Dudek, "Revised Draft Newhall Ranch Mitigation Feasibility Report" (January 2007; 2007A)

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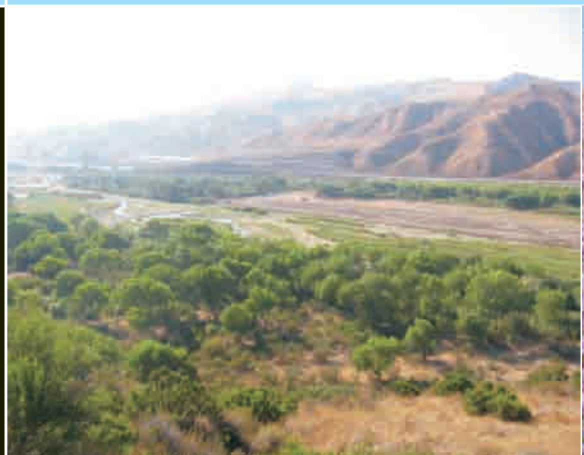
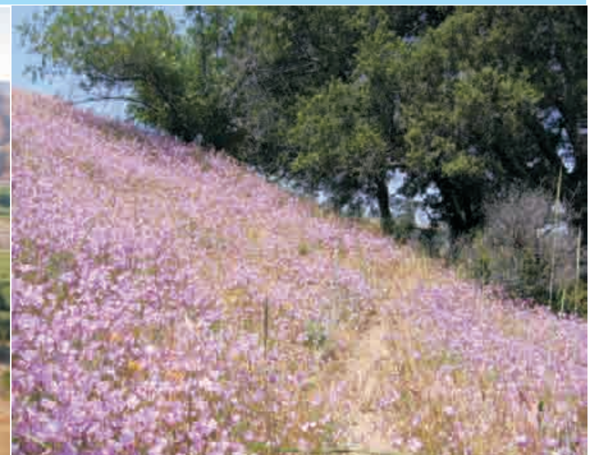
Newhall Ranch Mitigation Feasibility Study

JANUARY 2007

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SUMMARY OF FINDINGS

Dudek conducted general biological surveys, including vegetation mapping and sensitive species surveys/habitat assessments within the proposed open space and preserve areas of the 12,000-acre Newhall Ranch Specific Plan Area (NRSP), including the 4,205-acre Newhall Ranch High Country Specific Management Area (NRHC SMA), and the 1,518-acre Salt Creek area. This study excludes the open space areas within the canyon tributaries to the Santa Clara River (with the exception of Salt Creek) because mitigation within each of these canyons will be designed according to the proposed impacts for each individual canyon. Collectively, the proposed open space and preserve areas evaluated in this feasibility study are referred to as the Study Area in this report. The surveys were conducted in order to determine mitigation opportunities for slender mariposa lily (*Calochortus clavatus* ssp. *gracilis*), California sagebrush scrub, oak trees and oak tree vegetation communities and wetlands creation/restoration and enhancement.

For slender mariposa lily mitigation, Dudek estimated that there are approximately 559 acres of land suitable for slender mariposa lily transplantation. Potential transplantation areas were prioritized from 1 to 3 (with 1 being the highest priority sites and most suitable for transplantation) based on factors important to successful transplantation of this species. Based on this prioritization scheme, there are 280 acres of priority 1 suitable areas, 193 acres of priority 2 suitable areas and 86 acres of priority 3 suitable areas for slender mariposa lily mitigation.

For purposes of addressing California sagebrush scrub mitigation, suitable restoration areas identified within the Study Area have been subdivided into Areas A through G and total approximately 780 acres. The potential California sagebrush scrub mitigation areas were prioritized according to their perceived suitability similar to the potential slender mariposa lily mitigation areas described above. Areas identified as A, B and C are considered to be the most suitable (or priority 1 areas) for California sagebrush scrub restoration totaling approximately 354 acres. Priority 2 California sagebrush scrub restoration areas (Areas F and G) total 181 acres and Priority 3 California sagebrush scrub restoration areas (Areas D and E) total 246 acres.

Dudek evaluated potential areas for oak mitigation at the vegetation community level and oak mitigation on an individual oak tree basis. Approximately 205 acres were identified as having potential for incorporation of additional individual oak trees as mitigation. In addition to incorporating additional oaks within existing oak communities, there are approximately 111 acres considered suitable for creating specific oak vegetation communities, including 86 acres of valley oak savannah, 24 acres coast live oak woodland and 1 acre valley oak woodland.

Wetlands mitigation opportunities were evaluated in the context of the Hybrid Functional Assessment of Wetland and Riparian Habitats for the Newhall Ranch Habitat Management Plan

(HFA; URS 2004). There are 17 stream reaches within the open space and preserve areas within the Study Area that were examined for potential wetlands mitigation in this study. Based on the conceptual layout of wetlands creation/restoration and enhancement described in this report, it is estimated that a combined total of approximately 64.6 acres of wetlands vegetation communities could be created and that approximately 52.1 acres of wetlands enhancement credit is available within the Study Area.

After evaluating mitigation potential for each mitigation type individually, all mitigation types were evaluated collectively based on specific mitigation needs for the project in relation to mitigation availability. Based on this comprehensive evaluation, there are a total of 1,378 acres of area available for upland mitigation, including 417 acres available for slender mariposa lily mitigation, 470 acres available for California sagebrush scrub mitigation, 87 acres available for a combination of California sagebrush scrub and slender mariposa lily mitigation, 189 acres available for individual oak tree planting, 87 acres available for valley oak savannah mitigation, 11 acres available for live oak woodland mitigation and 0.4 acre available for valley oak woodland mitigation. In addition to the acreage for upland mitigation, there are 64.6 acres available for wetlands creation/restoration and 52.1 acres available for wetlands enhancement.

1.0 INTRODUCTION

This report discusses potential mitigation opportunities for slender mariposa lily (*Calochortus clavatus* ssp. *gracilis*), California sagebrush scrub, oak trees and wetlands creation/restoration and enhancement in proposed open space and preserve areas within the 12,000-acre Newhall Ranch Specific Plan Area (NRSP), including the 4,205-acre Newhall Ranch High Country Specific Management Area (NRHC SMA), and the 1,518-acre Salt Creek area. This study excludes the open space areas within the canyon tributaries to the Santa Clara River (with the exception of Salt Creek) because mitigation within each of these canyons will be designed according to the proposed impacts for each individual canyon. Collectively, the proposed open space and preserve areas evaluated in this feasibility study are referred to as the Study Area in this report. Mitigation for the state-listed endangered San Fernando Valley spineflower (*Chorizanthe parryi* var. *Fernandina*; SFVS) is not included in this plan and can be found in the *Draft Spineflower Conservation Plan* (Dudek 2007). This report is a companion document for the *Biological Resources Technical Report for Newhall Ranch Specific Plan Area, Los Angeles County, California* (Dudek 2006a), and the *Biological Resources Technical Report for the Newhall Ranch High Country Specific Management Area, Los Angeles County, California* (Dudek, 2006b) and detailed discussions of biological resources within the Study Area can be found in those documents.

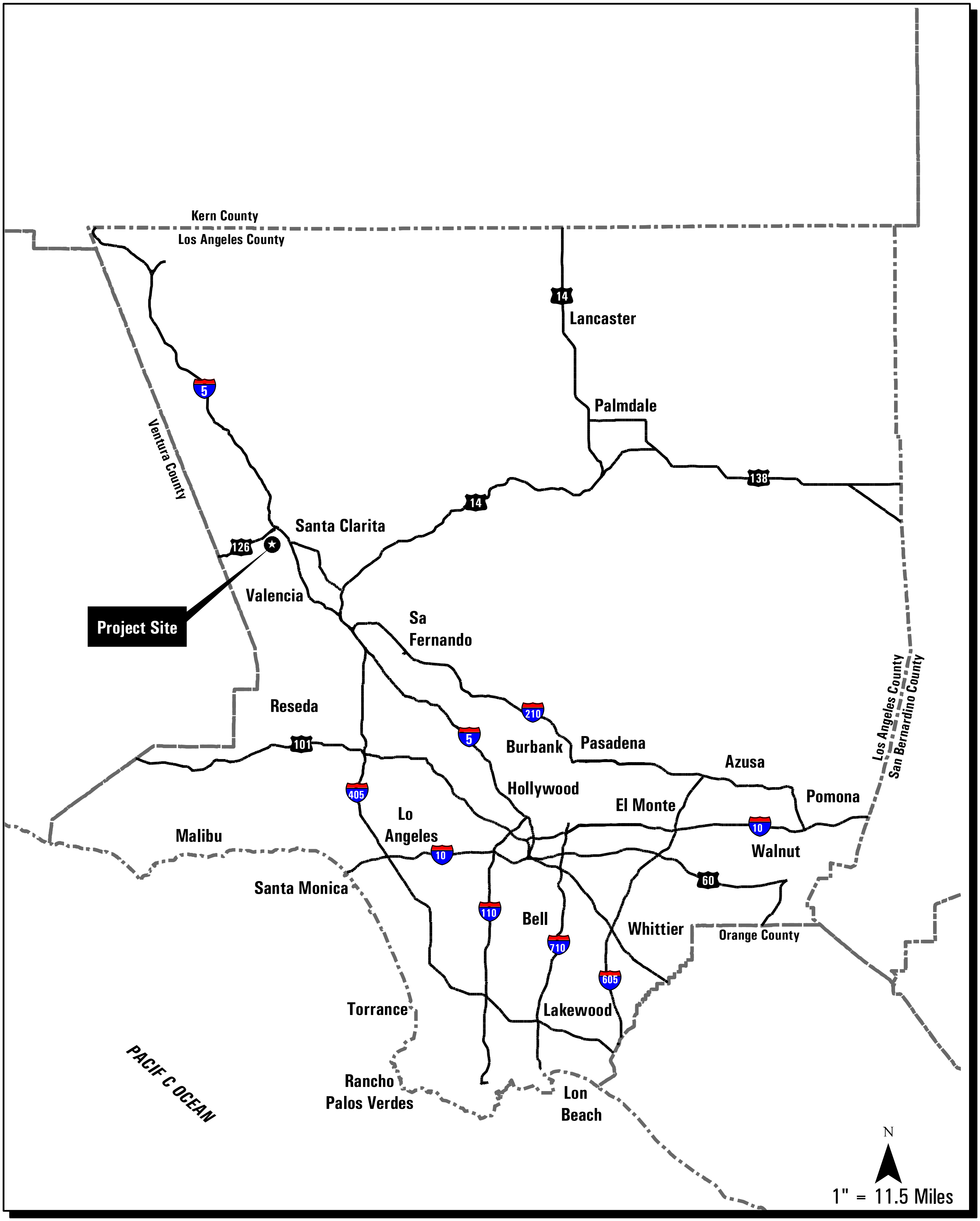
2.0 SITE DESCRIPTION

The Study Area is located in an unincorporated portion of the Santa Clara River Valley and straddles the Los Angeles/Ventura County Line (*Figures 1* and *2*). It lies roughly six miles west of Interstate 5 and west-southwest of the junction of I-5 and State Route 126 (SR-126). The City of Santa Clarita is located to the east of the Study Area.

Newhall Land (Newhall) leases out portions of the Study Area for oil and natural gas production, cattle grazing and agricultural operations (e.g., food crop production, dryland farming, honey farming). All such operations are currently ongoing. Southern California Edison and Southern California Gas Company have distribution lines within easements onsite and these easements/transmission lines are actively maintained.

2.1 Plant Communities and Land Covers

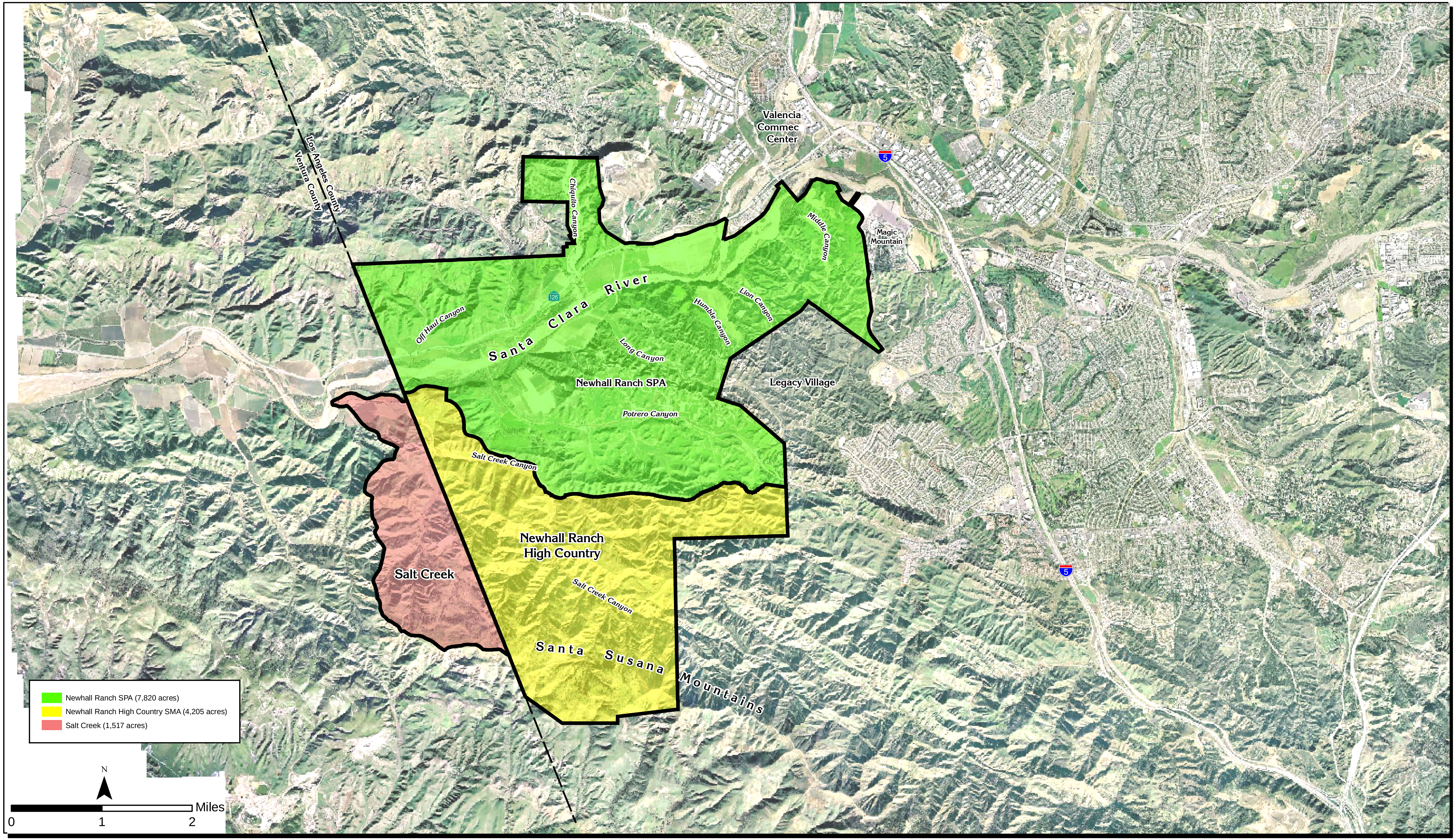
Native and naturalized vegetation communities within the Study Area are representative of those found in this region and provide examples of those plant communities found in the Santa Susana Mountains and the Santa Clara River ecosystems. (See *Figure 3* in map pocket).



Newhall Ranch Feasibility Mitigation Study

Regional Map

FIGURE 1



Newhall Ranch Feasibility Mitigation Study

Vicinity Map

FIGURE 2

Upland vegetation communities dominate the landscape within the Study Area north and south of the Santa Clara River. The majority of the site consists of the following upland plant communities:

California sagebrush scrub and sub-associations, chaparral and sub-associations, coast live oak woodland, valley oak woodland and savannah, California walnut woodland and California annual grasslands. The Santa Clara River and its tributaries support a variety of riparian vegetation communities. These include cottonwood willow riparian forest, southern willow scrub, mulefat scrub, arrowweed scrub, big sagebrush scrub, alluvial scrub, herbaceous wetland, coastal and valley freshwater marsh, bulrush-cattail wetland, elderberry scrub, river wash, oak riparian forest, cismontane alkali wetland, tamarisk scrub and giant reed.

2.2 Topography Geology and Soils

The Study Area is dominated by rugged terrain with east-, west-, and northwest- trending primary ridges, and north- and south-trending secondary ridges. Slope gradients range from moderate to very steep in most of the site to gentle within the Santa Clara River floodplain, tributary canyons and associated mesas. The major tributaries include south-to-north Tapo and Salt Canyon drainage areas, the west-to-east Potrero and Long Canyon drainages, north to south San Martinez Grande and Chiquito Canyon drainages, Castaic Creek, as well as numerous other smaller drainages. Site elevations range from approximately 800 feet above mean sea level (AMSL) in the Santa Clara River bottom in Ventura County to approximately 3,200 feet AMSL on the ridgeline of the Santa Susana Mountains along the southeastern boundary. Distinctive geographic features include Sawtooth Ridge; Razorback Ridge; Windy Gap; Ayers Rock; and Potrero, Grapevine, and Airport Mesas.

Geologically, the Study Area is located within the Transverse Ranges geomorphic province of southern California in the eastern portion of the Ventura depositional basin. This basin was produced by tectonic downwarping in the geologic past to produce a large-scale synclinal structure in which a thick sequence of Cenozoic sediments has accumulated. These sediments have been lithified into a sequence of sedimentary rock that has subsequently been uplifted, tilted, and tectonically deformed. The geologic strata are displaced by segments of the Del Valle and Salt Creek faults (Allan E. Seward 2002).

Soils in the Study Area are mapped as Balcom-Castaic-Saugus association, 30 to 50 percent slopes, eroded (NRCS 1969). Specifically, soils onsite include: Castaic and Saugus soils (30 to 65 percent slopes, severely eroded), Castaic-Balcom silty clay loams (9 to 15 percent slopes), Castaic-Balcom silty clay loams (15 to 30 percent slopes), Castaic-Balcom silty clay loams (30 to 50 percent slopes), Castaic-Balcom silty clay loams (30 to 50 percent slopes, eroded), Castaic-

Balcom silty clay loams (50 to 65 percent slopes, eroded), Chino loam, Cortina sandy loam (0 to 2 percent slopes), Gaviota rocky sandy loam (15 to 30 percent slopes, eroded), Gaviota rocky sandy loam (30 to 50 percent slopes, eroded), Gazos clay loam (30 to 50 percent slopes), Hanford sandy loam (0 to 2 percent slopes), Hanford sandy loam (2 to 9 percent slopes), Metz loamy sand (0 to 2 percent slopes), Metz loamy sand (2 to 9 percent slopes), Mocho loam (0 to 2 percent slopes), river wash, sandy alluvial land, Saugus loam (30 to 50 percent slopes), Saugus loam (30 to 50 percent slopes, eroded), Sorrento loam (0 to 2 percent slopes), Sorrento loam (2 to 5 percent slopes), terrace escarpments, Yolo loam (0 to 2 percent slopes), Yolo loam (2 to 9 percent slopes), Zamora loam (2 to 9 percent slopes), and Zamora loam (9 to 15 percent slopes) (USDA 1969).

Soils found onsite are characterized generally by steep to very steep, often eroded slopes. The soils are well drained, with moderate to moderately slow subsoil permeability, and medium to very rapid runoff. The erosion hazard is moderate to very high, largely dependent on slope steepness.

3.0 METHODS FOR EVALUATING MITIGATION POTENTIAL

Vegetation maps of the Study Area were used in the field to identify potential mitigation areas, opportunities, and constraints. Only areas within the proposed open space/preserve boundaries were evaluated. In general, areas supporting sensitive plant species were not considered suitable for mitigation in order to avoid impacts to sensitive plants. *Figure 3* includes the vegetation map of the Study Area with known locations of sensitive plants.

Dudek habitat restoration specialists Doug Gettinger, Marc Doalson, Scott Boczkiewicz, and Andy Thomson conducted the mitigation potential surveys in the NRHC SMA and the Salt Creek area on November 7-10, November 14-18 and December 19-21, 2005. In the remaining areas of the NRSP, Dudek habitat restoration specialists Doug Gettinger, Jeremy Sison, Mike Sweesy, and Andy Thomson conducted the mitigation potential surveys on August 15-16, 2006.

3.1 Slender Mariposa Lily Mitigation

A brief description of the species and general guidelines for salvaging and transplanting slender mariposa lilies is included in this section to provide some background and context for the process of evaluating potential slender mariposa lily receptor sites within the Study Area.

Slender mariposa lily is a perennial bulbiferous herb that is adapted to a mild, dry climate. It occurs in many natural habitat areas within the Study Area. It tends to grow in well-drained soils on ridgelines and steep to moderately steep slopes, often on west-, north and east-facing slopes; however it has also been observed on gentle slopes as well as on south-facing slopes. It generally occurs in California sagebrush scrub and grasslands habitats, but has been observed in other habitats, including chaparral and oak savannah habitats, among others. It tends to occur in large patches at low density. The corms are generally located 2-4 inches below ground surface. Whether or not this species blooms in a given year depends largely on weather conditions, primarily determined by rainfall.

The species can be transplanted by removing the underground storage structure, technically termed a corm (underground stem with thin papery leaves), and re-planting in an area with appropriate environmental conditions. The seed can also be salvaged and planted.

Salvaging the corms is probably best accomplished by digging up individual corms by hand with a shovel or digging spade. Ideally, the corms should be salvaged with their surrounding soil and associated biomass intact. However, due to the soil types that support this species, the soil mass surrounding individual corms may not stay consolidated as a solid mass when the corms are collected. Additionally, the species often occurs in steep, rugged terrain. Therefore, scooping out large sections of soil containing multiple corms with a backhoe, or similar construction equipment may not be practical. Nevertheless, if feasible, salvaging the associated soil along with the corms is preferable to ensure that the appropriate soil type, and associated biomass are present at the receptor site.

If soil is salvaged, the receptor site will need to be prepared in advance by excavating existing soils down approximately 8 inches. Then salvaged soil can be spread out in an approximately 4- to 8-inch deep layer at the receptor site. Salvaged corms can then be planted at an appropriate depth (approximately 2 to 4 inches) within the salvaged soil.

Because the species is adapted to a mild, dry climate, it is anticipated that the slender mariposa lily corms will be able to survive and become established without the installation of a temporary irrigation system. However, supplemental water may be required during the first and second years to mimic average rainfall conditions in the event of below-average rainfall.

If seed collection is included as part of a mitigation program, it should be collected from the plants when the seed is mature, but before the seed capsules open to disperse the seed. Collected seed should be temporarily stored in paper bags until it can be either transported to a nursery or dispersed at the receptor site.

From seed, mariposa lilies should be planted one-quarter to one-half inch deep (McDonald 1997). The success of seed planted directly in the field will depend on whether rainfall conditions are adequate for successful germination and establishment. Seed grown under nursery conditions typically results in approximately 70 percent germination, but field conditions could be much less. Mariposa lilies grown from seed typically take three years to produce flowers (Schmidt 1975). Mariposa lilies can be grown from seed in a nursery, and then transplanted to a receptor site after they are mature. The planting areas should be marked for future monitoring, which is typically required to evaluate the success of a particular slender mariposa lily mitigation program.

Slender mariposa lily can be subject to herbivory from rodents, ground squirrels, rabbits, deer, and snails. Additionally, cattle and other grazing animals are detrimental to slender mariposa lily populations. Therefore, protective structures (i.e., exclusionary fencing and/or plant cages) are crucial to the success of a transplantation program.

In general, most annual weeds do not appear to be a competitive threat to the survival of this species. However, some invasive exotic weeds can become a problem. Weeds should be monitored and controlled so they don't inhibit establishment.

A flexible management approach that is responsive to the future needs of the site should be used when maintaining translocated plants and seeded areas at receptor sites. Slender mariposa lily will likely require minimal maintenance; however, unforeseen maintenance issues can arise, which may require intervention to ensure project success. Regular monitoring of the transplanted population during an establishment period (establishment may take several years) is an important measure to determine the success of a program, and if/when maintenance measures should be implemented.

Dudek evaluated the suitability of potential receptor sites for slender mariposa lily throughout the Study Area. (See *Figure 4* in map pocket). In general, areas that appeared to have appropriate conditions for supporting this species were mapped and prioritized. Potential transplantation areas were prioritized from 1 to 3 (with 1 being the highest priority sites and most suitable for transplantation) based on factors important to successful transplantation of this species. Potential receptor sites were chosen based on similar environmental conditions to the areas where plants are present, including soils, slope aspect and gradient, and associated vegetation communities. Specifically, sites considered suitable generally have well-drained soils (e.g., gravelly loam, sandy loam or rocky clay soils), were on ridgelines or slopes, were in California sagebrush scrub or grasslands habitats, and had western, northern or eastern aspects. Additional sites with some minor variations from these conditions were also considered suitable. Sites were qualitatively ranked from 1 to 3 based on the perceived biological suitability of each individual site, in combination with non-biological considerations such as vehicular access, ruggedness of terrain and access to an irrigation water source. Sites were usually ranked 2 or 3 due to access constraints and/or ruggedness of terrain, not because they were less favorable for the species from an environmental standpoint.

An additional consideration for selecting suitable sites was the presence of previously mapped slender mariposa lily. While the presence of slender mariposa lily signifies that suitable conditions are present for this species, transplantation to a site already supporting this species might result in impacts to the species. This is particularly true for large-scale transplanting projects and projects involving soil translocation.

For small-scale projects, individuals could be planted in gaps between the locations of known individuals without impacting the existing plants. Thus, some areas that support slender mariposa lily were still included as potential transplantation sites, and could be utilized for small-scale transplantation projects, if needed. It is critical that if an area already supporting this species is utilized for a receptor site, that previous detailed mapping of existing individuals with a global positioning system (GPS), or flagging individual locations in the field, is performed prior to implementing a transplantation program.

3.2 California Sagebrush Scrub Mitigation

California sagebrush scrub typically occurs on dry sites, often steep, rocky slopes, with low moisture availability or soils containing heavy clays that do not readily release stored water (Holland 1986). These types of soils are common in the Study Area. Slopes with northern exposures could also be established with California sagebrush scrub, but could be expected to convert to chaparral or oak woodland over time, limiting their suitability for California sagebrush scrub mitigation. (See *Figure 5* in map pocket).

To provide for greater habitat value, California sagebrush scrub mitigation areas should be adjacent to existing California sagebrush scrub, chaparral, oak woodlands, and/or wetlands to the greatest extent possible. California sagebrush scrub mitigation areas could be planted with scattered oaks adjacent to stream courses or at higher elevations where deeper soils with greater moisture availability could support oaks. Mariposa lilies could also be planted within the California sagebrush scrub mitigation areas, where appropriate, as this species often grows within or adjacent to California sagebrush scrub plants and is a minor constituent of this habitat type.

California sagebrush scrub mitigation will be easier to plant, maintain, and monitor on more gentle slopes that are relatively close to access roads, but may be accomplished in a more passive manner on steeper slopes further away from access roads. On the steeper slopes, California sagebrush scrub mitigation would be expected to take longer to become established due to harsher environmental conditions. The steeper slopes would also be more difficult to plant, maintain, and monitor. The steepest slopes in the Study Area would not be suitable for anything other than preservation, as they are often cliffs or rock outcrops.

Competition from non-native annual grasses and broadleaf weeds such as black mustard (*Brassica nigra*), milk thistle (*Silybum marianum*) and tocalote (*Centaurea melitensis*), would likely pose the greatest challenge to establishing California sagebrush scrub in most areas. These quick to germinate, fast growing weeds are dominant in the potential mitigation areas and will compete with the California sagebrush scrub seedlings for water, nutrients, and sunlight. Weed control would be all but impossible on the steeper slopes, but could be successfully conducted in other areas.

California sagebrush scrub mitigation on the steeper slopes would be more at risk of being lost due to erosion, as occurred in numerous locations within the Study Area during heavy rains in the 2004-2005 rainy season. Entire sections of hillside slid down the slope, stripping all or most of the vegetation in the process. These inherently unstable slopes are one of the characteristics of the Balcom-Castaic-Saugus association, 30 to 50 percent slopes, eroded soils mapped within the Study Area.

Soils in the potential California sagebrush scrub mitigation areas include Castaic-Balcom silty clay loams, 15-30 percent slopes; Castaic-Balcom silty clay loams, 30-50 percent slopes; Castaic-Balcom silty clay loams, 30-50 percent slopes; Castaic-Balcom silty clay loams, 30-50 percent slopes, eroded; Castaic-Balcom silty clay loams, 50-65 percent slopes, eroded; Castaic and Saugus soils, 30-65 percent slopes, severely eroded; Gaviota rocky sandy loam, 15-30 percent slopes, eroded; Metz loamy sand, 2-9 percent slopes; Saugus loam, 30-50 percent slopes; Sorrento loam, 2-5 percent slopes; Terrace escarpments; Yolo loam, 0-2 percent slopes; Yolo loam, 2-9 percent slopes; Zamora loam, 2-9 percent slopes, and Zamora loam, 9-15 percent slopes.

Soils types onsite can greatly affect the success of California sagebrush scrub restoration. In general, the soils appear to be suitable throughout. For the Balcom-Castaic-Saugus association soils and the San Andreas and San Benito soils found onsite, soil depth ranges between 20 and 56 inches, but would likely be deeper along drainages and shallower near rock outcrops. The available water holding capacity ranges from 2.5 to 8.5 inches, depending on soil type and depth. Most soils onsite should hold from 3.75 to 5.5 inches of water at saturation. Inherent soil fertility ranges from low for the Saugus soils to moderate for the Balcom, Castaic, and San Andreas soils, to high for the San Benito soils. Soil reaction in the soil profile ranges from medium acid to moderately alkaline.

3.3 Oak Mitigation

Dudek evaluated the potential for oak mitigation within the Study Area. (See *Figure 6* in map pocket). In general, potential oak mitigation sites considered in this analysis were sites mapped as oak vegetation communities (e.g., coast live oak woodland, valley oak woodland, mixed oak woodland or valley oak savannah) that were sparse and could support additional oaks or sites that are disturbed (agricultural land, California annual grassland, or disturbed land) that could potentially support oak vegetation communities or individual oak trees. Only areas that are mapped as non-native habitats should be considered for oak mitigation at the vegetation community level. Most oak habitat that burned in the 2003 wildfire is slowly recovering with stump-sprouting trees and is not proposed for mitigation. As a component of the evaluation for oak mitigation, the potential to mitigate for impacts to California black walnut (*Juglans californica*) by incorporating this species into oak mitigation were also analyzed.

Soil types most appropriate for planting oaks tend to be deeper and have a greater water holding capacity for the trees to make use of during the dry season. Alternatively, oaks may be planted in many other soil types if there is a water source nearby for the trees to exploit, such as a perched water table or stream. The soil types with a greater water storage capacity that would be suitable for oaks include Metz loamy sand, Mocho loam, Yolo loam, and Zamora loam. These soils can store between four and 11 inches of water that can be available for the trees to draw on. Gazos clay loam is also suitable for oaks, but it tends to be shallower and only holds between 3 and 6 inches of water that would be available for the oaks to exploit. Areas with shallower soils and less water holding capacity would tend to support oaks at a lower density than deeper soils with greater water storage capacity.

Oak-dominated vegetation communities tend to occur in canyons and on north-facing slopes within the Study Area. Canyons and north-facing slopes tend to be more mesic than other areas due to decreased direct solar radiation.

In determining suitable oak tree mitigation sites, Dudek evaluated existing and adjacent vegetation, soils, slope, aspect, vehicular access (for installation and maintenance) and water availability (for irrigation). Potential oak mitigation sites included areas with appropriate soils, moderate slopes, northern aspect, vehicular access, water availability for irrigation, and adjacent native vegetation communities.

3.4 Wetlands Mitigation

Dudek examined the proposed open space and preserve areas within the Study Area for potential wetlands habitat creation/restoration and enhancement opportunities. The Salt Creek portion of the Study Area was evaluated by Dudek Biologists/Habitat Restoration Specialists Andy Thomson and Scott Boczkiewicz in November and December 2005. The remaining portions of the Study Area were evaluated by Dudek Biologists/Habitat Restoration Specialists Doug Gettinger and Andy Thomson on August 15-16, 2006.

Dudek referenced the *Hybrid Functional Assessment of Wetland and Riparian Habitats for the Newhall Ranch Habitat Management Plan* (HFA; URS 2004), which included the NRSP and portions of the Salt Creek watershed area in the assessment. To maintain consistency with this document, Dudek divided the stream channels within the Study Area into reaches as in the HFA for discussing wetlands creation/restoration and enhancement potential. There are a total of 57 reaches that were evaluated within the HFA, with 46 of these occurring within proposed open space and preserve areas. Stream reaches within the tributary canyons (with the exception of Salt Creek) were evaluated separately from this study and will be used for onsite mitigation. Therefore, 15 stream reaches were evaluated for wetlands mitigation potential in this study, including seven Santa Clara River Reaches (SCR-SA, SCR-PO, SCR-LO-DNST, SCR-LO-MID, SCR-LO-UPST, SCR-HU and SCR-MI), one Castaic Reach (CA) and seven Salt Creek Reaches (SA-E1, SA-2, SA-W1, SA-3, SA-4, SA-5 and SA-6) (See *Figure 7* in map pocket). Additionally, for purposes of this analysis, reaches SA-W1 and SA-E1 were each subdivided into two subreaches due to considerable topographic, habitat, and hydrologic variation between the upper portions of these reaches compared to the lower portions. The lower portions of these two reaches were labeled SA-W1-L and SA-E1-L and the upper portions were labeled SA-W1-U and SA-E1-U, respectively. Therefore, there are a total of 17 stream reaches discussed in this report.

Dudek considered three types of wetlands restoration potential, including wetlands enhancement, stream bank stabilization, and wetlands creation. Stream bank stabilization includes a component of wetlands creation. However, it is assumed that potential mitigation sites associated with stream bank stabilization will be approximately 50 percent wetlands mitigation with the other 50 percent of the area as upland transitional buffer. This is due to the deeply incised channels in most areas, and the likelihood that the upper portions of channel banks will not support wetlands vegetation.

For wetlands enhancement, the percent cover of non-native, invasive plants was estimated in wetland vegetation communities in potential wetlands enhancement areas within the Study Area. The estimated non-native, invasive plant cover percentages were applied to each area to get an estimate of the wetlands enhancement credit that could be achieved for each wetlands vegetation community.

For the Santa Clara River, there are substantial wetlands enhancement opportunities in various wetland vegetation communities. However, due to the extensive effort required to estimate and map invasive plant cover percentages, and the high potential for this to change between the present conditions and future implementation, specific enhancement opportunities were not evaluated in the Santa Clara River and associated wetlands vegetation communities.

For wetlands creation, Dudek evaluated the suitability of potential mitigation opportunities in the Study Area based on several factors pertinent to determining suitability of wetlands mitigation projects, including hydrology, soil conditions, existing vegetation, habitat connectivity, stream bank stability, construction/maintenance access, grading requirements, planting and irrigation requirements, mitigation credit, and long-term management considerations, as described below in *Section 3.5.1*. Each of the criteria used to evaluate the suitability of wetlands habitat creation/restoration and enhancement opportunities in the various reaches within the Study Area were prioritized based on their suitability for potential wetlands creation mitigation.

3.4.1 Suitability Factors

Each of the criteria used to evaluate the suitability of wetlands habitat creation/restoration opportunities in the various reaches within the Study Area is described in this section.

Hydrology

Hydrology is the most critical factor in determining potential suitability for wetlands creation/restoration. Hydrology along each of the reaches in the Study Area was evaluated based on a number of factors, including the location in the watershed, presence and/or persistence of surface water, source of water, and amount of surface water. Potential sites with the presence and/or persistence of surface water, a natural water source, and a higher amount of surface water were considered to have greater restoration potential, and therefore, were ranked higher in this analysis. The HFA classified each of the reaches as ephemeral, ephemeral/intermittent, riverine persistent or perennial (see *Section 4.5*). The HFA classifications for each stream reach were taken into consideration when evaluating and ranking hydrology in this analysis.

Soil Conditions

Soil conditions were evaluated based on the type of soils present, which relates to erosive potential and water holding capacity, presence of organic matter, and soil disturbance. In general, soil types throughout the Study Area were of the same type, Balcom-Castaic-Saugus association, which is a combination of silty clay loam and loam. The soils are derived from weakly consolidated sediments, soft sandstone and soft shale, and are generally highly erosive and well-drained. In the upper reaches (higher elevations), there seemed to be a greater composition of rock in the soil; however the soil remained unconsolidated and highly erosive.

Other soil types present in more limited areas include Chino loam, which occurs on nearly level land. It is a deep soil with a seasonally high water table present within three to four feet from the surface. This soil type is suitable for wetland mitigation. Sandy alluvial land, Cortina sandy loam, Hanford sandy loam, Sorrento loam, and Yolo loam are soils found along the Santa Clara River and its tributaries and are generally suitable for wetland mitigation. Castaic and Saugus soils are another soil type found in potential mitigation areas that are severely eroded and highly erosive.

In this analysis, soils with lower erosion potential, greater water holding capacity, higher presence of organic matter, and less soil disturbance were considered to have greater suitability for wetlands creation/restoration. However, nearly all soils within the Study Area appeared to have high erosion potential and high soil disturbance.

Existing Vegetation

The existing vegetation was evaluated based on the vegetation communities present, age and structural heterogeneity, including canopy development, presence of non-native, invasive plants and riparian corridor connectivity. Potential mitigation sites adjacent to stream channels with intact native wetland vegetation, diverse age and structural heterogeneity, a well-developed tree canopy, lack of non-native invasive plants and the presence of a riparian corridor were ranked higher in this analysis based on the rationale that if these conditions are present, then there are potentially adequate conditions to create additional wetlands habitat.

Habitat Connectivity

For potential wetlands enhancement areas, this criterion was evaluated based on connectivity of riparian habitat to adjacent transitional upland habitats. For potential wetlands creation areas and stream bank stabilization areas, this criterion was evaluated based on connectivity of the restored wetlands habitat after the hypothetical installation of the wetlands mitigation areas. The level of disturbance of the transitional uplands habitat was the primary consideration. Potential sites with degraded vegetated buffers dominated by non-native vegetation are more vulnerable to erosion and more likely to contribute weed seed to potential wetlands mitigation sites. Therefore, sites with native vegetated buffers were ranked higher than those with degraded, non-native buffers. An additional consideration was connectivity to permanent unnatural features such as roadways or developed areas. Adjacency to these types of areas was ranked moderate based on the fact that roadways or developed areas are less likely to be vulnerable to erosion, but depending on how edge areas are planted/maintained, can be more or less likely to contribute weed seed to potential wetlands mitigation sites.

Stream Bank Stability

A general assessment of channel morphology was conducted to identify areas with the highest stream bank stability. Features that provide insight into this issue include the presence of cut banks, slip faces, underfit/overfit stream courses, degree of braided flow and bed grain size. The stability of the stream banks along each of the reaches was evaluated based on the development of flood plain terraces, angle of the bank cuts, and stability of the bank soils. Areas with stream banks that have multiple terraces, gentle angles on the bank cuts and more stable bank soils were considered more suitable, and ranked higher, than those without terraces, steep bank cuts and instable bank soils.

Construction/Maintenance Access

Each of the reaches was evaluated based on construction and/or maintenance access to potential wetlands mitigation sites. Roads that are suitable for grading equipment was a key factor in the identification of wetland creation sites. Sites that are adjacent to existing roads or those that could be easily accessed from existing roads were considered more suitable potential wetlands creation/restoration sites than sites that are inaccessible to vehicles.

Grading Requirements

The amount of grading required to construct potential wetlands creation/restoration sites was evaluated. Potential sites where minimal grading would be needed to achieve creation/ restoration goals were considered more suitable sites, and therefore ranked higher than potential sites that would require extensive grading. No detailed calculations were made to determine actual volume of material that would have to be removed to restore or create wetlands vegetation communities. Estimations of grading requirements were generally based on the depth of cut required and the surface area to be graded.

Irrigation Availability

Irrigation availability was evaluated along each reach. Potential wetlands creation/restoration sites with access to a potential irrigation source were ranked higher than those without.

Mitigation Credit

The amount of acreage available for wetlands mitigation credit was evaluated at each potential site. Areas where greater wetlands mitigation acreage could be achieved were ranked higher than sites that would result in minimal wetlands mitigation acreage. In general, sites less than 1 acre were ranked low, sites between 1 and 5 acres were ranked moderate, and sites greater than 5 acres were ranked high for this factor.

Long-Term Management Considerations

Long-term management considerations include evaluating the potential for issues that could create long-term management problems in the future after the installation of wetlands mitigation. Factors such as the degree to which a site would be self-sustaining in the long-term, the potential for re-invasion of non-native invasive plant species, future access constraints, potential to be subject to damage from flooding, or contribute to flooding in unwanted areas, were evaluated for each potential wetlands creation/restoration site. Sites that would be self-sustaining, have minimal potential for re-invasion of invasive, non-native plant species, provide uninhibited long-term access, and be less prone to damage from flooding, or contribute flooding in unwanted areas were considered to have greater suitability in terms of minimizing long-term management problems, and therefore, ranked higher in this analysis.

4.0 RESULTS

4.1 Slender Mariposa Lily Mitigation Opportunities

Based on this analysis, there are a total of approximately 559 acres considered suitable for slender mariposa lily mitigation (*Table 1*). *Table 1* lists the amount of acreage within the NRHC SMA and Salt Creek area by the priority rankings 1-3 (with a priority ranking of 1 being the most suitable).

TABLE 1
Slender Mariposa Lily Mitigation Opportunities

Priority	NRHC SMA (acres)	Salt Creek (acres)	Total (acres)
Priority 1	154	126	280
Priority 2	145	48	193
Priority 3	51	35	86
Total	350	209	559

While a considerable amount of acreage was determined to be suitable for slender mariposa lily mitigation, it is anticipated that not all of this acreage will be available for large-scale translocation. Areas that currently support this species will generally be excluded from potential mitigation sites to avoid impacting existing populations. As previously mentioned, small-scale translocation projects could feasibly occur within a known population of this species if the presence of slender mariposa lily was accurately mapped during an average or greater than average rainfall year. However, areas adjacent to existing populations, rather than within them, are preferred, in order to avoid potential impacts to this species.

4.2 California Sage Brush Scrub Mitigation Opportunities

There are considerable opportunities for California sagebrush scrub mitigation within the Study Area (*Figure 5*). Agricultural land, California annual grassland, and disturbed areas may all be converted to California sagebrush scrub in areas with generally southern, western, or eastern exposures. Most of the road network within the Study Area needs to be maintained, but selected old road segments could potentially be abandoned and planted with California sagebrush scrub.

For purposes of discussing California sagebrush scrub mitigation, the Study Area has been subdivided into Areas A through G (*Figure 5*). Each area is discussed below with regards to its suitability for mitigation. The approximate maximum area available for mitigation within each of the area designations is given in *Table 2*.

TABLE 2
California Sagebrush Scrub Mitigation Opportunities

Area	Priority Ranking	NRHC SMA (acres)	Salt Creek (acres)	River Corridor (acres)	Total (acres)
Area A	1	64	83	--	147
Area B	1	44	94	--	138
Area C	1	68	--	1	69
Area D	3	145	--	--	145
Area E	3	101	--	--	101
Area F	2	15	119	--	134
Area G	2	47	--	--	47
Total		483	296	1	780

Area A – Area A is located at the western end of the Study Area along the lower reach of Salt Creek and consists primarily of gently sloping agricultural land surrounded by existing habitat (*Figure 5*). This area is ideally suited for mitigation, as it is easily accessible for plant installation, maintenance, and monitoring. Irrigation could also be provided for at least a portion of the area, if desired.

Area B – Area B is located in the valley southeast of Area A along Salt Creek and its tributaries. The area consists primarily of sloping rangeland and the valley bottom surrounded by existing habitat (*Figure 5*). Much of this area has been heavily grazed and is well suited for California sagebrush scrub mitigation. It is easily accessible for plant installation, maintenance, and monitoring. Some of the steeper slopes would be difficult to maintain and monitor, but could be restored in a more passive manner, possibly over a longer period of time. Temporary irrigation during the establishment period could be provided for at least a portion of the area by trucking in water.

Area C – Area C consists of rangeland located on the slopes and valley bottom, and agricultural land, both surrounded by existing habitat (*Figure 5*). The areas have dirt road access, so most of it is easily accessible for plant installation, maintenance, and monitoring. Some of the steeper slopes would be difficult to maintain and monitor, but could be restored in a more passive manner, possibly over a longer period of time. Temporary irrigation during the establishment period could be provided for at least a portion of the area by trucking in water.

Area D – Area D is rangeland located along a ridgeline and down the slopes below it. The area is surrounded by existing habitat (*Figure 5*), and some mariposa lilies have been found within the area. Most of this area is steep with no vehicular access available, so it would be difficult to plant, maintain, and monitor for California sagebrush scrub mitigation. All materials would have to be hauled in on foot or on pack animals, and irrigation would not be feasible. The steeper slopes would be difficult to maintain and monitor, but could be restored in a more passive manner, possibly over a longer period of time.

Area E – Area E is primarily rangeland located along the eastern portion of the Study Area (*Figure 5*). The potential California sagebrush scrub mitigation areas are surrounded by existing habitat. Most of this area is steep with no vehicular access available, so it would be difficult to plant, maintain, and monitor for California sagebrush scrub mitigation. A portion of the area has road access nearby, so it would be somewhat easier to reach, but access would still be on foot. All materials would have to be hauled in on foot or on pack animals, and irrigation would not be feasible. The steeper slopes would be difficult to maintain and monitor, but could be restored in a more passive manner, possibly over a longer period of time.

Area F – Area F is primarily rangeland located at higher elevations at the southwestern corner of the Study Area. It is surrounded by existing habitat, primarily oak woodlands and California annual grassland (*Figure 5*). There is also some agricultural land, with an old olive orchard that would have to be removed if this area were to be used for mitigation. Most of this land is on slopes facing north, so its suitability for California sagebrush scrub mitigation is limited. These areas might be more suitable for valley oak savannah or coast live oak woodland. Most of the area is reasonably close to roads, so access is generally good. However, irrigation may not be feasible.

Area G – Area G is primarily rangeland located at higher elevations at the southeastern portion of the Study Area. It is surrounded by existing habitat, primarily oak woodlands or savannah or chaparral (*Figure 5*). Most of this land is on slopes generally facing north, so its suitability for California sagebrush scrub mitigation is limited. These areas might be more suitable for valley oak savannah or coast live oak woodland. Most of the area is close to roads, so access is generally good. However, irrigation may not be feasible.

4.3 Oak Mitigation Opportunities

Potential mitigation sites for three oak vegetation communities were identified onsite, including valley oak savannah, coast live oak woodland and valley oak woodland (*Figure 6*). These areas have appropriate soils known to support oaks and are often adjacent to existing oak woodlands or oak savannah. Most of the proposed oak mitigation areas are easily accessible for planting, maintenance and monitoring. Irrigation could also be provided for at least a portion of these areas, if desired. Other locations are on steeper land away from access roads, making them more difficult to plant, maintain, and monitor. Irrigation would not be feasible in these areas unless there is a flowing stream nearby, which would allow bucket watering. In addition to oak mitigation at the vegetation community level, individual oak trees could be planted in several areas within the Study Area (*Figure 6*). This analysis identified areas for individual oak tree planting that would be suitable for coast live oak or valley oak. *Table 3* below includes the acreage estimated for oak mitigation within NRHC SMA, Salt Creek and River Corridor.

TABLE 3
Oak Mitigation Opportunities

Oak Mitigation	NRHC SMA (acres)	Salt Creek (acres)	River Corridor (acres)	Total (acres)
Individual Oaks	100	105	--	205
Coast Live Oak Woodland	5	13	6	24
Valley Oak Savannah	21	65	--	86
Valley Oak Woodland	1	--	--	1
Total	127	183	6	316

As mentioned in *Section 3.3*, the potential to mitigate for impacts to California black walnut by incorporating this species into oak mitigation was analyzed. California black walnut is a common component of coast live oak woodland, particularly on north-facing slopes, and could be appropriately planted for mitigation at the selected sites for coast live oak woodland described above and depicted in *Figure 6*.

4.4 Wetlands Mitigation Opportunities

This section provides the results of the wetlands mitigation feasibility analysis for stream reaches located within the Study Area.

The majority of the stream courses within the Study Area are highly dynamic, with relatively steep flow gradients and erosive soils throughout. Many areas of the stream channels are deeply incised (up to 30 feet below the adjacent floodplain terrace) within the site, isolating much of the remaining floodplain from the influence of seasonal hydrology. Additionally, the tributaries to the main drainages are deeply incised (up to 15 feet below the adjacent floodplain terrace). Ephemeral stormwater flows of significant velocity and volume can occur within the stream channels, as evidenced by recent erosion, sediment deposition and vegetation distribution within the channels. The margins of the channels are largely disturbed, particularly throughout the lower reaches, with mostly non-native upland buffers such as California annual grassland and agricultural land. The native habitat that is occasionally present along the margins is usually sparse from repeated disturbance. The instability of the stream courses within the Study Area was further exacerbated by the recent wildfire that burned through much of the Study Area in October 2003, denuding vegetation, and leaving the watershed and stream banks exposed to erosive flows during the rainy season of 2003-2004. Further, heavy rainfall in the region in 2004-2005 resulted in severe soil erosion throughout much of the Study Area, altering stream courses in some areas, eroding the stream banks, and uprooting emergent vegetation within the channels and along margins of the channels.

At the time of this assessment, wetland vegetation communities in the drainage channels that connect to the Santa Clara River were primarily in an early stage of development (with patchy exceptions), recovering from either the impacts of the recent wildfire or the recent stream bank and channel erosion during the last two years following the 2003 wildfire. Several of the burned trees and shrubs along the channels survived the wildfire and young re-sprouts from the burned vegetation are beginning to establish. Native seedlings were abundant throughout the drainage channels, particularly within the channel bottom and at the base of newly eroded stream banks. Vegetation within the Santa Clara River drainage also suffered extensive disturbance during severe flooding during the 2004-2005 rainy season. Large intact stands of mature cottonwood willow riparian woodland (among other vegetation communities) remain, but there are numerous areas recently scoured by flooding, with sparse vegetation.

Wetland vegetation communities present within the Study Area were listed above in *Section 2.1*. Each of the wetland vegetation communities are described in the biological resources technical reports for the Study Area (Dudek 2006a and 2006b). All of the wetland vegetation communities mapped onsite are native vegetation communities dominated primarily by native species, with the exception of giant reed and tamarisk scrub, which are dominated by non-native giant reed (*Arundo donax*) and tamarisk (*Tamarix* sp.), respectively. Adjacent vegetation communities are largely disturbed due to agriculture in the lower reaches and grazing in the middle and upper reaches.

4.4.1 Stream Reaches

According to the HFA, stream reaches were divided based on criteria such as substrate type (e.g., sand vs. silt), water regime (e.g., ephemeral vs. perennial stream segments) and adjacent land use (open space, paved road, agricultural field, etc.). Additionally, each reach was classified according to wetland and riparian habitat categories. In this analysis, reaches in the same vicinity or on the same channel with similar hydrology, biogeochemical and habitat were grouped together for discussion. The HFA scores are out of a total possible 1.00. The 17 stream reaches within the Study Area were classified as follows:

***Santa Clara River Reaches*:** The Santa Clara River Reaches include SCR-SA, SCR-PO, SCR-LO-DNST, SCR-LO-MID, SCR-LOW-UPST, SCR-HU and SCR-MI. These reaches are classified as a perennial river with southern cottonwood-willow riparian forest, mulefat scrub, giant reed, arrowweed scrub and herbaceous wetland. The Santa Clara River Reaches are surrounded by a mix of agriculture (primarily on the northern side) and natural habitat (primarily on the southern side). The average HFA score for these reaches was 0.75, with an average score of 0.83 for hydrology, 0.75 for biogeochemical and 0.76 for habitat (URS 2004).

***Castaic Creek Reach CA*:** Reach CA is classified as an intermittent tributary with patches of mulefat scrub and tamarisk scrub. This reach is the downstream portion of Castaic Creek before it joins the Santa Clara River. It is located in the northeastern portion of the Study Area. It is surrounded by disturbed land on the west side and development on the east side of the channel. The channel itself is sparsely vegetated river wash. The overall HFA score for this reach was 0.64, with a score of 0.83 for hydrology, 0.75 for biogeochemical and 0.51 for habitat (URS 2004).

***Salt Creek Reach SA-W1 (SA-W1-U and SA-W1-L)*:** Reach SA-W1 is classified as an ephemeral/intermittent tributary with patches of southern willow scrub. This reach is a group of tributaries to Salt Creek that are located in the western portion of the Study Area. The majority of this reach (SA-W1-U) was not considered for wetlands creation/restoration due to steep topography, access constraints, and limited mitigation credit available. Only the lower (northern) section (SA-W1-L) of this reach was considered to have some suitability for wetlands creation/restoration. This reach is surrounded by primarily natural habitat in the upper portions and disturbed, non-native habitat in the lower portions. The areas surrounding this reach are currently used for grazing cattle. Wetland vegetation communities along this reach include mulefat scrub and southern willow scrub in SA-W1-L. The overall HFA score for this reach was 0.79, with a score of 0.79 for hydrology, 0.85 for biogeochemical and 0.70 for habitat (URS 2004).

***Salt Creek Reach SA-E1 (SA-E1-U and SA-E1-L) and SA-2*:** Reach SA-E1 is classified as ephemeral tributary with patches of mulefat scrub. This reach was split into two contiguous reaches, SA-E1-U and SA-E1-L. The upper portion of Reach SA-E1 (SA-E1-U) is the upper portion (headwaters) of Salt Creek and a group of tributaries to Salt Creek located to the south and to the east of SA-2. Reach SA-E1-U is composed of primarily narrow, relatively steep, incised stream channels that are largely inaccessible for equipment and would provide limited mitigation credit. Reach SA-E1-L and SA-2 have a relatively mild gradient compared to SA-E1-U, with a broad flood plain. Reaches SA-E1 and SA-2 are surrounded by natural habitat and lands currently used for grazing. Wetland vegetation communities along these reaches include cismontane alkali wetland, mulefat scrub, river wash, big sagebrush scrub riparian, southern willow scrub and alluvial scrub. The overall HFA score for reach SA-E1 was 0.74, with a score of 0.64 for hydrology, 0.78 for biogeochemical and 0.70 for habitat. For SA-2, the overall HFA score was 0.81, with a score of 0.73 for hydrology, 0.87 for biogeochemical and 0.78 for habitat (URS 2004).

Salt Creek Reaches SA-3 and SA-4: Reaches SA-3 and SA-4 are classified as riverine-persistent with patches of cismontane alkali wetland and southern willow scrub. These two reaches are contiguous and are grouped together in this analysis, based on their similar characteristics. These reaches are surrounded by land that is currently used for grazing. Wetland vegetation communities along these reaches of Salt Creek include southern willow scrub, mulefat scrub, cismontane alkali wetland, coastal and valley freshwater marsh and river wash. The overall HFA score for reach SA-3 was 0.98, with a score of 0.96 for hydrology, 0.98 for biogeochemical and 0.98 for habitat. For SA-4, the overall HFA score was 0.96, with a score of 0.92 for hydrology, 0.96 for biogeochemical and 0.98 for habitat (URS 2004).

Salt Creek Reach SA-5: Reach SA-5 is an ephemeral tributary with patches of mulefat scrub and tamarisk. This reach is on the main stem of Salt Creek. It is surrounded on both sides by land that is currently used for grazing. Wetland vegetation communities along this reach include river wash and southern willow scrub. The overall HFA score for this reach was 0.73, with a score of 0.88 for hydrology, 0.83 for biogeochemical and 0.65 for habitat (URS 2004).

Salt Creek Reach SA-6: Reach SA-6 is a perennial tributary with patches of southern willow scrub. This reach is on the main stem of Salt Creek and is the reach of Salt Creek that connects to the Santa Clara River. It is surrounded on both sides by agricultural land through much of the reach. Wetland vegetation communities along this reach include arrowweed scrub, tamarisk scrub, alluvial scrub, mulefat scrub, river wash, elderberry scrub and southern willow scrub. The overall HFA score for this reach was 0.54, with a score of 0.54 for hydrology, 0.49 for biogeochemical and 0.65 for habitat (URS 2004).

4.4.2 Stream Reaches with Mitigation Potential

Out of the total 17 stream reaches that were evaluated in this study, there are 14 that are considered to have wetlands creation mitigation potential, including SCR-SA, SCR-PO, SCR-LO-DNST, SCR-LO-MID, SCR-LO-UPST, SCR-HU, SCR-MI, CA, SA-W1-L, SA-E1-L, SA-2, SA-3, SA-5, SA-6. Additionally, 15 of the reaches have wetlands enhancement potential, including SCR-SA, SCR-PO, SCR-LO-DNST, SCR-LO-MID, SCR-LO-UPST, SCR-HU, SCR-MI, SA-W1-L, SA-E1-L, SA-2, SA-3, SA-4, SA-5, SA-6 and CA.

As previously mentioned, all suitability criteria are ranked from high suitability to low suitability for potential wetlands creation mitigation in each reach (*Table 4*). In order to facilitate comparison of the relative suitability of potential mitigation opportunities between the reaches, rankings of high were given a score of three, rankings of moderate were given a score of two and rankings of low were given a score of one. All scores for each of the criteria were combined to produce a cumulative score for each reach. The total possible score is 30. Rankings are relative to each other within this study.

4.4.3 Wetlands Enhancement and Creation/Restoration Opportunities

Wetlands Enhancement Opportunities

Wetlands enhancement opportunities are abundant throughout the Study Area. There were 15 stream reaches in the Study Area that were considered to have wetlands enhancement potential. The Santa Clara River reaches in particular have extensive amounts of non-native invasive plants, including giant reed and salt cedar. While the presence of these non-native plant species is consistent throughout the Santa Clara River reaches, the abundance or proportion of these species varies widely, with some areas completely dominated, sometimes to the exclusion of all other species. Detailed percent cover estimates of non-native invasive plants were not made for the Santa Clara River reaches or the Castaic Reach in this study; however, it is estimated that cover of non-native invasive plants is in the range of five percent overall, with some areas lower and other areas much higher. In the Salt Creek drainage and many of the other tributary drainages, tree tobacco and salt cedar were prevalent, occupying up to 50 percent of the shrub cover in some areas, with most areas having around 10 percent cover of non-native plants.

TABLE 4
Potential Wetlands Creation Mitigation Evaluation Criteria Rankings

Reach	Hydrology	Soil Conditions	Existing Vegetation	Habitat Connectivity	Stream Bank Stability	Construction and Maintenance Access	Grading Requirements	Irrigation Availability	Mitigation Credit	Long-Term Management Considerations	Score
SCR-SA	H	H	H	H	M	H	M	H	H	H	28
SCR-PO	H	H	H	H	H	H	M	H	H	H	29
SCR-LO-DNST	H	H	H	H	M	H	M	H	M	H	27
SCR-LO-MID	H	H	H	H	M	H	M	H	H	H	28
SCR-LO-UPST	H	H	H	H	M	H	M	H	H	H	28
SCR-HU	H	H	H	H	M	H	M	H	H	H	28
SCR-MI	H	H	H	H	M	H	M	H	H	H	28
CA	L	M	M	L	L	H	L	H	L	M	17
SA-W1-L	M	L	M	L	L	H	M	L	H	M	18
SA-E1-L	L	L	L	M	L	M	M	L	M	M	15
SA-2	L	L	M	M	L	H	M	L	L	M	16
SA-3	H	L	M	M	L	H	M	L	L	M	18
SA-5	M	L	M	M	L	H	M	M	M	M	19
SA-6	H	L	M	L	L	H	L	H	H	M	20

Mitigation credit, in the form of wetlands enhancement, could be gained in multiple wetland vegetation communities occurring in the stream reaches, including alluvial scrub, arrowweed scrub, big sagebrush scrub, bulrush-cattail wetland, cismontane alkali wetland, cottonwood willow riparian forest, elderberry scrub, mulefat scrub, river wash and southern willow scrub (*Table 5*). In the Salt Creek reaches a total of approximately 5.4 acres of enhancement potential was identified within the Study Area. Within the Santa Clara River and Castaic reaches, there are extensive areas with opportunity for wetlands enhancement. While a detailed estimate was not performed, it is estimated that there are in the range of 40.9 acres of wetlands enhancement available within vegetation communities within the Santa Clara River stream reaches and the Castaic Reach, with the bulk of the potential enhancement acreage in cottonwood willow riparian forest, river wash and herbaceous wetlands. The combined total wetlands enhancement acreage is estimated to be approximately 52.07 acres (*Table 5*).

TABLE 5
Estimated Potential Wetlands Enhancement Acreages

Vegetation Community	NRHC SMA (acres)	Salt Creek (acres)	River Corridor[1] (acres)	Total (acres)
alluvial scrub	0.03	0.04	--	0.07
arrowweed scrub	--	0.03	0.25	0.28
big sagebrush scrub	0.97	--	--	0.97
bulrush-cattail wetland	0.14	--	--	0.14
cismontane alkali wetland	0.29	--	--	0.29
cottonwood willow riparian forest	--	--	13.94	13.94
elderberry scrub	0.05	0.04	--	0.09
giant reed[2]	--	--	5.51	5.51
herbaceous wetland	--	--	8.91	8.91
mulefat scrub	0.23	3.99	0.52	4.74
river wash	0.73	0.74	9.52	10.99
southern willow scrub	2.89	0.34	0.45	3.68
tamarisk scrub[2]	--	0.19	2.27	2.46
Total	5.33	5.37	41.37	52.07

[1]Acreage calculations for wetlands enhancement within the Santa Clara River Reaches are based on an estimated 5 percent cover of non-native invasive plants with the exception of giant reed and tamarisk scrub which are assumed to be 100 percent non-native.

[2]Giant reed and tamarisk scrub are non-native vegetation communities that are assumed to be composed of 100 percent non-native plant species.

Wetlands Creation/Restoration Opportunities

In general, wetlands creation/restoration in the Study Area will be challenging due to the highly erosive, well-drained alluvial soils throughout much of the Study Area and the extreme flood flow volume and velocity that can occur. Careful site selection is critical due to the potential for disturbance or loss of newly created or restored wetlands from intense storm events and consequent loss of soil and plant material. These factors were carefully considered when evaluating wetlands habitat mitigation opportunities in the Study Area.

As a consequence of the erosive alluvial soils in the Study Area and extreme flood flow volumes and velocities, particularly in winter 2004-2005 when record rainfall occurred, many of the channel reaches are deeply incised with vertical to nearly vertical, eroded banks lacking vegetation. Ten- to 15-foot vertical cut banks were not uncommon, particularly in the lower reaches, and were on average approximately eight to ten feet high. Structural stream bank restoration could potentially occur within many reaches in the Study Area, with the exception of some of the upper reaches where machinery access does not exist and reaches with intact vegetated buffers. Structural stream bank restoration would be particularly important in regions of the drainage where the stream buffer is used for agriculture or is heavily grazed and/or composed of non-native vegetation. It would require extensive grading in most areas to change the angle of the stream banks such that they could support vegetation and would require stream bank and stream bed stabilization structures (e.g., gabions, rip-rap, articulated concrete block, etc.), in addition to vegetation, to hold the soil on the banks in place. Some mitigation credit could be gained in the form of wetlands creation; however, the amount of acreage gained compared to the level of effort/cost to successfully implement this type of structural restoration might diminish the appeal of this type of restoration in much of the Study Area.

As previously mentioned, wetlands creation opportunities were identified in 14 reaches within the Study Area. Wetlands creation opportunities within these reaches are discussed in more detail below.

Santa Clara River Reaches (SCR-SA, SCR-PO, SCR-LO-DNST, SCR-LO-MID, SCR-LO-UPST, SCR-HU and SCR-MI)

The Santa Clara River Reaches scored the highest in the wetlands creation evaluation criteria rankings among the reaches determined to have wetlands creation potential within the Study Area. Scores ranged between 27 and 29 out of a possible 30. The areas identified for creation include agricultural land along the margins of the Santa Clara River. These areas are actively being farmed, but represent areas along the Santa Clara River where the flood plain has been restricted. In these areas, wetlands creation could be achieved by converting the agricultural areas into flood plain areas for the Santa Clara River. This would be achieved by grading these areas down to a level appropriate for establishing wetlands vegetation. In most cases, this is approximately a 6-12 foot grade cut. The grade would gradually increase in elevation moving away from the river. At some point, the vegetation would transition into uplands vegetation, where mitigation credit could be achieved for California sagebrush scrub or the creation of similar uplands vegetation communities.

There is flexibility in the types of wetlands vegetation communities and the individual acreage totals of those vegetation communities that could be created in the Santa Clara River stream reaches. Recommended wetland communities proposed as mitigation herein are generally based on surrounding vegetation communities. *Tables 6* and *7* below list the estimated acreages for wetlands creation by vegetation community. Specifically, *Table 6* lists the acreages by stream reach, and *Table 7* lists the acreages by preserve area. The acreages reported in these tables are based on the conceptual layout as shown in *Figure 7*.

TABLE 6
Estimated Potential Wetlands Creation Acreages by Stream Reach

Stream Reach	Vegetation Community (acres)					
	AS	BSS	CWRF	MFS	SWS	Total
SCR-SA	0	0	2.1	3.2	0	5.3
SCR-PO	0	0	10.8	0	0	10.8
SCR-LO-DNST	0	0	3.4	0	0	3.4
SCR-LO-MID	0	0	5.1	0	1.3	6.4
SCR-LO-UPST	0	0	6.4	0.3	0.6	7.3
SCR-HU	0	0	6.9	3.0	0	9.9
SCR-MI	0	0	0.01	2.3	0	2.3
CA	0	0	0	0.2	0	0.2
SA-W1-L	0	0	0	7.7	1.3	9.0
SA-E1-L	0	0.6	0	0.8	0	1.4
SA-2	0	0	0	0.9	0	0.9
SA-3	0	0	0	0.3	0	0.3
SA-5	0	0	0	1.3	0	1.3
SA-6	5.2	0	0	0.8	0	6.0
Total	5.2	0.6	34.7	20.9	3.3	64.5

AS = Alluvial Scrub; BSS = big sagebrush scrub; CWRF = Cottonwood Willow Riparian Forest; MFS = Mule Fat Scrub; SWS = Southern Willow Scrub

TABLE 7
Estimated Potential Wetlands Creation Acreages by Preserve Area

Vegetation Community	NRHC SMA (acres)	Salt Creek (acres)	River Corridor (acres)	Total (acres)
alluvial scrub	--	5.24	--	5.24
Big sagebrush scrub		0.6		0.6
cottonwood willow riparian forest	--	--	34.53	34.53
mulefat scrub	3.36	8.52	9.02	20.90
southern willow scrub	0.13	1.27	1.95	3.35
Total	3.49	15.63	45.50	64.62

Castaic Creek Reach (CA)

This reach is the downstream portion of Castaic Creek before it joins the Santa Clara River. According to the HFA, Reach CA is classified as an intermittent tributary with patches of mulefat scrub and salt cedar. This reach scored 17 out of a possible 30 in the wetlands creation evaluation criteria rankings among the reaches determined to have wetlands creation potential within the Study Area. Some of the reasons for the low score for this reach are the minimal amount of acreage of mitigation credit that could be achieved, poor habitat connectivity, minimal hydrology, extensive grading requirements compared to the amount of mitigation credit available and instability of the existing stream banks. The area identified for wetlands creation includes an area mapped as California annual grassland that lies between agricultural land and the western margin of the channel. In this area, wetlands creation could be achieved by expanding the flood plain of Castaic Creek toward the west by grading down the California annual grassland to a level appropriate for establishing wetlands vegetation. This area is immediately adjacent to an area proposed in Reach SCR-HU. Therefore, wetlands mitigation in this area would be conducted in concert with wetlands mitigation in SCR-HU. Similar to the scenario described for potential wetlands creation areas along the Santa Clara River, the grade would gradually increase in elevation moving away from the river. At some point, the vegetation would transition into uplands vegetation, where mitigation credit could be achieved for California sagebrush scrub or the creation of similar uplands vegetation communities.

Based on the conceptual layout as shown in *Figure 7*, it is estimated that approximately 0.2 acre of mulefat scrub could be established at this location in the River Corridor (*Table 6*).

Salt Creek Reach (SA-W1)

The upper (upstream) portions of reach SA-W1 (SA-W1-U) is composed of narrow tributaries in steep, rugged terrain. The upper portion of reach SA-W1 was not considered suitable for potential wetlands habitat creation/restoration because of the lack of vehicular access due to rugged terrain and steep topography. However, a comprehensive wetlands enhancement effort could include SA-W1-U to control non-native invasive plant species, such as tree tobacco and salt cedar. Non-native invasive weeds in the upper portions of the reach could potentially contribute seed that could be washed down into the lower reaches and present a maintenance issue in the long-term.

The lower (northern) portion of this reach (SA-W1-L) was considered suitable for both wetlands creation/restoration and wetlands enhancement potential. The gentle slope, broad flood plain, disturbed, primarily non-native, adjacent vegetation and easy vehicular access to this site were factors that led to this area being considered to have potential for wetlands creation/restoration.

This reach scored 18 out of a possible 30 in the wetlands creation evaluation criteria rankings among the reaches determined to have wetlands creation potential within the Study Area. Some of the reasons for the low score for this reach are the erosive soil conditions, poor habitat connectivity, unstable stream banks, and poor irrigation availability.

This lower portion of the reach is deeply incised (up to 15 feet in some areas and approximately eight feet on average throughout), with vertical to nearly vertical stream banks. The stream buffers are highly disturbed and currently support primarily non-native grasslands and ruderal land.

This reach was classified in the HFA as an ephemeral intermittent tributary. While there was surface water flowing through much of this reach during the site visits in fall 2005, the amount of surface water was minimal. Consequently, suitable vegetation communities for this reach would include primarily more drought-tolerant wetland vegetation communities, such as mulefat scrub, with occasional pockets of southern willow scrub.

Two creation/restoration approaches were considered for this reach. One approach would be to grade the angle of the stream banks back to form more gentle angles, and plant the newly formed stream bank slopes with wetland species to stabilize the slopes and create wetland habitat. This approach would help to stabilize the side slopes of the channel and allow the creation of wetlands habitat, but the channel slopes would still be vulnerable to extreme flood flow velocities with erosive forces likely great enough to potentially cause stream bed migration and wash out new restoration work. In order to improve the restoration success with this approach, hydrologic modeling to determine expected flow velocities and volumes at various regions in the channel and the installation of stream bank stabilization structures engineered with the capacity to withstand these types of storm flow events would likely be needed. Temporary irrigation would be important with this type of approach to help get plant material established on the side slopes of the channel in between rainy seasons in order to stabilize soils. Additionally, an extensive amount of grading would be required to gain a relatively small amount of mitigation acreage.

A second approach would be to install periodic check dams through the reach to slow storm flow velocities, capture sediment and improve percolation and groundwater recharge in order to facilitate the recruitment of wetlands vegetation. This approach is preferred for wetlands creation/restoration at this particular site because it would help to restore the incised channel and improve water quality by capturing sediment, improve groundwater recharge, and help restore the relationship between the stream channel and the floodplain. Planting and irrigation requirements would be minimized because a more passive restoration design could be utilized, wherein native wetland plant species would be expected to naturally recruit in suitable areas with adequate hydrology. Further, it is anticipated that a greater amount of wetlands mitigation acreage could be achieved because of improved groundwater recharge and improved relationship to the flood plain. Also, the area immediately behind the check dams could be excavated down to improve water holding capacity in the channel and increase the area of hydrologic influence, thereby increasing the amount of mitigation acreage. Excavated material behind each of the check dams could be pushed up to form natural berms on both sides of the check dams to improve water holding capacity and infiltration.

Similar types of check dam structures have been installed along this reach in the past, including a check dam structure to protect a gas pipeline and soil berms in some of the tributary canyons along this reach. The check dam at the gas pipeline crossing failed due to excessive erosion around one side of the check dam. The bermed areas appeared to function for a period of time (based on the amount of sediment deposited and the establishment of mulefat scrub behind the berms), but eventually, water flow over the soil berms resulted in erosion and down-cutting of the berms. Based on these examples, and after evaluating the channel conditions, it is critical that the construction of check dams along this reach are engineered and constructed appropriately to handle high flows during storm periods. They would need to be keyed deep into the side slopes of the channel and be constructed with non-erodable high flow and low flow outfalls and energy dissipators to prevent failure of the check dams over time.

Based on the installation of five check dams in SA-W1-L as shown in *Figure 7*, it is estimated that approximately 9.0 acres of wetlands vegetation communities could be established in this reach, including 7.7 acres of mulefat scrub and 1.3 acres of southern willow scrub (*Table 6*).

Salt Creek Reach (SA-E1)

Similar to SA-W1, the upper (upstream) portions of this reach (SA-E1-U) are primarily composed of narrow tributaries in steep, rugged terrain. This portion of SA-E1 was not considered suitable for potential wetlands habitat creation/restoration because of the lack of vehicular access due to rugged terrain and steep topography. However it was considered suitable for a comprehensive wetlands enhancement program to remove non-native, invasive plant species such as tree tobacco and salt cedar.

The lower portion of reach SA-E1 (SA-E1-L) was considered suitable for stream bank stabilization in several areas (*Figure 7*). This reach scored 15 out of a possible 30 in the wetlands creation evaluation criteria rankings among the reaches determined to have wetlands creation potential within the Study Area. Some of the reasons for the low score for this reach are the lack of adequate hydrology, erosive soil conditions, disturbed existing vegetation, instable stream banks and poor irrigation availability.

Stream bank stabilization in this portion of the reach would require grading the angles of the stream banks back to form more gentle angles, installing an erosion control blanket on the slopes, and planting the newly formed stream bank slopes with wetland species to stabilize the slopes and create wetland habitat. As previously mentioned, in order to improve the restoration success with this approach, hydrologic modeling to determine expected flow velocities and volumes at various regions in the channel, and the installation of stream bank stabilization structures engineered with the capacity to withstand these types of storm flow events, would likely be needed.

Based on the hypothetical design of stream bank stabilization in this portion of SA-E1 as shown in *Figure 7*, approximately 0.8 acre of mulefat scrub and 0.6 acre big sagebrush scrub could be established, with a 1.4-acre California sagebrush scrub upland transitional buffer (*Table 6*).

Salt Creek Reach (SA-2)

Reach SA-2 has a broad flood plain, with a gentle grade from upstream to downstream and a braided channel within vertical, eroded channel banks between approximately 3 feet and 15 feet high. It is currently primarily river wash habitat in the main channel, with occasional patches of mulefat scrub, southern willow scrub and big sagebrush scrub.

Wetlands habitat creation/restoration potential is limited in this reach because of the high quality native upland habitat surrounding much of this reach. This reach scored 16 out of a possible 30 in the wetlands creation evaluation criteria rankings among the reaches determined to have wetlands creation potential within the Study Area. Some of the reasons for the low score for this reach are the lack of adequate hydrology, erosive soil conditions, instable stream banks, minimal mitigation credit and poor irrigation availability. A few areas were proposed for stream bank restoration based on the excessively eroded stream banks; however, in two of these areas, native California sagebrush scrub habitat would be impacted by the implementation of stream bank stabilization. Based on this analysis, a total of 0.9 acre of mulefat scrub with a 1.3-acre California sagebrush scrub upland transitional buffer could be achieved in this reach (*Table 6*). This reach of the Salt Creek is entirely located in NRHC SMA.

Salt Creek Reach (SA-3)

Reach SA-3 scored very high in the HFA with an overall score of 0.98. While this reach still retains high wetlands functions and values, there has been substantial erosion, especially along the southern bank of the channel through this reach. The southern bank is a vertical to nearly vertical, unvegetated cut bank from ten to 15 feet high. This area scored 18 out of a possible 30 in the wetlands creation evaluation criteria rankings among the reaches determined to have wetlands creation potential within the Study Area. Some of the reasons for the low score are the minimal amount of acreage of mitigation credit that could be achieved, erosive soil conditions, instability of the existing stream banks and likely difficulty getting irrigation to the proposed site.

Potential wetlands mitigation in this reach would consist of structural stream bank restoration at one location, and would result in approximately 0.3 acre of mulefat scrub creation with a 0.2-acre California sagebrush scrub upland transitional buffer (*Table 6*).

Salt Creek Reach (SA-5)

Similar to reach SA-2, reach SA-5 has a broad flood plain, with a gentle grade from upstream to downstream and a braided channel within vertical, eroded channel banks between approximately six feet and 10 feet high. It is currently primarily river wash habitat in the main channel, with one area mapped as southern willow scrub at the upstream end of this reach, near reach SA-4.

Wetlands habitat creation/restoration potential is limited in this reach because of the minimal surface and subsurface water flow in comparison to the width of the channel, as evidenced by the vegetation distribution and density, and native habitat buffers on the southwest side of the channel in this reach. This area scored 19 out of a possible 30 in the wetlands creation evaluation criteria rankings among the reaches determined to have wetlands creation potential within the Study Area. Some of the reasons for the low score are the erosive soil conditions and instability of the existing stream banks. A few areas proposed for stream bank restoration on the southwest side of the channel are in native California sagebrush scrub habitat, and would be impacted by the implementation of stream bank stabilization. Stream bank stabilization on the northeast side of the channel would affect California annual grassland, and potentially some agricultural land. Based on this analysis, a total of approximately 1.3 acres of mulefat scrub creation with a 1.6-acre California sagebrush scrub upland transitional buffer could be achieved in this reach (*Table 6*).

Salt Creek Reach (SA-6)

Reach SA-6 was classified in the HFA as a perennial tributary to the Santa Clara River. It consists of a deeply incised channel, with very steep to vertical side cuts ranging from six feet high to approximately 30 feet high. It is surrounded by primarily agricultural land, and currently supports river wash and alluvial scrub wetland vegetation communities, with occasional patches of mulefat scrub, southern willow scrub, elderberry scrub, tamarisk scrub and arrowweed scrub.

This area scored 20 out of a possible 30 in the wetlands creation evaluation criteria rankings among the reaches determined to have wetlands creation potential within the Study Area. Some of the reasons for the moderate score are the erosive soil conditions, poor habitat connectivity, instability of the existing stream banks and extensive amount of grading required to achieve goals.

Stream bank stabilization in this reach would be a considerable and complex challenge based on the current conditions of the channel and apparent stormwater flows of significant velocity and volume through this reach. Extensive measures would be required to stabilize current erosion problems and prevent the possibility of future erosion problems. Depending on what is planned for the areas to the north and south of this channel outside of the NRHC SMA, portions of this reach of the Salt Creek Drainage might be a candidate for a buried bank stabilization project, similar to the type of structures being constructed by Newhall Land along sections of the Santa Clara River to protect development projects.

Similar to the other reaches where stream bank stabilization was considered, stream bank stabilization in this reach would require grading the angles of the stream banks back to form more gentle angles, and planting the newly formed stream bank slopes with wetland species to stabilize the slopes and create wetland habitat. Hydrologic modeling would be needed to ensure that the selected design would be adequate for the expected conditions in the channel. The installation of a temporary irrigation system would be needed in order to encourage vegetation establishment in between the annual rainy seasons.

Bank stabilization, as depicted in the hypothetical design on *Figure 7*, would result in the creation of approximately 6.1 acres of wetlands vegetation communities, including 5.2 acres of alluvial scrub and 0.8 acre of mulefat scrub, with a transitional upland buffer of approximately 4.9 acres of California sagebrush scrub (*Table 6*). While bank stabilization work would result in limited wetlands mitigation credit compared to the amount of work required, if this section of the channel is left untreated it will continue to result in significant erosion of the side banks and exacerbate already deteriorating conditions.

5.0 RECOMMENDATIONS

This section provides the mitigation recommendations for slender mariposa lily, California sagebrush scrub, oak trees, and wetlands for the Study Area.

5.1 Slender Mariposa Lily Mitigation Recommendations

The areas classified as having suitability for slender mariposa lily mitigation, which are not within areas already supporting this species, are recommended as priority areas for mitigation

(*Figure 4*). Areas classified as having suitability that already have slender mariposa lily growing in them are recommended for planting of individual corms in locations that have been verified as not containing mariposa lilies. The NRHC SMA and the Salt Creek area provide the vast majority of suitable transplantation areas for slender mariposa lily.

Some of the areas considered suitable for slender mariposa lily mitigation are also considered suitable for California sagebrush scrub restoration. Since slender mariposa lily often occurs within California sagebrush scrub habitat, a slender mariposa lily transplantation program could be accomplished in conjunction with California sagebrush scrub restoration in the same area.

This preliminary analysis should be followed up by a more detailed analysis of the potential transplantation areas during the development of a conceptual mitigation plan. A more detailed analysis should include sampling and testing soils at potential transplantation sites to ensure that appropriate soil conditions are present if soil salvage is not proposed. The conceptual mitigation plan should include a description of the exact methods of transplantation, maintenance, and monitoring guidelines for the transplantation program.

5.2 California sagebrush scrub Mitigation Recommendations

Areas identified as A, B, and C have a priority ranking of 1 for California sagebrush scrub restoration (*Figure 5*). Dudek estimates there are a total of approximately 354 acres of land within Areas A, B and C within the Study Area that would be suitable for California sagebrush scrub restoration. More detailed analysis of the areas would be required to determine the exact acreage suitable for restoration and how much of this acreage is too steep or otherwise constrained. Areas F and G have a priority ranking of 2 and total approximately 181 acres, while Areas D and E have a priority ranking of 3 and total approximately 246 acres. Additionally, because soil mapping was done at a generalized level and conditions vary widely depending on specific soil type, agricultural suitability soil tests should be performed and analyzed before mitigation is undertaken in any area. The test results may help determine specific plant assemblages and will help determine what soil amendments and/or fertilizers may be required, if any, for mitigation to be successful in the allotted time frame. This more detailed analysis would also determine the exact methods of restoration, maintenance, and monitoring that would be employed.

5.3 Oak Mitigation Recommendations

The areas classified suitable for oak mitigation at the vegetation community level include areas mapped with non-native vegetation communities that are adjacent to existing oak vegetation communities (*Figure 6*). Areas considered suitable for planting individual oak trees are

California annual grassland areas adjacent to valley oak savannah and areas mapped as existing oak habitat, but with sparse oak cover. Also, California black walnut could be appropriately planted for mitigation within a portion of the 24 acres considered suitable for coast live oak woodland mitigation.

Some of the areas considered suitable for oak tree mitigation were also considered suitable for slender mariposa lily mitigation (*Section 5.1*), California sagebrush scrub restoration (*Section 5.2*), and wetlands mitigation (*Section 5.4*). Oak mitigation could be appropriately incorporated into these types of mitigation and done in conjunction in some areas.

This preliminary analysis should be followed up by a more detailed analysis of the potential oak tree mitigation areas during the development of a conceptual mitigation plan. Agricultural suitability soil tests should be performed and analyzed before mitigation is undertaken in any area. The test results may help verify that the soil is suitable for oaks and will help determine what soil amendments and/or fertilizers may be required, if any, for mitigation to be successful in the allotted time frame. This more detailed analysis would also determine the exact methods of restoration, maintenance, and monitoring that would be employed.

5.4 Wetlands Mitigation Recommendations

Each of the 17 stream reaches within the Study Area that were evaluated for wetlands mitigation potential in this analysis had potential for wetlands enhancement, wetlands creation/restoration or both. There is flexibility in the types of wetlands vegetation communities and the individual acreage totals of those vegetation communities that could be created within the Study Area. In general, most potential creation/restoration sites that are located on the margins of the existing channels that are tributaries to the Santa Clara River are expected to be more suited to the creation of wetlands vegetation communities that require less water (e.g., mulefat scrub, alluvial scrub and big sagebrush scrub). The Santa Clara River provides greater opportunities for the creation of wetlands vegetation communities such as southern cottonwood-willow riparian forest and southern willow scrub due to the presence of perennial water.

Based on the criteria evaluated above for each reach within the Study Area, and the proposed design described above and depicted in *Figure 7*, the Santa Clara River reaches (SCR-PO SCR-LO-MID, SCR-LO-UPST, SCR-HU 28, SCR-MI, SCR-SA and SCR-LO-DNST) would provide the most suitable wetlands creation/restoration mitigation sites within the Study Area. Stream reaches SA-6, SA-5, SA-3, SA-W1-L, CA, SA-2 and SA-E1-L were also considered to have wetlands creation/restoration potential.

Wetlands enhancement opportunities are also abundant throughout the Study Area. The wetlands enhancement acreage estimate provide in *Table 4* is a very general estimate, and is expected to vary depending on flood conditions and potential expansion or invasion of additional areas by non-native invasive plant species over time. The actual percent cover of non-native invasive plants should be re-evaluated at the time of wetlands enhancement implementation. This estimate is also considered to be a conservative estimate, which is largely affected by the overall estimate of five percent cover that was made for wetlands vegetation communities within the Santa Clara River stream reaches. Actual acreage could vary considerably and detailed mapping of non-native invasive plants within the Santa Clara River stream reaches will be needed to refine the estimate.

If wetlands enhancement is implemented, a comprehensive wetlands enhancement program for interconnected reaches within the Study Area is highly recommended. Due to the invasive nature of the species present within the Study Area (e.g., giant reed, salt cedar, tree tobacco, etc.), enhancement in only portions of interconnected reaches would likely be temporary, as upstream or adjacent plant propagules from these invasive plant species are likely to re-invade habitat areas and become established. Ideally, a wetlands enhancement program would be accomplished in conjunction with the wetlands creation/restoration opportunities described in this report to provide a comprehensive treatment of wetland habitats within the Study Area.

As alluded to above, upland mitigation opportunities are often possible in conjunction with wetlands creation/restoration. For example, transitional buffers surrounding several of the proposed wetlands creation/restoration areas could be planted with California sagebrush scrub or coast live oak woodland to gain upland mitigation credit and to improve the overall functions and values of the system. Further, mitigation for impacts to mainland (holly-leaf) cherry (*Prunus illicifolia* ssp. *ilicifolia*), if needed, could be accomplished by incorporating this species into planting palettes for vegetation communities along the margins of wetlands creation/restoration areas. Comprehensive mitigation planning is recommended in order to both meet the mitigation needs for the project, and to provide the best restoration scenarios for functional, sustainable habitat.

This analysis is a generalized evaluation of wetlands mitigation suitability. Site specific studies are recommended prior to implementation of any of the ideas presented in this report. Due to the highly dynamic nature of the stream reaches evaluated within the Study Area, implementation of wetlands creation/restoration sites could be subject to extreme flow volumes and velocities, resulting in loss of restored areas. Detailed soils analyses, hydrologic studies, ground water studies, etc. should be conducted to ensure that the proposed mitigation design is adequate for potential conditions.

5.5 Specific Area Mitigation Recommendations

Figure 8 combines all of the various potential mitigation areas and prioritizes them into one comprehensive map based on current anticipated project acreage needs. Some potential mitigation areas could be used for more than one purpose and *Figure 8* depicts which species or habitat types were prioritized for areas with multiple mitigation possibilities. These choices were based on anticipated acreage needs for the various habitat types or individual species mitigation needs. Results of the combined mitigation analysis segregated by preserve area are included in *Table 8*.

TABLE 8
Combined Mitigation Acreage Estimate

Mitigation Type	NRHC SMA (Acres)	Salt Creek (Acres)	River Corridor (Acres)	Total (Acres)
Slender Mariposa Lily	249	168	--	417
Slender Mariposa Lily and California Sagebrush Scrub	52	35	--	87
California Sagebrush Scrub	354	115	1	470
Oaks				
Individual Trees	97	92	--	189
Coast Live Oak Woodland	2	8	1	11
Valley Oak Savannah	21	66	--	87
Valley Oak Woodland	0.4	--	--	0.4
Subtotal	120.4	166	1	287.4
Wetlands Enhancement	5.33	5.37	41.37	52.07
Wetlands Creation	3.49	15.63	45.50	64.62
Total	784.22	505.00	88.87	1,378.09

All of these acreages depicted in *Figure 8* and listed in *Table 8* are approximate and could change after more detailed and specific site investigations that are beyond the scope of this overview analysis. Detailed soils type and depth analyses, hydrologic studies, ground water studies, etc. should be conducted to ensure that the proposed mitigation designs are adequate for actual site conditions.

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7.0 REFERENCES

Allan E. Seward Engineering, Inc. 2002. *Geological Evaluation, San Fernando Valley Spineflower Occurrences*. Letter report prepared for Gatzke, Dillon and Balance, LLP, October 2002.

Dudek. 2006a. *Biological Resources Technical Report for Newhall Ranch Specific Plan Area, Los Angeles County, California*. Prepared for Newhall Land. October.

Dudek. 2006b. *Biological Resources Technical Report for the Newhall Ranch High Country Specific Management Area, Los Angeles County, California.* Prepared for Newhall Land. October.

Dudek. 2007. *Draft Spineflower Conservation Plan*. Prepared for Newhall Land.

Holland, R.F. 1986. *Preliminary Descriptions of the Terrestrial Natural Communities of California.* Non-game-Heritage Program, California Department of Fish and Game.

McDonald, Hugh P. 1997. *The Genus Calochortus in California: Part II*. Fremontia, Vol. 25, No. 1; 20-25. January.

Natural Resources Conservation Service (NRCS). 1969. *Report and General Soil Map, Los Angeles County, California.* United States Department of Agriculture.

Schmidt, Marjorie G. 1975. *Natives for Your Garden*. Fremontia, Vol. 2:4; 25-26. January.

U.S. Department of Agriculture (USDA). 1969. *Soil Survey, Antelope Valley Area, California. 187 pp.*

URS, 2004. *Hybrid Functional Assessment of Wetland and Riparian Habitats for the Newhall Ranch Habitat Management Plan*. Prepared for Newhall Land and Farming Company. October 20.