12/23/2014 Water Utility Board Meeting

Unit Well 31 Facility Design Project

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Well 31 Proposed Facility Design and Energy Use/Operational Evaluations

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Review of the November Water Board Meeting:

- **Presented the recommended Well 31 design concept for final design and construction.**
  - **Two concepts:**
    - **Option 1 – Detached Reservoir**
    - **Option 2 – Attached Reservoir**
  - **Public Hearing on the proposed facility designs.**
- **Information requested by the Water Board:**
  - **Energy evaluations for the proposed Fe & Mn treatment system & pumping operations.**
  - **Associated operational & maintenance costs.**
  - **Evaluation of other energy saving opportunities:**
    - **Incorporating a 2nd (upper aquifer) supply well.**
    - **Flow bypass to reduce treatment (meet WQ goals).**
    - **Energy analysis from ongoing UW Grad Project**

Recommended Facility Design Concept - Review

- **Consider steel vs. concrete tanks.**
  - **Concrete preferred, in building, size, durability.**
  - **Comparable capital costs, lower lifetime cost**
- **Estimated Construction Costs:**
  - **Option 1 - $5,470,000**
  - **Option 2 - $6,730,000**
  - **MWU Budget: $5,700,000**
- **Evaluation Matrix:**

Pumping Facility Decision Matrix

(Scale 1 – 3: 1 = Least Desirable, 3 = Most Desirable)

Scenario	Option 1	Option 1A	Option 2	Option 2A
Aesthetics	2	2	2	2
Operation and Maintenance	1	2	2	1
Capital & Construction Costs	3	3	1	1
1.5 MG Life Cycle Cost	2	3	1	1
Total Score	8	10	6	5

(Most Desirable Facility)

- **Recommended concept is Option 1A – regardless of energy/operational scenario**

Option 1 – Detached Tank

Option 2 – Attached Tank

Energy and Operational Analysis Scenarios

We evaluated energy needs and associated operating costs for four proposed pumping/treatment scenarios developed at Well 31.

Energy Evaluation Scenarios Considered:

1. **Pump & treat from lower aquifer at 2,200 GPM.**
2. **Pump 2,200 GPM from lower aquifer and treat only the portion of water required to meet MWU's water quality goal of 0.10 mg/L for iron.**
3. **Drill a new upper aquifer well and pump at 640 GPM without treatment; pump & treat from the lower aquifer at 1,560 GPM (max 2,200 GPM supply).**
4. **Drill a new upper aquifer well and pump at 640 GPM without treatment; pump & blend from the lower aquifer at 320 GPM to meet WQ goal for iron.**

Associated Costs:

- **Energy**
- **Operational & maintenance**
- **Impact on capital/construction cost**

Scenario 1 – Pump & Treat From Deep Well

Pump 2,200 GPM from deep well, treat 100% of flow, baseline scenario.
Total production of 700,000 gallons/day.

Energy Analysis:

- **High lift pumping** (*Constant - equal for all scenarios considered*)
  - **230,000 kWh/yr - Annual energy cost of $17,000/yr**
- **Deep Well pumping + treatment for Scenario 1**
  - **470,000 kWh/yr - Annual energy cost of $36,000/yr**

Operational & Maintenance Costs:

- **$44,000/year**

Estimated Annual operating cost:

- **O&M + High Lift Pumping + Well & Treatment Pumping = $97,000/yr**

Capital/Construction Impacts:

- **No impact**
- **Construction cost estimate for Option 1 + Scenario 1 = $5.47M.**

Scenario 2 – Pump From Deep Well & Treat Only the Portion Needed to Meet Water Quality Goals

Pump 2,200 GPM from deep well, treat 73% of flow and blend with untreated supply to meet WQ goal for iron (0.10 mg/L). Total production of 700,000 gallons/day.

Energy Analysis:

- **High lift pumping** (*Constant - equal for all scenarios considered*)
  - **230,000 kWh/yr - Annual energy cost of $17,000/yr**
- **Deep Well pumping + partial treatment for Scenario 2**
  - **451,000 kWh/yr - Annual energy cost of $34,000/yr** ***(-$2,000/yr)***

Operational & Maintenance Costs:

- **$52,000/year** *(blending inspections, increased water main flushing)* ***(+$8,000/yr)***

Estimated Annual operating cost:

- **O&M + High Lift Pumping + Well & Treatment Pumping = $103,000/yr** **(+$6,000/yr)**

Capital/Construction Impacts:

- **No impact**
- **Construction cost estimate for Option 1 + Scenario 2 = $5.47M.**

Scenario 3 – Drill Shallow Well & Pump Untreated, Pump & Treat Deep Well to Reach 2,200 GPM Supply

Shallow well supply of 640 GPM, untreated w/ 1,560 GPM deep well supply, treated. Total production of 700,000 gallons/day, combined 2,200 GPM supply capacity.

Energy Analysis:

- **High lift pumping** (*Constant - equal for all scenarios considered*)
  - **230,000 kWh/yr - Annual energy cost of $17,000/yr**
- **Two Well pumping + deep well treatment for Scenario 3**
  - **315,000 kWh/yr - Annual energy cost of $24,000/yr** ***(-$12,000/yr)***

Operational & Maintenance Costs:

- **$54,000/year** *(two wells for daily inspection, most equipment)* ***(+$10,000/yr)***

Estimated Annual operating cost:

- **O&M + High Lift Pumping + Well & Treatment Pumping = $95,000/yr** **(-$2,000/yr)**

Capital/Construction Impacts:

- **(+$330,000)** *(smaller filter bank, but requires additional well)*
- **Construction cost estimate for Option 1 + Scenario 3 = $5.8M.**

Scenario 4 – Drill Shallow Well & Pump Untreated, Pump & Blend Deep Well to Meet WQ Goals

Shallow well supply of 640 GPM, untreated w/ 320 GPM deep well supply, untreated. Total production of 700,000 gallons/day, combined 960 GPM supply capacity.

Scenario Analysis:

- **High lift pumping** (*Constant - equal for all scenarios considered*)
  - **230,000 kWh/yr - Annual energy cost of $17,000/yr**
- **Two Well pumping + deep well treatment for Scenario 3**
  - **221,000 kWh/yr - Annual energy cost of $17,000/yr** ***(-$19,000/yr)***

Operational & Maintenance Costs:

- **$53,000/year** *(two wells for daily inspection, increased flushing)* ***(+$9,000/yr)***

Estimated Annual operating cost:

- **O&M + High Lift Pumping + Well & Treatment Pumping = $87,000/yr** **(-$10,000/yr)**

Scenario Not Considered for Project

- **Max day demands not met (2.3-2.7 MGD)**
- **Blending ratio to eliminate treatment not feasible**
- **Water quality, shallow well contamination risks**

Recommended Operational Scenario

Well 31 Operational Scenario Decision Matrix

(Scale 1 – 3: 1 = Least Desirable, 3 = Most Desirable)

Alternative	Scenario 1: Pump 2,200 gpm from Deep Aquifer in Unit Well 31	Scenario 2: Pump 2,200 gpm from Deep Aquifer in Unit Well 31 and Treat a Portion to meet MWU standards of 0.1 mg/L Iron	Scenario 3: Pump and Treat 1,560 gpm from Deep Aquifer in Existing Well 31 and Mix with New Shallow Well
Energy Use	2	2	3
Operation & Maintenance	3	1	2
Capital Costs	3	3	1
Reliability	3	2	2
Water Quality	3	2	3
Operational Complexity	3	2	1
Distribution System Impacts	3	2	3
Totals	20	14	15

(Most Desirable Pumping Scenario)

Additional Considerations / Q&A

Total Cost of Fe & Mn treatment:

- Daily inspections, maintenance, energy use, backwash waste disposal
- Total filter production: 255.5 MGD (700K gallons/day)
- Annual estimated cost of $19,660/yr

Grad Project Evaluations and Energy Opportunities:

- Hydraulic modeling of PZ4 w/ Wells 9 & 31 to determine energy savings
- 80% VFD speed at Well 31 could mitigate $16,000/yr vs. without VFD
- Additional opportunities – Off-peak, flow distribution, HGL adjustments

Shallow Aquifer Considerations at Well 31 Location:

- Low specific capacity and limited depth of upper aquifer at Well 31
- Water quality reservations due to known groundwater contamination

Discussion and Q&A