Retrofitting Aeration Treatment into a 1930s Pump Station

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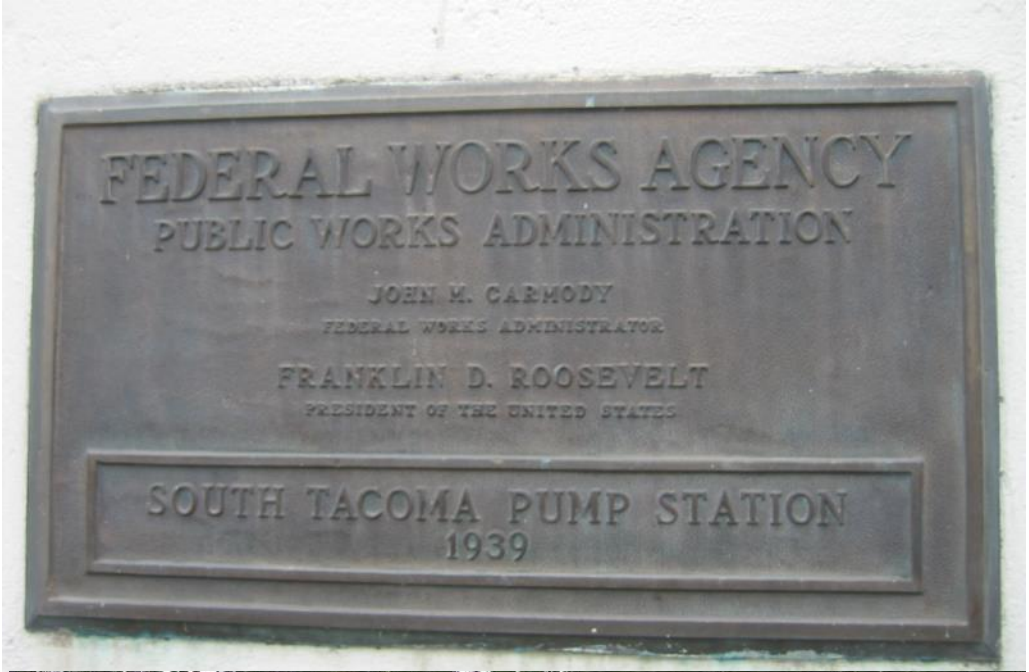
01 Background

Background

- Facility was constructed in 1939
- Part of the Franklin Roosevelt's Works Progress Administration
- 16.7 MGD with 0.5 MG clearwell
- Sends groundwater up to north and west end of the system
- Supplied by six wells



Background

- Usage has decreased over the decades
  - Groundwater use declined as Green River supply developed
- Currently a back-up system
  - Used infrequently
  - Planned shutdown of reservoirs
  - Emergencies
- Water treated with a tablet chlorinator

Project Goal

- South Tacoma Wellfield groundwater requires additional treatment
  - Low pH → corrosive to copper and brass plumbing
  - Radon

- Goal is to provide cost-effective improved water quality with minimum disruption

02 Design Issues and Constraints

Design Issue #1 – Location

- Pump station located in an urban residential area
- Surrounded on three sides by homes
- Concerns about chemical deliveries
- Limited available free space

Design Issue #2 – Structure

- Facility was finished in a time without seismic standards
- Concrete floor is very thin for today's standards
- Supporting beams are widely spaced

Design Issue #3 – Power Supply

- Main power supply is medium voltage 4160V for the pumps
- Available 480V power was limited
- Existing transformers were below-ground and very old.

Design Issue #4 – Record Drawings

- Complete set of pump station drawings were from 1939

- Several modifications have been made that were not fully documented

Evaluation

- Two alternatives: caustic soda and aeration
- Caustic soda
  - Highly effective
  - Requires chemical delivery and storage
  - Complexity of chemical feed control
- Aeration
  - Effective depending on water CO_2 content
  - No chemicals
  - No chemical control strategy needed
- Aeration was selected

Evaluation

- Started with in-depth review of all systems

- Structural analysis
  - Floors
  - Support columns
  - Exterior walls

- Review of power systems

- Analyzed control panels

Aeration Design

- Diffused aeration inside clearwell
- Same system as wastewater aeration basins
- Baffle wall to help channelize flow over diffuser heads

Equipment Placement

- Pump station had an old storage room filled with old files
- Removed all files
- Placed blower in the room

Equipment Placement

- One wall of the storage room is actually the back of medium voltage control panels

- Control panels and equipment had to be placed away from panels

Aeration Blower

- Blower design was crucial

- Weak floor means:
  - Must minimize equipment weight
  - Must minimize equipment vibration

- Selected centrifugal blower
  - Only location was to place blower directly over a beam

Ancillary Systems

- Air supply
  - Blower air to diffusers
  - Cooling air
- Ductwork placed in main pump room
- Intake and exhaust louvers matched into existing building openings.

Ancillary Systems

- Intake silencer
  - Was originally indoors
  - Silencer could not be accommodated
  - Placed outdoors

- Only visible modification to the building structure

03 Start-Up and Commissioning

pH and Well Use

- System generally worked
- Finished water pH was 7.5
- Problem was with one well
  - Well 3A
  - Raw water pH is 7.2
  - Treated water pH is 7.3
  - Reordered to be used last now
- Additional testing is ongoing

04 Summary

Lessons Learned

- Retrofitting can be readily accomplished
- Spend the time to do a careful site investigation
  - Don’t depend on record drawings alone
- Careful structural evaluation is always needed
  - Old concrete may not be adequate for new loads
- Attention to electrical systems is important

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