

APPENDIX I

Habitat Mitigation Alternatives Analysis

Draft

**Lower Cache Creek
Yolo County, California
City of Woodland and Vicinity
Potential Flood Damage Reduction Project**

Habitat Mitigation Alternatives Analysis

August 15, 2002

**LOWER CACHE CREEK
YOLO COUNTY, CALIFORNIA
CITY OF WOODLAND AND VICINITY
POTENTIAL FLOOD DAMAGE REDUCTION PROJECT**

HABITAT MITIGATION ALTERNATIVES ANALYSIS

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ACRONYMS

BA	Biological Assessment
CAR	Coordination Act Report
cfs	Cubic Feet Per Second
CR	County Road
DEIS/EIR	Draft Environmental Impact Statement/Environmental Impact Report
DWR	California Department of Water Resources
ER	Engineer Regulation
FB	Flood Barrier
GGS	Giant Garter Snake
HEP	Habitat Evaluation Procedure
I-5	Interstate 5
LED	Least Environmentally Damaging
NED	National Economic Development
NMFS	National Marine Fisheries Service
O&M	Operations & Maintenance
SRA	Shaded Riverine Aquatic
USFWS	U.S. Fish and Wildlife Service

1.0 Introduction

The purpose of the Lower Cache Creek Flood Damage Reduction Project is to provide an economically feasible and environmentally sensitive method to alleviate flood-related damages predicted to occur when the creek leaves its existing levee system. A Flood Barrier (FB), to be constructed along the urban/agricultural land boundary, has been identified as the National Economic Development (NED) plan, the tentatively selected plan, and the least environmentally damaging (LED) plan. Although it has been chosen as the LED plan, mitigation will still be required to offset impacts from construction of the project.

This document summarizes existing conditions in the project area, evaluates the potential effects of the FB on the area's biological resources, and describes the mitigation strategy that is being used to minimize or offset adverse effects. The final section includes mitigation, the mitigation alternatives analysis, and recommendations. Mitigation described within this report includes mitigation by avoidance of effects and compensatory mitigation for unavoidable effects.

Because no sponsor has been identified to support an ecosystem restoration component for Cache Creek, the proposed project does not include ecosystem restoration. The basis for the mitigation strategy presented in this document is to mitigate for the loss of habitat to the extent justified and to minimize incidental take of endangered species.

2.0 Project Conditions

2.1 Without Project Conditions

Existing levees border the entire creek from County Road (CR) 18B to the Cache Creek settling basin. The existing settling basin is also bounded by levees on all sides and covers 3,600 acres. Flows from Cache Creek enter the northwest corner of the settling basin and exit via two structures in the southeast corner of the basin: (1) a 1,700-foot concrete weir and (2) a grated 400-cubic feet per second (cfs) double-box culvert low-flow outlet. A training levee adjacent to the west levee ties into the end of the left levee of Cache Creek. Plans are to remove the release point of the training levee in increments, encouraging a broader distribution of sediment deposition in the upper portion of the basin over the 50-year design life of the settling basin.

Operations & Maintenance (O&M) activities for the existing Cache Creek levee system consist of periodic vegetation clearing on the levees and the removal of large snags in the stream channel to reduce any hindrances to flow. Over the project life, bank stabilization and setbacks from erosion areas as well as flood fighting are anticipated. Anticipated future repairs include 2,100 lineal feet of slope protection and 30,750 lineal feet of 150-foot setback levee. The future repair plans currently are only in the discussion stage, and at present no formal plans for repair and stabilization of the existing levee system have been made.

The lands to the north of Woodland are predominantly agricultural, consisting of row crops and orchard. There are numerous agricultural drainage ditches throughout the area. These ditches are supplied with water from irrigation runoff and surface runoff during storms. The local farmers typically clean the ditches of vegetation once a year. Under current conditions, there is no frequent or deep flooding of the agricultural lands; therefore, wildlife do not require refugia during the wet season. Based on recent records, the land between the existing Cache Creek

levees floods for a brief duration (less than a week) approximately once every 2 years and the creek floods adjacent agricultural lands (i.e., leaves the levee system) once every 10 years. Serious flooding from Cache Creek overflows causes local sheet flooding of agricultural lands once every 20 years, based on flooding experienced since 1950.

The Cache Creek settling basin has the ability to be farmed during the drier portions of the year (April through October); however, it is inundated during the wet season by waters from Cache Creek. Flood refugia for wildlife within the settling basin during the wet season is limited to the levees, including the training levee. Currently portions of the settling basin are dry even during floods. During the rest of the year, the creek remains within its man-made (low-flow) channel, which is the main water body within the settling basin. Agricultural practices, which vary year to year, provide an additional, but inconsistent, water source within the settling basin.

2.2 With Project Conditions

The proposed FB would include constructing a levee along the City of Woodland-Yolo County northern boundary. The FB would extend 6 miles, originating near the intersection of CR 19B and CR 96B and extending to the settling basin, just north of the City of Woodland. A 350-cfs drainage canal would be constructed on the waterside of the FB to serve internal drainage requirements of normal rainfall events and a 12-foot bench would separate the drainage channel from the FB. One thousand feet north of where the flood barrier intersects the existing west levee of the settling basin a 3,000-foot section of the west levee would be removed to ground level and a concrete inlet weir would be installed to an elevation of 45 feet (North American Vertical Datum, 1988) allowing flood flows to drain by gravity from the flood plain into the settling basin, bypassing the City of Woodland. In addition, a 5,250-foot section of the training levee within the settling basin would be removed. Removal of this section of training levee is a significant change from existing settling basin conditions.

An approximate 11,000 foot portion of the west slope of the settling basin west levee east of CR 102 to the new inlet weir would be flattened from a slope of 2H:1V to 3H:1V, and slope protection (riprap) would be added. Additionally, slope protection would be placed on the north slope of the Flood Barrier from CR 101 to the intersection with the west levee of the settling basin. The slope protection would be placed on these levees for protection against wave damage during periods of ponding. Slope protection would also be added to the embankment of I-5 where overtopping occurs at the juncture of the FB and I-5. This slope protection would extend 1100 feet north on both the east and west embankments of I-5.

Similar to without-project conditions, under with-project conditions, the existing levee system would still contain flood events within a flow range of 30,000 to 36,000 cfs. If this range is exceeded water could spill out of Cache Creek and flow northerly onto agricultural lands north of the creek. Water would also flow in a southeast direction (within the project area) across agricultural lands and towards the City of Woodland. The southeast corner, bordered by the FB to the south and the west levee of the settling basin to the east, is of low elevation in the project area and would be prone to flooding and ponding during major flood events. This area does not currently experience frequent or deep flooding (e.g., there has only been one event in the last 50 years that caused flooding in this area). Once the project has been built ponded water could produce a depth of up to 16 feet in the area at the juncture of the FB levee and the settling basin west levee. The duration of flooding in that area may last for 30 days or more until the water

passes through a series of culverts into the settling basin or the City of Woodland storm drain system. This flooding depth and duration is one of the significant changes from existing conditions.

Once the FB is completed, responsibility for maintenance of the facility would be transferred to the non-Federal sponsor. Maintenance of the levees would include grading and graveling roadways, weed control, rodent control, drainage inspection, maintenance of slope protection, and maintenance of project mitigation features after the 3 year establishment period.

3.0 Project-Related Adverse Effects

Seven habitat types will be impacted by construction of the FB: trees, scrub shrub, agricultural, ruderal upland, aquatic, giant garter snake (GGS) aquatic, and GGS upland.

Trees

Native trees can be found scattered along the FB alignment and I-5 embankment (predominantly cottonwoods and some oaks). Non-native trees (mostly walnuts and some olives) are also found within these areas, and as part of an orchard. Trees provide nesting, foraging, resting, and cover habitat for numerous native small mammals and birds. Native trees often provide better habitat for native wildlife than non-native trees, hence the higher replacement ratio for native trees noted in the next section.

Scrub Shrub

The scrub shrub cover-type consists of woody trees or shrubs averaging less than 20-feet tall. This cover-type is dominant along the settling basin training canal (low-flow channel). The band of scrub shrub varies from 10 to 120 feet wide further downstream. Species within this cover-type are dominated by cottonwood and willow species. This habitat is important nesting, foraging, resting, and cover habitat for songbirds such as the yellow warbler.

Agricultural

Agricultural land is the dominant habitat between Woodland and Cache Creek. Typical crops in the area include tomatoes and winter wheat. Agricultural fields, particularly fallow fields, provide foraging habitat for raptors, granivorous birds, and rodents.

Ruderal Upland

Ruderal upland habitat can be found on existing levees and margins of agricultural land. Typically ruderal vegetation occurs as a strip bordering levees and agricultural fields with a width ranging from about 20 to 100 feet or more. Vegetation includes annual grasses interspersed with yellow star-thistle, mile thistle, and teasel. Ruderal upland provides foraging habitat for raptors, granivorous birds, lagamorphs, and rodents.

Aquatic

Aquatic habitat occurs within the low-flow channel of the settling basin and within agricultural drainage ditches along the proposed FB alignment as well as the west levee of the

settling basin. Typically the low-flow channel is shallow with a soft benthic substrate and patches of emergent vegetation. This channel provides foraging and cover habitat for fish, amphibians, and reptiles including the following special-status species: giant garter snake (GGS), chinook salmon, and steelhead. The agricultural ditches also have a soft benthic substrate, however, the presence of water is variable making this aquatic habitat less suitable for fish.

GGS Aquatic

Potential GGS aquatic habitat occurs in the agricultural drainage ditches within the area. These ditches are soil lined and often develop emergent vegetation. Local farmers normally remove the vegetation on an annual basis. This potential habitat provides food and cover for the snake. GGS aquatic habitat must be adjacent to GGS upland habitat.

GGS Upland

Giant garter snake upland habitat consists of suitable contiguous terrestrial habitat within 200 feet of GGS aquatic habitat. The snake uses upland habitat for basking, cover and retreat sites. Uplands with higher elevations are used as cover and a refuge from floodwaters. During the winter GGS use small mammal burrows in uplands as hibernacula.

The following bullets outline the extent of project-related adverse effects including acreages an/or linear feet of habitats affected by the construction of the flood barrier.

- The FB footprint would cover 121.9 acres of agricultural lands.
- The FB footprint and rock armoring of the I-5 embankment would eliminate 54 native trees, 46 non-native trees, and 0.52 acre of upland.
- The removal of the training levee would impact 0.28 acre of scrub shrub, due to the construction of the haul route.
- The haul route would also be constructed across the low flow channel within the settling basin (culverts would be used to ensure continued flow of the creek) impacting 0.33 acre of aquatic habitat.
- The creation of the FB and its associated toe drain would eliminate 17,000 feet of agricultural drainage ditch, determined to be potential GGS aquatic habitat.
- The removal of 5,250 feet of the training levee and 3,000 feet of the west levee for the new weir would eliminate 15.9 acres of potential GGS upland habitat.
- The rock armoring of the FB and the west levee of the settling basin would cover 22.7 acres of GGS upland.

4.0 Mitigation Considerations

4.1 General Habitat

Under the provisions of the Fish and Wildlife Coordination Act, the USFWS has prepared a draft Coordination Act Report (CAR) to assess project-related effects to biological resources in the project area. Mitigation considerations used in this strategy document (see Table 1) are partially based upon the CAR. Because the majority of disturbed land will be reseeded (and in the case of riprap – covered with soil and reseeded) following construction as part of project design, compensatory mitigation will only involve an additional 2.92 acres for non-special-status species (2.89 acres for 316 trees plus 0.03 acres for net scrub shrub habitat losses). This acreage could be incorporated into any upland mitigation for the giant garter snake within the project area and therefore, may not require the purchase of additional mitigation lands. The only cost associated with compensating for trees and scrub shrub habitat losses would then include planting and establishment monitoring. If all mitigation were to be handled through a mitigation bank then separate sites would be necessary for giant garter snake habitat and trees/scrub shrub habitat.

Table 1: Lower Cache Creek Flood Barrier Impacts and Mitigation Considerations

HABITAT TYPE	IMPACTS	BASIS FOR MITIGATION	MITIGATION PROPOSED	COMMENTS
Native Trees	54 Trees	5:1 replacement of trees	270 Native Trees	Trees will be planted on 2.89 acres of mitigation site.
Non-Native Trees	46 Trees	1:1 replacement of trees	46 Native Trees	See above
Scrub Shrub	0.28 acre	Habitat Evaluation Procedure (HEP) analysis	0.31 acre scrub shrub habitat	Reseeding the haul route provides 0.28 acre. Remaining 0.03 acre will be planted in mitigation site.
Agricultural	121.9 acres	Minimize loss of habitat value	121.9 acres native grasses and forbs*	Reseeding the Flood Barrier provides 121.9 acres.
Ruderal Upland	0.52 acres	Minimize loss of habitat value	0.52 acre native grasses and forbs*	Covering and reseeded riprap provides 0.52 acre.

*Addressed through project design; additional mitigation lands not required.

4.2 Threatened and Endangered Species

Table 1 does not include mitigation considerations for threatened or endangered species. The Corps has requested from the USFWS and National Marine Fisheries Service (NMFS) a listing of special-status species for the project area as part of the development of a Technical Biological Appendix and Biological Assessment. According to information provided by USFWS and NMFS, which has been incorporated into the Technical Biological Appendix and Biological Assessment, the FB plan has the potential to affect the threatened giant garter snake and Central Valley steelhead, and the endangered chinook salmon. The specifics for the giant garter snake will be addressed during formal Section 7 Consultation with the USFWS. For planning purposes to develop the overall mitigation strategy for Cache Creek, the findings from prior consultation between the Corps and the USFWS regarding the snake in similar settings are considered in this document.

A field survey conducted by Sycamore Environmental biologist Dr. John Little, a recognized expert on the life history of the giant garter snake, determined that the bed and bank of Cache Creek and adjacent levees, and several areas of agricultural drainage ditch along the project footprint and the west levee of the settling basin are potential giant garter snake habitat (see Figure 1). No direct observations of the giant garter snake were made during the survey and a search of the California Natural Diversity Database did not turn up any records within the project area. However, construction of the FB would remove 17,000 feet of agricultural drainage ditch regarded as potential GGS aquatic habitat. This will be offset by the construction of the FB toe drain. Riprap placed along the FB between CR 101 to the west levee and along the west levee north to CR 102 would impact 22.7 acres of potential GGS upland habitat. Mitigation for this impact would include the placement of soil over the riprap and reseeding the soil. However, on other projects within the Corps' Sacramento District, this type of mitigation has not been entirely sufficient and additional mitigation may be required. Removal of 3,000 feet of the west levee of the settling basin and 5,250 feet of the training levee adjacent to Cache Creek would impact 15.9 acres of potential upland GGS habitat. The *Programmatic Formal Consultation for U.S. Army Corps of Engineers 404 Permitted Projects with Relatively Small Effects on the Giant Garter Snake within Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, and Yolo Counties, California (November 13, 1997)* provides the best estimate of what mitigation measures the USFWS might be expected to impose through their Biological Opinion as reasonable and prudent measures required by the terms and conditions of an incidental take statement (Sections 7(o)(2) of ESA). According to the *Programmatic Formal Consultation*, replacement of affected giant garter snake habitat occurs at a 3:1 ratio. All replacement habitat must include 2 parts upland to 1 part aquatic. Upland habitat needs to be within 200 feet of aquatic habitat for it to be available to the giant garter snake. Based on these potential habitat replacement requirements and losses of potential upland giant garter snake habitat due to training levee removal and the creation of the west levee weir (a total of 15.9 acres), 47.7 acres of giant garter snake aquatic and upland habitat would need to be provided as compensatory mitigation. These 47.7 acres would comprise 31.8 acres of upland and 15.9 acres of aquatic habitat.

Placement of the haul route over the low-flow channel of the settling basin would affect 0.33 acre of potential aquatic habitat for the giant garter snake, chinook salmon, and steelhead. This potential habitat would be temporarily impacted and restored to pre-project conditions after

construction; therefore, no additional mitigation would be required for this impact. This conclusion will be verified during consultation with USFWS and NMFS.

5.0 Mitigation Strategy

According to Engineer Regulation (ER) 1105-2-100, the first step in mitigation planning is to avoid effects if possible and then to minimize adverse effects through design modifications. (For example, one design modification may include covering riprap with a layer of soil of sufficient thickness to be biologically stable.) For those project effects that are unavoidable, the mitigation objective is to fully restore lost habitat values through reasonable and justifiable in-kind, on site replacement. The mitigation strategy or objective for this project is to fully replace the habitat values lost due to project implementation.

5.1 Mitigation Site Criteria

In accordance with ER 1105-2-100, project lands (lands required for authorized project purposes) are considered for mitigation purposes first, followed by public lands (lands owned or otherwise legally entrusted to a local, State, or Federal agency), and then private lands. Possible mitigation sites were selected based on the following key factors:

- 1) Recommendations of the Habitat Evaluation Procedure (HEP) team (consisting of representatives from the Corps, USFWS, DWR, and California Department of Fish & Game), whose site selection criteria included finding sites that could provide new habitat as close as possible to the site of impact.
- 2) Recommendations from Yolo County and the agricultural community to minimize losses of agricultural lands.
- 3) Preference for using biologically degraded sites currently exhibiting minimal habitat value with potential for improvement through mitigation.
- 4) Economy of mitigating on as few sites as possible to reduce the overall mitigation costs, and enhance environmental continuity.
- 5) Preference for sites that are stable (e.g., protected) in the long-term from agricultural or urban disturbances.
- 6) Preference for sites that do not flood for long durations.
- 7) Sites with a permanent water source for aquatic habitat that do not require extensive O&M.

5.2 Mitigation Sites

For this project, the project team researched lands that met many of the criteria listed above. In addition to project lands, three sites in combination with out-of-project-area mitigation banking (for a total of 5 sites [one site was used by two different strategies]) were considered for



Figure 1

mitigating all project-related adverse effects. All potential sites are described below and/or shown on Figure 2.

The design of the FB system does not immediately lend itself to the isolation of a plot of land directly amenable to mitigation, as would a levee system that paralleled Cache Creek. The only lands purchased by fee would be the land specifically used to construct the FB itself. Mitigation within the settling basin proper was not considered because it would conflict with the intended long-term use of the basin and the agricultural activities within the basin. The flood-induced ponded area adjacent to the west levee (east end of FB where it joins the west levee of the settling basin) is proposed for purchase of a flood easement. However, due to the duration of ponding (an inundation of 10 feet of water for up to 30 days) and the fact that a portion of project mitigation is to plant trees, (it is highly unlikely that any trees would survive), the use of most of the ponding area was negated as a mitigation site. On-site mitigation was limited to flood control structures or northern portions of the ponding area where floodwater depths and durations are significantly less.

Net losses of potential giant garter snake habitat (training levee removal and creation of the weir) comprise 100 percent of lands required for additional mitigation, with the exception of sites 4 and 5 of which 94 percent is giant garter snake mitigation (GGS upland and tree/scrub shrub mitigation are separate for these two sites). This mitigation necessitates aquatic and adjacent upland habitat. Project features and altered project designs were considered in order to reduce the amount of additional land to be purchased. Such a feature includes the flood barrier itself. A toe drain runs approximately $\frac{3}{4}$ the length of the FB and would provide potential aquatic habitat for GGS. However, in order to develop enough adjacent upland habitat to fully replace lost potential GGS habitat, a larger Flood Barrier would need to be constructed, especially west of I-5 where barrier heights are only 7 feet maximum. I-5 also acts as a migration barrier to GGS that might colonize habitat created to the west of I-5. Aside from cost implications this would also have additional environmental effects that would out-weigh any benefits from using a larger FB as additional GGS mitigation.

A project design modification that was considered was shifting the end of the training levee to the east rather than removing 5,250 feet. This would eliminate the need to compensate for 30.3 acres of lost potential GGS habitat. However, the training levee is currently scheduled for removal in stages as the settling basin fills with sediment; therefore, this design modification does not offer enough long-term stability to be a mitigation option.

Another mitigation site consideration is the permanent loss of potential GGS upland habitat due to construction of a concrete weir in the western settling basin levee and the removal of a portion of the training levee. This is an important issue for the settling basin portion of Cache Creek because 7,750 feet of upland GGS flood refugia will be removed within 200 feet of the creek in an area that floods annually. Creation of suitable upland habitat near Cache Creek subsequently becomes a primary factor for the mitigation strategy.

With these considerations and the mitigation site criteria in mind, it was determined that suitable giant garter snake aquatic habitat was regarded as the overall limiting factor for mitigation. Once sites with suitable aquatic and adjacent upland habitat were located they were evaluated for their ability to meet the criteria listed above.

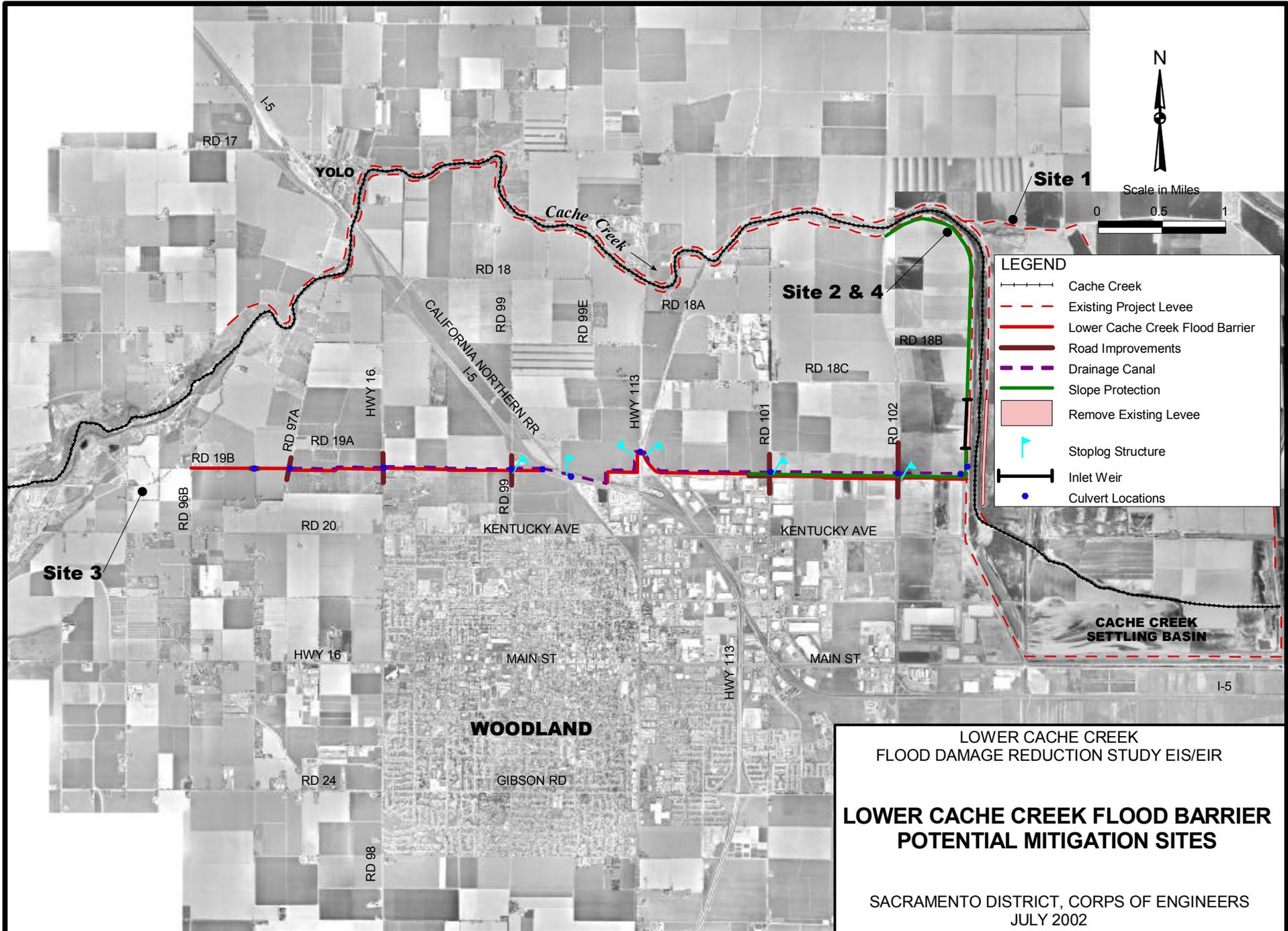
Several of the sites were limited in the overall amount of potential giant garter snake habitat that could be provided within the project area. To fully mitigate for impacts to potential GGS habitat, credits would need to be purchased at a mitigation bank. The Cache Creek Flood Damage Reduction Study falls within Wildlands Inc.'s - Pope Ranch Conservation Bank service area, which includes most of Yolo County. Pope Ranch is located at the eastern terminus of Midway Road (southwest of Sacramento) and is approved by the California Department of Fish and Game and the USFWS for giant garter snake mitigation. The cost per credit for the established GGS habitat includes land, surveying, design, construction and development of the habitat, permitting, monitoring and maintenance. Once credits with Wildlands, Inc. have been purchased, the Corps, DWR, and the local sponsor would be relieved of the contingent liabilities of guaranteeing the success of the mitigation. Wildlands, Inc. would be responsible for all financial and performance obligations.

While investigating the cost of using a mitigation bank for mitigating potential GGS habitat losses, it became apparent it might be more economical to also use a mitigation bank for tree and scrub shrub mitigation. Wildlands, Inc.'s Bank in Sheridan would provide mitigation for project impacts to riparian and oak woodland and would include the same services and release from liability as stated above.

Mitigation Site 1 (Settling Basin Trees & GGS) includes roughly 200 acres (although not all 200 acres would be acquired for mitigation) of land currently owned by the DWR within the northwest corner of the settling basin. This site would require a culvert breach of the training levee to ensure water flow into the historic Cache Creek channel for development of aquatic habitat. The primary concern for this site is the creation of a man-made wetland that will probably silt-in from Cache Creek flows, requiring long-term O&M to remain viable. Also, the site is subject to modifications of the settling basin, such as removal of the training levee, and subsequent changes in sedimentation and flooding creating a site that may be subject to instability.

Mitigation Site 2 (New Levee) includes roughly 83 acres (although not all 83 acres would be acquired for mitigation) of land privately owned along the right bank of Cache Creek where it turns south into the settling basin. Because this area is potentially subject to induced flooding by the FB structure, project costs already include a flood easement purchase of the land. This site would require the construction of a new section of setback levee, and the breaching of the existing levee to provide upland habitat adjacent to Cache Creek. All anticipated mitigation requirements could be provided on this site. The aquatic water source for this site would be Cache Creek; therefore, the site would not require O&M to maintain water flow. However, in order to use Cache Creek as a water source the creek bank would need to be leveled out which may impact significant amounts of riparian vegetation necessitating further mitigation.

Mitigation Site 3 (Abandoned Gravel Mine) includes lands owned by the County along the upstream banks of Cache Creek that are near ongoing ecosystem restoration projects. This site is an abandoned gravel mining pit that would be developed in much the same manner as the Cache Creek Conservancy Preserve at the old Teichert "Meadows Pit". Concurrence of the County, which would be necessary to use the site, has not yet been obtained because the County has not taken a formal position in support of the proposed project. The County would retain ownership of the land and could arrange to perform maintenance for the non-Federal sponsor



LOWER CACHE CREEK
 FLOOD DAMAGE REDUCTION STUDY EIS/EIR

**LOWER CACHE CREEK FLOOD BARRIER
 POTENTIAL MITIGATION SITES**

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
 JULY 2002

Figure 2

once initial planting and establishment has been accomplished. Because giant garter snake aquatic and upland habitats must be adjacent to each other, the limited amount of giant garter snake aquatic habitat available may not allow all GGS mitigation to be met on this site (an additional 4.7 acres is needed), but it is the belief of the environmental team that the site should be pursued for the following reasons: (1) the USFWS may be willing to accept 40 acres (the size of the site) adequate mitigation because the site is severely degraded and would be restored to a condition ideal for GGS habitation, and (2) the site would offer a contiguous block of land adjacent to the creek for GGS habitat. Other advantages of this site include restoration of a portion of Cache Creek for the future benefit of all County residents, and no loss of agricultural land, an important consideration for the County.

Mitigation Site 4 (Settling Basin Trees Only) includes land owned by the DWR in the northwest corner of the Cache Creek settling basin similar to *Site 1*; however, because this site is not adjacent to water and a culvert breach would not be constructed, it would only mitigate for the loss of trees and scrub shrub habitat, and not giant garter snake habitat. *Site 4* would only require the consent of DWR to plant trees on 2.92 acres of land, but would require a second location for giant garter snake mitigation such as an existing mitigation bank. This precludes mitigating for adverse effects on the GGS at the site of impact.

Mitigation Site 5 (Mitigation Banks) includes conducting all mitigation activities off-site at two mitigation banks. Mitigation banking would compensate for the loss of 15.9 acres of giant garter snake habitat (through the purchase of 47.7 acres) and 2.92 acres of trees and scrub shrub habitat.

5.3 Evaluation of Mitigation Sites by Site Selection Criteria

Mitigation Site 1 meets some but not all mitigation site selection criteria.

- (1) *Mitigation Site 1* provides new habitat in the northwest corner of the settling basin, thereby providing habitat restoration near the site of impact.
- (2) Although the settling basin is used for agricultural activities, currently the location of *Site 1* is not being farmed, but could be in the future. Therefore, the site potentially conflicts with the avoidance of agricultural land criterion.
- (3) The site is biologically degraded and mitigation could result in restoration of the old channel and adjacent lands.
- (4) *Mitigation Site 1* could provide only 24 acres of the 47.7 acres of GGS habitat needed because of physical limitations on the amount of aquatic habitat that can be created. This analysis assumes that the remaining GGS habitat would be provided at an existing GGS mitigation bank.
- (5) Changes to the settling basin design could affect the long-term stability of the site. In addition, the mitigation site could affect the function of the settling basin.

- (6) The site is located on a high elevation within the settling basin and should not be subjected to long-term flooding.
- (7) Permanent water would require a culvert breach from the Cache Creek channel, potentially requiring long-term operations and maintenance to sustain flow into the mitigation site area and to manage sedimentation.

Mitigation Site 2 meets most but not all the mitigation site selection criteria.

- 1) *Mitigation Site 2* is within the project area, near site 1 where Cache Creek empties into the settling basin, thereby providing habitat restoration near the site of impact.
- 2) The movement of the levee away from the creek would result in the loss of approximately 50 acres of agriculture land.
- 3) Agricultural land would be restored back to natural habitat. This would meet the preference for restoring biodegraded sites; however, in order to create access to a permanent water source extensive riparian vegetation may be affected.
- 4) *Mitigation Site 2* would not require any out-of-project-area mitigation or additional mitigation lands. All habitat restoration activities would be accommodated at this site.
- 5) Long-term stability would be achieved because the site would be protected between the Cache Creek levees.
- 6) Construction of habitat at the site would involve creation of upland habitat, not subject to long-term flooding.
- 7) The Creek would provide a permanent water source for the giant garter snake.

Mitigation Site 3 meets most but not all of the mitigation site selection criteria.

- 1) *Mitigation Site 3* is along Cache Creek, thereby providing habitat restoration within the project area but not near the site of impact to existing potential GGS habitat.
- 2) The land for *Mitigation Site 3* was used for gravel mining and is currently being managed by a public agency with the goal of habitat restoration; therefore, no agricultural land would be impacted.
- 3) The site is biologically degraded from previous use as a gravel mining location and would be amenable to habitat restoration.
- 4) *Mitigation Site 3* could provide only 40 acres of the 47.7 acres of GGS habitat needed because of physical limitations on the amount of aquatic habitat that can be created. This analysis assumes that the remaining GGS habitat would be provided at an existing GGS mitigation bank.

- 5) The site is surrounded by orchards and borders Cache Creek. The lack of adjacent row crop agriculture and the undevelopable nature of the creek provide long-term stability.
- 6) The site is not protected by the existing Cache Creek Levee System and maybe subject to frequent but not long-term flooding with proper mitigation design.
- 7) Cache Creek could provide a permanent water source with proper project design.

Mitigation Site 4 meets some but not all of the mitigation site selection criteria.

- 1) *Mitigation Site 4* is within the project area, on Sites 1 in the northwest corner of the Cache Creek settling basin, thereby providing habitat restoration near the site of impact.
- 2) Mitigation at Site 4 would result in the loss of 3 acres of potential agricultural land.
- 3) However, the conversion of agricultural land back to natural habitats would meet the preference for restoring biodegraded sites
- 4) *Mitigation Site 4* would not provide suitable habitat for the giant garter snake; however, all other habitat mitigation activities would be accommodated at this site. GGS habitat would be provided at an existing GGS mitigation bank.
- 5) The site is bordered by frequently farmed agricultural row cropland and is within the settling basin. This will affect the site's long-term stability.
- 6) The site is located on a high elevation within the settling basin and should not be subjected to long-term flooding.
- 7) Only trees and scrub shrub would be mitigated at this site making a permanent water source unnecessary.

Mitigation Site 5 meets some but not all of the mitigation site selection criteria.

- 1) *Mitigation Site 5* is completely outside the project area; therefore, it provides no habitat near the impact area.
- 2) Mitigation for GGS and trees at Site 5 is located on parcels that have been dedicated to mitigation banking and would not be converted to agricultural land.
- 3) However, the GGS site was previously agricultural land and would meet the preference for restoring biodegraded sites
- 4) *Mitigation Site 5* would provide GGS habitat and trees/scrub shrub at two different mitigation sites.
- 5) The GGS site is bordered by agricultural lands, which may affect the site's long-term stability. However, the tree site would be stable in the long-term.

- 6) The GGS site is within the Yolo Bypass, which is subject to annual flooding during the winter rainy season. The tree site would not be subject to long-term flooding.
- 7) The GGS mitigation bank would be responsible for developing a permanent water source. The tree mitigation bank does not require a permanent water source.

5.4 Cost Evaluation of Mitigation Sites

The estimated cost of each alternative site was also determined and are detailed in Tables 2-6. Costs of mitigation for the existing habitat types include the following:

- Trees – includes the cost of planting native trees and establishment monitoring for three years. These trees would be planted on acreage already accounted for under GGS uplands; therefore, no additional mitigation lands would be acquired, except under Sites 4 & 5 where additional lands/mitigation banks would be necessary.
- Scrub shrub – includes the cost of planting scrub shrub and establishment monitoring for three years. A portion of this cost (replanting the haul route) is included in project construction costs. This scrub shrub would be planted on acreage already accounted for under GGS uplands; therefore, no additional mitigation lands would be acquired, except under Sites 4 & 5 where additional lands/mitigation banks would be necessary.
- Agriculture – includes the cost of reseeding levees; however, this cost is included in project construction costs.
- Ruderal Uplands – includes the covering of riprap with soil and reseeding this soil with native grasses and forbs. This cost is included in project construction costs.
- Aquatic – includes the restoration of the low-flow channel to pre-project conditions. This cost is included in project construction costs.
- GGS Aquatic (replacement) – includes the cost of replacing the loss of these ditches with the toe drain. This cost is included in project construction costs.
- GGS Aquatic (mitigation) – includes the creation of a permanent source of water (i.e. culvert breach), initial clearing and rough grading, and habitat restoration.
- GGS Upland (replacement) – includes the covering of riprap with soil and reseeding this soil with native grasses and forbs. This cost is included in project construction costs.
- GGS Upland (mitigation) – includes the planting of native upland grasses and forbs and establishment monitoring for three years.
- Costs (Land) – includes the cost of acquiring lands for mitigation of lost habitat. These costs are estimates based upon the Gross Appraisal.

- Costs (Other) – includes construction, planting and all other costs (except lands), including mitigation banking costs. Mitigation banking costs include the cost of purchasing credits in a mitigation bank to compensate for GGS and/or tree and scrub shrub habitat losses. These costs were provided by a local mitigation bank.

According to the *Programmatic Formal Consultation*, replacement of affected giant garter snake habitat occurs at a 3:1 ratio. All replacement habitat must include 2 parts upland to 1 part aquatic. Based on these potential habitat replacement requirements and losses of potential upland giant garter snake habitat due to training levee removal and the creation of the west levee weir (a total of 15.9 acres), 47.7 acres of giant garter snake aquatic and upland habitat would need to be provided as compensatory mitigation. These 47.7 acres would comprise 31.8 acres of upland and 15.9 acres of aquatic habitat.

The cost of impact avoidance measures, such as reseeded disturbed areas, are included in the costs of the affected project features to meet environmentally sustainable design criteria; therefore, only the costs of measures to compensate for unavoidable impacts are included in Tables 2-6.

Table 2: Site 1 Estimated Mitigation Cost Analysis

HABITAT TYPE	HABITAT LOSS	PROPOSED MITIGATION	COSTS		COMMENTS
			LANDS	OTHER	
<i>Threatened & Endangered Species</i>					
T&E Aquatic	0.33 acre	0.33 acre	N/A	Included in project design	Restore to pre-project conditions
GGS Aquatic	17,000 feet agricultural drainage ditches	17,000 feet	N/A	Included in project design	Replaced by levee toe drains
		8 acres Site 1	\$8,000	\$128,000	
		7.9 acres GGS mitigation bank	N/A	\$197,500	
GGS Upland	38.6 acres	22.7 acres	N/A	Included in project design	Cover riprap with soil and reseeded
		16 acres Site 1	\$16,000	\$1,144,000	
		15.8 acres GGS mitigation bank	N/A	\$395,000	
<i>General Habitat</i>					
Trees	100 trees	316 native trees	N/A	\$204,900	Planted on Site 1
Scrub Shrub	0.31 acre	0.28 acre	N/A	Included in project design	Reseed haul route
		0.03 acre	N/A	\$2,400	Planted on Site 1
Agricultural	121.9 acres	121.9 acres	N/A	Included in project design	Cover riprap with soil and reseed levee and riprap
Ruderal Upland	0.52 acre	0.52 acre	N/A	Included in project design	Cover riprap with soil and reseed levee and riprap
Totals			\$24,000	\$2,071,800	TOTAL COSTS \$2,095,800

Table 3: Site 2 Estimated Mitigation Cost Analysis

HABITAT TYPE	HABITAT LOSS	PROPOSED MITIGATION	COSTS		COMMENTS
			LANDS	OTHER	
<i>Threatened & Endangered Species</i>					
T&E Aquatic	0.33 acre	0.33 acre	N/A	Included in project design	Restore to pre-project conditions
GGS Aquatic	17,000 feet agricultural drainage ditches	17,000 feet	N/A	Included in project design	Replaced by levee toe drains
		15.9 acres Site 2	\$63,600	\$254,400	
		0 acres GGS mitigation bank	N/A	N/A	
GGS Upland	38.6 acres	22.7 acres	N/A	Included in project design	Cover riprap with soil and reseeded
		31.8 acres Site 2	\$127,200	\$2,273,700	
		0 acres GGS mitigation bank	N/A	N/A	
<i>General Habitat</i>					
Trees	100 trees	316 native trees	N/A	\$204,900	Planted on Site 2
Scrub Shrub	0.31 acre	0.28 acre	N/A	Included in project design	Reseed haul route
		0.03 acre	N/A	\$2,400	Planted on Site 2
Agricultural	121.9 acres	121.9 acres	N/A	Included in project design	Cover riprap with soil and reseed levee and riprap
Ruderal Upland	0.52 acre	0.52 acre	N/A	Included in project design	Cover riprap with soil and reseed levee and riprap
Totals			\$190,800	\$2,735,400	TOTAL COSTS \$2,926,200

Table 4: Site 3 Estimated Mitigation Cost Analysis

HABITAT TYPE	HABITAT LOSS	PROPOSED MITIGATION	COSTS		COMMENTS
			LANDS	OTHER	
<i>Threatened & Endangered Species</i>					
T&E Aquatic	0.33 acre	0.33 acre	N/A	Included in project design	Restore to pre-project conditions
GGS Aquatic	17,000 feet agricultural drainage ditches	17,000 feet	N/A	Included in project design	Replaced by levee toe drains
		13.3 acres Site 3	\$13,300	\$212,800	
		1.6 acres GGS mitigation bank	N/A	\$65,000	
GGS Upland	38.6 acres	22.7 acres	N/A	Included in project design	Cover riprap with soil and reseeded
		26.7 acres Site 3	\$26,700	\$1,909,050	
		3.1 acres GGS mitigation bank	N/A	\$127,500	
<i>General Habitat</i>					
Trees	100 trees	316 native trees	N/A	\$204,900	Planted on Site 3
Scrub Shrub	0.31 acre	0.28 acre	N/A	Included in project design	Reseed haul route
		0.03 acre	N/A	\$2,400	Planted on Site 3
Agricultural	121.9 acres	121.9 acres	N/A	Included in project design	Cover riprap with soil and reseed levee and riprap
Ruderal Upland	0.52 acre	0.52 acre	N/A	Included in project design	Cover riprap with soil and reseed levee and riprap
<i>Totals</i>			\$40,000	\$2,521,650	TOTAL COSTS \$2,561,650

Table 5: Site 4 Estimated Mitigation Cost Analysis

HABITAT TYPE	HABITAT LOSS	PROPOSED MITIGATION	COSTS		COMMENTS
			LANDS	OTHER	
<i>Threatened & Endangered Species</i>					
T&E Aquatic	0.33 acre	0.33 acre	N/A	Included in project design	Restore to pre-project conditions
GGS Aquatic	17,000 feet agricultural drainage ditches	17,000 feet	N/A	Included in project design	Replaced by levee toe drains
		0 acres Site 4	N/A	N/A	
		15.9 acres GGS mitigation bank	N/A	\$397,500	
GGS Upland	38.6 acres	22.7 acres	N/A	Included in project design	Cover riprap with soil and reseeded
		0 acres Site 4	N/A	N/A	
		31.8 acres GGS mitigation bank	N/A	\$795,000	
<i>General Habitat</i>					
Trees	100 trees	316 native trees	\$2,890	\$204,900	Planted on Site 4
Scrub Shrub	0.31 acre	0.28 acre	N/A	Included in project design	Reseed haul route
		0.03 acre	\$30	\$2,400	Planted on Site 4
Agricultural	121.9 acres	121.9 acres	N/A	Included in project design	Cover riprap with soil and reseed levee and riprap
Ruderal Upland	0.52 acre	0.52 acre	N/A	Included in project design	Cover riprap with soil and reseed levee and riprap
<i>Totals</i>			\$2,920	\$1,399,800	TOTAL COSTS \$1,402,720

Table 6: Site 5 Estimated Mitigation Cost Analysis

HABITAT TYPE	HABITAT LOSS	PROPOSED MITIGATION	COSTS		COMMENTS
			LANDS	OTHER	
<i>Threatened & Endangered Species</i>					
T&E Aquatic	0.33 acre	0.33 acre	N/A	Included in project design	Restore to pre-project conditions
GGS Aquatic	17,000 feet agricultural drainage ditches	17,000 feet	N/A	Included in project design	Replaced by levee toe drains
		N/A	N/A	N/A	
		15.9 acres Site 5 mitigation bank	N/A	\$397,500	
GGS Upland	38.6 acres	22.7 acres	N/A	Included in project design	Cover riprap with soil and reseeded
		N/A	N/A	N/A	
		31.8 acres Site 5 mitigation bank	N/A	\$795,000	
<i>General Habitat</i>					
Trees	100 trees	316 native trees mitigation bank	N/A	\$158,950	
Scrub Shrub	0.31 acre	0.28 acre	N/A	Included in project design	Reseed haul route
		0.03 acre mitigation bank	N/A	\$1,650	
Agricultural	121.9 acres	121.9 acres	N/A	Included in project design	Cover riprap with soil and reseed levee and riprap
Ruderal Upland	0.52 acre	0.52 acre	N/A	Included in project design	Cover riprap with soil and reseed levee and riprap
<i>Totals</i>			\$0	\$1,353,100	TOTAL COSTS \$1,353,100

6.0 Comparison of Mitigation Alternatives and Conclusion

Initial mitigation planning identified several construction and design related activities that could avoid or minimize most project-related habitat effects with the exception of the endangered giant garter snake potential habitat. These include: (1) reseeding haul routes and construction easements, (2) placement of soil over riprap and reseeding these sites, (3) replacement of agricultural ditches with toe drains, and (4) restoration of the low-flow channel of Cache Creek to pre-project conditions. Additional habitat mitigation would include 2.89 acres of trees and 0.03 acre of scrub shrub, which is anticipated to be planted as part of GGS upland habitat (with the exception of Sites 4 & 5), and 47.7 acres of giant garter snake habitat. Mitigation sites were evaluated for their environmental value, feasibility, and cost.

Table 7 is a comparison of all mitigation sites using two techniques developed by the environmental planning team. (Because this is strictly a planning document, the USFWS was not involved in developing the two comparison techniques. Section 7 consultation will be used to finalize mitigation requirements and subsequent mitigation site selection.) The light gray column represents a simple pass/fail evaluation of each site with regards to the site criteria. Each site was evaluated based on whether or not it met the criteria. The total number of criteria being met was then tallied. (All N/A's were tallied as a Yes.) This initial comparison of sites did not fully take into account the importance of each site criterion. Also, the pass/fail system did not fully analyze the differences between each site for each criterion. Therefore, the sites were then evaluated using a site criteria weighted ranking, multiplied by a site rank. (The dark gray column represents the multiplied score for each site by criterion and the overall score.) Site criteria were weighted on a 1 to 5 scale (1 being least important; 5 being most important) using the best professional judgment of the environmental planning team based on the following:

- Criterion 1 (Provides 50% or more lost habitat within the project area) is of high importance, biologically, due to the need for providing lost habitat as close to the site of disturbance as possible, a consideration of high importance to the USFWS. This criterion was given a weighted ranking of 5.
- Criterion 2 (Minimizes the loss of agricultural lands) is important to Yolo County, which is highly dependent upon agriculture. However, because the mitigation requirements are so small in comparison to the overall amount of farmable land within the County, this criterion received a weighted ranking of 1.
- Criterion 3 (Biologically degraded) is important to the USFWS. However, most of the land within the project area is already degraded, giving this criterion a weighted ranking of 2.
- Criterion 4 (Mitigation on fewest number of sites) is also important to the USFWS because mitigation conducted on one large tract of land rather than numerous small tracts is more favorable biologically. However, this criterion received a weighted ranking of 2 because all sites had only one or two mitigation locations.

- Criterion 5 (Stable in the long-term from agricultural, urban, or other development) is important to the success of the mitigation site. The greater the chance for disturbance the less likely the site will be successful. This criterion was given a weighted ranking of 4.
- Criterion 6 (Does not flood for long durations) is important for the creation of GGS refugia from flooding and for the establishment of trees. However, 69 percent of the mitigation design will be creating GGS and tree uplands, thereby resolving the need for land that does not flood. This criterion is given a weighted ranking of 2.
- Criterion 7 (A permanent water source for aquatic habitat that does not require maintenance) is important for ensuring the long-term success of the mitigation site. This criterion is given a weighted ranking of 3.

The sites were then ranked, on a 1 to 5 scale (one being lowest; 5 being highest), of how well each site met the specific criteria, again using the best professional judgment of the planning team. The multiplied scores (site criteria weighted ranking X site ranking) were then logged in Table 7 and tallied to obtain an overall score, thereby allowing comparisons between sites. The results are as follows.

Site 1 would compensate for all but 23.7 acres of giant garter snake habitat. This site does not provide long-term stability if modifications to the settling basin are necessary. In addition it requires that some GGS mitigation be completed outside the project area at a mitigation bank, and the maintenance of a permanent water source would require future O&M. It received a pass/fail score of 4 and a weighted score of 59.

Site 2 would compensate for all giant garter snake habitat mitigation; however, it would impact extensive amounts of riparian vegetation during grading of the creek bank, which is necessary to provide adequate access to the creek by the GGS. It would also cause the most loss of agricultural lands. This site received a pass/fail score of 7 and a weighted score of 89.

Site 3 would compensate for all but 7.7 acres of giant garter snake habitat. It would also eliminate the need for conversion of agricultural lands for mitigation purposes. In addition the County prefers to retain ownership and may consider taking responsibility for site maintenance. This site received a pass/fail score of 7 and a weighted score of 87.

Site 4 would not compensate for any giant garter snake habitat and would require the conversion of 2.92 acres of agricultural land for mitigation purposes. This site received a pass/fail score of 4 and a weighted score of 59.

Site 5 would compensate for all habitat losses however all mitigation would be conducted outside the impact and project areas. This site received a pass/fail score of 6 and a weighted score of 64.

Mitigation costs for the alternatives ranged from \$1.3 million to \$2.9 million dollars including the cost of using an existing mitigation bank to provide additional habitat as needed.

Table 7: Comparison of Mitigation Sites

		<i>Mitigation Site 1 (Settling Basin Trees & GGS)</i>			<i>Mitigation Site 2 (New Levee)</i>			<i>Mitigation Site 3 (Abandoned Gravel Mine)</i>			<i>Mitigation Site 4 (Settling Basin Trees Only)</i>			<i>Mitigation Site 5 (Mitigation Banks)</i>		
Site Criteria	Weighted Criteria Score	Meets the criteria?	Site Rank	Score	Meets the criteria?	Site Rank	Score	Meets the criteria?	Site Rank	Score	Meets the criteria?	Site Rank	Score	Meets the criteria?	Site Rank	Score
Provides 50% or more of lost habitat within the project area	5	Yes*	4	20	Yes	5	25	Yes*	5	25	No	2	10	No	1	5
Minimizes the loss of agricultural lands	1	No	2	2	No	1	1	Yes	5	5	No	3	3	Yes	5	5
Biologically degraded	2	Yes	3	6	Yes	4	8	Yes	5	10	Yes	3	6	Yes	2	4
Mitigation on fewest number of sites	2	No	3	6	Yes	5	10	No	3	6	No	3	6	No	3	6
Protected in the long-term from agricultural, urban, or development	4	No	2	8	Yes	5	20	Yes	4	16	No	2	8	Yes	4	16
Does not flood for long durations	2	Yes	3	6	Yes	4	8	Yes	4	8	Yes	3	6	Yes	4	8
A permanent water source that does not require O&M	3	No	2	6	Yes	4	12	Yes	4	12	N/A****	5	15	Yes	5	15
<i>Total Cost & Overall Score</i>		3	<i>\$2,095,800</i>	<i>54</i>	6	<i>\$2,926,200</i>	<i>84</i>	6	<i>\$2,561,650</i>	<i>82</i>	3	<i>\$1,402,720</i>	<i>54</i>	5	<i>\$1,353,100</i>	<i>59</i>

*Requires additional mitigation at a GGS mitigation bank away from the site.

**The current landowner has expressed an interest in maintaining the site after initial planting and establishment has been accomplished.

***The operators of the mitigation bank would be responsible for maintaining the site.

****This site does not require a permanent water source.

Site 2 received the highest score; however, the cost of this alternative (nearly \$1.6 million over the least cost option) and its impact on riparian vegetation eliminates this site from consideration. Site 3 received the next highest score. It is the environmentally preferable alternative, because it satisfies the most mitigation site criteria without inducing further impacts. It also provides mitigation adjacent to the project area, which is the preference of the USFWS. At this time, Site 3 does not meet projected mitigation needs, however, this is a preliminary analysis and additional study may result in a lower requirement. It does offer Yolo County an incentive to support the project by providing the County with a process for restoring a biologically degraded County-owned parcel. However, it has a cost almost twice that of Site 5. Site 5 has the lowest cost per point of the overall score calculated in Table 7. This indicates that Site 5 is the most cost-efficient mitigation alternative.

Therefore, pending approval from the USFWS and NMFS, the lowest cost mitigation strategy that satisfies most of the current mitigation criteria is:

- The replanting of the FB with native grasses and forbs.
- The replanting of the haul route with native scrub shrub plants.
- The restoration of the low-flow channel of Cache Creek to pre-project conditions.
- The use of flood control structures for restoration of ruderal upland and the majority of giant garter snake aquatic and upland habitat. (Soil would be placed over the riprap to a depth of at least 18 inches and reseeded with native grasses and forbs to provide cover. Emergent habitat would be created within the toe drain to serve as aquatic habitat.)
- The use of *Site 5 (Mitigation Banking)* for the mitigation of 2.89 acres of trees, 0.03 acre of scrub shrub habitat, and 47.7 acres of GGS habitat.