**MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY**

**INTEROFFICE COMMUNICATION**

TO: File

FROM: Izabel Hartman

DATE: August 8, 2014

SUBJECT: Drinking Water Revolving Fund Project No. 7394-01
City of Grand Rapids (Conc. Rest. Phase 5/Filter Cells 3, 5, 7 & 9; Wilson PS)
Green Project Reserve (GPR) Funding Cost Calculation

The purpose of this memo is to document the cost calculations for the green reserve funding for the City of Grand Rapids, DWRF Project No. 7394-01. The total loan amount is $3,545,000. The portion of the project that qualifies as green is the Wilson Pump Station Improvements ($553,800). Therefore, the total cost of construction for the green portion of the project is $553,800. The total construction cost for the entire DWRF project is $3,000,725. In order to determine the percentage of non-construction costs associated with the green portion of the project, a proration was applied, as shown below:

553,800 / 3,000,725 = 0.1846

3,545,000 x 0.1846 = $654,407

The total amount of green reserve funding for this project comes to $654,407.

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The principal forgiveness amount is at 100 percent of GPR associated costs.

The total principal forgiveness amount for the project is $654,407.

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April 30, 2013
Project No. G130281

Ms. Izabel Hartman
Project Manager
RLS/Resource Management Division
Michigan Department of Environmental Quality
Constitution Hall - 3rd Floor South
525 West Allegan
Lansing, MI 48933

Re: City of Grand Rapids Drinking Water Revolving Fund (DWRF) Fiscal Year (FY) 2014
Green Project Reserve Letter

Dear Ms. Hartman:

This letter is in response to your request for Green Project Reserve letters for DWRF projects scheduled for FY 2014. The City of Grand Rapids has three scheduled projects for FY 2014; one has been identified as a green project: the Wilson Reservoir Pump Replacement.

The Wilson Reservoir is located on the West side of the distribution system and supplies the West High Pressure District which in turn supplies the West High-High District and the West Regulated District. The demands are summarized in the table below.

| | 2010 ADD | 2010 MDD | 2030 ADD | 2030 MDD |
|---|---|---|---|---|
| West High (mgd) | 3.64 | 7.87 | 4.40 | 9.59 |
| West High-High (mgd) | 0.38 | 0.82 | 0.61 | 1.30 |
| West Regulated (mgd) | 0.21 | 0.46 | 0.22 | 0.47 |
| Total (mgd) | 4.23 | 9.15 | 5.23 | 11.36 |
| System Total (mgd) | 37.18 | 81.52 | 42.92 | 94.45 |
| Percent of Total (%) | 11.4% | 11.2% | 12.2% | 12.0% |

ADD average daily demand
MDD maximum daily demand

As shown, the average daily demand over the next twenty-year planning period ranges from 4.23 to 5.23 million gallons per day (mgd).

There are three Wilson pumps: an 11 mgd 400 horsepower (HP) pump that is normally operated, a 14 mgd 600 HP standby pump, and a 25 mgd 900 HP pump that is not operated. The Wilson pumps are too large for the demands of the West High Pressure District. Further exacerbating this issue is the fact that the Covell Reservoir also supplies the West High and associated Pressure Districts using three pumps: 3.5 mgd, 5.0 mgd, and 6.0 mgd. Both reservoirs must be operated to ensure turnover and to maintain a residual chlorine concentration in the reservoirs. There is also the Leonard Tank, a one million gallon elevated storage tank in the West High Pressure District that is rapidly filled by the Wilson pumps.

The large Wilson pumps were installed in 1940 when the intended operation of the distribution system was different than today's operation. Installing a smaller pump that more closely matches demands in the West High Pressure District will increase efficiency of the Wilson Reservoir Pump Station. Also, the seventy-three year old pumps have experienced wear and tear over their lifetime that has resulted in multiple impeller replacements and damage to the volutes, resulting in a loss of pump efficiency.

As discussed in the DWRF Project Plan, the proposed project is to remove the 25 mgd pump and install a 6 mgd pump at the Wilson Reservoir to supply the West High Pressure District in conjunction with the existing pumps at the Covell Reservoir. The 11 mgd and 14 mgd Wilson pumps will be maintained to supply maximum day demands if needed.

The existing Wilson pumps are inefficient for the following reasons:

- The pumps exceed demand and rapidly fill the Leonard Elevated Storage Tank requiring frequent starts and stops.
- The pumps are started across the line, resulting in a large amp draw.
- The pumps have lost efficiency over the seventy-three years of operation. When new, the pumps produced 11 mgd at 170 feet of head with an efficiency of 86%. Based on current operating data, the pumps produce 9.9 mgd at 165 feet of head on average, which can be estimated as a 10% decrease in pump efficiency.
- To control the rate of fill for the Leonard Tank, the Covell pumps are typically turned off prior to turning on a Wilson pump. Thereby increasing the stops and starts for the Covell pumps.

The proposed 6 mgd pump increases efficiency by:

- More closely matching demand and decreasing the rate of fill on the Leonard Tank, and minimizing stops and starts.
- The proposed pumps are 86.3% efficient at the operating point.
- The proposed 250 HP motor is more efficient than the existing 400 HP motors.
- The proposed pump can be operated at the same time as the Covell pumps without filling the Leonard Tank at an excessive rate.
- During final design a variable frequency drive (VFD) will be evaluated to reduce the amp draw upon start-up and increase the operational flexibility with the Covell Reservoir pumps.

The attached table compares the energy savings from operating a more efficient 6 mgd pump while supplying the same average volume of water from the Wilson Reservoir. Further energy savings may be realized upon evaluation of the operation of the Wilson Reservoir with the Covell Reservoir (but is not included in this evaluation).

Operating the proposed 6 mgd pump as opposed to the existing 11 mgd Wilson pump reduces the daily energy consumption by 15%, saving 129,500 KW-h per year, and $12,300 per year. This savings is a combination of increased motor efficiency and increased pump efficiency. Based on a 20-year present worth analysis with a discount rate of 4.375%, the annual savings of $12,300 has a present worth of $161,730. If an energy escalation of 3% is assumed, then the present worth is $208,380.

As presented in the DWRF Project Plan, the estimated project cost is $680,000 which includes the 6 mgd pump, piping, valves, electrical, and instrumentation. The proposed energy savings over a twenty year planning period accounts for 30% of the capital investment.

If you have any questions or require additional information, please contact me at 616-464-3848 or ccirving@ftch.com.

Sincerely,

Cynthia C. Irving

Cynthia C. Irving, P.E.

nes
Attachment
By e-mail and Fed Ex
cc: Mr. Breese Stam, P.E. – City of Grand Rapids
Mr. Wayne Jernberg, P.E. – City of Grand Rapids
Mr. Scott Hayden - City of Grand Rapids
Mr. David S. Koch, P.E. - Black & Veatch

**Green Project Reserve: Energy Savings Calculations**

| | Existing Wilson 11 mgd Pump | Proposed 6 mgd Pump |
|---|---|---|
| Flow (mgd) | 9.9 | 6 |
| Flow (gpm) | 6,875 | 4,167 |
| Static Head (ft) | 157.1 | 157.1 |
| Dynamic Head (ft) | 8.0 | 3.9 |
| Total Dynamic Head (ft) | 165.1 | 161 |
| **Pump Efficiency (%)** | **76%** | **87%** |
| **Motor Efficiency (%)** | **95%** | **96%** |
| | | |
| Pump Brake Horsepower (HP) | 377 | 196 |
| Motor Input Horsepower (HP) | 396 | 203 |
| Power (KW) | 296 | 152 |
| | | |
| Average Electrical Use (KW-h/d)* | 2,307 | |
| Average Run Time of 11 mgd Pump based on Electrical Use (hrs/d) | 7.8 | |
| Volume of Water Pumped at Wilson based on Avg. Run Time (gal/day) | 3,217,484 | |
| Run Time of Proposed Pump to Supply Equivalent Volume (hrs) | | 13 |
| | | |
| Average Power Used (KW-h/d) | 2,307 | 1,952 |
| Energy Costs ($ per KW-h/d) | 0.095 | 0.095 |
| Yearly Operating Costs ($) | $79,995 | $67,695 |
| | | |
| **Average Energy Savings (%)** | | **15%** |
| **Energy Saved (KW-h/year)** | | **129,473** |
| **Monetary Savings ($ per year)** | | **$12,300** |

* Electrical use taken from utility bills for March 2010 through March 2012.

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE COMMUNICATION

TO: Izabel Hartman, Environmental Quality Analyst
Revolving Loan Section, Office of Drinking Water and Municipal Assistance

FROM: Michael Bolf, P.E.
Field Operations Section, Office of Drinking Water and Municipal Assistance
Grand Rapids District Office

DATE: June 5, 2013

SUBJECT: City of Grand Rapids – Fiscal Year 2014 – Wilson Station Pump Replacement
Qualification for Green Project Reserve Funding

The purpose of this memo is to confirm the basis for determining whether or not portions of the city of Grand Rapids DWRF Project No. 7394 - 1 qualify for the green project reserve funding under Public Law 111-88. The portion of the project for which the city is applying for GPR funding consists of the pump replacement at the Wilson Reservoir Pump Station. The city's consultant submitted an April 30, 2013 letter outlining the energy savings that could be realized through the implementation of these improvements.

I concur with the explanation provided by the city's consultant which details how replacing the existing 25 MGD pump with a new 6 MGD pump increases efficiency. Energy efficiency will be gained by virtue of more efficient equipment and by enhanced operational capability (i.e. more appropriate pump operation cycles). It is also important to note, that the Wilson Pumps must operate periodically even though, the existing Covell Reservoir pumps can supply much of the demand in the West High Pressure District. The reason, as FTCH indicated, is due to the need to keep water turned over in the large Wilson Reservoir. Therefore, discontinuing the routine operation of the existing Wilson Pumps is not an option.

It is also worth noting that the city currently start sand runs the existing 25 MGD pump (proposed to be replaced) periodically to ensure it is in proper working order. Exercising this pump is very inefficient because it starts across the line (constant speed) and the flow must be reduced by throttling a discharge valve. The proposed project will not only reduce the operation of the 11 MGD pump, but also eliminate operation of the existing 25 MGD pump. This energy savings was not accounted for in the business case.

I recommend approval for green project reserve funds, but I am not certain if the 15% energy savings projected in the business case qualifies.

The costs, if any, that qualify for green project reserve will be determined after bids are received and the amount of the loan established. At that point, the percentage of this loan that is provided by Public Law 111-88 can be applied to the total amount spent on this portion of the project to determine the green project reserve.