



October 26, 2018

Ian Thompson  
Owners' Representative Engineer  
Great Lakes Water Authority  
735 Randolph Street  
Detroit, MI 48226-2818

***Subject: GLWA Contract No. CS-166, "Capital Improvement Program Implementation Assistance and Related Services" Task C.14 – GLWA-CON-252 Cost Opinion Review***

Dear Mr. Thompson:

As a follow up to GLWA's recent request, PMA Consultants, LLC (PMA) has prepared the attached report reviewing the Cost Opinion of Probable Costs prepared for GLWA-CON-252 "Springwells Water Treatment Plant Steam, Condensate, Return, and Compressed Air Improvements".

Should you have questions or should you require any additional information, please contact me at 313.681.5128 (O), 313.407.7752 (M), or at [rsanders@pmaconsultants.com](mailto:rsanders@pmaconsultants.com).

Sincerely,

Robert G. Sanders  
Executive Director

File 4170- C.14  
Attachment

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**Compressed Air Improvements**  
**Assessment of Engineer’s Opinion of Probable Costs**

**Summary**

In response to bids for GLWA-CON-252 “Springwells Water Treatment Plant Steam, Condensate, Return, and Compressed Air Improvements” coming in nearly twice the Engineer’s Opinion of Probable Costs (cost opinion), and at the request of GLWA, PMA has performed a review of the cost opinion and provided an adjusted cost opinion (reconciliation) based on the findings. An analysis of the cost opinion finds that the cost opinion significantly underestimated the difficulty of the project as reflected in the labor productivity, estimate contingencies, and allocation for general conditions, and the cost opinion understated the hourly cost for labor. Adjusting the cost opinion to account for these items, along with a couple of other relatively smaller items, results in a revised total of \$20,118,679.97; compared to an initial cost opinion of \$12,267,804.00 and a low contractor bid of \$23,601,341.70.

**Introduction**

In August 2018, the Great Lakes Water Authority received three bids (ranging from \$23.6 million to \$27.3 million) in response to the Request for Bid for GLWA-CON-252 “Springwells Water Treatment Plant Steam, Condensate, Return, and Compressed Air Improvements”. The project consists primarily of replacing the subject lines and associated equipment throughout Springwells Water Treatment Plant. Some of the pipe being replaced is original to the Springwells facility when it was first commissioned in the 1930s.

In March 2018 the designer of record prepared an Engineer’s Opinion of Probable Costs for the scope of work of \$11 million which, plus allowances, totals \$12.2 million. As a result of the discrepancy between the cost opinion and the bids, PMA was requested to review the contents cost opinion, look for issues with the cost opinion approach, and reconcile the cost opinion.

**Discussion**

PMA performed a review of the contract documents and conducted a site review on the morning of October 7, 2018. Based on the site review it became apparent that the project is an extremely difficult job both to estimate and construct. Construction and operation of the Springwells facility started in the 1930s and has continued since that time. As a result of both the original design and the decades of modifications to the plant, much of the CON-252 work is in locations that are difficult to access, hard to get materials to, and are in less than ideal working conditions. To give a feel for the size and complexity of the project, PMA conducted a nearly three hour site review with GLWA personnel, while it covered many of the areas where work is to be performed, it was not exhaustive, and would not be sufficient a contractor to accurately estimate a job with a level of detail needed to commit to a hard dollar contract.

There are six areas in which the cost opinion did not fully address the potential cost of the work: 1) The cost of labor, 2) labor productivity, 3) cost of general conditions, 4) estimate contingency based on the estimating approach, 5) escalation, and 6) structural and architectural costs.

**1. Cost of Labor**

The labor rates that were used in the cost opinion were compared with actual labor rates that PMA has encountered in water/ wastewater projects throughout Southeast Michigan. The rates used in the cost opinion were approximately \$56-\$62 per hour as compared to contractor hourly labor rates for union labor of approximately \$75 - \$83 per hour. In providing a reconciled cost opinion

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summary, the labor costs contained in the original cost opinion should be increased by 33% to account for the actual costs for labor.

The cost opinion contained approximately \$2.4 million in labor, thereby the result of this 33% increase, results in a labor rate adjustment of \$800,000, plus general conditions, bonds, insurance, and contingency.

## **2. Labor Productivity**

The cost opinion was prepared using RS Means for most material prices, labor productivity, and presumably the labor rates. RS Means labor productivity assumes minimal interruptions and impediments to completing the work. When the conditions for installation are not ideal a labor correction factor needs to be added. Labor correction factors are typically added in situations such as:

Elevated work	Ladders between floors
Congested spaces	Additional rigging for material handling
Crawl spaces	Extreme environmental conditions
Low headroom	Owner occupied building
Ease of access	Lighting conditions
Material hoists	Secure site
Shutdown coordination	Cleanup requirements
Obstructions to work areas	

These are common challenges to many projects, but due to the existing conditions at the Springwells facilities, the volume and magnitude of these challenges is to an extreme for the work to be performed under CON-252. Almost all work areas across this project are impacted by at least one or more of these factors, some work areas are impacted by many of these factors, multiple times.

It appears that the cost opinion did include correction factors to the RS Means productivity for the work to be performed under this project (i.e. work over the filters and where the work was elevated, but on the whole, the conditions were not sufficiently addressed).

To adjust for the work challenges throughout the facilities, PMA included correction factors to the RS Means' productivity values by area. The productivity multipliers ranged from 1.4 in the relatively less encumbered facilities to 3.0 in areas such as the high lift and low lift pump station and in the tunnels. As a result to this adjustment, the number of labor hours that were included in the cost opinion are nearly doubled.

## **3. General Conditions Costs**

The cost opinion included 10% to cover general conditions. Given the precision with which the cost opinion was prepared, this is typically considered a reasonable assumption. However, given factors such as the size of the facility, the complexity of the required scaffolding, ladders, etc. needed to safely access areas, coordination required to work within the operating plant across several seasons, and the level of project supervision required, the included value in the cost opinion for general conditions appears to be under estimated.. Additionally, many of the factors

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that drive the labor productivity factors can also influence the general conditions higher. For these reasons the reconciliation includes 15% for general conditions.

#### **4. Estimate Contingency**

The cost opinion includes a contingency of 10%, presumably to cover the details that were not included in the detailed take off. In a review of the classifications of estimating provided in U.S Department of Energy (DOE) and AACE International documents, a Class 1 estimate could be prepared from the completed construction documents, at which point one would expect an estimate with as low as a 3% estimate contingency. Based on the level of detail provided in the cost opinion the estimate would be classified between a Class 2 and Class 3 estimate. At this level of estimate, it would not be unusual for the estimates to be over 20% low without an estimate contingency included.

Estimate details that do not appear to have been included in the cost opinion include items such as:

- The cost opinion for pipe that is insulated includes hangers sized for the bare pipe, not for insulated pipe, as is required;
- Any temporary relocation of utilities that may be required to access the work;
- Insulation replacement that is required at tie in locations;
- Painting of all pipe; and
- Uncertainty associated with field routing all pipe

Given the details missing from the cost opinion, and the nature of the risk associated with this project, the reconciliation uses an estimate contingency of 15%.

#### **5. Escalation**

The RS Means rates for labor and equipment are based on the best information available and are current with the previous quarter's price data available to the publisher. For a longer project such as CON-252, an assumption on escalation should be included in the cost opinion, but appears not to be addressed. The reconciliation includes 4% escalation to the overall value of the project.

#### **6. Architectural and Structural**

The cost opinion included only \$10,000 for architectural and structural items. This line item appears to significantly underestimate the level of effort required to access heaters in the wall, repair masonry and other structures after demolition, and other requirements of this project. The reconciliation has included a high level estimate of \$400,000 for these items.

### **Conclusion**

Table 1 summarizes the net result of the reconciliations discussed within this report. Essentially, the revised grand total is \$20,118,679.97 vs \$12,267,804.00 contained in the original Engineer's Opinion of Probable Costs.

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The reconciliation appears to be within a reasonable variance of the contractor's actual bids. There are likely other factors at play that lead to the additional cost difference that include the heated economy that allows contractors to no-bid projects with high uncertainties and risks, and contractor's that chose to bid the work routinely price the risk of the project into their final bid price. It is noteworthy that known large mechanical contractors known to the Authority were in attendance at the pre-bid walk throughs and in spite of the project being a primarily mechanical project elected not to bid the work, their decisions may have been influenced by the factors discussed above.

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**Table 1 – Reconciliation of Engineer's Opinion of Probable Costs**

	<i>Cost Opinion</i>	<i>Reconciliation</i>
<i>Mobilization</i>	\$123,000.00	\$123,000.00
<i>Hazardous Material Abatement</i>	\$400,000.00	\$400,000.00
<i>Demolition</i>	\$330,000.00	\$330,000.00
<i>Structural and Architectural</i>	\$10,000.00	\$400,000.00
<i>Deaerator &amp; Flash Tank Replacement</i>	\$415,000.00	\$415,000.00
<i>Steam &amp; Condensate HL&amp;LLPS</i>	\$1,950,000.00	\$1,950,000.00
<i>Steam &amp; Condensate Balance</i>	\$4,440,000.00	\$4,440,000.00
<i>HVAC</i>	\$98,000.00	\$98,000.00
<i>Sump Pump System</i>	\$20,000.00	\$20,000.00
<i>Compressed Air System</i>	\$300,000.00	\$300,000.00
<i>Natural Gas System</i>	\$125,000.00	\$125,000.00
<i>Electrical</i>	\$410,000.00	\$410,000.00
<i>Demobilization</i>	\$123,000.00	\$123,000.00
<i>All other</i>	\$82,000.00	\$82,000.00
<b><i>Added Labor Costs(Rate and Productivity)</i></b>		<b>\$4,158,817.94</b>
<i>Subtotal</i>	\$8,826,000.00	\$13,374,817.94
<b><i>General Conditions (Rev 10% to 15%)</i></b>	<b>\$882,600.00</b>	<b>\$2,006,222.69</b>
<b><i>Escalation (4%)</i></b>		<b>\$534,992.72</b>
<i>Insurance (3%)</i>	\$264,780.00	\$401,244.54
<i>Bond (1%)</i>	\$88,260.00	\$133,748.18
<i>Subtotal</i>	\$10,061,640.00	\$16,451,026.06
<b><i>Estimate Contingency (Rev 10% to 15%)</i></b>	<b>\$1,006,164.00</b>	<b>\$2,467,653.91</b>
<i>Total Construction</i>	\$11,067,804.00	\$18,918,679.97
<i>Provisional Allowance</i>	\$1,000,000.00	\$1,000,000.00
<i>Trailer Relocation Allowance</i>	\$200,000.00	\$200,000.00
<b><i>Grand Total</i></b>	<b>\$12,267,804.00</b>	<b>\$20,118,679.97</b>