Biological Assessment
Pajaro River and Salsipuedes and Corralitos Creeks
Management and Restoration Plan
Santa Cruz County, California

Prepared for

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EXECUTIVE SUMMARY

This Biological Assessment (BA) assesses the impacts that may result from the proposed project, identifies measures to minimize or avoid adverse impacts and evaluates reasonable project alternatives. The proposed project is based on three components: (1) The Pajaro River Management and Restoration Plan (CH2M Hill, 1997); (2) The Pajaro River 1998 Bank Erosion Assessment (Northwest Hydraulic Consultants, 1998); and (3) Proposed Long-term Maintenance Program for Salsipuedes and Corralitos Creeks (SCPWD, 1999). This project does not preclude or impede the development and implementation of a large-scale, long-term flood control project for the Pajaro River, which is currently being considered by Santa Cruz and Monterey Counties in cooperation with the U.S. Army Corps of Engineers.

Flood control management has been a primary issue regarding the Pajaro River and Salsipuedes and Corralitos Creeks since at least 1936 when the U.S. Army Corps of Engineers initiated a flood control study. The current earthen levee system was constructed along the lower segment of the river from Murphy’s Crossing to the river mouth in 1949. The levee has since damaged and overtopped during high stream flows, especially in the winters of 1986, 1989, 1995 and 1998. Emergency actions conducted in response to significant flooding in 1995 included removing most of the riparian habitat along the Pajaro River from Murphy’s Crossing Bridge to Highway 1 on both the Monterey and Santa Cruz County sides of the river. This action, as well as maintenance activities conducted by the County of Santa Cruz, has had negative impacts to federally listed species. Therefore, the County is proposing a new management and restoration plan for the Pajaro River and Salsipuedes and Corralitos Creeks. This plan includes revegetation of the riparian corridor and other measures that will reduce the impacts of maintenance activities to a less than significant level.

Three species known to use project area habitats are listed as threatened or endangered under the Federal Endangered Species Act: the tidewater goby (*Uecyclogobius newberryi*), California red-legged frog (*Rana aurora draytonii*) and the steelhead trout (*Oncorhynchus mykiss*). Project activities may have an adverse impact to these species and mitigation measures to avoid significant impacts are outlined in this BA.

The primary objective of the proposed project is to implement a management program along the Pajaro River and Salsipuedes and Corralitos Creeks that (1) maintains the flood carrying capacity of the system, (2) installs and maintains bank erosion measures as necessary, and (3) enhances and preserves habitat values. The project evaluated in this BA includes (1) ongoing resurfacing and maintenance of the Santa Cruz County levees along the Pajaro River and Salsipuedes Creek as needed to maintain the current levee geometry and elevation, (2) monitoring and installation of necessary bank protection measures to correct erosion problems along the Pajaro River, (3) establishing and managing vegetation along the Pajaro River, Salsipuedes, and Corralitos Creeks in a manner that balances habitat values with maximizing the flood carrying capacity of the river system and (4) limited periodic sediment (sand bar) removal from the channel bottom of Salsipuedes Creek and the Pajaro River in the Salsipuedes Creek Confluence Zone.
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A. Interim Coastal Zone/ Riparian Exception Permit (98-0189)
1.0 INTRODUCTION

The proposed project evaluated in this Biological Assessment (BA) includes management and maintenance activities along the Pajaro River and Salsipuedes and Corralitos Creeks. The intent of the proposed project is to maximize capacity in the channels for flood flows while protecting habitat values for native wetland and riparian vegetation, wildlife, and species with special status. This project description consists of management proposals described in Pajaro River 1998 Bank Erosion Assessment (Northwest Hydraulic Consultants, 1998), Pajaro River Management & Restoration Plan (CH2M Hill, 1997) and Proposed Long-term Maintenance Program for Salsipuedes and Corralitos Creeks prepared by the County of Santa Cruz Public Works Department (1999). Some of the management actions described in these plans were implemented by the U.S. Army Corps of Engineers (USCOE) on an emergency basis in response to flooding in 1998 and are not evaluated in this BA. The proposed project is described in detail in Section 1.2.

As a consequence of project implementation, the plan includes activities that could potentially adversely affect the California red-legged frog (CRLF; Rana aurora draytonii), tidewater goby (Eucylogobius newberryi) and steelhead trout (Oncorhynchus mykiss), species listed as federally threatened and endangered by the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). Therefore, this plan is subject to review under the California Environmental Quality Act (CEQA), the California Endangered Species Act and the Federal Endangered Species Act (ESA). This Biological Assessment meets the requirements of the ESA, whereas a separate Environmental Impact Report (EIR; Harding ESE, 2001) meets the requirements of CEQA.

Currently, under the interim Coastal Zone/Riparian Exception Permit (98-0189; Appendix A), issued September 11, 1998, the County was authorized to conduct flood control and stream management for three years contingent on the preparation of a Habitat Conservation Plan (HCP). However, the Habitat Conservation Plan was changed to a Biological Assessment at the request of NMFS, USFWS and the California Department of Fish and Game (CDFG) in March 2001. This Biological Assessment is very similar to the intended Habitat Conservation Plan, but is now subject to a Section 7 consultation rather than a Section 10 consultation based on the U.S. Army Corps of Engineers involvement in the project.

Section 7 Consultations under the Federal Endangered Species Act applies to the management of Federal lands as well as other Federal actions that may affect listed species including Federal approval of private activities through the issuance of Federal permits, licenses or other actions. Federal agencies must consult with U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service to ensure that their actions do not jeopardize listed species or destroy or adversely affect critical habitat. Federal agencies are directed by Section 7 of ESA to use their existing authorities to conserve threatened and endangered species.

1.1 Purpose/Legal Authority

This BA addresses the potential of jeopardizing listed species or significantly altering their habitat due to Santa Cruz County’s flood control and river management activities along the Pajaro River and Salsipuedes and Corralitos Creeks. Pursuant to the County’s consultation with NMFS and USFWS, all parties have agreed that the County should prepare a BA under Section 7 of the ESA for project impacts to the federally listed steelhead trout, tidewater goby and California red-legged frog, all of which have been documented in...
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and near the project site. The Federal Endangered Species Act requires an applicant for Section 7 permit to submit a BA for ‘major construction activities’ such as channel improvements that specifies, among other things, the impacts that are likely to result from the potential taking of listed species and the measures the permit applicant will undertake to minimize and mitigate such impacts. Accordingly, the purpose of the BA process is to identify measures that will allow impacts to a listed species while still conserving the species and not jeopardizing the continued survival of the population. NMFS has expressed the view that “conserve” means to recover which in turn means restoring the Pajaro to a more biologically functional condition.

The County of Santa Cruz has prepared this BA to assess the impacts of the proposed flood control and vegetation management activities and to evaluate alternatives to the project. The purpose of this document is to:

• Address the administrative requirements of the ESA
• Inform responsible and interested public agencies and the County of Santa Cruz of the nature of the proposed project, its possible impact(s) on threatened and endangered species, mitigation measures for those impacts and alternatives to the proposed project.

The purpose of this document is to inform decision-makers of potential significant environmental impacts of the proposed project. Additionally, the BA identifies possible means to minimize significant project effects and describes reasonable alternatives to the project that would reduce or eliminate one or more significant impacts. The lead agency (NMFS) is required to consider the information contained in the BA, along with other relevant information, in making its decision on the proposed project.

1.1.1 Consultation to date

January 13, 1998: Information on the presence of federally listed (or proposed for listing) threatened or endangered species or critical habitat in the Pajaro River received from NMFS.

February 4, 1998: Information on the presence of federally endangered and threatened species and critical habitat in the Pajaro River requested from USFWS.

February 18, 1998: Information on the presence of federally listed threatened and endangered species and critical habitat in the Pajaro River received from USFWS.

July 19, 1999: Field review and meeting between NMFS, USFWS, CDGF and County of Santa Cruz regarding the Pajaro River Habitat Conservation Plan and assessment of project site habitats and species covered under the HCP.

Fall, 2000: Conversation between Santa Cruz County and NMFS regarding steelhead spawning in the Pajaro.

January 8, 2001: Conversation between Harding ESE and CDFG regarding listed species in the Pajaro River.

January 9, 2001: Conversation between Harding ESE and NMFS regarding listed species in the Pajaro River.

January 17, 2001: Conversation between Harding ESE and USFWS regarding listed species in the Pajaro River.
March 1, 2001: Telephone conference between County of Santa Cruz, NMFS, USFWS and CDFG regarding the Pajaro River HCP. All parties agreed to the preparation of a Biological Assessment in lieu of a Habitat Conservation Plan.

March 21, 2001: Field trip with County of Santa Cruz, NMFS, USFWS, CDFG and Harding ESE regarding the Pajaro River BA.

May 29, 2001: Preliminary comments received from NMFS on draft Biological Assessment.

September 11, 2001: Biological Assessment completed and distribution to lead agency and other involved parties as well as steps towards initiation of formal Section 7 consultation begins.

1.2 Project Description

The primary objective of the proposed project is to implement a management program along the Pajaro River and Salsipuedes and Corralitos Creeks (Figure 1.2-1) that (1) maintains the flood carrying capacity of the system, (2) installs and maintains bank erosion measures as necessary, and (3) enhances and preserves habitat values. The project evaluated in this BA includes (1) ongoing resurfacing and maintenance of the Santa Cruz County levees along the Pajaro River and Salsipuedes Creek as needed to maintain the current levee geometry and elevation, (2) monitoring and installation of necessary bank protection measures to correct erosion problems along the Pajaro River, (3) establishing and managing vegetation along the Pajaro River, Salsipuedes, and Corralitos Creeks in a manner that balances habitat values with maximizing the flood carrying capacity of the river system and (4) limited periodic sediment (sand bar) removal from the channel bottom of Salsipuedes Creek and the Pajaro River in the Salsipuedes Creek Confluence Zone.

The following project description includes management and maintenance activities along the Pajaro River and Salsipuedes and Corralitos Creeks. The intent of the proposed project is to maximize capacity in the channels for flood flows while protecting habitat values for native wetland and riparian vegetation, wildlife, and species with special status. This project description consists of management proposals described in Pajaro River 1998 Bank Erosion Assessment (Northwest Hydraulic Consultants, 1998), Pajaro River Management & Restoration Plan (CH2M Hill, 1997) and Proposed Long-term Maintenance Program for Salsipuedes and Corralitos Creeks prepared by the County of Santa Cruz Public Works Department (1999). Some of the management actions described in these plans were implemented by the U.S. Army Corps of Engineers on an emergency basis in response to flooding in 1998 and are not evaluated in this BA.

Elements of the proposed project are listed below and described in the following sections. The project includes:

- **Levee resurfacing, maintenance and repair** of the Santa Cruz County levees along the Pajaro River and Salsipuedes Creek as needed to maintain the current levee geometry and elevation. Maintenance would consist of applying base rock to the tops of levees, surface grading of levee tops and slopes, patching potholes and levee shoulders, replacing gates and fences and controlling rodents that burrow into the levees.

- **Bank stabilization and erosion control** consisting of the installation of bank protection at an erosion site on the Santa Cruz County side of the Pajaro River located just east of the Highway 1 Bridge, ongoing monitoring of potential Priority 2 and 3 erosion sites along the Pajaro, yearly evaluation of the need to install erosion protection and installation of bank stabilization measures along portions of the Pajaro River banks.

- **Vegetation/channel management and maintenance** consisting of periodic sediment removal from the channel bottom along the Pajaro River (from 3500 ft downstream of the Pajaro and Salsipuedes confluence at the Southern Pacific Railroad Bridge to 500 ft upstream of the confluence [Reach D,
Figure 1.2-1 and 1.2-2)] and Salsipuedes Creek to remove accumulated sediment, and vegetation management along the Pajaro River and Salsipuedes and Corralitos Creeks to balance flood capacity with habitat protection.

- **Revegetation** along channel banks to provide a continuous riparian corridor and planting and establishment of trees at 40-foot intervals along the inner channel benches.

### 1.2.1 Levee Resurfacing, Maintenance and Repair

Erosion and settlement have caused the formation of low spots along the levees of the Pajaro River, resulting in a decrease of flood carrying capacity. The *Pajaro River Management & Restoration Plan (CH2M Hill, 1997)* proposed to raise the surface of the levees through levee resurfacing back to their original elevations on both the Monterey and Santa Cruz County sides of the River, upstream of Highway 1. In the autumn of 1998, the U.S. Army Corps of Engineers resurfaced the Santa Cruz and Monterey County levees as proposed in the plan and levee resurfacing was conducted along Salsipuedes Creek. This work was conducted on an emergency basis.

Under the project evaluated in this BA, ongoing resurfacing of the Santa Cruz County levees is proposed on an as-needed basis to maintain the levees at their original elevations. As needed levee resurfacing would be conducted according to the following methods. Earthen material would be obtained from an offsite borrow area and applied to the existing levee crowns. The levees would not be widened and material would not be added beyond the point where the levee slopes can be maintained without failing. Levee material would be conveyed to the levees with dump trucks on existing access roads, spread along the levee surface, and compacted. Four to six inches of base rock would be placed on top of the resurfaced levee within the existing footprint.

Ongoing maintenance and repair of the levee system along both the Pajaro River (Santa Cruz County side) and Salsipuedes Creek would continue according to Santa Cruz County's current management practices. Maintenance would consist of applying base rock to the tops of levees, surface grading of levee tops and slopes, patching potholes and levee shoulders, replacing gates and fences, and controlling rodents, such as gophers, which burrow tunnels into the levees. Levee repairs would be conducted using a combination of heavy equipment and handwork. Rodents would be controlled using bait stations with poison grain, gas cartridges and Fumitoxon. Fumitoxin is a Category 1 pesticide and is used by placing moisture-activated pellets in rodent burrows. The burrows are then closed, and moisture in the ground causes the pellets to release a toxic gas.

Maintenance and repair work would be conducted as needed throughout the year, although most work would be conducted between July 1 and October 15, prior to the rainy season.
Figure 1.2-1. The project area, which extends from the mouth of the Pajaro River to Murphy’s Crossing and from the Salsipuedes Creek confluence to Brown’s Valley Road in Corralitos.

Modified from *Northwest Hydraulic Consultants (1998)*
1.2.2 Bank Stabilization and Erosion Control

The Pajaro River 1998 Bank Erosion Study (Northwest Hydraulic Consultants, 1998) identified 70 specific sites in need of erosion repair along the Pajaro River, on both the Santa Cruz and Monterey County sides. The sites were prioritized into three categories according to the degree to which each site may threaten the integrity of the levee system. Priority 1 sites were those where high flows were considered likely to cause additional erosion that could threaten the levee in a single large event. Priority 2 sites were those where erosion was considered likely to progress into conditions that could threaten the levees in either a single event or series of events. At Priority 3 sites, erosion problems were considered less likely to progress rapidly into conditions that threaten the levees and, in some cases, would likely recover on their own given favorable hydraulic conditions. Following the 1998 flooding, USCOE repaired Priority 1 sites on an emergency basis by installing rock riprap along the eroded slopes.

The project under consideration in this BA includes the ongoing evaluation and, if needed, construction of bank stabilization measures at Priority 2 and 3 sites on the Santa Cruz side of the Pajaro River. With the exception of one Priority 2 site, bank erosion has not progressed at any of the Priority 2 or 3 sites to the point where installation of bank protection is currently considered warranted. The County Department of Public Works would conduct ongoing monitoring to determine if erosion is significant and warrants installation of bank protection. Materials placed along the bank may cause accumulation of sediment and reduce hydraulic capacity. Therefore, bank protection would not occur unless the following conditions are documented:

- The bank has eroded back sufficiently from its current (2000) location that installation of bank protection would not decrease channel hydraulic capacity below the current level.
- Geometric and hydraulic considerations, based on engineering evaluation, suggest that continued erosion of the bank is likely and that this could result in a threat to the levee.

Initial bank protection would be installed in the spring of 2002 at a Priority 2 site immediately upstream from the Highway 1 Bridge crossing over the Pajaro River. Although erosion is moderate at this location, the potential for future flood events to threaten the substructure of the bridge is considered high enough to warrant implementation of bank protection measures.

Eight different erosion treatments developed by Northwest Hydraulic Consultants (1998) combine rock protection, regrading of channel banks and biotechnical (i.e., use of vegetation) stabilization methods. The type of erosion protection selected would be determined on a case-by-case basis for specific site conditions. Design features of the treatments include:

- Encouraging reestablishment of a more stable channel form. In some cases, erosion control measures would encourage the natural trend of the river to form a narrower main channel. In most cases, erosion protection would correct the tendency of the channel to widen as a result of bank scour.
- Providing adequate scour protection at the toe of slope. Proposed treatments include buttressing with larger rock at the slope toe, incorporation of intermediate terraces, or use of a gravel filter/drain layer. Appropriate geotextile fabric or filter layer would be used between the rock and native material to provide separation of layers with different grain sizes and allow drainage of the slope.
- Establishing and maintaining woody vegetation along channel banks to control erosion (see Vegetation Management section).
- Using live vegetation (e.g., willow stakes or bundles, root wads, or willow/rock fencing) to anchor rock and filter fabric protection, support cut or fill slopes and provide for revegetation of channel banks.
• Using groins or other features that tie back into the older bank surface where previous bank protection measures are not providing adequate protection.
• Installing transitional measures to prevent erosion of bank protection structures from flanking flows.
• Maintaining the channel hydraulic capacity. The design of bank protection should not reduce the channel capacity, either directly or indirectly as a result of intended sediment deposition, to below that of nearby up- and downstream areas.
• Minimizing the creation of hydraulic conditions that would increase erosion potential on the Monterey County side of the river in relation to current (2000) conditions.

The river is a dynamic system. Therefore, conditions will change along the river over time. Future flood events may exacerbate bank erosion in some areas, cause erosion in new locations or facilitate the recovery of some existing erosion sites. Consequently, it is unknown which of the erosion sites would require bank protection over the 20-year life of the project. To ensure an adequate analysis of the environmental impacts of the worst-case project, this BA evaluates the potential impacts of implementing bank protection at all Priority 2 and 3 sites along the Santa Cruz County side of the Pajaro River.

1.2.3 Vegetation/Channel Management and Maintenance

Vegetation in the river channel can reduce the flood carrying capacity of the system by impeding flood flows and trapping silt and debris. The accumulation of sediment in the river system may also reduce its flood carrying capacity. Sediment becomes suspended in the water column and is conveyed through the river system and eventually to the Pacific Ocean. Sediment deposition in the channel likely occurs during any flow level, but high flows convey sediment at a faster rate. Sedimentation and changes to channel morphology are natural processes, which occur during any flow regime. The amount of sediment currently entering the Pajaro may be much greater today than it was historically due to current farming practices. However, historical cross-sections of the Pajaro have been used to compare channel bed elevations for the river over time (Northwest Hydraulic Consultants, 1998). Contrary to previous concerns that the channel bed is being raised with sand bar deposits, the channel bed was actually lowered in some reaches and is probably not aggrading in general (Northwest Hydraulic Consultants, 1998). Large sandbars may pose some threat of reducing flood capacity at the confluence of the Pajaro River and Salsipuedes Creek where the cities of Watsonville and Pajaro are located. Sandbars in Salsipuedes Creek also potentially pose some threat of reducing flood capacity because of the Creek’s narrow channel. Therefore, periodic removal of accumulated sediment in the Pajaro River at the Salsipuedes Creek Confluence Zone (extending from 3500 ft downstream of the Pajaro confluence at the Southern Pacific Railroad Bridge to 500 feet upstream of the confluence [Reach D, Figure 1.2-1 and 1.2-2]) and in Salsipuedes Creek is proposed.

The vegetation management program is described by cross sectional area of the river using the following terminology. The low flow channel is the area in the channel bottom supporting the greatest water flow during low flows. The channel bottom is the area between the toe of the bank on each side of the river excluding the low flow channel, the low flow channel 5-foot vegetation buffer and the Pajaro Lagoon. The lower channel bank is the area from the toe of the slope to 10 feet up the channel bank and the upper channel bank is the area from the top of the lower channel bank to the top of the bank. The inner channel bench is the area up to 55 feet wide from the top of the bank towards the levee slope and the outer channel bench is the area from the limit of the inner bench to the toe of the levee slope. The levee includes the top of the levee and both sides of the levee.
Figure 1.2-2. The Salsipuedes Creek Confluence Zone, which begins 3500 ft downstream of the confluence with the Pajaro River at the Southern Pacific Railroad Bridge and extends to 500 ft upstream of the confluence. This zone is bordered by the cities of Watsonville and Pajaro. Sandbars #8 to #15 are located in this zone and are shown as mapped by the Santa Cruz County Department of Public Works Drainage Maintenance Division for 2000/2001. The County mapped a total of 44 sandbars on the Pajaro River between Highway 1 and Murphy’s Crossing. Sandbars #13, #14 and #15 would be removed under the Management Plan described in this BA because they are greater than 4 ft in height and 250 ft in length.
The vegetation management program along the Pajaro River is described in detail in Table 1.2-1 and includes: (1) thinning of woody vegetation along channel banks by the selective removal of vegetation with stem diameters of three inches and larger, (2) removal of exotic, invasive plants including pampas grass (*Cortaderia jubata*), giant reed (*Arundo donax*) and German ivy (*Senecio mikanioides*) to improve establishment of native plants, (3) maintenance of a 12-foot-wide access and patrol road along the toe of the levee slopes, (4) selective removal of vegetation from the channel bottom and along benches and levee slopes to maintain flood capacity, (5) removal of silt accumulation and growth of vegetation in flap-gate channels and (6) periodic mechanized sediment (sand bar) removal within the channel bottom of the Pajaro from 3500 ft downstream of the Salsipuedes confluence at the Southern Pacific Railroad Bridge to 500 ft upstream of the confluence (Reach D, Figure 1.2-1 and 1.2-2).

Proposed vegetation maintenance activities along Salsipuedes and Corralitos Creeks are described in *Proposed Long-Term Maintenance Program for Salsipuedes and Corralitos Creeks*, prepared by the County of Santa Cruz Public Works Department. Major elements of the program include (1) removal of woody vegetation along the channel bottom and lower banks, (2) removal of fallen and leaning trees, (3) clearance of vegetation from the levee benches and levee slopes, (4) removal of silt accumulation and vegetation in flap-gate channels along Salsipuedes Creek, and (5) periodic mechanized sediment (sand bar) removal in Salsipuedes Creek. A leaning tree is considered one that will imminently fall into the river channel within one year. Sediment removed from the channel bottom is first offered to farmers to spread over their fields and if there are no takers the sediment is disposed of at the Buena Vista Landfill west of Watsonville.

The following describes the vegetation/channel maintenance program by section of the river system:

**Pajaro River from the Mouth to Highway 1**

- Natural vegetation establishment along the channel bottom and banks with two exceptions: (1) invasive weeds and vines, and woody vegetation growing in the channel with stem diameters greater than 3 inches would be removed, and (2) trees or shrubs to be removed would be cut at the base, and Rodeo, an herbicide, would be applied to the stumps.
- Dead or downed trees would be removed from the river with heavy equipment.
- Vegetation along the benches and levee slopes would be mowed.
- Removal of debris and sediment from flap gate channels (which convey the flow from agricultural fields and of street drainage to the stream channel) would be conducted with the use of vehicular equipment operating from the top of the levee.
- Roundup-Pro herbicide would be used to clear vegetation from the levee slopes and benches up to the existing riparian growth.

**Pajaro River from Highway 1 to Murphy Crossing**

- As water levels decline in the river through the dry season, a 5-foot-wide band of riparian vegetation would establish on each side of the low flow channel creating a buffer zone. Natural reestablishment would be allowed and would not be augmented by supplemental planting or seeding. Woody vegetation growing in this buffer zone with stem diameters greater than 3 inches would be removed manually. All vegetation outside of the buffer zone in the stream channel would be removed by hand or mowed. Trees or shrubs to be removed from the channel bottom would be cut at the base, and the herbicide Rodeo would be applied to the stumps.
- In areas where vegetation is currently growing densely along the upper channel banks, vegetation would initially be cleared by hand. Subsequently, vegetation would be mowed and the herbicide Rodeo applied. Trees with stem diameters larger than 3 inches would be removed from the low flow...
channel 5-foot vegetation buffer and the lower channel bank using hand tools.

- Accumulated sediment would be removed from the channel every 4 to 5 years at any single location from 3500 ft downstream of the Pajaro/Salsipuedes confluence at the Southern Pacific Railroad Bridge to 500 ft upstream of the confluence (Reach D, Figure 1.2-1 and 1.2-2). The following mechanized means would be employed to remove sandbars: (1) skip loader and dump truck in the channel to transport the sediment out of the channel, (2) ripping the sandbar and leaving the disturbed sediment in the channel to be washed out during high stream flow events, and (3) excavator and dump truck stationed outside of the channel to remove sediment from overhead and deposit in nearby dump truck for transport.

- Removal of debris from flap gate channels in the same manner as downstream of Highway 1.

**Salsipuedes Creek from the Confluence with the Pajaro River to State Highway 129**

- Natural establishment of vegetation on the toe of slope, along the lower channel slopes, and the channel bench.
- Fallen or leaning trees (A leaning tree is considered one that will imminently fall into the river channel within one year) in the riparian area and those that block or divert storm flows would be removed with heavy equipment.
- The herbicide Roundup-Pro would be applied to the levee slopes to clear vegetation.

**Salsipuedes Creek from State Highway 129 to Lakeview Road**

- Mechanical mowing and application of the herbicide Roundup-Pro would be used to control vegetation on levee slopes and benches twice annually.
- Channel bottom maintenance would consist of removal of all woody vegetation, fallen trees and log or debris jams. Emergent vegetation would be left in place because it does not normally impede floodwaters during winter storm flows. Vegetation removal would be performed by hand with no equipment operated in the channel bottom.
- Silt and sandbars that restrict channel capacity and divert water would be removed on an as-needed basis using vehicular equipment as described above for the Pajaro River.
- Flap-gate channels, which direct the flow of street drainage from pump stations across the levee bench to the creek, would be cleared of all vegetation and silt as needed using equipment operated from the top of bank.

**Salsipuedes Creek from Lakeview Road to East Lake Avenue/State Highway 152 (Confluence with Corralitos Creek)**

- Natural establishment of vegetation on the east side of the channel.
- On the west side of the channel, vegetation on the levee slopes and benches would be controlled twice per year by mechanical mowing and application of the herbicide Roundup-Pro.
- Fallen trees that divert or block water flow would be removed.
- Accumulated sediment would be dredged from the channel every 4 to 5 years at any single location by the same mechanical means as described above for the Pajaro River.

**Salsipuedes Creek from East Lake Avenue/State Highway 152 to College Lake**

- Fallen and overhanging trees, debris jams and silt would be removed on an as-needed basis using heavy equipment. Accumulated sediment would be dredged from the channel every 4 to 5 years at any single location by the same mechanical means as described above for the Pajaro River.
Corralitos Creek from East Lake Avenue/State Highway 152 to the Browns Valley Bridge

- Fallen or leaning trees that would block or divert storm waters would be cut into 3- to 4-foot sections and left in place. Their root structures would be left in place to provide habitat. This work would be conducted by hand during times of low flow. No equipment would be operated in the channel bottom in conjunction with this work element.
- In the winter months when there is substantial water flow, fallen trees would be removed using heavy equipment operated from the top of the channel.
- Vegetation that is blocking the channel and may divert storm flow would be removed with equipment from the channel banks.

Herbicide application would be conducted using a spray unit mounted on a pickup truck with a computerized application system that delivers a metered amount of herbicide at a predetermined speed using a 1.5-percent solution. Roundup-Pro herbicide would be sprayed along the upper portion of the levee as the truck drives along the levee surface. The bottom portion of the levee and the benches would be sprayed as the truck moves along the access road and on the bench land. Roundup, an herbicide designed for use in aquatic areas, would be applied to the upper banks and flap-gate channels of the Pajaro River and in flap-gate channels adjacent to Salsipuedes Creek using a backpack-style applicator or truck mount system where the area is accessible by vehicle.

Vegetation management activities would occur each year with initial herbicide application in March (weather permitting) then periodically from early spring to early fall. Herbicide would be applied on the levee slopes and in flap-gate channels three times each year: in early spring, mid summer, and late summer or early fall. Herbicide would be applied in flap-gate channels only when the channels are dry. Benches would be sprayed twice per year: once in mid summer and once at the end of summer or early fall.

Mowing would be conducted using a tractor-mounted mower once per year, generally in early July or at the end of June. Flap-gate channels would be cleared of vegetation and/or silt on an as-needed basis using mechanized equipment stationed overhead of the channel on levee or levee bench. In accordance with conditions of the County's agreement with CDFG, no vegetation control work would be conducted on the bench lands prior to April to maximize growth of vegetation for nesting birds.

The Pajaro River and Salsipuedes Creek would be surveyed each spring by Public Works maintenance crews to map sandbars and determine which may potentially contribute to some reduction in flood capacity in the Salsipuedes Creek Confluence Zone and in Salsipuedes Creek. Any areas determined to have such a degree of accumulated sediment would be scheduled for mechanized silt removal in the late summer when stream flows are lowest. Three different methods are proposed for silt removal. Two techniques require vehicular equipment (i.e. front loaders and dozers) to enter the stream channel to excavate and load sediment into dump trucks or rip the root mass of vegetation that has colonized on a sandbar. The third technique would be to remove sediment with an excavator stationed outside of the channel in the same manner in which flap gate channels would be cleared of sediment and debris. Sediment removed from the channel bottom is first offered to farmers to spread over their fields and if there are no takers the sediment is disposed of at the Buena Vista Landfill west of Watsonville.

September 11, 2001

Harding ESE
Table 1.2-1. Pajaro River Management and Restoration Plan

(Compiled from Table 7 of the Pajaro River Management and Restoration Plan [CH2MHill, 1997])

<table>
<thead>
<tr>
<th>Management Area</th>
<th>Management Objectives</th>
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<th>Management Techniques (applies to areas both above and below Highway 1, except as noted)</th>
<th>Restrictions on Management Actions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Flow Channel</td>
<td>Provide fish and wildlife habitat</td>
<td>Natural revegetation of native riparian vegetation, including emergent and floating aquatic vegetation.</td>
<td>Woody vegetation will be manually cut. Unless authorized by regulatory agencies, the County would not establish a low flow channel. Meandering geometry would be allowed to develop naturally.</td>
<td>Except for occasional crossings with mechanical equipment necessary for management in other areas of the river, no management activities are planned in the low flow channel (see channel bottom restrictions on management activities).</td>
</tr>
<tr>
<td>(Low flow channel location moves seasonally and annually along the channel bottom due to dynamics of flow events and channel composition)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Low Flow Channel Vegetation Buffer       | Provide riparian vegetation corridor and wildlife habitat, including shading and cover for fish and aquatic species. | Natural regeneration of 5-foot strips of native riparian vegetation along each side of the low flow channel. The vegetation buffer is expected to regenerate naturally. | Manual removal of woody vegetation greater than 3 inches diameter at breast height (dbh).                                                                                                                                                              | • Work will be conducted during the dry season, June 1 through October 15.  
• Except for occasional crossings with mechanical equipment necessary for management in other areas of the river, no other management activities requiring mechanical equipment are planned in the low flow channel vegetation buffer (see channel bottom restrictions on management activities). |
Table 1.2-1. Pajaro River Management and Restoration Plan

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</tr>
</thead>
</table>
| Channel Bottom  | Maintain hydraulic capacity of the river channel. | Natural regeneration only. | • Annual removal of vegetation  
• Woody vegetation would be manually cut, mowed and/or knocked down with mechanical equipment.  
• Woody root balls may be scarified with a ripper to a depth of 2 feet at selected locations  
• Mechanical equipment may include (but is not limited to): hydraulic excavators; flail mowers; trac-macs; and dozers with blades and ripper attachments.  
• Herbicides registered for use in aquatic areas will be applied with hand-held spray bottle (no backpack sprayers will be used) to cut willow stumps that are not physically uprooted or removed from the channel bottom. | • If possible, existing access roads will be used to reach the channel bottom. If additional access roads are constructed, they will be revegetated with willow cuttings in the fall immediately following access road clearing. Revegetation plans are described in lower and upper channel bank revegetation.  
• Use of all equipment in the channel bottom will be conducted during the dry season (June 1 to October 15).  
• All work, including tree root removal, will be done in the dry season and not encroach upon flowing waters.  
• Vegetation cuttings will be removed from the channel bottom for upland disposal or chipped on banks or benches, unless equipment used chips vegetation as it cuts.  
• If disturbed by vegetation removal, sandbar contours would be reestablished at natural grades. No sediments would be excavated during vegetation maintenance activities. |
Table 1.2-1. Pajaro River Management and Restoration Plan

(Compiled from Table 7 of the Pajaro River Management and Restoration Plan [CH2M Hill, 1997])

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</tr>
</thead>
<tbody>
<tr>
<td>Channel Bottom</td>
<td>(con’t)</td>
<td></td>
<td></td>
<td>• Equipment will be utilized in dry areas and restricted from encroaching upon flowing, except as necessary for crossing events (see below).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Equipment crossing flowing water will be restricted to narrow, shallow riffle sites and will be limited to one-time ingress and egress events, for one-time access to dry sandbars.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Crossing locations are expected to vary annually, depending upon sandbar locations. Crossing events are expected to be necessary at intervals of approximately 200 feet, although actual intervals may vary.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Temporary culverts will be placed at sites where repeated equipment crossings are necessary.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Standard erosion control devices including straw bales and silt fences will be installed for construction of culvert crossings.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Turbidity levels will be monitored and work will be discontinued if turbidity levels rise by</td>
<td></td>
</tr>
</tbody>
</table>

September 11, 2001

Harding ESE

Pajaro River and Salsipuedes and Corralitos Creeks Management and Restoration Plan Biological Assessment
### Table 1.2-1. Pajaro River Management and Restoration Plan

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</tr>
</thead>
</table>
| **Channel Bottom** (con’t) | Majority of channel:  
- Provide riparian vegetation corridor and wildlife habitat, including shading and cover for fish and aquatic | Majority of channel:  
- Combination of natural regeneration and planting of native vegetation to establish a minimum 10-foot wide riparian | Majority of channel:  
- Dead and downed trees that represent bank erosion and/or flood control problems will be removed  
- Invasive, non-native weeds (i.e. German ivy, pampas grass and giant reed) will be controlled manually and/or with herbicides | more than 10% of background levels during any crossing event.  
- Herbicide may be applied to willow trunks.  
- No sediment removal within the channel bottom is included as a part of the management plan. If grading or sediment removal is required, the County will obtain the necessary permits from regulatory agencies including USCOE, CDFG, Regional Water Quality Control Board (RWQCB), California Coastal Commission and the County Planning Department. |
| **Lower Channel Bank** (Area from toe-of-the-slope to 10 feet up the channel bank) | Majority of channel:  
- Provide riparian vegetation corridor and wildlife habitat, including shading and cover for fish and aquatic | Majority of channel:  
- Combination of natural regeneration and planting of native vegetation to establish a minimum 10-foot wide riparian | Majority of channel:  
- Dead and downed trees that represent bank erosion and/or flood control problems will be removed  
- Invasive, non-native weeds (i.e. German ivy, pampas grass and giant reed) will be controlled manually and/or with herbicides | Majority of channel:  
- All work will be conducted between June 1 and October 15, except for the removal of any dead/downed trees which represent a bank erosion or flood threat; these trees may be removed anytime using methods to minimize impact to adjacent riparian vegetation (i.e. operating equipment from unvegetated portions of the bench, etc). |
<table>
<thead>
<tr>
<th>Management Area</th>
<th>Management Objectives</th>
<th>Revegetation (applies to areas upstream of Highway 1)</th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Lower Channel Bank</strong></td>
<td>(con’t)</td>
<td>species.</td>
<td>registered for use in aquatic areas.</td>
<td>• Mechanical equipment used to remove dead and downed trees will be operated from the channel bench or from dry areas of the channel bottom.</td>
</tr>
<tr>
<td></td>
<td>Bank stabilization and erosion control</td>
<td>• Bank stabilization and erosion control</td>
<td>Bridge areas:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bridge areas:</td>
<td>Bridge areas:</td>
<td>Bridge areas:</td>
<td>Localized spraying of herbicides (hand-held spray bottle or backpack sprayer) will be allowed to control invasive, non-native weed species under restricted conditions (i.e. wind speeds lower than 5mph, no surface runoff, no rain predicted, etc).</td>
</tr>
<tr>
<td></td>
<td>• Minimize risk of vegetation and debris becoming entrapped, causing and/or exacerbating flooding.</td>
<td>• All woody vegetation adjacent to bridges will be removed from a distance of 50 feet on both sides of all bridges.</td>
<td>Erosion control:</td>
<td>• Non-native species removal in planting areas will be limited to manual removal during the plant establishment period (one year after implementation).</td>
</tr>
<tr>
<td></td>
<td>Bridges:</td>
<td>Erosion control:</td>
<td>Bridge areas:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Minimize risk of vegetation and debris becoming entrapped, causing and/or exacerbating flooding.</td>
<td>• Erosion sites have been identified and will be stabilized using a combination of typical civil engineering methods (i.e. riprap), bioengineering methods and revegetation.</td>
<td>Bridge areas:</td>
<td>• Vegetation will be removed between June 1 and October 15.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• The herbicide Rodeo may be sprayed to remove vegetation adjacent to bridges (50-foot strips) and sprayed to control invasive, non-native weeds between March 1 and October 15.</td>
</tr>
</tbody>
</table>

Table 1.2-1. Pajaro River Management and Restoration Plan

(Compiled from Table 7 of the Pajaro River Management and Restoration Plan [CH2MHill, 1997])

- Mechanical equipment used to remove dead and downed trees will be operated from the channel bench or from dry areas of the channel bottom.
- Localized spraying of herbicides (hand-held spray bottle or backpack sprayer) will be allowed to control invasive, non-native weed species under restricted conditions (i.e. wind speeds lower than 5mph, no surface runoff, no rain predicted, etc).
- Non-native species removal in planting areas will be limited to manual removal during the plant establishment period (one year after implementation).
- Vegetation will be removed between June 1 and October 15.
- The herbicide Rodeo may be sprayed to remove vegetation adjacent to bridges (50-foot strips) and sprayed to control invasive, non-native weeds between March 1 and October 15.
Table 1.2-1. Pajaro River Management and Restoration Plan

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</table>
| Upper Channel Bank | Areas upstream of Highway 1 with limited hydraulic capacity: Maintain hydraulic capacity. Areas downstream of Highway 1 and areas of “higher” hydraulic capacity upstream of Highway 1: Provide wildlife habitat and bank stability | Areas upstream of Highway 1 with limited hydraulic capacity: Natural regeneration of riparian vegetation. Areas upstream of Highway 1 with “higher” hydraulic capacity: Natural regeneration or planting as needed to support an extension of the 10-foot wide vegetation corridor on lower channel bank. | Areas upstream of Highway 1 with limited hydraulic capacity: Annual vegetation will be controlled/removed (cut, mowed, trimmed) through manual methods and/or mowing. Areas downstream of Highway 1 and areas of “higher” hydraulic capacity above Highway 1: Erosion control: Same as lower channel bank Note: Bridge areas will be managed as described above under lower channel bank | Areas of limited hydraulic capacity:  
- All work will be conducted between June 1 and October 15 of each year, except for the removal of any dead or downed trees which represent a bank erosion or flood threat; these trees may be removed anytime using methods that minimize impacts to adjacent riparian vegetation.  
- Discing or broad scale herbicide applications will be prohibited.  
- Mechanical equipment (i.e. mowers) will be operated from the bench.  
- Localized spraying (hand-held spray bottle or backpack sprayer) of the herbicide Rodeo will be allowed to control invasive non-native weed species under restricted conditions (i.e. wind speeds lower than 5 mph, no surface runoff, no rain predicted, etc). |
**Table 1.2-1. Pajaro River Management and Restoration Plan**

(Compiled from Table 7 of the Pajaro River Management and Restoration Plan [CH2MHi, 1997])

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</tr>
</thead>
</table>
| **Upper Channel Bank (con’t)** |                                                                                       |                                                        |                                                                                         | runoff, no rain predicted, etc).  
Areas of “higher” hydraulic capacity:                                      | Same as lower channel bank |
| **Inner Channel Bench** (Up to a 55-foot wide strip along inner bench from top-of-bank towards the levee slope) | Areas upstream of Highway 1 with limited hydraulic capacity: Maintain hydraulic capacity. Areas downstream of Highway 1 and areas of “higher” hydraulic capacity upstream of Highway 1: Provide wildlife habitat and additional bench stability. | Areas of limited hydraulic capacity: Riparian trees (i.e. cottonwood) will be planted and/or maintained at approximately 10 to 15 meter (~35 to 50 feet) centers with an under story of low growing herbaceous vegetation. Areas of “higher” hydraulic capacity: Natural regeneration and/or planting as needed to support an extension of riparian | Areas upstream of Highway 1 with limited hydraulic capacity: A combination of one of the following methods will be used to control low growing herbaceous under story of cottonwood trees: manual removal, mowing. Areas downstream of Highway 1 and areas of “higher” hydraulic capacity upstream of Highway 1: Same as lower channel bank. | Areas of limited hydraulic capacity:  
• Mowing may be conducted between May 1 and October 15.  
• Herbicide application will be limited to localized spraying (hand-held spray bottle, backpack sprayer or hose from a tank and truck) of invasive non-native weed species to be applied under restricted conditions (i.e. wind speeds lower than 5 mph, no surface runoff, no rain predicted, etc). Application of herbicide will be prohibited within 5 feet of all plantings.  
Areas of “higher” hydraulic capacity: Same as lower channel bank. |
### Table 1.2-1. Pajaro River Management and Restoration Plan

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</tr>
</thead>
</table>
| **Outer Channel Bench**
(Area from limit of inner channel bench to toe-of-levee slope) | Maintain hydraulic capacity | Natural regeneration only | • Existing ruderal (weedy) vegetation grassland areas will be treated with one or a combination of the following: herbicide application, mowing.
• A 12-foot wide access road will be routinely cleared and maintained on the bench upstream of Highway 1 and immediately adjacent to the levee toe-of-slope. | • Mowing may be conducted between May 1 and October 15.
• Herbicide will only be applied between March 1 and March 30 and/or from May 1 through October 15 under restricted conditions (i.e. wind speeds lower than 5 mph, no surface runoff, no rain predicted, etc).
• Herbicide application will be limited to the edged of the drip line of mature riparian vegetation.
• Existing cottonwood trees will be maintained unless they are dead or dying. |
| **Levee**
(Includes levee top and both levee sides) | • Maintain all-weather surface on levee patrol roads.
• Resurface and/or raise levee profile to | Natural regeneration only | Levee maintenance:
Levee maintenance includes application of base rock, grading levee top, pothole and shoulder patching of asphalt surface, gopher control, litter removal and vegetation | Levee maintenance:
• Mowing may be conducted between May 1 and October 15.
• Levee areas will not be disced. |
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<tbody>
<tr>
<td>Levee (con’t)</td>
<td>eliminate “low” spots and improve freeboard.</td>
<td></td>
<td>management.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Levee slope vegetation will be controlled by one or more of the following methods: manual labor, herbicide application and mowing.</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Levee restoration:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Levees will be resurfaced by importing and compacting appropriate material where necessary to provide freeboard, as needed.</td>
<td></td>
</tr>
<tr>
<td>Flap Gate Channels</td>
<td>Provide flood control</td>
<td>Natural regeneration only</td>
<td>• Vegetation, silt, soil and debris will be removed from the flap gate channels.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Vegetation will be controlled/removed by one or a combination of the following methods including hydraulic excavators utilized from the benches or dry channel bottom, mowers, and trac-mac.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Herbicide use limited to the period between March 1 and October 15.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Herbicide will not be used if water is flowing in flap gate channel.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Spoil material removed from flap gate channels will be disposed of in an upland site in a manner that prevents spoils form being washed by rainfall or run-off into the river using standard erosion control methods such as</td>
<td></td>
</tr>
</tbody>
</table>
### Table 1.2-1. Pajaro River Management and Restoration Plan

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</thead>
<tbody>
<tr>
<td>Flap Gate Channels</td>
<td></td>
<td></td>
<td>• Ten-foot wide access roads may be maintained on each side of the flap gate channels.</td>
<td>silt fencing and straw bales.</td>
</tr>
</tbody>
</table>
1.2.4. Revegetation

Riparian vegetation generally serves to stabilize channel banks and minimize erosion as well as provide habitat for wildlife. The *Pajaro River Management and Restoration Plan* (*CH2M Hill, 1997*) evaluated the flood capacity of the river under several scenarios in which varying degrees of vegetation cover would be allowed to establish along the channel. The County of Santa Cruz Flood Control and Water Conservation District Zone 7 Board determined that the scenario that most effectively balanced habitat preservation with flood control and bank erosion objectives was the preferred management proposal. This scenario is referred to as "Alternative 2" in the *Pajaro River Management and Restoration Plan*.

The revegetation program would only occur along the Pajaro River and is outlined in detail in Table 1.2-2 and includes: (1) revegetation along channel banks to provide a continuous riparian corridor and achieve the project objectives of bank stabilization and erosion control, (2) planting and establishment of trees at 40 foot intervals along the inner channel benches.
Table 1.2-2. Summary of proposed revegetation program for the Pajaro River between Highway 1 and Murphy’s Crossing (from Attachment B of the Pajaro River Management and Restoration Plan [CH2M Hill, 1997]).

<table>
<thead>
<tr>
<th>PLANTING PLAN</th>
<th>DESCRIPTION</th>
</tr>
</thead>
</table>
| **Low Flow Vegetation Buffer** | Minimum 5-foot riparian vegetation corridor that may move periodically with the flow channel due to dynamics of flow events, channel composition and vegetation growth.  
Natural regeneration is expected to provide a minimum 5-foot wide band of natural riparian vegetation on each side of the low flow channel. Dominant species expected to occur include willows and cattails. |
| **Lower Channel Bank** | Plantings will be implemented on the stable slopes of 2:1 or flatter. Areas with unstable or steeper slopes and/or greater flow velocities will be addressed in the erosion control plan.  
- Plant willow cuttings at average 4.5 foot centers, for a total of 2,180 willows per acre. Willow species planted will include Arroyo Willow, Yellow Willow, Red Willow and Sandbar Willow.  
- Plant one shrub thicket ever 500 liner feet along the bank. Each shrub thicket will be composed of 5 shrubs. Shrubs within the thickets will be planted on 5’ centers. A total of 45 shrubs (9 thickets) will be planted per acre including California Blackberry (total of 11 shrubs/acre), California Rose (total of 11 shrubs/acre) and Creek Dogwood (total of 11 shrubs/acre).  
- Broadcast Cereal Barley at 200 lbs. per acre.  
- Partially vegetated areas will be planted to create at least 2,180 established or planted willows per acre. |
| **Upper Channel Bank** | Plantings will be implemented on stable slopes of 2:1 or flatter. Areas with unstable or steeper slopes will be addressed in the erosion control plan.  
- Plant willow cuttings at average 10-foot centers, for a total of 450 willows per acre. Willow species planted will include Arroyo Willow, Yellow Willow, Red Willow and Sandbar Willow.  
- Plant 1 shrub thicket every 500 linear feet along the bank. Each shrub thicket will be composed of 5 shrubs. Shrubs will be planted on 5-foot centers. A total of 45 shrubs (9 thickets) will be planted per acre including California Blackberry (11 shrubs/acre), California Rose (11 shrubs/acre) and Creek |
<table>
<thead>
<tr>
<th>PLANTING PLAN</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dogwood (11 shrubs/acre).</td>
<td></td>
</tr>
<tr>
<td>• Broadcast Cereal Barley at 200 lbs. per acre.</td>
<td></td>
</tr>
<tr>
<td>• Partially vegetated areas will be in-filled to create at least 450 established willows or willow cuttings per acre.</td>
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**Inner Bench**
Approximate 55-foot wide strip along inner bench from top-of-bank toward the levee slope.

**Riparian Canopy:**
- Plant and/or maintain 30 riparian trees per acre at average 40-foot centers in a meandering row adjacent to top-of-bank including cottonwood (25 trees/acre) and sycamore trees (5 trees/acre).
- Each plant to receive individual plant protection, weed prevention and watering basin.
- Maintain existing under-story (ruderal annual grassland).

**Riparian Forest** (applies to Project Alternative 4 only):
- Plant 350 trees per acre at 11’ centers including cottonwood (87 trees/acre), willows (123 trees/acre), box elder (87 trees/acre), blue elderberry (18 trees/acre), California sycamore\(^*\) (18 trees/acre) and California walnut\(^*\) (17 trees/acre).
- Plant 625 shrubs/herbaceous plants per acre at 7-10’ centers including creek dogwood (125 plants/acre), California blackberry (187 plants/acre), California rose (95 plants/acre), Douglas’ mugwort (125 plants/acre), stinging nettle (31 plants/acre), California bee plant (31 plants/acre) and wild licorice (31 plants/acre).
- Each planting area to be encircled with above- and below-ground plant protection, and each plant to be installed with weed prevention, watering basin.

\(^*\)Alt. Bay Laurel and/or coast live oak
2.0 BACKGROUND OF COVERED SPECIES

The federally threatened and endangered species described in this section would be impacted by the proposed project and include steelhead, tidewater goby and California red-legged frog. The National Marine Fisheries Service (Jonathan Ambrose, personal communication) has suggested that Corralitos Creek historically supported populations of Central California Coast ESU coho salmon (*Oncorhynchus kisutch*), a federally threatened species. However, Snyder (1913) did not find coho in the Pajaro River system in 1908. Some adult coho were observed in Corralitos Creek in the 1960’s and 1970’s (Dave Streig, Monterey Bay Salmon and Trout Project) at a time when hatchery smolts were being stocked in the nearby San Lorenzo River. No juvenile coho were collected in the Corralitos Creek watershed in 1973 or 1974 (Smith, 1982) or in 1981 (Smith et al., 1983).

Coho require cool, relatively flat rearing habitat and regular migration access because of their fixed three-year life cycle (Shapovalov and Taft, 1954). They are unlikely to be successful in the Pajaro River system where droughts regularly block salmonid migration and most spawning and rearing habitat is either too steep or too warm for their success (Smith et al., 1983). Their presence now is especially unlikely as even relatively accessible, cool and flat streams like Gazos, Waddell and Scott Creeks have had marginal coho populations from 1992 to 2000 (Smith, 2001). Therefore, coho salmon are not covered in this BA.

2.1 Steelhead

2.1.1 Life History

Steelhead (*Oncorhynchus mykiss*) can be anadromous or resident in freshwater streams or rivers. Resident forms of this species remain throughout their lives in the freshwater stream in which they are hatched and are usually referred to as “rainbow” or “redband” trout. Steelhead is the anadromous life form of *O. mykiss* that is listed by the National Marine Fisheries Service as threatened (USFWS, 1998). They hatch in freshwater, migrate as juveniles to the ocean to mature and then return to spawn in fresh water (NMFS, 1996).

Steelhead can be divided into two reproductive ecotypes based on their state of sexual maturity at the time of river entry and the duration of their spawning migration. These two ecotypes are termed “stream maturing” and “ocean maturing.” Stream maturing steelhead enter fresh water in a sexually immature condition and require several months to mature and spawn. Ocean maturing steelhead enter fresh water with well-developed gonads and spawn shortly after river entry. These two reproductive ecotypes are more commonly referred to by their season of freshwater entry (i.e. summer and winter steelhead). Only winter steelhead are found in the South/Central California Coast Evolutionary Significant Unit (ESU) with river entry ranging from late November through March (Busby et al., 1996). Spawning occurs in January through April, and adults typically migrate back to the ocean within days after spawning.

Steelhead lay eggs in spawning gravels with cool, fast-moving water near riffles to keep eggs oxygenated. Depending on water temperature, steelhead eggs incubate for 1.5 to 4 months then hatch as “alevins”, a larval stage dependent upon food stored in a yolk sac. Once the yolk sac is absorbed, alevins emerge from the spawning gravels as juveniles or fry. Juveniles usually remain in fresh water for 1 to 2 years then migrate to the ocean as “smolts” (Shapovalov and Taft, 1954).
No studies of steelhead adult or smolt migration have been done for the Pajaro River system, but migration periods are probably similar to those of other streams in Santa Cruz County. Adult steelhead up-migration in Waddell Creek (Shapovalov and Taft, 1954) and the San Lorenzo River (Monterey Bay Salmon and Trout Project trapping records) is in late December through early April, with most of the run occurring in January through March. The migration of waiting adults can be triggered by storms and in dry years much of the migration may occur during a few storm periods. Smolt out-migration in Waddell Creek (Shapovalov and Taft, 1954; Smith, 1992-1994) and the San Lorenzo River (Smith, 1987-89) is primarily during late March through the end of May. The relatively fixed, prolonged migration period of smolts is apparently due to the importance of spring growth to most emigrating fish. Larger juveniles can migrate earlier before significant spring growth, but most fish must delay migration because they apparently require spring growth to achieve a size sufficient to successfully enter the ocean (Smith, unpublished San Lorenzo River and Waddell Creek trapping results).

2.1.2 Distribution and Abundance

Historically, steelhead ranged throughout the North Pacific Ocean from the Kamchatka Peninsula in Asia to the northern Baja Peninsula (NMFS, 1996). Steelhead likely inhabited most coastal streams in Washington, Oregon, and California as well as many inland streams in these states and Idaho. Although the present range of this species has not diminished substantially (extending from the Kamchatka Peninsula south to at least Malibu Creek in southern California), steelhead populations have experienced significant declines in recent decades (Nehlsen et al., 1991). In California, degradation or loss of over 90 percent of wetland and riparian habitats has been a major contributor to the reduction in numbers of steelhead. Habitat losses have occurred as a result of water diversions for agriculture, flood control and hydroelectric power, sedimentation from adjacent land use activities, and urbanization (NMFS, 1996). Recreational fishing and introduction of non-native predator species have also contributed to the decline.

The Pajaro River is one of the major drainages of the South/Central California Coast ESU, which includes rivers from the Pajaro to (but not including) the Santa Maria River (NMFS, 2000). Historic population estimates for steelhead in this ESU vary widely. During the mid 1960s McEwan and Jackson (1996) estimated runs of 1,000 to 2,000 steelhead in the Pajaro River and 3,200 in the Carmel River. During the same time period, the California Department of Fish and Game estimated runs of 27,750 individuals in some rivers of this ESU (NMFS, 1996). NMFS (1996) indicated that by 1990, steelhead runs were as low as 500 fish in five rivers combined (Pajaro River, Salinas River, Carmel River, Little Sur River, and Big Sur River) and Nehlsen et al. (1991) estimated a run of less than 100 steelhead in the Pajaro in 1991. According to Smith (personal communication, 2000), population numbers in the Pajaro probably declined as a result of the drought of 1987-1991, which hampered adult and smolt migrations and severely reduced summer stream flows in rearing habitat. Numbers likely increased during subsequent wet years. The current number of steelhead using the Pajaro River is unknown, but juvenile steelhead were present in all rearing tributaries in 1997 (Smith, unpublished data).

2.2 Tidewater Goby

2.2.1 Life History

The tidewater goby (Eucyclogobius newberryi) is a small fish, approximately 2 inches in length, which occurs in coastal wetlands of California (USFWS, 2000). All life stages of tidewater gobies occur at the upper end of lagoons, typically in waters with salinities less than 10 parts per thousand (ppt). Although gobies have been observed in waters with salinity greater than 42%, salinity tolerance experiments indicate
that this species has poor survival rates when exposed to saline waters for several days (Swift et al., 1989). Higher survival rates were achieved when fish experienced a gradual rise in salinity (Swift et al., 1989).

The tidewater goby occurs in loose aggregations of a few to several hundred individuals in shallow water less than 3 feet deep (Swift et al., 1989), although gobies have been observed at depths of 4.9 to 7.6 feet (Holland, 1992). They are weak swimmers and avoid areas of strong stream flow or tidal action. Therefore, they are a “lagoon” goby rather than a “tidewater” goby. Gobies tend to move along the bottom substrate, escaping from predators by swimming in short bursts of speed into deeper water or aquatic vegetation (Swift et al., 1989). Their peak nesting activity occurs from late April through early May when water temperatures are 75.6 to 79.6°F and salinities range from 5 to 10 ppt. Male gobies dig a vertical nesting burrow in coarse sand from 4 to 8 inches deep and remain to guard the eggs, which are hung from the ceiling and walls of the burrow until hatching. Larval gobies are found mid-water around vegetation until they become benthic (Swift et al. 1989). Gobies are capable of year round spawning, however, seasonal low temperatures and disruption during winter storms probably reduce the likelihood of spawning during other times of year (Swenson, 1993).

The tidewater Goby was Federally Listed as endangered on March 7, 1994. On June 24, 1999 USFWS proposed to de-list the northern populations of tidewater goby and to retain southern populations in Orange and San Diego Counties as endangered based on a re-evaluation of the species status throughout its range. The critical habitat designated by USFWS for the tidewater goby is effective December 20, 2000 and is located in Orange and San Diego counties, California (USFWS, 2000).

2.2.2 Distribution and Abundance

Historically, the tidewater goby occupied at least 87 of California’s coastal lagoons ranging from Del Norte County, near the Oregon border, south to northern San Diego County (Swift et al. 1989). The southern populations historically occupied the coastal lagoons, at the mouths of small to large streams, rivers and wetlands from Aliso Creek in Orange County, to Agua Hedionda Lagoon in northern San Diego County. Since 1900, more than 50% of the known populations of goby have disappeared, 35% of this number in the 6 years preceding surveys conducted in 1991 (Swift et al., 1989).

Currently, tidewater goby is found in approximately 43 California coastal lagoons from Tillas Slough at the mouth of the Smith River in Del Norte County south to Agua Hedionda Lagoon in San Diego County (USFWS, 2000). Three natural gaps in the distribution of the goby appear to be present in areas of steep coastlines that have precluded the formation of lagoons at stream mouths. These gaps include sections of the coast between Humboldt Bay and Ten Mile River, Point Arena and Salmon Creek, and Monterey Bay and Arroyo del Oso.

During years of mild winters and early sandbar formation at the mouth of the Pajaro (such as 1987-1991), gobies are probably abundant and distributed throughout the lagoon, including upstream to Highway 1 (CNDDB, 2001; Swanson and HRG, 1993). In years of heavy storms and late sandbar closure, gobies may be rare and restricted to calmer portions of the lagoon and Watsonville Slough. Tidewater gobies were present in 1991 and 1992 (Swanson and HRG, 1993), but were not captured during sampling of the Pajaro River lagoon and Watsonville Slough areas between 1997 and 1999 (Smith, 1997-1999).


2.3 California Red-Legged Frog

2.3.1 Life History

The California red-legged frog (CRLF) is one of two subspecies of red-legged frog found on the Pacific coast (USFWS, 1996). CRLF is the largest native frog in the western United States, ranging from 1.5 to 5.1 inches in length. California red-legged frogs found in coastal drainages are rarely inactive, whereas those found in interior sites may hibernate. CRLF occupies a fairly distinct habitat, combining both specific aquatic and riparian components. Adults require dense, shrubby or emergent riparian vegetation closely associated with deep, still or slow-moving water. The largest densities of CRLF are associated with deep-water pools with dense stands of overhanging willows (Salix spp.) intermixed with cattails (Typha spp.) (Hayes and Jennings, 1988).

California red-legged frogs generally breed from late November through April (USFWS, 1996). Egg masses that contain about 2,000 to 6,000 dark reddish brown eggs are typically attached to vertical emergent vegetation, such as bulrushes (Scirpus spp.) or cattails. Eggs are laid during or shortly after large rainfall events in late winter and early spring and hatch in 6 to 14 days. Larvae undergo metamorphosis 3.5 to 7 months after hatching. Sexual maturity is normally reached at 3 to 4 years of age, and individuals may live 8 to 10 years (USFWS, 1996).

During the dry season, both juvenile and adult CRLF may move away from breeding sites and can be found in streams as far as 3 kilometers (1.8 miles) away and 30 meters (100 feet) away from water (Rathbun et. al, 1993). California red-legged frogs move up and downstream from their breeding sites to look for food and to seek estivation habitat. Estivation is a dormant or sluggish period similar to hibernation, but occurs in certain species during hot and dry periods. Estivation habitat for the CRLF potentially includes any feature that provides cover and moisture during the dry season that is within 300 feet of aquatic or riparian habitat and could include logs, boulders, industrial debris, watering troughs, abandoned structures or other man made features (USFWS, 1996).

With the first rains of the wet season, CRLF may make overland excursions through upland habitat. Several studies, one in northern Santa Cruz County and one on the San Simeon coast indicates that individual CRLF will move about one mile and up to two miles within a wet season. In addition, CRLF are capable of moving in a straight line through uplands rather than being restricted to using habitat corridors (USFWS, 1996). Topography, vegetation type and riparian corridors do not appear to affect their dispersion. CRLF populations east of Zmudowski State Park would have relatively unobstructed migration possibilities through the park to the project and the Pajaro River corridor. It is probable that habitat in the Pajaro River provides estivation habitat for CRLF during the summer months and aid adult CRLF as they migrate in search of food or breeding habitat.

The CRLF is adapted to survive variable climate and spatial or temporal variations (USFWS, 1996). Its variable life history allows the frog to respond and recover from adverse conditions. The Pajaro River, as well as its riparian zone and flood plain, probably provided extensive CRLF habitat historically. Two of the three most significant CRLF populations remaining occur in the counties just south and north of Santa Cruz county, one in Monterey County (Rancho San Carlos) and another in San Mateo County (Pescadero Marsh Natural Preserve). Because CRLF habitat is fragmented in the Pajaro River watershed, the Pajaro River itself may currently play a key role in providing estivation habitat during migration and may provide an important opportunity in the recovery of CRLF in the watershed.

Any features that provide shade or cover, such as riparian vegetation, emergent vegetation, downed trees or logs, man-made or natural debris, boulders, animal burrows, or leaf litter in the Pajaro River or its flood
plain can be beneficial to CRLF during migration (USFWS, 1996). The retention of dense riparian vegetation along ephemeral backwater areas could create conditions favoring successful CRLF breeding and survival. In addition, the construction of backwater ephemeral areas along the Pajaro or its tributaries could be beneficial. Breeding CRLF require dense shrubby or emergent riparian vegetation associated with slow moving pools that are deeper than 0.7 meters. Dense stands of overhanging willows provide ideal habitat for CRLF (Hayes and Jennings, 1988). Any restoration efforts would have to address the bullfrog population (Rana catesbeiana), which is present in the Pajaro River and preys heavily on CRLF. While the CRLF metamorphoses within one wet season (and can thus utilize ephemeral systems), the bullfrog requires two or three wet seasons to achieve maturity. Unlike the CRLF, bullfrogs seldom venture far from a permanent body of water (USFWS, 1996).

2.3.2 Distribution and Abundance

The historical range of CRLF extended along the California coast from the vicinity of Point Reyes National Seashore in Marin County and inland from the vicinity of Redding in Shasta County, southward to northwestern Baja California, Mexico. The historic geographic range of CRLF has been reduced by 70 percent in California as a result of factors including habitat loss and alteration, overexploitation and introduction of exotic predators. Currently, CRLF is known to occur in 243 streams or drainages in 22 counties, primarily in the central coastal region of California (USFWS, 1996). Monterey, San Luis Obispo and Santa Barbara counties support the greatest number of currently occupied drainages. The most secure aggregations of CRLF are found in aquatic sites that support substantial riparian and aquatic vegetation and lack non-native predators (e.g. bullfrogs [Rana catesbeiana], bass [Micropterus spp.], and sunfish [Lepomis spp.]). Only three areas within the entire historic range of the CRLF may currently support more than 350 adults. These include Pescadero Marsh Nature Preserve in San Mateo County, Point Reyes National Seashore, and Rancho San Carlos in Monterey County (USFWS, 1996).

There are at least four known sightings of CRLF within two miles of the project site along the main stem of the Pajaro River (CNDDB, 2001). An additional four known sightings of CRLF are between two and four miles of the project site (CNDDB, 2001). Another sighting of CRLF is only 1,800 feet from the Pajaro River Corridor, although it is approximately 3 miles east of the project site (CNDDB, 2001).
3.0 IMPACTS TO COVERED SPECIES

3.1 Steelhead

3.1.1 Presence on the Project Site

The Pajaro River serves as the pathway for adult steelhead migrating to spawning and nursery habitat in the Salsipuedes Creek watershed and in watersheds in Santa Clara County, and also for steelhead smolts migrating from those habitats to the ocean. Historic population estimates for steelhead in Pajaro River watershed vary widely. During the mid 1960s McEwan and Jackson (1996) estimated runs of 1,000 to 2,000 steelhead in the Pajaro River. NMFS (1996) indicated that by 1990, steelhead runs were as low as 500 fish in five rivers combined (Pajaro River, Salinas River, Carmel River, Little Sur River, and Big Sur River) and Nehlsen et al. (1991) estimated a run of less than 100 steelhead in the Pajaro in 1991. According to Smith (personal communication, 2000), population numbers in the Pajaro probably declined as a result of the drought of 1987-1991, which hampered adult and smolt migrations and severely reduced summer stream flows in rearing habitat. Numbers likely increased during subsequent wet years. The current number of steelhead using the Pajaro River is unknown, but juvenile steelhead were present in all rearing tributaries in 1997 (Smith, unpublished data).

The river itself does not generally provide suitable spawning or rearing conditions for steelhead because of high summer water temperatures, low summer stream flows and sandy or silty substrate. Upstream of the confluence with the San Benito River, the Pajaro River is very warm and turbid in summer, with substrate of fine silt from the surrounding agricultural lands. Downstream of the San Benito River the streambed is dominated by sand. A very limited amount of gravelly spawning habitat is present in the Chittenden Pass-Aromas area, but none is present elsewhere on the Pajaro River. Because the streambed is dominated by sand, aquatic insects suitable as food for juvenile steelhead are relatively scarce. The high summer water temperatures (70-80°F; Smith, unpublished data) would require any rearing steelhead juveniles to have access to abundant food in order to meet their high metabolic demands for survival and growth. Such productive feeding areas could potentially be provided by fast-water riffles and runs that are deep enough for steelhead to maintain swimming positions for feeding on drifting insects and with gravel or cobble bottoms to provide those insects (Smith and Li, 1983). However, the only place on the Pajaro River with such habitats is in the Chittenden Pass area, where the channel narrows and is steep and substrate coarsens through the San Andreas fault zone; some juvenile steelhead were collected there in late summer during 1973 (Smith, 1982). No steelhead were captured in late summer elsewhere in the Pajaro River during sampling from 1973-1995 (Smith, 1982; Smith et al., 1983; Smith, unpublished data). Even in 1908 the lower Pajaro River was a shallow, sandy stream (Snyder, 1913). Snyder (1913) captured steelhead in the river at four sites between Watsonville and Highway 101, but they were “usually light silvery in color…” and were probably smolts migrating from tributaries.

The Pajaro River immediately upstream and downstream of Murphy Crossing is generally dry in summer (Smith et al., 1983; Smith, unpublished data). However, in wet years the reach goes dry later in the summer. After a series of very wet years, flows may persist all summer. Persistent summer flows are restored downstream as groundwater surfaces from a perched water table. The location and amount of emerging flows varies with annual rainfall; in wet years persistent surface flow is present within a mile of Murphy Crossing, but in drier years surface flows are restored closer to Salsipuedes Creek, 4.8 miles downstream of Murphy Crossing. From the point of surface flow emergence, low summer stream flows...
Impacts to Covered Species

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(several to less than one cfs) are present downstream to the lagoon, even in drought years. Flow is also added to the Pajaro River in summer by Salsipuedes Creek, even in the driest years. Since the streambed downstream of Murphy Crossing is mobile sand, pools are generally shallow (averaging < 2 feet deep), and deeper habitat is present only at sharp bends or associated with localized scour around fallen trees or other structures.

The amount of riparian vegetation in the Pajaro River channel has varied substantially over the last two decades, depending on the amount of vegetation removal conducted for flood control purposes and the degree of winter flooding (Smith, unpublished data). Young willows grow quickly in portions of the stream with summer flow, but are torn from the streambed by large floods. Near Murphy Crossing, the lack of summer flow usually results in slow growth of young willows and restricts most of the riparian vegetation to the stream bank and terraces where scour is reduced. However, downstream, where summer flows are regularly present, willows and cattails rapidly encroached into the channel bed during periods of minimal winter scour and limited vegetation removal effort between 1987 and 1991. By 1990, most of the low flow channel was lined and partially shaded by willows. Willows were also abundant in the remainder of the channel bed. Summer water temperatures were probably warm (>70°F), even in shaded sections, because of low stream flow, sparse shading of much of the channel and warm inflows from Salsipuedes Creek, which isn’t well shaded. However, the low flow channel was narrow, relatively deep and reasonably well defined, due to the confining riparian vegetation. The Pajaro River channel is presently poorly shaded due to scour in recent wet winters (1994-1995, 1996-1997, and 1997-1998) and riparian vegetation removal for channel maintenance. Water temperatures are probably warmer now, but the extent of warming in spring and summer has not been documented with temperature monitoring. Because of scour and loss of riparian vegetation, the low flow channel is now generally broad, shallow and poorly defined, with the channel braided in some locations.

3.1.1.1 Eastern Watershed

The majority of steelhead using the Pajaro River as a migration pathway utilize the eastern portion of the watershed, and must negotiate the entire reach of Pajaro River between Murphy Crossing and the lagoon. Pescadero, Uvas, Llagas and Pacheco Creeks, and their tributaries, provide potential steelhead spawning and rearing habitat (Smith 1982; Smith et al. 1983; Smith, unpublished data). Pescadero and Uvas creeks provide access, spawning and rearing in all but extreme drought years. Llagas and Pacheco creeks have drier watersheds and more difficult passage, especially for out-migrating smolts; steelhead use of those streams is less frequent and less extensive. Steelhead were common in Uvas Creek and its tributaries, but were relatively scarce in Llagas and Pacheco Creeks in 1997 and 1998 (Smith, unpublished data). Chesbro Reservoir on Llagas Creek and Uvas Reservoir on Uvas Creek, which are operated by the Santa Clara Valley Water District, regulate late spring through fall stream flows in those two streams. Normally, reservoir releases are adjusted to the percolation capacity of the middle reaches of the two streams, and steelhead passage through the lower reaches is blocked by dry streambeds by May to early June (with flows persisting significantly longer in Uvas Creek than in Llagas Creek). Flows in Pacheco Creek are partially regulated by a dam on the North Fork of Pacheco Creek (operated by the Pacheco Water District). Flow regulation by the dam and the generally dry nature of the watershed usually block smolt out-migration by early to late May. Storage capacity of the reservoirs in the upper watershed is relatively low compared to average annual runoff, and unregulated tributaries are present in all 3 watersheds. Except in severe drought years, adult upstream access is provided by reservoir spill and tributary runoff during the winter storms of January through March or early April.
3.1.1.2  *Salsipuedes/Corralitos Creek Watershed*

Steelhead regularly spawn and rear in the upper watershed of Corralitos Creek, which joins Salsipuedes Creek immediately downstream of College Lake (*CNDDB*, 2001; *Smith et al.*, 1983). City of Watsonville diversion dams on Corralitos and Browns Creeks and wells downstream of their confluence reduce spring stream flows during smolt out-migration. The diversions and wells also usually result in drying of the stream channel in summer from Browns Valley Road in Corralitos downstream to below Varni Road. That reach generally serves steelhead only as a migration pathway. However, summer stream flow is usually present, except in droughts, from near Varni Road downstream to below Green Valley Road. Steelhead spawn and rear in this perennial reach. Corralitos Creek is dry in summer at and immediately upstream of Highway 152, above the confluence with Salsipuedes Creek. The entire reach from Browns Valley Road to Highway 152 is well shaded by an intact riparian corridor. Spring water temperatures are cool for migrating steelhead smolts, and summer water temperatures are cool in the perennial portions of the stream. Pools are relatively shallow because of a lack of downed trees or structures in the channel.

Two tributaries to College Lake and Salsipuedes Creek may be used by steelhead for spawning and rearing. Adult steelhead access is good to Casserly Creek, and fish with smolt coloration and genetics similar to Corralitos Creek fish were captured in spring 1997 (*Sundermeyer*, 1999; *Smith, unpublished data*). However, passage is much more difficult on Green Valley Creek. Size structure of fish in spring 1997, lack of smolted fish and distinctive genetics indicate that all or most of the “rainbow trout” in Green Valley Creek are now resident, rather than migratory steelhead (*Sundermeyer*, 1999). Although no dams or major diversions occur on the two streams, spring stream flows decline quickly, probably blocking late-migrating smolts in average or dry years. In early May 1997 smolt passage was not possible on either of the College Lake tributaries, despite the wet winter, but smolts were still apparently moving down Corralitos Creek (*Smith, unpublished data*).

College Lake is quite turbid in winter and spring, because most of its stored water is turbid storm runoff and because the bare, fine-grained soils of the shallow lakebed are easily stirred up by wind and wave action. The turbid conditions and probable lack of food availability suggest that steelhead smolts migrating through the lake from Green or Casserly Creeks spend little time in the lake.

College Lake is presently pumped dry in late spring to allow agricultural use of the lakebed. The pumped water provides several weeks of higher stream flows for Salsipuedes Creek and for the Pajaro River between the creek and the estuary. Depending on the timing of the pumping, this augmented flow may improve smolt migration conditions in both reaches. However, once pumping begins the lake is lowered below the outlet dam, and smolts in College Lake can only pass downstream through the pumps. The mortality rate of fish in the pumps is unknown. Salsipuedes Creek from the lake outlet downstream to its confluence with Corralitos Creek is a silty, turbid ditch.

Salsipuedes Creek, from Corralitos Creek downstream to the Pajaro River, has summer flows even in drought years due to agricultural runoff from College Lake, and due to groundwater inflow downstream. Maintenance activities for the last 5 decades have resulted in the removal of all woody riparian vegetation from most of the channel, with the exception of the short reach between Highway 129 and the mouth. Summer water temperatures throughout Salsipuedes Creek are warm, reaching 75-80°F in the afternoon (*Smith, unpublished data*), because of low summer flows and the lack of shading. Pools are normally very shallow (< 1 foot deep), because of the absence of channel complexity (downed trees, boulders, sharp bends). Summer substrates are silty, due to agricultural runoff from College Lake, but suitable spawning gravels are present in winter. Steelhead can successfully spawn in the stream, especially in the short shaded reach near the mouth. However, the high summer water temperatures eliminate rearing juveniles.
Juvenile steelhead were observed in late spring of 1973 and 1981, but were absent by late summer (Smith, unpublished data).

3.1.1.3  Pajaro River Fish Passage

No studies of steelhead adult or smolt migration have been done for the Pajaro River system, but migration periods are probably similar to those of other streams in Santa Cruz County. Adult steelhead upmigration in Waddell Creek (Shapovalov and Taft, 1954) and the San Lorenzo River (Monterey Bay Salmon and Trout Project trapping records) is in late December through early April, with most of the run occurring in January through March. The migration of waiting adults can be triggered by storms, and in dry years, much of the migration may occur during a few storm periods. Smolt out-migration in Waddell Creek (Shapovalov and Taft, 1954; Smith, 1992-1994) and the San Lorenzo River (Smith, 1987-1989) is primarily during late March through the end of May. Conditions for smolt and adult migration in the Pajaro River depend on channel shape and gradient and stream flow, through their effects on depth and velocity. Stream depth must be sufficient for the submerged fish to fully use their broad tails for propulsion and with sufficient clearance to prevent the body and tail from dragging on the substrate. Stream velocities affect the overall speed of upstream or downstream migration, and can also become an obstacle to upstream passage over shallow riffles. Upstream migrating adults require substantially greater flows and channel depths than downstream migrating smolts, because they are larger and they must fight against the current of shallow habitats. However, conditions for smolt migration in the Pajaro River are more likely to be a problem than conditions for adults for four reasons: (1) smolt migration occurs in late spring when stream flows are naturally low and declining, rather than during the high flows of winter; (2) “route-finding” through shallow, low-velocity riffles can be more precarious, even though smolts can pass shallower water than adults; (3) the timing of attempted smolt migration does not appear to change with annual runoff patterns; and (4) smolts have a more continuous, prolonged migration period rather than the episodic dash that adults can make during storms. The relatively fixed, prolonged migration period of smolts is apparently due to the importance of spring growth to most emigrating fish. Larger juveniles can migrate earlier before significant spring growth, but most fish must delay migration because they apparently require spring growth to achieve a size sufficient to successfully enter the ocean (Smith, unpublished San Lorenzo River and Waddell Creek trapping results). Avoiding predation is also apparently an important factor in smolt migration as almost all movement occurs at night (Smith, unpublished San Lorenzo River and Waddell Creek trapping results).

The Pajaro River channel downstream of Murphy Crossing is quite flat, and adult steelhead passage can be inhibited by shallow, gravel riffles that form across the channel. In 1997 only five shallow, gravelly riffles were present between Murphy Crossing and Salsipuedes Creek (Smith, unpublished data). Two wide, shallow, diagonal riffles at and within a mile downstream of Murphy Crossing provided the most difficult potential steelhead passage. Both occurred in the portion of the stream lacking summer flows and channel bed willows. A third diagonal riffle was evaluated further downstream where summer flows are normally present and willows and cattails lined portions of the low flow channel. At that riffle, scour along the willows and cattails appeared to concentrate the flow and provide easier passage. For the remainder of the channel between Murphy Crossing and the lagoon, passage problems for steelhead were substantially less severe and were associated with broad, shallow portions of the sandy channel. The low flow thalweg appeared to be better defined and deeper where willows occupied the channel bed and/or lined the toe of the stream bank. Low flow channel crossovers in reaches barren of channel willows in 1997 and in 1999 were often shallow and braided. Downstream of Murphy Crossing the channel presently lacks deep pools and structures such as logs, undercut banks or overhanging vegetation, which limits the number of good resting areas for migrating fish trapped by low, between-storm flows.
Impacts to Covered Species

During the low flow conditions of late spring, out-migrating adults or smolts are also most likely to be hindered by the few shallow, short riffles. The fish do benefit by moving with the current, but where the channel is poorly defined through riffles or shallow, sandy areas, migrating fish could be stranded in shallow secondary channels. Where the channel is better defined, route finding should be easier and average current speed should also be higher, speeding the downstream movement of fish. The Pajaro River from Murphy Crossing to the lagoon presently has few deep pools or other hiding areas, and because of limited shading, it probably also has warm (>70°F) afternoon water temperatures in late spring. Fortunately, smolts travel at night, when temperatures are cooler and the reach is only about 7 miles long. Therefore downmigrating fish can potentially travel through the reach in one or two nights. High temperatures during migration are unlikely to block or kill migrating fish, but they may reduce smolt salinity tolerance and readiness to enter seawater (Zaugg, 1981; McCormick, et al., 1999). Late-run smolts may require additional adaptation time in the estuary.

3.1.1.4 Pajaro River Estuary/Lagoon

The Pajaro River estuary/lagoon is generally shallow, narrow, and structurally simple (Swanson and HRG, 1993). During storm flows, the only calm backwaters are in Watsonville Slough, which enters near the mouth of the river. When the sandbar is fully open, the highest tides can penetrate upstream to Highway 1, but tidal action is moderated by partial sandbar closure in late spring and summer. Brackish water from tides and lagoon impoundment keeps the channel bed free of willows downstream of Highway 1. Sandbar formation is primarily a function of beach-building processes, and thus is affected by sand supply and direction, shape and size of waves. Tidal flux through the mouth is substantially higher than freshwater inflows during late spring and summer, but both are secondary to beach dynamics in affecting bar formation. With the right wave action and sand availability the bar can fully close in a single tidal cycle, but at other times, tidal flux is sufficient to keep the bar partially open all summer. The sandbar at the Pajaro River rarely closes until late summer or fall. In some years, full closure of the bar occurs only with the first weak fall storms, which apparently close the bar by changing wave direction and mobilizing enough sand to plug the mouth. The Santa Cruz County Department of Public Works usually opens the sandbar immediately prior to the first large winter storm to prevent flooding. The Department also has permits to open (and attempt to re-close) the sandbar in late spring or summer if high lagoon water levels produce flooding, but such an action has rarely been necessary.

In summers with only partial sandbar formation, the shallow (<3 feet deep) upstream portion of the lagoon can be fresh or mildly brackish (<6 ppt) if the bar is mostly closed, or quite saline (>15 ppt) if the mouth is wide open (Swanson and HRG, 1993). Portions of the downstream half of the lagoon can exceed 6 feet in depth and be stratified for salinity, with the bottom of the water column reaching salinities of 25 to 30+ ppt. Periodic tidal action tends to keep the bottom waters cool (<60-65°F) near the mouth, but upstream of the first bend the lower portion of the stratified water column traps heat and is usually warm (>70°F). The lower portion of the stratified water column can also be hypoxic. If the sandbar fully forms, the lagoon can be up to 3 feet deeper and gradually freshens from Pajaro River inflows and from agricultural runoff. After full sandbar formation, wind action tends to gradually (6+ weeks) mix the water column downstream of the first bend, reducing or eliminating salinity, temperature and oxygen stratification. Full sandbar formation also inundates the relatively small amount of salt marsh fringing the lower part of the lagoon; otherwise the marsh is flooded only by very high tides. Nutrients, including input from agricultural runoff, are abundant in the summer lagoon, so dense phytoplankton and filamentous algal blooms are common.

Steelhead smolts use the Pajaro River lagoon to adjust to salt water and to feed prior to entering the ocean. The sandbar usually remains open during their out-migration period (April through early June). However,
juvenile steelhead do not use the lagoon for summer rearing (Swanson and HRG, 1993), since steelhead spawning areas are too far upstream to allow juvenile movement to the lagoon for rearing.

3.1.2 Potential Impacts of the Project

Impacts to steelhead will occur from project activities including the removal of vegetation and clearance of downed trees from the channel bottom, removal of accumulated sediment (sandbars) and the use of herbicides.

Under the vegetation management proposal, downed trees and woody vegetation greater than 3 inches in diameter will be removed from the channel bottom between Highway 1 and the mouth of the Pajaro River. Downed trees and vegetation in the channel bed are typically very scarce along this reach because of brackish water inundation by tides and summer sandbar development. Although they provide some escape cover for fish, downed trees in the wide sandy channel downstream of Highway 1 do not generally provide backwater or significantly deeper habitats.

Between Highway 1 and Murphy Crossing, the County proposes to remove all vegetation from the channel bottom during the dry season of each year with the exception of a 5-foot buffer on each side of the low flow channel. The vegetation would be removed by hand or mowed and the stumps treated with herbicide during the summer of each year. Trees or shrubs with stem diameters greater than 3 inches would be cut at the base (manually) within the 5-foot vegetative buffer. In areas where braided channels form as water levels decline, County Public Works personnel would allow vegetation to develop along the deepest channel.

Steelhead are impacted by lack of vegetation in the channel bottom in a number of ways. Water temperature increases as a result of the decrease in shading of the low flow channel. Out-migrating steelhead smolts, typically unable to survive temperatures exceeding 20°C throughout a 24-hour period or 24°C for more than an hour, are particularly susceptible to high water temperatures. Vegetation also provides structural features that offer cover, facilitate pool formation and contribute to formation of a concentrated low flow channel. Because the reach of the Pajaro under consideration is generally used by steelhead for migration only, residence time by adults or smolts in the channel is typically short. In addition, smolt migration occurs primarily at night when temperatures are cooler. Under adverse conditions, steelhead may migrate to Highway 1 from Murphy crossing within two days. However, increasing the number of pools and vegetative cover in the channel would probably increase steelhead survival. Formation in the spring of a continuous low flow channel of sufficient depth is critical to out-migrating adults and smolts. A low flow channel with a minimum water depth of 6 inches through April 15 each year for adults and 4 inches through June 15 each year for smolts is desirable to maintain conditions suitable for steelhead migration. However, in dry years stream flows may not be present through June 15 or may be insufficient for successful smolt migration, despite a well-defined low flow channel. In addition, water temperatures in the Pajaro River at the upstream end of the project reach may have spring water temperatures above those desirable for steelhead.

The current lack of vegetation along much of the Pajaro River channel bottom between Murphy Crossing and Highway 1 decreases the potential for formation of a concentrated low flow channel during the dry season and reduces shading of the channel. The proposed 5-foot vegetative buffer is intended to improve habitat conditions for fish by causing water to concentrate along a defined pathway, facilitating the creation and maintenance of a low flow channel that is deep enough to allow steelhead passage. In addition, the buffer would provide some shading of the channel that may lower water temperature during the dry season and during smolt migration in the spring.
The characteristics of the vegetative buffer would probably vary substantially from year to year. In wet years, the buffer zone may be very sparse because of scour, and portions of the vegetation remaining from previous years may no longer border the low flow channel because of channel migration. In drier years, the growth of willows and other riparian plants would produce a denser border, especially along portions of the channel with summer-long stream flows. After several drier years, the concentration of scour along the buffer zone vegetation would result in a deeper, more defined low flow channel in spring and improved passage conditions for migrating steelhead adults and smolts. In the driest of years, however, there may not be any flow in some reaches of the Pajaro, despite a well-defined low flow channel. Following wet years, the loss of a dense border and defined low flow channel due to scour would be less critical for steelhead migration conditions because the accompanying high spring stream flow would result in improved water depths for steelhead passage. Dry years immediately following wet years would have a sparse vegetation band because of the delay in vegetation colonization and growth. Summer stream flow may be increased somewhat by the reduction of in-channel vegetation, however, the vegetation buffer may be insufficient to promote formation of a low flow channel deep enough for steelhead passage. Shading of the water by the short, narrow buffer would probably be insufficient to reduce spring or summer water temperatures, but resting areas and escape cover for migrating steelhead would be improved.

The County proposes to establish and maintain riparian vegetation from the toe of slope to near the top of bank on the Santa Cruz County side of the river. Riparian vegetation would provide for shading of the low flow channel and overhanging escape cover and channel scour where the low flow channel flows along the bank, improving conditions for migrating steelhead and resident warm water fishes.

Periodic removal of accumulated sediment from the channel could adversely affect fish by destabilizing the low flow channel and increasing stream turbidity. Removal of sandbars every 4 to 5 years at a single location could alter the low flow channel and associated vegetation buffer and temporarily increase stream turbidity if dredging was conducted when surface water was present. Sandbar removal could cause significant adverse impacts to migrating steelhead if the low flow channel was removed or turbidity increased during migration periods.

Fallen and leaning trees would be removed from Salsipuedes and Corralitos Creeks as part of the proposed vegetation management. In addition, from the Highway 129 to Highway 152 crossings of Salsipuedes Creek, all woody vegetation would be removed annually except for the east side of the channel from Lakeview Road to Highway 152. Losses of downed trees and in-channel woody vegetation could adversely affect survival of steelhead juveniles along reaches of the watershed where summer rearing occurs. These natural structures in the channel create pools and provide shading and escape cover for rearing and migrating fish.

Resident fish in Salsipuedes Creek could be adversely impacted by the loss of habitat features from the Highway 129 crossing to the Pajaro River confluence. Although suitable summer rearing habitat for steelhead is not present along the reach from Highway 129 to Highway 152, vegetation removal would reduce shade and escape cover for migrating steelhead. Tree removal would reduce shade and escape cover for migrating steelhead from Varni Road upstream and for steelhead juveniles rearing in perennial portions of the stream in wetter years from Highway 152 to Varni Road.

The County uses the herbicides Roundup and Rodeo to control vegetation on levee slopes and in the stream channel along the Pajaro River as well as Salsipuedes Creek. The pesticide Fumitoxin is also used to control mammals that burrow into levee walls. Roundup and Rodeo are extensively used herbicides manufactured by the Monsanto Company. Of animals that have been studied, fish species appear to be the most sensitive aquatic receptors to these herbicides. These herbicides were rated as “slightly toxic” to
rainbow trout and fathead minnow and “slightly toxic” to “practically non-toxic” to amphibians. Because animal uptake is slow and environmental levels are typically very low, Monsato does not expect buildup of toxic tissue residue levels of herbicide due to bioaccumulation. These herbicides and pesticide have been used for many years and agricultural pesticides (e.g. toxaphene, DDT and diazinon) also runoff into the river contributing to concentrations higher than published toxicity thresholds for resident aquatic species (Hunt et al. 1999). The combined effect is probably severely impacting steelhead and other aquatic species. Furthermore, toxic levels could also occur in higher vertebrates due to bioaccumulation from eating a large number of prey items with low pesticide and/or herbicide levels. For example, Belted Kingfishers (Ceryle alcyon) and other predators that eat many fish each day could accumulate toxic pesticide and/or herbicide levels.

3.2 Tidewater Goby

3.2.1 Presence on the Project Site

Tidewater goby was first recorded in the Pajaro River in 1949 (CNDDB, 2001). When no gobies were found during sampling in 1989, it was believed that this species was extirpated from the Pajaro (Swift et al., 1989). Smith (1990-1992) “rediscovered” Goby in the lagoon in 1991 (Swanson and HRG, 1993). Subsequently, no gobies were found during sampling in the Pajaro River lagoon and Watsonville Slough in the wet years of the late 1990s (Smith, 1997-1999). Tidewater gobies are weak swimmers and avoid areas of strong stream flow or tidal action. Ecologically, they are a “lagoon” goby rather than a “tidewater” goby. During years of mild winters and early sandbar formation at the mouth of the Pajaro (such as 1987-1991), gobies are probably abundant and distributed throughout the lagoon, including upstream to Highway 1 (Smith, personal communication, 2000). In years of heavy storms and late sandbar closure, gobies may be rare and restricted to calmer portions of the lagoon and Watsonville Slough (Smith, personal communication, 2000).

3.2.2 Potential Impacts of the Project

3.2.2.1 Pajaro River

Development projects resulting in the modification or reclamation of coastal marsh habitats are cited as the major factor adversely affecting tidewater goby (USFWS, 2000). Upstream water diversions, dredging for navigation or harbors, and construction of coastal roadways have directly impacted coastal lagoons or altered salinity and temperature regimes so that conditions are no longer favorable for the goby. Lack of protection in highly channelized rivers and creeks also constitutes a threat to the goby. High flows during winter floods can scour the channel, washing gobies into the ocean or to downstream areas where salinity levels exceed the range of tolerance for gobies. Once a population has been extirpated, the short life span of the tidewater goby and lack of tolerance for marine waters severely restrict their potential for natural re-colonization (Swift et al., 1989).

Clearance of downed trees on the Pajaro River downstream of Highway 1 would remove potential escape cover and limit deepwater habitat for tidewater goby. Maintenance actions will remove downed trees and woody vegetation greater than 3 inches in diameter from the channel bed. However, vegetation in the channel bed is presently very scarce because of brackish water inundation by tides and summer sandbar development. Although they provide some escape cover for fish, downed trees in the wide sandy channel downstream of Highway 1 are generally scarce, even without maintenance and do not provide backwater or significantly deeper habitats.
As described above in Section 3.1.2, the use of pesticides for rodent control, and herbicides for vegetation control, could contribute to toxic levels to aquatic species including gobies.

3.3 **California Red-Legged Frog**

3.3.1 **Presence on the Project Site**

3.3.1.1 **On Site Habitat**

There are at least four known sightings of CRLF within two miles of the project site along the main stem of the Pajaro River (CNDDDB, 2001). An additional four known sightings of CRLF are between two and four miles of the project site (CNDDDB, 2001). Another sighting of CRLF is only 1,800 feet from the Pajaro River Corridor, although it is approximately 3 miles east of the project site (CNDDDB, 2001). Surveys for this species on the project site have primarily included one to two-day habitat-level investigations by Harding ESE (1998) and Biosearch (1998). No focused species-specific surveys have been conducted with the exception of limited pre-construction surveys commissioned by the U.S. Army Corps of Engineers during repair work along Salsipuedes Creek and the Pajaro River (Ibis Environmental Services, 1999a-h). Between February and August 1999, the Corps implemented levee and bank rehabilitation work at 23 sites damaged during 1998 flooding. A Biological Opinion issued by USFWS required CRLF surveys of the construction sites and adjacent areas 24 hours prior to the start of work and onsite monitoring for the frog throughout construction. Wildlife biologists conducted spot light surveys of riparian and aquatic habitats in the predawn and sunrise hours. An estimated 2.5 miles (all repair sites combined) of the Salsipuedes Creek and Pajaro River channels were surveyed during the rehabilitation work. No red-legged frogs were observed during the surveys. Bull frogs were observed in Salsipuedes Creek approximately 1,500 feet upstream of its confluence with the Pajaro and at several sites in the Pajaro, including approximately 0.6 mile, 2 miles and 3.5 miles upstream of the Salsipuedes Creek confluence and at 3 sites between the Highway 1 crossing and the Salsipuedes Creek confluence. Other amphibian sightings included several unidentified frogs, Pacific tree frog (*Hyla regilla*) and western toad (*Bufo boreas*). Two western pond turtles, a state and federal species of concern, were observed basking on logs downstream of the Highway 1 crossing.

The presence of resident populations of CRLF on the project site is considered unlikely primarily because of the lack of suitable breeding habitat. CRLF breeds in the winter and early spring, attaching its eggs to emergent vegetation. Because the eggs are easily dislodged, preferred breeding habitats include ponds or backwater pools in streams with very slow-moving water. The Pajaro River below Murphy Crossing is a broad, flat channel with fast moving water through the winter and early spring. Pools and backwater areas may form in some areas within the river channel as water levels decline through the dry season, but probably not early enough in the CRLF breeding season to allow for successful breeding. Further, emergent vegetation required for egg attachment doesn’t typically begin to grow until water levels decline in the spring.

Salsipuedes Creek is a relatively straight channel with few meanders. Emergent vegetation along the stream channel consists primarily of bulrush and a few small patches of watercress (*Rorippa nasturtium aquaticum*) and horsetail (*Equisetum* spp.) The portion of the creek with a natural bank is heavily vegetated with willow (*Salix* spp.), blackberry (*Rubus* spp.), elderberry (*Sambucus* spp.), cottonwood (*Populus* spp.), eucalyptus (*Eucalyptus* spp.) and ornamentals associated with landscaping. Levee slopes and benches are vegetated with non-native grasses and forbs, with a predominance of wild radish (*Raphanus sativus*). Overhanging vegetation is generally absent from the creek, with few exceptions along the natural banks. Although emergent vegetation is allowed to grow in the channel, swift moving water
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through the winter and early spring and the absence of pools or backwaters likely preclude successful breeding in the channel.

Currently, the creek has few meanders and varies in width between 15 and 30 feet from toe of slope to toe of slope. Water depth during May generally ranges from approximately 1 to 3 feet. An approximately 1.5 mile reach of the creek borders residences on the east bank. There is no levee on the east side of the channel in this area, and the natural bank is not routinely maintained (the stream bank slopes into the residential yards). A maintained levee system is in place along the remainder of the creek, from the confluence with Corralitos Creek to the confluence with the Pajaro River. Upland areas along the levees are agricultural or developed, and consist of orchards, row crops, buildings and roads. Upland areas along the natural banks are landscaped residential yards.

Corralitos Creek remains in a mostly natural state with a moderately dense riparian canopy along much of its length. The riparian corridor is approximately 30 to 50 ft wide and is heavily vegetated throughout with an upper tree canopy, intermediate shrub canopy, and smaller grasses and forbs. Adjacent upland areas include agricultural crops (including grapes and orchards) and low-density rural residential dwellings. The upper reach of the creek is steep with a rocky bottom and banks; lower reaches of the creek are not as steep and have vegetated and rocky banks. Steep and moderate slopes border the creek in the upper reaches, and moderate slopes are present in the lower reaches. The width ranges between approximately 15 and 30 feet from toe of slope to toe of slope. There are few meanders on Corralitos creek, and no slow-moving slack pools or backwaters were observed.

Heavy scouring has occurred along the creek channel. Further, emergent vegetation is essentially absent in the upper reaches of the creek. Sparse woody emergent vegetation is present along the lower reaches of the stream channel south of Varni Road. Emergent vegetation includes primarily willow and cottonwood. Vegetation along the streambed includes dense willow, blackberry, elderberry and poison oak. An upper tree canopy consisting primarily of cottonwood and eucalyptus shelters most of the creek. Therefore, these habitat characteristics may provide suitable habitat for CRLF breeding and estivation purposes.

Habitat suitability for breeding is limited, however, by the lack of slow-moving water in pools or backwaters, and the virtual absence of emergent vegetation for egg attachment or cover. Much of the creek gradient is steep with fast-moving waters through most of the rainy season. Portions of Corralitos Creek are dry during the summer months and may not retain surface water long enough for CRLF larvae to transform. The total absence of suitable breeding habitat along Corralitos Creek cannot be concluded, however, based on the available information. In some reaches, suitable breeding conditions may be present during drier years when surface flow is slow moving earlier in the season. Seasonal surveys would be necessary to further evaluate habitat conditions during years of varying rainfall.

Breeding populations of CRLF in the Pajaro, Salsipuedes and Corralitos Creeks are further precluded by the presence of predators such as mosquitofish, crayfish and bullfrog. Mosquitofish and crayfish appear to prey on CRLF larvae, and mosquitofish may compete with CRLF for aquatic insects (USFWS, 1996). Bullfrogs prey on CRLF and other amphibians and aquatic reptiles. Researchers have found evidence that bullfrogs will prey on CRLF subadults as well as juveniles and larvae. Several researchers have observed declines and eventual extirpation of CRLF populations once bullfrogs have become established at a site (USFWS, 1996). Hayes and Jennings (1988) reported a negative correlation between the presence of bullfrog and CRLF, although Allaback and Laabs reported that both species might coexist at certain locations, particularly in the coastal zone (Biosearch Wildlife Surveys, 1998).
California red-legged frogs have not been documented along the Pajaro River, Salsipuedes or Corralitos Creeks, but they have been observed in recent years as close as College Lake, Hansen Slough and San Miguel Road near Murphy Crossing. The Pajaro River and Salsipuedes and Corralitos Creek corridors may provide summer refuge habitat for frogs migrating from nearby habitats. Suitable habitat may be present for foraging, estivation and cover along portions of the project site. The U.S. Fish and Wildlife Service defines estivation habitat as “…all aquatic and riparian areas within the range of the species, including landscape features that provide cover and moisture during the dry season within 300 feet of a riparian area (USFWS, 1996).” Adult CRLF are most likely to be encountered near breeding sites during the dry season, sheltering in emergent vegetation, undercut banks or semi-submerged root balls to avoid predation and desiccation (USFWS, 1996). However, they are also known to take refuge in small mammal burrows, under boulders, leaf litter, or logs, or under agricultural debris or structures such as watering troughs, abandoned sheds, or hay ricks (USFWS, 1996). Researchers report that CRLF likely feed along the shoreline and on the water surface of aquatic sites, preying primarily on invertebrates (Hayes and Tennant, 1985). Larger frogs were found to consume vertebrates such as Pacific tree frog and California mice (Peromyscus californicus) (Hayes and Tennant, 1985).

The lowest reaches of the Pajaro River do not support suitable habitat for CRLF. A narrow band of sand dunes is present at the mouth, followed by salt marsh vegetation that extends upstream approximately ¼ mile. Riparian habitat along the banks of the Pajaro upstream of the estuarine zone provides potentially suitable cover and foraging habitat for CRLF. A mature riparian forest is present along the north and south banks of the Pajaro River from ¼ mile inland of the mouth, upstream to Highway 1. Leaf litter, logs and other vegetative debris offer suitable habitat for CRLF adults. Ongoing vegetation clearance limits habitat suitability for CRLF along the outer bench and levee of the river. Furthermore, small mammal burrows in levees are routinely filled in by maintenance personnel and small mammals controlled with the pesticide Fumitoxin.

During the mid to late 1990s, the combination of vegetation removal and scour during flood events resulted in the loss of riparian vegetation along much of the Pajaro River between Highway 1 and Murphy Crossing. According to County maintenance personnel, however, willows are rapidly re-establishing along the banks (T. Reynolds, personal communication, 2000). An estimated 23 percent of the Santa Cruz County bank, from Highway 1 to Murphy Crossing, currently (summer 2000) lacks riparian vegetation. Portions of riverbank lacking riparian vegetation generally support a dense growth of wild radish, wild mustard and a variety of non-native grasses. Sufficient vegetative cover is present along the entire project site to support migration, cover and foraging for CRLF.

3.3.1.2 Migration from Off-Site Habitats
In the absence of a resident population, use of the project site by California red-legged frogs would require the migration of adults to the site from nearby populations. Several sightings of CRLF in recent years have been recorded in the region of the project site; several within migration distance to the Pajaro River and Salsipuedes and Corralitos Creeks. In 1990, CRLF was observed in the East Branch of Hanson Slough, approximately 1.3 miles north of the Pajaro (CNDDB, 2001). More than 10 adults were observed in a seasonal wetland with semi-permanent ponds up to three feet deep. In the winter of 1996, several juveniles (judged to be approximately 1 year old) were observed on Buena Vista Drive near the main entrance to the Buena Vista Landfill and Gallighan Slough (Biosearch Wildlife Surveys, 1998), approximately 2.6 miles north of the Pajaro. In 1994, three juvenile CRLF were observed in a drainage ditch east of Zmudowski Beach State Park, approximately 1.3 miles south of the Pajaro (CNDDB, 2001). Three individuals were identified by call in Ellicott pond in February 1997, approximately 3.7 miles north of the Pajaro (CNDDB, 2001). The pond is designated as a federal sanctuary and ecological preserve. CRLF were observed in
1996 at Kirby Park, 3.2 miles south of the Pajaro River (Biosearch Wildlife Surveys, 1998). CRLF are known from Soda Lake, a large natural lake 3.7 miles east of the Murphy Crossing of the Pajaro (Biosearch Wildlife Surveys, 1998) and at the mouth of Casserly Creek at College Lake (David Sudjjian, personal communication). In the fall of 1997, a juvenile CRLF was observed in a drainage ditch along San Miguel Canyon Road near its intersection with San Juan Road, approximately 1,800 feet south of the Pajaro River near Murphy Crossing (Biosearch Wildlife Surveys, 1998).

Additional reports of CRLF in the vicinity of the Pajaro River were made in the 1970’s, although subsequent extensive land use changes reduce the likelihood that populations still exist at the sites. CRLF larvae were observed at Bennett Slough and Struve Pond in 1973, approximately 2.5 miles from the project area (Biosearch Wildlife Surveys, 1998). However, saltwater intrusion has degraded the ponds, and it is unlikely that CRLF could have persisted at these localities (Biosearch Wildlife Surveys, 1998). CRLF was observed in 1978 in Gallaghan Slough, approximately 2 miles from the Pajaro and at Farm Pond near Ellicot Pond (Biosearch Wildlife Surveys, 1998). Since that time, the pond was converted from a seasonal to a permanent water body, and subsequent breeding has not been documented (Biosearch Wildlife Surveys, 1998).

Northern red-legged frogs may move out of riparian zones into adjacent upland forests during the non-breeding season and have been reported 200-300m from water (USFWS, 1996). Recent telemetry studies indicate that California red-legged frogs also leave riparian zones (Jennings, personal communication). California red-legged frogs may move seasonally within aquatic habitats between breeding sites and foraging habitat (USFWS, 1996).

3.3.2 Potential Impacts of the Project

Without further surveys for California red-legged frogs and suitable habitat within the project area, the County should assume that CRLF uses project area drainages for breeding during the wet season as well as for cover, estivation and foraging during the dry season. Project activities that may impact CRLF include the use of pesticides and herbicides, removal of fallen trees from the channel bottom, removal of accumulated sediment (sandbars) and any work in ponded areas.

3.3.2.1 Pajaro River

Between Highway 1 and the mouth of the Pajaro River, project activities would include vegetation management in the channel and intermittent levee repair work. CRLF may use riparian habitats along this reach of the river. However, the river water along this reach is probably too saline for frogs to tolerate, particularly during the dry season. Vegetation management in the channel is not expected to adversely affect CRLF. If present during maintenance work, there is some potential, however, for individual frogs to be directly impacted by workers and/or heavy equipment accessing the channel through riparian habitat along the river. In addition, frogs migrating to the river from nearby areas would need to cross the levee. Direct impacts to individual frogs could occur if they are crossing the levee during levee maintenance work.

Vegetation management between Highway 1 and Murphy Crossing would result in the annual removal of potential dry season aquatic habitat in the channel bottom, with the exception of the 5-foot vegetation buffer on either side of the low flow channel. Riparian and emergent vegetation would be allowed to grow in the buffer, providing cover and potential summer estivation habitat. Although willows with stem diameters greater than 3 inches would be removed, the root balls would be left in place, enhancing habitat value for CRLF. The buffer zone vegetation would be expected to attract aquatic invertebrates, providing forage for CRLF.
Depending on where the low flow channel develops, frogs moving from the riverbank may be exposed to predation as they cross open channel that has been cleared of vegetation before reaching the vegetation buffer. The vegetation buffer may also improve conditions for bullfrog by concentrating the low flow channel and increasing vegetation cover.

Establishment of riparian vegetation along the channel banks would enhance potential CRLF habitat, compared to the existing condition, by creating a continuous riparian corridor. Any features that provide shade or cover, such as riparian vegetation, emergent vegetation, downed trees or logs, man-made or natural debris, boulders, animal burrows, or leaf litter in the Pajaro River or its flood plain can be beneficial to CRLF during migration. Therefore, a continuous riparian corridor may enhance the value of the river as a movement corridor and may also decrease predation by providing more escape cover for frogs. The retention of dense riparian vegetation along ephemeral backwater areas could create conditions favoring successful CRLF breeding and survival. In addition, the construction of backwater ephemeral areas along the Pajaro or its tributaries could be beneficial. Breeding CRLF require dense shrubby or emergent riparian vegetation associated with slow moving pools that are deeper than 0.7 meters. Dense stands of overhanging willows provide ideal habitat for CRLF (Hayes and Jennings, 1988).

Any restoration efforts would have to address the bullfrog population (Rana catesbeiana), which is present in the Pajaro River and preys heavily on CRLF. While the CRLF metamorphoses within one wet season (and can thus utilize ephemeral systems), the bullfrog requires two or three wet seasons to achieve maturity. Unlike the CRLF, bullfrogs seldom venture far from a permanent body of water (USFWS, 1996). Slow-moving, ponded, well-vegetated areas will benefit both CRLF and bullfrogs. However, bullfrogs may be excluded if these are ephemeral areas because of their reliance on permanent bodies of water. Because of the presence of predators of CRLF, such as the bullfrog, the Pajaro River could act as a sink to which frogs are attracted, but where reproduction and/or survival are low.

As described above in Section 3.1.2.2, the use of pesticides for rodent control, and herbicides for vegetation control, could contribute to toxic levels to aquatic species including California red-legged frogs. Furthermore, maintenance personnel routinely place the pesticide Fumitoxin in small mammal burrows in levees and the burrow entrances are filled. California red-legged frogs seek cover in areas such as small mammal burrows and may be impacted directly or indirectly by small mammal burrow management.

3.3.2.2 Salsipuedes and Corralitos Creeks

Along Salsipuedes Creek, vegetation on most levee slopes and benches would be controlled twice annually by mechanical mowing and/ or application of Roundup-pro herbicide. These activities could directly impact frogs that are present during vegetation removal. Vegetation removal may also decrease the value of the creek as a movement corridor for frogs and may increase predation by reducing potential escape cover.

Channel bottom maintenance on Salsipuedes Creek from Highway 129 to Lakeview Road would consist of removal of all woody vegetation, fallen trees and log or debris jams. Emergent vegetation in the stream channel would be left in place. Along all of Salsipuedes and Corralitos Creeks, fallen or leaning trees would be removed from the stream channel. Logs and other debris located in the creek channel or along the banks provide shade, cover and estivation habitat for CRLF. Therefore, removal of these features from creeks will have an impact on available CRLF habitat.

Along Salsipuedes Creek, rodents are controlled with Fumitoxin pellets that are placed in mammal burrows and the burrow entrance(s) are subsequently closed. These burrows provide cover for CRLF and burrow management may directly or indirectly affect CRLF.
Adult California red-legged frogs require dense, shrubby or emergent riparian vegetation closely associated with deep, still or slow-moving water. The largest densities of CRLF are associated with deep-water pools with dense stands of overhanging willows (Salix spp.) intermixed with cattails (Typha spp.) (Hayes and Jennings, 1988). Therefore, any maintenance work in ponded areas, slow-moving pools and other backwater areas of Salsipuedes and Corralitos Creeks should be avoided to retain suitable CRLF breeding habitat and avoid direct impacts.
4.0 MINIMIZATION, MITIGATION, MONITORING AND REPORTING

4.1 Minimization and Mitigation Measures
A number of elements need to be addressed to conserve, or minimize the impact of the proposed project on steelhead and the California red-legged frog. Ideally, the aim is to restore the river to a more functional condition for steelhead, frogs and other wildlife species. Also, river conditions should be monitored throughout project implementation to determine the effectiveness of conservation measures. A series of mitigation measures have been identified for implementation. Mitigation and monitoring elements are described in the following sections.

4.1.1 Steelhead
As water level declines in the Pajaro during the dry season, a low flow channel or series of braided channels forms across the relatively flat bottom of the riverbed. The location and configuration of the low flow channel(s) may change from year to year depending on patterns of flow and sediment deposition during the previous rainy season. Sparse vegetative growth in the channel, characteristic of conditions since the flooding of the mid 1990s, appears to influence the formation of a series of braided channels rather than a concentrated low flow channel. One continuous thalweg would provide a deeper channel than if the channel is braided. Smolt out-migration is a limiting factor to steelhead in the Pajaro because it occurs later in the year than adult up-migration, when flow is naturally lower. The following are measures that will help to conserve steelhead in the project area.

The effectiveness of the vegetative buffer zone in maintaining a well-defined low flow channel for spring steelhead migration should be monitored and evaluated.
Formation of a continuous low flow channel with a minimum water depth of 6 inches through April 15 and 4 inches through June 15 is desirable for successful out-migration of steelhead. In dry years, however, there will not be any flow in some reaches of the Pajaro, despite a well-defined low flow channel. The monitoring program outlined below (Section 4.2) should be undertaken to evaluate the effectiveness of the vegetative buffer in facilitating the formation and maintenance of a low flow channel that meets the minimum depth requirements (when flow permits). The monitoring should assess how quickly the vegetative buffer becomes established during the dry season, the effectiveness of the buffer in creating and maintaining a concentrated low flow channel, and under what flow conditions the buffer is ripped out during a flood. Measurements should be taken to determine the density of the vegetation buffer, how much shading the buffer provides and the depth of the low flow channel. Monitoring should be conducted during the 20-year life of the project to allow for evaluation during both drought and flood cycles.

The vegetative buffer zone may reduce the impacts of in-channel vegetation clearance to a less than significant level for steelhead, but monitoring should be conducted to evaluate the effectiveness of the vegetation management proposal.
If the vegetation buffer is too sparse during some years to facilitate creation of a low flow channel, re-establishment of vegetation shall be enhanced by planting willow cuttings along the low flow channel in the spring.

As water levels decline in the spring of each year, channel monitoring should include an assessment of whether the vegetative buffer is developing sufficiently to support the creation of a defined low flow channel. After high flow events, planting may be necessary to maintain a low flow channel because of vegetation lost to scour. During wet years, the low flow channel vegetation buffer may be lost, but it may not be critical to steelhead passage because of high spring flows. If vegetation does not re-establish, is sparse or slow to develop in some areas, supplemental planting should be conducted along both sides of the thalweg segments where biological monitoring has determined it is necessary to re-create adequate depth of the final thalweg. Willow cuttings shall be obtained from existing vegetation in the immediate area and planted at 1.5-foot centers along both sides of the low flow channel. Planting shall be conducted in early spring or late fall and be supervised by a qualified biologist.

Water temperatures shall be monitored to document temperature patterns along the Pajaro River and Salsipuedes Creek and evaluate conditions for migrating smolts.

Permanent stations shall be established along the Pajaro River and Salsipuedes Creek to evaluate water temperature, especially during periods of smolt out-migration. Continuous temperature monitoring devices shall be installed and set to record water temperature between late March and the beginning of July of each year with periodic downloading of the information for analysis. A temperature no greater than 24 degrees C for a maximum of one hour during the daytime and 20 degrees C maximum (average) in a 24-hour period shall be maintained through June 15 (if flows persist). Most out-migrating steelhead should have passed through the river by June 1. Steelhead move almost exclusively at night when the water temperature is cooler, but if fish stop along the way they need to contend with warmer daytime temps. Fish should be able to make it from Murphy Crossing in 2 days, but some deeper pools and vegetative cover are necessary for steelhead to successfully navigate this stretch. Deeper water and more shading from vegetation will decrease water temperatures. Temperature should be monitored along the Pajaro River at a minimum of 3 stations between Murphy Crossing and Salsipuedes Creek, 1 station at the mouth of Salsipuedes Creek and 2 stations between Salsipuedes Creek and Thurwacker Bridge. At least one station should be established on Salsipuedes Creek below the Corralitos Creek confluence. The locations of the stations should overlap with permanent transects established to monitor vegetation and hydraulic conditions. In addition, air temperature should be monitored at some of the stations to determine how water temperature correlates with air temperature.

A meandering low flow channel shall be maintained during sand bar removal or reconstructed following in-channel work.

If possible, the low flow channel should be avoided during sand bar removal. If impacts to the low flow channel are unavoidable, a low flow channel shall be reconstructed when sand bar removal is completed. A five-foot band of willow cuttings shall be planted along both sides of the recreated channel to re-establish the vegetation buffer.

Measures shall be implemented to minimize turbidity during any in-water construction.

Cofferdams or other measures to minimize turbidity should be implemented if sand bar removal is conducted in areas with surface water.
Sandbar removal shall be conducted at the end of the summer.
Sandbar removal shall be conducted at the end of summer when sedimentation effects would be short-lived and eliminated by winter rains. No sand bar removal shall be conducted before July 1 to avoid potential impacts to out-migrating smolts.

Sandbar removal in the Pajaro River channel shall be limited to the Salsipuedes Creek Confluence Zone, which begins 3500 ft downstream of the Pajaro confluence at the Southern Pacific Railroad Bridge and extends to 500 feet upstream of the confluence (Reach D, Figure 1.2-1 and 1.2-2). Only sandbars greater than 4 feet in height (above water level) and 250 feet in length and located in the Salsipuedes Creek Confluence Zone shall be removed.

Sandbar removal on the Pajaro outside of the Salsipuedes Confluence Zone is not part of this project. If the County finds that sandbar removal outside of the Salsipuedes Confluence Zone is necessary because of threats to flooding and or the levee integrity, the County will obtain the necessary permits from regulatory agencies.

In Salsipuedes and Corralitos Creeks, large (3-foot) boulders or other structures anchored to the channel bed shall be placed in the channel at the toe of the bank to replace habitat lost by woody debris removal.

At toe of slope, large boulders or other structures shall be incorporated into bank protection that should scour along the base of the rock to create pools and cover structure. The placement of boulders in the channel would serve to create pools and escape cover for migrating and resident steelhead. These structures should be installed when bank erosion repairs will be done anyway.

Any vehicular equipment that crosses a wetted channel will be inspected to be free of grease, oil and fuel that could enter the watercourse. Heavy equipment will only cross a wetted channel in very extreme cases. In all circumstances, when operating heavy equipment within or adjacent to the wetted channel, fuel and oil tanks/pans should be surrounded by secondary containment devices. Hydraulic oils will meet, at minimum, Environmental Protection Agency aquatic toxicity requirements and be biodegradable.

Oil, grease and fuel are toxic to wildlife and their entry into the Pajaro River system from the use of maintenance equipment shall be avoided. Oil, grease and fuel entering the Pajaro River system will have a negative on steelhead, California red-legged frog and tidewater goby.

4.1.2 California Red-Legged Frog
Measures taken to conserve steelhead should also positively benefit California red-legged frogs. Additionally, other measures that minimize impact to existing frog habitat and direct impact to frogs shall be taken. These include:

Fallen or leaning trees removed in all parts of Corralitos and Salsipuedes Creeks shall be cut into 3- to 4-foot sections and left in place. Their root structures shall also be left in place. These features will provide estivation habitat and escape cover for California red-legged frogs.

Project implementation would result in the removal of fallen and leaning trees that would block or divert storm waters in Salsipuedes and Corralitos Creeks. In Corralitos Creek, from East Lake Avenue/State Highway 152 to the Browns Valley Bridge, these trees would be cut into 3- to 4-foot sections and left in...
place. Their root structures would also be left in place. This work would be conducted by hand during times of low flow and no equipment would be operated in the channel bottom. These natural structures provide estivation habitat and escape cover for California red-legged frogs.

A continuous corridor of riparian/aquatic cover shall be maintained in the project area including ongoing supplemental planting as needed.

A continuous riparian corridor would facilitate California red-legged frog movement through the project area and provide hiding and escape cover.

Vegetation removal and other work shall be avoided within ponded areas of Corralitos Creek, Salsipuedes Creek and the Pajaro River to avoid impacts to California red-legged frogs.

Breeding CRLF require dense shrubby or emergent riparian vegetation associated with slow moving pools that are deeper than 0.7 meters. These areas shall be avoided to prevent direct impacts to frogs.

Maintenance workers shall be briefed on the potential presence of California red-legged Frog in work areas and be informed of avoidance measures to be employed.

Measures to avoid impacts to California red-legged frogs include not removing fallen logs and branches that provide upland frog habitat, not filling in small rodent burrows or other potential frog refuges and limiting herbicide application to dry, upland areas. An informational handout detailing these measures shall be developed.

Permanent access ramps shall be established to minimize impacts to riparian areas keeping clear of vegetation to avoid direct impacts to frogs.

Further California red-legged frog conservation measures shall include the creation of summering and breeding habitat. Some of the measures taken to conserve steelhead and the measures identified above for California red-legged frogs shall enhance frog summering and breeding habitat. Summering (estivation) habitat for the CRLF potentially includes any feature that provides cover and moisture during the dry season that is within 300 feet of aquatic or riparian habitat and could include logs, boulders, watering troughs or other man made features (USFWS, 1996). The following are habitat management objectives for frog breeding habitat described in the Finding on petition to list the California red-legged frog (USFWS, 1993).

Objective #1: Maintain dense stands of native riparian vegetation to maintain cool water temperatures and ensure hiding cover. Greater than 25 percent of riparian area thickly vegetated. Ideally vegetation at ground level should be sufficiently thick to prevent entry of Racoons (Procyon lotor) and predatory wading birds such as Bitterns (Botaurus lentiginosus) and Black-crowned Night Herons (Nycticorax nycticorax).

Objective #2: Maintain emergent vegetation in slow or still pools for egg laying and hiding cover. At least 25 percent of the pool area should be thickly vegetated with cattails, bulrushes or other emergent vegetation.

Objective #3: Maintain water depth greater than 28 inches (70cm). California red-legged frogs are found in association with deep water, although it is currently unclear if water depth helps maintain microclimate, is more likely to contain hiding cover, or serves other functions. Measurement: measure water depth.
Objective #4: Maximize the isolation of California red-legged frog populations from all introduced aquatic predators (bullfrogs and exotic fish). Ideally, keep introduced aquatic predators out of drainages with red-legged frog populations. Measurements 1) Survey for the presence/absence of introduced fish and bullfrogs in ponds and slow moving streams, 2) Manage spacing of newly constructed water impoundments to ensure that all new impoundments are greater than one mile from existing impoundments with bullfrogs.

These four objectives shall be implemented in locations identified along the Pajaro River and Salsipuedes and Corralitos Creeks. The following are survey efforts, habitat restoration, predator control and potential off-site mitigation measures that shall be implemented.

Surveys shall be conducted to evaluate potential habitat and determine the presence of California red-legged frogs and their breeding status.

Surveys shall be conducted in order to estimate the California red-legged frog’s density and distribution as well as potential breeding areas in the project area. Areas suitable for habitat restoration shall also be identified based on where suitable habitat could be created and predators such as the bullfrog are absent. These surveys may result in the acknowledgment that suitable habitat is limited and habitat restoration is unfeasible. In this case, the project should contribute to the conservation of the California red-legged frog by funding research and surveys and/or habitat restoration in other areas. Off-site mitigation measures should be a last resort in conserving California red-legged frogs.

If feasible, breeding habitat shall be created in areas identified during surveys.

Breeding habitat shall meet the standards described above in Objectives 1 through 4 and those presented in Table 4.1-2. Even if suitable habitat can be created there are several problems associated with restoring California red-legged frogs to the project area. The population may be geographically isolated from other populations and losses would occur when frogs attempted dispersal to other areas. The population may also become a sink if breeding success and survival are low due to predators such as the bullfrog, habitat fragmentation and toxic poisoning from agricultural pesticides (see Hunt et al. 1999) and/or herbicides. Frogs may also have to be captured from another location and introduced in the Pajaro and this may have a significant effect on the source population(s). However, creating ephemeral, backwater areas that meet the frog breeding habitat standards outlined above, will provide potential breeding habitat for frogs while excluding bullfrogs which rely on perennial water sources.

Bullfrogs and other introduced frog predators may have to be controlled and/or eradicated in order to successfully restore California red-legged frogs.

Several researchers in California have noted the decline and eventual disappearance of California red-legged frogs once bullfrogs become established at the same site (USFWS, 1996). Bullfrogs could be located with calling surveys and then removed. However, once established, it is extremely difficult to eliminate bullfrogs, but it is possible to control them and reduce their numbers. Crayfish and mosquitofish shall also be removed, if feasible.
Table 4.1-2. Criteria Used to Evaluate California Red-legged Frog Habitat

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<tr>
<th>RANKING CRITERIA</th>
<th>HABITAT QUALITY</th>
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<tr>
<td></td>
<td>High</td>
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<tr>
<td>Availability and duration of surface water</td>
<td>Seasonal to semi-permanent surface water</td>
</tr>
<tr>
<td>Emergent wetland vegetation present</td>
<td>Occasional emergent/submergent vegetation</td>
</tr>
<tr>
<td>Condition of adjacent riparian cover, overhanging vegetation</td>
<td>Vegetative cover over low-flow channel interspersed with open banks</td>
</tr>
<tr>
<td>Condition of adjacent terrestrial habitat, buffer</td>
<td>Buffer of adjacent woodland or other native vegetation cover exceeds 200 feet</td>
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<tr>
<td>Presence of predators</td>
<td>Bullfrogs, predatory fish, other exotic predators absent</td>
</tr>
<tr>
<td>Distance to other high/moderate water source</td>
<td>&lt;1 km</td>
</tr>
<tr>
<td>Water depth</td>
<td>Deep and shallow present (0.3 to &gt;1 m)</td>
</tr>
<tr>
<td>Flushing flows (for streams)</td>
<td>Occasional</td>
</tr>
</tbody>
</table>
4.2 Monitoring

The ESA section 7 regulations require that an BA specify measures the applicant would take to “monitor” the impacts of the taking resulting from project actions [50 CFR 17.22(b)(1)(iii)(B) and 50 CFR 222.22(b)(5)(iii).] Monitoring measures described in the BA should be as specific as possible and be commensurate with the project’s scope and the severity of its effects.

Monitoring programs should include periodic accountings of take, surveys to determine species status in project areas or mitigation habitats, and progress reports on fulfillment of mitigation requirements (e.g. habitat acres acquired). Monitoring plans for BAs should establish target milestones to the extent practical, or requirements throughout the life of the BA, and where appropriate, adaptive management options.

The mitigation measures described above (Section 4.1) need to be monitored to determine if they are effective in conserving the identified species. Modifications to these measures may be necessary to fulfill the objectives of the conservation program. The monitoring program is as follows.

4.2.1 Steelhead

Twelve permanent monitoring stations will be established along the Pajaro River between Murphy crossing and Highway 1 and two permanent stations along Salsipuedes Creek between the Corralitos Creek and Pajaro River confluences. Continuous read permanent temperature gages will be installed at seven of these stations (every other station). During spring of each year the following will be measured at each station:

- Depth and width of each channel (if braided) or the low flow channel
- Width, height, density and species composition of vegetation on both sides of low flow channel
- Channel width from toe of bank to toe of bank
- Qualitative evaluation of hydraulic and vegetative characteristics of low flow channel and vegetation buffer

The goal of monitoring the vegetation buffer is to determine if planting is necessary. These measurements will be analyzed to determine if there is an association between the development of a low flow channel and the density, width, or species composition of vegetation, growth of vegetation and hydrologic conditions in months preceding growth of vegetation.

The monitoring program for steelhead will also include the following elements:

- Install permanent flow gage somewhere along river
- Walk the length of the Pajaro River, from Murphy crossing to the mouth, and Salsipuedes Creek from the Corralitos Creek confluence to the Pajaro River confluence in June to determine whether there is a continuous channel of sufficient water depth for steelhead passage. In areas where surface flow is less than the required depth, measure the flow at its deepest point (i.e. if channel is braided, measure the deepest channel).
- Identify problem areas that may require supplemental planting every year or earthwork to maintain a low flow channel. For example, about 1 mile downstream of Murphy crossing is dry almost every year and vegetation doesn’t grow well in the channel.
- Check boulders, logs and other structures placed in Corralitos and Salsipuedes Creeks to determine how effectively they create deeper water habitat in the creeks for use by steelhead.
The monitoring program for steelhead will evaluate whether the following performance criteria are met:

- Continuous low flow channel from Murphy Crossing to the River mouth and from Corralitos confluence to Pajaro confluence. A water depth of 6 inches deep through April 15, and 4 inches deep through June 15 is preferable. In dry years, however, flow may not be present through June 15 (or even May) in some reaches, despite a well-defined low flow channel.
- Water temperature is no greater than 24 degrees C (1 hr maximum) during the daytime and 20 degrees C maximum (average) in a 24 hr period.

If the performance criteria are not met then some of the following contingency measures should be implemented:

- Supplemental willow planting when buffer is sparse
- In channel earthwork to create low flow channel
- Increase width of vegetative buffer
- Allow buffer vegetation to grow taller

4.2.2 California red-legged frog

Surveys shall be conducted for California red-legged frogs at least twice annually (once during the breeding season, and once in the summer during estivation) to estimate their density, breeding status and potential breeding and estivation habitat. Habitat measurements (using standard protocols such as those provided by USFWS) will be taken in areas where frogs are documented to determine which habitats they are using in the project area. Bullfrog surveys shall also be conducted in areas where CRLF are located. If CRLF breeding habitat is created, these areas shall be monitored for use by frogs. Areas identified as potentially suitable CRLF habitat, shall be monitored for condition and use by frogs.

4.3 Reporting

A report outlining the monitoring conducted by the County shall be submitted to the appropriate authorities (NMFS, USFWS, CDFG) each year detailing the results of the monitoring program and any contingency measures implemented due to not meeting performance criteria.
5.0 PROJECT ALTERNATIVES

The *Pajaro River and Salsipuedes and Corralitos Creeks Management and Restoration Plan Environmental Impact Report (Harding ESE, 2001)* provides a detailed description and analysis of project alternatives. The following is a summary of the project alternatives.

5.1 Identifying Alternatives

There are a total of seven alternatives evaluated in *Pajaro River and Salsipuedes and Corralitos Creeks Management and Restoration Plan Environmental Impact Report (Harding ESE, 2001)*. The impacts associated with each alternative, the mitigation measures proposed for the mitigated alternative and the estimated hydraulic capacity and cost of implementing the alternatives are summarized in Table 5.1-1. Each alternative has four project components of which only the vegetation/channel management and revegetation/restoration components vary between alternatives. The project components are 1) levee resurfacing, maintenance and repair, 2) bank stabilization and erosion control, 3) vegetation/channel management and maintenance and 4) revegetation/restoration. Alternatives 1-4 are those proposed in the *Pajaro River Management and Restoration Plan (CH2M Hill, 1997)*, of which Alternative 2 was designated as the preferred by the Zone 7 Board and is the proposed project in this BA. Alternative 5 is similar to Alternative 4, but with reduced vegetation removal on Salsipuedes and Corralitos Creeks. Alternative 6 is the proposed project (Alternative 2) with mitigation measures incorporated and the last alternative is the No Project Alternative. The following sections outline each component of the project alternatives presented in Table 5.1-1.

1) Levee Resurfacing, Maintenance, and Repair. The project proposes to raise the surface of the levees back to their original elevations (upstream of Highway 1) on both the Monterey and Santa Cruz County sides of the River. In the autumn of 1998, the USCOE resurfaced the Santa Cruz and Monterey County levees as proposed in the Plan. In addition, levee resurfacing was conducted along Salsipuedes Creek. Because the work was conducted on an emergency basis, the resurfacing was not evaluated in this BA.

Under the proposed project (Alternative 2) evaluated in this BA, ongoing maintenance of the Santa Cruz County levees is proposed on an as-needed basis to maintain original levee elevations. Therefore, this component of the project does not vary between alternatives except for in the No Project Alternative under which no levee maintenance would occur.

2) Bank Stabilization and Erosion Control. The Pajaro River 1998 Bank Erosion Study (*Northwest Hydraulic Consultants, 1998*) identified 70 specific sites in need of stabilization along the Pajaro River on both the Santa Cruz and Monterey County sides. The sites were prioritized into three categories according to the degree to which each site may threaten the integrity of the levee system. Following the 1998 flooding, the USCOE repaired Priority 1 sites by installing rock riprap on the eroded slopes. The work was conducted on an emergency basis and therefore was not evaluated in this BA.

The project under consideration in this BA includes the ongoing evaluation and, if needed, construction of bank stabilization measures at Priority 2 and 3 sites on the Santa Cruz side of the Pajaro River. Installation of bank protection would only be conducted at sites where conditions described in Section 2.0 are present over the 20-year life of the project. Thus, specific sites had not been identified at the time this BA was developed. To ensure an adequate analysis of the environmental impacts of the worst-case project scenario, this BA has evaluated the potential impacts of implementing bank protection at all Priority 2 and 3 sites.
along the Santa Cruz County side of the Pajaro River. Therefore, this portion of the project does not vary between alternatives, except for in the No Project Alternative for which no further bank stabilization and erosion control was evaluated.

3) Vegetation/Channel Management and Maintenance.

Pajaro River: Proposed vegetation maintenance activities on the channel bottom, banks, benches and levees of the Pajaro River are described in the Plan. These vegetation maintenance activities are the same for all of the project alternatives and include:

- Manual removal of woody vegetation with stem diameters of 3 inches or greater from the Low Flow Channel, but retention of a 5' Foot Vegetation Buffer and manual removal of same size vegetation from the lower channel bank (thinning).
- Manual and/or mechanical removal of vegetation from the Channel Bottom (excluding the Low Flow Channel Vegetation Buffer).
- Periodic mechanical removal of sediment (sandbars) from the channel bottom from the Southern Pacific Railroad Bridge 3500 feet downstream of, to 500 feet upstream of, the Salsipuedes Creek confluence (Reach D, Figure 1.2-1).
- Control and/or removal of vegetation on the upper channel bank or benches.
- Control of vegetation on the levee tops and slopes.

Salsipuedes and Corralitos Creeks: Proposed vegetation maintenance activities along Salsipuedes and Corralitos Creeks are described in Proposed Long-Term Maintenance Program for Salsipuedes and Corralitos Creeks (1999), prepared by the County of Santa Cruz Public Works Department. Management activities include:

- Removal of woody vegetation along the channel bottom and lower banks.
- Removal of fallen and leaning trees.
- Clearance of vegetation from the levee benches and levee slopes.
- Removal of silt accumulation and vegetation in flap-gate channels along Salsipuedes Creek.
- Periodic mechanized sediment (sand bar) removal in Salsipuedes Creek.

These vegetation management activities are the same for each of the project alternatives except for Alternative 5, which specifies no removal of woody vegetation from the channel bottom or lower banks of Salsipuedes and Corralitos Creeks, and the No Project Alternative under which there would be no vegetation management activities. The maintenance plan for Salsipuedes and Corralitos Creeks has not undergone an analysis of hydraulic capacity based on alternative management regimes as done for the Pajaro River in the Pajaro River Management and Restoration Plan. Therefore, there is no supporting evidence that vegetation removal is necessary in these creeks to maintain flood flow capacity. As such, a reduced vegetation removal alternative for the two creeks (Alternative 5) was evaluated in addition to the No Project Alternative.

4) Revegetation/restoration. The Pajaro River Management and Restoration Plan outlined four revegetation alternatives (Alternatives 1-4), which varied in the extent of revegetation activities, and evaluated the flood capacity of the Pajaro River (no evaluation of flood capacity has been conducted for Salsipuedes and Corralitos Creeks) under each scenario. Table 5.1-1 summaries these alternatives and compares the hydraulic capacity and cost of each. The County has identified up to $300,000, in available funding, for implementation, maintenance and monitoring of restoration revegetation activities. Alternative 2 maximizes the extent of vegetation cover for wildlife benefit while maintaining hydraulic capacity, meets the project’s objectives, and falls within the County’s available funding. Although Alternative 2 was designated the preferred alternative in the Plan, it was not designated the environmentally superior alternative in the EIR (Harding ESE, 2001) as evaluated in Table 5.1-1.
### Table 5.1- Pajaro River and Salsipuedes and Corralitos Creeks Management and Restoration Plan Project Alternatives.

<table>
<thead>
<tr>
<th>ITEM</th>
<th>ALTERNATIVE 1</th>
<th>ALTERNATIVE 2: PROPOSED PROJECT</th>
<th>ALTERNATIVE 3</th>
<th>ALTERNATIVE 4</th>
<th>ALTERNATIVE 5: REDUCED VEGETATION REMOVAL ON CREEKS</th>
<th>ALTERNATIVE 6: MITIGATED ALTERNATIVE</th>
<th>ALTERNATIVE 7: NO PROJECT ALTERNATIVE</th>
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<td>Levee resurfacing</td>
<td>Levee resurfacing on an as-needed basis along sorted portions of the levees that contain low spots, upstream of Highway 1</td>
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<td>Levee resurfacing on an as-needed basis along sorted portions of the levees that contain low spots, upstream of Highway 1</td>
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Pajaro River and Salsipuedes and Corralitos Creeks
Management and Restoration Plan
Biological Assessment
### Project Alternatives

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<th>ITEM</th>
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<th>ALTERNATIVE 2: PROPOSED PROJECT</th>
<th>ALTERNATIVE 3</th>
<th>ALTERNATIVE 4</th>
<th>ALTERNATIVE 5: REDUCED VEGETATION REMOVAL ON CREEKS</th>
<th>ALTERNATIVE 6: MITIGATED ALTERNATIVE</th>
<th>ALTERNATIVE 7: NO PROJECT ALTERNATIVE</th>
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<td>Periodic mechanical removal of accumulated sediment (sandbars) on the channel bottom of the Pajaro River (between 3500 ft downstream and 500 ft upstream of Salsipuedes confluence) and Salsipuedes Creek every 4-5 years at a single location.</td>
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### Revegetation (applies to Santa Cruz side of the Pajaro River between Highway 1 and Murphy’s Crossing). See Table 2.3-2 for details of the revegetation program.

- **5’ wide band of riparian vegetation adjacent to each side of the low flow channel**
- **Minimum 10’ wide band of riparian vegetation along Santa Cruz County lower channel bank**
- **Meandering plantings of riparian trees at 40’ centers, planted along the inner channel bench.**

Note: these three items meet the special conditions of the USCOE 404 permit for sandbar removal.

- **5’ wide band of riparian vegetation adjacent to each side of the low flow channel**
- **Riparian vegetation from toe of channel bank to 8 feet below the top of bank**
- **Meandering plantings of riparian trees at 40’ centers, planted along the inner channel bench.**

### Riparian area revegetated

<table>
<thead>
<tr>
<th></th>
<th>ALTERNATIVE 1</th>
<th>ALTERNATIVE 2: PROPOSED PROJECT</th>
<th>ALTERNATIVE 3</th>
<th>ALTERNATIVE 4</th>
<th>ALTERNATIVE 5: REDUCED VEGETATION REMOVAL ON CREEKS</th>
<th>ALTERNATIVE 6: MITIGATED ALTERNATIVE</th>
<th>ALTERNATIVE 7: NO PROJECT ALTERNATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riparian area revegetated</td>
<td>9 acres at bank</td>
<td>21 acres at bank</td>
<td>28 acres at bank</td>
<td>23 acres at bank</td>
<td>8 acres at bench</td>
<td>23 acres at bank</td>
<td>8 acres at bench</td>
</tr>
</tbody>
</table>
## Project Alternatives

**Harding ESE**  
**56**

<table>
<thead>
<tr>
<th>ITEM</th>
<th>ALTERNATIVE 1</th>
<th>ALTERNATIVE 2: PROPOSED PROJECT</th>
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<th>ALTERNATIVE 6: MITIGATED ALTERNATIVE</th>
<th>ALTERNATIVE 7: NO PROJECT ALTERNATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMPACTS: The relative weight (1-5) of the impact is given for each alternative. 1= least impact 5= greatest impact</td>
<td>1= least impact 5= greatest impact</td>
<td>1= least impact 5= greatest impact</td>
<td>1= least impact 5= greatest impact</td>
<td>1= least impact 5= greatest impact</td>
<td>1= least impact 5= greatest impact</td>
<td>The mitigation measure(s) associated with each impact are given following the relative weight of that impact for this alternative (Mitigated Alternative)</td>
<td>1= least impact 5= greatest impact</td>
</tr>
<tr>
<td>Water quality and hydrology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>With no vegetation management the No Project Alternative will eventually have an impact on hydraulic capacity.</td>
<td>1= least impact 5= greatest impact</td>
</tr>
<tr>
<td>Establishment of vegetation in channel bottom and on banks and bank protection measures will reduce hydraulic capacity.</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>Install bank protection only where it will not decrease hydraulic capacity and erosion is substantial as to threaten levee. Apply grass seed and mulch immediately after maintenance activities.</td>
</tr>
<tr>
<td>Geology and soils</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Levee resurfacing and maintenance may cause erosion and in-stream sedimentation</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>Implement erosion control plan to reduce sediment.</td>
</tr>
<tr>
<td>Bank stabilization on Santa Cruz Co. side may increase erosion and bank movement on Monterey Co side or other areas up or downstream of the improvement.</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Revegetation of banks will reduce bank erosion.</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Sediment deposition in the Salsipuedes Creek confluence area may reduce hydraulic capacity.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>Reduced sandbar removal</td>
</tr>
<tr>
<td>Biological resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removal of fallen and leaning trees would decrease shade cover, escape cover and pool formation for steelhead and tidewater gobies, decrease estivation habitat for red-legged frogs and basking sites for pond turtles.</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>Place three-foot boulders, log sections or other structures in channel to replace woody debris removed.</td>
</tr>
<tr>
<td>Vegetation removal from channel bottom will affect low</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>Monitor low flow channel</td>
</tr>
<tr>
<td>ITEM</td>
<td>ALTERNATIVE 1</td>
<td>ALTERNATIVE 2: PROPOSED PROJECT</td>
<td>ALTERNATIVE 3</td>
<td>ALTERNATIVE 4</td>
<td>ALTERNATIVE 5: REDUCED VEGETATION REMOVAL ON CREEKS</td>
<td>ALTERNATIVE 6: MITIGATED ALTERNATIVE</td>
<td>ALTERNATIVE 7: NO PROJECT ALTERNATIVE</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
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<td>---------------</td>
<td>-------------------------------------------------</td>
<td>---------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>flow channel and reduce shading impacting steelhead. These activities in ponded areas may directly impact red-legged frogs.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Establishment of riparian vegetation on banks would benefit steelhead and birds.</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>In-channel removal of accumulated sediment (sandbars) may adversely impact steelhead, red-legged frog and pond turtle as well as snowy plover at the river mouth.</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Removal of vegetation on levee slopes and benches would impact nesting birds.</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Bank protection measures will reduce potential nesting habitat for swallows.</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Herbicide use to control vegetation may adversely impact in-stream wildlife.</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Rodent control may directly or indirectly impact red-legged frogs.</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Air quality</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Levee maintenance, bank protection measures and vegetation management activities would generate dust and vehicle exhaust emissions.</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Noise</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>

- *Flow channel and reduce shading impacting steelhead. These activities in ponded areas may directly impact red-legged frogs.*
  
  - *Establishment of riparian vegetation on banks would benefit steelhead and birds.*
    
  - *In-channel removal of accumulated sediment (sandbars) may adversely impact steelhead, red-legged frog and pond turtle as well as snowy plover at the river mouth.*
    
  - *Removal of vegetation on levee slopes and benches would impact nesting birds.*
    
  - *Bank protection measures will reduce potential nesting habitat for swallows.*
    
  - *Herbicide use to control vegetation may adversely impact in-stream wildlife.*
    
  - *Rodent control may directly or indirectly impact red-legged frogs.*
    
  - *Air quality*
    
  - *Levee maintenance, bank protection measures and vegetation management activities would generate dust and vehicle exhaust emissions.*

<table>
<thead>
<tr>
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<th>ALTERNATIVE 6: MITIGATED ALTERNATIVE</th>
<th>ALTERNATIVE 7: NO PROJECT ALTERNATIVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment used for maintenance activities would generate noise.</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>Limit equipment operation to the hours of 8am to 5pm weekdays and outfit equipment with mufflers in good working condition.</td>
<td>1</td>
</tr>
<tr>
<td>Visual resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management activities may impact scenic quality.</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>None</td>
<td>1</td>
</tr>
<tr>
<td>Impact totals: Higher values= greater impact</td>
<td>49</td>
<td>47</td>
<td>43</td>
<td>45</td>
<td>44</td>
<td>34</td>
<td>22</td>
</tr>
<tr>
<td>HYDRAULIC CAPACITY AND COST</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydraulic capacity, based on current river conditions (with no levee improvements)</td>
<td>In Pajaro a reduction of: 5-7% (Reaches C-E) 10-15% (Reaches E-G)</td>
<td>In Pajaro a reduction of: 8-11% (Reaches C-E) 12-18% (Reaches E-G)</td>
<td>In Pajaro a reduction of: 8-11% (Reaches C-E) 16-20% (Reaches E-G)</td>
<td>In Pajaro a reduction of: 8-11% (Reaches C-E) 12-20% (Reaches E-G)</td>
<td>In Pajaro a reduction of: 8-11% (Reaches C-E) 12-18% (Reaches E-G)</td>
<td>Unknown</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unknown for creeks³</td>
<td>Unknown for creeks</td>
<td>Unknown for creeks</td>
<td>Unknown for creeks</td>
<td>Unknown for creeks</td>
<td>Unknown for creeks</td>
<td>Unknown for creeks³</td>
</tr>
<tr>
<td>Hydraulic capacity with levee resurfacing project²</td>
<td>In Pajaro approximately: 18 yr. with 3 feet freeboard 35 yr. with no freeboard</td>
<td>In Pajaro approximately: 18 yr. with 3 feet freeboard 35 yr. with no freeboard</td>
<td>In Pajaro approximately: 18 yr. with 3 feet freeboard 35 yr. with no freeboard</td>
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<td>In Pajaro approximately: 18 yr. with 3 feet freeboard 35 yr. with no freeboard</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$270,000</td>
<td>$288,200</td>
<td>$334,500</td>
<td>$990,000</td>
<td>$990,000</td>
<td>$288,200</td>
<td>None</td>
</tr>
<tr>
<td>Total restoration costs²</td>
<td>$229,350</td>
<td>$200,800</td>
<td>$184,100</td>
<td>$194,050</td>
<td>$194,050</td>
<td>$200,800</td>
<td>None</td>
</tr>
<tr>
<td>Annual vegetation management costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

³ Including 10-foot freeboard.
² Project period includes up to 50 years.

Equipment used for maintenance activities would generate noise.

Visual resources

Management activities may impact scenic quality.

Impact totals: Higher values = greater impact

Hydraulic capacity, based on current river conditions (with no levee improvements)

Hydraulic capacity with levee resurfacing project²

Total restoration costs²

Annual vegetation management costs
5.2 **Environmentally Preferred Alternative**

Alternative 2 outlined in the Pajaro River Management Plan was selected from the range of proposed alternatives because it most effectively balanced habitat preservation with flood control and bank erosion objectives of the project and fell within the County’s budget. Yet, based on the evaluation in the EIR (*Harding ESE, 2001*), it was not considered the environmentally superior alternative. Based on the evaluation summarized in Table 5.1-1, where the relative weight of each impact was designated for each alternative, the No Project Alternative was the environmentally preferred alternative. CEQA requires that if the alternative with least environmental impact is the No Project Alternative, one of the other remaining alternatives shall be designated as the environmentally superior alternative. Of the alternatives with no mitigation measures incorporated, Alternative 3 was found to be the environmentally superior alternative based on the evaluation of all project impacts. However, when mitigation measures are incorporated with the proposed project (Alternative 2), this then becomes the environmentally superior alternative (Alternative 6). Therefore, Alternative 6 (Mitigated Alternative) was designated the environmentally preferred alternative in the EIR (*Harding ESE, 2001*).
6.0 OTHER BA SECTIONS

6.1 Cumulative Effects
Cumulative effects occur when two or more individual effects together create a significant environmental impact, or compound or increase other environmental impacts. The impacts of the project must be viewed in the context of environmental impacts caused or expected to be caused by other closely related past, present, and reasonably foreseeable projects.

6.1.1 Cumulative Projects

Pajaro Valley Water Management Agency Local Water Supply and Distribution

The Pajaro Valley Water Management Agency (PVWMA) is planning to develop additional facilities to eliminate groundwater overdraft and prevent further seawater intrusion. To accomplish this goal the agency plans to develop facilities to operate pipelines and pumping, diversion, and treatment facilities for various local water supplies and to construct a water delivery system to provide irrigation water to coastal and inland areas. The project components include: 1) direct application of water diverted from College Lake; 2) direct application and use for groundwater recharge of water diverted from Harkins Slough; 3) direct application and use for groundwater recharge of the Pajaro River high flows drawn near Murphy Crossing and 4) reclamation of wastewater from the Watsonville Treatment Plant. A final EIR was released May 7, 1999 assessing the environmental impacts of the proposed project on land use and planning, geology and soils, hydrology and water quality, vegetation and wildlife, cultural resources, traffic and circulation, air quality, socio-economics and public services, and visual/aesthetic and recreational resources. Particular components of the PVWMA project when combined with the Pajaro River and Salsipuedes and Corralitos Creeks Management and Restoration Plan (proposed project) could potentially have a negative cumulative effect on biological resources.

Pajaro River Watershed Flood Prevention Authority

Assembly Bill 807 established the Pajaro River Watershed Flood Prevention Authority (approved and filed on October 10, 1999). “Appointing authorities” from certain counties and local governments would appoint members to the board of authority, which would impose a state-mandated local program to undertake flood prevention and control projects within the Pajaro River Watershed. These projects may have negative cumulative impacts with the project proposed.

Watsonville City Parks Improvements

The City of Watsonville Department of Parks, Recreation and Neighborhood Services operates and maintains parks and bicycle paths along the Pajaro River including River Park, Atri Park and a 1.2 mile portion of the Pajaro River levee path designated for bicycle and pedestrian recreation. Park maintenance activities and pedestrian use of parks could potentially have negative cumulative impacts.

Lane Widening of the Highway 1 Bridge at the Pajaro River
Caltrans is widening the Highway 1 Bridge to create shoulders next to the outside lanes. Construction activities could have negative cumulative impacts.

**Pajaro River Watershed Steelhead Habitat Restoration Project**

The Pajaro River Watershed Council received a $46,000 grant from the Department of Fish and Game for steelhead habitat restoration. Implementation of habitat restoration may have a positive cumulative impact for fish and other wildlife using the Pajaro River System.

**BASIS/OASIS**

The Biological/Organic Agricultural Systems in Strawberries (BASIS/OASIS) and the Bio-intensive Methods and Innovator’s Group in the Monterey Bay Region work with farmers to develop bio-intensive farming techniques to reduce pesticide use in strawberries. These programs could have a positive cumulative impact to wildlife in the Pajaro River system by reducing pesticide runoff.

### 6.2 Covering Unlisted Species

Treatment of unlisted species is a crucial issue for BAs and Section 7 Consultations. While BAs are developed for listed species, they can also cover proposed, candidate or other rare or declining unlisted species. The inclusion of proposed, candidate, or unlisted species in a BA is voluntary, although highly encouraged, and is the decision of the applicant.

Numerous species not listed as federally threatened or endangered, but with other special status (e.g. species of concern), have been treated in the Pajaro River and Salsipuedes and Corralitos Creeks Management and Restoration Plan Environmental Impact Report (*Harding ESE, 2001*), which includes conservation measures for these species.

### 6.3 Amendment Procedures

It is necessary to establish a procedure whereby the Section 7 permit can be amended. However, it is extremely important that the cumulative effect of amendments would not jeopardize any endangered species or other species of concern. Amendments must be evaluated based on their effect on the habitat as a whole. The Service must be consulted on all proposed amendments. The types of proposed amendments and the applicable amendment procedures are described in the following sections.

#### 6.3.1 Amendments To The Development Plans

It is acknowledged that upon the written request of the County of Santa Cruz, the local agency having land use regulatory jurisdiction, is authorized in accordance with applicable law to approve amendments to development plans for the subject property which do not encroach on any endangered species habitat that is not presently contemplated to be taken as a consequence of the development, and which do not alter the conditions set forth in this BA.

#### 6.3.2 Minor Amendments to the BA

Minor amendments involve routine administrative revisions or changes to the operation and management program and which do not diminish the level or means of mitigation. Such minor amendments do not alter the terms of the Section 7 permit.
Upon the written request of the County of Santa Cruz, the Service is authorized to approve minor amendments to this BA, if the amendment does not conflict with the primary purpose of this BA.

6.3.3 All Other Amendments
All other amendments will be considered an amendment to the Section 7 permit, subject to any other procedural requirements of federal law or regulation, which may be applicable to amendment of such a permit.

6.4 Funding
The ESA requires that the BA detail the funding that would be made available to implement the proposed mitigation program. Measures requiring funding in a BA typically include onsite measures during project implementation or construction (e.g. pre-construction surveys, biological monitors, exclusion fences, etc.) as well as onsite and offsite measures required after completion of the project or activity (e.g. revegetation of disturbed areas and acquisition of mitigation lands).

The County has identified up to $300,000, in available funding, for implementation, maintenance and monitoring of restoration revegetation activities. The estimated cost of Alternative 2 (preferred alternative) is $288,200 (Table 6.4-1). This estimate does not include levee resurfacing costs, erosion repair costs and annual maintenance costs below Highway 1 or above Murphy Crossing. Alternative 2 balances the maintenance of wildlife habitat while maximizing hydraulic capacity within the project objectives, and falling within the County’s available funding. However, the cost of implementing minimization and mitigation measures and the monitoring program has not been estimated and funding has not been identified.

6.5 Effect Determination
Based on the information presented in this Biological Assessment, we conclude that the proposed project is LIKELY TO ADVERSELY AFFECT the federally listed species and/or critical habitat present in the project area. Therefore, formal Section 7 consultation will be initiated with NMFS so that it can be determined whether the proposed activities may affect, may jeopardize or may result in adverse modification or destruction of designated critical habitat for species under the jurisdiction of NMFS.
Table 6.4-1. Comparison of hydraulic capacity reduction, area of riparian vegetation and costs associated with the four alternatives presented in the Plan.

<table>
<thead>
<tr>
<th>Item</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Alternative 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydraulic capacity, based on current river conditions (with no levee improvements)</td>
<td>Reduction of: 5-7% (Reaches C-E) 10-15% (Reaches E-G)</td>
<td>Reduction of: 8-11% (Reaches C-E) 12-18% (Reaches E-G)</td>
<td>Reduction of: 10-14% (Reaches C-E) 16-20% (Reaches E-G)</td>
<td>Reduction of: 8-11% (Reaches C-E) 12-20% (Reaches E-G)</td>
</tr>
<tr>
<td>Hydraulic capacity with levee resurfacing project¹</td>
<td>Approximately: 18 yr. With 3 feet freeboard 35 yr. With no freeboard</td>
<td>Approximately: 18 yr. With 3 feet freeboard 35 yr. With no freeboard</td>
<td>Approximately: 18 yr. With 3 feet freeboard 35 yr. With no freeboard</td>
<td>Approximately: 18 yr. With 3 feet freeboard 35 yr. With no freeboard</td>
</tr>
<tr>
<td>Riparian areas (Santa Cruz Co. only)</td>
<td>9 acres at bank</td>
<td>21 acres at bank</td>
<td>28 acres at bank</td>
<td>23 acres at bank 8 acres at bench</td>
</tr>
<tr>
<td>Total restoration costs²</td>
<td>$270,000</td>
<td>$288,200</td>
<td>$334,500</td>
<td>$990,000</td>
</tr>
<tr>
<td>Annual vegetation management costs</td>
<td>$229,350</td>
<td>$200,800</td>
<td>$184,100</td>
<td>$194,050</td>
</tr>
</tbody>
</table>

¹Capacity values are approximations only and are not based on specific hydraulic modeling
²Levee resurfacing costs, erosion repair costs, and annual maintenance costs below Highway 1 or above Murphy Crossing are not included.
7.0 REFERENCES


Ibis Environmental Services, 1999a. Final Surveying and Monitoring Report for California Red-Legged Frog (Rana aurora draytonii), Levee Repairs along Salsipuedes Creek, Site 2, Santa Cruz County. Prepared for U.S. Army Corps of Engineers under contract to Tetra Tech, Inc. April.

Ibis Environmental Services, 1999c. Final Surveying and Monitoring Report for California Red-Legged Frog (Rana aurora draytonii), Levee Repairs along Pajaro River, Sites 1, 16, 25, and 27, Santa Cruz County. Prepared for U.S. Army Corps of Engineers under contract to Tetra Tech, Inc. August.

Ibis Environmental Services, 1999d. Final Surveying and Monitoring Report for California Red-Legged Frog (Rana aurora draytonii), Levee Repairs along Salsipuedes Creek, Site 6, Santa Cruz County. Prepared for U.S. Army Corps of Engineers under contract to Tetra Tech, Inc. August.


Ibis Environmental Services, 1999g. Final Surveying and Monitoring Report for California Red-Legged Frog (Rana aurora draytonii), Levee Repairs along Pajaro River, Sites 3, 17, 19, and 26, Monterey County. Prepared for U.S. Army Corps of Engineers under contract to Tetra Tech, Inc. December.

Ibis Environmental Services, 1999h. Final Surveying and Monitoring Report for California Red-Legged Frog (Rana aurora draytonii), Levee Repairs along Pajaro River, Sites 4 and 9, Monterey County. Prepared for U.S. Army Corps of Engineers under contract to Tetra Tech, Inc. December.


Shapovalov, L. and A. C. Taft. 1954. The life histories of the steelhead rainbow trout (Salmo gairdneri gairdneri) and silver salmon (Oncorhynchus kisutch). California Department of Fish and Game Bulletin 98. 275 pp.


8.0 BA PREPARERS

8.1 County of Santa Cruz Planning Department
Kim Tschantz, Historical Context and editing

8.2 Harding ESE
Tim Laughlin: Principal-in-Charge, Quality Assurance and Quality Control
Sally Bull and James Breitlow: Project Managers
Mark Gookin: Task Manager
Keenan Foster: Botany
Dr. Jerry Smith: Fisheries
David Arsenault: Wildlife
APPENDIX A

Interim Coastal Zone/Riparian Exception Permit (98-0189)