



Background and Recommendations Regarding the Sheet-Piling Project on Alhambra Creek

By Skip Lisle, M.S., President

Description of project and site

The City of Martinez is proposing to add steel sheet piling between Alhambra Creek and two properties owned by Mr. Earl Dunivan.

The lower, or downstream, property is a large building that directly borders the creek adjacent to the original beaver dam. The section of the upper property that borders the creek is a patio wall. The topography, vegetation, and soil structures present between each of the two structures and the creek are very different. The bank at the lower property is tall, steep, has a high percentage of relatively large rock (rip-rap), and contains some large tree-root formations. The upper bank along the patio is shorter, narrower, and comprised largely of fine sediments.

Since occupied by beavers, this section of Alhambra Creek has become a small but rich wetland ecosystem used by many species. As part of the greater human habitat in Martinez, I will describe it as a "green space," which is often used for wildlife viewing.

Project goals

My understanding is that relative to the beavers and the ecosystem, this project has several goals: 1) to make the greatest possible attempt to prevent beavers from being hurt during the pile-driving process; 2) to limit disruptions to the greatest extent possible so beavers do not leave the area; and 3) to minimize any reduction in the size and quality of the greenspace.

Digging by beavers

Beavers have dug holes of various sizes along both banks, but cannot be held responsible for all voids and other changes in the topography. Holes have a combination of origins including water-caused erosion, air spaces in rip-rap, cavities caused by decaying roots, and digging by rats and muskrats.

I am not an expert in subterranean mapping, but without digging the entire bank up there may be no good way to "map" these cavities. Ground-penetrating radar is a possibility, but it apparently it performs poorly in clay soils. Probing with poles reveals some information, but not a lot. Fortunately for the wall-construction process, knowing

the origin, size, and shape of voids is rather irrelevant. It is the presence or absence of beavers that is the critical information.

Bank cavities made by beavers typically start just below the water surface and slope uphill so beavers can get out of the water to a dry spot. Chambers are frequently close to the ground surface because "bad air" needs to be able to escape through the roof just as it does in traditional conical lodges.

Beavers are energy economists, so cavity-digging activity is most prevalent in deep, fine soils that are easy to cut through. Beavers are much less inclined to dig through rocky soils, particularly where the rocks are relatively large. It is highly unlikely that they would attempt to dig through cement unless it was quite decayed.

Work performed prior to the pile driving

Members of the Public Works crew and myself have attempted to confirm the presence of beavers, or beaver cavities, underneath the areas where the pilings will be placed. In my pre-visit planning, I envisioned locating an entrance hole beneath the water line and then, to intersect it and view inside, digging into the dry bank just above it. Once this was done, and beavers shooed out if necessary, the hole would be sealed off with fencing to prevent re-occupation prior to pile driving. This would be the surest way to know that beavers were not in a given hole. Unfortunately, because of the nature of the bank, this proved impossible on the lower property. The holes there are low and surprisingly level. The bank is tall and steep. Even if we were able to dig through the roots and rip-rap, we would have had to remove an enormous amount of material. I decided it was impractical to do this by hand; in that location the best approach would be to simply recommend placing the sheets as far away from the streamside entry holes as possible, and putting them in slowly. Assuming there are beavers present, this strategy reduces the likelihood of pilings hitting or trapping them. In addition, any cavity here would be fairly low, so there would be a good opportunity for beavers to be warned by the initial penetration of the piling and exit the hole. Because of the density of large rocks, this section of bank is poor digging and den habitat. It is therefore less likely that there are beavers in this location than in the fine-sediment areas.

Perhaps there is a sophisticated, robotic camera probe that would work. Beyond the fact that we don't have one, it would have to be launched underwater. I don't have a lot of confidence that there is such a device that could do everything we need it to do.

Our work in the fine sediments beside the terrace was more successful. We began by removing a very small portion of the original lodge to expose an old section of sheet pilings already in place (the new ones will tie into it). We also had to dig down where those pilings ended to ensure that the living chamber was not underneath the spot where the first new piling will be placed. I feared that our work would force us directly into the chamber and drive the beavers, if they were there, out. Fortunately, that did not become necessary. It was lucky that someone had previously placed pilings there and that the beavers chose to live in front of them instead of to the side or behind them. No beavers were seen exiting.

From there we worked downstream clearing vegetation from the bank, lowering the soil profile where the pilings will go, and searching for evidence of beaver cavities in that zone. We did not find anything that suggested beaver presence from the old lodge down to the end of the patio wall.

I am comfortable that we have taken every reasonable precaution to protect the beavers and that there is a high likelihood that no beavers will be directly impacted by the pilings themselves. However, there is no way to guarantee that outcome short of removing the entire bank with heavy equipment. To remove the banks to that extent, assuming it was possible, would represent a fate, for the beavers and the ecosystem, worse than the aforementioned risk.

Potential strategies not pursued

I recommended that the water level not be dropped to facilitate the inspection of burrows. Once construction begins, the beavers will be stressed. A familiar water level, vegetation, and, hopefully, additional hiding places are what will give them some sense of security. That should not be lessened.

Before I arrived, I considered the option of fencing off the creek upstream and downstream of the beavers to prevent them from leaving the area entirely. I also envisioned building a manmade shelter for the beavers at these points. As I have become re-acquainted with the area, however, I have gained confidence that that may not be necessary. Because of the new, small, downstream dam, the pooled habitat has become much longer than when I was last here. There is also a reasonable amount of vegetation in many areas along the banks. Perhaps there are also some burrows. We do not know for sure, but the beavers may choose to go down into this area, or upstream, to hide out during the construction process. It is very hard to know for sure, but it seems that it is better to risk the chance of beavers leaving the vicinity rather than to limit the length of this “escape area” with fences.

Recommendations for the construction process

There are several things that should be done to minimize the threat to, and disturbance of, beavers.

- ✧ **Place the sheet piles as close to the two walls as possible.** This will reduce the possibility of hitting or trapping beavers and minimize the loss of greenspace. This is particularly important on the lower property where it is not possible to fully inspect the bank for the presence of beavers. Moreover, this strategy will maximize stream-flood capacity in the channel.

- ✧ **Drive the sheets as slowly as possible, particularly during the initial few feet.** If there is a beaver underneath, this may allow them time to recognize the threat and escape out of the bank.

- ✧ **Minimize cutting of vegetation.** Vegetation is important as cover and food for wildlife. It also provides important shade for fish and for the beavers when they are out in the daytime. It is quite possible that the construction process will “flush” the beavers from lodges and bank cavities where they typically spend the days. Hopefully, they will retreat to other cavities further away from the construction. If they do

not do this, it is possible that they will spend at least part of the day attempting to hide in the vegetation at the water's edge. As nocturnal animals, beavers are sensitive to heat and sun. Thus, the importance of preserving as much overhead vegetation as possible.

Predicting the beavers response

There has never been an experiment in the behavior of beavers in close-proximity to noise and heavy, sustained vibration. We can only speculate as to what will happen. Although the scale is very different, the fact that these beavers are used to small vibrations caused by motor vehicles, and to the constant presence of humans, may help. The beavers might hold fast in their burrows, particularly if they are on the side of the creek away from the pilings. A more likely scenario is that they will come out and try to move away, probably downstream, and look for another burrow. If those aren't present the beavers may spend the day attempting to hide along the shoreline. If the beavers move out, the tendency of many people will be to follow them. Even though they are used to people, they would likely feel less stressed without a crowd gathered around them. With the possible exception of some supplemental feeding, I think it is best to just leave them alone and hope for the best. Hopefully, at night they will return to their favorite burrows, get some rest, have some food, and prepare for the next day's disturbance.

Our greatest challenge is that presented by the "unnatural": sustained large-scale vibration. On the plus side, beavers are resilient and have a good capacity for dealing with rapid and dramatic environmental changes. For thousands of years they have dealt intermittently with breached dams, rapid de-watering of habitat, and having their hiding places dug into by predators. Let's hope their adaptability wins out over this strange, unknown event.