San Clemente Dam Removal Project

Project Description

In Cannery Row, John Steinbeck wrote *"The Carmel is a lovely little river. It isn't very long but in its course it has every thing a river should have."* Since 1921, however, the Carmel River and its wildlife resources have been impacted by San Clemente Dam. As a result of the dam, the Carmel River suffers accelerated erosion, the once vibrant steelhead run has dramatically decreased, and lives and property below the dam are threatened with collapse of the unsafe structure. Today, there is an extraordinary opportunity to remove the antiquated dam and initiate a watershed restoration process that will bring this river back to life.

Background

The Carmel River is located in Monterey County along California's central coast. The river has its headwaters in Los Padres National Forest and its 255-square mile watershed drains the north side of the Santa Lucia Mountains. The river provides essential habitat for many important species, including steelhead trout and California red-legged frog, both listed as threatened under the Federal Endangered Species Act.

Figure 1: San Clemente Dam

San Clemente Dam is a 106-foot high concrete arch dam located approximately 18.5 miles from the Pacific Ocean on the Carmel River (Figure 1). California American Water (CalAm) owns and operates the dam. When the dam was constructed in 1921, it had a reservoir storage capacity of approximately 1,425 acre-feet. Today the reservoir is over 90% filled with more than 2.5 million cubic yards of sediment, leaving a reservoir storage capacity of approximately 125 acre-feet. At this point, the sole function of the dam is to provide a diversion point for water withdrawals from the river.

In the early 1990s, the California Department of Water Resources (DWR) Division of the Safety of Dams (DSOD) issued a safety order, determining that the dam structure could potentially fail in the event of either the maximum credible earthquake or probable maximum flood. CalAm was tasked with finding a solution to this safety problem and proposed a project to strengthen the dam's structure. In 2006, DWR released a Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS) evaluating CalAm's preferred approach of Dam Strengthening (also referred to as 'buttressing"), as well as four alternative projects.

The most feasible alternative, the Carmel River Reroute and Dam Removal (Reroute and Removal) option, provided a solution to the dam safety issue, while also addressing the other issues related to the dam's impact on the river. The Reroute and Removal project would provide numerous public benefits including:

- Permanent resolution to the dam safety concern
- Unimpaired access for steelhead trout to over 25 miles of spawning and rearing habitat

- Restoration of sediment to the lower river and Carmel River State Beach
- Restored ecological connectivity of aquatic and riparian habitats

For these reasons, the California State Coastal Conservancy (Conservancy), National Marine Fisheries Service (NMFS), and the Planning and Conservation League Foundation worked with CalAm to develop a feasible approach to cooperatively implementing the Reroute and Removal option. In December 2007, DWR certified the Final EIR/EIS, and in February 2008, DSOD confirmed the Reroute and Removal project would alleviate the dam safety deficiencies.

Implementation Strategy

The Conservancy, CalAm and NMFS, outlined the key elements of the implementation strategy for the Reroute and Removal project, in an agreement signed in February 2008. Per the agreement, project implementation will be shared by the three entities as follows:

- The Conservancy will manage project planning and design;
- The Conservancy, with the assistance of NMFS, will coordinate with the regulatory agencies to secure all permits and expeditious approval of the project;
- CalAm will manage the project construction;
- Upon completion of the project, CalAm will transfer the project area lands, approximately 928 acres, to the Monterey Peninsula Regional Park District for watershed conservation and compatible public access.

Project Costs

The total project cost for the Reroute and Removal project is currently estimated at $83 million (Figure 2). According to the implementation agreement, CalAm will pay an amount equivalent to the estimated cost of buttressing the dam, or approximately $49 million. The Conservancy, with assistance from NMFS, will secure the additional $34 million from state, federal, and private foundation sources (the "public funders").

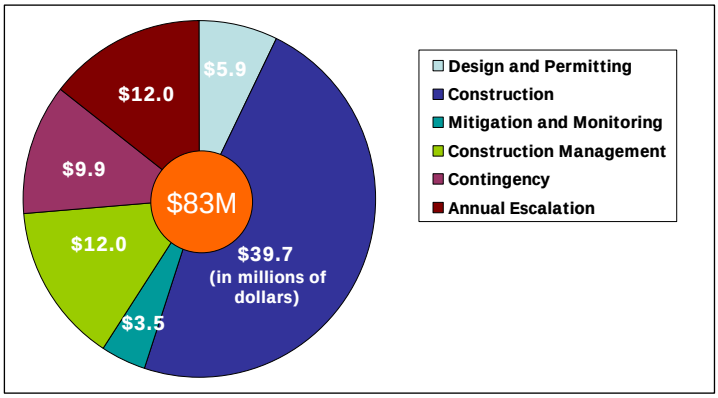

Figure 2: Project Costs

This cost estimate includes the costs of final design and engineering, additional technical studies and review, environmental review and permitting, project construction, design and implementation of required mitigation and monitoring measures, project management, and project administration. The $83 million cost estimate includes a 25% contingency as well as a category for "unidentified items" accounting for 10% of the construction costs. Thus, it is considered a fairly conservative cost estimate.

There is a potential opportunity for reducing the cost of dam removal by obtaining the assistance of the U.S. Department of Defense's Innovative Readiness Training Program (IRT). Through this program, members of the military reserves achieve their training objectives through participation in civilian projects. Civilian partners must pay for equipment and materials, but the military pays for the labor costs. IRT troops could potentially undertake many elements of the dam removal project including construction of roads, pipelines, and the diversion dike; earthmoving; blasting of the reroute channel;

and removal of the dam (see Project Description for more information). IRT staff has expressed serious interest in participating in the project. The project team is working on an application for IRT participation.

Project Description

Figure 3: Aerial Photo of Project Site

With any dam removal project in the western U.S., one of the most difficult issues is determining how to manage the sediment which has accumulated behind the dam. It is estimated that there are 2.5 million cubic yards of sediment behind San Clemente Dam. Due to limited and difficult access to the dam site, trucking the sediment out was deemed infeasible, both environmentally and economically. Likewise, due to the current significant flooding issue along the lower Carmel River, allowing the sediment to erode downstream was deemed infeasible because it would likely worsen downstream flooding. Therefore, the project design proposes to re-route a half-mile portion of the Carmel River into San Clemente Creek and use the abandoned reach as a sediment storage area. This is described in greater detail below and illustrated in Figures 3-5.

San Clemente Dam is located just downstream of the confluence of the Carmel River and San Clemente Creek (Figures 3 and 4). The two waterways are separated by a narrow ridge. As can be seen in Figure 3, the majority of the sediment which has accumulated behind the dam is located along the Carmel River side of the reservoir. The design of the Reroute and Removal project takes advantage of this situation by transforming the Carmel River arm of the lower reservoir (already full of sediment) into a permanent sediment storage area. This design minimizes the amount of sediment which must be excavated and moved, thereby reducing the project cost as well as some of the environmental impacts.

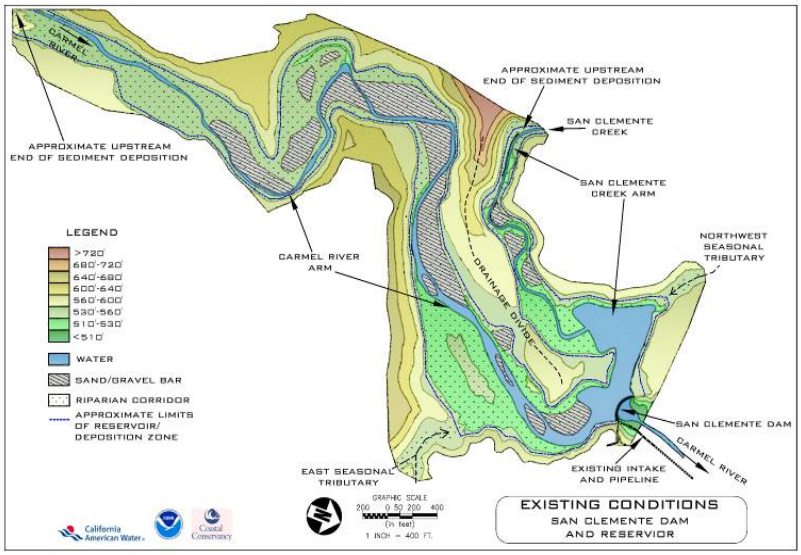

Figure 4: Schematic of Existing Conditions

To establish the lower Carmel River arm of the reservoir as a permanent sediment storage area, the river must

be rerouted into the adjacent San Clemente Creek, upstream of this area. This will be accomplished by cutting a “diversion channel” (also called a bypass channel) through the narrow ridge separating the two waterways, approximately one-half mile upstream of the dam (Figure 5, Label #1). The diversion channel would be cut by a combination of blasting and ripping the rock. Rock excavated from the diversion channel would then be used to create structure that would block the river from entering the sediment disposal area and divert it into the newly cut diversion channel. This structure, the “diversion dike”, would essentially be a new ridge cutting across the valley floor (Figure 5, Label #2).

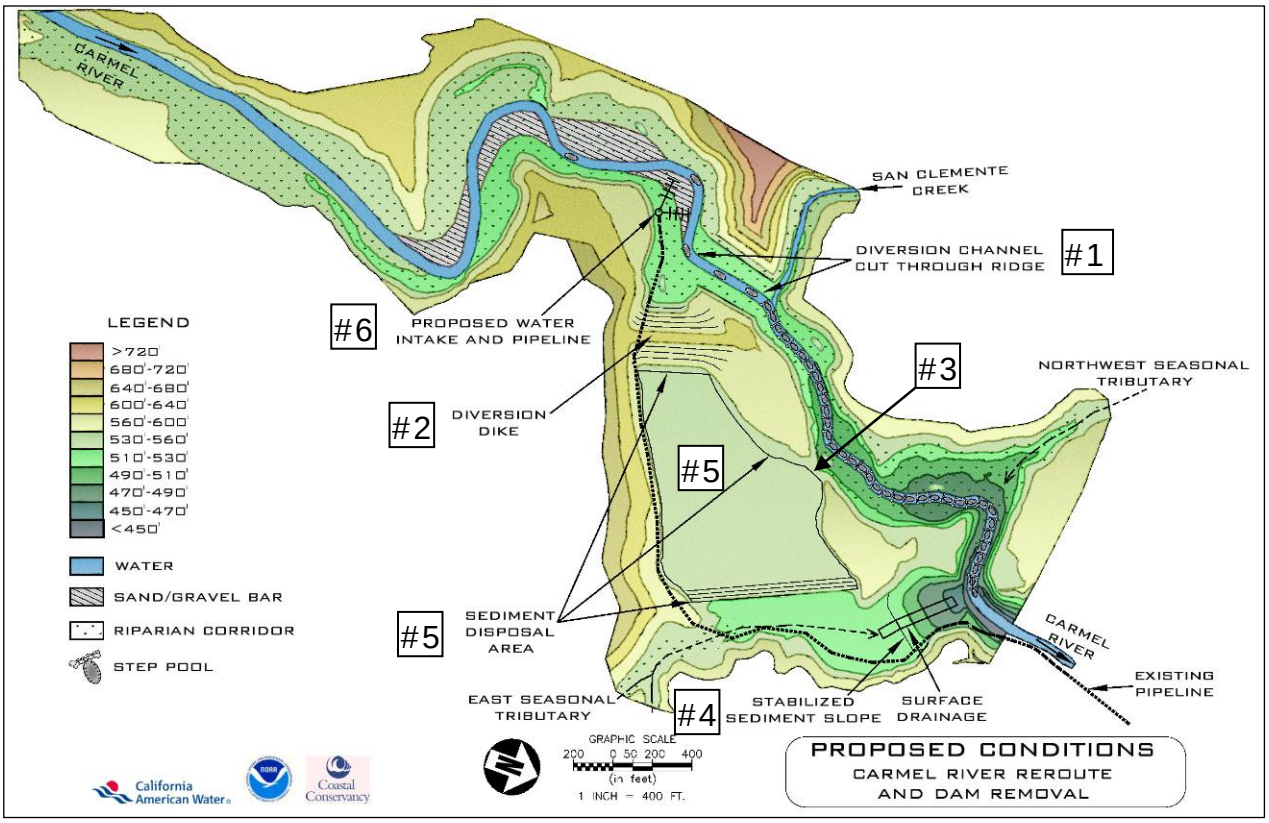

Figure 5: Schematic of Dam Removal Project Components

Although the majority of accumulated sediment is already on the Carmel River side of the reservoir, approximately 380,000 cubic yards of sediment that has accumulated in the San Clemente Creek arm would need to be excavated and added to the Carmel River sediment storage area. A temporary haul road would be created at a low point in the ridge separating the river and the creek (Figure 5, Label #3) to transport the excavated sediment , using heavy earthmoving equipment. Sediment that has accumulated immediately behind the dam on the Carmel River side would also need to be excavated and moved further upstream. Once all the sediment excavation and placement is complete, the sediment disposal area will slope gently up from the edge of the river (Figure 5, Label #4) to a broad plain (Figure 5, Label #5) where the disposed sediment has been placed. The sediment slope will be stabilized to ensure that it is not eroded by the river during high flows. Eventually the sediment disposal area is expected to revegetate with upland scrub habitat similar to the surrounding hillsides.

On the San Clemente Creek side of the reservoir, the half-mile reach between the dam and the downstream end of the diversion channel would be reconstructed to carry the combined flows of both the river and the creek, and to allow for fish passage. First, the sediments would be excavated down to

the pre-dam elevations. In order to facilitate fish passage, a series of step pools will be created along this reach. The step pools will be created by placing large rocks across the bottom of the channel (Figure 6a). In high flows, water will flow over the rocks creating small (approximately 1 foot) jumps for the steelhead. Behind the rocks, water will pool, creating an area of slower moving water where the fish can rest before taking the next jump. This design is based on naturally-forming step pools that can be found further upstream in steeper reaches of the Carmel River (Figure 6b).

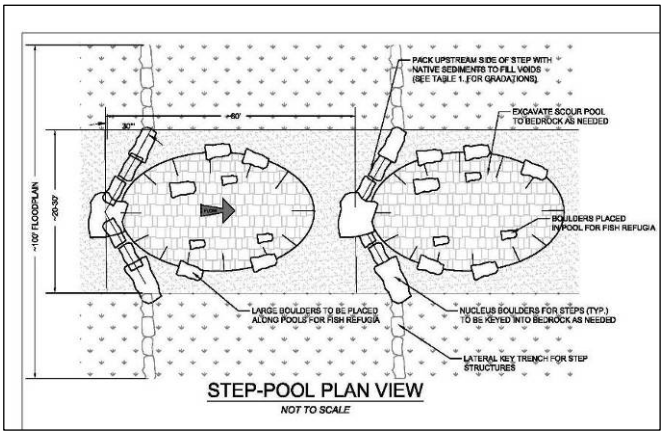

Figure 6a: Step-pool Design

Along both the reconstructed reach of San Clemente Creek and the diversion channel, measures will be taken to restore and/or establish riparian habitat. This will include creation and/or enhancement of seasonal ponds that can be used by California red-legged frogs. The ultimate goal is to create a dynamically resilient riparian corridor. In other words, the design assumes that while step pools, frog ponds, riparian habitat and other features may be changed by high flows, the system will naturally re-establish itself in such a way so that the functions of fish passage, sediment transport, and habitat support will continue to be provided.

Figure 6b: Step pools in upper Carmel River

Once the sediment excavation and stream restoration is complete, the dam will be demolished. The concrete rubble will be used to help stabilize the sediment stockpile and the diversion dam. All concrete rubble will be used on site. No construction wastes will need to be trucked off site.

CalAm currently maintains a water withdrawal or “diversion” point in the reservoir. This diversion point will not be functional once the dam is removed and the reservoir drained. Therefore, the project includes a component to relocate the diversion point. As shown on Figure 5, Label #6, the new water withdrawal structure will be placed upstream of the diversion channel. The new diversion point will be below ground along the bank of the river using a Ranney collector, a well-established technology for subsurface water withdrawal.

Finally, the project currently includes notching the Old Carmel River Dam (OCRD) located approximately 1800 feet downstream of San Clemente Dam. The OCRD is a 32-foot high structure built in 1893. Notching it would improve fish passage. However, in a separate effort, the National Marine Fisheries Service is working with CalAm to have the dam removed rather than notched. Removing the OCRD would provide even greater benefits to fish passage and river function.

Project Construction

Construction of the project is expected to take three years. Construction activities will be restricted to approximately April to November to avoid the rainy season and impacts to migrating steelhead. During years two and three of construction, the Carmel River and San Clemente Creek will be diverted around the reservoir and dam site, and the reservoir will be dewatered.

Primary access to the site during construction will be from Cachagua Road. There is an existing jeep trail off of Cachagua Road that leads part way to the reservoir. This jeep trail will be improved and extended all the way to the reservoir (Figure 7, Label #1). For work on the dam itself, construction equipment will be brought in along San Clemente Drive and the low access road to the dam (Figure 7, Label #2). The low access road will need to be improved to accommodate construction vehicles.

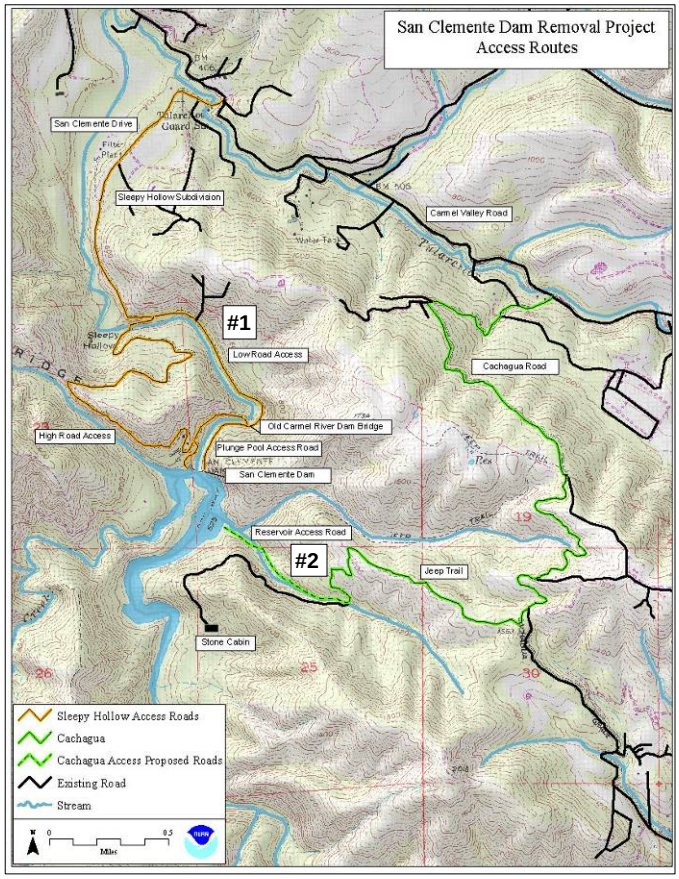

Figure 7: Construction Access Routes

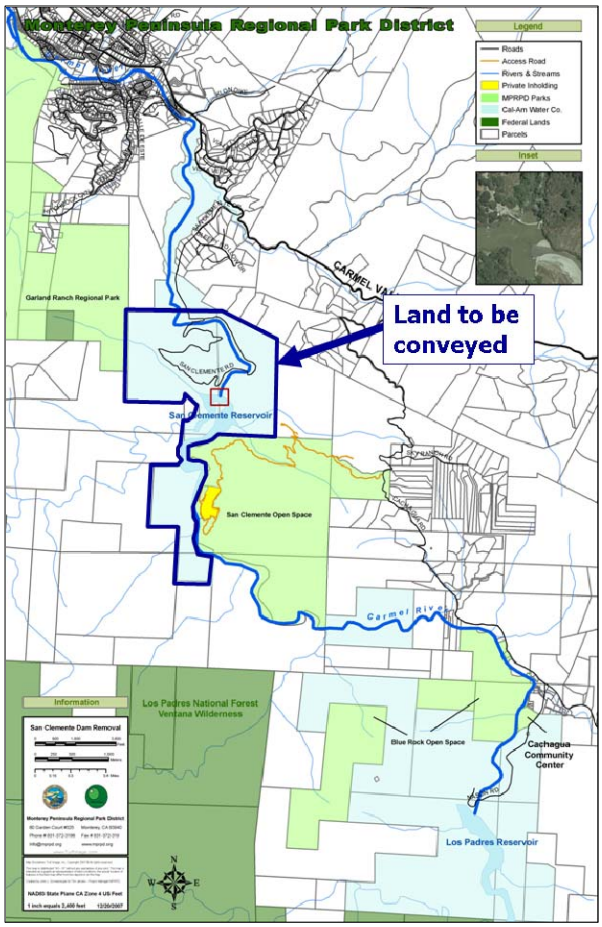

Figure 8: Land to be Conveyed to MPRPD

The first year of construction would consist primarily of road improvements and site preparation work such as clearing the area for the diversion channel excavation and creating the temporary haul road. In the second year, the diversion channel will be cut, the diversion dike constructed, and sediment excavated from San Clemente Creek. The third year of construction will include reconstruction of the San Clemente Creek arm, stabilization of the sediment disposal area, dam removal, and initiation of habitat restoration elements. Habitat monitoring and maintenance is expected to continue for several years after the project construction is complete.

At the completion of the project, CalAm will transfer the project lands (Figure 8) to the Monterey Peninsula Regional Park District (District). The donated property will link Garland Regional Park and the San Clemente Open Space, which are both owned and operated by the District. Use of the property will be restricted for watershed conservation and compatible public access.

Summary

The Reroute and Removal project presents a unique opportunity for public and private interests to work together to realize public benefits far beyond what either could achieve working alone. It offers a permanent solution to the dam safety issue while also restoring the Carmel River's natural processes and providing unimpaired access to over 25 miles of spawning and rearing habitat for steelhead trout.

Additional Information:

http://www.scc.ca.gov/disp_gen.file?san_clemente

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