EXHIBIT 12-A

Carmel River Bank Stabilization at Rancho San Carlos Road
Project Description and Work Plan

EXISTING CONDITION

The proposed Carmel River Bank Stabilization at Rancho San Carlos Road Project (RSC Project) is located at River Mile 3.8 (measured from the Pacific Ocean) just downstream of the Rancho San Carlos Road Bridge **(Figure 1)**. The project area contains two eroding stream banks almost opposite from each other. Concern for the stability of the right bank (Moratz Property) started in 2011 and interim measures such as jute netting, willow planting, and irrigation were carried out to try and stabilize the bank. Then in February of 2017, during a high flow event (9,570 cubic feet per second at the U.S.G.S Near Carmel gage) the left bank on Quail Lodge Property experienced significant erosion and approximately 10 to 15 feet of bank eroded along 300 lineal feet **(Figure 2)**. During the high flows, numerous large cottonwood trees toppled out of the river bank and culturally significant Santa Barbara Sedge beds were lost. Currently the left bank is very vulnerable to erosion from high flows because it has lost its protective vegetative cover and is on the outside of a meander bend in an area that can erode during high flows. Because these vulnerable streambanks are so close together, work on one bank can impact the other. Therefore, a comprehensive project addressing both banks is being proposed **(Figure 3)**.

PROJECT DESCRIPTION

On June 21, 2017, the District contracted with Balance Hydrologics to provide a design for the RSC Project. Based on investigations of the site, a log cribwall (approximately 160 feet in length) was recommended for stabilizing the left bank with a smaller boulder log structure (approximately 60 feet long) for the right bank. Balance Hydrologics chose this design based on the fact that:

- The riparian corridor is a source of large wood debris to the channel; a log-based structure would be appropriate for the project site.
- Long-term stability of the site will be enhanced by successful vegetation growth and the development of root networks through the structure by woody vegetation.
- Banks should be reassembled with a mix of sand, gravel, and cobble for the lower bank; finer material would only be appropriate on the upper bank.
- Regulatory agencies prefer projects that incorporate large wood and revegetation versus banks covered in rip rap only.

A log cribwall will protect the most severely damaged portion of the left bank. Other options for treating the left bank were considered—for instance, boulder barbs and log/boulder toe protection—but the cribwall was chosen for a number of reasons. The 2D hydraulic model indicated that shear stress is relatively low at the 10-year design event (at most 1.0 lb/ft2 on the left bank) and velocity is at most 8.1 ft/sec. According to stability thresholds for stream restoration materials summarized by Fischenich (2001), a number of treatments would be capable of withstanding these conditions. A purely vegetation based treatment was not selected because the long-term stability of the treatment depends on the successful establishment of vegetation. Moreover, there is high risk for failure of vegetative treatments during the establishment period, which could be as much as four to five years. For example, the probability of a 10-year event—which would be expected to cause a vegetative treatment to fail—during a 5-year establishment period is approximately 41 percent. On the opposite end of the spectrum from a purely vegetative treatment are hard surfacing options such as rip rap. A hard-surfacing option was not selected because large clasts are not geomorphically appropriate for the project reach. Furthermore, hard surfacing options are predisposed to offsetting a bank erosion problem to downstream reaches. Rip rap and similar hard surfacing schemes are not favored by regulatory agencies for similar reasons. Lastly, these types of treatments tend to detract from the aesthetic quality of a system.

The log cribwall will provide immediate protection up to the design event, and the plantings within the cribwall will provide long-term protection after the logs have decomposed (anticipated to occur over several decades). Visually, the cribwall have wood, rock and vegetation elements immediately after construction, with vegetation becoming more dominant as it grows in. The bank roughness introduced by the cribwall will control velocities around the bend and not deflect flow to the next downstream bend, as would a hard-surfacing option. The log structure resembles a wood debris jam, which is geomorphically appropriate for the reach given abundant sources of large woody material along the riparian corridor and in the upper watershed. Large boulders have been used in the past with bank stabilization projects and providing a non-biodegradable means of scour protection was necessary to support the cribwall. The boulders are designed in a staggered pattern to maintain roughness around the bend should the channel continue to incise. The design attempts to maintain the channel width so as to not oppose the prevailing process of meander belt widening, nor adversely affect flood hydraulics. The ballast of the log structure is sufficient for stability, and it does not require extensive keying into the bank that would result in a larger construction footprint. The rootwads in the lower portion of the cribwall will provide benefits to aquatic habitat, as will vegetation in the cribwall once it matures.

The cribwall begins at the end of the concrete debris on the left bank, and extends for approximately 160 feet downstream. The cribwall was designed to be this length not only to protect the most vulnerable portion of the bank, but also to reshape the bank in a way that will eliminate the “scalloped” shape that formed after the major failure during winter 2017. The 2D hydraulic model indicated flow eddying within the scalloped area and flow accelerating as it leaves the scalloped area, which suggests that the bank irregularity is susceptible to ongoing erosion. The modest narrowing of the channel mentioned earlier is related to addressing the scalloped bank in order to avoid hydraulic patterns that would increase the risk of further bank erosion.

Construction of the left bank cribwall involves excavating below the river bed approximately 6 feet to place 1.5 ton boulders. Then logs are then place on top of these boulders and are back filled with half ton rock and then smaller channel material such as cobbles and gravels as you go up in elevation. A final set of boulders are placed at the back of the cribwall structure to anchor the logs. These boulders are eventually buried after the project is complete with a slope of 2:1. The final slope is covered with an erosion control blanket and the whole structure and finished slope is heavily planted with willows, black cottonwoods **(Figure 4)**.

The right bank stabilization structure also incorporates boulders, logs with rootwads, and river bed material such as gravel and cobble. The basic design uses 1.5 boulders as footers to help support the logs and well as one footer log. Log anchors will also be incorporated to secure them to the site. The area will also be revegetated with willows and black cottonwoods **(Figure 5)**.

Once vegetation starts to mature at both the cribwall and the right bank structure many of the elements of the design will start to blend in with the surrounding environment. A picture of a previously constructed cribwall with vegetation was provided by Balance Hydrologics **(Figure 6).**

Vicinity Map

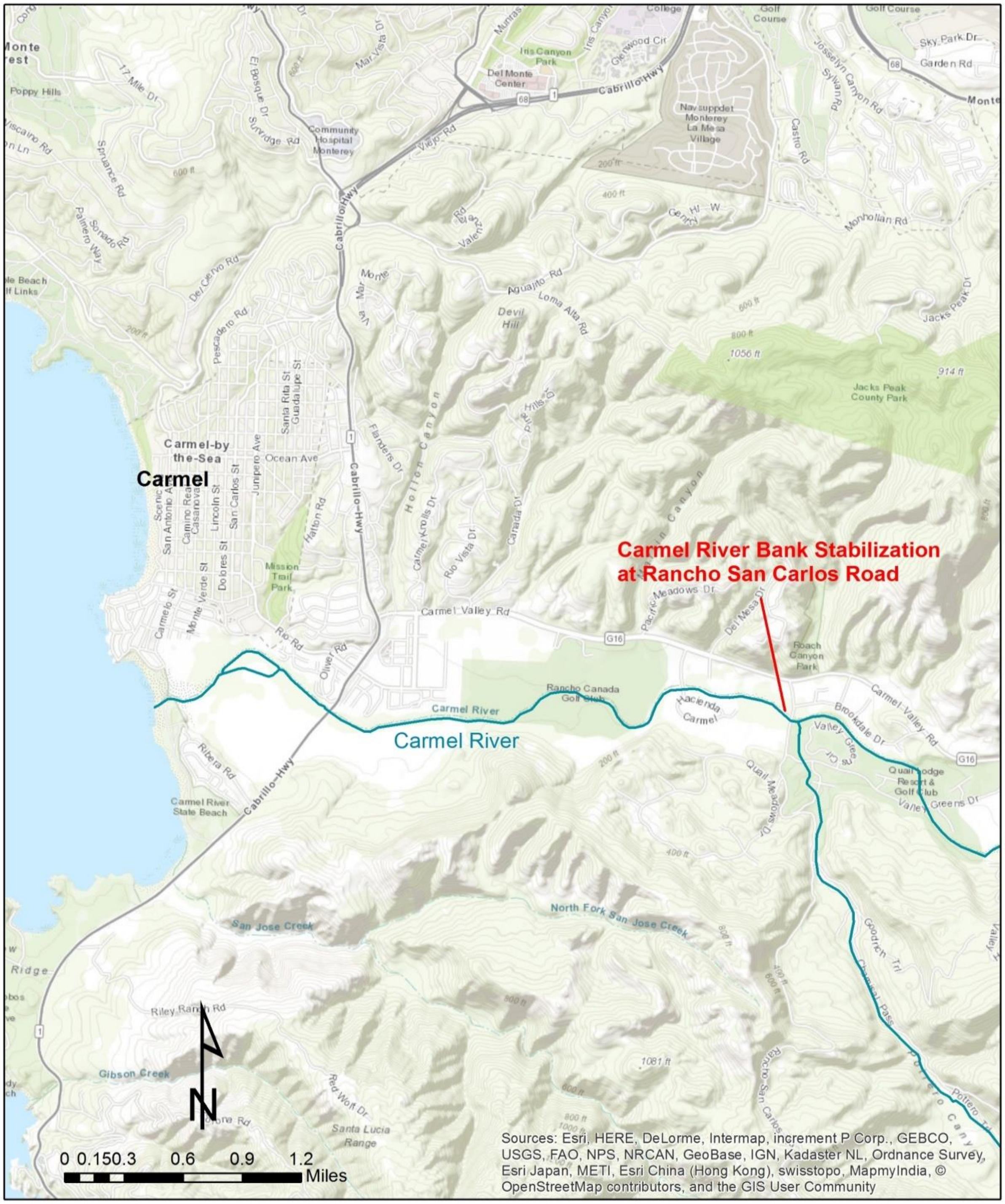

Figure 1. Project located just downstream of Rancho San Carlos Road Bridge

Figure 2. Left streambank after winter of 2017 erosion event (note lack of protective vegetation)

Figure 3. Aerial image showing locations of erosion just downstream of Rancho San Carlos Road Bridge

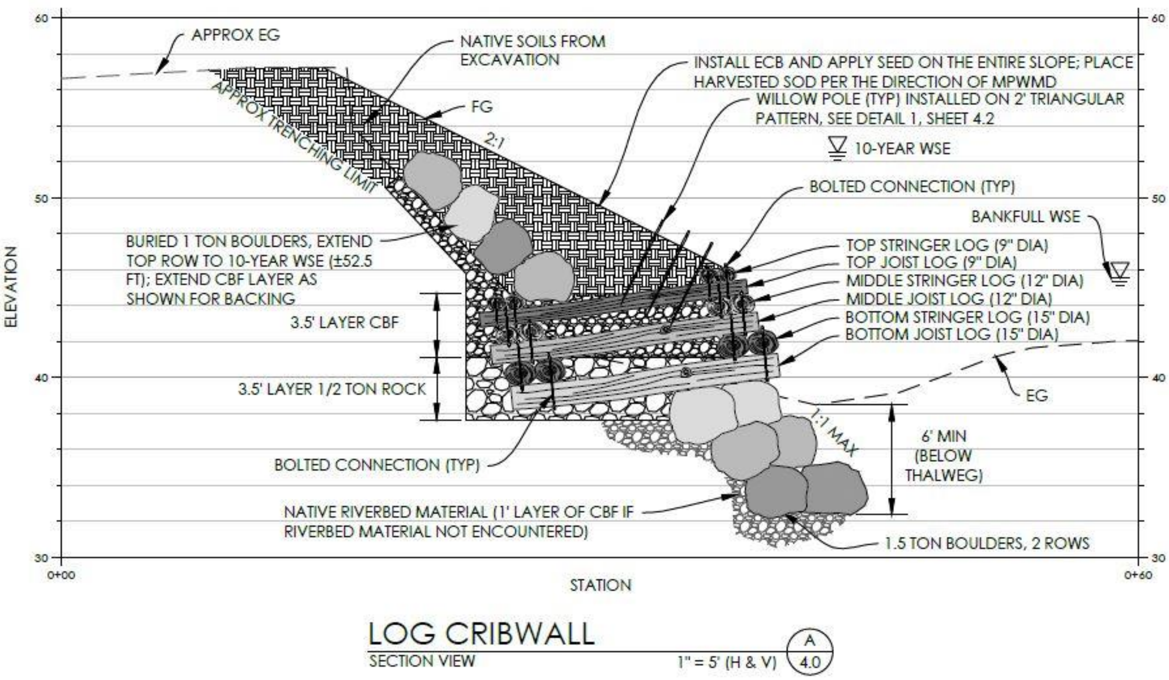

Figure 4. Example section view of log cribwall

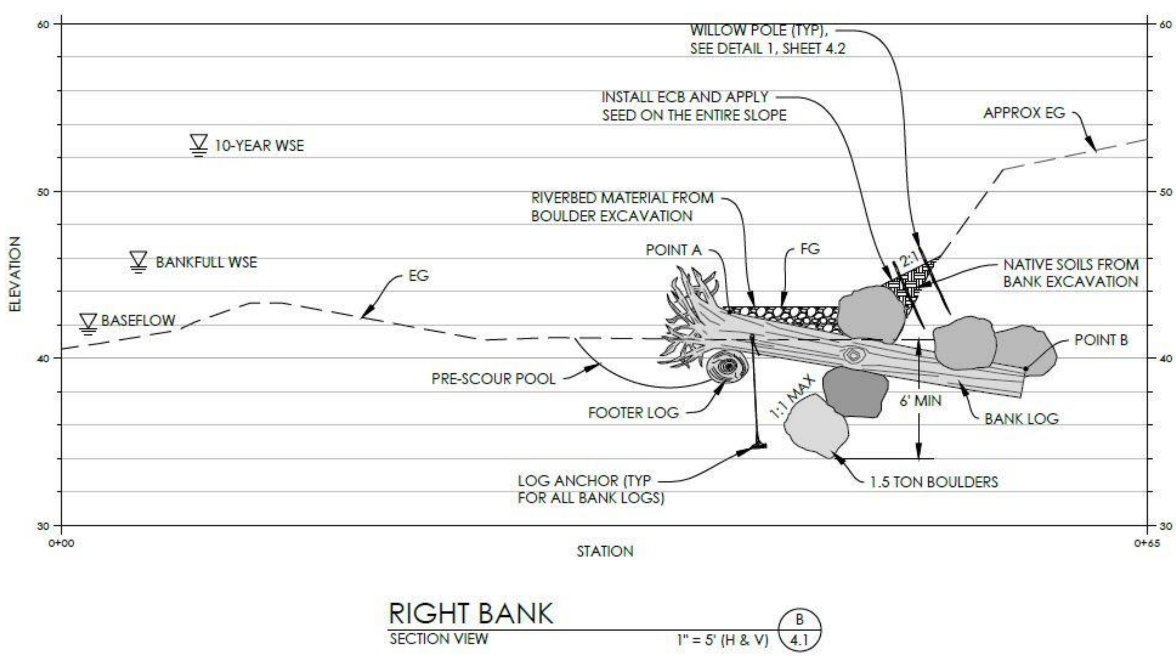

Figure 5. Example section view of right bank stabilization structure

Figure 6. Example of completed log cribwall