Sunol Valley Water Treatment Plant Upgrade
Engineering / Project Management Survey
Sunol, California

I. Survey Respondent and Presenter:

Name: Ravi Krishnaiah, Project Manager

II. Project to be discussed at this site:

We will be presenting information on the Sunol Valley Water Treatment Plant Expansion and Treated Water Reservoir Project.

The Sunol Valley Water Treatment Plant (SVWTP) is located on land owned by the San Francisco Public Utilities Commission (SFPUC) in the Alameda Creek Watershed in the Sunol Valley. The plant treats all water from the two local reservoirs – Calaveras and San Antonio – before the water is served to our customers. It also filters Hetch Hetchy water on the occasions when the Sierra supply does not meet required drinking water standards. Should the Bay Area be cut off from Hetch Hetchy supplies because of an emergency, the treatment plant must sustainably treat 160 million gallons of water a day to meet minimum customer demands.

The project is part of the $4.8B Water System Improvement Program (WSIP) to seismically upgrade, repair and replace our facilities from the risk of earthquake damage. There are 83 projects including: pipelines, tunnels, dams, reservoirs, pump stations, storage tanks, and treatment facilities. Over 85 percent of the WSIP projects are completed.

III. Purpose of the project in relation to system performance objectives:

The Sunol Valley Water Treatment Plant Upgrade, which was completed in September 2013, ensures that the 2.6 million San Francisco Bay Area residents who depend on water from the Hetch Hetchy reservoir will be able to receive clean and reliable drinking water following a seismic event . The SVWTP was designed to meet a Level of Service (LOS) requirement to produce 160 million gallons per day (MGD) within 24 hours of a major earthquake, and to maintain production for at least 60 days. The project includes new connections and facilities that will enable the plant to treat enough water to meet basic customer demands alone, for up to 60 days after

a major earthquake. This project will help to increase delivery reliability and water quality to the Hetch Hetchy Regional Water System

The Treated Water Reservoir (TWR) component of this project satisfied the need to have a balancing reservoir for a large water treatment plant such as the SVWTP and satisfied the California Department of Health's regulatory requirement .

IV. Description of what was built:

The following major components were added under this project:

- A single 17.5-million gallon (mg) circular TWR (Treated Water Reservoir) which was constructed along with a new 3.5-MG rectangular chlorine contact tank on the northern portion of the existing plant site - Roughly 500,000 cubic yards of excavated material was hauled to a disposal site immediately east of the plant
- A 40 MGD treatment train consisting of new flocculation/sedimentation basin
- Upgrades to all 12 existing filters - The upgrades included converting the filters into deep-bed filters, with new media, air backwash, new bottoms, thickened walls with more reinforcement, and new filter troughs. Two new blowers for air supply were also added as part of the air-water backwash system
- A new filter wash-water recovery basin and improvements to the flow distribution structure and associated facilities
- New chemical storage and feed facilities for disinfection including sodium hypochlorite and ammonia. New fluoride facilities were also added
- Approximately 2,700 feet of 78-inch-diameter pipe that connects the new TWR to the existing plant discharge pipeline - This included a 400-foot tunneled crossing of Alameda Creek
- Replacement of nine existing chemical tanks and associated electrical and instrumentation
- A new emergency generator and improvements to the plant electrical system, substation, electrical panels, and new motor control centers
- An upgrade of the instrumentation and controls
- Replacement of the plant's existing boiler
- Improvements to the influent chemical mixing system and repaving of the existing plant access road

V. Engineering/Project Management/Environmental Challenges in Design, Construction, Testing, and Implementation:

<u>Engineering Challenges</u>

Seismic Design Challenges:

A major issue that affected the design of these new facilities was that the plant is less than 1,000 feet from the Calaveras Fault, with a maximum credible earthquake (MCE) estimated at M7.25. SFPUC developed a set of General Seismic Requirements (GSR) used by all designers working on the WSIP. The GSR was used to design the TWR and CCT for this project.

There were many implications of the GSR criteria. The 35-foot tall CCT walls would normally be about three feet thick using IBC 2006 criteria and site-specific response spectra; however, under the GSR the thickness increased to five feet with the backfill extending to the tops of the walls. Under IBC criteria the TWR could be founded on a mat foundation, but under the GSR the sliding forces are so large that the reservoir could slide several feet horizontally. Therefore, the TWR was founded on piles.

The project also includes a soil nail retaining wall in order to protect the TWR. The GSR forces require the soil nails to be longer than typical. . To confirm their strength, test nails were constructed and tested.

The geotechnical data estimated differential settlement across the TWR of up to nine inches, which would compromise the TWR structure. Therefore, cast-in drilled-hole (CIDH) piles driven 10 feet into the underlying shale support the reservoir. More than 1,000 piles at 10 feet on center were required along with a special analysis to ensure adequate rock strength to resist movement.

<u>Environmental Challenges</u>

The SVWTP is uniquely situated on SFPUC watershed lands within the pristine Alameda Creek Watershed. Of particular concern was the presence of habitat supporting state and/or federally protected species, including the California tiger salamander, California red-legged frog, and Alameda whip snake. To minimize impacts to these protected species, the EIR and regulatory agency permits required mitigation measures during construction.

To help control storm water runoff the contractor installed thousands of feet of fiber rolls, placed erosion control matting over the steeper slopes, and applied acres of hydro-mulch containing native seed to disturbed areas.

Another large challenge for the team was how to address the disposal of spoils that resulted from significant earth excavation during construction. In order to construct the 17.5 million gallon Treated Water Reservoir (TWR), over 450,000 cubic yards of material had to be excavated from a hillside and hauled off the construction site before the CIDH pile drilling could be started. A site close by the new TWR location was used as a disposal site for this material and the material was sculpted into gently sloping hills or mounds providing a natural screen from public view. The spoils disposal near the SVWTP had significant environmental benefits as well.

During SVWTP construction, the project team also had to contend with swallows protected under the federal Migratory Bird Treaty Act nesting within existing plant infrastructure. During a schedule-critical phase of the project, swallows nesting under the eaves of the filter basins prohibited planned

demolition work. Due to the critical nature of the work, the project environmental team was able to secure an expedited permit from the USFWS to remove the nests and relocate the swallow nestlings to a wildlife rehabilitation center.

VI. Lessons Learned from an Engineering / Project Management Perspective:

Part of the project's scope and one of the most complex aspects of the project involved Plant Shutdowns for the seismic retrofit and upgrade of the existing 12 conventional filter basins. This retrofit work included demolition of the existing under-drain block system, filter media, troughs, and gullet walls. Once completed the filter basins were rebuilt with a new plastic under-drain block system, new filter media and new troughs. A new air scour piping was installed as part of a new backwash and air scour system and the existing filter basin walls were retrofitted for seismic purposes.

The retrofit of the existing 12 filters needed to be performed in a systematic manner such that banks of three filters at a time were taken out of service, leaving the remaining nine filter basins in-service as part of the plant's need to treat water. The contract specifications defined the timeline when each of these Filter Shutdowns/Outages would be performed. Upon issuance of the Notice to Proceed for the project it became apparent that the first filter shutdown of Filter Banks 1, 3, and 5, would not be able to be performed over the timeline originally planned in the contract specifications. This was due to conflicts with other WSIP Project shutdowns, as well as procurement delays of long lead material including the filter media and stainless steel air scour piping. Through a number of collaborative meetings with the contractor, plant operators, design engineer, construction manager, and SFPUC staff, a revised schedule for performing the Filter Retrofit shutdowns was created. The ability of the project team to overcome the challenge of changing the filter retrofit sequence was crucial to maintaining the project schedule and the SFPUC's water system, while still being able to complete important upgrades to the project.

Other Lessons Learned:

Change Management: At the request of the Owner, this project added approximately $10 million worth of change order items after the project was bid. The addition of such a large volume of changes posed several challenges including construction sequencing primarily related to shutdown requirements that were difficult to overcome. The lesson learned here is not to add major changes after the project is bid.

Undocumented Existing Conditions: This project had to overcome unknown field conditions related to undocumented underground plant utilities and also incomplete as-built conditions. The lesson learned is to take the extra time and expense during the planning and design phases to perform

thorough investigations of existing conditions at a facility as complex as SVWTP, especially if multiple projects have been done over the years and as-built conditions are not thoroughly known.

Global Change Order: Due to the large number of changes, SFPUC was faced with the challenge of negotiating a global change order for cumulative time and cost impacts mid-way through the construction period. The global change order included several unresolved changes and time impacts resulting from these changes. This change order enabled the project team to resolve many issues that had accumulated mid-way through the project and enabled the project teams from the owner and contractor to work together and finish the project successfully.

VI. SVWTP Materials Attached for Use in Workshop Participant Binders and Posting to BAYWORK Website:

- Photos: Sunol Valley Water Treatment Plant
- Sunol Valley Water Treatment Plant Fact Sheet