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TECHNICAL MEMORANDUM

To: City of Davis
Attn: Roger Pulley, City Manager
From: Scott Zotti, PE
RE: Davis Water Treatment Plant Improvements
DWSRF Green Reserve Program

Date: December 7, 2011

Purpose

The purpose of the Technical Memorandum (TM) is to document the energy savings of selected equipment for proposed improvements for the Davis Water Treatment Plant Improvements project. This project has applied for and is slated to receive funding through the Drinking Water State Revolving Fund (DWSRF) loan assistance program. A recent initiative of the DWSRF program is the Green Project Reserve (GPR) fund, which grants principle forgiveness on qualifying equipment. This TM has been prepared with the specific intent of qualifying certain elements of the project which may be eligible for GPR funding. Refer to the engineering report for information not contained herein.

Summary

- The water treatment plant improvements project for the City of Davis proposes a new cluster filtration system in place of a standard filtration arrangement. The proposed system would allow the use of gravity flow to backwash the filters, thereby removing the need for a dedicated backwash pumping system and saving annual energy and pump maintenance costs.
- Anticipated Total Loan Amount = \$8,615,256
- Total cluster filtration construction cost estimate = \$1,396,148
 - Filter equipment costs= \$780,000
 - Valving and piping=\$169,530
 - Instrumentation=\$70,000
 - Electrical=\$24,423
 - Site Civil= \$60,000
 - Concrete= \$292,195
- Associated qualifying GPR professional/legal/bond fees = \$ 257,982
- Green Project Reserve total = \$1,654,130 (19.2% of requested loan)
- Annual average energy savings = 8,165 Kw-Hr or \$735.
- Anticipated total present worth capital cost, power, and O&M savings over twenty years at 3% anticipated interest, and assuming power costs stay constant = \$30,000 capital cost + \$10,935 electrical costs + \$2,976 anticipated O&M costs (assuming \$200/year O&M)= \$43,911.

Background

- The dual media filtration will require backwashing. It is assumed this will occur for 20 minutes, at a rate of 15 gpm/ft², per ODEQ regulations. Historically, the plant has used a backwash tower, and relied on pressure and flow from the tower to conduct backwashing.

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WATER QUALITY DIVISION

- The project required that the filters either be rehabilitated or replaced. Due to extensive costs of rehabilitating the old filters, a new filter system was proposed. A cluster filter system was chosen as the best alternative in order to save footprint, improve operability, and reduce electrical costs.
- The proposed filtration system is expected to have equal construction costs as a standard filtration system, but has been designed in such a way that the filters are able to self-backwash, relying on gravity flow and the use of vacuum pressure already present in the proposed pneumatic valving system.

Results

- The cluster filtration arrangement was selected by the City of Davis as the most economical approach to gravity filtration. The proposed arrangement will result in reduced capital costs, reduced footprint, and reduced overhead and maintenance, as a pumping arrangement for the backwash will not be required and the filters will be arranged in a more efficient layout.

Calculated Energy Efficiency

- It is assumed that one filter will be backwashed each day for 20 minutes at 15 gpm/ft².
- The filtration units would require 23,520 gallons per day.
- If a backwash pump were used in place of the proposed cluster filtration system, and assuming that the existing backwash tower is utilized and the pump operates for 6 hours a day, a 123 gpm pump would be needed (at approximately 85' of calculated head).
- A vertical turbine pump sized for these flow conditions would require a 5 horsepower motor¹.
- The annual power consumption for the standard system requiring this backwash pump can be calculated from the number of hours the motor will operate. For the standard system, the estimated annual power consumption is 8,165 KW-h/year.
- The proposed cluster filtration system will require no backwash pumping, and 0 KW-h/year energy consumption.

Engineering Fees

- GPR qualifying items (before professional fees) = \$1,396,148, or 19.2% of construction amount
- Total professional fees for the project = \$1,343,656
 - Engineering/Professional fees= \$1,163,456
 - Bond council fees= \$84,800
 - Local counsel fees= \$42,400
 - Financial advisor fees= \$53,000
- GPR qualifying professional fees= 19.2% x \$1,343,656= \$257,982
- Total GPR qualifying funds = \$1,396,148 + \$257,982 = \$1,654,130 (19.2% of total loan).

Conclusion

- An energy efficient filtration system will save the City an average of 8,165 KW-hr a year.
- Energy reductions will result in energy savings of \$735 a year, at 9 cents per kilowatt – hour.
- The total present worth savings in energy savings, capital costs, and O&M savings over the lifetime of the improvements, or 20 years, is \$43,911.

1. Fairbanks Morse Pump Specifications, FM 6F.4; 7-Stage Vertical Turbine Pump