APPENDIX H
HABITAT RESTORATION PLAN

CHAPTER 1.0 INTRODUCTION

The Habitat Restoration Plan (HRP) is a key element of the Adaptive Management Program (AMP) component for the overall Southern Subregion NCCP/MSAA/HCP Habitat Reserve Management Program (HRMP) as described in *Part I, Chapter 7.* The HRP describes the spectrum of possible upland restoration activities within the Southern NCCP/MSAA/HCP Habitat Reserve and in wetland/riparian areas subject to the aquatic resources restoration component. The term "restoration" is used very broadly in this plan and covers a range of activities from enhancement of existing degraded habitats to creation of new habitats. The restoration activities described in this plan would be undertaken in accordance with certified/approved restoration plans under the NCCP/MSAA/HCP and the SAMP.

The remainder of *Chapter 1* provides background information for the Habitat Restoration Plan as it relates the Southern NCCP//MSAA/HCP and SAMP. *Chapter 2* describes the upland component of the HRP and *Chapter 3* describes the aquatic resources restoration component.

SECTION 1.1 BACKGROUND

1.1.1 Relationship to the Southern Subregion NCCP/MSAA/HCP

As noted above, the HRP is a key component of the AMP for the Southern Subregion NCCP/MSAA/HCP HRMP. Implementation of an adaptive management program is one of the three fundamental conservation planning principles set forth under the NCCP Conservation Guidelines (*Appendix D*). As stated in the NCCP Conservation Guidelines "…a status quo strategy of 'benign neglect' management likely will result in substantial further loss of CSS biodiversity…" The Guidelines concluded that habitat reserves…should be managed in ways responsive to new information as it accrues." Although the Conservation Guidelines were directed toward coastal sage scrub (CSS), the same adaptive management principles apply to the diversity of vegetation communities and habitat types in the Habitat Reserve.

a. NCCP/MSAA/HCP Planning Guidelines Restoration Recommendations

The Draft Southern Planning Guidelines set forth in *Section 6.0* a set of restoration recommendations for upland and wetland/riparian habitats in the various sub-basins within the San Juan Creek and San Mateo Creek watersheds.

The upland restoration addressed in *Section 6* of the Draft Southern Planning Guidelines included CSS and valley needlegrass grassland (VGL). Several restoration areas were selected on the basis of their important location and function in the Habitat Reserve. Restoration in these areas would contribute to Habitat Reserve function and would help maintain *net habitat value* on a *long-term basis* for species that receive regulatory coverage under the program (termed "Covered Species"). The selected CSS and VGL restoration areas are show in *Figure 43-M* of the *Part IV, Map Book* and consist of the following:

- CSS restoration in Sulphur Canyon and elsewhere along Chiquadora Ridge in the Gobernadora sub-basin;
- CSS and VGL restoration along Chiquita Ridge in the Chiquita sub-basin;
- VGL restoration in the upper Cristianitos sub-basin and portions of Blind Canyon Mesa in the Gabino and Blind Canyons sub-basin;
- CSS/VGL restoration in upper Gabino Canyon sub-basin; and
- CSS/VGL restoration in the Chiquita Canyon sub-basin.

The Draft Southern Planning Guidelines recommendations for wetland/riparian restoration include both abiotic (geomorphology and hydrology) and biotic (vegetation communities and habitats) components. Abiotic and biotic components must to be addressed together because their functions are closely linked (*e.g.*, excessive fine sediment generation adversely affects downstream habitat of the arroyo toad). Several areas have been identified for restoration based on their impacts on habitat quality and long-term function in the Habitat Reserve. It should be noted that some of the wetland/riparian areas targeted for restoration may not be in the Habitat Reserve *per se*, but may have a downstream habitat impacts that affect the function of the reserve. Areas identified for wetland/riparian restoration consist of the following:

- Gobernadora Creek to address historic meander condition and excessive sediment resulting from upstream land uses;
- Creation of breeding habitats in Gobernadora Creek for tricolored blackbird, least Bell's vireo, southwestern willow flycatcher and other riparian species;
- Upper Gabino Creek to address erosion and excessive sediment generation (this restoration program would occur in combination with upland CSS/VGL restoration);
- Chiquita Creek and upper Cristianitos to address locally-induced headcuts; and

- San Juan Creek and Arroyo Trabuco to address invasive plants and animal species.

Although not specifically part of the aquatic resources restoration plan element discussed here, additional wetland/riparian areas have been identified for enhancement through control of invasive species such as giant reed (*Arundo donax*), tamarisk (*Tamarix* spp.), pampas grass (*Cortaderia selloana*), castor bean (*Ricinus communis*), and tree tobacco (*Nicotiana glauca*). Major targeted areas include San Juan Creek, Arroyo Trabuco Creek and lower Cristianitos Creek. Details of this program are provided in the Invasive Species Control Plan (*Appendix J*).

1.1.2 Relationship to the San Juan Creek Watershed and Western San Mateo Creek Watershed SAMP

The AMP and this HRP are intended to comply with the goals, objectives, and Tenets and Principles of the SAMP. The U.S. Army Corps of Engineers (USACE) has stated the Purpose of the SAMP as follows:

> *The purpose of the effort is to develop and implement a watershed-wide aquatic resource management plan and implementation program (SAMP), which will include preservation, <u>enhancement, and restoration</u> and development within the study area.* (underline added for emphasis)

One of the Objectives of the SAMP pertaining specifically to enhancement and restoration is as follows:

> *Preserve and <u>enhance</u> existing aquatic resources and establish <u>a regional restoration management</u> plan for aquatic resources in the study area, including development of a comprehensive aquatic resource reserve program. The aquatic resource reserve system would accommodate mitigation requirements for contemplated development within the watershed, and other conservation efforts. To the extent feasible, the ultimate goal is to provide for a comprehensive reserve and adaptive management program for both aquatic and upland natural resources.* (underline added for emphasis)

This overall goal and restoration objective are reflected in several of the SAMP Tenets developed by the USACE:

i. No net loss of acreage and functions of waters of the U.S./State
ii. Maintain/restore riparian ecosystem integrity
iv. Maintain/protect/restore riparian corridors
v. Maintain and /or restore floodplain connection
vi. Maintain and/or restore sediment sources and transport equilibrium

For example, restoring historic meander conditions and controlling excessive sediment being generated by upstream development in Gobernadora Creek, in conjunction with restoring riparian habitats in association with the Gobernadora Ecological Restoration Area (GERA), addresses all five of the Tenets expressed above.

The Draft Watershed Planning Principles provide a link between the goals and objectives of the SAMP and the Tenets and Principles. The Draft Watershed Planning Principles provide Planning Recommendations for relevant sub-basins that, in turn, have been translated into the specific restoration actions (including wetland/riparian and upland restoration) described in this plan. The Draft Watershed Planning Principles Recommendations and associated restoration actions are as follows:

- Within the Chiquita sub-basin, address existing areas of channel incision that result from primarily localized processes/land uses, as contrasted with terrace-forming valley-deepening areas that are primarily a result of long-term geologic conditions. Site by site geomorphic analysis would be undertaken to define these areas.
    - This recommendation would be addressed through implementing creek stabilizations at locally-induced headcuts in Chiquita Creek that have been caused by road crossings and other anthropogenic causes.
- Within the Gobernadora sub-basin, protect the valley floor above the knickpoint to provide for creek meandering (as occurred historically) and for restoration of riparian processes and habitat. Floodplain restoration should account for both the existing and potential future sediment regimes and potentially excessive surface and groundwater. The existing channel that has isolated the creek from the floodplain in some areas also should be addressed as part of the restoration effort.
    - These recommendations would be addressed by implementing wetland/riparian restoration in the portion of the Gobernadora Creek below the Ranch boundary with Coto de Caza. Riparian restoration would provide a northward extension of riparian habitats suitable for the least Bell's vireo, southwestern willow flycatcher and other riparian species. Restoration may include construction of a detention/water quality basin below Coto de Caza and also may include creation of breeding habitat for the tricolored blackbird.
- Within the Cristianitos sub-basin, where feasible, protected headwater areas should be targeted for restoration of native vegetation to reduce the generation of fine sediments from the clayey terrains and to promote infiltration, and to enhance the value of upland

habitats adjacent to streams. In addition, stream stabilization opportunities should be examined in Cristianitos Creek (above the confluence with Gabino Creek) in the context of longer-term geological processes.

- o These recommendations would be addressed both by VGL restoration in uplands in upper Cristianitos adjacent to the creek to reduce erosion-generated fine sediments and by stabilizing locally-induced headcuts to the extent feasible (the origin of the headcuts as anthropogenic and/or geologic needs further investigation).

- Within the upper Gabino sub-basin, protect headwaters through restoration of existing gullies, using a combination of slope stabilization, grazing management, and native grasslands and/or scrub restoration. To the extent feasible, restore native grasses to reduce sediment generation and promote infiltration of stormwater.

  - o These recommendations would be addressed by a three-pronged approach: **(1)** restoration of eroded gullies; **(2)** upland CSS/VGL restoration to reduce erosion-generated fine sediments; and **(3)** wetland/riparian restoration. Grazing in upper Gabino is addressed in the Grazing Management Plan (*Appendix G*).

SECTION 1.2 PURPOSE OF THE HABITAT RESTORATION PLAN

The HRP is a key component of the AMP which is designed to fulfill the following purposes of the Southern Subregion NCCP/MSAA/HCP:

1. The HRMP is one of the four programmatic elements of the Conservation Strategy to carry out the Scientific Review Panel (SRP) and NCCP Science Advisors conservation planning principles and tenets of reserve design.

2. The HRMP, and the AMP and HRP components, provide for recovery of listed Covered Species in the Southern Subregion and contribute to recovery of the species rangewide.

3. The HRMP, and the AMP and HRP components, are coordinated and consistent with the SAMP Program.

4. The HRMP and AMP and HRP components are coordinated with the County GPA/Zone Change and other planning programs potentially impacting the planning area.

5. The HRMP and AMP and HRP components are consistent with the comprehensive Water Quality Management Plan (WQMP; *Appendix K*).

CHAPTER 2.0 UPLAND HABITAT RESTORATION PLAN

This Chapter describes the conceptual approach for the restoration of coastal sage scrub (CSS), valley needlegrass grassland (VGL), and mixed CSS/VGL vegetation communities in the Habitat Reserve. The term "restoration" is used very broadly in this conceptual plan. It is intended to cover the spectrum of possible restoration activities within the Habitat Reserve, from creation of new habitats to enhancement of existing degraded habitats through timed grazing, prescribed burning, and other more direct, intensive measures. As a planning area-wide comprehensive program, this section summarizes restoration recommendations for several sub-basins and explains how these recommendations could contribute to a more effective Habitat Reserve and AMP. In addition, this section provides a conceptual approach to site preparation, general plant palettes for revegetation, timed grazing and prescribed burning, short-term, long-term monitoring and maintenance, and reporting of the restoration program. This conceptual upland habitat restoration plan is considered preliminary and will be subject to refinement and modification during the NCCP/MSAA/HCP approval and environmental documentation processes. This section includes the following components of the upland portion of the HRP:

- Definition of Terms
- Habitat Restoration Goals
- Success Criteria
- Preliminary Designation of CSS Restoration Areas
- Preliminary Designation of VGL Restoration Areas
- Preliminary Designation of CSS/VGL Restoration Areas
- Implementation Plan
- Maintenance Plan
- Monitoring Program

SECTION 2.1 DEFINITION OF TERMS

As indicated above, the term "restoration" is used in the broad sense to refer to the spectrum of restoration activities to be conducted in the Habitat Reserve. Where appropriate, several other terms will be used throughout this document to refer to specific kinds of restoration activities. These other terms are defined here.

Passive Restoration: Passive restoration generally refers to removing or controlling disturbance events such as discing that perpetuate non-native or disturbed habitats. Passive restoration may involve some site preparation and maintenance such as weed control, and trash and debris removal, but generally the site would be allowed to revegetate naturally without extensive intervention. Some initial seeding may be used if the natural seed bank onsite is inadequate.

Passive restoration sites would be monitored, and if habitat quality on the site does not appear to be improving by a designated period, active restoration may be applied.

Active Restoration: Active restoration broadly refers to the specific application of restoration techniques. On a large scale (*e.g.*, 10s to 100s of acres), active restoration techniques may include timed-grazing or prescribed burning. On a smaller scale (*e.g.*, a few acres or less), active restoration may include site-intensive techniques such as soil preparation, planting and/or seeding, irrigation, weed control, erosion control, etc. Active restoration implies a higher level of effort than passive restoration and typically is used on sites that would not regenerate naturally, or would only regenerate over an unacceptably long period of time without direct intervention. For example, a mitigation requirement that a site meet certain performance standards such as percent native plant cover or species occupation within five years probably would require active restoration to ensure that the performance standards were met.

Revegetation: Revegetation involves active restoration of a site whereby container plants and/or seeds are used to create or restore habitat. Typically the target native vegetation community is absent from the site; *e.g.*, a site supporting non-native annual grasslands revegetated with VGL. Site preparation and maintenance may include annual grass and weed control, and trash and debris removal. Depending on site conditions, soil remediation and/or irrigation may be necessary to support a viable revegetation site. Generally, revegetation sites would have higher performance standards than passively restored sites and the monitoring and maintenance program is more specific as far as the responsibilities of a project Restoration Ecologist and an Installation/Maintenance Contactor.

Enhancement: Enhancement generally refers to restoration of sites that support degraded forms of the target native vegetation community. The level of effort needed to enhance a site typically is less than revegetating a site because the target native community is already present. A primary enhancement approach in the Habitat Reserve where low quality native habitat is already present would include timed grazing and prescribed burning to control non-native invasive grasses and weeds. Seeding may be used to supplement the existing native vegetation, but planting of container plants and irrigation generally are not used on enhancement sites. Enhancement tends to be more passive, letting nature take its course.

In practice, there often is not a clear distinction between active and passive restoration, revegetation and enhancement because each site has its own distinct requirements for successful restoration. The Restoration Ecologist and Reserve Manager would have the flexibility to implement the appropriate restoration techniques in an adaptive fashion to produce the desired results in the most efficient manner. However, specific performance standards would be set for each restoration site so that success can be objectively measured.

SECTION 2.2 HABITAT RESTORATION GOALS

The goal of this conceptual restoration plan is to provide a framework that would guide the restoration of CSS and VGL vegetation communities that would maintain or enhance biological values (*e.g.*, ecosystem and species) in the Habitat Reserve. The restored vegetation communities should provide habitat values and functions that are equal to, or greater than, that of the vegetation communities prior to development.

The CSS restoration component of this plan primarily is intended to provide habitat within the Habitat Reserve that would be suitable for forage, cover, nesting and dispersal by the California gnatcatcher. The VGL revegetation component of this plan is intended to provide suitable habitat within the Habitat Reserve for VGL plant and animal species, such as the grasshopper sparrow.

Careful site selection is extremely important for the long-term success of a restoration program. Sites that are selected for restoration of CSS and VGL must contribute to the long-term net habitat value of the Habitat Reserve. The preliminary designation of restoration areas, as described below, considered both onsite and adjacent habitat conditions in order to provide the best opportunity for a successful restoration program that contributes to the long-term habitat values and functions of the Habitat Reserve. For example, the proposed CSS restoration areas are sited in locations along Chiquita and Chiquadora ridges that would augment existing high quality CSS that supports a *major population* of the California gnatcatcher. Successful restoration of CSS in these areas would increase the carrying capacity of these areas for the gnatcatcher. Similarly, the proposed VGL restoration areas are sited in locations that currently support low quality VGL or annual grasslands considered restorable to VGL because they are situated on clay soils and adjacent to existing VGL. Areas proposed for CSS/VGL restoration are sited in locations that appear to naturally support a mosaic of CSS and VGL, based on recent observations that grasslands in nearby areas appear to be gradually type-converting to a CSS/VGL mix. Furthermore, mature CSS vegetation is better able to withstand significant pressure from non-native plant species invasion than more uniform grasslands and therefore could provide a natural barrier that would protect VGL habitat, which typically suffers from invasive species dominance. The CSS/VGL matrix increases habitat diversity and value and likely reestablishes the historical condition of these areas. The co-occurrence of CSS and VGL habitats in this manner would increase the likelihood of the persistence of high quality native habitat in the long-term.

2.2.1 Time Lapse

With active restoration, CSS that is suitable cover, foraging, nesting and dispersal habitat for the California gnatcatcher may be achievable in three to five years from the initial installation of

seed and container plants if environmental conditions are consistent with those that are optimal for the vegetation. It is estimated that it would take three to four years for VGL habitat to develop enough structure to provide the functions and values needed for occupation by wildlife species. As CSS or VGL habitat matures, it would become increasingly suitable for a greater variety and higher number of plant and wildlife species.

For both CSS and VGL, the length of time to develop high quality habitat is largely dependent on a variety of factors, including weather, pest herbivory (*e.g.*, pocket gophers, ground squirrels, rabbits), and weed competition. A longer time period may be required when any of the above factors is unusual (*e.g.*, weather) or exceeds what normally occurs (*e.g.*, abnormally high pest levels). As a hedge against drought conditions, the addition of temporary irrigation systems may be needed in some areas to ensure timely seed germination and seedling survival until seedlings have become established and are capable of surviving without supplemental water. The anticipated increase in the survival rate would help the vegetation develop more quickly than would be expected from a non-irrigated revegetation effort.

SECTION 2.3 SUCCESS CRITERIA

The goal of the CSS restoration program is the establishment of self-sustaining habitat that would provide foraging, cover, nesting and dispersal habitat for the California gnatcatcher, as well as other resident sage scrub species. Similarly, the goal of VGL habitat revegetation and enhancement is to provide suitable habitat for various grassland plants, including native needlegrass and annual herbs and wildlife species such as the grasshopper sparrow. Performance criteria have been established to define when the restoration effort is successful and are outlined in *Section 2.3.3*.

2.3.1 Rationale for Expecting Success

Based on current understanding of the preliminary restoration sites (including enhancement and revegetation sites), existing soils within the restoration sites would remain essentially undisturbed from the current condition. Soil texture, slope, and solar aspect are similar to other native vegetation areas in the vicinity. The target vegetation types are modeled after the existing native vegetation types adjacent to each area, *i.e.*, CSS restoration areas are contiguous with existing CSS, etc. Planted species would be located according the micro-climate and topography in which the species commonly occurs. The presence of adjacent existing native vegetation would accelerate the time required for animals to utilize these new biological resources as these sites establish and the vegetation matures.

2.3.2 Target Functions

The primary target function of the restored CSS is habitat that provides cover, foraging, nesting and dispersal habitat for the California gnatcatcher. To achieve the target functions and values of the proposed restoration, the plan would create a diversity of CSS subassociations that are most often used by the California gnatcatcher.

The primary target function of the restored VGL is habitat that includes a diversity of grassland plant species and an environment suitable for colonization by additional native grassland plant (including perennial bunch grasses and annual forbs) and wildlife species. A primary target animal species for restored VGL is the grasshopper sparrow, which prefers grasslands that contain vertical (*e.g.*, perch sites) and horizontal (*e.g.*, openings) structural diversity. Also, the restored VGL would provide foraging habitat for several raptors. Finally, certain areas of VGL would exhibit soil characteristics that are suitable for the introduction of special-status plant species such as thread-leaved brodiaea, many-stemmed dudleya, and intermediate mariposa lily (see Translocation, Propagation and Management Plan for Special-status Plants, *Appendix I*).

The areas proposed for CSS/VGL restoration are located in upper Gabino Canyon and lower Chiquita Canyon (see description below and *Figure 43-M, Part IV, Map Book*). Target wildlife species have not been designated for upper Gabino Canyon because neither the California gnatcatcher or grasshopper sparrow are known to occur in this area nor have these areas been determined to be important for these species. However, it is expected that restoration of CSS/VGL in this area would attract a variety of native wildlife species, and it would not be surprising if the grasshopper sparrow used restored habitat in the future. CSS/VGL restoration in lower Chiquita Canyon would be consistent with the proposed CSS restoration in this area; some areas preliminarily designated as CSS restoration in *Figure 43-M, Part IV, Map Book* may be more suitable for CSS/VGL restoration over the long-term considering that small patches of VGL often occur in small openings in CSS. In any case, both the gnatcatcher and grasshopper sparrow would be target species for CSS/VGL restoration in Chiquita Canyon. It is expected that a variety of raptors would forage in CSS/VGL restoration areas in both upper Gabino and lower Chiquita canyons.

2.3.3 Performance Standards

A key component for evaluating the success of a restoration plan is setting appropriate performance standards. For example, survival of all container plants typically is required at the end of an initial four-month maintenance period. With such a performance standard, if it was determined that plant mortality, erosion problems, or seed germination progress was unacceptable, a replanting program would be initiated within the restoration area at the end of the first summer.

Specific performance standards must be attained within both passive and active restoration areas at the end of each year of the five years following initiation of the restoration effort. For passive restoration of CSS and VGL, the primary focus of the restoration effort is to control the cover of non-native grasses and weeds in the restoration area while native species are naturally reestablishing. *Table 1* shows proposed performance standards for the allowable percent of non-native cover for CSS and VGL. For example, for VGL in year 3 the allowable non-native cover would be up to 60 percent. The proposed CSS performance standards are based on observed performance of other CSS restoration areas in coastal southern California such as the Palos Verdes Peninsula (Dudek, pers. obs.) and Turtle Rock (O'Connnell and Erickson 1998). The proposed VGL performance standards are based on observed cover of VGL on portions of RMV in 1989 by St. John and 2001 by Dudek (see *Figure 13-M, Part IV, Map Book.* St. John mapped some areas in the range of 80-100 percent needlegrass while Dudek mapped areas in the 50 percent range in a drought year.

Within CSS/VGL restoration areas, the non-native cover performance standard would be weighted by the acreage ratio of CSS/VGL. For example, for a 10-acre site with 8 acres of CSS and 2 acres of VGL the Year 1 calculation of percent non-native cover would be as follows:

% non-native cover = (((8 ac CSS x 0.1) + (2 ac VGL x 0.7))/10 ac) x 100 = 22%

Because, by definition, passive restoration allows for the natural regeneration of the native vegetation community, quantitative yearly performance standards for native species cannot be prescribed *a priori* because each likely would regenerate at a different rate.

In contrast to passive restoration, specific performance standards for revegetation of native species can be set for active restoration sites. The long-term performance standards shown in *Table 1* for native vegetation cover, species diversity, the overall survival rate of container plantings, and non-native cover are established to measure the success of the restoration program. For example, the criterion for CSS native vegetation cover in year 4 is 70 percent. Should it be determined that any part of the plantings have failed to meet yearly performance standards, corrective measures would be taken. The corrective measures would be implemented to bring the restoration effort into compliance with the required performance standards as quickly as possible. These corrective measures may include replanting failed areas with container plantings of appropriate species, re-seeding, or adjustments to irrigation and maintenance practices.

For the CSS restoration areas, habitat occupation or utilization by gnatcatchers would likely offset apparent vegetation deficiencies such as cover and diversity in the first three years of monitoring. Multiple years of foraging and nesting by gnatcatchers within restoration areas would satisfy the overall success requirement of the CSS restoration, together with sufficient

conformance to the performance criteria. Likewise, for VGL and CSS/VGL restoration areas, occupation by the grasshopper sparrow would likely satisfy the overall success requirement.

TABLE 1
RECOMMENDED CSS AND VGL HABITAT PERFORMANCE STANDARDS FOR ACTIVE REVEGETATION AREAS

YEAR	% COVER[1]		% DIVERSITY[2]		% SURVIVAL[3]		% N0N-NATIVE COVER[4]	
	CSS	VGL	CSS	VGL	CSS	VGL	CSS	VGL
Year 1	20%	5%	70%	40%	70%	60%	10%	70%
Year 2	30%	15%	70%	40%	80%	80%	10%	70%
Year 3	50%	30%	70%	50%	80%	90%	10%	60%
Year 4	70%	50%	70%	50%	80%	90%	10%	50%
Year 5	80%	80%	70%	60%	80%	90%	10%	50%

[1] % Cover = Percent cover of native species (aggregate of all layers) within the designated area.

[2] % Diversity = Percent of species diversity originally installed that shall be represented. Replacement plantings shall be required if the total number of species lost exceed this percentage.

[3] % Survival = Survival of all container stock and shrub transplants originally planted. This measure may include survival of individual volunteers. Any quantity of dead plants exceeding this percentage shall require replacement plantings, unless the project meets or exceeds the total native cover performance standard.

[4] % Non-native Cover = Maximum % cover of non-native species present during any given year.

SECTION 2.4 PRELIMINARY DESIGNATION OF CSS RESTORATION AREAS

The main goal of the CSS restoration program is to establish CSS in areas that would: **(1)** contribute to the Habitat Reserve by increasing the carrying capacity for the California gnatcatcher and other sage scrub species; and /or **(2)** would contribute to connectivity in certain important locations. With these goals in mind, the following areas have been tentatively identified for CSS restoration. As portrayed in *Figure 43-M, Part IV, Map Book*, these restoration areas total approximately 363 acres. Final selection of these areas for restoration/enhancement would require additional field study to determine the likelihood of a successful restoration program, including factors such as soil conditions and presence of exotic species both within the restoration area and surrounding habitat.

- Sulphur Canyon in the Gobernadora sub-basin was identified for restoration to provide additional habitat and enhance connectivity between Chiquita Canyon and Wagon Wheel

Canyon to the west and Gobernadora and Bell canyons to the east. Sulphur Canyon is currently characterized by CSS on the slopes of the canyon and grazed annual grasses on the valley floor. The Sulphur Canyon restoration area totals approximately 131 acres. An additional 13-acre restoration area lies south of Sulphur Canyon on Chiquadora Ridge. Restoration in this area would help create a continuous band of CSS along the ridgeline.

- Several side canyons between Chiquita Ridge and Chiquita Creek were identified for restoration. Restoration of the two large canyons, totaling about 178 acres, located just northwest and southwest of the "Narrows" would greatly improve the habitat integrity of Chiquita Ridge, which narrows to less than 2,000 feet in width at the top of these side canyons. This restoration area would provide substantial "live-in" habitat for California gnatcatchers and other species, and improve the integrity of the Habitat Reserve along Chiquita Ridge. Two areas totaling about 21 acres each are located along lower Chiquita Ridge. Restoration of these two areas would extend native vegetation to the western edge of Chiquita Creek and provide additional habitat for the gnatcatcher and other resident CSS species.

SECTION 2.5 PRELIMINARY DESIGNATION OF VGL RESTORATION AREAS

The main goal of the VGL restoration program is to restore native grassland and enhance the quality of existing degraded native grassland in the Habitat Reserve such that net habitat value of the existing grassland system is maintained. Restoration of native grassland also would help stabilize areas that currently suffer from erosion such as upper Cristianitos and upper Gabino canyons. Areas identified for VGL restoration includes areas that: **(1)** currently support annual grasses, but have suitable clay soils and are adjacent to existing VGL; **(2)** currently support low quality VGL (*i.e.*, areas with less than 10 percent cover of native grasses); and **(3)** would contribute to an overall native grasslands ecosystem (*i.e.*, small, isolated patches of native grasslands would not be considered valuable to the Habitat Reserve). Because establishing a functioning native grassland system is a goal of the restoration program, impacts to native grasslands in a particular sub-basin may be mitigated in another sub-basin to achieve greater value for the overall Habitat Reserve. As show in *Figure 43-M, Part IV, Map Book*, upper Cristianitos, portions of Blind Canyon mesa, and lower Chiquita Ridge totaling approximately 200 acres are recommended for VGL restoration.

- Upper Cristianitos is recommended for VGL revegetation and enhancement because of adjacent existing VGL and to reduce the generation of fine sediments from clayey terrains, promote stormwater infiltration and to enhance the value of upland habitats adjacent to Cristianitos Creek. This area includes patches of annual grassland underlain by clay soils suitable for revegetation and low quality VGL suitable for enhancement. These recommended revegetation and enhancement areas also are contiguous with

existing medium quality grassland, suggesting a high likelihood of successful restoration. The revegetation and enhancement areas in upper Cristianitos total approximately 127 acres.

- Portions of Blind Canyon mesa totaling approximately 45 acres are recommended for grassland revegetation and enhancement. This area has at least one patch of annual grassland suitable for revegetation and possibly two patches of low quality VGL suitable for enhancement. These areas are adjacent to existing medium quality VGL, suggesting a high likelihood of successful restoration. Additional fieldwork in the area may reveal additional restoration opportunities. Also, depending on the siting of the Planning Area (PA) development area, some targeted areas may not be available for restoration.

- Three relatively small patches of potential VGL revegetation totaling approximately 28 acres were identified in the southern portion of Chiquita Ridge. These areas currently support annual grassland but are located in an area supporting a mosaic of medium quality VGL and CSS, indicating a high likelihood of successful revegetation.

SECTION 2.6 PRELIMINARY DESIGNATION OF CSS/VGL RESTORATION AREAS

Areas proposed for CSS/VGL restoration are sited in locations adjacent to areas that may naturally support a mosaic of CSS and VGL *Figure 43-M, Part IV, Map Book*). A comparison of recent aerial photos (Year 2000) with the NCCP vegetation map and site-specific native grassland mapping by Dudek in 2001 indicates that some areas of upper Gabino Canyon mapped in the early 1990's as grassland appear to be type-converting to a CSS/VGL mix (see *Figure 13-M, Part IV, Map Book*. This type conversion may be a result of the natural drought-wet cycle and the current mosaic of CSS and VGL in this area may reflect natural successional processes. CSS/VGL mosaics provide important biological and structural diversity and valuable habitat for a variety of plant and wildlife species.

The following areas are recommended for CSS/VGL restoration: upper Gabino Canyon; and in the Chiquita sub-basin in the area east of the Santa Margarita Water District wastewater treatment plant, the citrus groves west of Chiquita Creek and the disced areas west of the creek to the Chiquita ridgeline.

- Upper Gabino Canyon suffers from moderate to severe erosion and currently generates fine sediment due to extensive gully formation in the headwaters area. A combination of slope stabilization, grazing management and CSS/VGL restoration would reduce sediment generation and promote infiltration of stormwater which would reduce downstream impacts. This area has been identified for CSS/VGL restoration because

some areas mapped as grassland in 1990 have since naturally revegetated with sparse CSS. Allowing a mixed community to regenerate may thus represent a more natural climax situation. This area has at least one area of annual grassland adjacent to the creek suitable for revegetation and several patches of low quality VGL suitable for enhancement. The revegetation area totals about 13 acres and the enhancement areas total about 87 acres.

- As discussed above for CSS, restoration of disturbed areas of Chiquita Canyon west of Chiquita Creek would provide additional habitat for upland species occupying Chiquita Ridge, and particularly the gnatcatcher. Restoration of areas previously used for agricultural purposes, including grazing and citrus, would also benefit riparian species by removing uses that may contribute to downstream impacts. Additional field work, including an analysis of soils, would be needed to identify the areas best revegetated with CSS alone or CSS/VGL.

SECTION 2.7 IMPLEMENTATION PLAN

Implementation of the upland habitat restoration plan would be comprised of several steps, including:

1. Assessment of the sites to determine the most effective restoration approach; *i.e.*, passive restoration or active restoration, revegetation, or enhancement.
2. Determination of the appropriate restoration treatment.
3. Appropriate planting techniques.
4. Weed control
5. Erosion control

2.7.1 Site Assessment

A Restoration Ecologist would inspect each of the designated restoration sites and prepare a detailed restoration plan for each of the sites. A key initial determination would be whether the site can be passively restored or whether it would require active restoration (*i.e.*, timed grazing, prescribed burning, planting, irrigation, etc.).

a. Passive Restoration

Passive restoration would receive first priority and primarily would involve removal or control of disturbance factors that perpetuate the non-native characteristics of the site (*e.g.*, discing, over-grazing, non-native grasses and weeds). Depending on existing site conditions, passive restoration may involve active site preparation and treatment such as weed control (as described

below). The key concept of passive restoration is that the native habitat would naturally reestablish if disturbance factors are kept in check. For passive restoration to be effective, the site likely would need to be relatively small and mostly bounded by native vegetation (to facilitate colonization by native species) and/or have an adequate seed bank to support the growth of native species.

b. Active Restoration

Active restoration would be implemented if passive restoration is considered to be inappropriate for the site; *i.e.*, the native vegetation community is unlikely to naturally reestablish itself because of its large size, lack of immediately adjacent native habitat, and/or lack of a native seed bank. The key difference between passive and active restoration is that focused restoration activities would be implemented. Active restoration can take the form of enhancement or revegetation, as defined in *Section 2.1*. The two primary approaches to enhancement of large areas (*i.e.*, 10s to 100s of acres) would be timed grazing and prescribed burning. For smaller areas, or where timed grazing or prescribed burning is not practical, enhancement actions may include mowing, selective use of herbicides, and pulling of weeds. On active revegetation sites native species would be planted through container stock and/or by seeding and closely monitored and maintained until success criteria are achieved.

2.7.2 Restoration Treatments

a. Site Preparation

Whether the restoration effort is passive or active, proper site preparation is critical to successful habitat restoration. Site preparation would include the removal of weeds and debris such as scattered rocks and concrete that may interfere with restoration efforts. Initial weed eradication would be concentrated on removing standing biomass from the sites.

For both passive and active restoration sites, initial weed control efforts may involve a variety of treatments, including timed grazing, prescribed burning and chemical and mechanical (*e.g.*, mowing, weed whacking, hand-pulling) treatments of non-native grasses and other exotic invasive species such as artichoke thistle (*Cynara cardunculus*), sweet fennel (*Foeniculum vulgare*) and mustard (*Brassica* spp.). Depending on the site, one or a combination of these treatments would be used. For example, chemical treatment of artichoke thistle on the Ranch has proven to be effective for this species, which is highly resistant to other forms of control such as grazing. Repetitive treatments are desirable over a prolonged period to effectively reduce the weed seed bank that is present in the soil. This process is anticipated to require one year to reduce the seed bank to the greatest extent possible within that time period. A “grow and kill” procedure involving site irrigation to promote weed seed germination followed by herbicide

treatment to kill weed seedlings would be conducted where appropriate. Additional cycles of irrigation and herbicide treatment may be required in these areas.

b. Goats

Goats could be used on an "as-needed" basis in the spring to control weeds in native grasslands. As browsers, goats forage on leaves, flower buds and fibrous materials of noxious weeds that cattle may ignore. Removal of the leaves inhibits critical functions such as photosynthesis, transpiration and respiration. Goats tend to leave plant stems (as opposed to mowing and herbicides) and thus the plant is inhibited from sending out more roots and shoots. Removal of flower buds inhibits reproduction. Thus goats provide a biological control alternative to herbicides and more labor-intense hand-pulling.

c. Timed Cattle Grazing

Cattle grazing will be conducted in the Habitat Reserve as described in the Grazing Management Plan (GMP; *Appendix G*). Although the GMP is a "coordinated management plan" and not a formal element of the AMP, appropriately-timed grazing can help maintain and enhance native grasslands. The reader is directed to the GMP for a discussion of the relationship between cattle grazing and the maintenance/enhancement of native grassland.

d. Prescribed Burning

Prescribed burning could be used to enhance both CSS and VGL where appropriate. It is envisioned that any prescribed burning primarily would be used in the San Mateo Watershed portion of the Habitat Reserve where there are fewer constraints on its use (*e.g.*, risks to property, public opposition, etc.).

It is generally believed that CSS is adapted to a fire regime, although the nature of this adaptation is not completely understood. High fire frequencies may be detrimental to the floristic composition and structure of CSS (Malanson and O'Leary 1982). Alternatively, too long of fire intervals may result in senescence and reduced productivity. However, the CSS in lower and middle Chiquita Canyon south of Oso Parkway has not burned since the 1950's and this area supports the highest densities of California gnatcatchers in the subregion. A potential confounding factor is that this area has been consistently grazed, which suggests that in the absence of fire grazing may be a positive contributing factor to the productivity of the area for the gnatcatcher by helping to maintain the appropriate habitat structure and control the proliferation of invasive species. As noted above in the discussion of grazing, the use of grazing as an enhancement/management tool in the Habitat Reserve needs to be tested.

Prescribed burning is anticipated to be used in the San Mateo Watershed in the following areas:

- Upper Gabino Canyon CSS/VGL enhancement areas
- Upper Cristianitos VGL enhancement areas
- Blind Canyon enhancement areas, as appropriate and feasible

Following Menke's (1996) recommendation, prescribed burning would be used a secondary component of enhancement, with grazing as the primary component, but only as provided for in the GMP. While fire has a beneficial effect in reducing litter, thatch and alien species, frequent burning can damage native grasses. Menke recommends burning only every third or fourth year.

The Wildland Fire Management Plan (*Appendix N*) provides more detail on the use of prescribed burning for the enhancement and management of VGL and CSS.

e. Revegetation

In smaller areas that require intensive revegetation of CSS, VGL and CSS/VGL, restoration would be achieved through a process involving site preparation, installation of temporary irrigation (where necessary), selective container plant installation, and seed installation throughout all active restoration areas. Container plants would be installed in all CSS and VGL revegetation areas. Native grass container plants would be salvaged from development sites or from nursery grown stock.

Enhancement for VGL and CSS/VGL would primarily involve long term control of annual grasses and exotic species that now coexist with native grassland species. Selected enhancement areas have been identified in previously mapped VGL habitat where non-native species are dominant. These areas would receive native grass plants that are salvaged from development areas, where possible and practical, and the grassland seed mix.

The following sections describe the revegetation treatments that would be used for each vegetation type. Long-term maintenance is described in *Section 2.8* and would begin after the mitigation installation work receives final approval and acceptance.

1. CSS Revegetation

The revegetation treatment for CSS would rely upon the use of container plants and a native seed mix to reintroduce CSS species to the revegetation sites. Container plant installation would be an important component of the revegetation treatment at these sites to facilitate more rapid plant establishment and area coverage, particularly on the steeper slopes. Species with seed that is not readily available or that do not readily germinate would be introduced using nursery-grown

container plants. Container plants would be inoculated with appropriate mycorrhizae by the nursery staff to promote more healthy, vigorous growth. Most native CSS species that are installed from nursery containers are capable of seed production within the first year after installation. This on-site seed production is an important part of the revegetation process.

Native seed would originate from local sources in Southern California to the greatest extent feasible. The seed mix would contain appropriate mycorrhizae to help promote healthy, vigorous plant growth. Common CSS species such as California sagebrush (Artemisia californica), California bush sunflower (*Encelia californica*), orange bush monkey-flower (*Mimulus aurantiacus*), coastal goldenbush (*Isocoma menziesii*), white sage (*Salvia apiana*), California buckwheat (*Eriogonum fasciculatum*), and native bunchgrass (*Nassella* spp.) would be included in the seed mix.

Revegetation would consist of a native seed mix and container plants of coastal sage scrub species. The seed mix also would contain nurse crop species that would provide initial soil surface stabilization. Although each site would need to be evaluated for the most appropriate species, a sample plant palette for the revegetation areas based on typical CSS stands in the Southern NCCP/MSAA/HCP planning area is provided in *Tables 2* and *3*.

TABLE 2
CONCEPTUAL CSS RESTORATION CONTAINER PLANT PALETTE[1]

Botanical Name	Common Name	Size	Typical Spacing (in feet)
Artemisia californica	California sagebrush	1 gal.	4
Baccharis pilularis	Coyote bush	1 gal.	6
Bothriochloa barbinodis	Beard-grass	1 gal	20
Encelia californica	California bush sunflower	1 gal.	4
Eriogonum fasciculatum	California buckwheat	1 gal.	5
Galium angustifolium	Narrow-leaved bedstraw	1 gal.	20
Heteromeles arbutifolia	Toyon	1 gal.	12
Isocoma menziesii	Coastal goldenbush	1 gal.	4
Isomeris arborea	Bladderpod	1 gal.	6
Keckiella cordifolia	Heart-leaved penstemon	1 gal.	12
Leymus condensatus	Giant wild rye	1 gal.	5
Malosma laurina	Laurel sumac	1 gal.	12
Marah macrocarpus	Manroot	1 gal.	6
Melica imperfecta	Coast range melic	1 gal.	?
Mimulus aurantiacus	Orange bush monkey-flower	1 gal.	6
Mirabilis californica	Coastal wishbone plant	1 gal.	6
Nassella lepida	Foothill needlegrass	1 gal.	?
Opuntia littoralis	Coastal prickly pear	1 gal.	6

TABLE 2
CONCEPTUAL CSS RESTORATION CONTAINER PLANT PALETTE[1]

Botanical Name	Common Name	Size	Typical Spacing (in feet)
Opuntia prolifera	Coast cholla	1 gal.	6
Rhus integrifolia	Lemonadeberry	1 gal.	12
Salvia apiana	White sage	1 gal.	4
Sambucus mexicana	Mexican elderberry	1 gal.	12

[1] The plant palette for any given revegetation site would be site-specific to reflect the species composition of the native vegetation in the vicinity and other site conditions such as slope, aspect and soil conditions.

TABLE 3
CONCEPTUAL CSS REVEGETATION SEED MIX

Botanical Name	Common Name	%P/%G[1]	Lbs/Ac
Ambrosia psilostachya	Western ragweed	20/30	1.0
Artemisia californica	California sagebrush	15/50	6.0
Deinandra fasciculata	Fascicled tarweed	10/25	1.0
Dichelostemma capitatum	Blue dicks	95/50	0.5
Encelia californica	California bush sunflower	40/60	6.0
Eriogonum fasciculatum	California buckwheat	10/65	20
Galium angustifolium	Narrow-leaved bedstraw	80/30	1.0
Gnaphalium californicum	California everlasting	10/25	0.5
Gnaphalium canescens	Felty everlasting	10/25	0.5
Isocoma menziesii	Coastal goldenbush	30/30	6.0
Lotus scoparius	Deerweed	90/60	1.0
Lupinus bicolor	Miniature lupine	98/80	2.0
Lupinus succulentus	Arroyo lupine	95/85	6.0
Melica imperfecta	Coast range melic	90/60	1.0
Mimulus aurantiacus	Orange bush monkey-flower	2/60	1.0
Nassella lepida	Foothill needlegrass	60/60	1.5
Nassella pulchra	Purple needlegrass	70/60	3.0
Salvia apiana	White sage	70/30	8.0

[1] %P = seed purity or the amount of seed vs. other non-seed material such as stems, leaves, chaff, anthers , etc. %G = percent viable seed. These two measures are used as minimum standards for seed. Together they define the amount of Pure Live Seed (%PLS) in each pound of seed. Seed is tested for these standards because it can have a significant effect on the vegetation coverage that would result from putting down a pound of seed with a high PLS vs. a low PLS.

2. VGL Revegetation and Enhancement

Revegetation and enhancement of VGL would require a variety of treatments that would vary depending on the site location and feasibility. Where timed grazing and prescribed burning are not appropriate, treatments would consist of container plant installations, native bunchgrass salvaged plant transplantations (where practical), and seeding. In areas where a CSS/VGL plant species matrix is appropriate, the CSS plant palette would supplement the VGL plant palette. A list of proposed VGL plant and seed species is provided in *Tables 4* and *5*.

TABLE 4
CONCEPTUAL VGL REVEGETATION AND ENHANCEMENT CONTAINER PLANT PALETTE

Botanical Name	Common Name	Size	Typical Spacing (in feet)
Artemisia californica	California sagebrush	1 gal.	4
Ericameria palmeri var. pachylepsis	grassland goldenbush	1 gal.	20
Eriogonum fasciculatum	California buckwheat	1 gal.	20
Isocoma menziesii	coast goldenbush	1 gal.	20
Leymus condensatus	giant wild rye	1 gal.	5
Nassella lepida	foothill stipa	1 gal.[1]	3
Nassella pulchra	Purple needlegrass	1 gal.[1]	3

[1] Use 1-gallon containers for salvaged plants and C-10 leach tube (1 5/8"x8 1/4") for nursery grown plants. Nursery plants would be used only to supplement quantities of salvage plants to achieve the total quantity.

TABLE 5
CONCEPTUAL VGL REVEGETATION AND ENHANCEMENT SEED MIX

Botanical Name	Common Name	%P/%G[1]	Lbs/Ac
Agrostis diegoensis (?)	Leafy bentgrass	90/80	1.0
Aristida ternipes var. hamulosa	Hook three-awn grass	?90/70	1.0
Bloomeria crocea var. crocea	Common golden star	90/60	3.0
Calochortus splendens	lilac mariposa	90/80	2.0
Castilleja exserta	Common owl's-clover	50/50	2.0
Dichelostemma capitatum	blue dicks	90/80	1.0
Eschscholzia californica	California poppy	90/80	2.0
Deinandra fasciculata	Fascicled tarweed	20/80	0.5
Deinandra paniculata	paniculate tarweed	20/80	0.5
Lasthenia californica	coast goldfields	50/60	1.0
Lupinus bicolor	Lindley's annual lupine	98/85	4.0
Melica imperfecta	California melic	80/60	2.0

TABLE 5
CONCEPTUAL VGL REVEGETATION AND ENHANCEMENT SEED MIX

Botanical Name	Common Name	%P/%G[1]	Lbs/Ac
Nassella lepida	foothill stipa	90/60	6.0
Nassella pulchra	purple needlegrass	90/80	6.0
Osmadenia tenella	rosin-weed	unknown	0.5
Plantago erecta	California plantain	90/80	3.0
Sisyrinchium bellum	blue-eyed grass	95/75	1.0

[1] %P = seed purity or the amount of seed vs. other non-seed material such as stems, leaves, chaff, anthers , etc. %G = percent viable seed. These two measures are used as minimum standards for seed. Together they define the amount of Pure Live Seed (%PLS) in each pound of seed. Seed is tested for these standards because it can have a significant effect on the vegetation coverage that would result from putting down a pound of seed with a high PLS vs. a low PLS.

Treatments for the enhancement areas would rely heavily on weed removal and replacement by salvaged plants from within developed areas. Native bunchgrass plants within the limits of grading would be salvaged prior to grading and relocated in the VGL enhancement areas to the extent feasible. If feasible, depending on the progress of site preparation activities, plants shall be removed and immediately relocated to a receptor hole in the enhancement area. Otherwise, salvaged plants would be potted and stored until the following fall when the receiving site is ready. A receptor hole shall be dug in the enhancement areas to the same depth and twice the width of the salvaged bunchgrass. The salvaged bunchgrass shall then be planted according to the techniques described in *Section 2.7.3*. If it is determined that plant salvage is not feasible, container plants would be substituted.

2.7.3 Planting Techniques

All container plants and salvaged plants shall be installed using industry standard techniques. A hole twice the diameter of the rootball would be excavated to the depth of the rootball. Each hole would be filled with water and allowed to drain prior to plant installation. Each container plant rootball shall be scarified prior to installation if dead roots occur on the surface of the rootball. Salvaged plant rootballs do not need scarification. Planting backfill shall be native soil.

CSS species would receive a 2-inch thick layer of bark mulch 18 inches out from the base of each plant to reduce weed growth and water evaporation. After installation, each plant shall be irrigated to the depth of the rootball.

2.7.4 Seed Application

A two-step hydroseed technique would be used to install all seed mixes. This technique involves an initial application of a hydroseed slurry composed of water, seed, fertilizer (if any), and a low

volume of fiber mulch. The second hydroseed slurry application contains water and a heavier volume of fiber mulch. The purpose of the two-step process is to achieve the greatest seed-soil contact. In any cases where seed applications are within small in-fill enhancement areas, installation would be performed using hand broadcast methods.

2.7.5 Irrigation System & Schedule

Where needed, temporary on-grade irrigation systems would be installed to enhance germination and establishment of native seedlings. The systems would be controlled automatically by irrigation clocks, and may be designed to shut off during rains events. Areas of similar topography may be controlled by a single remote control valve. The precipitation rate of the system would be approximately 0.2 inch per hour for any given area of the system.

The frequency and duration of irrigation are critical to seed germination and establishment. The application of water shall be keyed to existing conditions and water requirements of each stage of seed germination and seedling establishment. Irrigation shall be used to maximize container plant survival and deep root growth while minimizing non-native species growth and seed production. During September and October of each year, the plants should show signs of water stress and dormancy; a condition that is typical for CSS and VGL species during the fall season.

The sites shall be reviewed by onsite personnel regularly for appropriate soil moisture. Visibly moist, but not saturated, soil in the top 3-4 inches is the desired condition during seed germination and seedling establishment. As the winter season progresses, soil moisture would naturally penetrate to deeper soil horizons. As seedlings reach 3-4 inches in height, irrigation frequency should be reduced to weekly, biweekly, and monthly intervals.

During each inspection, holes shall be dug with a hand shovel or using a soil probe to determine the depth and amount of soil moisture. Enough holes shall be dug to establish a representative sample of the site, *i.e.*, until soil conditions are the same in more than three holes dug across the site. The irrigation schedule shall be modified as necessary based on this inspection. Irrigation heads shall be adjusted or capped where wet areas occur next to dry areas to facilitate additional irrigation of the drier areas.

Irrigation system operation shall be suspended in anticipation of rain events. The system shall be shut-off at a master control valve three to five days prior to a predicted rain storm or series of storms. System operation shall be resumed immediately if a predicted storm does not materialize and if the site requires supplemental irrigation to maintain soil moisture conditions that are sufficient for seed germination and seedling establishment. System operation shall be resumed after a rain event upon a site inspection to determine soil moisture levels.

2.7.6 Weed Control

In restoration areas where a considerable weed seed bank has built up in the soil, weed control activities would be performed for the first year prior to container plant and seed installation. Weed abatement is most effective when time is given to repeated treatment of resprouting weeds. This is especially true for persistent weeds such as artichoke thistle, black mustard, sweet fennel (*Foeniculum vulgare*), smooth cat's-ear (*Hypochoeris glabra*), tocalote (*Centaurea melitensis*), wild radish (*Raphanus sativus*), Crete hedypnois (*Hedypnois cretica*), Italian thistle (*Carduus pycnocephalus*), bull-thistle (*Cirsium vulgare*), milk-thistle (*Silybum marianum*), and annual grasses. Early treatment and regular follow-up treatment of these species would reduce the weed density in the restoration areas over the long-term. Herbicide treatment of non-native grasses and follow-up treatment to reduce seed production would be essential for establishing native vegetation cover.

2.7.7 Erosion Control

Where needed, rice straw wattles would be installed on the slopes and a silt fence at the bottom of the slopes as erosion control devices. The location of these applications would be determined by the Restoration Ecologist. Soil stability would be inspected by the Restoration Ecologist during the rainy season to establish any further erosion control applications that might be necessary.

SECTION 2.8 MAINTENANCE AND MONITORING PLAN

Maintenance and monitoring activities that are necessary to maximize the likelihood of successful revegetation and enhancement would be conducted according to this plan. The Maintenance and Monitoring Plan provides direction to the Restoration Ecologist, Reserve Manager, and the Installation/Maintenance Contractor for routine maintenance of the restoration projects to be conducted throughout the initial plant establishment period and five-year monitoring period. This section is intended to provide a brief description of those activities.

2.8.1 Maintenance Activities

Maintenance activities shall apply to all areas of revegetation and enhancement. Immediately following implementation of the restoration program, a maintenance program would be initiated to ensure successful germination and growth of the installed native species.

Because mature CSS effectively controls non-native species, restored CSS and CSS/VGL areas likely would become self-sustaining over time, needing very little or no maintenance once

established. Maintenance activities for CSS and CSS/VGL would thus focus on maximizing the likelihood of the establishment of self-sustaining habitat during the five-year maintenance period. Maintenance activities shall include weed control, supplemental irrigation (as appropriate), pest control (as appropriate), and site access restrictions.

Restored VGL likely would require additional maintenance to reduce the buildup of non-native biomass. Native perennial grasses benefit from biomass reduction because it removes thatching that begins to crowd out new growth. Historically grasslands were grazed to prevent this and consequently, grasses have adapted to this condition. Depending on the restoration site, the grass thatch that is built up should be removed periodically. In the first few years of revegetation sites, mowing and/or with hand tools such as rakes and weed whip machines should be used. Once native grasses are well established timed grazing and prescribed burning can be used for long-term management. Biomass reduction for VGL restoration areas should begin in the summer or fall after two years of active growth, and continue annually. A determination of which method would be most effective and feasible would be made by the Restoration Ecologist and the Reserve Manager.

2.8.2 Four-Month Maintenance and Monitoring Period

During the four-month period following completion of restoration activities, weed control measures, irrigation schedules, and special management needs would be determined. A replanting program would be initiated at the completion of the four-month maintenance period if 100 percent container plant survival is not attained. The plant establishment period shall be included in the installation contract to be performed by the Installation/Maintenance Contractor. Successful completion of the contract shall include 100 percent survival of all container plants at the end of the plant establishment period. New replacement plants shall be provided and installed for the Installation/Maintenance Contractor to obtain final contract sign-off and payment.

2.8.3 Five-Year Maintenance and Monitoring Program

Following the four-month maintenance period, a long-term five-year maintenance program would be initiated. Long-term maintenance would be initiated following the end of the plant establishment period. Maintenance shall occur on an as-needed basis throughout the five-year maintenance period. Maintenance personnel are expected to conduct maintenance activities on a timely basis by conducting work at a frequency and intensity that would result in the greatest potential for native vegetation to establish and become the dominant vegetation type within the restoration area. If necessary, corrective measures (such as re-seeding or container planting) would be promptly implemented to bring the restoration effort into compliance with the performance standards shown in *Table 1*.

Supplemental irrigation of restoration sites would be conducted only when determined to be necessary by the Restoration Ecologist. Irrigation schedules would provide adequate water to maximize the survival of installed container plants and seedling establishment without creating conditions that promote non-native species that are dependent upon constant moist soil conditions.

Irrigation of the restoration sites would be closely monitored, and if necessary, the irrigation schedule and rates for each area would be modified to provide moisture and ensure successful germination and growth. The Restoration Ecologist would determine the need for changes in irrigation schedules in consultation with the Installation/Maintenance Contractor. An accurate record of these activities would be maintained by the Installation/Maintenance Contractor.

2.8.4 Weed Control

It shall be the Installation/Maintenance Contractor's responsibility to control weeds within the restoration areas. Before initiating any weed control measures, the Installation/Maintenance Contractor would meet onsite with the Restoration Ecologist and Reserve Manager to determine the extent and methods of weed control. The Installation/Maintenance Contractor would notify the Reserve Manager at least three days prior to implementing approved weed control measures. Weed control would be conducted in all active restoration areas for the duration of the five-year maintenance period. As outlined in *Section 2.3.3* and *Table 1* no more than 10 percent non-native cover in any given year during the five-year maintenance period would be tolerated within CSS restoration areas. In VGL restoration areas the percent of non-native cover ranges from 70 percent in Year 1 to 50 percent in Year 5. In CSS/VGL restoration areas the allowable percent non-native cover is a function of the ratio of CSS to VGL in the restoration area, as described in *Section 2.3.3*.

During the five-year maintenance program, non-native grasses shall be removed with hand tools, by hand, or treated with a monocot-specific herbicide. Hand tools such as "weed whips" shall be used only where solid patches of non-native grasses are present and in the absence of native seedlings. Hand removal shall be used where native shrub seedlings are present. Chemical treatment shall be limited to large areas of non-native grass with no native species present. Target non-native grass species include Italian ryegrass (*Lolium multiflorum*), wild oat (*Avena* spp.), Bermuda grass (*Cynodon dactylon*), brome grasses (*Bromus* spp.), and any future infestations of veldt grass (*Ehrharta calycina*), which is expanding into Orange County. After the five-year maintenance program, or sooner if deemed appropriate by the restoration ecologist, prescribed burning may used for long-term weed control, as described in the Wildland Fire Management Plan (*Appendix N*).

Herbicide treatments would be used on non-native weedy forbs such as smooth cat's-ear, tocalote, Crete hedypnois, Italian thistle, bull-thistle, milk-thistle, Carolina geranium (*Geranium carolinianum*), scarlet pimpernel (*Anagallis arvensis*), red-stemmed filaree (*Erodium cicutarium*), white-stemmed filaree (*E. moschatum*), and broad-lobed filaree (*E. botrys*).

Species such as black mustard (*Brassica nigra*), wild radish (*Raphanus sativus*), etc. that can be successfully removed by hand shall be hand-pulled once individuals reach approximately 12 inches of height. Artichoke thistle, sweet fennel and other weeds that cannot be successfully removed by hand, shall be spot-sprayed with a broadleaf herbicide. Weeding should focus on the elimination of weed seed production and weed plant removal. All weeds shall be disposed of off-site at an approved disposal location.

The prime period for weed removal is in the spring during the months of March and April. Weed eradication at this time is ideal because soils are typically still moist enough for hand-pulling and therefore can be removed before their detrimental effects of robbing native plants of sunlight, moisture, and nutrients occur. Additionally, it is imperative that weeds are removed before they can successfully produce seeds and contribute to the weed seed bank. If weeds are not controlled during this period of time, successful establishment of CSS species or VGL species would be prolonged or reduced.

This ideal weeding period happens to coincide with the California gnatcatcher breeding season (February 15 - July 30). Therefore, in the event that a gnatcatcher or multiple gnatcatchers inhabit a restoration site, special arrangements for weed removal would be made. Those arrangements would include: **(1)** The presence of a wildlife biologist during the weed removal event and the establishment of flagging to determine the allowable proximity of weeding activities to the gnatcatchers, and especially nest sites; **(2)** Hand weeding only would be allowed within the area designated by the wildlife biologist; and **(3)** Restrict weeding to no more than four hours between 11:00 am and 5:00 pm to allow for sufficient foraging time. Weed removal activities would be discontinued if the wildlife biologist notes any obvious gnatcatcher distress.

Although the welfare of the gnatcatchers is paramount, it is critical that successful weed eradication take place during the spring to ensure establishment of quality CSS habitat. Mature CSS habitat has the capacity to withstand invasive weed species. Therefore, careful attention to the exclusion of weedy invasive species during the maturation of CSS species is key to the long-term success of the restoration program.

2.8.5 Clearing and Trash Removal

Pruning or clearing of native revegetation plantings would be prohibited. The revegetation areas would be allowed to develop naturally. Plant debris of native shrubs would not be removed from

the restoration sites. Native plant debris provides valuable micro-habitats for invertebrates, reptiles, small mammals, and birds; all necessary elements of normally functioning CSS and VGL communities. The decomposition of the plant debris also is essential for the replenishment of the soil's nutrients and minerals.

Trash shall be regularly removed from restoration areas by hand and appropriately disposed of offsite. Such trash shall be removed as needed, but at no less than at 1-month intervals for the first year, and quarterly thereafter.

2.8.6 Pest Control

Pests, including insects, mites, snails, rabbits, and rodents, are expected to occur within the restoration areas. In accordance with an Integrated Pest Management Program, active control of pests with the use of chemical pesticides would be avoided in favor of allowing natural environmental controls to take effect or the use of directed controls (*e.g.*, trapping). If destruction of the habitat plantings by pests becomes a problem, the Installation/Maintenance Contractor would consult with the Reserve Manager and the Restoration Ecologist to determine remedial measures to be taken.

SECTION 2.9 MONITORING PROGRAM

Monitoring of the restoration areas shall be accomplished by the Restoration Ecologist, under direction of the Reserve Manager. Restoration efforts would be considered successful when the performance standards stated in *Section 2.3.3* and *Table 2* for the specific vegetation type have been met. At that point, the restoration project would be considered to be established. Vegetation monitoring would continue to the end of the full five-year monitoring period. Vegetation monitoring would consist of qualitative and quantitative data collection and analysis. The results of these surveys would be recorded and included in annual reports submitted to the Reserve Manager for incorporation into the overall Habitat Reserve report (see *Part I, Chapter 7, Section 7.3.8*).

2.9.1 Monitoring Period for Project Success

Qualitative surveys consisting of a site walkover and characterization of the restoration sites would be conducted. For active restoration sites, the Installation/Maintenance Contractor shall be present during qualitative surveys to review maintenance activities and requirements.

Quantitative surveys would involve the collection and analysis of transect data to describe the vegetation structure, identify trends in habitat development, and identify existing and potential problems that could negatively affect project success.

2.9.2 Qualitative Data Collection Methods

After the initial planting effort has been completed in a revegetation or enhancement area, the area would be monitored every two weeks for the initial four-month period, quarterly through the end of year 2, and semi-annually for years 3-5. For passive restoration sites, the areas would be monitored quarterly through the end of year 2, and semi-annually for years 3-5. Qualitative surveys would be conducted by the Restoration Ecologist and consist of a general site walkover and a characterization of the revegetation planting on active restoration sites. General observations, such as health of planted species, signs of over watering, and drought stress would be noted. Revegetation plantings would be examined to visually estimate percentage of cover, species mortality, species composition, seedling recruitment, and soil, weed, and pest problems. Maintenance needs would be recorded and submitted by the Restoration Ecologist to the Reserve Manager and Installation/Maintenance Contractor for appropriate action subsequent to each survey.

The irrigation system would be tested regularly by the Installation/Maintenance Contractor during the irrigation season to ensure that it is functioning properly. Maintenance needs would be recorded and submitted to the Restoration Ecologist and Reserve Manager for appropriate action.

2.9.3 Quantitative Data Collection Methods

To augment qualitative survey data, more precise data would be collected and analyzed by the Restoration Ecologist to document and evaluate the progress of the restoration program toward meeting habitat goals. Immediately following project initiation (*i.e.*, site preparation for passive and active restoration sites and installation on active sites), permanent sampling locations would be established within the restoration areas, marked and recorded on maps. These sampling stations would be surveyed two times per year to determine germination and transplant success, species mortality, pest problems, percentage of relative cover, and species composition. The frequency of data collection may be reduced to one time per year at the discretion of the Restoration Ecologist and Reserve Manager. Consistent sampling techniques would be used throughout the monitoring process to ensure accuracy in comparative analysis.

Quantitative plant distribution data would be collected from sampling locations (transect lines for CSS and CSS/VGL and quadrats for VGL) to compare the restored vegetation with the habitat characteristics of comparable existing CSS and VGL vegetation in the general project area. All

transects would be 25 meters long and would be established randomly within the revegetation areas. The number and locations of transect lines and quadrats within a restoration area would be determined at the time of project installation, but would be adequate to provide a representative sampling of the restoration area.

CSS and CSS/VGL transect data would be collected by recording each species that intersects an imaginary vertical plane located at each half-meter mark along the transect. All species present within a 5-meter wide band centered on the transect line would be recorded. Relative species cover and species diversity would be derived from these data.

One-meter quadrat samples within the VGL enhancement areas would be taken randomly each year. The sampling methodology would consist of randomly tossing a 1-meter quadrant frame in front or to the side of the field monitor. Native and non-native vegetation cover would be estimated within the quadrat. A count of individual species would be made for each quarter quadrat in a clockwise pattern beginning in the lower left quarter. Individuals would be categorized by size class within one of the quadrat quarters, alternating in a clockwise pattern for each successive quadrat sample.

A reference transect of existing established CSS and VGL habitat occupying similar topography and subject to similar environmental conditions would be established as a control. Each transect sampling area would be photographed to document the progress of revegetation over the five-year monitoring period. Photo-documentation would be included in all status reports.

Transect data collection shall be achieved by recording each plant species that intersects an imaginary vertical plain at each half-meter along the transect line. Data would be converted to relative cover.

2.9.4 Record Keeping

Following each monitoring visit, the Restoration Ecologist would recommend actions, as needed, to the Reserve Manager that would promote survival and coverage criteria as described in the performance standards. The Restoration Ecologist, Reserve Manager, and Installation/Maintenance Contractor would work together to monitor, maintain, and replant restoration areas, if necessary.

Over the five-year period following restoration implementation, an annual report prepared by the Restoration Ecologist that discusses the results of the restoration monitoring and maintenance efforts for that year would be submitted to the Reserve Manager for incorporation into the overall report for the Habitat Reserve. Vegetation cover by species, compliance with required performance standards, species heights, seedling recruitment, pest problems, weed control

problems, pest control measures implemented, additional required maintenance procedures, and the general health of the revegetation plantings would be summarized in these reports. Photo-documentation of the sites would be included in the reports to provide a visual record of the restoration progress.

SECTION 2.10 COMPLETION OF RESTORATION

2.10.1 Notification of Completion

Upon completion of Year 5 of the monitoring period or when the restoration area(s) have achieved the Year 5 performance criteria, the Restoration Ecologist shall prepare a final report for the Reserve Manager that describes the relative success of each restoration area.

2.10.2 Contingency Measures

Contingency measures would be implemented if restoration efforts fail to meet performance criteria at the end of the five-year monitoring period. Such measures shall include additional container plant and/or seed installation, additional weed control efforts, an evaluation and appropriate modification of the irrigation system, and the extension of the maintenance and monitoring period until such time that the performance criteria are achieved.

2.10.3 Long-Term Management

Long-term management beyond the five-year monitoring program would be in compliance with the HRMP for the Southern NCCP/MSAA/HCP Habitat Reserve, as described in *Part 1, Chapter 7*. The Reserve Manager would determine whether a restoration site would be subject to long-term monitoring and management.

CHAPTER 3.0 AQUATIC RESOURCES RESTORATION PLAN

California Executive Order W-59-93 established the California Wetlands Conservation Policy to ensure no overall net loss in the quantity and quality of California's wetlands. In accordance with this policy CDFG similarly requires mitigation to compensate for impacts to streambeds and lakes and associated wetland resources pursuant to Section 1600 *et seq*. of the Fish and Game Code.[1]

The purpose of this Chapter is to describe the Aquatic Resources Restoration Plan (ARRP) component of the overall Habitat Restoration Plan, which is a component of the overall Southern Subregion NCCP/MSAA/HCP Habitat Reserve Management Plan (HRMP). Like the upland habitat restoration component described in *Chapter 2*, the ARRP identifies **(1)** potential restoration sites and potential aquatic functions, **(2)** the approximate acreage that could be restored at each site, **(3)** the types of vegetation communities serving as habitat that could be incorporated into each site, **(4)** the monitoring and maintenance procedures to be implemented, and **(5)** the performance standards that will be used to determine success. The evaluation of functions associated with compensatory mitigation sites relies on a function-based assessment tool such as the USACE's Hydrogeomorphic (HGM) Methodology.[2] It is expected that, to the extent feasible, restoration will be implemented in advance of impacts. An exact timetable has not yet been developed for implementation of all aquatic restoration actions designed to address future impacts to aquatic resources, but 18 acres of highly functioning marsh and riparian vegetation have already been established in GERA and are presently available to offset project impacts up to the extent of this acreage. Sites not required for MSAA mitigation purposes will be available for consideration as part of the long-term implementation of the Adaptive Management Program (AMP) aquatic habitat restoration goals.

This document describes the restoration plan for the creation, restoration and/or enhancement of wetlands as well as restoration of selected streams, including invasive species control, in the proposed NCCP/MSAA/HCP Habitat Reserve, with particular emphasis on the mitigation of areas considered to be CDFG wetlands pursuant to Fish and Game Code Section 1600 *et seq.* This plan is proposed to serve as the aquatic resources restoration component of the HRMP for

[1] According to the Fish and Game Policies, published in the Fish and Game Addenda to the California Fish and Game Code, CDFG defines wetlands in accordance with the USFWS definition set forth in *Classification of Wetlands and Deepwater Habitats of the United States;* FWS/OBS 79/31; December 1979. This definition requires the presence of at least one of the following attributes: (1) at least periodically, the land supports predominately hydrophytes, (2) the substrate is predominately undrained hydric soil; and (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year.

[2] Smith, R.D., Ammann, A., Bartoldus, C., and Brinson, M.M. 1995. "An approach for assessing wetland functions using hydrogeomorphic classification, reference wetlands, and functional indices." Technical Report WRP-DE-9, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Brinson, M.M., Hauer, F.R., Lee, L.C., Nutter, W.L., Rheinhardt, R.D., and Whigham, D. 1995. "A guidebook for application of hydrogeomorphic assessments to riverine wetlands," Technical Report WRP-DE-11, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Southern Subregion Conservation Strategy and associated Master Streambed Alteration Agreements (MSAA). This plan also encompasses the proposed SAMP Aquatic Resource Conservation Area (ARCA) that will be located within the boundary of the future NCCP/MSAA/HCP Habitat Reserve (*i.e.*, the NCCP Habitat Reserve will be larger than the ARCA because the Habitat Reserve will include upland vegetation communities). With approval of the NCCP/MSAA/HCP, ARCA restoration/enhancement actions directed toward meeting mitigation requirements established pursuant to the RMV individual long-term permit/SAMP permitting procedures would be undertaken within the joint management framework established for implementing SAMP and NCCP/MSAA/HCP mitigation and other restoration actions. With regard to vegetation communities, this ARRP addresses impacts to jurisdictional wetlands as defined by CDFG pursuant to Executive Order W-59-93[3] and includes all wetland and riparian areas that exhibit characteristics consistent with CDFG-defined wetlands. Areas that are not CDFG-defined wetlands and areas of southern coast live oak riparian forest within CDFG jurisdiction[4] will be addressed through the NCCP/MSAA/HCP AMP component of the HRMP where it is determined to be a priority by the Reserve Manager and Scientific Panel.

Consistent with the definition of terms provided above in *Section 2.1.*, the term "restoration" is inclusive in this ARRP as it addresses the spectrum of possible restoration activities within the Habitat Reserve, ranging from:

- creation of new vegetation communities that in some instances may require substantial grading;
- enhancement of existing degraded vegetation communities that could include limited grading; and
- other measures such as minor recontouring, removal of invasive species and/or some replanting that rely extensively on natural processes to enhance and restore aquatic values.

This ARRP is based upon substantial data collected on the aquatic ecosystems in support of the SAMP and NCCP/MSAA/HCP. These data, along with data collected during monitoring of approximately 125 acres of created and restored wetland and riparian areas on RMV, provide a robust data set that can be used to inform and guide the proposed restoration projects. In light of

[3] In California, Executive Order W-59-93 established the California Wetlands Conservation Policy to ensure no overall net loss in the quantity and quality of California's wetlands. In accordance with this policy CDFG similarly requires mitigation to compensate for impacts to streambeds and lakes and associated wetland resources pursuant to Section 1600 *et seq*. of the Fish and Game Code.

[4] Coast live oak (*Quercus agrifolia*) has a wetland indicator status of Upland (UPL) as do most of the understory shrubs and herbs associated with this community. Therefore the no-net-loss policy does not apply to this community for purposes of determining compensatory mitigation.

the importance of invasive species control in enhancing and restoring aquatic resources values and functions, this section includes a summary of the invasive exotic control program for San Juan and Trabuco creeks as set forth in greater detail in the Invasive Species Control Plan (*Appendix J*).

Given that the NCCP/MSAA/HCP is a planning area-wide comprehensive program, this section summarizes the restoration program for several sub-basins and explains how these actions, as part of the AMP, could contribute to enhancement and restoration of values and functions of wetlands/riparian areas. The restoration plan has been developed to ensure no-net-loss of either acreage or function associated with CDFG-defined wetlands.

The proposed program incorporates the USACE's functional assessment approach. As set forth in more detail below, the HGM approach, which utilizes "variables" to define or describe each function associated with a particular wetland type can be used during the design and monitoring phases to ensure that hydrologic, biogeochemical and habitat functions are maximized in the restoration sites. RMV has successfully used this approach for approximately 65 acres of wetlands and riparian vegetation communities created in GERA, Chiquita Canyon and the Arroyo Trabuco.[5] The hydrologic and water quality measures associated with the Water Quality Management Plan (WQMP; *Appendix K*) prepared for the project will be incorporated into the USACE's analysis of the mitigation ratios. Incorporation of the WQMP measures, in concert with the use of HGM variables (see below under performance standards), during site design will ensure that impacts to hydrology and water quality are minimized and mitigated consistent with the framework WQMP reviewed in the NCCP/MSAA/HCP EIR/EIS.

As noted above, this ARRP addresses impacts to CDFG jurisdiction associated with development within the proposed RMV Planning Areas (PAs) and includes site selection, site design, site preparation and site construction. Proposed plant palettes, short-term and long-term monitoring and maintenance measures to be implemented in accordance with the program are also included. Specific mitigation sites, as well as amounts by wetland/riparian type, are defined in the final conditions for the MSAA.

Under the proposed RMV MSAA, at the time a site-specific application is made to the County of Orange for a particular development increment with impacts on CDFG wetlands, CDFG will apply the appropriate area-specific mitigation requirements set forth in the Special Conditions:

[5] RMV has created and performed associated monitoring of approximately 125 acres of wetland and/or riparian habitat between 1989 and 2005. Of the 125 acres, approximately 65 acres were designed, implemented and monitored for a variety of variables/functions using the HGM approach. Performance standards have been achieved for all 125 acres.

Mitigation for Unavoidable Impacts to CDFG-Defined Wetlands

Mitigation for temporary wetlands impacts will be provided through:

- Habitat values and functions provided by 18 acres of already existing created/restored wetlands within GERA that is providing temporal gain; and

- Habitat value and function enhancement provided through implementation of the AMP, including invasive species control such as the eradication of about 90 acres of giant reed in the RMV Planning Area.

Mitigation for permanent wetlands impacts will be provided through:

- 1:1 restored wetlands acreage provided by 18 acres of already existing created/restored wetlands within GERA;

- Additional wetlands acreage, if required, through the creation/restoration of wetlands at a 1:1 ratio pursuant to the ARRP before impacts occur; and

- Assurances of funding for the AMP and implementation of the AMP help assure that values and functions will be maintained and thereby support the use of a 1:1 ratio.

Mitigation for Impacts to Non-Wetland Streambeds

Mitigation for temporary impacts:

- Not required for impacts to streambeds that are unvegetated or minimally vegetated by wetland species, or vegetated by upland species.

Mitigation for permanent impacts to vegetated non-wetlands streambeds will be provided through:

- Control of invasive species, including the eradication of about 90 acres of giant reed in the RMV Planning Area; and

- Implementation of the AMP to help assure that values and functions are maintained

With regard to temporal impacts and permanent wetlands impacts, this plan provides for low intensity monitoring and maintenance (as necessary) for approximately 18 acres of existing created alkali marsh, alkali meadow, and southern riparian scrub in GERA. These 18 acres of existing wetlands were created in 1998 and 1999 as part of the Ladera Ranch wetland restoration program that, according to conditions in the Section 404 and 1603 Authorizations from the USACE and CDFG, included a sliding scale whereby excess creation areas (*i.e.*, not specifically needed to offset impacts associated with Ladera Ranch) could be utilized for future projects

within RMV. The 18 acres have achieved the five-year performance standards and would be subject to ongoing monitoring until such time as they are used to offset future impacts associated with permitting procedures authorizations and future MSAA authorizations in conjunction with the NCCP/MSAA/HCP.

SECTION 3.1 DEFINITION OF TERMS

Section 2.1 defined restoration in terms of upland restoration. The term "restoration" was used in the broad sense to refer to the spectrum of restoration and enhancement activities that can be used to enhance and restore vegetation communities. Here, restoration is defined in a similar manner in regard do aquatic values and functions. Where appropriate, several other terms are used throughout this section to refer to specific kinds of aquatic resource restoration activities.

Wetland Functional Assessment: A methodology whereby various hydrologic, biogeochemical and typical wetland/aquatic functions are qualitatively or quantitatively scored or rated. The USACE has developed one approach, the Hydrogeomorphic (HGM) Approach, which utilizes "variables" to define or describe each function associated with a particular wetland type. The HGM approach has been designed for evaluating functional losses associated with specific projects and can be used for very small projects with minor impacts (*e.g.*, impacts to fractions of an acre) or for projects that cover thousands of acres on the landscape that affect multiple areas of the aquatic ecosystem. The USACE has also developed a functional assessment tool for evaluating large areas at a coarser scale that is often utilized for evaluating large watershed areas. In addition to using the functional assessment to evaluate impacts, the approach can be used to design wetland restoration sites to ensure that the target functions are achieved.

Passive Restoration: Passive restoration generally refers to removing or controlling disturbance events resulting in conversion from native to non-native or disturbed vegetation communities. Passive restoration may involve some site preparation and maintenance such as weed control, and trash and debris removal, but generally the site would be allowed to revegetate naturally without extensive intervention. Where non-native cover is particularly high, weed removal may be more intensive. Some initial seeding or planting of cuttings or container stock may be used if the natural seed bank onsite is inadequate, particularly in areas where removal of substantial weed cover has left areas somewhat unvegetated. Passive restoration sites would be monitored, and if the site is not meeting performance standards by a designated period, more intensive restoration approaches may be implemented.

Active Restoration: Active restoration broadly refers to the specific application of restoration techniques. On any scale (*e.g.*, from less than one acre to 100 acres such as the GERA), active restoration may include site-intensive techniques such as grading, soil preparation, planting

and/or seeding, irrigation, weed control, erosion control, etc. Active restoration implies a higher level of effort than passive restoration and typically is used on sites that would not regenerate naturally, or would only regenerate over an unacceptably long period of time without direct intervention. For example, a mitigation requirement that a site meet certain performance standards such as percent native plant cover or species occupation within five years probably would require active restoration to ensure that the performance standards were achieved. Two types of active restoration are "Enhancement" and "Revegetation."

A. Enhancement: Enhancement generally refers to restoration of sites that support degraded forms of the target native vegetation community. The level of effort needed to enhance a site typically is less than revegetating a site because the target native community is already present. For aquatic ecosystems, primary enhancement measures include the removal of invasive plant species. Seeding may be used to supplement the existing native vegetation, but planting of container plants and irrigation generally are not used on enhancement sites. Enhancement tends to be passive, letting nature take its course (*e.g.*, elimination or control of giant reed in a streamcourse allowing native species such as willows to re-colonize the area and take advantage of increased water supplies resulting from the removal of giant reed), as contrasted with other types of active wetland/riparian restoration.

B. Revegetation: Revegetation involves active restoration of a site whereby container plants and/or seeds are used to create or restore vegetation communities. Typically the target native vegetation community is absent from the site; *e.g.*, a site supporting ruderal vegetation revegetated with wet meadow vegetation or mule fat scrub. Depending on site conditions, some grading may be required to restore or enhance site hydrology. Irrigation, though not necessary, may be desirable to hasten establishment of the target species, which in turn reduces the amount of non-native species able to colonize the site. Generally, revegetation sites would have higher performance standards than passively restored sites and the monitoring and maintenance program is more specific.

In practice, there often is not a clear distinction between active and passive restoration, revegetation and enhancement because each site has its own distinct requirements for successful restoration. The Reserve Manager would have the flexibility to implement the appropriate restoration techniques in an adaptive fashion to produce the desired results in the most efficient manner. However, specific performance standards would be set for each restoration site relative to hydrologic, biogeochemical and vegetation community functions so that success can be objectively measured.

SECTION 3.2 SUMMARY OF B-12 ALTERNATIVE IMPACTS ON CDFG JURISDICTIONAL AREAS AND PROPOSED MITIGATION

The project includes nine planning areas subject to review under MSAA/NCCP EIR/EIS. The applicant's Proposed Project would result in development of Planning Areas 1, 2, 3, 4, 5, and 8 with limited potential development in Planning Area 7. Project impacts, according to vegetation community type are summarized in *Tables 5* through *8* below.

TABLE 5
SUMMARY OF DEVELOPMENT AND INFRASTRUCTURE IMPACTS TO CDFG JURISDICTIONAL AREAS FOR B-12 ALTERNATIVE

Alternative	Permanent Impacts							Temporary Impacts		
	Development			Infrastructure			Total Permanent Impacts	Infrastructure		
	Riparian	Unvegetated Streambed	Subtotal	Riparian	Unvegetated Streambed	Subtotal		Riparian	Unvegetated Streambed	Subtotal
B-12[1.]	115.95	14.07	130.03	27.60	0.37	27.97	**158.00**	52.62	1.98	54.60

1. As previously discussed this represents an overstated impact analysis and ultimate impacts will be less due to the limitations on development in Planning Areas 4 and 8, and orchards in Planning Areas 6 and 7. The overstated footprint for Planning Area 4 impacts 15.94 acres of CDFG jurisdiction including 14.18 acres of riparian habitat, for Planning Area 6 and Planning Area 7 impacts 4.12 acres of CDFG jurisdiction including 3.75 acres of riparian habitat and for Planning Area 8 impacts 27.15 acres of CDFG jurisdiction including 23.51 acres of riparian habitat.

TABLE 6
SUMMARY OF IMPACTS TO CDFG JURISDICTION IN DEVELOPMENT AREAS BY HABITAT TYPE FOR THE B-12 ALTERNATIVE

Habitat Type	B-12[1]
Alkali Meadow (5.2)	1.29
Seasonal Pond (5.3)	0.64
Coastal Freshwater Marsh (6.4)	0.54
Riparian Herb (7.1)	1.46
Southern Willow Scrub (7.2)	13.25
Mule fat Scrub (7.3)	15.87
Oak Riparian Woodland (7.5)	51.96
Sycamore Riparian Woodland (7.4)	9.25
Arroyo Willow Forest (7.6)	21.70
Unvegetated Streambed	14.07
Total	**130.03**

As previously discussed this represents an overstated impact analysis and ultimate impacts will be less due to the limitations on development in Planning Areas 4 and 8, and orchards in Planning Areas 6 and 7.

TABLE 7
SUMMARY OF INFRASTRUCTURE IMPACTS TO CDFG RIPARIAN HABITAT AND UNVEGETATED STREAMBEDS BY INFRASTRUCTURE TYPE FOR THE B-12[1]

CDFG Jurisdictional Areas						
Alternative	Riparian (acres)		Unvegetated Streambed (acres)		Total CDFG (acres)	
	Temporary	Permanent	Temporary	Permanent	Temporary	Permanent
B-12 Alternative[2]						
Trails	14.23	6.49	0.02	0.02	14.25	6.51
Drainage Facilities[3]	0.84	3.73	0.01	0.05	0.85	3.78
Water-Sewer[4]	1.79	3.60	0.06	0.04	1.85	3.64
Road/Bridge Construction[5]	12.37	13.78	0.00	0.26	12.37	14.04
Maintenance of Existing RMV Planning Area Facilities	23.39	NA	1.89	NA	25.28	NA
Total	**52.62**	**27.60**	**1.98**	**0.37**	**54.60**	**27.97**

1. Jurisdictional areas falling outside of the GLA study area boundary are estimated using NCCP data.
2. As previously discussed this represents an overstated impact analysis and ultimate impacts will be less due to the limitations on development in Planning Areas 4 and 8, and orchards in Planning Areas 6 and 7
3. Includes culvert outfalls and Gobernadora Water Quality Basin
4. Includes non-domestic water, domestic water, and sewer.
5. Due to the lack of final design details on the location of road/bridge construction, a contingency of 50 percent of additional impact is assumed for both alternatives.

TABLE 8
SUMMARY OF INFRASTRUCTURE IMPACTS TO CDFG JURISDICTION BY HABITAT TYPE FOR ALTERNATIVE B-12

Habitat Type	Trails		Drainage Facilities		Sewer-Water		Roads/Bridges		Existing RMV Maintenance		Total	
	Perm.	Temp.	Perm.	Temp.	Perm.	Temp.	Perm.	Temp.	Perm.	Temp.	Perm.	Temp.
Alkali Meadow (5.2)					0.03	0.04		0.16		2.28	0.03	2.48
Coastal Freshwater Marsh (6.4)	0.05	0.19	0.02	0.05	0.10	0.13	0.11	0.30		1.87	0.28	2.54
Riparian Herb (7.1)			0.03	0.07						0.24	0.03	0.31
Southern Willow Scrub (7.2)	2.28	4.77	2.19	0.24	0.40	0.56	0.84	1.16		5.47	5.71	12.20
Mule fat Scrub (7.3)	0.86	1.63	0.19	0.17	0.80	0.03	1.47	2.97		1.35	3.32	6.15
Sycamore Riparian Woodland (7.4)	0.19	0.83			0.21	0.31	1.93			2.41	2.33	3.55
Oak Riparian Woodland (7.5)	1.17	2.48	0.06	0.09	1.72	0.41	8.41	0.20		7.07	11.36	10.25
Arroyo Willow Forest (7.6)	1.65	3.75	1.17	0.15	0.34	0.31	1.02	7.58		2.71	4.18	14.50
Scalebroom/Mule fat Scrub	0.29	0.58	0.07	0.07							0.36	0.65
Total	**6.49**	**14.23**	**3.73**	**0.84**	**3.60**	**1.79**	**13.78**	**12.37**	**0.00**	**23.39**	**27.60**	**52.62**

SECTION 3.3 RESTORATION GOALS AND SITE SELECTION

The goal of this conceptual restoration plan is to provide a framework to guide restoration of the aquatic ecosystem (CDFG wetlands and other vegetated streambeds) in a manner that would maintain or enhance hydrologic, biogeochemical and vegetation community functions that would be impacted by development allowed within areas designated for Covered Activities. In fulfilling the mitigation ratios and other measures specified in the Special Conditions, the restored aquatic ecosystem should exhibit hydrologic, biogeochemical and vegetation community functions and values that are equal to, or greater than, those exhibited by the aquatic ecosystem(s) prior to development. Thus, the ARRP is intended to provide replacement aquatic vegetation communities and/or enhanced aquatic functions within ARCAs that would compensate for loss of hydrologic, biogeochemical functions and vegetation community functions while also ensuring no-net-loss in the vegetation community acreage within the aquatic ecosystem for CDFG-defined wetlands.

A major focus of the overall minimization program is to maintain hydrogeomorphic processes, which in turn is key for achieving other goals such as establishment of target vegetation communities and associated faunal components. As noted above, RMV has developed a separate WQMP that will minimize impacts to hydrologic and biogeochemical processes and where potential impacts would be expected, measures to offset or compensate for potential impacts. In addition to development of a detailed WQMP that will minimize potential impacts to hydrologic and biogeochemical processes, the restoration program will incorporate elements of the HGM approach, as outlined below under "performance standards" that will provide for creation/restoration/enhancement of both hydrologic and biogeochemical functions in addition to vegetation community functions.

Site selection is extremely important for the long-term success of a restoration program. Sites that are selected for restoration of wetlands must contribute to the long-term net aquatic resource values and functions within the Habitat Reserve. The designation of potential restoration areas, as described below, is based upon detailed investigations of the aquatic resources within the Habitat Reserve.

The importance of site selection has already been demonstrated through significant restoration efforts within the GERA, Cañada Chiquita, Arroyo Trabuco, and Narrow Canyon (approximately 125 acres combined among the sites, of which approximately 18 acres in GERA have been "banked" for future projects).[6] In creating vegetation communities that would currently support a number of proposed Covered Species such as least Bell's vireo, southwestern willow

[6] Department of the Army Permit 97-00342-ES and Streambed Alteration Agreement 5-081-98.

flycatcher, yellow-breasted chat, yellow warbler, southwestern pond turtle, southern tarplant, and Coulter's saltbush, these efforts have demonstrated that, where suitable conditions exist, vegetation community creation or restoration can be very successful.

Finally, techniques for carrying out the control of invasive exotics have been refined through prior and ongoing efforts. Invasive species control (primarily giant reed and pampas grass) has been implemented and is ongoing within Trabuco Creek by the County of Orange and RMV. Control of invasive species has also been implemented in Cristianitos Creek by Northrop Grumman (formerly TRW), and this program would continue until the lease with RMV expires.

3.3.1 Relationship of Restoration Timing to Project Phasing

Timeframes for the establishment of wetland and/or riparian areas vary significantly according to the type of vegetation community subject to restoration/creation. For example, creation of emergent marsh vegetation communities requires little time, and it is possible to establish functioning marsh in as little as 1.5 to 2 years when sufficient hydrology is present. Similarly, creation of alkali or wet meadow vegetation can be achieved in approximately 2 to 3 years with irrigation to hasten establishment and early growth. Vegetation communities such as mule fat scrub, southern willow scrub, or willow forest require more time, with substantial function achieved at between four and seven years. Invasive species control may require extensive efforts over time with substantial long-term benefits resulting from larger scale, comprehensive watershed scale actions.

Phasing of development associated with RMV Covered Activities is expected to extend over a 15- to 25-year time period. Development phasing would provide opportunities to implement and, in many instances carry out compensatory mitigation in advance of impacts. The existing 18 acres of created vegetation communities in GERA that includes alkali marsh, alkali meadow, southern riparian scrub, and southern willow scrub, are proposed as compensation for impacts associated with the initial phases of development.

Use of a function-based mitigation design, coupled with the opportunity to implement and monitor the aquatic resource creation, restoration, and/or enhancement measures in advance of impacts, would provide high levels of certainty that all impacted functions are replaced without substantial temporal loss or any long-term loss of values and functions.

3.3.2 Preliminary Designation of Wetland, Stream and Riparian Restoration Areas

The main goal of the ARRP is to describe the methodologies for**: (1)** enhancement or restoration of wetlands that have been substantially degraded such that measurable losses of hydrologic,

biogeochemical or vegetation community functions have occurred, and whereby the lost function(s) can be restored or reintroduced; **(2)** creation of wetlands to replace areas of CDFG jurisdictional wetlands impacted by Covered Activities; and **(3)** as noted above, a substantial portion of the compensatory mitigation can be implemented in advance of impacts, providing a high level of certainty that there is no-net-loss of aquatic function or acreage. Furthermore, in all cases, vegetation community creation, restoration, and/or enhancement would occur in areas adjacent to existing wetland and/or riparian resources optimizing the potential hydrologic, biogeochemical and vegetation community functions of both existing and restoration areas.

Areas evaluated and identified, as potential restoration sites are set forth below. Based on the detailed evaluations performed, all of these sites represent excellent candidate sites; however, it may not be necessary or desirable to use each site, or only portions of these sites may ultimately be utilized. Determination of which of the potential restoration sites would be used will depend on the level of impact associated with implementation of development within areas authorized as Covered Activities pursuant to the proposed Conservation Strategy. As noted above, area-specific mitigation acreage requirements according to vegetation community type will be determined at the time of incremental verification actions pursuant to the terms of the MSAA authorizing impacts associated with a specific planning area or infrastructure construction or improvement.

a. Potential Aquatic Vegetation Creation/Restoration Areas

Each of the sites addressed below is depicted on *Figure 1, Sheets 1-7* attached to this Appendix. The size of the potential restoration area is also provided on the appropriate figure. All of the potential restoration areas are under the ownership of RMV and will be placed within the Habitat Reserve no later than the occurrence of impacts for which the restoration area will be used as compensation. RMV will be responsible for all the proposed restoration efforts. Finally, all of the potential sites addressed below have been subject to extensive monitoring efforts that include (as appropriate for each site), groundwater monitoring, stream gage data, aerial photographic analysis, water chemistry measurements (*e.g.*, electroconductivity data), botanical inventories, faunal inventories (focus on special-status avifauna including raptors), and general observations, extending back to the early 1990s.

- **GERA** currently includes approximately 18 acres of alkali marsh, alkali meadow and southern riparian scrub vegetation created for the Ladera Ranch Project that was not needed to compensate for project impacts and, as established in the Ladera Ranch 404 and 1603 Authorizations, is available to use as compensation for impacts associated with future RMV projects. All 18 acres meet the USACE definition of wetlands in accordance with the 1987 Manual. This existing creation area would be subject to ongoing

monitoring and maintenance until it is "utilized" to offset impacts associated with the early phases of the development program. In addition, because the 18 acres are established and both the USACE and CDFG have provided concurrence that the 18 acres achieved the five-year performance standards, the 18 acres are also to be used to offset temporal losses for up to 18 acres of temporary impacts.

- **Gobernadora Canyon** immediately downstream of Coto de Caza, extending to below the confluence with Sulphur Canyon. This includes the proposed location of a multi-purpose basin that would cover an estimated 40 acres and would serve a number of functions including detention and harvesting of storm waters by the Santa Margarita Water District (SMWD), water quality treatment wetlands and possible creation of riparian areas along with re-establishment of a meander of the channel through the upper reaches of Gobernadora Creek. The 40 acres extends south from Coto de Caza to where Gobernadora Creek crosses from the east to the west side of the valley bottom. While no design for this basin has been prepared it is anticipated that some vegetation community values could be created as part of the future design. It should be noted that areas of the basin designed for flood control and water quality treatment purposes would require periodic maintenance to maintain the capacity of the flood control function and the treatment capability of water quality treatment wetlands. Possible riparian areas created and/or enhanced adjacent to Gobernadora Creek would not require ongoing maintenance under achievement of performance standards. Currently, all 40 acres consist of upland vegetation communities dominated by non-native grasses and forbs including ripgut brome (*Bromus diandrus*, UPL), foxtail barley (*Hordeum murinum* ssp. *leporinum*, UPL), wild oats (*Avena fatua*, UPL), soft chess (*Bromus hordeaceus*, FACU-), wild radish (*Raphanus sativus*, UPL), and black mustard (*Brassica nigra*, UPL).

  Below the area where the creek crosses the valley bottom, an additional 45.4 acres have been identified as candidate areas for creation of alkali marsh, alkali meadow, southern willow riparian and mule fat scrub vegetation. This area is also upland, dominated by the non-native grasses and forbs noted above. In addition to the 45.4 acres of marsh, meadow, willow and mule fat creation areas, additional areas have been identified as potential southern coast live oak riparian creation areas.

- **Gobernadora Canyon/"Fertile Crescent"** at the "mouth of Cañada Gobernadora. This area exhibits appropriate hydrology for restoration due to the presence of high groundwater and sheet flow from Gobernadora Creek. This area has been degraded by past agricultural practices. Some site grading and site preparation would be necessary to restore hydrology to a larger area and to provide for a mosaic of aquatic vegetation community types, including alkali meadow, alkali marsh and southern willow

scrub/forest. Vegetation community creation/restoration in this area would, among other things, be targeted at habitat for the southwestern pond turtle, which recently colonized a pond created nearby in GERA in 1999/2000. Up to 2.7 acres have been identified as available for restoration or creation.

The potential 2.7-acre area is located between existing wetlands and the southern willow riparian forest created in GERA. Restoration of up to eight acres would result in an expansion of GERA. The eight-acre area is a mosaic of upland area vegetated by non-native grasses and forbs and wetland that is also vegetated with mostly non-native hydrophytes. Upland species include Italian ryegrass (*Lolium multiflorum*, FAC*), (*Hordeum murinum* ssp. *leporinum*, UPL), soft chess (*Bromus hordeaceus*, FACU-), wild radish (*Raphanus sativus*, UPL), and black mustard (*Brassica nigra*, UPL). Wetland areas are vegetated with herbaceous species including alkali weed (*Cressa truxillensis*, FACW) and alkali mallow (*Malvella leprosa*, FAC*), which are native and bristly ox-tongue (*Picris exhioides*, FAC*), whorled dock (*Rumex conglomerates*, FACW), curly dock (*Rumex crispus*, FACW-), rabbit's-foot grass (*Polypogon monspeliensis*, FACW) and Spanish sunflower (*Pulicaria paludosa*, FACW).

- **Sulphur Canyon** at the confluence with Gobernadora Creek. This area exhibits appropriate hydrology for restoration due to the presence of shallow subsurface water and sheet flow from Sulphur Canyon Creek which exhibits a three to eight foot wide ribbon of wetland vegetated with arroyo willow (*Salix lasiolepis*, FACW) and mule fat (*Baccharis salicifolia*, FACW) with an understory of Mexican rush (*Juncus mexicanus*, FACW), creeping spikerush (*Eleocharis macrostachya*, OBL), and California club-rush (*Scirpus cernuus*, OBL). The creek exhibits surface water due to shallow subsurface water year round; additionally there is one seep that exhibits groundwater discharge at the toe of slope approximately 70 feet west of the drainage. The seep is further evidence of the shallow subsurface water and supports water parsnip (*Berula erecta*, OBL) and Olney's bulrush (*Scirpus americanus*, OBL). This area has been degraded past agricultural practices. Some site grading and site preparation would be necessary to restore hydrology to a larger area capable of expanding the wetlands and to provide for a mosaic of aquatic vegetation types. Approximately 2.7 acres have been identified as available for potential restoration or creation.

- **Chiquita Creek** between the "Narrows" and the SMWD Treatment Facility. Approximately 8.8 acres have been identified in this area for creation of mule fat scrub, or transitional riparian areas immediately adjacent to Chiquita Creek. Hydrologically, these areas would be supported by groundwater and overbank flow from Chiquita Creek. Some grading would be required to locate the restoration areas closer to areas of shallow subsurface water and to allow for overbank discharge into the restored areas. A similar

program was undertaken downstream in Chiquita Canyon, covering approximately ten acres that has proven highly successful in achieving five year performance standards. The 21 acres consist entirely of upland that supports non-native grasses and forbs including ripgut brome (*Bromus diandrus*, UPL), foxtail barley (*Hordeum murinum* ssp. *leporinum*, UPL), wild oats (*Avena fatua*, UPL), soft chess (*Bromus hordeaceus*, FACU-) wild radish (*Raphanus sativus*, UPL), and black mustard (*Brassica nigra*, UPL).

Additional areas have been identified as candidate areas for southern coast live oak riparian vegetation. The areas proposed for southern coast live oak riparian forest would be immediately adjacent to existing or restored vegetation in Chiquita Creek or in canyons tributary to Chiquita Creek. Potential areas for southern coast live oak riparian restoration or creation are generally dominated by non-native grasslands.

- **Chiquita Creek** between SMWD Treatment Facility and New Ortega Highway**.** Detailed investigations of the slope wetlands on both sides of lower Chiquita Canyon indicate subsurface flows to the creek, along with typically perennial flows (but intermittent flows during dry climatic cycles), would allow for expansion of the wetlands in this area with only minimal grading. Approximately 10.9 acres have been identified as available for alkali marsh, alkali meadow, or willow riparian creation. The 10.9 acres proposed for restoration currently support a predominance of non-native grasses and forbs including (*Lolium multiflorum*, FAC*), (*Hordeum murinum* ssp. *leporinum*, UPL), soft chess (*Bromus hordeaceus*, FACU-), wild radish (*Raphanus sativus*, UPL), and black mustard (*Brassica nigra*, UPL). Patches of saltgrass (*Distichlis spicata*, FACW), a facultative phreatophyte, suggest shallow subsurface water at depths of less than eight feet.

b. Stream Restoration

- **Gobernadora Creek at the knickpoint located adjacent to GERA.** Detailed investigations by Balance Hydrologics indicate that the knickpoint is a key area in preventing continuing headcutting and incision in the middle reach of Gobernadora Creek. Restoration of this area, as proposed in the Balance Hydrologics Report[7], would maximize the likelihood of long-term functioning of the upper one-half of GERA which supports approximately 40 acres of wetland vegetation, including southern willow riparian forest, alkali marsh and alkali meadow, and mule fat scrub. This 40-acre portion of GERA supports least Bell's vireo, southwestern willow flycatcher, yellow-breasted chat, as well as southern tarplant.

[7] Balance Hydrologics, Inc. July 2004. *Short-term Erosion Control Action Plan for Lower Gobernadora Creek, Rancho Mission Viejo, Orange County, California.* Letter Report Prepared for Rancho Mission Viejo.

- **Chiquita Creek between the "Narrows" and the SMWD Treatment Facility.** Studies indicate areas of localized headcuts affecting the channel at various points along Chiquita Creek, which supports a mosaic of southern arroyo willow riparian forest, alkali meadow, alkali marsh and freshwater marsh. Reversal of the incision effects would ensure long-term functioning of portions of Chiquita Creek. Reversal of the entrenchment would also provide for passive- or active-expansion of the wetland and riparian vegetation adjacent to the creek, specifically as described for this specific area above.

- **Restoration of Upper Reaches of Gabino Creek and Gabino Creek Tributary.** This area exhibits headcutting, entrenchment, and channel degradation resulting in excess generation of fine sediments. There are two approaches to restoration in this area, one involving a passive approach and the other significantly more active. A passive approach would involve the stabilization of headcutting through low technology solutions such as straw wattles and limited planting. The active approach would entail substantial landform stabilization and would be conducted in coordination with potential restoration of nearby uplands with CSS/VGL that would serve to increase infiltration of stormwater runoff and reduce the excess generation of fine sediments that has contributed to the loss of aquatic function.

- **Upper Reaches of Cristianitos Creek.** Like Gabino Creek noted above, this area exhibits headcutting, entrenchment, and channel degradation resulting in excess generation of fine sediments. Portions of the upper reaches of the Cristianitos Creek watershed have been impacted by past clay mining activities that are now competed and subject to restoration activities in accordance with surfacing mining regulations. Mining in other areas was started prior to surface mining regulations and are not subject to reclamation/restoration requirements. Areas not covered under existing reclamation requirements would be subject to restoration by RMV that would include (but not be limited to) the following treatments: recontouring to restore historic or at a minimum "natural" contours, replanting with native valley needlegrass grassland and coastal sage scrub. Such restoration activities would be undertaken at the discretion/direction of the Reserve Manager and Science Panel.

SECTION 3.4 INVASIVE EXOTIC CONTROL

- Removal of giant reed from San Juan Creek has been identified as a "high priority" component of the Invasive Species Control Plan (*Appendix J*). San Juan Creek supports populations of the arroyo toad and least Bell's vireo, along with other Covered Species such as the yellow-breasted chat, yellow warbler, and southwestern pond turtle. As set

forth in the Invasive Species Control Plan, giant reed can have a number of adverse impacts on native riparian ecosystems including alteration of hydrologic regimes, alteration of fire regimes and elimination of native riparian vegetation (*i.e.*, willow scrub and forest) by direct competition. Elimination of giant reed from approximately 87.7 acres would substantially enhance the ability of the reach of San Juan Creek associated with the RMV property to support the arroyo toad and least Bell's vireo, contributing significantly to recovery of these species within the subregion.

- Removal of giant reed and pampas grass from Trabuco Creek between Crown Valley Parkway and Avery Parkway has been identified as a "high priority" component of the Invasive Species Control Plan. Trabuco Creek supports a *major population* in a *key location* of least Bell's vireo, along with other Covered Species such as the yellow-breasted chat and yellow warbler. Elimination of giant reed and pampas grass, from approximately 95.7 acres would substantially enhance the ability of this reach of Trabuco Creek to support least Bell's vireo, contributing significantly to recovery of this species within the subregion.

SECTION 3.5 SUCCESS CRITERIA

The goal of the ARRP is the establishment of self-sustaining vegetation communities that provide hydrologic, biogeochemical and vegetation community functions typical of the target geomorphic settings and associated wetland and/or riparian vegetation community types.

3.5.1 Rationale for Expecting Success

There are a number of reasons why wetland and/or riparian enhancement, restoration, or creation would be successful within the RMV portions of the Habitat Reserve.

A variety of investigations have been completed that address the aquatic resources within the RMV portion of the Habitat Reserve. These investigations include the following:

- PCR Services Corporation, PWA Ltd., and Balance Hydrologics, Inc. 2002. *Baseline Geomorphic and Hydrologic Conditions, Rancho Mission Viejo: Portions of the San Juan and Western San Mateo Watersheds.*

- PCR Services, Dudek & Associates. 2002. *Geomorphic and Hydrologic Needs of Aquatic and Riparian Endangered Species.*

- PCR Services. 2003a. *Functional Evaluation of Slope Wetlands, Rancho Mission Viejo.*

- PCR Services. 2003b. *Functional Evaluation of Vernal Pools, Rancho Mission Viejo.*
- Balance Hydrologics. 2002. *Preliminary Technical Memo: Geologic and Hydrogeologic Framework for Restoration Design of Lower Gobernadora Canyon*
- Balance Hydrologics, 2005. *Geomorphologic Factors Affecting Sediment Generation and Transport under Pre- and Post-Urbanization Conditions at Rancho Mission Viejo and in the San Juan And San Mateo Watersheds, Orange County, California.*
- NCCP/SAMP Working Group. 2002. *Draft Watershed and Sub-Basin Planning Principles.*
- Glenn Lukos Associates. 2002. *Ladera Ranch Wetland Mitigation Monitoring: Fourth Annual Report.* October 2002.
- Glenn Lukos Associates. 2003. *Ladera Ranch Wetland Mitigation Monitoring: Fourth Annual Report.* December 2003.
- Glenn Lukos Associates. 2003. *Fifth Annual Monitoring Report for 7.65-Acre Wetland Mitigation Site Associated with Tesoro High School Wetland Impacts, Chiquita Canyon, Orange County.* December 2003.

These studies provide sufficient data relative to surface water and groundwater conditions to provide detailed planning, including site design, for aquatic restoration at the candidate locations. All of the candidate restoration sites have been subject to detailed investigations and sufficient hydrology data have been collected for each of the sites to ensure successful implementation.

In addition to these detailed studies, as noted previously RMV has established a successful aquatic restoration track record by creating approximately 125 acres of wetland and or riparian vegetation within the GERA, Chiquita Canyon, and the Arroyo Trabuco. Wetland/riparian vegetation created in GERA within the last 13-14 years, has variously supported as many as six pairs of least Bell's vireo, one pair of southwestern willow flycatcher, southwestern pond turtle, yellow-breasted chat, and yellow warbler. In addition, both the GERA and Chiquita sites support over 10,000 individuals of southern tarplant, a CNPS List 1B taxon.

3.5.2 Target Functions

Target functions to be enhanced, restored or created, vary from site to site based on site-specific conditions and associated site-specific goals. For example, there are two primary goals associated with restoration efforts in Upper Gobernadora: **(1)** management of excessive surface and subsurface water flows causing downstream erosion in the creek and reestablishment of sinuosity/meander to the creek; and **(2)** creation of a large block of wetland/riparian vegetation that would serve as replacement to compensate for losses of wetland/riparian vegetation communities in other portions of the Habitat Reserve. Controlling excess water flows through the construction and operation of the proposed multi-purpose basin and reestablishment of sinuosity/meander to the creek would result in restoration of a variety of hydrologic, biogeochemical and vegetation community functions that can be directly measured. Similarly, creation of a large block of wetland and riparian vegetation would result in establishment of a variety of hydrologic, biogeochemical and vegetation community functions that can be directly measured. Specific target functions for vegetation restoration would be determined upon selection of the candidate sites. Selection of candidate sites would be determined by **(1)** mitigation needs for Covered Activities, and **(2)** contribution of the candidate site to the overall function of the Habitat Reserve.

In a similar manner, removal of giant reed from San Juan Creek would result in enhanced hydrology because water usage by this species is approximately twice that of native riparian areas (*e.g.*, southern willow riparian forest, mule fat scrub, etc.). Giant reed removal would also provide for restoration of sediment transport regimes and would allow for expansion of native riparian vegetation into the areas that are currently infested with giant reed. These changes are expected to provide a measurable benefit to two listed species, the arroyo toad and least Bell's vireo, both of which occur in San Juan Creek.

3.5.3 Performance Standards

Performance standards for each of these restoration program components would be markedly different because they would be developed to address the desired function. For example, creation of southern arroyo willow riparian forest in GERA has created vegetation communities used by nesting least Bell's vireo and southwestern willow flycatcher while areas of alkali meadow in Chiquita are occupied by self-sustaining populations of southern tarplant. Relative to invasives removal and as noted above, the primary purpose for removal of giant reed from San Juan Creek is to enhance/expand usable or potential willow-dominated vegetation communities for the arroyo toad, least Bell's vireo and other special-status and common species of wildlife. As such, performance standards would be developed that **(1)** measure the target hydrologic, biogeochemical and vegetation community functions for restored or created communities; **(2)** define monitoring requirements for areas subject to enhancement, including areas subject to invasives removal to assure that (for example) giant reed or tamarisk remain under control; and

(3) define monitoring requirements for reviewing the status of natural regeneration in the context of overall stream dynamics.

As discussed above in *Section 3.3 Restoration Goals and Site Selection* (and summarized below), a representative number of wetland functions, as described in *A Guidebook for Application of Hydrogeomorphic Assessments to Riverine Wetlands*, would be evaluated as part of the overall quantitative monitoring program to ensure no-net-loss of wetland function through successful implementation of the ARRP components. Because of the varying nature of the ARRP components, they have been separated into three categories for purposes of establishing performance standards. Temporary impacts would be subject to the performance standards set forth for each of the vegetation communities addressed below. The categories addressed below include:

- Emergent Marsh, Wet Meadow, and/or Riparian Scrub/Forest Creation
- Invasive Exotic Removal from San Juan and/or Trabuco Creeks
- Translocation of Impacted Special-status Plants

a. Vegetation Community Creation or Restoration: Emergent Marsh and Wet Meadow

The HGM variables to be evaluated for performance were determined based upon their use in mitigation programs that have already been completed in GERA, Chiquita Canyon, and the Arroyo Trabuco. Variables to be monitored include: Plant Roughness, Coarse Woody Debris (for woody riparian areas only), Aerial Net Primary Productivity, Surfaces Suitable for Microbial Activity, Percent Cover of Vegetation (in each strata), and Species Composition. The quantitative vegetation sampling would provide sufficient data to determine performance for the following variables: Plant Roughness, Aerial Net Primary Productivity, Surfaces Suitable for Microbial Activity, Percent Cover of Vegetation (in each strata), Species Composition, Recruitment of Natives, and Vegetation community Heterogeneity. Coarse Woody Debris would be evaluated using direct visual estimates.

In addition to the identified wetland functions that would be evaluated by measuring specific variables, a variety of hydrological indicators would be evaluated because the presence of such indicators provide valuable information regarding wetland functioning. Hydrological indicators that would be monitored include the presence of debris rack, sediment deposits, drainage patterns, water marks, ponding duration, ponding depth, and extent of ponding.

Standard Vegetation Monitoring procedures would be as follows:

- **First-Year Monitoring**. During the first year, monitoring would occur every month. One quantitative survey would be performed to determine planted species' growth performance. The following performance standards would be achieved at the end of the first year:

    - 30 percent coverage of native species relative to reference standard (5 percent deviation allowed);

    - percent cover of non-native species not exceeding 10 percent (includes tree and shrub layers only and does not include herb layer);

    - recruitment of native hydrophytes ratio of seedlings to saplings would be at least 50 percent of that of reference site;

    - vegetation community heterogeneity would be 50 percent (or greater) of the reference site; and

    - Replanting would be performed, as necessary, during the appropriate planting period, with the appropriate-sized stock or by seeding to ensure that these performance standards are achieved. If substantial non-compliance with the performance standards occurs, RMV would consult with the CDFG to determine whether corrective measures and an extension of the five-year monitoring period would be necessary. At the end of the first year, a report summarizing the performance of the emergent marsh, and riparian areas would be submitted to the Responsible Parties for distribution to CDFG.

- **Second-Year Monitoring**. During the second year, monitoring would occur on a quarterly basis. One quantitative survey would be performed to determine planted species' growth performance. The following performance standards would be achieved at the end of the second year:

    - at least 45 percent coverage of native species relative to reference standard (<5 percent deviation allowed);

    - percent cover of non-native species not exceeding 10 percent (includes tree and shrub layers only and does not include herb layer);

    - recruitment of native hydrophytes ratio of seedlings to saplings would be at least 75 percent of that of reference site;

- vegetation community heterogeneity would be 75 percent (or greater) of the reference site; and

- Replanting would be performed, as necessary, during the appropriate planting period, with the appropriate-sized stock to ensure that these performance standards are met. If substantial non-compliance with the performance standards listed above occurs, RMV would consult with the CDFG to determine whether corrective measures and an extension of the five-year monitoring period would be necessary. At the end of the second year, a report summarizing the revegetation site performance would be submitted to the Responsible Parties for distribution to CDFG.

- **Third-Year Monitoring**. During the third year, monitoring would occur quarterly. One quantitative survey would be performed to determine planted species growth performance. The following performance standards would be achieved at the end of the year:

  - at least 65 percent coverage of native species relative to reference standard (<5 percent deviation allowed);

  - percent cover of non-native species not exceeding 10 percent (includes tree and shrub layers only and does not include herb layer);
  - recruitment of native hydrophytes ratio of seedlings to saplings would be at least 75 percent of that of reference site;

  - vegetation community heterogeneity would be 75 percent (or greater) of the reference site; and

  - Replanting would be performed, as necessary with the appropriate-sized stock to ensure that these performance standards are achieved. If substantial non-compliance with the performance standards listed above occurs, RMV would consult with the CDFG to determine whether corrective measures and an extension of the five-year monitoring period would be necessary. At the end of the third year, a report summarizing the revegetation site performance would be submitted to the Responsible Parties for distribution to CDFG.

- **Fourth-Year Monitoring**. During the fourth year, monitoring would occur quarterly. One quantitative survey would be performed to determine planted species' growth performance. The following performance standards would be achieved at the end of the year:

- o at least 75 percent coverage of native species relative to reference standard (<5 percent deviation allowed);
- o percent cover of non-native species not exceeding the reference site by more than 10 percent (includes tree and shrub layers only and does not include herb layer);
- o recruitment of native hydrophytes ratio of seedlings to saplings would be at least 75 percent of that of reference site;
- o vegetation community heterogeneity would be 75 percent (or greater) of the reference site; and
- o Replanting would be performed as necessary, during the appropriate planting period, with the appropriate-sized stock to ensure that these performance standards are achieved. If substantial non-compliance with the performance standards listed above occurs, RMV would consult with the CDFG to determine whether corrective measures and an extension of the five-year monitoring period would be necessary. At the end of the fourth year, a report summarizing the revegetation site performance would be submitted to the Responsible Parties for distribution to CDFG.

- **Fifth Year Monitoring**. During the fifth year, monitoring would occur quarterly. One quantitative survey would be performed to determine planted species' growth performance. The following performance standards would be achieved at the end of the year:
  - o at least 85 percent coverage of native species relative to reference standard (<5 percent deviation allowed);
  - o percent cover of non-native species not exceeding 10 percent (includes tree and shrub layers only and does not include herb layer);
  - o recruitment of native hydrophytes ratio of seedlings to saplings would be at least 75 percent of that of reference site;
  - o vegetation community heterogeneity would be 75 percent (or greater) of the reference site; and
  - o Replanting would be performed, as necessary, during the appropriate planting period, with the appropriate-sized stock to ensure that these performance standards are achieved. If substantial non-compliance with the performance standards listed above

occurs, RMV would consult with the CDFG to determine whether corrective measures and an extension of the five-year monitoring period would be necessary. At the end of the fifth year, a report summarizing the revegetation site performance would be submitted to the applicant for distribution to CDFG.

b. Hydrological Indicators

- **First-Year Monitoring**. One quantitative survey would be performed, at the end of the first year to determine compliance with the following performance standards:[8]

  - The presence of Debris Rack, Sediment Deposits, Water Marks and/or Drainage Patterns individually or in combination, within the created wetland would achieve between 25 percent and 75 percent of the reference standard based upon visual estimates.

  - If the collective measure of hydrologic indicators does not achieve the performance standard, additional grading, planting, or configuration of the wetland would be performed to ensure hydrological functioning within the created wetlands.

- **Second-Year Monitoring**. One quantitative survey would be performed, at the end of the second year to determine compliance of the referenced variables with the following performance standards:

  - The presence of Debris Rack, Sediment Deposits, Water Marks and/or Drainage Patterns individually or in combination, within the created wetland would achieve between 25 percent and 75 percent of the reference standard based upon visual estimates.

  - If the collective measure of hydrologic indicators does not achieve the performance standard, additional grading, planting, or configuration of the wetland would be performed to ensure hydrological functioning within the created wetlands.

- **Third-Year Monitoring**. One quantitative survey would be performed, at the end of the third year to determine compliance of the referenced variables with the following performance standards:

[8] The performance standards are adapted from the Corps HGM Riverine Guidebook .

- The presence of Debris Rack, Sediment Deposits, Water Marks and/or Drainage Patterns individually or in combination, within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.

- If the collective measure of hydrologic indicators does not achieve the performance standard, additional grading, planting, or configuration of the wetland would be performed to ensure hydrological functioning within the created wetlands.

- **Fourth-Year Monitoring**. One quantitative survey would be performed, at the end of the fourth year to determine compliance of the referenced variables with the following performance standards:

  - The presence of Debris Rack, Sediment Deposits, Water Marks and/or Drainage Patterns individually or in combination, within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.

  - If the collective measure of hydrologic indicators does not achieve the performance standard, additional grading, planting, or configuration of the wetland would be performed to ensure hydrological functioning within the created wetlands.

- **Fifth-Year Monitoring**. One quantitative survey would be performed, at the end of the fifth year to determine compliance of the referenced variables with the following performance standards:

  - The presence of Debris Rack, Sediment Deposits, Water Marks and/or Drainage Patterns individually or in combination, within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.

  - If the collective measure of hydrologic indicators does not achieve the performance standard, additional grading, planting, or configuration of the wetland would be performed to ensure hydrological functioning within the created wetlands.

c. Coarse Woody Debris (For Woody Riparian Sites Only)

- **First-Year Monitoring**. One quantitative survey would be performed, at the end of the first year to determine compliance with the following performance standard:

- The amount of coarse woody debris within the created wetland would achieve between 25 percent and 75 percent of the reference standard based upon visual estimates.

- If the measure of coarse woody debris in the created wetland does not achieve the performance standard, additional coarse woody debris would be added in the form of willow, sycamore, and/or oak snags.

- **Second-Year Monitoring**. One quantitative survey would be performed, at the end of the second year to determine compliance of the referenced variables with the following performance standard:

  - The amount of coarse woody debris within the created wetland would achieve between 25 percent and 75 percent of the reference standard based upon visual estimates.

  - If the measure of coarse woody debris in the created wetland does not achieve the performance standard, additional coarse woody debris would be added in the form of willow, sycamore, and/or oak snags.

- **Third-Year Monitoring**. One quantitative survey would be performed, at the end of the third year to determine compliance of the referenced variables with the following performance standard:

  - The amount of coarse woody debris within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.

  - If the measure of coarse woody debris in the created wetland does not achieve the performance standard, additional coarse woody debris would be added in the form of willow, sycamore, and/or oak snags.

- **Fourth-Year Monitoring**. One quantitative survey would be performed, at the end of the fourth year to determine compliance of the referenced variables with the following performance standard:

- The amount of coarse woody debris within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.

- If the measure of coarse woody debris in the created wetland does not achieve the performance standard, additional coarse woody debris would be added in the form of willow, sycamore, and/or oak snags.

- **Fifth-Year Monitoring**. One quantitative survey would be performed, at the end of the fifth year to determine compliance of the referenced variables with the following performance standard:

  - The amount of coarse woody debris within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.

  - If the measure of coarse woody debris in the created wetland does not achieve the performance standard, additional coarse woody debris would be added in the form of willow, sycamore, and/or oak snags.

d. Microtopographic Complexity

- **First-Year Monitoring**. One quantitative survey would be performed, at the end of the first year to determine compliance with the following performance standard:

  - The number of depressions and/or hummocks per unit area (*e.g.*, 10 x 10 m) within the created wetland would achieve between 25 percent and 75 percent of the reference standard based upon visual estimates.

  - If the measure of microtopographic complexity does not achieve the performance standard, additional grading would be performed to increase the number of depressions and hummocks in the created wetlands.

- **Second-Year Monitoring**. One quantitative survey would be performed, at the end of the second year to determine compliance of the referenced variables with the following performance standard:

- The number of depressions and/or hummocks per unit area (*e.g.*, 10 x 10 m) within the created wetland would achieve between 25 percent and 75 percent of the reference standard based upon visual estimates.

- If the measure of microtopographic complexity does not achieve the performance standard, additional grading would be performed to increase the number of depressions and hummocks in the created wetlands.

- **Third-Year Monitoring**. One quantitative survey would be performed, at the end of the third year to determine compliance of the referenced variables with the following performance standard:

  - The number of depressions and/or hummocks per unit area (*e.g.*, 10 x 10 m) within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.

  - If the measure of microtopographic complexity does not achieve the performance standard, additional grading would be performed to increase the number of depressions and hummocks in the created wetlands.

- **Fourth-Year Monitoring**. One quantitative survey would be performed, at the end of the fourth year to determine compliance of the referenced variables with the following performance standard:

  - The number of depressions and/or hummocks per unit area (*e.g.*, 10 x 10 m) within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.

  - If the measure of microtopographic complexity does not achieve the performance standard, additional grading would be performed to increase the number of depressions and hummocks in the created wetlands.

- **Fifth-Year Monitoring**. One quantitative survey would be performed, at the end of the fifth year to determine compliance of the referenced variables with the following performance standard:

  - The number of depressions and/or hummocks per unit area (*e.g.*, 10 by 10m) within the created wetland would achieve between 75 percent and 125 percent of the reference standard based upon visual estimates.

- If the measure of microtopographic complexity does not achieve the performance standard, additional grading would be performed to increase the number of depressions and hummocks in the created wetlands

SECTION 3.6 IMPLEMENTATION PLAN

Implementation of the ARRP would be comprised of several steps, including:

1. Assessment of site hydrology, including preparation of water budgets where appropriate (preparation of water budgets would typically be needed for wetland creation projects to ensure that sufficient hydrology is present to support the target community but would not be required for activities such as giant reed or pampas grass removal);

2. Assessment of the sites to determine the most effective restoration approach; *i.e.*, passive restoration or active restoration, amount of grading where necessary, revegetation, or enhancement;

3. Appropriate planting techniques; and

4. Assessment of site-appropriate methods for invasives control (see Invasive Species Control Plan, *Appendix J*).

3.6.1 Assessment of Restoration Approach

For the sites noted above, sufficient hydrological information has been collected to provide a high level of confidence that the sites exhibit sufficient hydrology. In some cases, additional data may be collected to ensure that the optimal plant palettes are developed relative to site-specific conditions and also to ensure that water is not "robbed" from existing vegetation communities downstream of the proposed site. For example, areas in Chiquita Canyon between the Narrows and the SMWD Treatment Facility exhibit potential for a variety of wetland or riparian types that would in part be determined by grading to ensure maximum hydrology. Marsh vegetation could be incorporated into this area; however, it is expected that slightly "drier" transitional riparian or alkali meadow vegetation communities (that use only about one half the water of marshes) would be incorporated into this area to ensure that potential downstream impacts are eliminated. Where grading is determined to be a necessary component of the program, grading plans would be developed that provide the restoration personnel with sufficient detail to properly implement the program. It is important to note that "in-the-field" adjustments are often necessary during final grading to ensure the highest level of function.

Where substantial grading is required, it is expected that the majority of the non-native seed banks would have been removed and that "grow-and-kill" programs or other intensive site preparation would not be necessary.

For projects where significant grading is not required, it may be necessary to conduct grow-and-kill programs or other types of weed/invasive plant removal. A variety of approaches, including hand removal, mechanical removal, or herbicide use may be appropriate depending on site-specific conditions. It is also likely that some sites may receive a variety of treatments, including heavy grading in some areas, light grading in other areas, and no grading with only weed control in other areas.

For many restoration sites, it is often necessary to evaluate soil conditions and, as appropriate, augment or rehabilitate poor or damaged soils. Soils on the RMV portion of the Habitat Reserve are, however, generally well understood and past restoration projects have been conducted without the need for soil augmentation.

a. Passive Restoration

Passive restoration would typically follow invasive exotic species control. For example, as giant reed is removed from portions of San Juan Creek or Trabuco Creek, it is expected that native riparian vegetation communities such as southern arroyo willow or mule fat scrub would reestablish. The key concept of passive restoration, in the context of the aquatic ecosystem, is that the native vegetation would naturally reestablish if the removal sites are kept free of the target invasive species. For passive restoration to be effective, however, the site likely would need to be bounded by native vegetation (to facilitate colonization by native species) and/or have an adequate seed bank upstream to support the growth of native species.

b. Active Restoration

Active restoration would be implemented if passive restoration is considered to be inappropriate for the site; *i.e.*, the native vegetation community is unlikely to naturally reestablish itself because of its large size, lack of immediately adjacent native vegetation, and/or lack of a native seed bank. Furthermore, if monitoring of restoration sites indicates that passive restoration is not working, active restoration would be implemented. The key difference between passive and active restoration is that focused restoration activities would be implemented.

3.6.2 Revegetation Efforts

The revegetation treatment for alkali or freshwater marsh, met meadow, southern willow riparian forest, and transitional riparian scrub would rely upon the use of container plants, acorns/seedlings and a native seed mix to reintroduce the appropriate wetland/riparian species to revegetation sites. *Tables 9* through *12* provide conceptual plant palettes for each of these vegetation communities.

Container plant installation would be an important component of the revegetation treatment at wetlands sites to facilitate more rapid plant establishment and area coverage; for coast live oak, the use of seedlings may prove more effective over time. Species with seed that is not readily available or that do not readily germinate would be introduced using nursery-grown container plants. Both container stock and seed would originate from the San Juan and San Mateo Creek watersheds. All of the target species are available within the GERA and/or Chiquita Canyon restoration areas, having been documented during extensive monitoring programs.

TABLE 9
CONCEPTUAL ALKALI OR FRESHWATER MARSH RESTORATION CONTAINER PLANT PALETTE

Botanical Name	Common Name	Size	Typical Spacing (in feet)
Scirpus americanus	Olney's bulrush	liners	4
Scirpus californicus	California bulrush	1 gal.	4
Scirpus acutus	Hardstem bulrush	1 gal	4
Juncus xiphioides	Iris-leaved rush	liners	4
Scirpus pungens	Three-square	liners	4
Eleocharis macrostachya	Creeping spikerush	liners	3
Typha domingensis	Southern cattail	1 gal.	5
Scirpus maritimus	Alkali bulrush	Liners	4
Paspalum distichum	Knot grass	Liners	4
Berula erecta	Water parsnip	Liners	10
Polygonum lapathifolium	Willow smartweed	seed	scattered
Baccharis douglasii	Douglas baccharis	1 gal.	6
Cyperus eragrostis	Tall nutsedge	seed	scattered
Epilobium ciliatum	Willow herb	seed	scattered
Bidens laevis	Burr marigold	seed	scattered
Pluchea odorata	Marsh fleabane	seed	scattered
Anemopsis californica	Yerba mansa	liners	6

TABLE 10

CONCEPTUAL ALKALI MEADOW CONTAINER PLANT PALETTE

Botanical Name	Common Name	Size	Typical Spacing (in feet)
Distichlis spicata	Saltgrass	liners	4
Juncus Mexicanus	Mexican rush	liners	4
Juncus rugulosus	Wrinkled rush	liners	4
Muhlenbergia rigens	Deer grass	liners	4
Leymus triticoides	Alkali ryegrass	liners	5
Carex preagracilis	Clustered field sedge	liners	5
Centromadia parryi australis	Southern tarplant	seed	random
Anemopsis californica	Yerba mansa	liners	5
Eleocharis macrostachya	Creeping spikerush	liners	3
Juncus bufonius	Toad rush	seed	scattered
Spergularia marina	Marsh sand-spurry	seed	scattered
Atriplex coulteri	Coulter's saltbush	seed	site-specific

TABLE 11
CONCEPTUAL SOUTHERN WILLOW RIPARIAN FOREST

Botanical Name	Common Name	Size	Spacing
Salix lasiolepis	Arroyo willow	liners or gallon	10 to 20 ft
Salix laevigeta	Red willow	liners or gallon	10 to 20 ft
Salix gooddingii	Black willow	liners or gallon	10 to 20 ft
Salix exigua	Narrow-leaf willow	liners or gallon	10 to 20 ft
Populus trichocarpa balsamifera	Black cottonwood	liners or gallon	10 to 20 ft
Baccharis salicifolia	Mule fat	liners or gallon	10 to 20 ft
Baccharis emoryi	Emoryi baccharis	liners or gallon	10 to 20 ft
Baccharis douglasiana	Douglas baccharis	liners or gallon	10 to 20 ft
Eleocharis montevidensis	Slender creeping spikerush	liners	4 ft
Juncus mexicanus	Mexican rush	liners	4 ft
Juncus rugulosus	Wrinkled rush	liners	4 ft
Juncus macrophyllous	Large-leaved rush	liners	4 ft
Artemisia douglasiana	Mugwort	liners	6.0
Cyperus eragrostis	Tall nudsedge	liners	4 ft
Leymus triticoides	Alkali ryegrass	liners	4 ft

TABLE 12
CONCEPTUAL TRANSITIONAL RIPARIAN SCRUB RESTORATION CONTAINER PLANT PALETTE

Botanical Name	Common Name	Size	Typical Spacing (in feet)
Baccharis salicifolia	Mule fat	liners	10
Baccharis emoryi	Emory baccharis	liners.	10
Sambucus mexicanus	Mexican elderberry	1 gal	20
Artemisia douglasiana	Mugwort	liners	20
Atriplex lentiformis breweri	Brewer's saltbush	1 gal	16
Baccharis pilularis	Coyote brush	liners	10
Leymus triticoides	Alkali ryegrass	1 gal.	6
Carex praegracilis	Clustered field sedge	liners	6
Muhlenbergia rigens	Deergrass	1 gal	6
Juncus patens	Spreading rush	liners	6

Baccharis douglasii	Douglas baccharis	1 gal.	8

3.6.3 Planting Techniques

All container plants and salvaged plants would be installed using industry standard techniques. A hole twice the diameter of the rootball would be excavated to the depth of the rootball. Each hole would be filled with water and allowed to drain prior to plant installation. Each container plant rootball would be scarified prior to installation if dead roots occur on the surface of the rootball. Salvaged plant rootballs do not need scarification. Planting backfill would be native soil.

Oak woodland species would receive a 2-inch thick layer of bark mulch 18 inches out from the base of each plant to reduce weed growth and water evaporation. After installation, each plant would be irrigated to the depth of the rootball.

3.6.4 Seed Application

A two-step hydroseed technique would be used to install all seed mixes. This technique involves an initial application of a hydroseed slurry composed of water, seed, fertilizer (if any), and a low volume of fiber mulch. The second hydroseed slurry application contains water and a heavier volume of fiber mulch. The purpose of the two-step process is to achieve the greatest seed-soil contact. In any cases where seed applications are within small in-fill enhancement areas, installation would be performed using hand broadcast methods.

3.6.5 Irrigation System & Schedule

Where needed, temporary on-grade irrigation systems would be installed to enhance germination and establishment of native plantings. The systems would be controlled automatically by irrigation clocks, and may be designed to shut off during rains events. Areas of similar topography may be controlled by a single remote control valve. The precipitation rate of the system would be approximately 0.2 inch per hour for any given area of the system.

The frequency and duration of irrigation are critical to seed germination and container plant establishment. The application of water would be keyed to existing conditions and water requirements of each stage of seed germination and seedling establishment. Irrigation would be used to maximize container plant survival and deep root growth while minimizing non-native species growth and seed production.

During each inspection, holes would be dug with a hand shovel or using a soil probe to determine the depth and amount of soil moisture. Enough holes would be dug to establish a

representative sample of the site, *i.e.*, until soil conditions are the same in more than three holes dug across the site. The irrigation schedule would be modified as necessary based on this inspection. Irrigation heads would be adjusted or capped where wet areas occur next to dry areas to facilitate additional irrigation of the drier areas.

Irrigation system operation would be suspended in anticipation of rain events. The system would be shut-off at a master control valve three to five days prior to a predicted rain-storm or series of storms. System operation would be resumed immediately if a predicted storm does not materialize and if the site requires supplemental irrigation to maintain soil moisture conditions that are sufficient for seed germination and seedling establishment. System operation would be resumed after a rain event upon a site inspection to determine soil moisture levels.

3.6.6 Weed Control

In wetland and riparian restoration areas, weed seed bank build up can occur quickly if weeds are not controlled. The suite of weeds that colonize wetland and riparian sites on RMV and south Orange County vary with annual rainfall patterns, hydrologic characteristics of specific wetland sites, seasonality and types of disturbance that site receive (*e.g.*, regular flood scour, sediment deposition, etc.). Weed abatement is most effective when time is given to repeated treatment of resprouting weeds. The following species are those most likely to require some level of control during the establishment phase of restoration projects: bristly ox-tongue (*Picris echioides*), Spanish sunflower (*Pulicaria paludosa*), yellow sweet-clover (*Melilotus indica*), white sweet clover (*Melilotus albus*), burr clover (*Medicago polymorpha*), English plantain (*Plantago major*), prickly lettuce (*Lactuca serriola*), Bermuda grass (*Cynodon dactylon*), Italian ryegrass (*Lolium multiflorum*), bull-thistle (*Cirsium vulgare*), sugar beets (*Beta vulgaris*), and poison hemlock (*Conium maculatum*). Where they become established, other invasives such as giant reed, tamarisk, and African umbrella sedge (*Cyperus involucratus*), should also be removed immediately. Early treatment and regular follow-up treatment of these species would reduce the weed density in the restoration areas over the long-term. Herbicide treatment of non-native grasses and follow-up treatment to reduce seed production would be essential for establishing native vegetation cover.

SECTION 3.7 MAINTENANCE AND MONITORING PLAN

Maintenance and monitoring activities that are necessary to ensure successful revegetation and enhancement would be conducted in accordance with this plan. The Maintenance and Monitoring Plan provides direction to the Restoration Ecologist, Reserve Manager, and the Installation/Maintenance Contractor for routine maintenance of the restoration projects to be conducted throughout the initial plant establishment period and five-year monitoring period. This section is intended to provide a brief description of those activities.

3.7.1 Maintenance Activities

Maintenance activities would apply to all revegetation and enhancement areas. Immediately following implementation of the restoration program, a maintenance program would be initiated to ensure successful germination and growth of the installed native species.

Because mature vegetation communities effectively control non-native species, restored wetland and riparian areas likely would become self-sustaining over time, needing very little or no maintenance once established (unless invasive species such as giant reed re-establish]. Maintenance activities for wetland and restoration areas would thus focus on ensuring the establishment of self-sustaining vegetation during the five-year maintenance period. Maintenance activities would include weed control, supplemental irrigation (as appropriate), pest control (as appropriate), and site access restrictions.

3.7.2 Four-Month Maintenance and Monitoring Period

During the four-month period following completion of restoration activities, weed control measures, irrigation schedules, and special management needs would be determined. A replanting program would be initiated at the completion of the four-month maintenance period if 100 percent container plant survival is not attained (woody species only).[9] The plant establishment period would be included in the installation contract to be performed by the Installation/Maintenance Contractor. Successful completion of the contract would include 100 percent survival of all container plants at the end of the plant establishment period (woody species only). New replacement plants would be provided and installed for the Installation/Maintenance Contractor to obtain final contract sign-off and payment.

3.7.3 Five-Year Maintenance and Monitoring Program

Following the four-month maintenance period, a long-term five-year maintenance program would be initiated. Long-term maintenance would be initiated following the end of the plant establishment period. Maintenance would occur on an as-needed basis throughout the five-year maintenance period. Maintenance personnel are expected to conduct maintenance activities on a timely basis by conducting work at a frequency and intensity that would result in the greatest potential for native vegetation to establish and become the dominant vegetation type within the restoration area. If necessary, corrective measures (such as re-seeding or container planting)

[9] Up to ten percent loss of herbaceous container stock (*e.g.*, *Scirpus* spp. *Juncus* spp. or *Carex* spp. is acceptable as these species reproduce vegetatively, often making it difficult to determine which individual represents the original planting. Where die-off greater than ten percent is evident in the first four months, other problems such as insufficient hydrology or soil chemistry may need to be evaluated to determine reasons for high mortality.

would be promptly implemented to bring the restoration effort into compliance with the performance standards noted above in *Section 3.5.3*.

Supplemental irrigation of restoration sites would be conducted as necessary as determined by the Restoration Ecologist. Irrigation schedules would provide adequate water to maximize the survival of installed container plants and seedling establishment. Irrigation of the restoration sites would be closely monitored, and if necessary, the irrigation schedule and rates for each area would be modified to provide moisture and ensure successful germination and growth. The Restoration Ecologist would determine the need for changes in irrigation schedules in consultation with the Installation/Maintenance Contractor. An accurate record of these activities would be maintained by the Installation/Maintenance Contractor.

3.7.4 Weed Control

It would be the Installation/Maintenance Contractor's responsibility to control weeds within the restoration areas. Before initiating any weed control measures, the Installation/Maintenance Contractor would meet onsite with the Restoration Ecologist and Reserve Manager to determine the extent and methods of weed control. The Installation/Maintenance Contractor would notify the Reserve Manager at least three days prior to implementing approved weed control measures. Weed control would be conducted in all active restoration areas for the duration of the five-year maintenance period. No more than 10 percent non-native cover in any given year during the five-year maintenance period would be accepted within wetland or riparian restoration areas.

During the five-year maintenance program, the non-native species noted above in Implementation Section, would be removed with hand tools, by hand, or treated with appropriate herbicides. Hand tools such as "weed whips" would be used only where solid patches of non-native grasses are present and in the absence of native seedlings. Hand removal would be used where native herb, shrub or tree seedlings are present. Chemical treatment would be limited to large areas of non-native grass with no native species present.

The prime period for weed removal is in the spring during the months of March and April. Weed eradication at this time is ideal because soils are typically still moist enough for hand-pulling and therefore can be removed before their detrimental effects of robbing native plants of sunlight, moisture, and nutrients occur. Additionally, it is imperative that weeds are removed before they can successfully produce seeds and contribute to the weed seed bank. If weeds are not controlled during this period of time, successful establishment of target wetland vegetation would be extended in duration and potentially reduced in extent.

3.7.5 Clearing and Trash Removal

Pruning or clearing of native revegetation plantings would be prohibited. The revegetation areas would be allowed to develop naturally. Plant debris of native shrubs would not be removed from the restoration sites. Native plant debris provides valuable micro-habitats for invertebrates, reptiles, small mammals, and birds; all necessary elements of normally functioning wetland and/or riparian communities. The decomposition of the plant debris also is essential for the replenishment of the soil's nutrients and minerals.

Trash would be regularly removed from restoration areas by hand and appropriately disposed of offsite. Such trash would be removed as needed, but at no less than at 1-month intervals for the first year, and quarterly thereafter.

3.7.6 Pest Control

Pests, including insects, mites, snails, rabbits, and rodents, are expected to occur within the restoration areas. In accordance with an Integrated Pest Management Program, active control of pests with the use of chemical pesticides would be avoided in favor of allowing natural environmental controls to take effect or the use of directed controls (*e.g.*, trapping). If destruction of the vegetation plantings by pests becomes a problem, the Installation/Maintenance Contractor would consult with the Reserve Manager responsible for mitigation within the Habitat Reserve and the Restoration Ecologist to determine remedial measures to be taken.

SECTION 3.8 MONITORING PROGRAM

As noted above under the Performance Standards in *Section 3.5.3*, each of the three specific components of the Restoration Program (*i.e.*, vegetation creation, stream restoration/rehabilitation, invasive exotic removal) each has its own set of performance standards and as such, each has a separate monitoring program relative to the methods used. The monitoring program set forth below is separated accordingly.

3.8.1 Vegetation Creation or Restoration: Emergent Marsh, Wet Meadow, Riparian Scrub/Forest

Monitoring would be performed by an agency-approved biologist (or Restoration Ecologist) with appropriate credentials and experience in native vegetation restoration, restoration monitoring, wetland delineation, and the USACE's HGM approach. The performance of the mitigation would be evaluated by evaluating the target function variables described above in *Section 3.5.2.* Due to overlap among the variables, field data collected for Percent Vegetative Cover, Coarse Woody

Debris (based upon direct visual estimates), Microtopographic Complexity, Species Composition, Seedling Recruitment, and Vegetation Community Heterogeneity would provide the information necessary to determine performance compliance for all variables. The Reserve Manager or designated Restoration Ecologist would be responsible for development of data sheets to be used in collection of the information associated with each variable (it should be noted that Appendix 3 of the Guidebook provides examples of data sheets that can be used or modified for use in the field during monitoring of the variables). The target function variables are described below.

a. Percent Vegetation Cover

The Percent Vegetative Cover would be determined using standard quantitative vegetation sampling methodologies, which utilize transects or quadrats that characterize each vegetation strata (canopy, shrub, and herbaceous) in terms of total cover. Included in this variable would be percent cover by non-native invasive species. Data regarding non-native invasive species would be used in determining the types of remedial measures needed to ensure that the mitigation area remains healthy.

b. Species Composition

Data regarding Species Composition would be collected during the quantitative vegetation sampling discussed above.

c. Recruitment of Native Hydrophytes

Beginning with year three of the five-year monitoring program, recruitment of native hydrophytes would be evaluated by comparison with the reference site. The measurement of recruitment of native hydrophytes would be conducted during performance of quantitative vegetation surveys (by transect or quadrat sampling method) and would be conducted for appropriate vegetation strata.[10] Comparison of the mitigation site with the reference site could be accomplished by measuring the ratio of seedlings/saplings/or clonal shoots to established shrub/trees or by absolute numbers as determined appropriate by the Restoration Ecologist.

d. Vegetation Heterogeneity (Vegetation Patchiness)

Beginning with year three of the five-year monitoring program, vegetation patchiness would be evaluated by comparison with the reference site. Characterization of vegetation community

[10] For example, areas of willow riparian forest would include three strata - canopy, shrub, and herbaceous layers whereas, mule fat scrub would include only the shrub and herb layers.

heterogeneity or patchiness greatly depends upon scale and would be based upon direct visual observations made during performance of quantitative sampling.

e. Coarse Woody Debris (Riparian Vegetation Only)

Coarse Woody Debris would be evaluated by direct visual observation, comparing the reference site with the GERA mitigation areas. For purposes of this mitigation program, Coarse Woody Debris is defined as woody vegetation deriving from trees and/or shrubs greater than 2.5 inches in diameter.

f. Microtopographic Complexity

Microtopographic Complexity would be evaluated by direct observation, comparing the restoration sites with reference sites. Microtopographic complexity would be measured during performance of vegetation transects, recording number of hummocks/mounds and depressions along with the change in topographic relief by class.[11]

g. Specific Conductance

Specific conductance would be measured using appropriate devices. Measurements obtained during monitoring of mitigation areas in Chiquita and GERA used an Oakton hand-held conductivity meter. Any similar device is appropriate/acceptable.

h. Hydrological Indicators

In addition to the variables referenced above, observations regarding field indicators for hydrology would be recorded during quantitative sampling for comparison with the reference site(s). Hydrological indicators to be recorded (as appropriate for each site), by direct observation, include Debris Rack, Sediment Deposits, Ponding Duration, Ponding Depth, Ponding Extent, Water Marks, and Drainage Patterns in the Wetland.

i. Wetland Delineation

Determination that the mitigation wetlands, expected to meet CDFG-defined wetland criteria, including at least one of the following: wetland hydrology, soils, and vegetation. The determination that wetland hydrology, and/or soils, and/or vegetation is/are present would be made using the 1987 Corps Manual.

[11] The HGM Guidebook for Riverine Wetlands suggests microdepression size classes of 0.5, 1.0, and 1.5 meters with depths of 5, 10, and 15 centimeters.

j. Selection of Reference Site(s)

A reference site (or sites) would be identified in Chiquita Canyon, Canada Gobernadora, or other appropriate canyons in the Habitat Reserve as determined appropriate by the Restoration Ecologist in coordination with CDFG. The reference sites would be located in areas that would be preserved in perpetuity and would correspond to wetlands to be impacted relative to the functions, and related variables, discussed throughout this mitigation program. The reference site(s) would be approved by the CDFG prior to implementation of the mitigation program.

3.8.2 Record Keeping

Following each monitoring visit, the Restoration Ecologist would recommend actions, as needed, to the Reserve Manager that would promote survival and coverage criteria as described in the performance standards. The Restoration Ecologist, Reserve Manager, and Installation/Maintenance Contractor would work together to monitor, maintain, and replant restoration areas, if necessary.

Over the five-year period following restoration implementation, an annual report prepared by the Restoration Ecologist that discusses the results of the restoration monitoring and maintenance efforts for that year would be submitted to the Reserve Manager for incorporation into the overall report for the Habitat Reserve (see *Part 1, Chapter 7, Section 7.3.8*). Vegetation cover by species, compliance with required performance standards, species heights, seedling recruitment, pest problems, weed control problems, pest control measures implemented, additional required maintenance procedures, and the general health of the revegetation plantings would be summarized in these reports. Photo-documentation of the sites would be included in the reports to provide a visual record of the restoration progress.

SECTION 3.9 COMPLETION OF RESTORATION

3.9.1 Notification of Completion

Upon completion of Year 5 of the monitoring period or when the restoration area(s) have achieved the Year 5 performance criteria, the Restoration Ecologist would prepare a final report for the Reserve Manager that describes the relative success of each restoration area.

3.9.2 Contingency Measures

Contingency measures would be implemented if restoration efforts fail to meet performance criteria at the end of the five-year monitoring period. Such measures would include additional

container plant and/or seed installation, additional weed control efforts, an evaluation and appropriate modification of the irrigation system, and the extension of the maintenance and monitoring period until such time that the performance criteria are achieved.

3.9.3 Long-Term Management

Long-term management beyond the five-year mitigation performance standard monitoring program would be in accordance with the AMP. The Reserve Manager would determine whether a restoration site would be subject to long-term monitoring and management pursuant to the HRMP.