Project Descriptions:

San Diego Pipeline No. 6

Ref.: - Final EIR certified by MWD's Board in May 1993

- Multiple Board items from March 2001 (Item 9-2) through March 2006 (Item 8-4) authorizing design, R/W acquisition, professional services agreements, and construction of the North Reach.

Pipeline 6 is a joint project between Metropolitan and the SDCWA. Metropolitan's portion consists of approximately 6.5 miles of tunnel and 12.5 miles of buried pipeline construction measuring ten feet in diameter. It will be constructed from the Lake Skinner Reservoir in southern Riverside County to just north of the San Luis Rey River in north San Diego County. The San Diego County Water Authority (SDCWA) will connect at the San Luis Rey River and build 11 additional miles of pipeline and/or tunnel, ending at their diversion structure just north of the City of San Marcos in San Diego County.

As described in the FEIR, SD6 is the result of a comprehensive planning effort. The various studies, conducted in the 1980's and early 1990's, addressed the myriad issues of population growth, water demand, conservation, reclamation, water quality, service reliability and flexibility, and drought management. SD6, along with comprehensive groundwater management, conservation, and water reclamation programs, is needed to provide sufficient water deliveries to meet 1) water resources management, 2) system reliability, and 3) system flexibility objectives in San Diego and southern Riverside Counties. On the basis of these issues and objectives, the needs analysis identified additional conveyance capacity required in the year 2010 ranging from 470 cfs to 636 cfs. Currently, the assumption is that 520 cfs will go to SDCWA and 80 cfs will go to Rancho California at the Deportola/Anza road intersection, for a total of 600 cfs. Downstream control will be provided by SDCWA at the diversion structure in San Marcos.

Second Lower Cross Feeder (Ref. Board Letter Item 8-2 Jan 2006 authorizing design)

The Second Lower Cross Feeder (SLCF) is a new 84-inch diameter pipeline approximately 2.4 miles long and designed to convey up to 100 cfs of treated water into the Diemer service area. It will be bi-directional in order to provide an additional future delivery route into the "Central Pool" (Los Angeles, Orange, and Ventura Counties) once the Central Pool Augmentation (CPA) Program is completed. This connection will improve operational flexibility and reliability by augmenting the Diemer water treatment plant's service area through delivery of additional treated water from the Jensen water treatment plant. The SCLF will allow deliveries to be maintained to much of the Diemer service area during emergencies, scheduled shutdowns and outages, and ensure treated water quality.

West Valley Conveyance (Ref. West Valley Area Study – Report No. 1042 March 1993)

C. SANTA CLARA RIVER VALLEY CONCEPT

The Santa Clara River Valley concept would convey water from Metropolitan's Foothill Feeder, westerly along the Santa Clara River, and then turn south to Calleguas MWD's boundary. This concept would "transfer" Calleguas MWD demands on West Valley Feeder No. 2 to the new Santa Clara Feeder and allow more of West Valley Feeder No. 2 to be used by LADWP and Las Virgenes MWD. Las Virgenes could also receive additional supplies through a planned connection to Calleguas' distribution system. The pipeline would be routed mostly through undeveloped lands making construction generally easier and less costly on a per foot basis. However, it is expected these routes will be longer than the San Fernando Valley routes making total project costs higher than for the San Fernando Valley routes.

A Santa Clara Feeder would provide a second route for water supplies into the West Valley service area and add to the areas' supply reliability. Depending on the route, the Santa Clara Feeder may not cross the Santa Susana fault or would cross it miles from the existing crossing in the Santa Susana tunnel.

Under this concept, additional treatment plant capacity would be required. Conceptually water could be treated at the beginning of the pipeline near Castaic Lake or at the end of the pipeline in Moorpark. There are potential feasible sites for a new filtration plant near Castaic Lake, including a 200-acre plateau southeast of Castaic Lake at an elevation of approximately 1350 feet, or land adjacent to Castaic Lake Water Agency's Rio Vista Treatment Plant near Santa Clarita. A potential site for a filtration plant in Moorpark is in Happy Camp Canyon or near Lake Bard. However, a promising alternative for additional treatment capacity would be to expand and utilize the existing Rio Vista Treatment Plant.

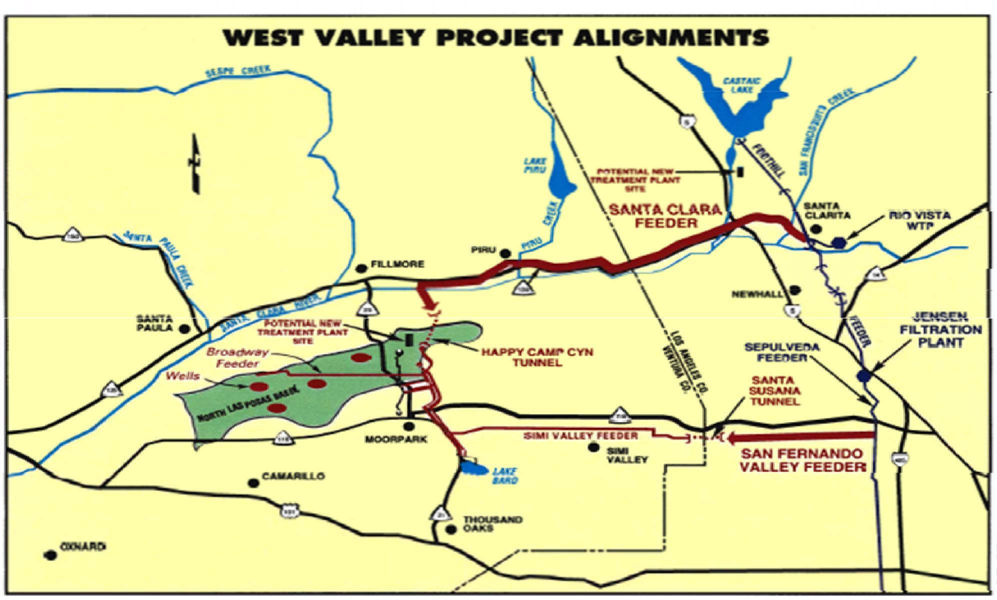

FIGURE 6-1

East Branch State Water Project

(Ref. Phase II Draft East Branch Enlargement Feasibility Report – April 29, 2008)

10.1 CONCLUSIONS

This report presents the results of the URS/MWH cost analysis studies and provides a basis for further project design development. The report focuses on recommending the most economical combination of canal raise and hydraulic structure (including check structures and siphons) improvements to accommodate increasing flow in the East Branch of the California Aqueduct from the current (Phase I) 2,010 cfs to 2,876 cfs (Phase II) and to explore innovative designs to reduce cost. This report supplements DWR's East Branch Aqueduct Enlargement Study (DWR, 2004).

The canal capacity will need to be increased, in part, by raising the canal banks. The amount of the raise required will vary depending upon the hydraulic operating scenarios ultimately selected and the height of existing canal lining and embankment. The following seven alternatives were evaluated to raise the canal embankments:

- Alternative 1: Earthfill embankment (similar to DWR's 2004 study)
- Alternative 2: Roller compacted concrete (RCC)
- Alternative 3: Spread footing wall
- Alternative 4: Concrete parapet
- Alternative 5: Earthfill embankment with retaining wall
- Alternative 6: Slipform wall
- Alternative 7: Precast panel wall

These alternatives were evaluated based on criteria that included implementability, operational flexibility, maintainability and reliability, and cost.

The earthfill embankment raise (Alternative 1) may be used where DWR already has right-of way or in undeveloped areas where additional right-of-way can be obtained (i.e., developments do not encroach on the canal embankments). To improve seismic reliability, the earthfill embankment is also the only canal raise alternative that may be used where the canal traverses an active fault zone. Where developments encroach on the canal, Alternatives 2 through 7 were considered. For canal raise requirements greater than 8 inches, a precast panel system (Alternative 7) was found to have the lowest cost. Where the canal raise is less than 8 inches, a slip form wall or vertical curb was found to be more cost effective.

The enlargement of the East Branch Aqueduct will require modifications to the 11 siphons and 15 check structures upstream of Pearblossom Pumping Plant. Downstream of Pearblossom Pumping Plant, modifications to the Tejon siphon and the Antelope check structure and siphon are needed. This evaluation included adding two bays to existing two bay check structures and a single bay added to three bay check structures so that all check structures will have four bays. A single barrel will be added to the thirteen siphons.

Modifying the check structures while minimizing impacts to existing operations presents one of the greatest challenges to the East Branch Aqueduct Enlargement. In addition to adding a bay at each check location, the modification will include adding a siphon barrel at these check locations

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with siphons and modifying the existing radial gates and inlet and outlet transitions to accommodate the raised canal crest.

To increase canal capacity, overchutes can be handled in two ways. They can be raised to meet the desired freeboard or anchored in their existing position. However, overchutes cannot be raised without also raising the upstream flow transitions. In most cases, this would result in significant grading requirements at the upstream end of the overchute. Accordingly, anchoring overchutes in place was found to be more economical than raising them. As such, the anchorage concept was adopted for this feasibility study. Bridges will need to be raised to a minimum clearance of 1-foot above the maximum water surface elevation to meet CALTRANS requirements.

The canal raise portion of the work will not present much impact to operations during construction. From an operations standpoint, the canal lining raise could most likely be scheduled to occur anytime during the year. The check/siphon modifications will present the majority of the scheduling challenges for the work. Due to the importance of maintaining the water supply in the East Branch Aqueduct, a full shutdown of the facility for an extended period of time is not feasible. It is assumed that most work involved in expanding the capacity of the canal would be done at its current full flow capacity. This requirement may add considerable difficulty to the expansion of checks and raising of bridges. However, modifications to checks and siphons will likely necessitate a reduction of flow. This reduction in flow will depend on the number of similar structures that can remain in operation during construction. Multiple crews and shifts may be necessary to minimize the period of time flow is reduced (mid-October to mid-February).

For scenario development, the general approach was to evaluate combinations of improvements to increase canal capacity to 2,876 cfs. Various combinations of improvements were evaluated using the calibrated HEC-RAS hydraulic model to check the effect that various improvements would have on canal water surface elevations. Three scenarios were considered:

- Scenario 1: DWR 2004 Report Conditions, updated to reflect current costs, for comparison purposes; includes 16 check bays.
- Scenario 2: Canal Raise Alternative – includes precast panel wall (in lieu of full embankment raise) in portions of the canal; includes 23 check bays.
- Scenario 3: Smooth Siphon Alternative - includes application of a smooth polyurethane or epoxy coating to the inside of all the siphons to the structural improvements of Scenario 2 to reduce the height of canal raise.

The estimated construction costs (including 20 percent contingency but no "soft costs"), in third quarter 2007 dollars, and present values for the three scenarios are summarized below:

Cost	Scenario 1 – DWR 2004 Report – Updated	Scenario 2 – Canal Raise Alternative	Scenario 3 – Smooth Siphon Alternative
Construction Cost	$372 million	$363 million	$347 million
Present Value	$400 million	$390 million	$390 million

As shown in the above summary, the estimated construction costs of the three scenarios are similar (costs are within 7 percent of each other). Although Scenario 3 - Smooth Siphon Alternative could have a slightly lower initial cost than the other two scenarios, this scenario would require periodic reapplication of the polyurethane or epoxy coating. This product has only been in use since about 1993, so it does not have an extensive service record for this product. The estimated interval for reapplication could be between 10 and 30 years; 15 years was assumed for the life cycle analysis. This reapplication would need to be done during periods when the canal can operate at lower flow rates (mid-October to mid-February). Clearly, there are performance risks associated with this scenario that must be quantified if siphon coatings are to be further considered. At this time, there does not appear to be a clear benefit for this scenario.

The cost of Scenario 1 would be greater than shown above with the addition of right-of-way costs. It appears that significant cost savings could be achieved by using precast panel walls, or similar walls (Scenario 2), instead of a full canal embankment raise (Scenario 1). Full canal embankment raises can only be used in areas where developments have not encroached on the East Branch canal embankments and where the canal crosses active fault zones. Further engineering and cost studies will need to be undertaken to confirm the most cost-effective canal raise system on a specific location basis.

To evaluate the cost tradeoff of using 16 check bays instead of 23 used for Scenario 2, but increasing the canal crest elevation, the cost of this variant of Scenario 2 was estimated. The total cost was found to be about $362 million, which is nearly the same as for Scenario 2. Thus, no significant cost benefit was realized for this variant. Furthermore, for this variant, there would also be less operational flexibility than for Scenario 2 with the 23 check bays.

The overall construction duration for the three scenarios is estimated to be about 2500 days (6.8 years). Currently, modifications to Pearblossom Pumping Plant define the end of construction. It may be possible that work at Pearblossom could be initiated earlier than originally planned to shorten the overall project schedule.

10.2 RECOMMENDATIONS FOR FURTHER STUDIES

Further studies and engineering are needed to develop the concepts explored in this report for the Phase II East Branch Enlargement. Recommendations include:

- Conduct alternative analysis to optimize size of additional siphon barrels.
- Prepare alternative analyses on a site specific basis for construction of new check structures separated from existing check structures.
- Establish order of priorities for structures and related canal lining raises. Priority could be given to areas where capacity can be increased most cost effectively. For instance, the canal upstream of Pearblossom could be improved to provide increased capacity early in the East Branch Enlargement.
- Complete digital terrain model of the canal so that the cost of the earthfill embankment canal raise alternative can be estimated more accurately and compared to other alternatives.
- Complete right-of-way mapping for the canal and incorporate the cost of right-of-way into the overall scenario costs.
- Perform slope stability analyses of the canal embankments for the enlarged aqueduct capacity using properties of the embankment materials that are based on laboratory testing data.
- Confirm locations of earthfill borrow materials for use in canal embankments.
- Perform structural analyses of the culverts, radial gates and other features for the increased loading from the enlarged aqueduct.
- Perform hydraulic analyses to assess the performance of the transitions to the enlarged check structures.

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