

COUNCIL ACTION FORM

SUBJECT: VALUE ENGINEERING AND COST UPDATE FOR NEW WATER TREATMENT PLANT

BACKGROUND

This report describes efforts by staff and the City's consulting engineers to apply value engineering principles to the new water treatment plant, provides an updated cost estimate for the new plant, and recommends approval of a major change order to the engineering services agreement. The effect of these efforts is an estimated net savings to the project of approximately \$4,000,000.

On August 28, 2012, Council approved a professional services agreement with FOX Engineering of Ames for the final detailed design of the new water treatment plant, including bidding and construction phase services. As a part of that agreement, FOX was to provide an updated Opinion of Probable Construction Costs (OPCC) as the design phase reached the 40%, 80%, and 100% stages.

Prior to that time, cost estimates for the project had been prepared based on limited information. The design at that level included definitions of the plant capacity, block schematics of the treatment process, flow and hydraulic diagrams for main process systems, and preliminary equipment lists. At that level of detail, the cost estimate was essentially a parametric estimate (that is, using cost curves and \$ per square foot), with some budget-level pricing from vendors included for major materials and equipment. That was the available level of detail when the cost estimate was prepared for the 2012-2017 Capital Improvements Plan (CIP). Because of the lengthy delay in land acquisition, little additional design detail was developed during the following year. As a result, the cost estimate used in the 2013-2018 CIP was simply an inflation adjustment from the prior year's estimate.

UPDATED COST ESTIMATE

In April of this year the design work reached the 40% threshold and the design team undertook the first cost opinion based on an actual set of working plans and specifications. Whereas the previous estimates had been primarily parametric estimates, the 40% cost opinion was more deterministic. There was an actual developed building floor plan with initial sections available, as well as Process and Instrumentation Drawings, yard piping plans, and a nearly complete listing of motors and process equipment. The 40% cost opinion was prepared by HDR Engineers, a sub-consultant to FOX Engineering. HDR's design-build team prepared the cost estimate. This provided the advantage of having the cost estimate prepared in the same fashion

as a contractor would prepare their bid; and provided an independent perspective to the cost estimate.

The previous CIP estimate had been reported in current day (October 2012) dollars only¹, since the delays in land acquisition made it difficult to anticipate an actual bid date.

The 40% cost opinion was also prepared in current day dollars. As such, it incorporated inflationary increases from the May 2012 estimate to May 2013. Then the 40% estimate was for the first time inflated forward to reflect reasonably anticipated bid prices. The inflation estimate consisted of two components:

- Inflating the cost estimate forward from May 2013 to an anticipated bid date in the summer of 2014
- Inflating the cost estimate forward from the bid date to the mid-point of construction

The adjustment to the midpoint of construction is typically negligible for smaller projects of shorter duration. For a project of this magnitude with a 30-month construction window, however, the contractor will need to figure in inflation for work that will be occurring as much as two and a half years in the future.

To obtain the total project cost, the 40% cost opinion was combined with the cost of engineering services, land acquisition, environmental assessments, easements, and other non-construction expenses. **The resulting total project cost estimate now stands at \$77,795,000².** This is an increase of \$9,677,000 over what is shown in the 2013-2018 CIP. Of that increase, \$5,116,000 is attributable to inflation-related adjustments from the October 2012 cost estimate to the anticipated mid-point of construction. The balance of the increase not related to inflation is \$4,561,000.

VALUE ENGINEERING

In reviewing the scope of the project with the design team, there were only a handful of discrete changes made at the direction of staff that would have increased the cost estimate. The largest portion of the non-inflationary cost increase is simply the result of a different cost estimating method.

City staff was not anticipating that the 40% cost opinion would show any cost increase other than for inflation. Staff also noted that the estimate included only a very modest 2% change order allowance, and included no contingency for unexpected conditions during construction or for any owner-directed changes after the award of the contract.

The original design process for the project included a “value engineering” (VE) session that was to be conducted at the 80% complete stage at an estimated cost of \$500,000.

¹ See 2013-2018 Capital Improvements Plan, Page 28 “New Water Treatment Plant” – “Note that any future inflation is not factored in at this time.”

² A detailed break-down of the cost estimate is attached to this report.

After receiving the 40% cost estimate, however, staff determined that it was necessary to begin a comprehensive re-evaluation of the design immediately, looking for ways to reduce the cost without sacrificing the fundamental mission of the facility.

An internal value engineering process was developed and facilitated by the senior staff team spearheading the project. The process began with an initial brainstorming session with department staff from operations, maintenance, engineering, and management; a process that generated 94 individual cost-saving ideas. Next that list of ideas went through a “screening” stage that eliminated ideas that were not possible to accomplish, or that on their face did not appear to generate tangible cost savings.

The remaining items next went through a formal scoring process that evaluated the degree to which each suggestion impacted the operational functionality of the facility. The 34 ideas that passed through this screen were presented to the outside design team for them to quantify the potential cost impacts.

When staff met with the consulting team to present the list of ideas, the consultants had prepared their own list of 46 cost-saving ideas. After extensive review and discussion, the ideas were consolidated into seven key areas (shown below) that the design team believed would generate the greatest level of cost savings.

1. Eliminating the large lime sludge holding tank. This tank was a ‘fail-safe’ in the event that the sludge lines that will run under the river were to become plugged or damaged. The tank would have also allowed the solids contact units (SCU’s) to be drained quicker when they needed service. Without the large tank, there will still be a smaller storage tank that will be capable of holding 12 hours of lime sludge production. There will also be two separate sludge lines running under the river. The SCU’s can still be drained, but they also would need to drain through the pipes under the river. The facility would lose the ability to capture and reclaim the water from the SCU’s when they are drained.
2. Redesigning the finished water clear well so that the bottom elevation was raised to match the elevation of the pipe gallery. This would reduce the difficulty of the excavation and the quantity of concrete. The trade-off is that it will be more complicated in the future to add an on-site ground storage reservoir between the treatment plant and the clear well.
3. Eliminating the at-grade entrance into the west end of the pipe gallery. This entrance was intended to allow a small vehicle to be able to pull into the pipe gallery to load or unload pipe, valves, or mechanical equipment from the lowest level of the facility. Eliminating the at-grade entrance will make this more difficult but not impossible, as there is still a ramp that connects the pipe gallery to an exterior doorway by passing through the chemical feed area.

4. Reallocate space in the chemical feed and maintenance areas. There were a number of design decisions made early in the process that dictated the size and placement of these functional areas along the south side of the facility. Through the brainstorming activities, however, several creative ideas were generated that allowed the square footage of the area to be reduced, as well as reducing the excavation quantities and eliminating the need for a second elevator to comply with ADA requirements.
5. Optimize the design of the administrative office space. The design included some additional office space that was not needed immediately. It also included entry atriums large enough to accommodate the frequent 30-40 person tour groups visiting the facility. Through a collaborative brainstorming effort between City staff and the design team, a number of options were identified that would still provide some additional square footage for future growth. The administrative space included a training room that was large enough to accommodate a group the size of the entire Water and Pollution Control Department staff at a training event seated classroom style. The revised floor plan reduced the size of the training room by approximately 20%. It will still accommodate a group of this size, though not in a classroom style arrangement.
6. Miscellaneous Changes. There were a number of smaller items that were either stand-alone suggestions or that individually offered smaller dollar savings. These items were consolidated into a single category for simplicity.
7. Materials of construction for the Solids Contact Units. Through the design process, staff performed a life cycle cost analysis for constructing the SCU's out of painted carbon steel versus unpainted stainless steel. Initially, the capital cost of the stainless steel option is approximately \$1,000,000 higher; but over the next 50 years would result in a savings of \$1,700,000 (or a net savings of \$700,000) from not needing to repaint the units every 15-20 years. Staff is still recommending that the stainless steel option be included in the base bid, but recommends that a bid deduct price be requested on the proposal form to substitute the painted carbon steel units. That way, the City can decide which option to select based on the actual out-of-pocket cost instead of based on non-binding quotations from equipment manufacturers.

Nearly all of the cost saving ideas that made it to the end of the value engineering process were recommended by staff for adoption into the final design of the new facility, with an estimated gross reduction of \$3,474,855 from the 40% cost opinion. This estimate is based on direct construction costs only, and do not include roll-ups such as the contractor's overhead and profit, and have not been inflated to the future bid date. As such, the actual savings could potentially be even greater than presented here. However, the precision of the estimates were "order of magnitude" only, and both City staff and the consultants are intentionally being conservative with the estimates at this time. A more precise cost estimate will be

developed at the end of the calendar year and will be reflected in the CIP presented in January.

In addition, by developing a value engineering process utilizing internal resources to identify cost-saving design modifications instead of hiring outside consultants, the process immediately saved the \$500,000 included in the 40% cost opinion estimate for independent VE consulting. **This brings the overall gross project savings generated by this process to an estimated \$3,974,600.**

SELECTED REDESIGN

To incorporate these changes will require portions of the project that had already been designed to be redesigned. The design phase services in the contract with FOX Engineering did not include any contingency for additional redesign hours. It is appropriate to compensate the design team for the changes to the design that are now being requested by the City. It is worth noting that only those revisions that have a net reduction in the construction cost, including the redesign expense, are being recommended for the revised scope of the project.

Staff has worked with the consulting team to define the level of additional design work needed to incorporate the changes from the value engineering process. FOX Engineering has submitted a proposed change order to Task Order 4.1 to incorporate the design changes in the amount of \$529,745³. This includes \$71,300 authorized by Council on August 13th. The terms and conditions of the Master Agreement with FOX remain in place. **Staff believes the proposal to be an appropriate reflection of the additional work being requested, and recommends that the City Council approve the change order to Task Order 4.1**

40% OPCC	\$ 77,795,000
- VE Recommendations	3,974,600
+ Redesign fees	529,745
Total Estimated Project Cost	\$ 74,350,145

It is important to note that this is just an estimate, and the actual bid prices will depend on many additional factors outside the City's or the consultant's control. This includes the general bidding climate, contractors' estimates of inflation during the construction period, and the number of other projects bidding at the same time.

OTHER MEASURES TO MITIGATE IMPACTS ON WATER RATES

In addition to the value engineering process, staff is also looking for other ways to mitigate the impact of the project costs on our customers' water rates. In particular, staff is working with the Iowa DNR to update the preliminary engineering report's projection of future drinking water demand. The project has been delayed by several years since the capacity was approved by the IDNR and there has been a new

³ A table showing the estimated cost savings versus redesign expense is attached.

census that supports a higher population projection. This could allow a higher percentage of the project costs to be eligible for inclusion in the SRF loan, reducing the amount that must be paid in cash. Staff is also working to provide a reprioritized CIP that may delay some projects, allowing the new water plant project to proceed as the higher priority.

The cost estimate for the project will be updated one more time prior to the next Capital Improvements Plan being presented to the City Council.

ALTERNATIVES:

1. Approve a change order to Task Order 4.1 under the Master Agreement with FOX Engineering for the design, bidding and construction of the new water treatment plant in an additional lump sum amount of \$529,745.
2. Do not approve the change order, and direct staff to remain with the design as envisioned in the 40% OPCC, with the estimated project cost of \$77,795,000.
3. Provide additional direction to staff on the project.

MANAGER'S RECOMMENDED ACTION:

The new water treatment plant project is exceptionally important for the long-term viability of the Ames community, both in terms of increasing the capability of the utility to meet growing demands, as well as to improve the redundancy and reliability of the treatment process. A project of this magnitude comes with a large price tag. The 40% Opinion of Probable Construction Cost is the first cost estimate for the project that is based on actual design details for the facility. **Staff and the design team have undertaken a substantial value engineering process that has identified a potential net savings of \$3,444,855 from the 40% OPCC cost estimate. To incorporate these changes into the design will require a change order with FOX Engineering. Staff has reviewed the proposed change order and believes that it appropriately reflects the level of additional design work needed.**

Therefore, it is the recommendation of the City Manager that the City Council adopt Alternative No. 1, thereby approving a change order to Task Order 4.1 under the Master Agreement with FOX Engineering for the design, bidding and construction of the new water treatment plant in the lump sum amount of \$529,745.

Additional details of the costing and value engineering taken are shown on the following pages.

40% Opinion of Probable Construction Costs Estimate

June 28, 2013

	Treatment Facilities	Water Pipelines	Lime Pond Facilities
General Conditions	200,000		
Sitework and Yard Piping	3,886,000		
Main Treatment Building	18,426,000		
Chemical Feed Area	4,852,000		
Maintenance and Vehicle Area	964,000		
Administration Area	1,521,000		
Storage Building	97,000		
Lime Sludge Tank and Pump Building	1,091,000		
Electrical, Instrumentation, and Controls	8,331,000		
Interconnecting Pipelines		3,550,000	
Lime Pond Modifications			478,000
Subtotal	39,368,000	3,550,000	478,000
Contractors Field Overhead and Mobilization	3,149,000	284,000	38,000
Contractor's Fee	3,401,000	307,000	41,000
Bonds & Insurance	689,000	62,000	8,000
Undefined Scope of Work	6,991,000	630,000	85,000
Subtotal	53,598,000	4,833,000	650,000
Escalation from bid date to mid-point of construction	2,010,000	48,000	7,000
Lime Sludge Removal (already under contract)			1,570,000
Subtotal	55,608,000	4,881,000	2,227,000
Opinion of Total <u>Construction</u> Costs	62,716,000		
Escalation from date of estimate to bid date	2,085,000	98,000	13,000
Change Order Reserve	1,112,000	98,000	44,000
Subtotal	58,805,000	5,077,000	2,284,000
	66,166,000		
Engineering, Legal, Fiscal	8,240,000		
Land/Easement Acquisition	874,000		
Value Engineering	500,000		
Special Inspections	700,000		
Independent Commissioning (LEED)	75,000		
LEED Registration	10,000		
IDNR Construction Fees	21,000		
All Pre-design Phase Engineering	774,000		
Environmental Assessments	3,000		
Geotechnical Exploration	6,000		
Furniture / Technology Allowance	175,000		
City of Ames Building Fees	250,000		
Opinion of Total <u>Project</u> Costs	77,795,000		

Final Value Engineering Alternatives Accepted

Brief Description	Estimated Construction Costs Reduction/Item	Estimated Redesign Fees	Estimated Net Cost Reduction
Sludge Storage Reconfiguration			
	\$470,000	\$83,800	\$386,200
Group Subtotal	\$470,000	\$83,800	\$386,200
Reduce Clearwell and Backwash Recovery Basin			
	\$460,000	\$26,900	\$433,100
Group Subtotal	\$460,000	\$26,900	\$433,100
Eliminate Vehicle Entrance on West Side of Building into Pipe Gallery			
	\$443,500	\$44,400	\$399,100
Group Subtotal	\$443,500	\$44,400	\$399,100
South-side Reconfiguration ^(a)			
Eliminate CO2 room--Include in south side reconfiguration.	Estimated as a group		
Delete two garage bays. South side reconfiguration. See FOX/HDR List Item D.	Estimated as a group		
Group Subtotal	\$513,000	\$146,700	\$366,300
Modify Architectural/Structural of Admin/Training			
Use polished concrete instead of terrazzo.	\$35,000		
Eliminate precast veneer panels w/brick @ Main Treatment Bldg	\$216,000		
Eliminate thin-set brick from precast at Admin/Ops Bldg	\$30,000		
Completely eliminate second entrance and training lobby.	\$171,500		
Remove both training room sinks.	\$3,000		
Remove sidelights from around doors in conference room.	\$0		
Remove dormer for south staff entrance	\$25,000		
Eliminate standing seam metal roof and trusses. Replace with parapet wall where needed.	\$140,000		
Minimize lobby and eliminate Clerestory.	\$217,500		
Group Subtotal	\$838,000	\$188,645	\$649,355

Modify Chemical Systems			
Ammonia bulk storage only, no pumps or day tank.	\$21,000		
Group Subtotal	\$21,000	\$2,000	\$19,000
Modify Architectural/Structural of Admin/Training			
HSPS piping and electrical for only 5 MGD capacity.	\$79,900	\$3,000	\$76,900
Group Subtotal	\$79,900	\$3,000	\$76,900
Modify Site Work			
Pavement reduction on south side of building.	\$75,000		
Replace porous pavement parking with concrete parking.	\$9,000		
Reduce landscaping to minimum required by code.	\$0		
Do not demolish slabs on east side of property.	\$20,000		
Eliminate constructing lime cell 4B.	\$90,000		
Group Subtotal	\$194,000	\$1,000	\$193,000
Other Structure Modifications			
Eliminate storage space on top of lab.	\$103,000		
Eliminate clean agent fire suppression.	\$15,400		
Remove wall between lab and control room.	\$16,800		
Replace submarine doors into SCUs with large diameter pipe and blind flange.	\$77,000		
Remove stairs, landing, guardrails from SCU submarine door access.	\$33,000		
Minimization of parapet height.	\$110,000		
Eliminate maintenance building.	\$100,000		
Group Subtotal	\$455,200	\$33,300	\$421,900
CONSTRUCTION TOTALS ^(b)	\$3,474,600	\$529,745	\$2,944,855

Omit 80% Value Engineering			
Outside VE Services	\$500,000		
Group Subtotal	\$500,000	\$0	\$500,000
PROJECT TOTALS	\$3,974,600	\$529,745	\$3,444,855

(a) There is additional cost avoidance beyond what is indicated from equipment not included in the 40% OPCC (wheelchair lift or elevator)

(b) Costs shown are direct costs before multipliers (e.g. electrical rollup, overhead and profit, escalation to mid-point)

Final Value Engineering Alternatives Rejected

Brief Description	Estimated Construction Costs Reduction/Item	Reason for Rejection
Eliminate north door of electrical equipment room in chemical feed area	Not Quantified	The need for the door is dictated by code, and is dependent upon the capacity of the equipment in the room. Removal will be incorporated if code allows once equipment is sized.
Reduce the capacity of lime silos from 25 MGD to 15 MGD	\$35,000	The cost in the future to incrementally increase the capacity of the lime silos as the plant expands would be in the vicinity of \$200,000. The small incremental cost makes this appropriate to include in the initial construction.
Change architectural fencing to chain link	\$20,000	Fencing immediately adjacent to the parking lot will be architectural fence; areas not visible to the public will be chain link.
Leave 13th Street Grade 'as is'	\$25,000	This was a purely aesthetic issue when initially included. With other redesign suggestions, however, this quantity of fill dirt will likely be needed. Extent will be limited to only what is necessary for construction.
Eliminate sidewalk from building to 13th Street	Not Quantified	This is a mandatory code issue and will be included in the design.