Construction Company
ENGINEERS | Jacobs, CH2M Hill, and Precision Planning, Inc.

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