# Utilizing The Engineer-Procure-Construction Management Procurement Process To Get A Bang Without Going Bust

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Tampa Bay Water is a wholesale water provider for 2.4 million customers in the cities of St. Petersburg, New Port Richey, and Tampa, and Hillsborough, Pinellas, and Pasco counties. A diverse supply comprised of groundwater, surface water, and desalinated water provides a high quality, reliable, and environmentally sustainable solution for the Tampa Bay community.

Tampa Bay Water is a recognized leader in the drinking water community for constructing large and complicated projects, such as its transition from an all-groundwater system supply to a diversified system where 50 percent of the supply comes from treated surface water and desalinated water. Some projects were constructed using the traditional design-bid-build process, while several others were completed using alternative project delivery methods. The 66 million gallon per day (mgd) regional surface water treatment plant and its expansion to 120 mgd were successfully completed using a design-build-operate (DBO) method; the emergency management building was completed as a construction-manager-at-risk (CMAR) project. The public-private partnership design-build-own-operate-transfer (DBOOT) project delivery method that was used for the construction of the 25-mgd Tampa Bay desalination facility was ultimately modified to be completed using the DBO method.

The use of the engineer-procure-construction management (EPCM) project delivery method for the Lithia Hydrogen Sulfide Removal Project is discussed herein. This project was originally conceived as one of 11 projects to address the rapid growth in southern Hillsborough County, where demands were exceeding the limited available groundwater supply. The hydrogen sulfide ($H_2S$) in the existing groundwater is between 1 and 4 milligrams per liter (mg/l). Hillsborough County partially removes the $H_2S$ via tray aeration units. Increasingly high flows exacerbated the poor $H_2S$ removal and led to taste and odor complaints. The tray aeration technology is outdated, and Hillsborough County requested that Tampa Bay Water take over the treatment on its side of the meter.

Tampa Bay Water completed two rounds of pilot testing of multiple oxidation and filtration methods to remove the $H_2S$ from the groundwater. Ozone oxidation was chosen as the optimal solution based on the water quality results of the pilot testing and the project life cycle cost analysis. Ozone oxidation is used for $H_2S$ removal at the neighboring Toho Water Authority and Orlando Utilities Commission facilities. Tampa Bay Water retained Carollo Engineers as an owner's engineer to assist with the preliminary design, property acquisition, and procurement of the design, construction, and operations of the 45-mgd Lithia Hydrogen Sulfide Removal Facility.

## Project Delivery Options

Tampa Bay Water considered four project delivery options: design-bid-build, engineer-procure-construction management, design-build, and construction-manager-at-risk. Each project delivery option was evaluated for owner control, risk allocation, cost and quality control, and scheduling.

### Design-Bid-Build

The Design-Bid-Build (DBB) method is the traditional method of project delivery used successfully for most water and wastewater capital projects in the United States, and involves three participants: the design professional, the general contractor, and the contracting agency.

The relationship between the design professional and the general contractor is not a contractual relationship and is not established until after the design is complete. Projects delivered via a DBB structure typically follow a sequential approach for the design, construction, and operation. Cost certainty is not established until the design is 100 percent complete and the general contractor provides a bid for the work. There is limited opportunity to reduce project costs and accelerate schedules. This also provides little protection against cost escalation that can occur over the duration of the detailed design phase.

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When compared with other delivery methods, the relative advantages and disadvantages of DBB delivery are:

Advantages

- *Institutional compatibility*. Tampa Bay Water is thoroughly familiar with the DBB process, along with the contracting and professional services industries.
- *Control of the projec*t. Contracting agency is responsible for completing preliminary and final design, maintaining a high degree of control over the details of the final product, including compatibility with existing facilities.

Disadvantages

- *Additional risk allocation*. Contracting agency assumes the majority of the risk for design, quality control, and constructability of the project.
- *Cost certainty*. Establishing the final cost for a project early is difficult to do in the DBB process. An estimate of the project cost is provided and updates during design, but the "true" cost of the project is determined by the responsive low bidder. Furthermore, the cost can vary as the construction process reveals areas that were not fully considered in the contract documents.

### Engineer-Procure-Construction Management

Engineer-Procure-Construction Management (EPCM) is a project delivery method where a contracting agency selects a firm for the overall design, procurement, and management of the construction process. The EPCM team is not the general contractor, but instead is more akin to an "agency" construction manager, and is typically selected through a quali-

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fications-based process. General contractors and subcontractors are procured by the EPCM team directly, which ultimately holds the financial risks of the project. The EPCM provides cost and schedule guarantees to the contracting agency.

When compared with other delivery methods, the relative advantages and disadvantages of EPCM delivery are:

Advantages

- *More control over the process.* The contracting agency selects the EPCM as, in effect, a program manager, who works directly with the agency to develop the design, directly procure the general and/or subcontractors for construction, and provide construction management services.
- *Transfer of risk.* The bulk of the cost, scheduling, and quality control risk is placed upon the EPCM team.

Disadvantages

- *Familiarity.* EPCM is an unfamiliar delivery process to Tampa Bay Water.
- *Contract documents.* Tampa Bay Water did not currently have standard contract documents established for projects delivered via the EPCM methodology.

**Design-Build**

The Design-Build (D/B) delivery method calls for a single entity contracted to be responsible for furnishing both design and construction services. The D/B firm can self-perform and/or contract directly with professional consultants and subcontractors to complete the work. Because D/B is a single point of responsibility for both design and construction, the D/B firm assumes design as well as construction liability. Selection of the D/B team is based on the best overall value in terms of qualifications, technical and business merit, and/or project costs.

When compared with other delivery methods, the relative advantages and disadvantages of D/B delivery are:

Advantages

- *Cost and schedule certainty.* D/B teams are allowed the most flexibility for developing innovative designs in a competitive procurement setting. Such flexibility lends itself to potential for cost savings and defined schedules.
- *Transfer of risk.* The bulk of the cost, scheduling, and quality control risk is placed upon the D/B team.

Disadvantages

- *Less control.* The contracting agency provides some degree of overall project concept, as well as a preliminary design that has been developed by a design professional. In general, with lower level of control, there is lower overall project flexibility (and potential cost savings) and quality control.

**Construction-Manager-At-Risk**

In Construction-Manager-At-Risk (CMAR), the two major participants are the design professional and the CMAR. Both contract directly with the contracting agency through a qualifications-based process. In this delivery method, the design professional is responsible for the design, while the CMAR is responsible for delivering the construction work. The CMAR is placed "at risk" in the project for delivering the work by a specific date and within a guaranteed maximum price. The date where the CMAR goes at risk is made on a project-specific basis, with the understanding that the earlier it is set, the more any potential contingency may be included in the guaranteed maximum price.

The contractual and working relationships associated with the CMAR method are essentially the same as those presented for the DBB method, with one important exception: the preconstruction role of the CMAR. The CMAR is

retained at an early stage of design, and provides a variety of preconstruction services, including value engineering, constructability reviews, estimating, scheduling, and trade packaging. Prior to design completion, the CMAR would establish a guaranteed maximum price (including a schedule) to which the CMAR would become contractually bound.

When compared with other delivery methods, the relative advantages and disadvantages of CMAR delivery are:

Advantages

- *Team building.* A strong relationship develops as the CMAR and the design professional work together during the design to complete the construction documents. In addition, the CMAR is selected early in the process, thereby increasing a perceived level of "ownership" in the product.
- *Time and cost savings.* The interaction of the CMAR and the design professional during design could result in changes and innovation that save time and money during construction. In addition, this approach would allow construction to begin before final design has been completed. No bidding period after design completion is necessary, resulting in further reduction of overall schedule.

Disadvantages

- *Risk transfer.* The involvement of the CMAR during the design does not relieve the contracting agency of the risk of design errors. The design is still provided by the contracting agency to the CMAR.
- *Familiarity.* CMAR is an unfamiliar delivery process to Tampa Bay Water.
- *Negotiating the price.* This can be a challenge, particularly if there is a substantial amount of self-performance by the CMAR. Understanding the cost structure of the CMAR and internal estimating assumptions, particularly on productivity rates, can be difficult.

For this project, the EPCM delivery method was chosen to allow Tampa Bay Water significant input in the project to address performance requirements and the significant permitting involved in moving the project forward.

## EPCM Procurement

A two-step procurement process for selecting the EPCM team included a Request for Qualifications (RFQ) and Request for Proposals (RFP). Tampa Bay Water staff and the owner's engineer first developed a RFQ that solicited potential EPCM teams for interest in the project. Statements of Qualifications (SOQ) were submitted by eight EPCM teams. Components developed by Tampa Bay Water staff and the owner's engineer for the RFQ included:

- Project narrative describing an overview of the proposed treatment facility, related background information, and prescriptive design criteria
- Project scope of services
- Opinion of estimated construction costs
- Draft design and construction Phase contract documents

Information requested of the EPCM teams in the RFQ included:

- Demonstration of team and key personnel qualifications and experience
- Documentation of surety requirement demonstrating financial capability
- Documentation of professional insurance capability
- Documentation of safe work history

## EPCM Documents

Developing the contract documents used for design and construction under the EPCM

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| Contract Model | Advantages | Disadvantages |
|---|---|---|
| **EJCDC** D 700 (2002) | Most owner-protective for changes to contract price and time.<br>Best language for termination and requiring backup information for the cost of the work.<br>Common and proven use within water industry.<br>Readily accepted by EPCM firms. | Will require supplementation/ modification by Tampa Bay Water legal staff.<br>Dispute resolution process was not detailed.<br>Owner does not own the contract documents. |
| **DBIA** Doc. 535 (1998) | Second most owner-protective.<br>Recognized use within water industry. | More bias toward EPCM.<br>Worst for changes to contract price and time and termination.<br>Language not favorable to owner for claims.<br>No designation on who owns the contract documents.<br>No requirements for providing backup for cost of the work.<br>Less detailed risk allocation. |
| **AGC** Owner/ Contractor Agreement and General Conditions (1998) | Well-defined dispute resolution process.<br>Defines that the owner owns the contract documents. | Least owner-friendly (strong bias in favor of EPCM).<br>Language not favorable to owner for claims.<br>No language included for a guaranteed maximum price proposal, reduction of withholding, or to address differing site conditions.<br>Doesn't include detailed risk allocation (often favoring EPCM). |
| **Tampa Bay Water** DBO Example (3/20/2000) | Can be tailored to be the most owner-friendly.<br>Can provide detailed owner prescription for risk allocation.<br>Best language for claims.<br>Defines that the owner owns the contract documents. | Requires Tampa Bay Water legal commitment to develop.<br>Unfamiliar to EPCM community and will require legal evaluations by firms.<br>May be intimidating to EPCM firms. |

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delivery was an important step to establish quality, cost expectations, schedule, and risk allocation. Tampa Bay Water staff and the owner's engineer completed a detailed evaluation of four contract models:

- EJCDC D700 (2002)
- DBIA Doc. 535 (1998)
- AGC Owner/Contractor Agreement and General Conditions (1998)
- Custom contract using a previous Tampa Bay Water DBO contract (2000).

A comparative matrix of the four contract models was built around ten issues of concern to Tampa Bay Water:

- Change order accord and satisfaction
- Changes to contract price and time
- Claims – notice and waiver
- Contractor reliance upon owner-furnished information
- Cost of the work
- Determination of guaranteed maximum price (GMP)
- Differing site conditions
- Dispute resolution
- Ownership of documents
- Termination
- Withholding

To help make a selection for this project, a summary of the advantages and disadvantages were assembled for each contract model and are summarized in the table.

Based on this comprehensive contract model review, Tampa Bay Water selected the EJCDC contract model. The model was preferred for its owner-protective focus, proven use in the water industry, and acceptance by the contracting community, and it could be supplemented to include key provisions important to Tampa Bay Water.

Using the EJCDC contract model, Tampa Bay Water established a primary contract that includes both design and construction phase agreements where the construction phase can be executed once the design and permitting is complete. The contract was set up to develop a guaranteed maximum price prior to executing the construction phase of the contract. The design phase agreement included a provision to allow Tampa Bay Water to publicly advertise and bid the project if a guaranteed maximum price could not be achieved between the EPCM firm and Tampa Bay Water. Both liquidated damages and bonuses were included in the contract for design and construction phases.

Included with the contract were exhibits developed by Tampa Bay Water and the owner's engineer that were specific to both the

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design and construction phase agreements. The contract was included in the RFQ to provide an opportunity for EPCM teams to comment on the contract. It was clearly noted in the RFQ that the contract was subject to Tampa Bay Water's sole and absolute discretion regarding comments received on the contract in the SOQs.

A selection committee of Tampa Bay Water staff then evaluated and ranked each SOQ based on information demonstrating their qualifications based on the Consultants' Competitive Negotiation Act. The final rankings resulted in a short list of five EPCM teams. The short-listed teams were then invited to submit a proposal in response to the Agency's RFP.

After confirming their previously identified qualifications and abilities to complete the project, Tampa Bay Water received proposals from each of the short-listed EPCM teams. Components developed by Tampa Bay Water staff and the owner's engineer for the RFP included:

- Preliminary design drawings and specifications defining the treatment process expectations.
- Final draft contract documents.

Information requested of the short-listed EPCM teams in the RFP included:

- Clarification of any changes to the team and key personnel.
- Design phase services methodology to address the scope of work, permitting, and anticipated level of labor estimates.
- Construction phase services approach, and understanding of the site and permit requirements, construction challenges, quality control, and budget and schedule control.
- Approach and issues to commissioning, startup, and training.
- Proposed fee percentages for overhead and profit as a percentage of the work.

The same selection committee used in the RFQ step then evaluated and ranked each proposal based on information demonstrating their understanding and approach to the project. The EPCM team selected to complete this project was Veolia Water North America-South, LLC.

The effort invested in the procurement process for selecting the EPCM team proved beneficial to Tampa Bay Water. Going through the two-step process signaled the seriousness and importance the teams placed on competing for this project in a qualifications-based arena, and inhibited submittals from marginal teams. The effort to develop the contract specifics established expectations for the project that resulted in a quickly negotiated agreement to begin work.

## Construction Procurement

After a 14-month design and permitting period, the project was ready to begin construction bidding. Contrary to typical DBB projects, the EPCM team was able to split the project into several different bid packages and privately bid the packages to prequalified vendors and subcontractors. The EPCM team was required to provide three bids in an open book format for each package unless Tampa Bay Water approved that fewer bids were acceptable.

The first package bid was the ozone system components, which included the liquid oxygen storage, the ozone generators, the side-stream injection system, the ozone destruct system, and associated control instrumentation. Ozone generator manufacturers have different methods for providing cooling water and power to the ozone generators. Bidding the ozone system components prior to the rest of the project components allowed the project design to be modified prior to bidding the rest of the bid packages. The bidders were required to hold their price for 120 days if the EPCM could not execute a contract to purchase the ozone system components within the 120-day period. Since this period is longer than the typical bidding period, the bidders were given the option to increase a portion of the package price based on the stainless steel price index. This also limited the bidders risk and helped to reduce the pricing of excessive uncertainty into the bid price, reducing the overall project price.

There are several manufacturers that produce ozone generators, but all manufacturers do not have a good track record for their equipment efficiency, longevity, and service. The EPCM team evaluated the options early on in the project and submitted a short list of three qualified vendors to Tampa Bay Water. The private bidding completed by the EPCM team eliminated the risk of ending up with an inferior product, while still maintaining competitive bidding.

The other bid packages included large diameter pipe and valves, large bore stainless steel pipe and valves, chemical injectors and static mixers, emergency power generation system, control system integrator, security system components, steel buildings, and furnishings. The remainder of the work was bid to prequalified general contractors.

The EPCM team was also able to impose conditions in the bidding that the manufacturers and subcontractors usually did not have to deal with, such as liquidated damages, withholding, and a requirement to hold their prices for an extended period of time. Some bid packages also required that the manufacturers have a Florida professional engineer on staff. Many of the vendors were negative toward these requirements. Some declined to bid, and others submitted bids with qualifying statements or disclaimers. The EPCM team summarized that information in the open-book bidding backup and therefore did not always select the lowest bid in the guaranteed maximum price proposal for construction.

## Lessons Learned

Having an owner's engineer was essential to protect Tampa Bay Water's interest since it did not have direct experience using ozone for hydrogen sulfide removal and was unfamiliar with EPCM procurement and project delivery.

The preliminary design package prepared by the owner's engineer that was submitted to the public in the request for proposals included very detailed design drawings and specifications. Feedback was received that this effort could have been kept more conceptual since the EPCM team started over with its own drawings and specification. The level of detail provided would have been more appropriate if the guaranteed maximum price proposal was received with the EPCM design phase proposal, rather than after final design and bidding.

Having an owner's engineer and EPCM team increases the project budget percentage that is spent on engineering services, but increases the overall oversight and quality of the project. Having a construction manager in control over construction also adds administrative overhead and profit markup to the project. This additional capital cost is expected to be offset in the long run by the value gained from the prequalified contractors and equipment.

Gathering project improvement ideas in the proposals was very beneficial. Also, having liquidated damages and bonuses during the design period was a great motivator to keep the project on schedule; in fact, the design was completed four months ahead of schedule.

The EPCM team identified qualified vendors earlier in the design process; however, the stringent bidding requirements ended up excluding several bidders during the construction procurement. It would be better to make them aware of the bidding requirements, or to consider relaxing the requirements, to increase participation and competitiveness from the vendors during the construction procurement process for future projects.