Wetland Mitigation and Monitoring Proposal

For

Rio Del Oro

Sacramento County, California

26 June 2009

Prepared For:
Elliott Homes, Inc.
and
GenCorp Real Estate

ECORP Consulting, Inc.
ENVIRONMENTAL CONSULTANTS

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1.0 SUMMARY

This Wetland Mitigation and Monitoring Proposal has been prepared for Elliott Homes, Inc. and GenCorp Real Estate to outline the mitigation proposed for the Rio Del Oro Project (Project). This proposal was prepared to provide additional information to the U.S. Army Corps of Engineers (Corps), the U.S. Fish and Wildlife Service (Service), and the Environmental Protection Agency (EPA) (collectively, 'Regulatory Agencies') on the mitigation intended to offset impacts anticipated during implementation of the Project. Once the appropriate permits for the Project are obtained from the Regulatory Agencies, final mitigation monitoring plans, construction plans, and operations and management plans will be developed incorporating all permit requirements as needed.

The 3,829-acre Project is located in Sacramento County, California. There are a total of 56.632 acres of waters of the U.S. within the Project, including 35.485 acres of vernal pools, 6.044 acres of seasonal wetland swales, 6.418 acres of seasonal wetlands, 3.540 acres of ponds, and 5.145 acres of ephemeral drainages. Of these 56.632 acres, 27.902 acres will be directly impacted and 2.179 acres will be indirectly impacted. A total of 12.946 acres of non-jurisdictional (isolated) aquatic features also occur on the project site, including 2.414 acres of vernal pools, 0.653 acre of seasonal wetland swales, 9.158 acres of seasonal wetlands, and a 0.721 acre of ponds. These features occur primarily within the dredge tailings that cover much of the Project. Activities associated with Project implementation will result in the grading and filling of wetlands to establish construction grade and the installation of infrastructure for mixed land uses.

As partial mitigation for Project implementation, a 507-acre area located in the southern portion of the Project containing the highest quality and density of vernal pools will be set aside as a Wetland Preserve. Within the Wetland Preserve, 20.413 acres of vernal pools, 2.457 acres of seasonal wetland swales, 3.354 acres of seasonal wetlands, 0.616 acre of pond, and 1.889 acres of ephemeral drainages will be preserved. The portion of Morrison Creek located within this area will also be preserved and enhanced. An additional 13.449 acres of vernal pools and 0.752 acres of seasonal wetland swales are proposed to be restored/created[1] within the Wetland Preserve. On-site success monitoring of both preserved and constructed vernal pool habitat within the Wetland Preserve will be conducted for over a ten-year period.

In addition to the Wetland Preserve, approximately 187 acres of Open Space Corridors will be established on-site. These Open Space Corridors will contain 16.941 acres of seasonal wetland habitat and approximately 8.402 acres of low-flow channel. Success monitoring of the constructed seasonal wetland habitat within the Open Space Corridors will occur for five years following construction and adjacent build out, with a phased monitoring approach.

To offset any temporal losses, the applicants propose a phased impact and mitigation plan that will establish the Wetland Preserve in Phase One as well as the majority of construction of vernal pool habitat in early phases, prior to the majority of impacts.

[1] For the remainder of this document, the term 'construction' will be used to refer to both restoration and creation, unless there is a specific reason to discuss these activities separately.

Specific success criteria for the different types of constructed wetland habitat have been set forth in this document. Both the Wetland Preserve and Open Space Corridors (collectively referred to as 'Preserves') will be fenced, protected by Deed Restrictions or Conservation Easements, and managed as wetland/wildlife habitat in perpetuity. Long-term monitoring and maintenance funding will be provided through an endowment, a Community Facilities District, or other similar mechanism such as a Mello-Roos District as approved by the Corps and Service. This and other long-term management information will be included in the *Operations and Management Plan for the Rio Del Oro Wetland Preserve* and the *Operations and Management Plan for the Rio Del Oro Open Space Preserve*, which will be submitted for agency approval under separate cover.

The approximately 160-acre Cook Property, located south of Highway 16 in Sacramento County, is proposed as off-site mitigation (preservation of existing vernal pool and wetland habitat) for the Project. A preliminary wetland assessment conducted by ECORP Consulting, Inc. (ECORP) identified 2.67 acres of vernal pools, 9.90 acres of seasonal marsh, 2.63 acres of seasonal wetland swales, a 6.51-acre pond, and an 0.58-acre intermittent drainage (Frye Creek) at the site. The remainder of the site includes associated upland areas and approximately 21.27 acres of irrigated pasture. The likelihood of the presence of listed vernal pool branchiopods, as well as the Cook Property's proximity to other regional conservation areas, makes the Cook Property an ideal location to mitigate impacts to biological resources resulting from the Project.

Finally, 16.666 acres of seasonal wetland and/or vernal pool habitat is proposed to be purchased at the Clay Station Mitigation Bank[2] as mitigation. The Clay Station Mitigation Bank was established in 1994 vernal pool, seasonal marsh, and seasonal wetland habitat was constructed at the site. All constructed wetland habitat has completed the five-year success monitoring and the site has entered its long-term monitoring and management phase. The Bank is awaiting its final credit release, meaning that the remaining acreage to be purchased at the Clay Station Mitigation Bank is already functioning as wetland habitat.

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[2] *The Mitigation Bank Enabling Instrument: Clay Station Mitigation Bank* (ECORP-Sugnet 1999) provides additional information on the Clay Station Mitigation Bank.

2.0 MITIGATION PLANNING

2.1 On-Site Mitigation

On-site mitigation containing both wetland preservation and wetland construction for the Project will occur within two areas: the Wetland Preserve and the Open Space Corridors.

2.1.1 Existing Functions, Values, Baseline Information

At the request of the Corps, ECORP conducted an assessment of the various wetland resources located within the Project in 2004 (ECORP 2004a). Data collected were used to support the on-site alternatives analysis component of the project's Draft Environmental Impact Statement / Environmental Impact Report (EIS/EIR) (EDAW 2008). The assessment compared the relative biological values of wetlands located within the Project's on-site Preserves with those wetlands proposed to be filled as a result of Project implementation. Most wetlands designated for fill are located in the northern and central portions of the Project, primarily within a manipulated landscape, largely the result of historical mining activities.

The 'relative value' of wetlands within preserve and impact areas was assessed by evaluating various ecological and biological conditions observed within the Project. Several characteristics were used to assess relative conservation value, including: 1) level of disturbance; 2) uniqueness of habitat; 3) wetland size, density, and connectivity; 4) hydrology; 5) occurrence of native and/or specialized plant species; and 6) occurrence of special-status species. Studies associated with the South Sacramento County Habitat Conservation Plan (HCP) have recognized many of these parameters as being important in assessing conservation value of vernal pool resources in the County. Data were collected during several survey efforts including a re-delineation of wetlands on the property, an amphibian survey, and rare plant surveys conducted by ECORP during 2003, 2004, and 2006. The assessment investigation made the following findings.

The majority of the area proposed to be the Wetland Preserve was found to be relatively undisturbed with the exception of minor disturbances resulting from cattle grazing practices. Vernal pool densities were found to vary, as several scattered clusters of vernal pools are present. Vernal pools range in size from small (0.002 acre) to large (1.3 acres), and occur in localized clumps that are often connected by linear seasonal wetland swales and drainages including the upper reaches of Morrison Creek. This continuity among wetlands serves to provide dispersal opportunities for wetland-dependant species including various aquatic invertebrates (including vernal pool branchiopods), amphibians, and a high diversity of plant species. In general, the variability in vernal pool sizes, depths, and degree of continuity increases the likelihood that favorable wetland conditions for plant and animal species will persist regardless of variable annual conditions, and that dispersal to suitable habitat is achievable. Studies associated with the HCP have, similarly, correlated increased vernal pool density and pool size with conservation value.

Generally, the inundation periods of the wetlands on the site tend to be longer for the southern grassland vernal pools (located within the Wetland Preserve) than for seasonal wetlands to the north (impact area). Consequently, unique plant species adapted to the hydrological regime characteristic of vernal pools occur more frequently in the Wetland Preserve. These plants include several native, obligate hydrophytes such as Vasey's coyote thistle (*Eryngium vaseyi*), slender popcorn flower (*Plagiobothrys stipitatus*), Carter's buttercup (*Ranunculus bonariensis*), and creeping spikerush (*Eleocharis macrostachya*). Rare plant surveys conducted by ECORP in May 2003 identified Greene's legenere *(Legenere limosa*, a California Native Plant Society List 1B.1 species (CNPS 2008)) in two wetlands in the Wetland Preserve. Additionally, several of the wetlands within the Wetland Preserve were found to support the federally-listed vernal pool fairy shrimp (*Branchinecta lynchi*, federally threatened) and the vernal pool tadpole shrimp (*Lepidurus packardi*, federally endangered) (Sugnet and Associates).

In contrast, much of the northern two-thirds of the Project is highly disturbed, primarily due to gold dredging operations during the 1920s and 1950s. As a result of past dredging operations, long rows of cobble tailings, as high as 60 feet tall, were deposited throughout the site. The soils in these areas have been highly altered and consist primarily of Xerorthents with smaller patches of slickens deposits. The overall density of seasonal wetlands within the rock tailing areas was found to be much less than that of the Wetland Preserve, which accommodates a significant portion of the Project's vernal pools and seasonal wetlands. The wetlands in the dredger lands are much more scattered in their distribution. Many of these wetland features tend to be smaller and less interconnected, as evidenced by fewer seasonal wetland swales and drainages. The majority of these features are isolated between dredger tailings.

The dredger seasonal wetlands were found to be typically dominated by facultative, non-native wetland plants, including Mediterranean barley (*Hordeum marinum*), Italian ryegrass (*Lolium multiflorum*), and curly dock (*Rumex crispus*). Several of the seasonal wetlands also contain woody species such as willow (*Salix* spp.) and Fremont cottonwood (*Populus fremontii*); however, these species appear to be deep-rooted remnants established when the area received more water, due to past Aerojet operations. The dredger seasonal wetlands typically support a lower diversity of plant species than the grassland wetlands in the Preserve.

Wet season branchiopod surveys of the dredger tailings in the upper portion of the Project were conducted by Gibson and Skordal in 2000 and 2001. Gibson and Skordal documented that the dredger tailings were unsuitable habitat for fairy shrimp, as no shrimp were found within the dredger wetlands. These surveys identified only a few vernal pool fairy shrimp and vernal pool tadpole shrimp in open grassland wetlands located along the outer edge of the survey area, adjacent to, but not within, the dredger tailings areas.

The relative biological and conservation value of wetlands located within the area proposed to be the Wetland Preserve were found to be higher than those for wetlands planned for impact. In general, the proposed preserved wetlands are situated on lands that have experienced considerably less disturbance. The Wetland Preserve contains an assemblage of vernal pools and other wetlands, situated on the Laguna Formation, that support a more diverse vegetation community than that present in mined portions of the proposed development area. Additionally, wetland densities and connectivity are greater in the Wetland Preserve, whereas most of the wetlands proposed for impact are either scattered in their distribution and/or are typically small, isolated features. The Wetland Preserve encompasses vernal pools and wetlands of various sizes and depths that support native plant species.

ECORP's 2004 assessment of the relative conservation values of the Project's wetland resources is consistent with findings of previous studies associated with development of the HCP, which correlated increased vernal pool density and pool size with increased conservation value.

2.2 Off-Site Mitigation

Off-site mitigation for the Project is proposed to occur at two different sites: The Cook Property and the Clay Station Mitigation Bank. The entire Cook Property is proposed to be preserved in perpetuity, while the Clay Station Mitigation Bank in an approved mitigation bank. Credits would be purchased at the Clay Station Mitigation Bank to mitigation for impacts to wetlands incurred during Project implementation.

2.2.1 Existing Functions, Values, Baseline Information

<u>2.2.1.1 Cook Property</u>

A preliminary wetland assessment conducted by ECORP Consulting, Inc. identified the following wetland habitats on the Cook Property; 2.67 acres of vernal pools, 9.90 acres of seasonal marshes, 2.63 acres of seasonal wetland swales, as well as other waters including a 6.51 acre pond and 0.58 acre intermittent drainage (Frye Creek). The remainder of the site includes associated uplands and approximately 21.27 acres of irrigated pasture.

The likelihood of the presence of listed vernal pool branchiopods, as well as the Cook Property's proximity to other regional conservation areas, makes the Cook Property an ideal location to mitigate impacts to biological resources resulting from the Project. While protocol-level branchiopod surveys have not been conducted on the Cook Property to date, it is likely that vernal pools on the site support vernal pool branchiopods. The Cook Property is situated in an area of Sacramento County that is known to support several branchiopod species, including those that are federally-listed as threatened or endangered. Surveys conducted by ECORP and other investigators in the immediate vicinity of the Cook Property have identified vernal pool fairy shrimp (federal listed threatened), mid-valley fairy shrimp (*Branchinecta mesovallensis*), vernal pool tadpole shrimp (federal listed endangered), and California linderiella (*Linderiella occidentalis*).

<u>2.2.1.2 Clay Station Mitigation Bank</u>

The Clay Station Mitigation Bank was established in 1994 and all wetland habitat has completed its five-year success monitoring period. In addition, the Clay Station Mitigation Bank supports vernal pool fairy shrimp and tadpole shrimp. The Mitigation Banking Review Team has authorized Clay Station Mitigation Bank to sell credits to offset impacts in a service area that includes the Project and the Project is well within the bank established service area.

3.0 RESPONSIBLE PARTIES

3.1 Applicants

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3.2 Parties Having Financial Responsibility

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GenCorp Real Estate
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3.3 Owner(s) of the Mitigation Sites

3.3.1 On-Site Wetland Preserve

Present owners: Elliott Homes, Inc. and GenCorp Real Estate
Expected long-term owner: Sacramento Valley Open Space Conservancy, Wildlife Heritage Foundation, or other conservation-oriented third party entity
Parties responsible for long-term maintenance: Sacramento Valley Open Space Conservancy, Wildlife Heritage Foundation, or other conservation-oriented third party entity

3.3.2 On-Site Open Space Corridors

Present owners: Elliott Homes, Inc. and GenCorp Real Estate
Expected long-term owner: City of Rancho Cordova or other conservation-orientated third party entity
Parties responsible for long-term maintenance: City of Rancho Cordova, Sacramento Valley Open Space Conservancy, Wildlife Heritage Foundation, or other public entity

3.3.3 Off-Site Mitigation at the Cook Property

Present owner: Elliott Homes
Expected long-term owner: Sacramento Valley Conservancy
Parties responsible for long-term maintenance: Sacramento Valley Open Space Conservancy, Wildlife Heritage Foundation, or other public entity

3.3.4 Off-Site Mitigation at Clay Station Mitigation Bank

Present owner: Elliott Homes
Expected long-term owner: Elliott Homes
Parties responsible for long-term maintenance: Elliott Conservancy

3.4 Preparer of the Mitigation Proposal

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4.0 PROJECT REQUIRING MITIGATION

4.1 Location of Project

The approximately 3,829 acre Project (Assessor's Parcel No. 072-0370-036, 043 ,045-048, 066, 067, 070, 071, 072-0440-003, 005-016, and 072-0540-023) is located south of White Rock Road, north of Douglas Road, and east of Sunrise Boulevard in the City of Rancho Cordova, California. The site corresponds to portions of Sections 5, 6, 7, 8, 9, and 10 of Township 8 North, Range 7 East, on the "Carmichael, California" U.S. Geological Survey 7.5-minute quadrangle and portions of Sections 31 and 32 of Township 9 North, Range 7 East, on the "Buffalo Creek, California" U.S. Geological Survey 7.5-minute quadrangle (Figure 1. *Rio Del Oro Project Site and Vicinity*).

4.2 Brief Summary of Overall Project

The Project consists of grading and filling to establish construction grade and installation of infrastructure for a master-planned community on an approximately 3,829± acre parcel (Figure 2. *Rio Del Oro Land Use Plan*). The proposed land use plan includes high, medium, and low-density residential, retail/commercial, office, park, schools, Wetland Preserve, and Open Space Corridors.

4.3 Jurisdictional and Non-Jurisdictional Aquatic Resources Affected by Project

The Project will permanently impact approximately 27.902 acres of waters of the U.S., composed of 15.072 acres of vernal pools, 2.923 acres of ponds, 3.587 acres of seasonal wetland swales, 3.064 acres of seasonal wetlands, and 3.256 acres of ephemeral drainages to be filled during construction grading.

Additionally, the Project will permanently impact 12.946 acres of isolated wetlands, composed of 2.414 acres of vernal pools, 0.653 acre of seasonal wetland swales, 9.158 acres of seasonal wetlands, and 0.721 acre of ponds. Seasonal wetland habitat to be constructed within the Open Space Corridors is proposed as mitigation for the majority of impacts to isolated waters. Isolated vernal pool habitat mitigation will occur within the on-site Wetland Preserve. Table 1 below provides acreage of the wetlands and other waters of the U.S. that would be impacted by the proposed Project. Please note that this Proposal includes mitigation for impacts to both jurisdictional and non-jurisdictional waters.

Table 1 – Waters/Wetlands Existing, Preserve, and Impact				
Wetland Type	**Existing Jurisdictional**	**Existing Isolated[1]**	**Preserve**	**Impact**
Wetlands				
Vernal Pool	35.485	2.414	20.413	15.072
Seasonal Wetland Swale	6.044	0.653	2.457	3.587
Seasonal Wetland	6.418	9.158	3.354	3.064
Pond	3.540	0.721	0.616	2.923
Other Waters of the U.S.				
Ephemeral Drainage	5.145	--	1.889	3.256
Total:	**56.632**	**12.946**	**28.729**	**27.902**

[1] All isolated wetlands will be impacted

4.3.1 *Aquatic Functions*

A delineation of the Project was first conducted by Gibson and Skordal in 1999 and revised by ECORP on October 21, 2004 (Figure 3. *Rio Del Oro Wetland Delineation*). The delineation was verified by the Corps on January 10, 2005. A total of 56.632 acres of waters of the U.S. are located within the Project. In addition, 12.946 acres of non-jurisdictional wetlands were identified on the site.

4.3.1.1 Vernal Pools

Vernal pools are poorly drained, isolated depressions that occur within the annual grassland landscape. Vernal pools are fed by direct rainfall or surface run-off. Water ponds for several weeks at a time during the rainy season and may dry completely between storm events.

In the Mediterranean climate of California's Central Valley, fall rains initiate the "wetting" stage, during which seeds germinate and dormant perennials re-sprout. As soils saturate and standing water accumulates, the pool enters the "aquatic" phase. Inundation may be periodic or continuous, and this variability supports a diverse plant and animal community. As water levels recede, primarily through evaporation, the "drying" phase begins during which pool basins begin drying and plant flowering reaches its peak, followed by the setting of seeds. The final phase is the "drought" phase, which is characterized by dry soils and dead or dormant vegetation. Since vernal pools hold ponded water and have emergent vegetation, they are responsible for some nutrient uptake/transformation. However, because of the brief period of inundation of the vernal pools on the site, it is unlikely that the pools provide any significant contribution to overall regional water quality (i.e., minimal effects on groundwater recharge, flood flows, or sediment stabilization).

There are numerous vernal pools throughout the annual grassland habitat portions of the Project, particularly in the non-mined areas. On-site vernal pools vary in maximum water depth from a couple of inches to 18 inches deep, and range from 0.002 to 1.3 acres in size. Plant species observed within vernal pools include Carter's buttercup, Vasey's coyote thistle, creeping spikerush, and slender popcorn flower. Typical wildlife associated with vernal pools includes various aquatic invertebrates and amphibians such as the pacific chorus frog (*Pseudacris regilla*).

The vernal pool fairy shrimp and vernal pool tadpole shrimp, listed as federally-listed as threatened and endangered, respectively, are known to occur within several vernal pools within the Project. Two years of determinate-level wet season surveys have been performed on the site; both vernal pool tadpole shrimp and vernal pool fairy shrimp were located in vernal pools dispersed within the open grassland habitat along the outer edges of the Project.

4.3.1.2 Seasonal Wetland and Seasonal Wetland Swale

Seasonal wetlands are scattered throughout both the mined and non-mined areas of the Project. These seasonal wetlands are ephemerally wet areas that are usually underlain by clay or a heavy clay loam that act to suspend runoff within low-lying areas. They become inundated during the winter and fall but dry completely during the summer months. Unlike vernal pool wetlands, vegetation inhabiting on-site seasonal wetlands are predominately non-native wetland generalist plants such as Italian ryegrass, Mediterranean barley, dock (*Rumex* spp.), and rabbits-foot grass (*Polypogon monspeliensis*). Less common are native species such as Baltic rush (*Juncus balticus*) and creeping spikerush. Many of the seasonal wetlands that occur within the cobble tailings low areas also contain woody species such as willow and cottonwood. The vegetation in seasonal wetlands can function to remove/transform nutrients, as well as help with sediment stabilization. However, due to the size of these wetlands and the relatively low amount of water conveyed through this habitat, contribution to overall regional water quality is relatively low (i.e., minimal effects on groundwater recharge or flood flows).

Various seasonal wetland swales are located within the Project and consist of shallow, ephemerally wet areas that convey water between larger drainages or other wetland/water features during storm events. They occur as linear wetland features but lack bed-and-bank, and are lined with vegetation. Portions of a swale remain saturated into the growing season, support some hydrophytic vegetation, and exhibit hydric soil characteristics. The vegetation community of on-site swales consists primarily of non-native wetland generalist plants such as Italian ryegrass and Mediterranean barley, dock, as well as native annual species including coyote thistle.

When inundated, these seasonal wetlands potentially provide habitat for aquatic invertebrates and amphibians. For most of the remainder of the year, wildlife usage is similar to that of typical Central Valley non-native annual grassland habitat.

Isolated seasonal wetlands can provide habitat for federally-listed branchiopods. Therefore, some of the isolated seasonal wetland depressions on the site have been considered potential habitat for federally-listed branchiopods.

4.3.1.3 Pond

Several wetland features identified as ponds are present within the Project and consist primarily of modified or excavated basins or impounded drainages. They currently provide water for cattle grazing. For the most part, the ponds are seasonally inundated yet they hold water significantly longer than other seasonal wetland types. Several may even remain inundated throughout the year. The ponds largely lack emergent vegetation except for scarce individuals that exist around the high water mark.

Ponds can contribute to water quality through nutrient removal/transformation, collections of flood waters during local storm events, and reduction in sediment loads and turbidity. Many wildlife species are likely to use the stock ponds throughout the year and these may include great egret (*Ardea alba*), great blue heron (*A. nerodias*), belted kingfisher (*Ceryle alcyone*), bullfrog (*Rana catesbeiana*), and Pacific chorus frog. These ponds can be particularly important to wildlife seeking water during summer months, when other features have dried down.

4.3.1.4 Ephemeral Drainage

Ephemeral drainages are linear features that provide a conduit to flow during storm events. In general, they exhibit bed-and-bank characteristics and are largely un-vegetated due to the depth and scouring effects of flowing water. Occasionally however, some hydrophytic vegetation is present along the upper edges, and in areas where sediment accumulation provides suitable substrate for plant establishment.

The dominant ephemeral drainage located on-site is Morrison Creek, which runs from east to west through the southern section of the site and is identified on the U.S. Geographic Survey topographic map as a 'blue line' feature. Ultimately, this feature drains into Mather Lake, located southwest from the Project. Several other smaller sections of ephemeral drainages were mapped in the Project. They consist primarily of seasonal wetland swale features that have eroded and developed bed-and-bank characteristics.

The ephemeral drainages are important to water quality in that they transmit sheet flows and water from local storm events into larger drainages and tributaries. Depending on the flow capacity, the ephemeral drainages may also contribute to overall regional water quality in terms of nutrient transformation and sediment stabilization.

4.3.2 Hydrology and Topography

The Project is comprised of level to gently rolling terrain, and is situated at elevations between 125 to 200 feet above sea level. The Project has historically been used for cattle grazing and dredge mining. Dredge tailings cover about 70 percent of the surface area of the Project, with the average depth of dredging reported to have been between 80 and 110 feet. Intermixed within the dredge tailings and the annual grassland are wetland features (as discussed above) including vernal pools, seasonal wetlands, seasonal wetland swales, ephemeral drainages, and man-made ponds.

4.3.3 Geology and Soils

There are eleven different soils types mapped for the Project. According to the Soil Survey of Sacramento County, California (United States Department of Agriculture, Natural Resource Conservation Service 1993), soil series for the site include: (145) Fiddyment fine sandy loam, 1-8% slopes; (158) Hicksville loam, occasionally flooded, 0-2% slopes; (159) Hicksville gravelly loam, 0-2% slopes; (181) Natomas loam, 0-2% slopes; (191) Red Bluff loam, 0-2% slopes; (192) Red Bluff loam, 2-5% slopes; (193) Red Bluff Loam, 0-5% slopes; (196) Red Bluff-Xerorthents, dredge tailing complex, 2-5% slopes; (198) Redding gravelly loam, 0-8% slopes; (223) Slickens; and (245) Xerorthent, dredge tailings, 2-50% slopes (Figure 4. *Rio Del Oro NRCS Soil Types*). The Fiddyment, Hicksville, Natomas, Red Bluff, and Redding soils occur in the grasslands within areas which have not been disturbed by historic mining activities. The Slickens and Xerorthent dredge tailings soils occur with areas that have been substantially disturbed by historic mining activities.

4.3.4 Vegetation

Within the portions of the Project disturbed by past dredge mining and grazing activities, a mix of grass-covered tailings and limited riparian habitat are present. Due to the disturbed nature of the riparian habitats, the vegetation typically found in riparian habitats is not present. Vegetation that occurs along the banks of the ephemeral drainage includes ryegrass, rabbits-foot grass, brass buttons (*Cotula coronopifolia*), and tall flatsedge (*Cyperus eragrostis*). Scattered tree and shrub species include Fremont cottonwood, willow, and coyote brush (*Baccharis pilularis*).

Within the non-disturbed areas of the Project, the characteristic plant community is non-native annual grassland. The vegetation is characterized by a dominance of non-native grasses and forbs. Common species include soft chess (*Bromus mollis*), Italian ryegrass, ripgut brome (*Bromus diandrus*), wild oat (*Avena fatua*), little quaking grass (*Briza minor*), and medusa head (*Taeniatherum caput-medusae*). Other herbaceous species observed in this community include turkey mullein (*Eremocarpus setigerus*), hairy hawkbit (*Leontodon taraxacoides*), rose clover (*Trifolium hirtum*), Fitch's spikeweed (*Hemizonia fitchii*), yellow star-thistle (*Centaurea solstitialis*), vinegar weed (*Trichostema lanceolatum*) and sticky tarweed (*Holocarpha virgata*).

4.4 Federally-Listed Threatened and Endangered Species

The Wetland Preserve and limited portions of the development area are known to support the federally-listed vernal pool fairy shrimp (federally threatened) and vernal pool tadpole shrimp (federally endangered).

5.0 ON-SITE MITIGATION

The proposed on-site mitigation will occur within the approximately 3,829-acre Project. This mitigation is proposed to occur in the form of 1) preservation of the highest quality on-site wetland habitat by the establishment of a approximately 507-acre Wetland Preserve within the south-eastern portion of the Project, 2) construction of approximately 17.87 acres of vernal pool habitat within the Wetland Preserve, and 3) the construction of approximately 17 acres of seasonal wetlands and approximately eight acres of low-flow channel within the approximately 187-acre Open Space Corridors running throughout the Project (Figure 5. *Rio Del Oro Wetland Preserve, Impact, and Compensation Plan* and Attachment A – *Rio Del Oro Wetland Preserve, Impact and Compensation Plan*).

5.1 Basis for Design

The mitigation proposed to take place within the Project would include 1) the construction component of the mitigation for impacts to waters of the U.S. and for impacts to federally-listed branchiopod habitat, and 2) a portion of the preservation requirement for impacts to the to waters of the U.S. and for impacts to federally-listed branchiopod habitat. Within the Project, the proposed Preserves were selected for their existing wetland habitat, wetland construction potential, appropriate soils characteristics, and their proximity to planned future preserve areas (resulting in larger, contiguous preserved areas).

5.1.1 Site Feasibility and Restoration Area Selection

The on-site Wetland Preserve was assessed for appropriate wetland construction locations. A soils investigation was undertaken by Davis^2 Soil Scientists. Appropriate soils (restricting layer needed for wetland construction) were located within the Preserves, although due to past uses of the site, significant soil movement will need to occur in some locations to accommodate the wetland construction. Topography, field data, historic wetland signatures (observable on historic aerials) and soils characteristics were then used to create conceptual wetland construction plans. Emphasis was placed first on restoring wetlands that were eliminated or degraded by past land use practices. In some cases, portions of vernal pools were impacted and will be restored. The secondary focus was vernal pool creation in the most appropriate areas within the Preserve. Further analysis will be conducted once Resource Agency approval is obtained.

Morrison Creek within the Wetland Preserve was assessed by ECORP's fluvial geomorphologist. Two enhancement/restoration opportunities were identified: correction of two head-cuts within the channel and re-grading or redistribution of spoil piles left behind after Morrison Creek was redirected into its current position.

The location of the Open Space Corridors were selected based on the presence of upstream topographical low points along the project boundary. From those points, the Corridors were then designed as needed to appropriately drain the site, ultimately joining Morrison Creek in the southwest portion of the project site.

5.2 Characteristics of Design Reference Site

The design reference site for the proposed constructed vernal pools is the proposed Wetland Preserve located within the Project. The Wetland Preserve contains a number of existing wetlands, including vernal pools, seasonal wetlands, seasonal wetland swales, a pond, and ephemeral drainages. A total of 30 existing preserved vernal pools will be used as reference vernal pools for the vernal pool mitigation and will be monitored along with the constructed and other nearby existing features (see Section 5.6.2 below) No reference seasonal wetland or low-flow channel features are proposed to be monitored for the wetlands constructed within the Open Space Corridors.

5.3 Proposed Mitigation Sites

The following sections outline the various characteristics of the two different areas where on-site mitigation for the Project is proposed. On-site mitigation will provide preservation and compensatory mitigation habitat for listed branchiopod and plant species within their core-recovery area.

5.3.1 Location and Size of Mitigation Areas

5.3.1.1 Wetland Preserve

The Wetland Preserve is approximately 507 acres in size and is located in the southern portion of the approximately 3,829-acre Project (Figure 6. *Conceptual Wetland Preserve Detail*).

5.3.1.2 Open Space Corridors

The Open Space Corridors are approximately 187 acres in size and are located throughout the Project (Figure 7. *Conceptual Open Space Corridors Detail*).

5.3.2 Ownership Status

5.3.2.1 Wetland Preserve

Elliott Homes, Inc. and GenCorp Real Estate are currently the entire Project owners; however, once the success monitoring period of the constructed habitats has been completed, the City of Rancho Cordova, the Sacramento Valley Open Space Conservancy, the Wildlife Heritage Foundation, or other conservation-oriented third party entity will become the owner of the Wetland Preserve.

Point of Contact for Corps Access to the Site: During construction and 5-year monitoring: Elliott Homes, Inc. and GenCorp Real Estate
Following Corps Sign-off: Sacramento Valley Open Space Conservancy, Wildlife Heritage Foundation, or other conservation-oriented third party entity

Deed Restrictions, Conservation Easements and Operations and Management: Deed restrictions or a conservation easement will be recorded over the Wetland Preserve and will require that the

Wetland Preserve is maintained as wetland and wildlife habitat in perpetuity. The *Operations and Management Plan for the Rio Del Oro Wetland Preserve*, to be submitted under separate cover, will detail the ownership and long-term management of the Wetland Preserve. Copies of the proposed language will be submitted to the Corps for approval prior to recordation and copies of the recorded documents will be provided to the Corps no later than 30 days subsequent to recordation. In addition, recordation will occur prior to the start of Project construction.

5.3.2.2 Open Space Corridors

Elliott Homes, Inc. and GenCorp Real Estate currently own the entire Project; however, once the success monitoring period of the constructed habitats has been completed the City of Rancho Cordova, the Sacramento Valley Open Space Conservancy, the Wildlife Heritage Foundation, or other conservation-oriented third party entity will become the owner.

Point of Contact for Corps Access to the Site:
During construction and 5-year monitoring: Elliott Homes, Inc. and GenCorp Real Estate
Following Corps Sign-off: City of Rancho Cordova, Sacramento Valley Open Space Conservancy, Wildlife Heritage Foundation, or other public agency

Deed Restrictions, Conservation Easements and Operations and Management:
Deed restrictions or a conservation easement will be recorded over the Open Space Corridor and will require that they be maintained as wetland and wildlife habitat in perpetuity. The *Operations and Management Plan for the Rio Del Oro Open Space Preserve*, to be submitted under separate cover, will detail the ownership and long-term management of the Open Space Corridors. Copies of the proposed language will be submitted to the Corps for approval prior to recordation and copies of the recorded documents will be provided to the Corps no later than 30 days subsequent to recordation.

5.3.3 Waters of the U.S.

5.3.3.1 Wetland Preserve

The existing waters of the U.S. within the Wetland Preserve include approximately 20.413 acres of vernal pools, 2.457 acres of seasonal wetland swales, 3.354 acres of seasonal wetlands, 0.616 acres of ponds, and 1.889 acres of ephemeral drainages. In addition, the portion of Morrison Creek located within this area will also be preserved. Please refer to Section 4.3.1 Aquatic Functions for information of the aquatic functions of these wetland types.

5.3.3.2 Open Space Corridors

The Open Space Corridors contain approximately 5.864 acres of waters of the U.S. and approximately 0.273 acres of isolated wetlands. Waters of the U.S. include approximately 2.454 acres of ephemeral drainage, 1.242 acres of seasonal wetlands, 0.344 acres of seasonal wetland swale, and 1.824 acres of vernal pool. Isolated wetlands include approximately 0.205 acres of seasonal wetlands and 0.068 acres of seasonal wetland swale. All of these wetlands will be impacted during Project implementation and during the construction of the Open Space

Corridors. Please refer to Section 4.3.1 Aquatic Functions for information of the aquatic functions of these wetland types.

5.3.4 Hydrology and Topography

5.3.4.1 Wetland Preserve

The Wetland Preserve is situated at an elevation of 125 to 200 feet above sea level. The Wetland Preserve is primarily flat grassland that has been used for grazing livestock. Within the non-native annual grassland existing wetland features include vernal pools, seasonal wetland swales, seasonal wetlands, pond, and ephemeral drainages, including a portion of Morrison Creek.

5.3.4.2 Open Space Corridors

The Open Space Corridors vary in elevation across the Project, which is situated at an elevation of 125 to 200 feet above sea level. The proposed Open Space Corridors are planned within areas that were highly mined in the 1920s and 1950s, thus the landscape is dominated by dredge tailings intermixed with waters of the U.S. (ephemeral drainages, seasonal wetlands, seasonal wetland swales, and vernal pools) and isolated wetlands (seasonal wetlands and seasonal wetland swales). Upon Project development these tailings will be removed and the land restored to a more natural contour and will contain low-flow channels, seasonal wetlands, and associated riparian habitat. Post construction, the Open Space Corridors will convey treated storm water and urban runoff.

5.3.5 Geology and Soils

5.3.5.1 Wetland Preserve

There are four different soils types mapped for the Wetland Preserve area. According to the Soil Survey of Sacramento County, California (United States Department of Agriculture, Natural Resource Conservation Service 1993), soil series for the Wetland Preserve include: (159) Hicksville gravelly loam, 0-2% slopes; (192) Red Bluff loam, 2-5% slopes; (193) Red Bluff Loam, 0-5% slopes; and (198) Redding gravelly loam, 0-8% slopes (see Figure 4). The Hicksville, Red Bluff, and Redding soils occur in the grasslands within areas which have not been disturbed by historic mining activities. The Xerorthent dredge tailings soils occur with areas that have been substantially disturbed by historic mining activities.

5.3.5.2 Open Space Corridors

There are six different soils types mapped for the Open Space corridors. According to the Soil Survey of Sacramento County, California (United States Department of Agriculture, Natural Resource Conservation Service 1993), soil series for the Open Space Corridors include: (159) Hicksville gravelly loam, 0-2% slopes; (191) Red Bluff loam, 0-2% slopes; (192) Red Bluff loam, 2-5% slopes; (196) Red Bluff-Xerorthents, dredge tailing complex, 2-5% slopes; (198) Redding gravelly loam, 0-8% slopes; (245) Xerorthents, dredge tailings, 2-50% slopes (see Figure 4).

The Hicksville, Red Bluff, and Redding soils occur in the grasslands within areas which have not been disturbed by historic mining activities.

5.3.6 Vegetation

5.3.6.1 Wetland Preserve

The Wetland Preserve plant community is dominated by non-native annual grassland. Common species include soft chess, ryegrass, ripgut brome, wild oat, little quaking grass, and medusa head. Other herbaceous species observed in this community include turkey mullien, hairy hawkbit, rose clover, Fitch's spikeweed, yellow star-thistle, vinegar weed, and sticky tarweed.

Although Morrison Creek occurs within the Wetland Preserve a typical riparian forest does not occur due to the historic uses of the property. Vegetation that occurs along the banks of the ephemeral drainage includes ryegrass, annual rabbit-foot grass (*Polypogon monspeliensis*), brass buttons, and tall flatsedge. Scattered tree and shrub species include Fremont cottonwood, willow, and coyote brush.

5.3.6.2 Open Space Corridors

Within portions of the Open Space Corridors which have been disturbed by historic mining operations, the characteristic plant community is non-native annual grassland. The vegetation is characterized by a dominance of non-native grasses and forbs. Common species include ripgut brome, soft brome (*Bromus hordeaceus*), wild oat, ryegrass, Mediterranean barley, and medusahead grass. Other non-native herbaceous species include hairy hawkbit, filaree (*Erodium botrys*), pineapple weed (*Chamomilla suaveolens*), and yellow star-thistle.

5.3.7 Present and Historic Uses of Mitigation Areas

The Preserves are currently fallow undeveloped property and are used for cattle grazing.

5.3.7.1 Wetland Preserve Historic Uses

Two areas within the Wetland Preserve (referred to as the 'Kappa/Gamma Complex' and the 'Metal-Lined Hole' area) were used historically for industrial and agricultural purposes as described below.

The Kappa/Gamma Complex is located on the eastern side of the Wetland Preserve and is approximately 30 acres in size. The Kappa/Gamma Complex facilities were used for several activities including the testing of the Thor rocket, the development and testing of hydrogen components, for evaluation of the use of self-igniting propellant, and testing of engines and supply systems. Testing activities generated wastewater that was channeled to concrete-lined burn basins where the wastewater would be burned off and the remaining fluids were pumped to an unlined percolation pond that contained several deep, dry wells to enhance the percolation of wastewater into the soil. The Kappa/Gamma Complex currently contains volatile organic compounds within shallow surrounding soils and in January 2006 a Remedial Action

Plan for institutional control (land use restrictions) was approved by the California Department of Toxic Substances Control.

The Metal-Lined Hole area is located on the western side of the Wetland Preserve and occupies approximately a 1- to 2-acre location. The area contains two 80-foot circular concrete curbs and a 1.8-foot-diameter by 9-foot-deep vertical steel pipe surrounded by a 6-foot-square concrete pad (36 square feet), which is approximately 1 foot thick. Originally the Metal-Lined Hole was full of an unknown oily fluid that was pumped into three drums by the Mcdonnell Aircraft Corporation for appropriate off-site disposal. The Metal-Lined Hole was later filled with bentonite and capped with a layer of cement. In 1978 Metal-Lined Hole the site was leased to Cetec Antenna Company where the Metal-Lined Hole was used for a vertical antenna array and the concrete curbs were used for horizontal antenna arrays until the late 1980s when it was decommissioned. The Final Remedial Action Plan for this site indicated that the trace volatile organic compounds concentrations of limited extent near the site did not warrant further remedial actions. In December 2000 the Final Remedial Action Plan was approved by the California Department of Toxic Substances Control. Groundwater-water monitoring wells are also located within the Wetland Preserve. Historic photos indicate significant portions of the Wetland Preserve were farmed.

<u>5.3.7.2 Open Space Corridors Historic Uses</u>

These areas were previously mined, then used as buffers for testing facilities that are no longer active, with exception of some surface mining of the exposed aggregate.

5.3.8 Present and Proposed Uses of Adjacent Areas

<u>5.3.8.1 Wetland Preserve</u>

Land uses surrounding the Wetland Preserve are currently agricultural to the west, north and south, and light industrial to the east. Residential development is being developed south of the Project (across Douglas Road) as part of the Sunridge Specific Plan Area. The Wetland Preserve is currently zoned as industrial with aggregate resource overlay, but will be rezoned as open space. The Kappa/Gamma Complex and the Metal-Lined Hole within the Wetland Preserve (as addressed above in Section 5.3.7 Present and Historic Uses of Mitigation Areas) will undergo further clean-up activities prior to or during project implementation. Please refer to the *Operations and Management Plan for the Rio Del Oro Wetland Preserve*, to be submitted under separate cover, for more information on long-term management of the Wetland Preserve.

<u>5.3.8.2 Open Space Corridors</u>

The adjacent land use of the Open Space Corridors is the same as the Wetland Preserve (see Section 5.3.8.1 above). The Open Space Corridors are currently zoned as industrial with aggregate resource overlay, but will be rezoned as open space. Please refer to the *Operations and Management Plan for the Rio Del Oro Open Space Preserve*, to be submitted under separate cover, for more information on long-term management of the Open Space Corridors.

5.4 Construction Area Selection

5.4.1 Wetland Preserve – Vernal Pool Construction

The surface morphology of the Wetland Preserve has been analyzed using hydrologic modeling tools in ESRI's ArcGIS software. It was used to determine if the naturally-occurring vernal pool and seasonal wetland habitats (depressional wetlands) are likely to function appropriately in a post-development setting and with the construction of additional vernal pools within the adjacent uplands. Specifically, the purpose of the investigation was to determine if the development of the surrounding property, the construction of Rancho Cordova Parkway, and the construction of additional vernal pool habitat would lead to a reduction of watershed area necessary to sustain the naturally-occurring depressional wetlands and constructed vernal pools. To accomplish this, the Wetland Preserve was mapped in May 2007 with LIDAR (Light Detection and Ranging) to develop a fine scale topographic model. Using the LIDAR-derived topographic model, the watershed boundaries of each naturally-occurring depressional wetland were established. Using these data, ECORP staff determined the ratio of each naturally-occurring depressional wetland to its corresponding watershed size.

This analysis suggests that the implementation of Project will not decrease the watershed ratios below the levels necessary to sustain the naturally-occurring depressional wetlands or the 13.449 acres of proposed vernal pool construction within the Wetland Preserve. Attachment B provides a summary of the Watershed Analysis.

The on-site Preserve was then assessed for appropriate vernal pool construction locations. A soils investigation was undertaken by Davis^2 Soil Scientists. Appropriate soils (restricting layer needed for wetland construction) were located within the Wetland Preserve, although due to past uses of the site, significant soil movement will need to occur in some locations to accommodate the wetland construction. Topography, a field assessment, historic wetland signatures (observable on historic aerials) and soils characteristics were then used to create the conceptual wetland construction plan. Emphasis was placed first on restoring wetlands that were eliminated or degraded by past land use practices. In some cases, portions of vernal pools were impacted and will be restored. The secondary focus was vernal pool creation in the most appropriate areas within the Preserve. Further analysis will be conducted once Resource Agency approval is obtained. At that time the Watershed Analysis will updated to further refine the construction of this habitat such that each wetland feature is supported by a watershed of adequate size.

The Wetland Preserve is being designed to maximize protection of existing and compensatory vernal pool habitat. Drainage will be designed so that summer nuisance flows are directed to low-flow channels to be constructed along the perimeter that will parallel a proposed trail system. The Wetland Preserve configuration was also designed to maintain existing hydrology to preserved and constructed vernal pool habitat. Areas adjacent to the Wetland Preserve generally flow away from the Wetland Preserve and as such, development of these areas will not compromise the hydrology of the protected resources.

5.4.2 Wetland Preserve – Morrison Creek Enhancement

Two opportunities for enhancing Morrison Creek were identified by ECORP's fluvial geomorphologist: correction of two head-cuts and redistribution of spoil piles left from when Morrison Creek was redirected into its current position (see Figure 8 – *Morrison Creek Enhancement Opportunities*).

5.4.2.1 Redistribution of Streambank Spoils

The goal of spoil redistribution is to eliminate channel entrenchment and provide floodplain access for Morrison Creek as it flows through the project site. Streambank spoils should be re-graded away from the stream in a direction perpendicular to stream flow. Ideally, the spoils will be re-graded so the material is "feathered" out to blend naturally with the existing topography. Spoils should be re-graded so they do not create any new impoundments, fill or dewater any existing wetland features, or create any levees or dikes. Care should be taken to provide Morrison Creek access to its floodplain at the flow associated with the 2-year recurrence interval (RI). This is most easily accomplished by re-grading streambank spoils so the entrenchment ratio (ER) for Morrison Creek is greater than 3.0. The ER is the ratio of the flood prone width (W_{fp}) divide by the bankfull width (W_{bkf}). In other words, the W_{fp} should be $\geq 3 \times W_{bkf}$. The W_{bkf} will be determined by a qualified fluvial geomorphologist based on channel geometry and watershed runoff relationships.

5.4.2.2 Halting Head-cut Advancement

There are two head-cuts on Morrison Creek migrating through the Wetland Preserve. These head-cuts will continue to erode in an upstream direction through the Wetland Preserve unless mitigation measures are implemented. If left unaddressed, the erosion will continue in a head-ward direction. This will increase channel incision and will further confine flows within the channel banks. Confined flows will continue to erode the channel bottom and reduced the width-to-depth (W/D) ratio. The W/D is defined as the W_{bkf} divided by the maximum depth at bankfull (D_{max}). As the W/D declines a stream becomes deeper compared to its width. This leads to more entrenchment and increases the ER. The end result is an erosive stream disconnected from its floodplain. Grade control structures need to be installed at each head-cut to arrest the erosive forces and stop the head-ward erosion.

Grade control structures can be derived from native material found on-site, or fabricated off-site and installed in place. Appropriate footers should be installed to protect against undermining. Actual dimensions of the grade control structure will depend upon the channel geometry at the bankfull elevation. Bankfull elevation and its associated channel geometry will be determined by a qualified fluvial geomorphologist.

5.4.3 Open Space Corridors

Approximately 187 acres of drainage corridors, constructed seasonal wetlands, and associated riparian and upland habitats will be established on-site within the Open Space Corridors. The drainage corridors will be a re-creation of drainages that were previously on the site prior to dredging activities. The corridors will range from 200 to 300 feet wide and will consist of a meandering low-flow channel, adjacent wetlands, riparian plantings and a bike trail. A total of 25.347 acres of wetlands will be constructed within the Open Space Corridors, including approximately eight acres of low-flow channel and 17 acres of seasonal wetlands (see Figure 7). Upon approval of this Mitigation Proposal by the Regulatory Agencies, a detailed channel/wetland design and planting plan will be completed. Figure 9. *Representative Drainage Corridor Segment*, represents a portion of a nearby project on Morrison Creek. The final design for the drainage corridors will be similar to what is shown in Figure 9, modified as needed to accommodate flow, water quality, and habitat requirements for the Rio del Oro project.

The drainage corridors will reestablish defined drainageways for the site which have not been present since the dredging operations completely altered the character and topography of the majority of the site. It is anticipated that riparian habitat to be established within the Open Space Corridors will offset California Department of Fish and Game mitigation requirements. Additionally, three detention basins (approximately 7, 6, and 26 acres in size) will be constructed within the Open Space Corridors as part of the Project for flood protection.

5.5 Habitats to be Constructed

On-site mitigation planned in the Wetland Preserve includes construction of 13.449 acres of vernal pools and 0.752 acre of associated seasonal wetland swale. On-site mitigation planned within the Open Space Corridors consists of 16.941 acres of seasonal wetland and 8.402 acres of low-flow channel (see Figure 5 and Attachment A).

5.5.1 Evaluation of Temporal Losses

The constructed wetland habitat within the Preserves should begin functioning hydrologically during the first rainy season after completion of the excavation and countouring of the constructed wetlands. Substantial vegetative cover within the wetland features is expected to be established within three years after construction. Vegetative cover is also expected to increase annually and reach the established performance standards within four to five years.

The Project has developed a phased impact/compensation plan that will offset temporal losses. The approximately 507-acre Wetland Preserve will be established concurrent with Phase One and all of the compensatory vernal pool habitat will be constructed within the first two phases of the Project (Figure 10. *Phased Wetland Construction*). Mitigation habitat within the Open Space Corridors will be constructed concurrent with build-out of those areas. This approach, providing excess mitigation in the early phases of the Project, is proposed to eliminate potential temporal losses of wetland functions and values.

Although Phase One impacts total only approximately 6.117 acres of wetlands, approximately 6.715 acres of vernal pools, 0.636 acres of seasonal wetland swales, 10.492 acres of seasonal wetland, and 4.234 acres of low-flow channel will be constructed within the Preserves during the implementation of Phase One. Additionally, approximately 38.956 acres of existing wetland habitat will be permanently preserved and managed (on-site and off-site) concurrent with Phase One impacts. Subsequent Project phases and associated mitigation acreages are presented in Table 2 – *Impact and Mitigation Phasing* below and on Figure 11. *Phased Impact*

Analysis. If phasing of the project changes, a description of the phase and mitigation for that phase will be submitted to the Corps and Service for approval prior to construction activities.

Table 2 – Impact and Mitigation Phasing

PHASE	IMPACTS	ON-SITE MITIGATION						OFF-SITE MITIGATION		TOTAL MITIGATION
		Preservation		Creation						
		Vernal Pool	Other	Vernal Pool	Seasonal Wetland Swale	Low-Flow Channel	Seasonal Wetland	Preservation (at Cook Property)	Creation (at Clay Station)	
PHASE 1	6.117	20.413	8.316	6.715	0.636	4.234	10.492	22.290	16.666	89.762
PHASE 2	4.046	0	0	6.734	0.116	0.246	0	0	0	7.096
PHASE 3	7.915	0	0	0	0	2.003	0.144	0	0	2.147
PHASE 4	1.559	0	0	0	0	0	0	0	0	0
PHASE 5	3.943	0	0	0	0	0.643	3.990	0	0	4.633
PHASE 6	4.540	0	0	0	0	0.011	0	0	0	0.011
PHASE 7	3.714	0	0	0	0	1.260	2.310	0	0	3.570
PHASE 8	9.016	0	0	0	0	0	0	0	0	0
Totals:	**40.848**	**20.413**	**8.316**	**13.44**	**0.752**	**8.397**	**16.936**	**22.290**	**16.666**	**107.219**

5.5.2 Long-Term Goals

The long-term goal of the on-site mitigation is to benefit Sacramento County by increasing the local abundance of endemic plant species associated with local wetland ecosystems, by contributing to the recovery and survival of vernal pool invertebrates, listed under the federal Endangered Species Act, and to insure that there is no net loss of wetland habitat resulting from the construction of the Rio del Oro project.

5.6 Success Criteria and Monitoring

The purpose of success monitoring is to determine if the overall goal of wetland construction is being accomplished and to develop and implement corrective measures, if necessary. The following outlines the proposed monitoring methodology, the criteria by which successful restoration will be judged, and the duration of the monitoring period.

5.6.1 CRAM Assessments

California Rapid Assessment Method (CRAM) assessments will be conducted on the wetlands within the on-site Wetland Preserve to track changes in wetland function and values, and to help identify the source of any adverse conditions within the Wetland Preserve. CRAM data were collected in the Wetland Preserve in early summer of 2008 to provide a baseline to which later data may be compared.

5.6.1.1 CRAM Background Data Collection

The Wetland Preserve was divided into 14 Assessment Areas (AAs) where the CRAM analysis was performed (Figure 12. *Rio Del Oro CRAM Assessment Areas*). Each AA is a wetland system, or portion of a wetland system, that was assessed. Following the guidelines in the *California Rapid Assessment Method for Wetlands*, Version 5.0.1 (Collins et al 2007) (CRAM User's Manual), the boundaries of the AA were delineated primarily based on watershed boundaries. The watershed boundary incorporates the topography, hydrology, and other features that control the sources, volumes, rates, or general composition of sediment or water supply that would influence the wetlands within each AA. The AA should remain constant over time to provide a repeatable CRAM survey in future years.

Of the 14 AAs that were established, ten were assessed using the CRAM Vernal Pool Systems Field Book (USEPA and SFEI 2008). The wetlands within these AAs were considered to be hydrologically interconnected and thus classified as a Vernal Pool System (as classified in Figure 3.2 of the CRAM User's Manual). Four AAs (AA-7, AA-12, AA-13, and AA-14) were comprised of a single large feature. The features within the AAs were originally classified variously as seasonal wetlands, pond, seasonal wetland swale, and vernal pool in the wetland delineation (ECORP 2004b), but were later reclassified as vernal pools during the CRAM assessment, based on floristic and hydrologic conditions. Since each of these AAs was comprised of a single vernal pool, they were assessed using the CRAM Depressional Field Book. Baseline CRAM results will be included in the first year monitoring report, as well as the CRAM results following wetland construction.

5.6.1.2 CRAM Post-Wetland Construction Monitoring

Within the first year following vernal pool construction, the 14 previously established AAs will be re-sampled utilizing the same CRAM methodology used to collect the background data. Additionally, more AAs encompassing the newly constructed wetlands will be established and sampled using same methodology three years after the constructed wetlands have been built, and again within one year after adjacent construction to the Wetland Preserve has been completed.

Some decrease in overall CRAM scores is anticipated, due to the impact that development adjacent to the Wetland Preserve will have on buffer scores. However, if overall CRAM scores drop by more than 20 points, a remediation and/or contingency plan will be developed describing how any underperforming features will be addressed (see Section 10 Potential Contingency Measures). This plan will call for additional CRAM assessments to be conducted following implementation of any remediation to determine if CRAM scores have improved.

5.6.2 Vernal Pools

Approximately 13.449 acres of vernal pools and 0.752 acres of seasonal wetland swales will be constructed within the Wetland Preserve. Additionally, 20.413 acres of existing (historic) vernal pools will be preserved within the Wetland Preserve. There will be three categories of on-site vernal pools that will be monitored within the Wetland Preserve. These categories are 1) the compensatory vernal pools constructed on-site ('constructed pools'), 2) the existing historic vernal pools found within the same watersheds as the compensation vernal pools ('nearest neighbor pools'), and 3) existing historic vernal pools not sharing a watershed with constructed pools or nearest neighbor pools ('reference pools'). Thirty (30) wetlands from each of these categories have been selected and will be monitored as outlined below unless otherwise noted. Please see Attachment C – *Rio Del Oro Monitored Vernal Pool Locations* for the locations and names, and category of each pool that will be monitored.

5.6.2.1 Success Criteria

In order to judge whether or not the goal of no net loss of function and values has been met for the constructed vernal pools, a set of success criteria have been developed. Additionally, to judge whether the constructed vernal pools have indirectly impacted the performance of the nearest neighbor pools (e.g., by altering the natural hydrology of the area), the same set of success criteria will be used to judge the performance of the nearest neighbor pools. These success criteria are based on performance of the reference pools. The reference pools will be monitored in the same manner as the constructed pools and the nearest neighbor pools. The data collected will be used to determine whether these pools are functioning within the same range as the preserved pools. Therefore, the preserved pools will establish on an annual basis the success criteria for the constructed pools and nearest neighbor pools, as outlined in Table 3 below.

Table 3 – Success Criteria: Vernal Pools

Hydrology:

1) Depth and duration of ponded water in constructed pools and nearest neighbor pools should be within the range of depth and duration exhibited by the reference pools.

Vegetation:

1) Absolute and relative cover of each vernal pool endemic*in constructed pools and nearest neighbor pools should be within the range of values for absolute cover and relative cover of vernal pool endemic species exhibited by the reference pools.
2) The number of vernal pool endemics in constructed pools and nearest neighbor pools should be within the range of the number of vernal pool endemics exhibited by the reference pools.
3) The number and cover of non-native species in constructed pools and nearest neighbor pools should be within the range of the number and cover of non-native species exhibited by the reference pools.

* Vernal pool endemic species will be 'vernal pool indicators' and 'vernal pool associates' as defined in the CDFG's list: *Catalog of Plant Species Known to be Associated with Vernal Pools* (CDFG 1998) or other species that are not listed, but are recognized by vernal pool biologists to be associated with vernal pools.

At the end of the ten-year monitoring period the constructed pools and nearest-neighbor pools must meet the success criteria with three years of no human intervention for mitigation to be considered successful.

5.6.2.2 Target Jurisdictional Acreage to be Constructed

Following the first rainy season after vernal pool construction, the inundated or saturated acreage of the constructed vernal pools will be mapped post-construction using field assessed topography, limits of ponding, and hydrophytic vegetation. Mapping will initially be digitized off an aerial photo, then ground-truthed to include any constructed habitat. Any changes will be made to the digitized map using a sub-meter accurate GPS unit. These data will be used to calculate the total inundated vernal pool acreage. This data will be included in the annual monitoring reports and will verify that the mitigation acreages required are saturated or inundated as intended.

5.6.2.3 Monitoring Schedule

The constructed pools, nearest neighbor pools, and the reference pools will be monitored for seven years over a ten-year period. The monitoring period will begin with the first rainy season following vernal pool construction activities. See Attachment D – *Rio Del Oro Vernal Pool Monitoring Schedule – Years 1-10* for an outline of the monitoring schedule by monitoring year. Monitoring will be extended beyond the ten-year period only for those vernal pools that are not meeting the established success criteria.

5.6.2.4 Vernal Pool Branchiopods

Over the ten-year monitoring period, the constructed pools will be monitored in Years 1, 2, 3, 5, 7, and 10. In addition, all 30 nearest neighbor pools and all 30 reference pools will be sampled these years for vernal pool branchiopods. Annual vernal pool branchiopod surveys will include two sampling visits, conducted once during the early rainy season and once during the later part of the rainy season. Surveys will be conducted in compliance with Service guidelines regarding sampling for potentially occurring threatened or endangered branchiopods (e.g., fairy shrimp and tadpole shrimp), although the two-week sampling protocol will not be followed. The vernal pools will be sampled by pulling a "D-frame" aquatic dip-net (20 x 24 mesh/inch) through them. Three dip-net passes, each approximately 3 meters in length, will be made through each sampled pool. Sampled areas will include the deepest portion of the pool, the pool edge, and an area located between the pool center and pool edge. During each pass, the face of the dip-net will be undulated up and down, intermittently touching the pool bottom, in order to sample various strata within the water column of the wetland. Special-status vernal pool branchiopods will be identified to species level (when possible) in the field and released unharmed. Adult specimens may periodically be retained as voucher specimens.

5.6.2.5 Hydrology

The purpose of hydrologic monitoring is to determine if the constructed vernal pools and nearest neighbor pools are inundated for periods sufficient to support appropriate wetland biota and are functioning within the range exhibited by the reference pools.

In Years 1 and 2 following wetland construction, all (100%) of the constructed pools will be qualitatively monitored for hydrology to identify features not functioning as intended (i.e., not ponding water, not fully ponding water, or inappropriate ponding duration). In these two years, a combination of aerial photos and appropriately timed site visits will be used. Aerial photographs will be taken twice annually, once during the peak period of inundation, typically during January or February, and once when the vernal pool plants are flowering, typically April or May. In addition to the aerial photographs, biologists will make a minimum of one site visit during peak inundation to field check the hydrology of the vernal pools. The 30 nearest neighbor pools and the 30 reference pools will also be monitored in the same manner to observe if poor pool function is a result of natural causes (e.g., abnormal rainfall). In Year 3, general hydrology monitoring will continue only for constructed pools not exhibiting appropriate hydrology in Years 1 and 2. Following floristic monitoring in Year 3, remediation will be investigated for any pools that have continued to underperform, and a remediation and/or contingency plan will be developed describing how any underperforming features will be addressed (see Section 10 Potential Contingency Measures).

In Years 5, 7, and 10, the selected 30 constructed pools, 30 nearest neighbor pools, and 30 reference pools will be monitored for depth and ponding duration (see Attachment D). Staff gauges will be installed in each of these 90 features and will be checked twice a month during the rainy season of each monitoring year, starting when the wetlands become inundated (contain greater than 3 cm of ponded water) and continuing until all monitored pools contain less than 3 cm of ponded water. Staff gauges will be installed in the deepest part of each monitored vernal pool and depth and percent inundation will be recorded during each site visit. Percent inundation is defined as the percent of aerial coverage of inundation (including open water and areas of emergent vegetation where standing water is still present) relative to the intended size of each monitored wetland. The exact placement of the gauges cannot be anticipated prior to construction, but the first monitoring report will include a map indicating actual locations. If found to be economically feasible, digital data loggers can be used in lieu of the bi-monthly field visits, and will be attached to staff gauges. The data collected from the reference pools will be used to establish the hydrology success criteria on an annual basis for the nearest neighbor and constructed pools.

5.6.2.6 Floristics

The purpose of floristic monitoring is to determine if the constructed vernal pools and nearest neighbor pools are supporting appropriate vernal pool biota and are functioning within the range exhibited by the reference pools.

In Years 1 and 2 following wetland construction, all (100%) of the constructed pools will be qualitatively assessed for vernal pool floristics to identify features not functioning as intended (e.g., dominated by upland or marsh plant species). In these two years, biologists will conduct an appropriately timed site visit when the vernal pool plants are flowering, typically April or May. During this site visit, a qualitative assessment will be made regarding the general habitat function of all constructed vernal pools, noting any features that appear to be underperforming. The 30 nearest neighbor pools and the 30 reference pools will also be monitored in the same manner to observe if poor constructed pool function is a result of natural causes (e.g., abnormal rainfall). In Year 3, qualitative floristic monitoring will continue only for constructed pools not exhibiting appropriate floristics in Years 1 and 2. After qualitative floristic data has been collected in Year 3, remediation will be investigated for any pools that have continued to underperform over the three-year period, and a remediation and/or contingency plan will be developed describing how underperforming features will be addressed (see Section 10 Potential Contingency Measures).

In Years 4, 5, and 10, quantitative floristic surveys of all 30 selected constructed pools, all 30 selected nearest neighbor pools, and all 30 selected reference pools will be conducted. In Year 8, quantitative floristic surveys of any of the 30 constructed pools that did not meet all hydrology and floristic success criteria in Year 5 will be conducted, along with all 30 nearest neighbor pools and all 30 reference pools (to provided comparison data). In Year 9, quantitative floristic surveys of any of the 30 constructed pools that did not meet all hydrology and floristic success criteria in Year 8 will be conducted, along with all 30 nearest neighbor pools and all 30 reference pools (to provided comparison data). If all 30 selected constructed pools meet all success criteria in Year 5, then no further monitoring is required until Year 10. Data for the 30 selected reference pools will only be collected if needed to establish the success criteria for the constructed vernal pools. See Attachment D for the vernal pool monitoring schedule.

Quantitative floristic surveys will be conducted in the spring during peak flowering periods. Timing of floristic surveys will be adjusted according to site specific conditions (typically in April or May). Data collected from each monitored vernal pool will include an estimate of absolute vegetative cover (based upon aerial coverage of the total vegetative aggregate, excluding non-vegetative cover such as bare ground, rocks, and algal matting), a cumulative species list, and the absolute cover of each wetland species present within a wetland (estimated to the nearest percentage). An example of the floristic monitoring data sheet to be used is found in Attachment E.

Data from each monitored vernal pool will be entered into a database, and the following will be calculated: the number of vernal pool endemics (defined as 'vernal pool indicator' and 'vernal pool associate' (VPI/VPA) species), the absolute cover of VPI/VPA species, the relative cover of VPI/VPA species, the number of non-native species, and the absolute cover attributable to non-native species. These will be calculated as defined below.

Calculations

Number of Vernal Pool Indicator and Vernal Pool Associate Species

The California Department of Fish and Game's *California Vernal Pool Assessment Preliminary Report* (1998) is a list of plant species documented to occur within vernal pools. This list assigns each species to one of five categories:

1. Vernal pool indicators (**VPI**): species that are restricted to vernal pools and are not known from other habitats;
2. Vernal pool associates (**VPA**): species that regularly occur in vernal pools but are not restricted to them, also occurring in similar wetland habitats;
3. Generalist (**GEN**): species that are distributed in a number of habitats, both wetland and upland, which can include disturbed places, vernal pools, and pool margins;
4. **VPI?**: species that is a VPI in certain region(s) only, and can be a VPA or GEN in other regions;
5. **VPA?**: species that is a VPA in certain region(s) only, and is a GEN in other regions;
6. **VPI/VPA**: species that is a VPI in some regions and a VPA in other regions, yet not known to be a GEN, in any region.

Those species encountered in the vernal pools monitored within the Wetland Preserve that fall in the latter three categories will evaluated for the Sacramento region by staff biologists and assigned as a VPI, a VPA, or a GEN.
The number of VPI/VPA species for each vernal pool will be calculated by totaling the number of VPI/VPA species found in an individual vernal pool.

Total Aerial Cover of Vernal Pool Vegetation

Total aerial cover of vernal pool vegetation is defined as the percent of aerial coverage of plant coverage relative to the total as-built size of each monitored wetland. This total cannot exceed 100%.

Absolute Cover of Vernal Pool Indicator and Vernal Pool Associate Species

The absolute cover of each plant species present within a vernal pool will be estimated in the field to the nearest percentage and recorded during floristic monitoring. The absolute cover of all VPI/VPA species will then be generated by totaling the estimated absolute cover of each VPI/VPA species found within an individual vernal pool. This total can exceed 100%.

Relative Cover of Vernal Pool Indicators and Vernal Pool Associate Species

The relative cover of VPI/VPA species will be calculated by totaling the estimated absolute percent cover of all VPI/VPA species found within an individual vernal pool, and dividing it by the total absolute cover of all plant species found within the same individual vernal pool. This total cannot exceed 100%.

Number of Native Species
The number of native species for each vernal pool will be calculated by totaling the number of native plant species found in an individual vernal pool.

Absolute Cover of Non-Native Species
The absolute cover of each plant species present within a wetland will be estimated in the field to the nearest percentage and recorded during floristic monitoring. The absolute cover of all non-native species will then be generated by totaling the estimated absolute cover of each non-native species found within an individual vernal pool. This total can exceed 100%.

5.6.2.7 Wildlife

Wildlife surveys will occur in conjunction with hydrologic and floristic monitoring visits. A biologist will walk meandering transects through the Wetland Preserve and generate a cumulative list of all species observed utilizing the Wetland Preserve. Wildlife signs, such as scat, pellets, or bones, will also be noted.

5.6.2.8 Photo Documentation

As described under hydrology, aerial photos of the site will be taken twice annually as outlined in Attachment D. In addition, a minimum of five permanent photo points will be established within the Wetland Preserve. The photos are intended to provide a photographic history of the constructed vernal pools. Additional photo points may be established, if desired.

5.6.2.9 General Wetland Preserve Monitoring

In conjunction with the other success monitoring activities, inspections will be performed by qualified biologists who will address potential maintenance issues such as thatch accumulation or newly introduced non-native species. Results from these inspections will be included in the annual success monitoring reports. Please refer to the *Operations and Management Plan for the Rio Del Oro Wetland Preserve* for more information on these items.

Once success monitoring of the Wetland Preserve has been completed, long-term monitoring will commence and will be conducted as outlined in the *Operations and Management Plan for the Rio Del Oro Wetland Preserve*.

5.6.3 Seasonal Wetlands and Low-Flow Channel

A minimum of 16.941 acres of seasonal wetland and 8.402 acres of low-flow channel will be constructed within the Open Space Corridors (see Figure 5 and Attachment C). As the wetland and low-flow channel designs are still conceptual, the exact location and number of constructed seasonal wetlands is currently unknown. Once final construction plans have been developed and approved by the Regulatory Agencies, then a subset containing half (50%) of the constructed seasonal wetlands will be randomly selected and monitored as outlined below.

5.6.3.1 Success Criteria

In order to judge whether or not the goal of no net loss of function and values has been met for the constructed low-flow channel and seasonal wetlands, a set of success criteria have been developed. Table 4 outlines the success criteria for the constructed seasonal wetlands.

Table 4 – Success Criteria: Seasonal Wetlands

Performance Standard:

1) Wetlands will be inundated or saturated for sufficient periods to support a predominance of wetland plant species (those listed as FAC, FACW, or OBL in *The National List of Plant Species that Occur in Wetlands: California (Region 0)* (Reed 1988[3]).

Success Criteria:

1) 95% of the wetland acreage must be inundated or saturated for period of sufficient duration to support wetland vascular plants as the most prevalent and dominant component;
2) Prevalence Index will be less than 3.0;
3) The following annual minimum vegetative cover values will be met:

Year 1:	Minimum 10% relative cover
Year 2:	Minimum 30% relative cover
Year 3:	Minimum 50% relative cover
Year 4:	Minimum 60% relative cover
Year 5:	Greater than or equal to 70% relative cover

Table 5 below outlines the success criteria for the low-flow channel.

Table 5 – Success Criteria: Low-Flow Channel

Hydrology:

1) Flows will be appropriate to support the establishment and dominance of hydrophytic vegetation across the low-flow channel.

Vegetation:

1) Each low-flow channel transect will have 90% cover of hydrophytic vegetation or open water in late winter / early spring; and
2) Each low-flow channel transect will have a Prevalence Index of less than 3.0.

5.6.3.2 Target Jurisdictional Acreage to be Constructed

Following the first rainy season after the start of monitoring, the extent of inundated seasonal wetland and low-flow channel areas will be mapped using post-construction using field assessed topography, limits of ponding, and hydrophytic vegetation. Mapping will initially be digitized off an aerial photo, then ground-truthed to include all constructed acreage. Any changes will be made to the digitized map using a sub-meter accurate GPS unit. These data will be used to

[3] Categories found in the *National List of Plant Species That Occur in Wetlands: California (Region 0)* (Reed 1988):

Obligate Wetland (OBL)	=	occur almost always in wetlands (>99% probability).
Facultative Wetland (FACW)	=	usually occur in wetlands (67%-99% probability).
Facultative (FAC)	=	equally likely to occur in wetlands and non-wetlands (34%-66% probability).
Facultative Upland (FACU)	=	usually occur in non-wetlands (67%-99% probability).
Obligate Upland (UP	=	occur almost always in non-wetlands (>99% probability).

calculate the total wetland acreage ponding. This data will be included in the annual monitoring reports and will verify that the required mitigation is inundated as intended.

5.6.3.3 Monitoring Schedule

Per the design for the proposed seasonal wetlands and low-flow channel, the majority of the water received by these constructed features is expected be urban runoff resulting from the construction of the Project adjacent to the Open Space Corridors. The Project will be constructed in 8 phases, with phases 2, 3, 4, 5, and 6 occurring adjacent to the Open Space Corridors (see Figure 11). As such, although the seasonal wetlands and low-flow channel will be constructed during the early phases of the Project, these constructed features are not expected to reach their full habitat function until build out of adjacent and upstream construction has been completed. Therefore, the monitoring period for the constructed seasonal wetlands and low-flow channel will also have a phased approach to mirror the build-out along the Open Space Corridor.

Monitoring will begin with the first rainy season following the completion of adjacent and up-stream construction activities. The wetlands will be monitored over a period of five years or until success criteria have been met. At the end of the monitoring period, the constructed seasonal wetlands and low-flow channel must meet the success criteria in Tables 4 and 5. Once the established criteria have been met, no further monitoring of the mitigation wetlands will be required.

5.6.3.4 Hydrology

The purpose of hydrologic monitoring is to determine if the constructed seasonal wetlands and low-flow channel are inundated for periods sufficient to support appropriate wetland biota. Aerial photographs will be taken twice annually each monitoring year, once during the peak period of inundation, typically during January or February and once again in March or April. Aerial photographs can help identify areas that warrant additional attention during subsequent field visits. In particular, aerial photographs will be used to help identify: 1) areas that do not pond water, 2) areas that are ponding late in the season, and 3) off-site activities that may be affecting hydrologic function within the mitigation area.

The aerial photographs will be used to estimate the extent of inundation of the constructed seasonal wetlands. The aerial photos will be visually examined and the hydrology of the constructed seasonal wetlands will be scored according to their percentage of inundation outlined in Table 6 below. Percent inundation means the percent of aerial coverage of inundation (including open water and areas of emergent vegetation where standing water is still present) relative to the total as-built size of each monitored wetland. Hydrology may also be assessed by direct observation during appropriately timed site visits.

Table 6 – Hydrologic Monitoring Inundation Scoring System

Score	Percent Inundation
0	0% (dry)
1	1-49%
2	50-79%
3	80-99%
4	100%

5.6.3.5 Water Quality

The purpose of the water quality monitoring is to determine the presence/absence of various pollutants in runoff from the development, and to determine if additional Best Management Practices (BMPs) may need to be implemented. Post construction water quality monitoring will be conducted twice annually (once each during the early and late wet season) following build-out of adjacent development for each phase at the Project. Water quality sampling will occur within the constructed seasonal wetlands along the low-flow channel. The exact number of samples will be determined by the amount constructed wetlands and may average two or more sampling locations per phase, depending on the size of proximity of development to the wetlands. Approximately ten sampling locations are proposed at complete build-out. Samples will be collected by qualified personnel, and will be analyzed at a certified laboratory or by using properly calibrated field instruments. Proposed water quality monitoring parameters include: pH, temperature, dissolved oxygen, total suspended solids, total nitrogen, nitrate, total phosphorus, and oil and grease. One background sample from an isolated existing wetland will be used for reference during each sampling event. The exact sampling locations and events will be determined as the project progresses.

5.6.3.6 Floristics

In order to accurately evaluate the performance of the low-flow channel as well as the seasonal wetlands, two methods of monitoring will be used. Floristic data for the constructed low-flow channel will be collected using the point-intercept method (Federal Interagency Committee for Wetland Delineation 1987) and as described below. Floristic data for the selected 50% of the constructed seasonal wetlands will be collected using a species list/percent cover method as described below. This monitoring will occur each year over the five-year monitoring period. Timing of floristic surveys will be adjusted according to site specific conditions to capture the highest number of flowering plant species.

Five transects run perpendicular to the low-flow channel will be been randomly selected within each mile of length of constructed low-flow channel. Final locations and length of transects will be developed once the final design of the Open Space Corridors has been approved. For each transect, plant species data will be collected by the point-intercept sampling method at regular intervals of each transect. All plant species (or bare ground or open water where no plants are present) at each regular interval will be recorded. These data will be used to calculate

Prevalence Index (PI) and percent cover (as defined below) for each of the monitored transects.

For the constructed seasonal wetlands, a species list/percent cover method of monitoring will be used. In the field, biologists will record floristic data for each monitored wetland including an estimate of percent absolute vegetative cover, a detailed species list, and an estimate of the absolute cover of each species. The estimate of absolute cover will be based upon the modified Braun-Blanquet scale as show in Table 7 below. The estimate of total vegetative cover will be based upon aerial coverage of the total vegetative aggregate, excluding non-vegetative cover such as bare ground, rocks, and algal matting.

Table 7 – Braun-Blanquet Cover Estimate Scale

Scale	Percent Cover
0	< 1%
1	1-5%
2	6-25%
3	26-50%
4	51-75%
5	76-100%

Data from each monitored wetland will be entered into a database and cumulative vascular plant species list will be generated for each monitored seasonal wetland. For each constructed seasonal wetland sampled, the Prevalence Index (PI), the relative cover of wetland species, species richness, wetland species richness, native species richness will be calculated. In addition to the calculations performed for each individual feature, an overall plant species list and a vascular plant species frequency of occurrence list will be generated. These calculations are explained below.

Calculations For Low-Flow Channel Monitoring

Percent Cover

Total percent vegetative cover for each low-flow channel transect will be calculated as follows:

$$\text{Percent Vegetative Cover} = \frac{F1}{F1 + F2 + F3} \times 100$$

Where: F1 = frequency of occurrence of all plant species,
F2 = frequency of occurrence bare ground, and
F3 = frequency of occurrence of open water.

Frequency of occurrence for the above calculation is defined as the number of times a plant species, bare ground, or open water occurs along the transect.

The percent cover of hydrophytic vegetation or open water for each low-flow channel transect will be calculated as follows:

$$\text{Percent Cover of Hydro Vegetation and Open Water} = \frac{F1 + F2 + F3 + F6}{F5 + F4 + F6} \times 100$$

Where: F1 = frequency of occurrence for OBL species,
F2 = frequency of occurrence for FACW species,
F3 = frequency of occurrence for FAC species,
F4 = frequency of occurrence of all plant species,
F5 = frequency of occurrence bare ground, and
F6 = frequency of occurrence of open water.

Frequency of occurrence for the above calculation is defined as the number of times the defined item (e.g., OBL species, bare ground, open water) occurs along the transect.

Prevalence Index

The Prevalence Index (PI) is a standard method of determining whether a floristic data set should be categorized as a wetland or upland plant community. This is accomplished by weighting each plant species category (i.e., OBL, FACW, FAC, FACU, and UPL) (Reed 1988) and then determining which is the dominant category in that particular sample. The PI, as described in the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (Federal Interagency Committee for Wetland Delineation 1987), is calculated using the point-intercept sampling method. For the point-intercept data, the PI will be calculated as follows:

$$PI = \frac{(1.0*F1) + (2.0*F2) + (3.0*F3) + (4.0*F4) + (5.0*F5)}{\Sigma\,(F1 + F2 + F3 + F4 + F5)}$$

Where: F1 = frequency of occurrence for OBL species,
F2 = frequency of occurrence for FACW species,
F3 = frequency of occurrence for FAC species,
F4 = frequency of occurrence for FACU, and
F5 = frequency of occurrence for UPL and other species not meeting above categories.

Frequency of occurrence is defined as the number of times a particular species occurs along the transect.

The index ranges from 1.0 to 5.0, where "all areas having a mean prevalence index of less than 3.0 meet the hydrophytic vegetation criterion" (Federal Interagency Committee for Wetland Delineation, 1987).

Calculations For Seasonal Wetland Monitoring

Relative Cover of Wetland Species

Relative cover of wetland species reflects the percentage of the total vegetative cover that is made up of wetland plant species within an individual wetland. Wetland species include those categorized as obligate (OBL), facultative wetland (FACW), or facultative (FAC) (Reed 1988). For the constructed seasonal wetlands, the relative cover of wetland species will be calculated using the cover class data recorded for each wetland sampled. Since the percent cover of each species was recorded according to the Braun-Blanquet cover scale, the cover of each species is estimated to be equivalent to the mid-point of its cover class value. The Braun-Blanquet cover scale has six possible cover classes and each has been assigned a mid-point value as shown in Table 8.

Table 8 – Braun-Blanquet Cover Class Mid-Point Values

Cover Class	Mid-Point Value
0	0.1
1	2.5
2	15.0
3	37.5
4	62.5
5	87.5

In order to calculate the amount of the overall vegetative cover attributable to wetland species for the constructed seasonal wetlands, the mid-point cover class value for all wetland species will be summed and then divided by the sum of all of the mid-point cover class values for all the species found in each wetland.

$$\text{Relative Cover of Wetland Species} = \frac{(F1 + F2 + F3)}{\sum (F1 + F2 + F3 + F4 + F5)}$$

where:
F1 = Σ cover class mid-point values for OBL species,
F2 = Σ cover class mid-point values for FACW species,
F3 = Σ cover class mid-point values for FAC species,
F4 = Σ cover class mid-point values for FACU, and
F5 = Σ cover class mid-point values for UPL or other species.

The final value is then expressed as a percentage.

Species Richness

Species richness is defined as the total number of plant species recorded within an individual wetland.

Wetland Species Richness

Wetland species richness is defined as the total number of wetland plant species recorded within an individual wetland. Wetland plants include those that are categorized as obligate (OBL), facultative wetland (FACW), or facultative (FAC) (Reed 1988).

Native Species Richness

Native species richness is defined as the number of native plant species found in an individual wetland.

Species Frequency of Occurrence

Frequency of occurrence is defined as the number of pools in which a species is observed within a given preserve, divided by the number of pools sampled. For example, if 100 pools were surveyed and Species A was recorded in 37 of them, the frequency of occurrence of Species A would be 0.37.

Prevalence Index

The Prevalence Index (PI) is a standard method of determining whether a floristic data set should be categorized as a wetland or upland plant community. This is accomplished by weighting each plant species category (i.e., OBL, FACW, FAC, FACU, and UPL) (Reed 1998) and then determining which is the dominant category in that particular sample. The PI, as described in the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (Federal Interagency Committee for Wetland Delineation 1987), is calculated using the point-intercept sampling method. For the species list/percent cover method of monitoring, the data collection method will not be the point-intercept method. Therefore, the PI calculation has been modified in order to accommodate the format of the raw data. Since the percent cover of each species will be recorded according to the Braun-Blanquet cover scale, the cover of each species will be estimated to be equivalent to the mid-point of its cover class value. The Braun-Blanquet cover scale has six possible cover classes and each has been assigned a mid-point value as shown in Table 8.

The "frequency of occurrence" variable in the original calculation will be replaced with the "sum of the cover class mid-point values." Thus, the calculation of this modified PI is as follows:

$$PI = \frac{(1.0*F1) + (2.0*F2) + (3.0*F3) + (4.0*F4) + (5.0*F5)}{\sum (F1 + F2 + F3 + F4 + F5)}$$

Where: F1 = $\sum$ cover class mid-point values for OBL species,
F2 = $\sum$ cover class mid-point values for FACW species,
F3 = $\sum$ cover class mid-point values for FAC species,
F4 = $\sum$ cover class mid-point values for FACU, and
F5 = $\sum$ cover class mid-point values for UPL and other species not meeting above categories.

The index ranges from 1.0 to 5.0, where "all areas having a mean prevalence index of less than 3.0 meet the hydrophytic vegetation criterion" (Federal Interagency Committee for Wetland Delineation, 1987).

5.6.3.7 Wildlife

Wildlife surveys will occur in conjunction with hydrologic and floristic monitoring visits. A biologist will walk a meandering transect through the Open Space Corridors and generate a cumulative list of the type and number of all species observed utilizing the Open Space Corridors. Wildlife signs, such as scat, pellets, or bones, will also be noted.

5.6.3.8 Photo Documentation

As described under hydrology, aerial photos of the site will be taken twice annually in each monitoring year. In addition, a minimum of five permanent photo points will be established within the Open Space Corridors. The photos are intended to provide a photographic history of the constructed wetlands. Additional photo points may be established, if desired.

5.6.4 Morrison Creek Enhancement

The corrected head-cuts will be monitored monthly during the rainy season for the first year following enhancement. If the actions taken to correct the head-cuts are found to be effective at the end of the first rainy season, no further monitoring will be required. If further monitoring is needed, it will be outlined and proposed in the first year monitoring report. The re-graded spoil piles will be monitored for erosion issues/revegetation in first year following re-grading. After the disturbed areas have been re-vegetated no further monitoring will be required.

5.6.5 General Open Space Corridor Monitoring

In conjunction with the other success monitoring activities, inspections will be performed by qualified biologists who will address potential maintenance issues such as thatch accumulation and newly introduced non-native species. Results from these inspections will be included in the annual success monitoring reports. Please refer to the *Operations and Management Plan for the Rio Del Oro Open Space Preserve*, to be submitted under separate cover, for more information on these items.

Once success monitoring of the Open Space Corridors has been completed, long-term monitoring will commence and will be conducted as outlined in the *Operations and Management Plan for the Rio Del Oro Open Space Preserve*.

6.0 OFF-SITE MITIGATION

The proposed off-site mitigation will occur at two sites within Sacramento County, the Cook Property and the Clay Station Mitigation Bank.

6.1 Basis for Off-Site Mitigation

The mitigation proposed to occur within the off-site Cook Property and Clay Station Mitigation Bank are intended to fulfill the remaining preservation and creation requirements required for impacts to waters of the U.S. and as required by the Service for impacts to listed branchiopod habitat not met by the on-site mitigation.

6.2 Characteristics of Proposed Mitigation Sites

The following sections outline the various characteristics of the two different off-site areas where mitigation for the Project will take place. The off-site mitigation will provide preservation and compensatory habitat for listed vernal pool branchiopods within their core-recovery area.

6.2.1 Location and Size of Mitigation Areas

6.2.1.1 Cook Property

The approximately 160-acre Cook Property is located south of Highway 16 in Sacramento County, California (Figure 13. *Cook Property Project Site and Vicinity).* The Cook Property is bordered to the north and west by existing conservation properties, to the east by Eagles Nest Road, and to the South by Florin Road. The Cook Property is within the same core-recovery as the Project and has been identified by the Service as a important component in establishing a large-contiguous preserve area in the region (Figure 14. *Cook Property Location*). In addition to wetland preservation, the Cook Property has the option of gaining additional income from grazing, as well as the continued use of crop production within the two irrigated pastures.

6.2.1.2 Clay Station Mitigation Bank

The Clay Station Mitigation Bank is located on Clay Station Road in southern Sacramento County, approximately 15 miles south of the Rio del Oro project (Figure 15. *Clay Station Mitigation Bank Project Site and Vicinity*). The Clay Station Mitigation Bank site is bounded by Clay Station Road to the east, Laguna Creek and associated riparian habitat to the west, farmland to the north, and Brown's Creek to the south and is adjacent to other large preserves, such as Gill Ranch to the east.

6.2.2 Ownership Status

6.2.2.1 Cook Property

Elliott Homes, Inc. is the present owner of the Cook Property; however, once the site has been established as a preserve, the Sacramento Valley Open Space Conservancy, the Wildlife Heritage Foundation, or another conservation-oriented third party entity will become the owner.

6.2.2.2 Clay Station Mitigation Bank

Elliott Homes, Inc. is the present owner and expected long-term owner of the Clay Station Mitigation Bank. The Elliott Conservancy is the conservation-oriented third party entity responsible for long-term management of the Clay Station Mitigation Bank.

6.2.3 Waters of the U.S.

6.2.3.1 Cook Property

A preliminary wetland assessment conducted by ECORP identified approximately 2.67 acres of vernal pools, 9.90 acres of seasonal marshes, 2.63 acres of seasonal wetland swales on the property, as well as other waters including an approximately 6.51-acre pond and 0.58 acres of an intermittent drainage (Frye Creek) (Figure 16. *Cook Property Preliminary Wetland Assessment*). The remainder of the property includes associated uplands and approximately 21 acres of irrigated pasture.

6.2.3.2 Clay Station Mitigation Bank

Clay Station Mitigation Bank includes a total of approximately 101.453 acres of waters of the U.S. This waters acreage is composed of both preserved and constructed wetland habitat, of which only the constructed habitat is available for sale through the bank. Preserve on-site waters of the U.S. include 2.22 acres of seasonal wetlands, 2.56 acres of seasonal marsh, 0.27 acres of Browns Creek, and 3.74 acres of Laguna Creek. Waters of the U.S. constructed within Phase I of the Clay Station Mitigation Bank include 23.420 acres of vernal pools and 14.050 acres of seasonal wetlands (ECORP 1999). Waters of the U.S. constructed within Phases II and III of the Clay Station Mitigation Bank include 37.962 acres of vernal pools and 17.231 acres of seasonal wetlands (ECORP 2008).

6.2.4 Wildlife Habitat and Use

6.2.4.1 Cook Property

The likelihood of the presence of federally-listed branchiopods, as well as the property's proximity to other regional conservation areas, makes the Cook Property an ideal location to mitigate impacts to biological resources resulting from the Project. While protocol-level vernal pool branchiopod surveys have not been conducted on the Cook Property to date, it is likely that vernal pools on the property support vernal pool branchiopods. The site is situated in an area of Sacramento County that is known to support several vernal pool branchiopod species, including those that are federally-listed as threatened or endangered. Surveys conducted by ECORP and other investigators in the immediate vicinity of the Cook Property have identified vernal pool fairy shrimp (federal listed threatened), mid-valley fairy shrimp, vernal pool tadpole shrimp (federal listed endangered), and California linderiella. According to the California Natural Diversity Database vernal pool fairy shrimp and vernal pool tadpole shrimp have been documented 800 feet to the west of the property (Figure 17. *CNDDB Occurrences of Federally-listed Branchiopod Species*).

6.2.4.2 Clay Station Mitigation Bank

Wildlife species which have been observed within the annual grassland habitat at the Clay Station Mitigation Bank include western meadowlark (*Sturnella neglecta*), horned lark (*Eremophila alpestris*), western kingbird (*Tyrannus verticalis*), black-tailed jackrabbit (*Lepus californicus*), western yellow-bellied racer (*Coluber constrictor*), gopher snake (*Pituophis catenifer*), and western fence lizard (*Sceloporus occidentalis*). The annual grassland also provides foraging habitat for raptors including northern harrier (*Circus cyaneus*), red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), and American kestrel (*Falco sparverius*).

Laguna Creek and its associated riparian corridor provides habitat for many wildlife species in various stages of their life history. Birds which have been observed within trees or shrubs in the riparian zone include downy woodpecker (*Picoides pubescens*), tree swallow (*Tachycineta bicolor*), and bushtit (*Psaltriparus minimus*). Mammals which utilize the creek/riparian corridor for cover and migration routes include mule deer (*Odocoileus hemionus*), raccoon (*Procyon lotor*), and striped skunk (*Mephitus mephitus*). Fish which have been observed within the creek channel include brown bullhead (*Ictalarus nebulosus*), largemouth bass (*Micropterus salmoides*), and bluegill (*Lepomis macrochirus*).

Since the construction of the compensation wetlands at the site, the diversity of wildlife species has increased. Vernal pools and marshes on-site provide seasonal aquatic habitats for the following animals: wintering waterfowl, including green-winged teal (*Anas crecca*), mallard (*Anas platyrhynchos*), northern pintail (*Anas acuta*), American wigeon (*Anas americana*); migrant shorebirds, including greater yellowlegs (*Tringa melanoleuca*), western sandpiper (*Calidris mauri*), and least sandpiper (*Calidris minutilla*); nesting birds, including American avocet (*Recurvirostra americana*); black-necked stilt (*Himantopus mexicanus*); and amphibians and reptiles including pacific chorus frog, bullfrog, valley garter snake (*Thamnophis sirtalis fitchi*), and mountain garter snake (*Thamnophis elegans elegans*).

6.2.5 Historical, Present, and Proposed Uses of Mitigation Areas

6.2.5.1 Cook Property

Homesteads are currently present in the north-eastern portion of the Cook Property. Additionally, two irrigated pastures totaling 21.27 acres are being used on the site. The uplands and irrigated pastures are being grazed by cattle. A preliminary wetland assessment conducted by ECORP revealed that the following wetland types are present at the Cook Property; approximately 2.67 acres of vernal pools, 9.90 acres of seasonal marshes, 2.63 acres of seasonal wetland swales, as well as other waters including a 6.51 acre pond and a 0.58 acre intermittent drainage (Frye Creek). In addition to wetland preservation, the Cook Property has the option of gaining additional income from grazing, as well as the continued use of crop production within the two irrigated pastures.

The Cook Property is being proposed as an open space preserve, and will be maintained and managed as such. Deed restrictions or a conservation easement will be recorded and will require that the site be maintained as wetland and wildlife habitat in perpetuity. If required, a detailed operations and management plan will be developed for the Cook Property and funded by an endowment. Copies of proposed language will be submitted to the Regulatory Agencies for approval prior to recordation and copies of the recorded documents will be provided to the Regulatory Agencies no later than 30 days subsequent to recordation. In addition, recordation will occur prior to or concurrent with the start of Project construction.

6.2.5.2 Clay Station Mitigation Bank

The Clay Station Mitigation Bank was established in 1994 and included the construction of vernal pool, seasonal marsh, and seasonal wetland habitat in two Phases. In addition to the site supporting federally-listed branchiopods (including the vernal pool fairy shrimp and vernal pool tadpole shrimp), the Project is well within the bank's established service area. All constructed wetland habitat has completed its success monitoring and the site has entered its long-term monitoring and management phase. The Clay Station Mitigation Bank is zoned as open space. Please refer to the *Mitigation Bank Enabling Instrument: Clay Station Mitigation Bank* (ECORP-Sugnet 1999) for additional information on the Clay Station Mitigation Bank.

6.2.6 Present and Proposed Uses of Adjacent Areas

6.2.6.1 Cook Property

The Cook property is bordered to the north and west by existing conservation properties, to the east by Eagles Nest Road, and to the South by Florin Road.

6.2.6.2 Clay Station Mitigation Bank

The Clay Station Mitigation Bank is surrounded by agricultural uses to the north, south, and west, and is also adjacent to other proposed conservation areas, including the 10,400 acre Gill Ranch property to the east.

6.3 Mitigation Area Selection

6.3.1 Cook Property

The Cook Property is within the same core-recovery area as the Project and has been identified by the Service staff as an important component in establishing a large-contiguous preserve area in the region (see Figure 14).

The likelihood of the presence of listed vernal pool branchiopods, as well as the Cook Property's proximity to other regional conservation areas, makes the site an ideal location to mitigate impacts to biological resources resulting from the Project. While protocol-level vernal pool branchiopod surveys have not been conducted on the Cook Property to date, it is likely that vernal pools on the property support vernal pool branchiopods. The site is situated in an area of Sacramento County that is known to support several branchiopod species, including those that are federally-listed as threatened or endangered. Surveys conducted by ECORP and other investigators in the immediate vicinity of the Cook Property have identified vernal pool fairy shrimp (federal listed threatened), mid-valley fairy shrimp, vernal pool tadpole shrimp (federal listed endangered) and California linderiella (see Figure 15).

6.3.2 Clay Station Mitigation Bank

The Clay Station Mitigation Bank was established in 1994 and included the construction of vernal pool, seasonal marsh, and seasonal wetland habitat. All constructed wetland habitat has completed its success monitoring and the site has entered its long-term monitoring and management phase, meaning that all habitat available to be purchased at the Clay Station Mitigation Bank is already fully functioning as wetland habitat. Additionally, the wetland habitat at Clay Station Mitigation Bank exhibits functions and values that are similar to those to be impacted at the Project site. Please refer to the *Mitigation Bank Enabling Instrument: Clay Station Mitigation Bank* (ECORP-Sugnet 1999) for additional information on the Clay Station Mitigation Bank.

6.4 Long-Term Goals

The long-term goal of the proposed off-site mitigation is to benefit Sacramento County by preserving in perpetuity the local abundance of endemic plant species associated with local vernal pool ecosystems, by contributing to the recovery and survival of vernal pool branchiopods, listed under the federal Endangered Species Act, and to ensure that there is no net loss of wetland habitat resulting from the construction of the Project.

7.0 IMPLEMENTATION PLAN

7.1 Rationale for Expecting Implementation Success

ECORP has successfully designed and overseen the construction of numerous other compensation wetlands in Sacramento County, including many vernal pool mitigation banks and projects. This experience will be used in the design and construction of the compensation habitat for the Project. In addition, the mitigation will be constructed in proximity to existing, functioning features within an established watershed. An extensive watershed analysis has been conducted for the proposed compensatory vernal pool habitat within the 507-acre Wetland Preserve (see Section 5.4 Construction Area Selection). In addition, Davis^2 Soil Scientists have conducted soil testing and has concluded the site's soils are appropriate for vernal pool construction, although due to past uses of the site, significant soil movement will need to occur in some locations to accommodate the wetland construction. The Clay Station Mitigation Bank was designed and construction oversight was conducted by ECORP. The site is regularly visited by resource agency staff during bank tours and considered an example of a successful wetland mitigation site.

7.2 Implementation Schedule

Wetland grading is expected to begin the summer after all requirements for commencement of construction have been fulfilled. Vernal pool inoculum to be used in the constructed vernal pools will be collected from on-site wetlands prior to impacts in the development area. Mitigation habitat within the Open Space Corridors will be constructed concurrent with the phased build-out of those areas. This approach, providing excess mitigation in the early phases of the project, is proposed to eliminate potential temporal losses of wetland functions and values. See Figure 10 for the anticipated phasing of the mitigation.

8.0 ON-SITE PRESERVE MAINTENANCE DURING MONITORING PERIOD

8.1 Maintenance Activities

In addition to the specific success monitoring schedule and activities outlined in this Proposal, general maintenance monitoring of the Preserves will be conducted as required by the *Operations and Management Plan for the Rio Del Oro Wetland Preserve* and the *Operations and Management Plan for the Rio Del Oro Open Space Preserve.* The goal of these inspections will be to ensure the Preserves are maintained in good condition.

8.2 Pest Plant Species Control / Grazing

A component of the post-construction maintenance and monitoring effort within the Preserves will be to assess the revegetation of the disturbed upland areas, with particular attention given to minimizing the spread of yellow star-thistle. If the grading operation results in small populations of star-thistle that can realistically removed by hand, then hand removal will be used. Although use of herbicides is not desirable, if larger populations become established, the herbicides *Roundup* (or generic) and *Transline* (or generic) will be utilized to control the growth of yellow star-thistle until hand removal is again practical. Each herbicide will not be used more than three years in a row. If other herbicides are proposed for use, Corps and Service approval will be obtained. Grazing will also be used the second year after wetland construction when vegetation becomes established in the restored areas to minimize the invasion of yellow star-thistle and to maintain a healthy vernal pool grassland.

8.3 Maintenance Schedule

The general maintenance monitoring of the Preserves will occur, at minimum, once annually during the success monitoring. Maintenance actions such as repair/replacement of fencing and signage, Preserve signage, unauthorized use, trash removal, erosion control measures, vandalism, or thatch build up will be addressed promptly by Elliott Homes, Inc. and GenCorp Real Estate.

8.3.1 Wetland Preserve

Success monitoring of the vernal pool habitats within the Wetland Preserve will occur over a ten-year period as outlined in Attachment D. Annual maintenance inspections of the site will occur concurrently with other monitoring activities for the first ten years after vernal pool construction, or until mitigation success obligations have been met.

8.3.2 Open Space Corridors

Success monitoring of the drainage corridors and associated constructed wetland habitats will occur for five years. Annual maintenance inspections of the concurrently with other monitoring activities for the first five years after construction, or until mitigation success obligations have been met.

8.4 Parties Responsible for Maintenance During Monitoring Period

Elliott Homes, Inc.
Contact: Russ Davis
80 Iron Point Circle, Suite 110
Folsom, California 95630
Phone: (916) 984-1300
Fax: (916) 984-1322

GenCorp Real Estate
Contact: David Hatch
620 Coolidge Drive, Suite 100
Folsom, California 95630
Phone: (916) 351-8534
Fax: (916) 351-8669

9.0 MONITORING REPORTS

9.1 As-Built Conditions

An as-built report will be submitted to the Service and the Corps within sixty days of wetland construction completion of each phase. This as-built will consist of a set of the wetland construction plans with any changes clearly marked in red ink. In addition, a map will be submitted with the first year's monitoring report utilizing GPS technology and/or aerial photography to indicate the ponded acreage of the constructed wetlands.

9.2 Annual Reports

Monitoring reports presenting the results of the success monitoring of the constructed wetland habitats will be prepared and submitted for each year of success monitoring by December 31st of each monitoring year. The report will refer to the Corps regulatory branch number for the Rio Del Oro Project and the Service file number, once known. The reports will be sent to the attention of Chief, Sacramento Valley Office, Regulatory Branch, at the Corps and Branch Chief, Endangered Species Branch, Sacramento Field Office, at the Service. Monitoring reports shall include:

1) A map showing the Preserves including wetland locations, locations of various monitoring activities outlined in this proposal, and photo points;
2) Hydrology, vegetation, wildlife, and photographic monitoring results as described above;
3) An assessment of the monitoring results against the established success criteria;
4) A description of the overall site condition and any management actions taken during that year; and
5) Any recommended management actions to be done within the Preserves (if necessary, a contingency plan, as described in Section 10.2 Remediation and Contingency Plan, will be prepared).

10.0 POTENTIAL CONTINGENCY MEASURES

10.1 Initiating Procedures

If any annual performance criterion is not met for all or any portion of the mitigation in any year, or if the final success criteria are not met, the applicants shall prepare an analysis of the cause or causes of failure, and if deemed necessary by the Corps and the Service (as appropriate[4]), propose remedial action for approval.

10.2 Remediation and Contingency Plan

The remediation plan will identify those measures (e.g., re-grading, reseeding, etc.) appropriate to remediate the situation. The remediation plan and associated post-remediation monitoring will be developed on a case by case basis as the type of remediation and monitoring may vary depending on the extent and type of remediation is needed. If such remediation measures are implemented during the first five years of the ten-year vernal pool monitoring period or within the first three years of the five-year seasonal wetland and low-flow channel monitoring period, no extension of the initial monitoring period will occur. If such remediation measures are implemented beyond these years, then monitoring of the remediated wetlands will be extended, but only for the remediated areas until they meet their success criteria or some other action is taken to replace the non-functioning habitat.

If remediation occurs and a wetland continues to underperform and additional remediation is not feasible, not practical or would result in an unnatural wetland configuration, then the pool will be deemed non-functional. If any mitigation wetlands are deemed non-functional, they will be mitigated for at an off-site mitigation bank, other mitigation area or by payment into the in-lieu fund as approved by the Corps and the Service[4].

10.3 Alternative Locations for Contingency Mitigation

A feasibility study will be done prior to the construction of the on-site seasonal wetlands and low-flow channel. If results of this study indicate that the proposed low-flow channel locations will not support the desired habitat, then another Corps approved site and/or a Corps approved mitigation bank or off-site mitigation facility will be used for the remaining mitigation requirements.

[4] Only mitigation for federally-listed branchiopod habitat (i.e., vernal pools) needs approval from both the Service and the Corps; for seasonal wetland and low-flow channel, only Corps approval is needed.

11.0 COMPLETION OF MITIGATION RESPONSIBILITIES

11.1 Notification

When the success monitoring periods are complete, and the applicants believe that the final success criteria have been met, the applicant shall notify the Corps and the Service (as appropriate) as part of the final monitoring report.

11.2 Agency Confirmation

Following receipt of the report, the Corps and/or Service may require a site visit to confirm the completion of the mitigation effort. At the end of the five-year monitoring period for the constructed seasonal wetlands, and the end of the ten-year monitoring period for the constructed vernal pools, monitoring will cease if the mitigation is found by the Service and Corps to be in substantial compliance with the established success criteria. Once the initial success monitoring period is complete, all of the provisions of the *Operations and Management Plan for the Rio Del Oro Wetland Preserve* and the *Operations and Management Plan for the Rio Del Oro Open Space Preserve* will be implemented for long-term management of the Preserves.

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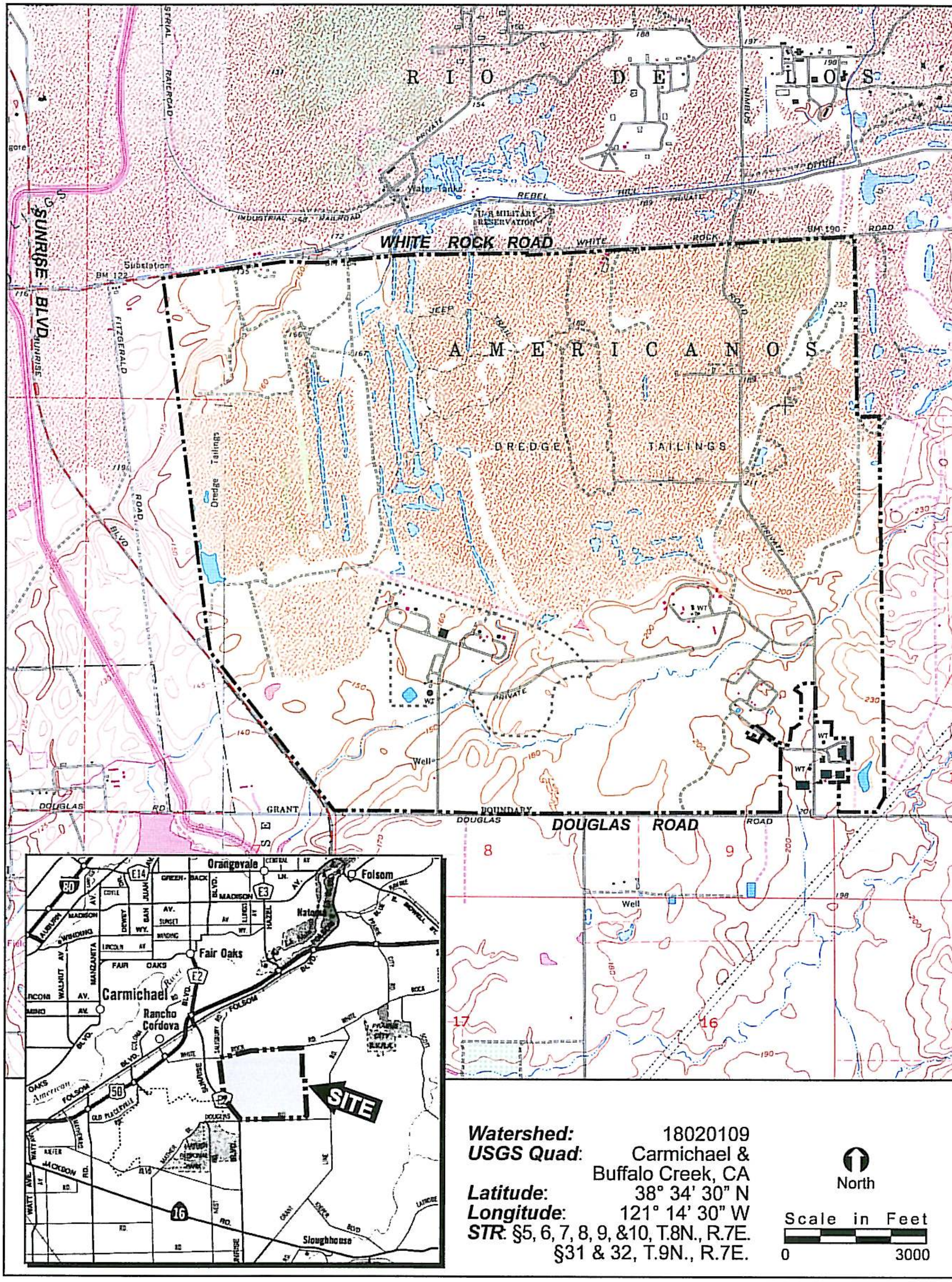

Watershed: 18020109
USGS Quad: Carmichael & Buffalo Creek, CA
Latitude: 38° 34' 30" N
Longitude: 121° 14' 30" W
STR: §5, 6, 7, 8, 9, &10, T.8N., R.7E. §31 & 32, T.9N., R.7E.

North

Scale in Feet
0 3000

FIGURE 1. Rio Del Oro Project Site and Vicinity

2002-009 Rio del Oro

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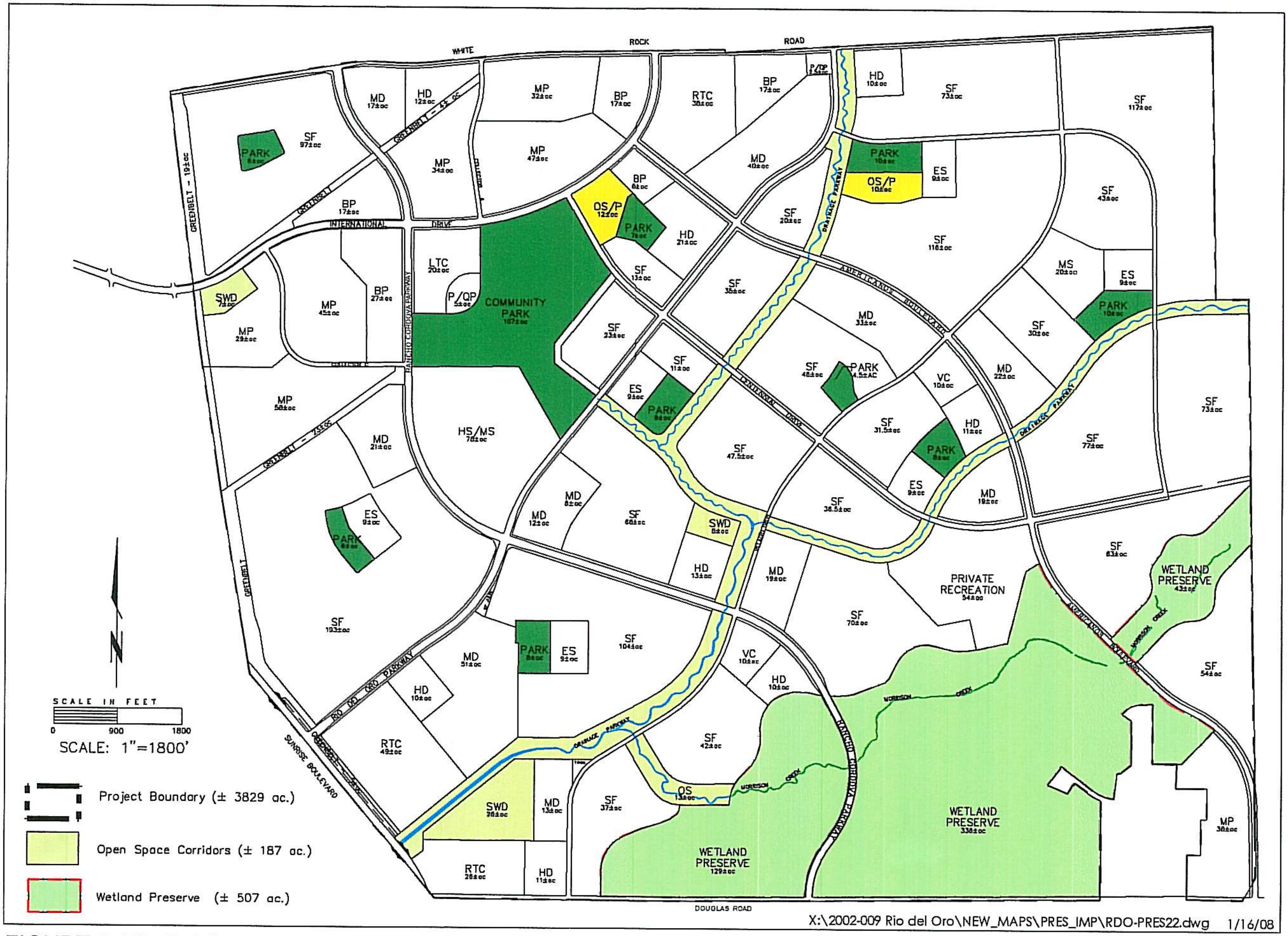

FIGURE 2. Rio Del Oro Land Use Plan

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CLASSIFICATION	JURISDICTIONAL ACREAGE	ISOLATED ACREAGE	EXISTING ACREAGE
Existing Wetlands:			
Vernal Pool	35.485	2.414	37.899
Seasonal Wetland Swale	6.044	0.653	6.697
Seasonal Wetland	6.418	9.158	15.576
Other Waters:			
Ephemeral drainage	5.145	---	5.145
Pond	3.540	0.721	4.261
TOTAL:	56.632	12.946	69.578

Isolated wetlands

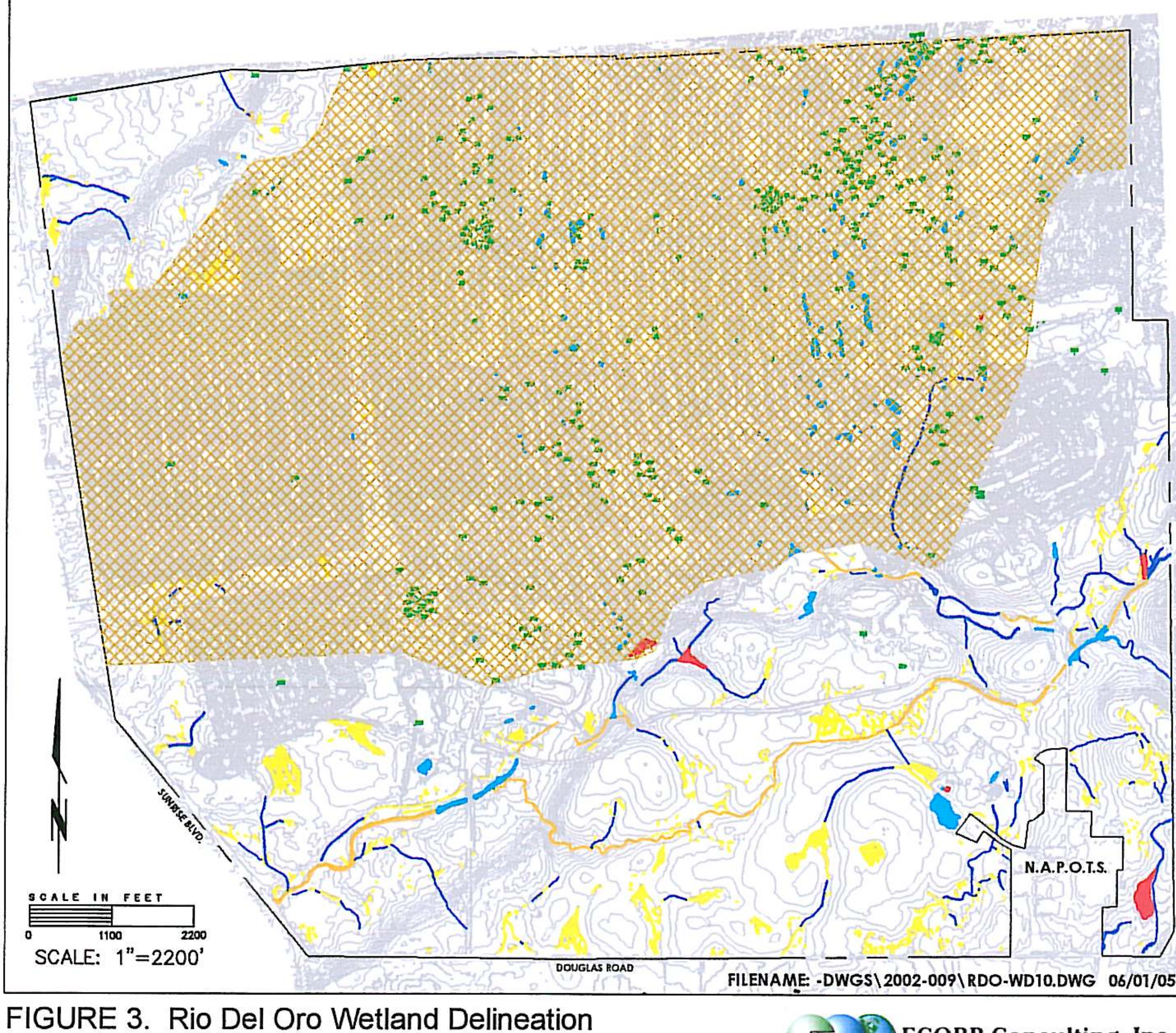

FIGURE 3. Rio Del Oro Wetland Delineation

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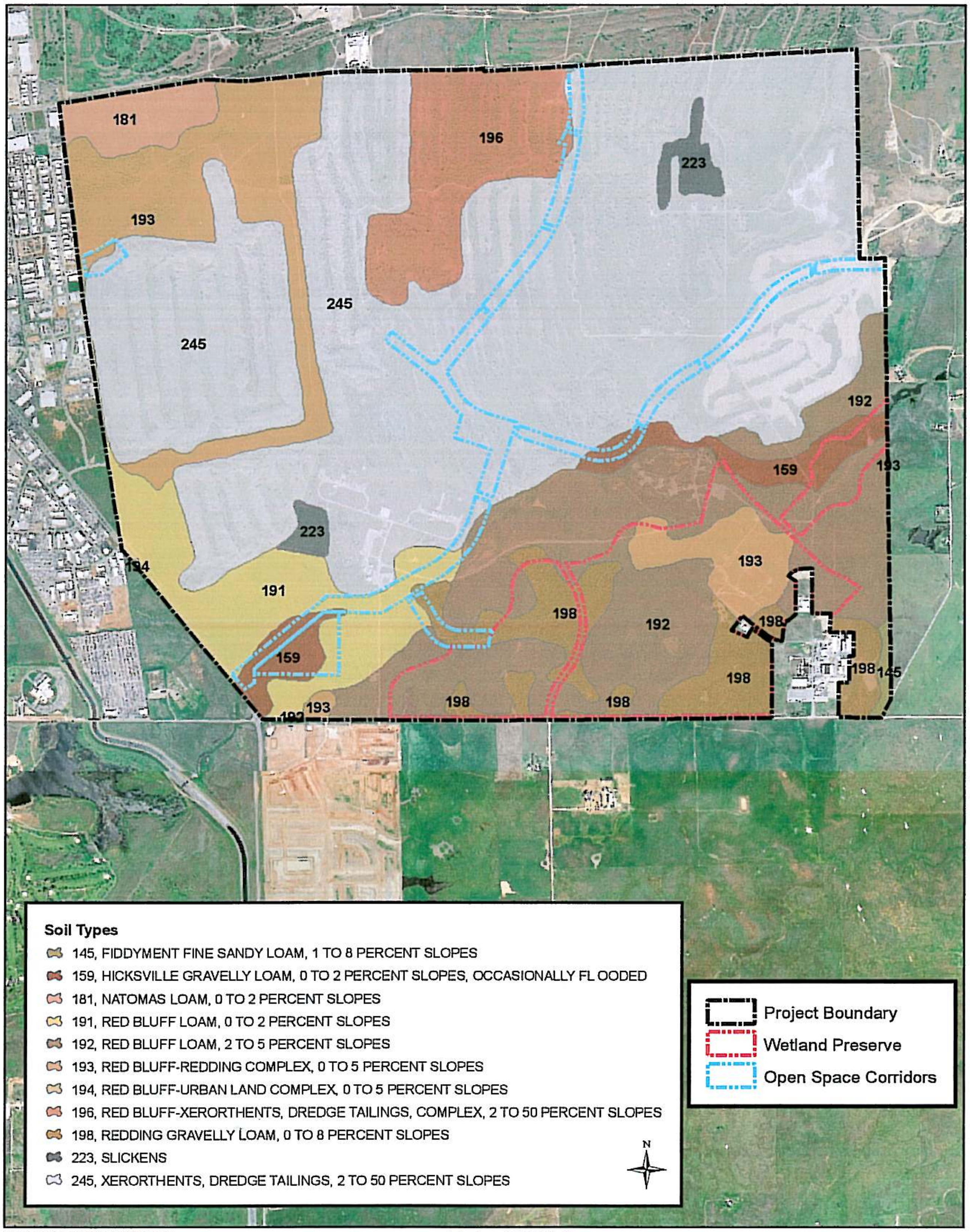
2002-009 Rio del Oro



1 inch = 2,500 feet

Figure 4. Rio Del Oro NRCS Soil Types

0 1,250 2,500 5,000 Feet

2002-009 Rio Del Oro

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WATERS OF THE U.S. ACREAGE [1]

CLASSIFICATION	JURISDICTIONAL ACREAGE	IMPACTS * DIRECT	IMPACTS * INDIRECT	MITIGATION PRESERVE	MITIGATION CONSTRUCTION
Wetlands:					
Vernal Pool	35.485	15.072	2.179	20.413	13.449
Pond	3.540	2.923		0.616	N/A 0.000
Seasonal Wetland Swale	6.044	3.587		2.457	0.752
Seasonal Wetland	6.418	3.064		3.354	N/A 0.000
Other Waters:					
Ephemeral Drainage	5.145	3.256		1.889	N/A 0.000
Riparian Wetland	---	---		---	16.941
Channel	---	---		---	8.402
TOTAL:	56.632	27.902	2.179	28.729	39.544

Project Boundary

Line of Indirect Impact

Elderberry Location

Isolated Wetlands

* In addition, 12.946 acres of isolated wetlands are located on the site, all of which will be impacted

Open Space (+/- 187 ac.)

Wetland Preserve (+/- 507 ac.)

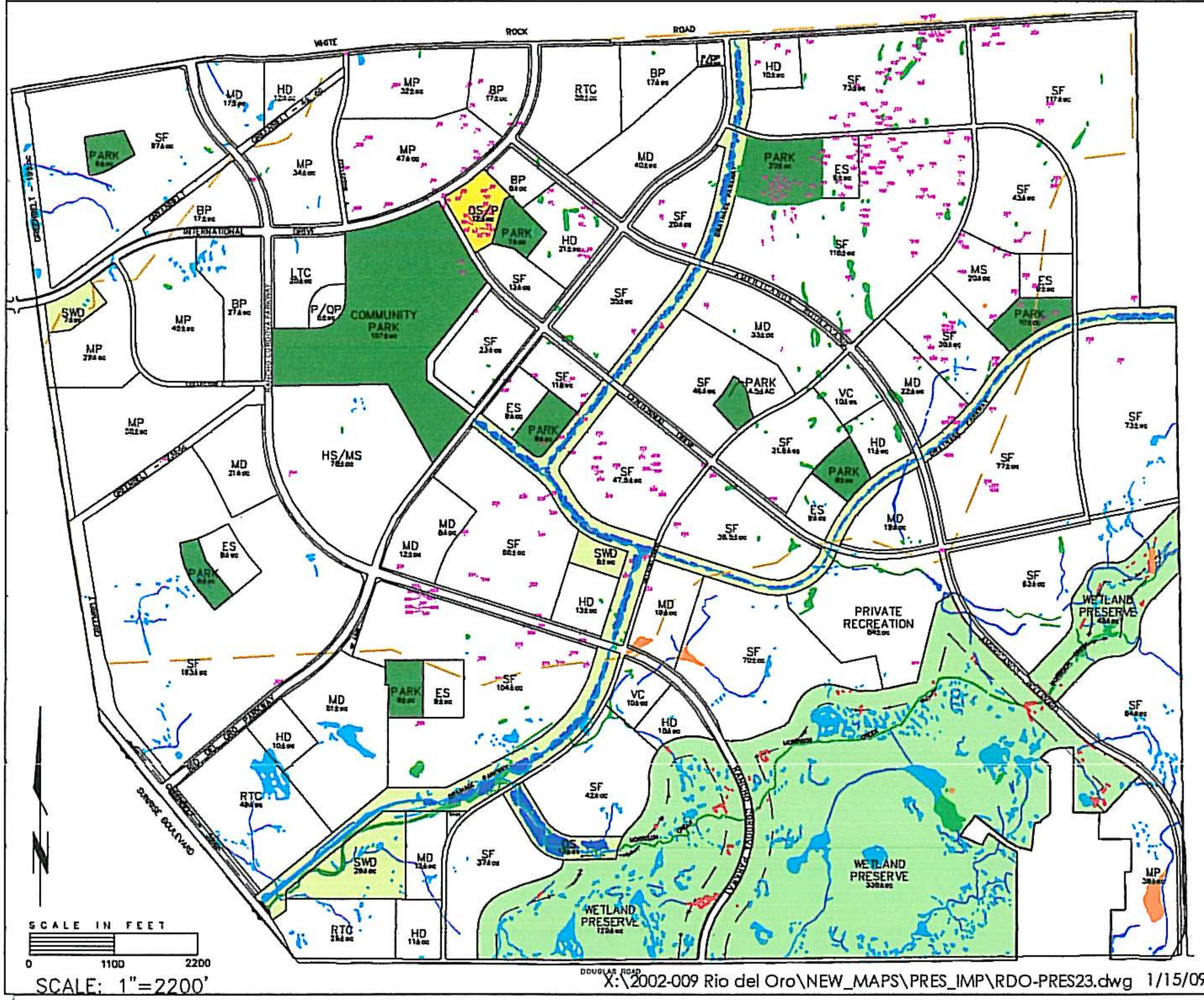

FIGURE 5. Rio Del Oro Wetland Preserve, Impact, and Compensation Plan

ECORP Consulting, Inc.
ENVIRONMENTAL CONSULTANTS

2002-009 RIO DEL ORO

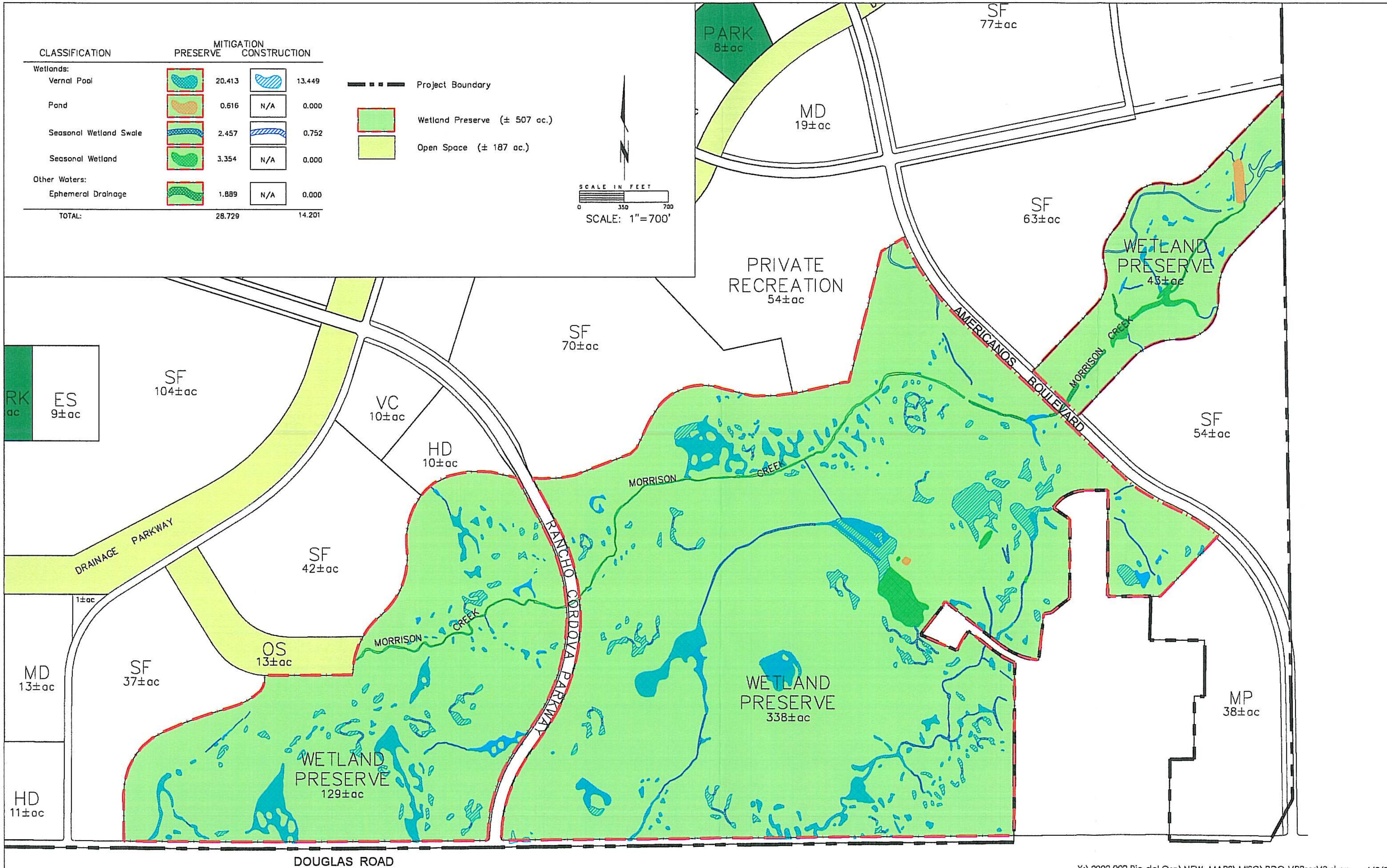

FIGURE 6. Conceptual Wetland Preserve Detail

2002-009 RIO DEL ORO

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Source: HLA, *Drainage Parkway*, 040407.

FIGURE 7. Conceptual Open Space Corridors Detail

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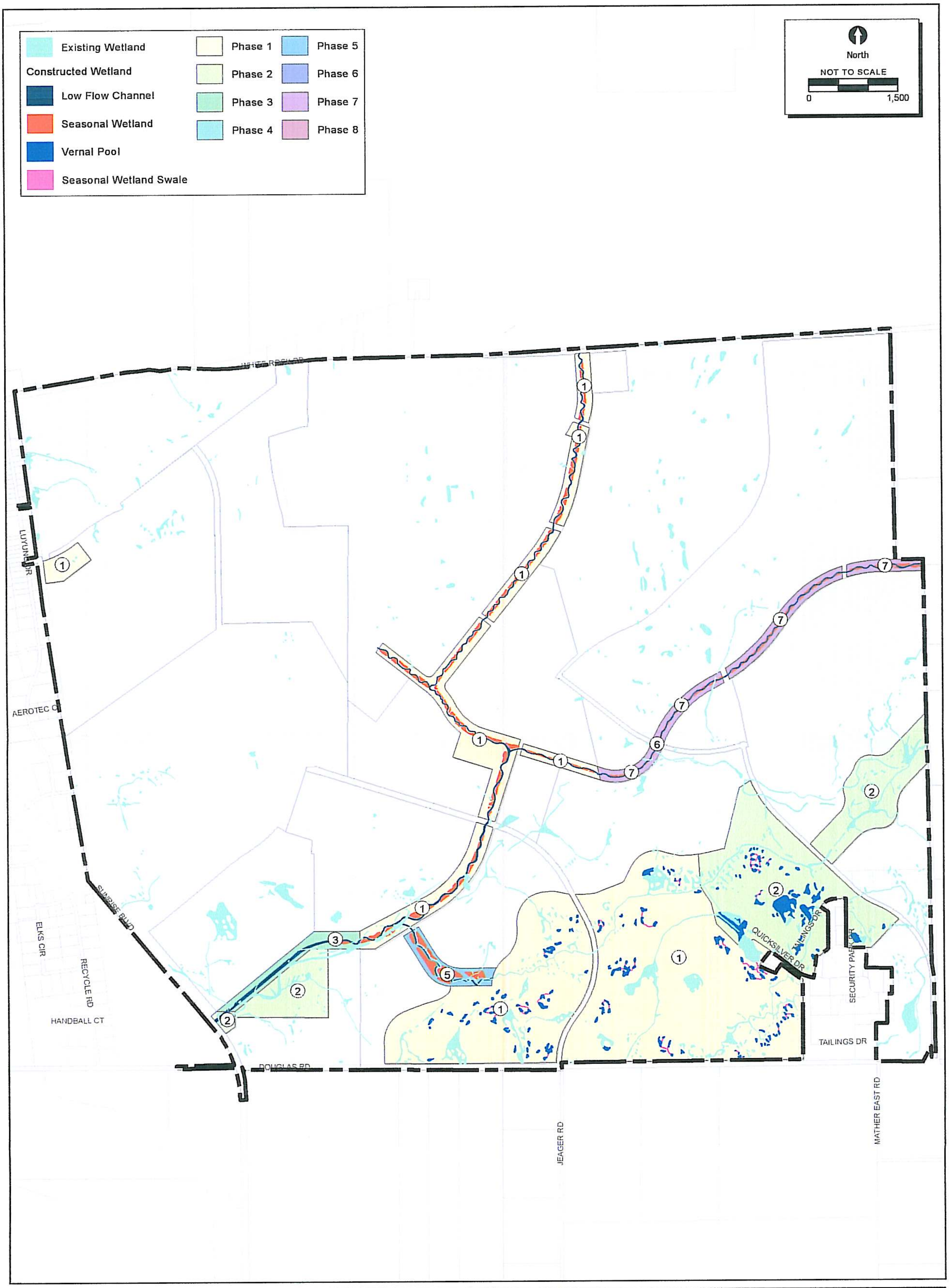
↑
Head-cut #1 on Morrison Creek illustrating the vertical face with plunge pool.

←
Spoil piles on both banks of Morrison Creek.

FIGURE 8. Morrison Creek Enhancement Opportunities

FIGURE 9. Representative Drainage Corridor Segment



	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8	Constructed Total
Seasonal Wetland	10.492		0.144	-	3.990	-	2.310	-	16.936
Low Flow Channel	4.234	0.246	2.003	-	0.643	0.011	1.260	-	8.397
Vernal Pool	6.715	6.734	-	-	-	-	-	-	13.449
Seasonal Wetland Swale	0.636	0.116	-	-	-	-	-	-	0.752
Total	22.076	7.096	2.148	-	4.633	0.011	3.570	-	39.534

Location: J:\GIS_Maps\2002-009_Rio_Del_Oro\Phased_Impacts\PhasedImpacts_v3(2009-06-01)\Phased_Wetland_Construction_v1.mxd

*Acreages by phase may change slightly upon development of construction plans

FIGURE 10. Phased Wetland Construction

2002-009 Rio del Oro

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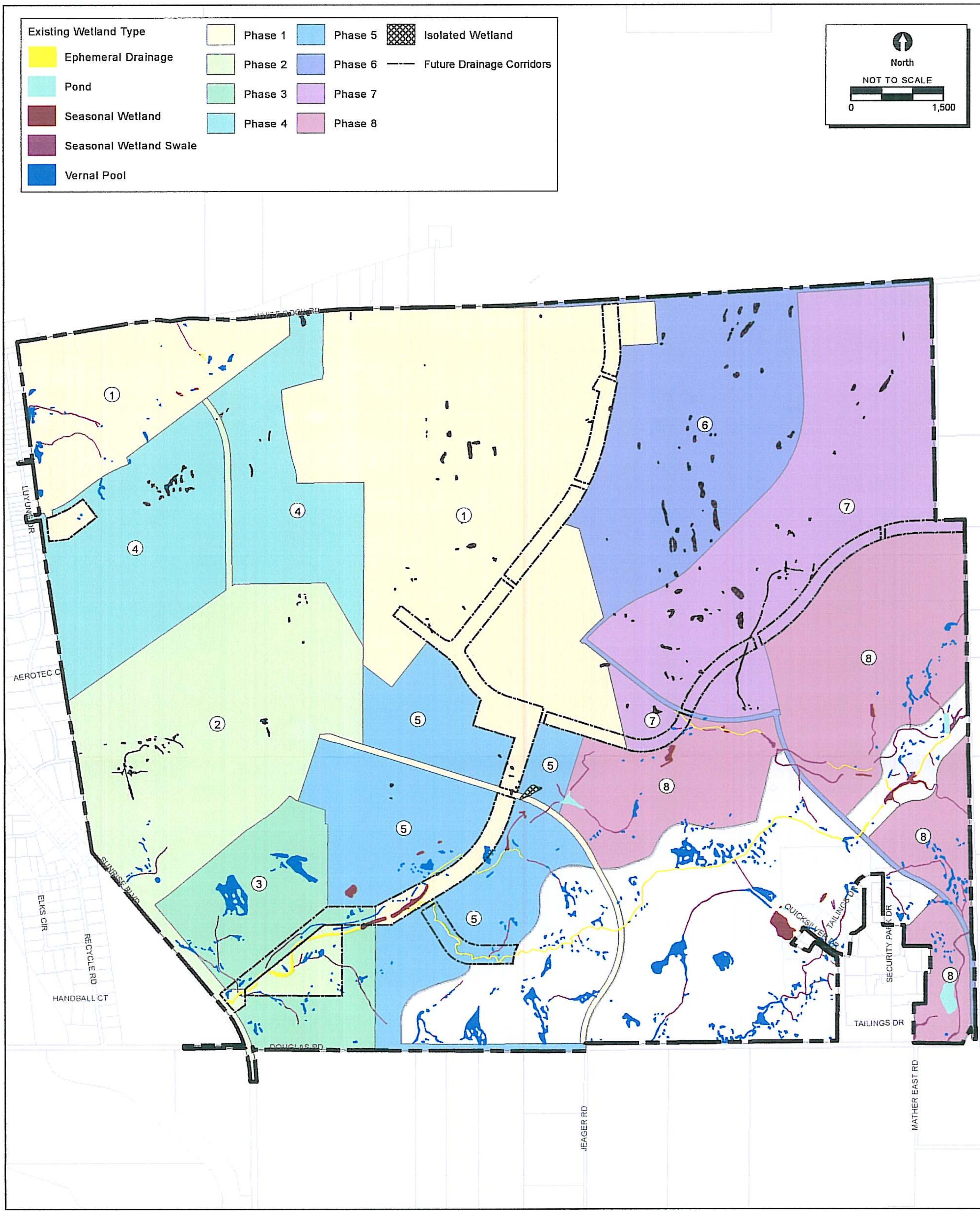

Wetland Impacts by Phase

	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7	Phase 8	Impact Total
Isolated Wetlands									
Pond	0.105	-	-	-	0.585	-	0.031	-	0.721
Seasonal Wetland	1.903	0.035	-	0.107	0.091	4.249	2.772	-	9.158
Seasonal Wetland Swale	-	0.073	-	-	-	-	0.580	-	0.653
Vernal Pool	-	0.977	-	1.204	0.012	-	0.221	-	2.414
Isolated Total	2.009	1.085	-	1.311	0.688	4.249	3.604	-	12.946
Jurisdictional Wetlands									
Ephermal Drainage	0.145	1.407	0.503	-	0.832	0.046	0.039	0.284	3.256
Pond	-	-	-	-	0.022	-	-	2.901	2.923
Seasonal Wetland	1.150	-	0.315	-	0.794	-	-	0.805	3.064
Seasonal Wetland Swale	0.377	0.262	0.360	-	0.362	0.128	0.018	2.081	3.587
Vernal Pool	2.436	1.292	6.737	0.249	1.245	0.118	0.053	2.943	15.072
Jurisdictional Total	4.108	2.961	7.915	0.249	3.255	0.291	0.110	9.013	27.902
Impact Total	6.117	4.046	7.915	1.559	3.943	4.540	3.714	9.013	40.848

*Acreages by phase may change slightly upon development of construction plans

Location: J:\GIS Maps\2002-009 Rio Del Oro\Phased Impacts\PhasedImpacts v3(2009-06-01)\Phased Impacts v6.mxd

FIGURE 11. Phased Impact Analysis

2002-009 Rio del Oro

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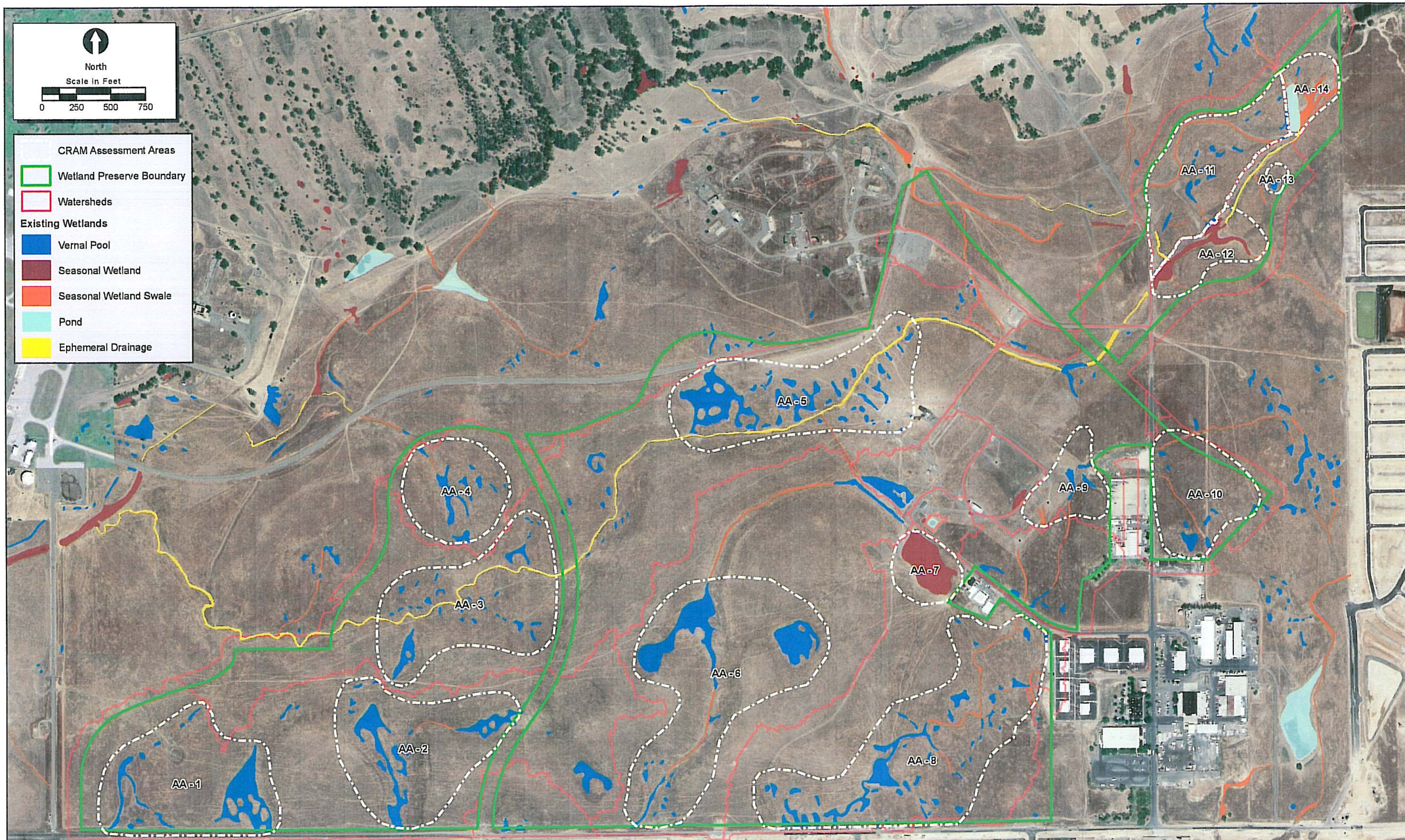

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Image Source: Aerials Express, 2007.

Figure 12. Rio Del Oro CRAM Assessment Areas

2002-009 Rio Del Oro - CRAM

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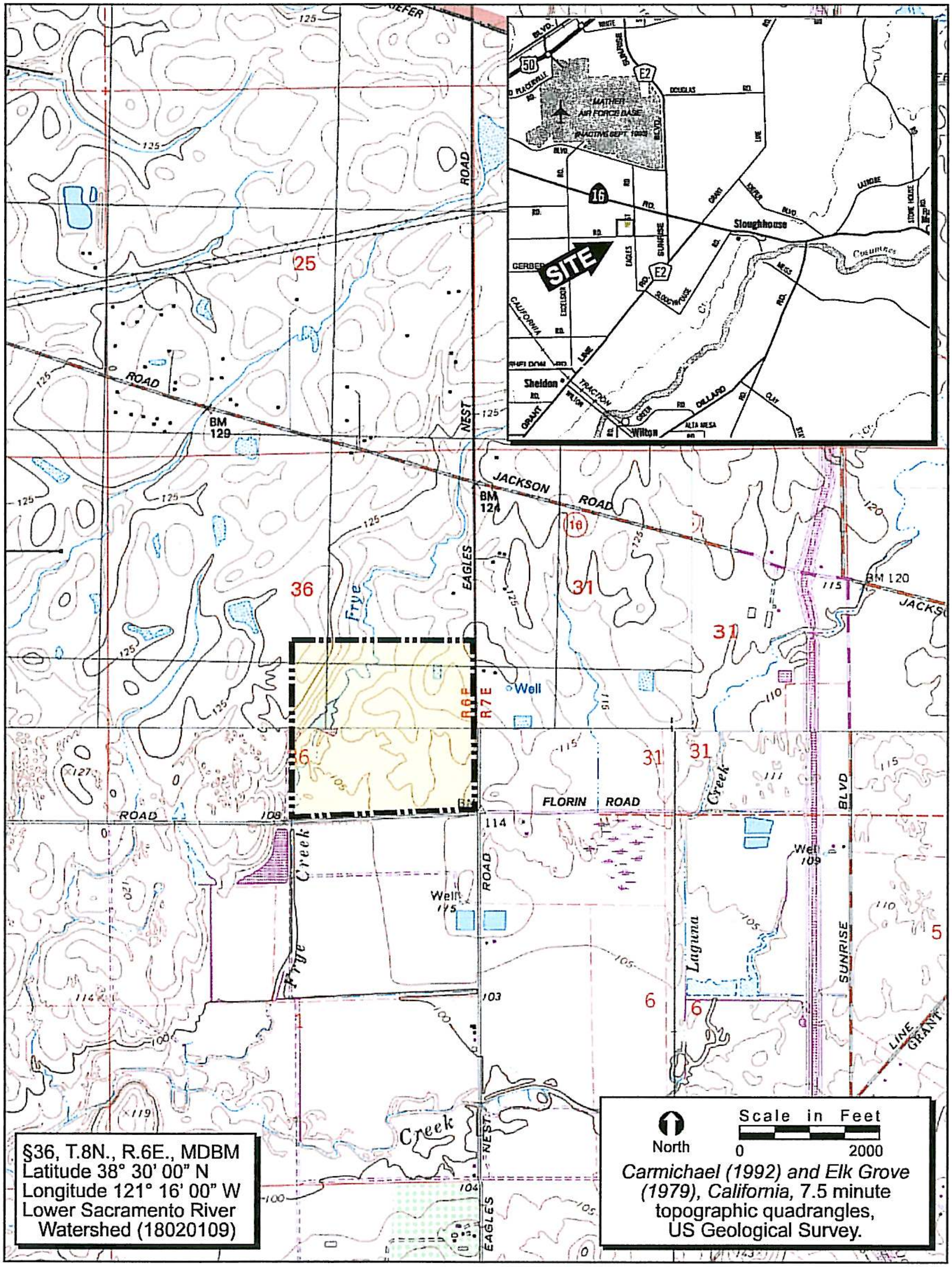

FIGURE 13. Cook Property Project Site and Vicinity

2002-009 Rio del Oro

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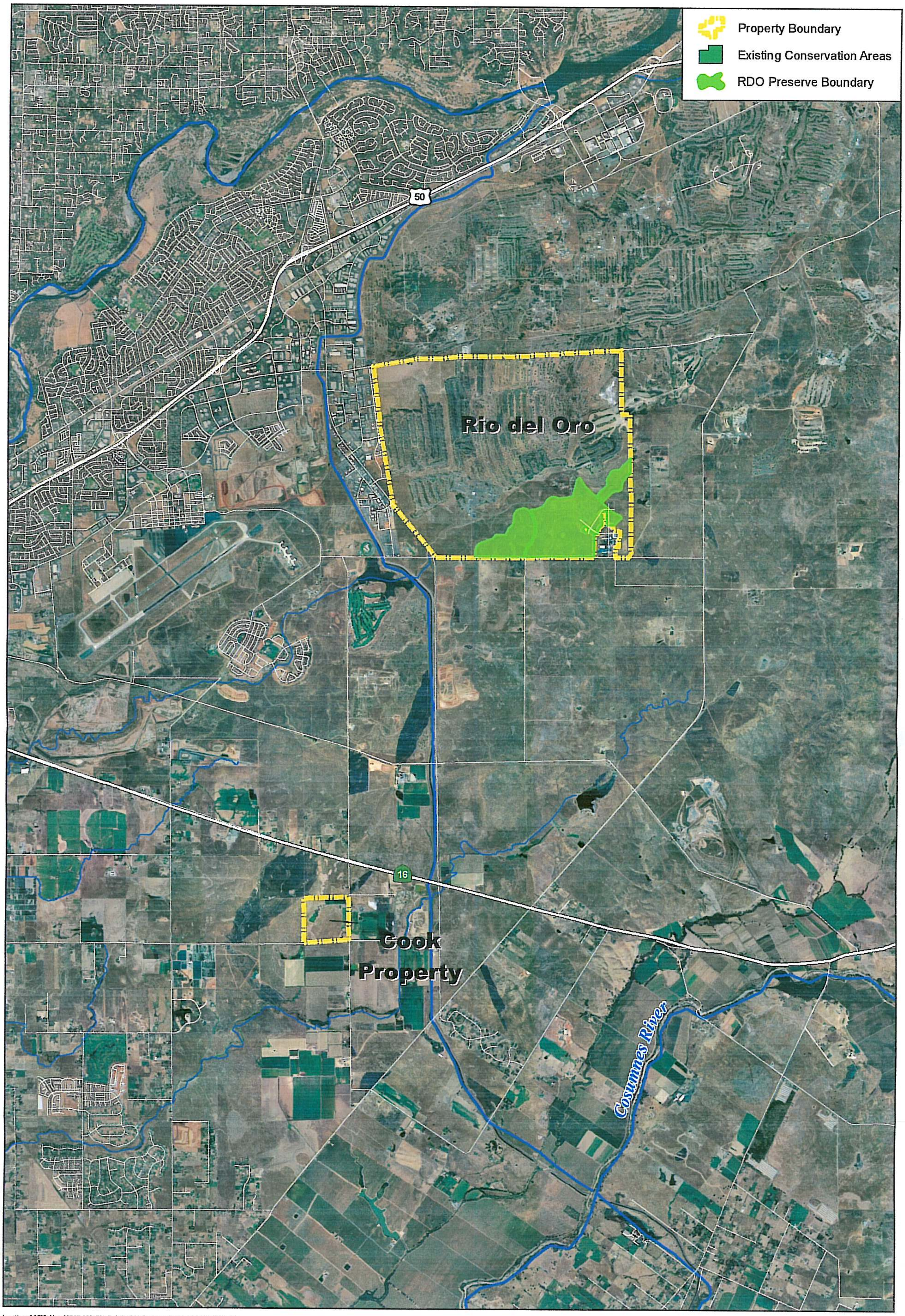

Location: J:\GIS_Maps\2002-009_Rio_Del_Oro\Cook_Property_Location(Tabloid).mxd

FIGURE 14. Cook Property Location

1 inch = 1 miles

0 0.5 1 2 Miles

2002-009 Rio Del Oro

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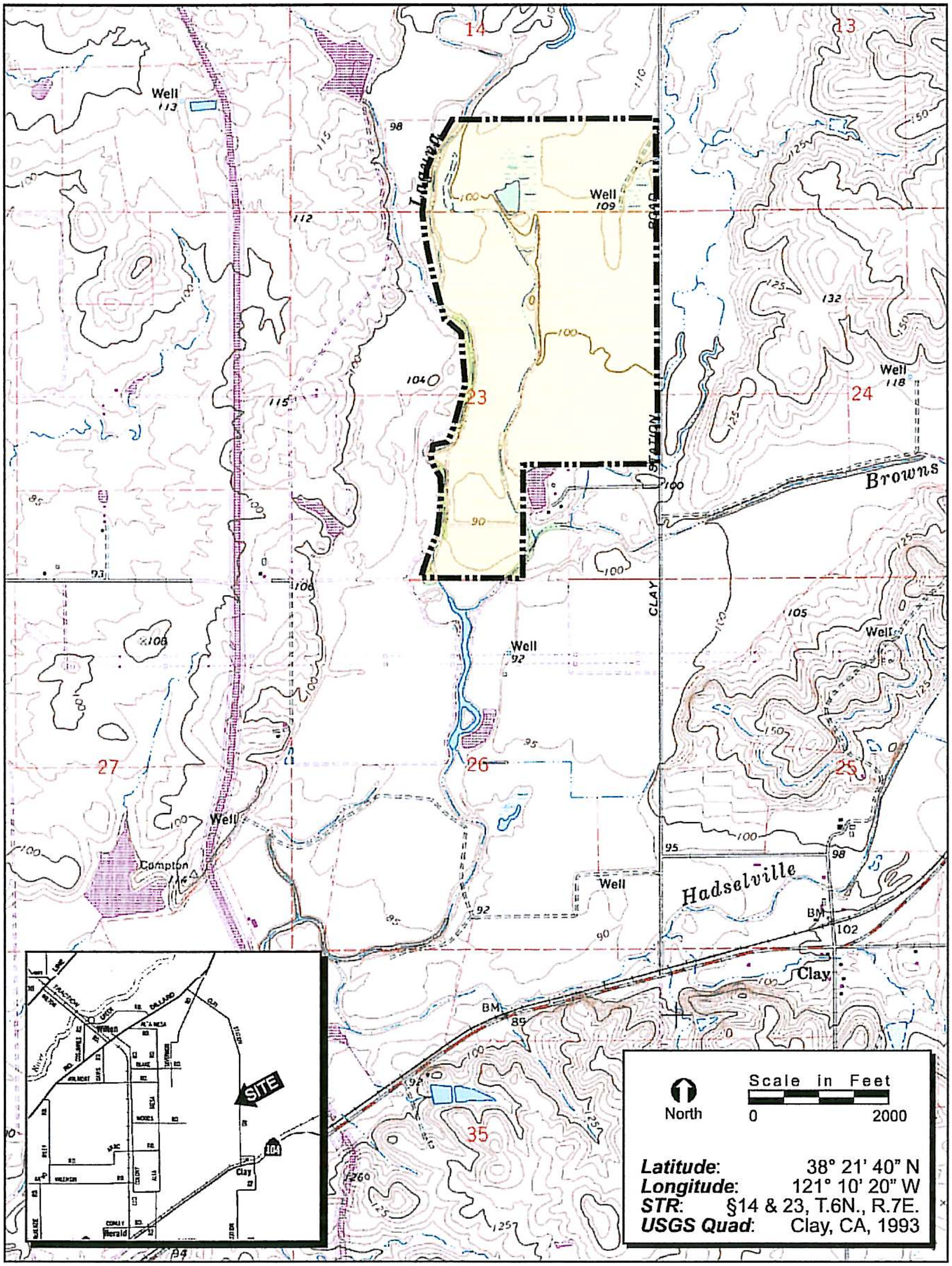

FIGURE 15. Clay Station Mitigation Bank Project Site and Vicinity

2002-009 Rio del Oro

ECORP Consulting, Inc.
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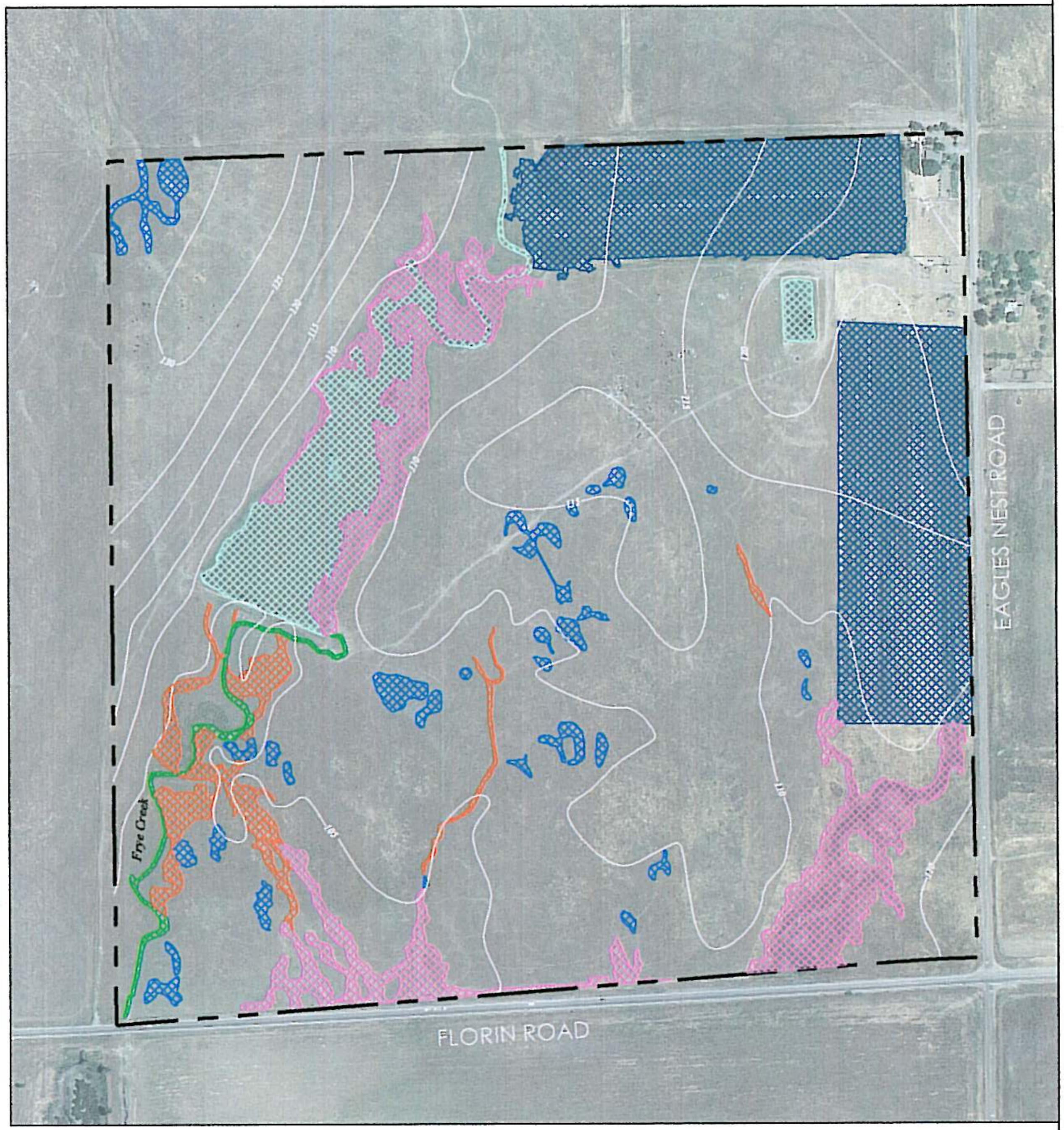
APPROXIMATE WATERS OF THE U.S. ACREAGE[1]

CLASSIFICATION	APPROXIMATE ACREAGE
WETLANDS:	
Vernal Pool	2.67
Seasonal Marsh	9.90
Seasonal Wetland Swale	2.63
OTHER WATERS:	
Pond	6.51
Intermitent Drainage	0.58
TOTAL:	22.29

OTHER FEATURES[2]

Project Boundary	±160
Irrigated Pastures	21.27

SCALE IN FEET
0 500 1000
SCALE: 1"=500'



X:\2002-009 Rio del Oro\WA\Cook Mil\Cook-WA.dwg 28 JULY 2006

FIGURE 16. Cook Property Preliminary Wetland Assessment

ECORP Consulting, Inc.
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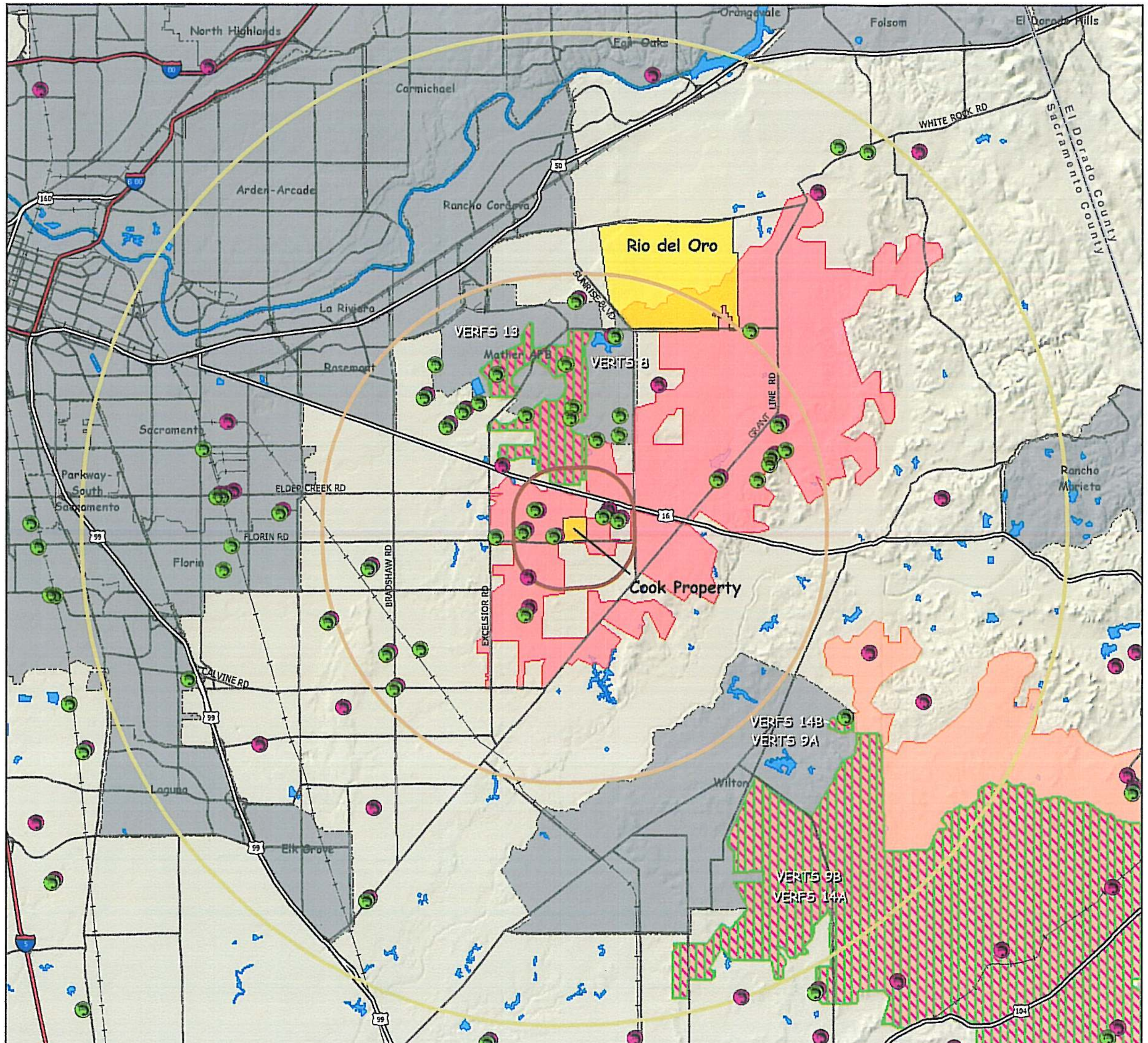

J:\GIS_Maps\2002-009_Rio_Del_Oro\Mitigation_Maps\Cook_CNDDB_fed_shrimp_v2.mxd

Map Date: 01/02/09
GIS Specialist: JDS

Figure 17. CNDDB Occurrences of Federally-listed Branchiopod Species

2002-009 Rio del Oro - Cook Property

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Map Features

Administrative Boundaries

- [1] Project Boundary
- City Boundary
- County Boundary

Distance From Project

- 1 mile
- 5 mile
- 10 mile

Transportation

- Interstate
- State Highway
- Roads
- Railroads

Aquatic Features

- Lakes and Reservoirs
- Rivers

[2] CNDDB Occurrences of Federally Listed Branchiopods

Endangered

- Vernal Pool Tadpole Shrimp

Threatened

- Vernal Pool Fairy Shrimp

Branchiopod Critical Habitat

- [3] Vernal Pool Fairy Shrimp
- [3] Vernal Pool Tadpole Shrimp

USFWS Southeastern Sacramento Valley Core Areas

- [4] Cosumnes/Rancho Seco
- [4] Mather

This map may include multiple species' occurrences at each location, some of which may not be visible on this graphic. The CNDDB occurrences shown may not reflect the actual location of the occurrence.

N

1" = 13,000 '

SCALE IN FEET

0 6,500 13,000

NOTES

[1] Project Boundary: Sacramento County GIS Parcel Database (Boundary Approximate)

[2] CDFG California Natural Diversity Database (CNDDB), December 2008 Update (GIS Shapefile)

[3] USFWS Vernal Pool Species Final Critical Habitat, February 2006.

[4] USFWS Vernal Pool Recovery Core Areas, April 2006.

CNDDB Occurrences Located on USGS 7.5' Quadrangles: Bruceville, Buffalo Creek, Carbondale, Carmichael, Clay, Elk Grove, Florin, Folsom, Folsom SE, Galt, Goose Creek, Rio Linda, Sacramento East & Sloughhouse, CA

LIST OF ATTACHMENTS

Attachment A – Rio Del Oro Wetland Preserve, Impact and Compensation Plan

Attachment B – Watershed Analysis of the Hydrologic Function of the Rio Del Oro Preserve for Preservation for Existing Wetlands and Construction of Mitigation Wetlands

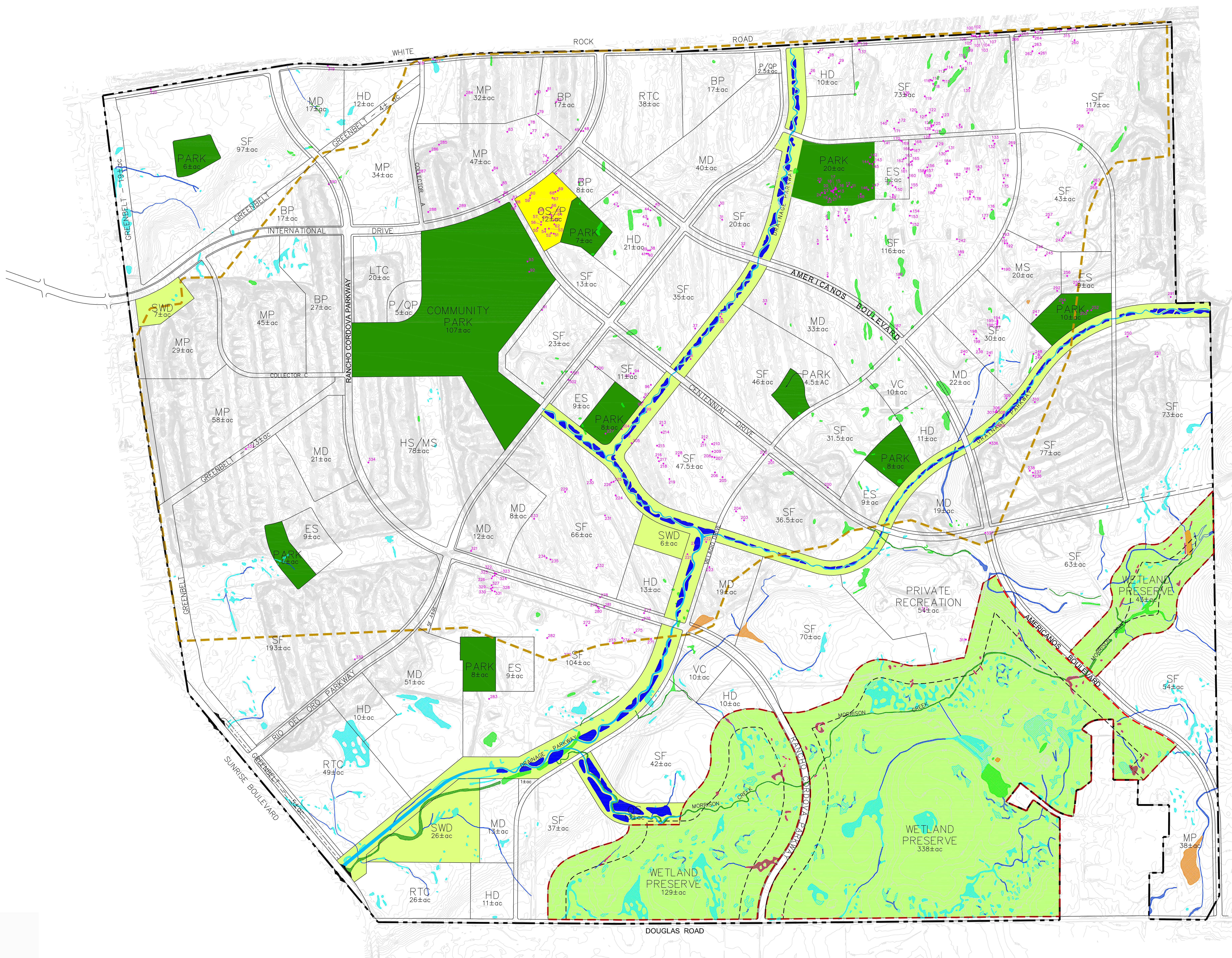
Attachment C – Rio Del Oro Monitored Vernal Pool Locations

Attachment D – Rio Del Oro Vernal Pool Monitoring Schedule – Years 1-10

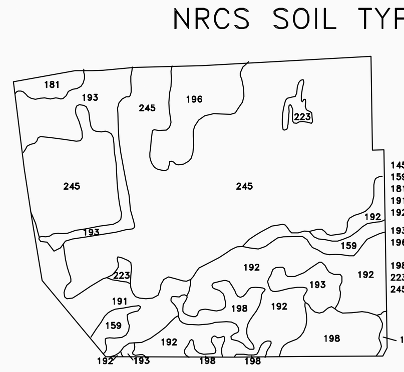
Attachment E – Example of Vernal Pool Floristic Monitoring Data Sheet

ATTACHMENT A

Rio Del Oro Wetland Preserve, Impact and Compensation Plan



NRCS SOIL TYPES



145 Fiddyment fine sand loam, 1–8% slopes
159 Hicksville gravelly loam, 0–2% slopes
181 Natomas loam, 0–2% slopes
191 Red Bluff loam, 0–2% slopes
192 Red Bluff loam, 2–5% slopes
193 Red Bluff loam, 0–5% slopes
196 Red Bluff–Xerorthents, dredge tailing complex, 2–5% slopes
198 Redding gravelly loam, 0–8% slopes
223 Slickens
245 Xerorthent, dredge tailings, 2–50% slopes

WATERS OF THE U.S. ACREAGE

CLASSIFICATION	Existing: Jurisdictional Acreage	Existing: Isolated Acreage	Direct Impacts: Jurisdictional Acreage	Direct Impacts: Isolated Acreage	Indirect Impacts: Jurisdictional Acreage	Indirect Impacts: Isolated Acreage	Mitigation: Preserve	Mitigation: Construction
Wetlands:								
Vernal Pool	35.485	2.414	15.072	2.414	2.179	–	20.413[1]	13.449
Pond	3.540	0.721	2.924	0.721	–	–	0.616	N/A 0.000
Seasonal Wetland Swale	6.044	0.653	3.587	0.653	–	–	2.457	0.752
Seasonal Wetland	6.418	9.158	3.064	9.158	–	–	3.354	N/A 0.000
Other Waters:								
Ephemeral Drainage	5.145	–	3.256	–	–	–	1.889	N/A 0.000
Riparian Wetland	–	–	–	–	–	–	–	16.941
Channel	–	–	–	–	–	–	–	8.402
TOTAL:	56.632	12.946	27.903	12.946	2.179	–	28.729	39.544

[1] In addition, 12.946 acres of isolated wetlands are located on the site, all of which will be impacted

Project Boundary
Line of Indirect Impact
●100 Elderberry Location and ID#
Wetland Preserve (+/- 507 ac.)
Open Space (+/- 187 ac.)
VELB Preserve (+/- 44 ac.)
Park (+/- 179 ac.)
Isolated Wetlands

NOTES

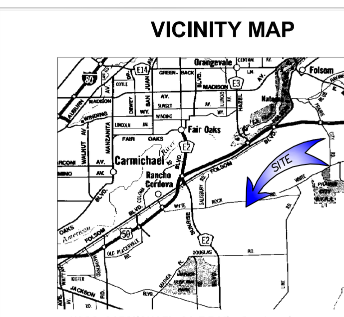
Gross Project Acreage: ± 3829

Base data source: G.C. Wallace

This exhibit depicts information and data produced in strict accord with the U.S. Army Corps of Engineers wetland delineation methods described in the 1987 Corps of Engineers Wetland Delineation Manual and conforms to specifications per the Corps Sacramento District. However, wetland boundaries have not been legally surveyed and may be subject to minor adjustments if exact locations are required.

SCALE: 1"=500'

VICINITY MAP



USGS: CARMICHAEL, CA 7.5 Min. Quadrangle

RIO DEL ORO

PROPOSED PRESERVE/IMPACT MAP

DATE: 18 OCTOBER 2006 | REVISION DATE: 6/2/09 | PROJECT NUMBER: 2002-009
CAD SPECIALIST: CN/MC/KO/JH | SCALE: 1"=500' | MAP NAME: RDO-PRES23.dwg
MAP LOCATION: X:\2002-009 Rio del Oro\NEW_MAPS\PRES_IMP
WETLAND VERIFICATION LETTER DATE: | PM: BG

ECORP Consulting, Inc.
ENVIRONMENTAL CONSULTANTS

Northern California, 2525 Warren Drive, Rocklin, CA. 95677, Ph: 916.782.9100 • Bay Area, 2100 Embarcadero, Ste. 202, Oakland, CA. 94606, Ph: 510.434.0150 • Orange County, 1801 Park Court Place Bldg B. Ste. 103, Santa Ana, CA. 92701, Ph: 714.648.0630 • Inland Empire, 412 East State St., Redlands, CA. 92373, Ph: 909.307.0046

ATTACHMENT B

Watershed Analysis of the Hydrologic Function of the Rio Del Oro Preserve for Preservation for Existing Wetlands and Construction of Mitigation Wetlands

Watershed Analysis of the Hydrologic Function of the Rio del Oro Preserve for Preservation of Existing Wetlands and Construction of Mitigation Wetlands

Introduction

At the request of EDAW/AECOM, ECORP Consulting, Inc. (ECORP) investigated the feasibility of constructing mitigation wetlands within the proposed Rio del Oro preserve. The analysis was conducted to address comments provided on the project EIR, specifically regarding potential adverse hydrologic effects to existing wetlands or proposed compensatory wetlands within the designated preserve.

The analysis evaluated the verified wetland delineation of the entire Rio del Oro project site and adjacent watersheds. A total of 295 vernal pools were located on the project site. Vernal pools are topographic basins within the grassland community and are typically underlain with an impermeable or semi-permeable hardpan or duripan layer. Vernal pools may be inundated with up to one foot of water through the wet season and are dry by late spring through the following wet season. Sixteen (16) seasonal wetlands were also mapped within the Rio del Oro project site. Seasonal wetlands are ephemerally wet areas where runoff accumulates within low-lying depressions and/or adjacent to watercourses. These areas may remain inundated for extended periods into the spring and summer. Additionally, there are three stock ponds present on the site. These man-made features have historically been used to support cattle grazing operations.

Objectives

The objectives of the investigation were to determine:

1. if the proposed Rio del Oro preserve configuration will negatively impact existing wetlands within the preserve
2. if the proposed Rio del Oro preserve will support the construction of mitigation wetlands without impacting existing wetlands, and
3. if the proposed construction of Rancho Cordova Road through the Rio del Oro preserve will negatively impact existing or proposed compensatory wetlands.

Methods

ECORP took a six (6) step approach to assess potential direct and indirect impacts for the Project. These included:

1. Acquiring a high resolution LIDAR based topographic survey;
2. Creating a grid model of the Project;

3. Utilizing industry standard hydrologic assessment tools to determine physical characteristics of the site;
4. Establishing a method for assessing the hydrologic boundaries between individual depressional water features and their watershed areas;
5. Establishing a baseline for typical wetland to watershed ratios, and;
6. Modeling potential future watershed characteristics based on the construction of 13.449 acres of mitigation wetlands and the construction of Rancho Cordova Road.

This approach provides a comprehensive quantitative assessment of current Project characteristics, models the change in the topography of the Site based on the proposed mitigation wetland design and the Rancho Cordova Road alignment, and evaluates how the changes to the Site characteristics will modify hydrologic characteristics of each individual wetland and its corresponding watershed.

Establishing the Ground Model

Traditional Ground Models

The first step in establishing a high quality hydrologic model of the Site is to develop an elevation model of the study area. Large scale projects require high quality topographic ("topo") information, traditionally generated using photogrametric methods. Traditional topo is created through the analysis of stereoscopic orthophoto pairs, coupled with a site survey. This topographic data is supplied as contour lines placed at 1-foot, 2-foot, or greater intervals and spot elevations, with the focus of the data being on the contour lines to generate the description of the ground surface. These topographic contour lines are generated through a combination of computer based, automation processes and the effort of a photogramatic technician, who provides quality control and assurance that the contours created are readable, logical and aesthetically pleasing. This type of topographic model provides an easy to read, topographically exact method for site evaluation; however, it has some limitations.

There are three limitations of traditionally derived topography important to this study:

1. The ratio of the contour interval to the physical characteristics of the features of interest;
2. The deficiency of information describing the ground elevations between contours, and;
3. The aesthetically pleasing nature of the contours.

The first limitation of traditional topographic mapping is the contour interval spacing. This is important to this study because the depressional wetland features of interest are vernal pools and seasonal wetlands, which can be very shallow in depth (<1ft deep.) Only the largest and deepest wetlands have physical characteristics that exceed the threshold that allow them to be mapped using traditional topographic methods. Many sites in the Sacramento Valley Area are unable to property depict the depressional wetland features due to the limitations of traditional photogrametric methods. This threshold also affects the mapping of the site micro-topography. Small ridges and hummocks determine micro-scale surface water flow across the site are unable to be properly mapped with this method.

The second limitation of traditionally derived topography for this study is the deficiency of elevation information between contours. Most topographic datasets provide spot elevations spaced at regular or irregular intervals across a site. They tend to be spaced in intervals much larger than the size of the depressional features and micro-topography of interest. Like the aforementioned vertical feature tolerance for contours, not all features of interest are depicted in the topographic model of the site.

The final limitation of traditionally derived topographic contours concerns their aesthetically pleasing nature. Because traditional topo is developed with the intent of being read by surveyors, engineers and architects, many topographic features are omitted from the contours in an effort to keep them simple to read and pleasing to use. For example, a traditional photogrametric approach to mapping a drainage feature creates smooth and regular contours, providing an easy to read and straightforward to visualize depiction of the drainage. In contrast, the actual drainage may contain topography greater than one foot in elevation (e.g., rocks, ponds, and other features). Small topographic features may be omitted from the final topographic data to make it more usable, but the removal of these features decreases the utility of the contours for micro-scale hydrologic modeling. The limitations of traditionally derived topo do not allow for the detailed evaluation of seasonal wetlands, vernal pools, and their micro-watersheds.

The LIDAR based model

Due to the limitations of traditionally derived topographic contours, an alternative higher density source of topography was required for the present analysis. Airborne LIDAR was selected as the topographic data collection method of choice for this study. LIDAR, an acronym for Light-Imaging Detection And Ranging, also known as ALSM (Airborne Laser Swath Mapping) or Laser Altimetry or LADAR (Laser Detection and Ranging) is an optical remote sensing technology that measures properties of scattered light to find range and/or other information of a distant target. LIDAR system components include a high precision survey GPS (Global Positioning System) unit, an IMS (Inertial Measurement System), and a laser (usually in the 600-1500 nanometer range.)

The LIDAR system is mounted in an aircraft which flies transects across a project site. While in flight, the laser sweeps across the site sending pulses of light to the ground, and records the time it takes for those pulses to return to the aircraft. Meanwhile, the GPS unit records the precise location of the laser and the IMS measures the pitch, roll and yaw of the aircraft. At the hanger, this information is loaded into a computer and the data are processed to provide locations and elevations for all spots from which the laser received reflected pulses. These locations, or returns, are then filtered to remove

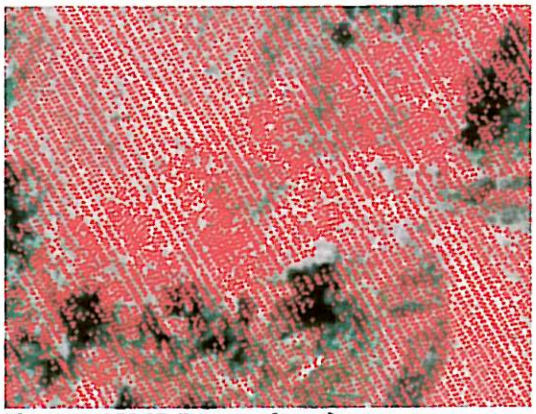


Figure 1. LIDAR Returns (x,y,z)

x,y,z values depicting trees, buildings and other non-ground features. This 'bare earth' dataset is then distributed for use. An example of these filtered spot elevations (in red) can be seen in Figure 1, where pulses reflected from tree canopy (dark green) have been removed.

The LIDAR derived Bare Earth measurements represent a different method for depicting the ground surface than traditional topographic contours. Depending on the sensor and the altitude of the flight, LIDAR returns can achieve vertically precision of up to +/-3 inches relative to each other. This allows LIDAR data to accurately represent the physical characteristics of depressional wetland features. The data primarily rely on the massive number of spot elevations recorded by the sensor to depict topography. The data record a nearly continuous field of elevation values across the site, allowing for the mapping of mirco-scale features which otherwise are not detected by traditional topo. Figure 2 depicts the density of point elevations around vernal pools. Contour lines can be generated from the Bare Earth dataset, but because the LIDAR sensor captures all ground features, the contours are not as pleasing to the eye. Therefore, contour lines resulting from LIDAR represent a more precise model of the earth for the purposes of micro-scale modeling.

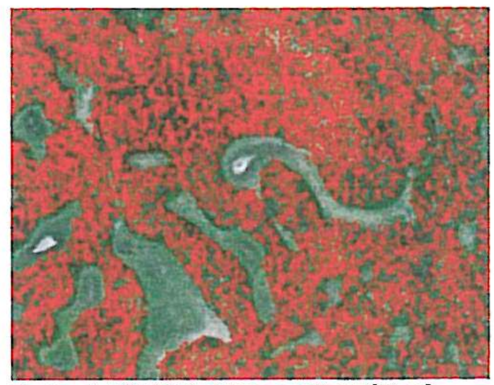


Figure 2. LIDAR Returns on Vernal Pool Grassland Landscape

Project LIDAR Topographic Model

The LIDAR based aerial survey of the Site was conducted by Airborne1 in April 2007 using a Partnavia fixed wing aircraft equipped with an Optech 2050 LIDAR system. Transects of the site were flow at an Altitude of 4500ft with the sensor operating 50,000 pulses/second at a scan angle of 18º and a scan frequency of 30 Hz. The resulting recoded data have an average point spacing of 2ft, and a vertical RMSE of 7 inches, well within the accuracy and parameters required for mapping depressional wetland features.

Once the Bare Earth LIDAR topography was delivered to ECORP Consulting it was loaded into a GIS (Geographic Information System), so that the 15 million data points (x,y,z spot heights with an average ground distance of two feet,) could be analyzed, interpreted and checked for quality. All spot heights were loaded into an ESRI (Environmental Research Institute) File Geodatabase, and converted into a continuous field raster based DEM (Digital Elevation Model) in the ESRI GRID format. The GRID format is the standard structure used for most topographic modeling within a GIS. Converting the data to a GRID normalizes the data point spacing and greatly increases the speed as which the data can be interpreted and analyzed. Creating a DEM allows for the use of GRID based modeling tools that have been developed, peer reviewed and are considered industry standard for many applications.

The resultant dataset depicts the sites physical characteristics and allows for a visual assessment of the site, as well as the measurement of quantitative parameters. Figure 3 depicts a shaded relief model of the DEM, where purple line represents the Site boundary.

Figure 3. Shaded Relief Model

This representation of the topographic model clearly shows the location of various topographic features within the Site boundary, including an existing road running east-west along the northern boundary of the preserve. Remnant features created by past farming can be seen in the form of striations paralleling the drainages, indicating that this area was once used for active farming. Also, the pattern of these remnant features indicate that the original farming practices did not include tilling the depressional wetlands.

After the shaded model of the DEM was computed a curvature model of the Site was created. The curvature model, shown in Figure 4, quantitatively measures the convexity or concavity of each cell within the DEM, establishing the relief of the terrain and quickly identifying depressions on the landscape. The model represents a combination of the slope and aspect values for the site, and provides a visual representation of the site that can be quickly checked against field collected data.

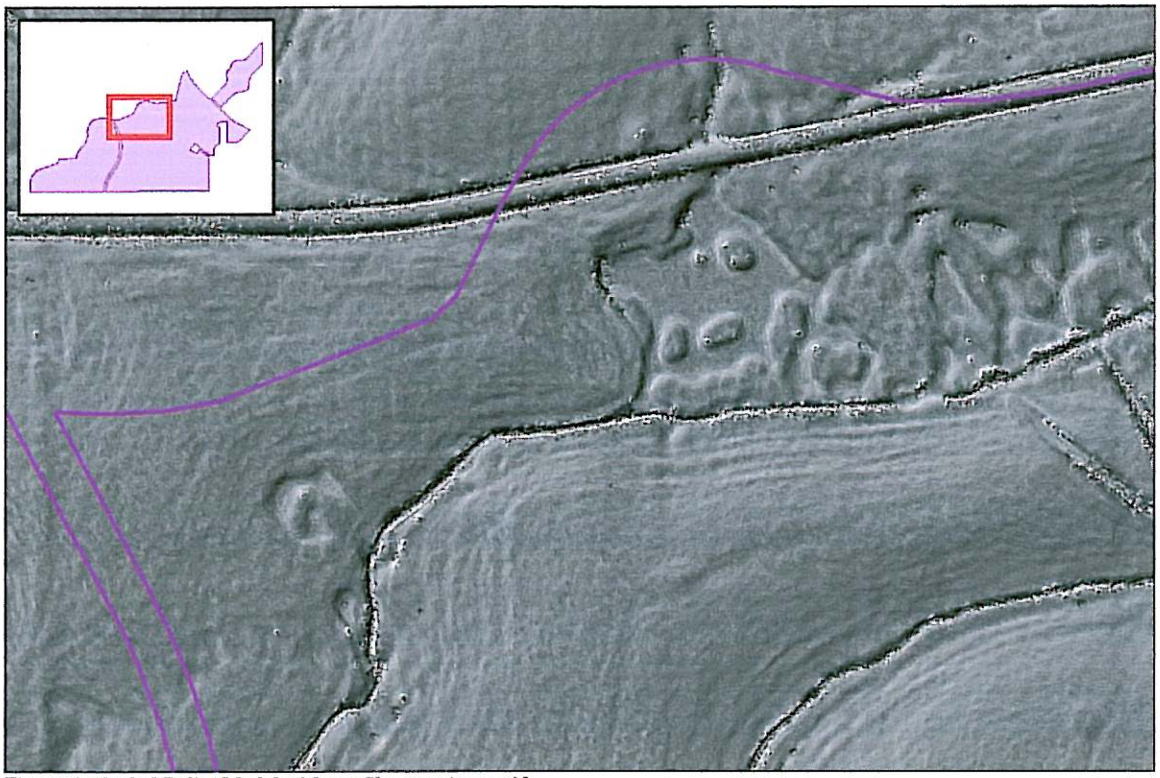


Figure 4. Shaded Relief Model with profile curvature grid

Overlaying the depressional wetlands from the wetland delineation on top of the shaded elevation curvature model provides additional indication of the accuracy of the LIDAR topographic survey. A graphic depiction of this overlay can be seen in Figure 5. The boundaries of the depressional wetlands match the locations computed by the model, suggesting that the LIDAR survey is sufficient for mapping the micro topography of the site. Once the LIDAR survey was checked against the field collected data the hydrologic model could be created.

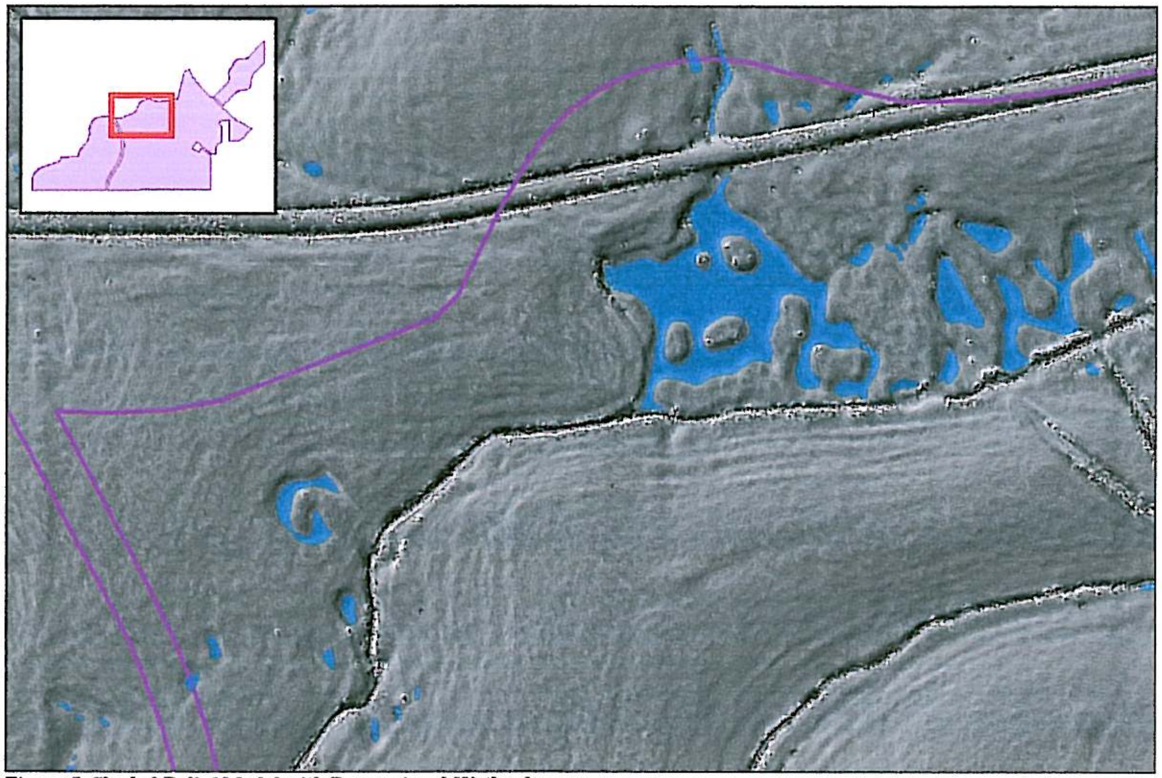


Figure 5. Shaded Relief Model with Depressional Wetlands

Hydrologic Model

Site surface hydrology was evaluated and characterized using the hydrology tool package available in ESRI's ArcInfo. The tool set allows for the preparation of a hydrologically correct DEM that can be used to define the characteristics of a project site, including potential surface water conveyance pathways, watershed boundaries and water feature connectivity. The process involves creating a DEM, measuring the change in elevation to determine the flow direction of water that falls onto any cell within the elevation grid, and determining the accumulated upstream watershed for any depressional water feature within the model.

The primary challenge of modeling a site containing depressional wetland features is that the majority of hydrologic modeling tools have been designed for flow-through hydraulic systems. The models require water that enters the system must eventually exit the system in order to evaluate site characteristics. In order to model a vernal pool grassland landscape it is necessary to be able to describe the site with existing depressions. It is then imperative to evaluate the process that allows depressional wetlands to fill before reaching their maximum volume, and finally to be able to model the site as a flow through system once the pools have reached their maximum capacity. Before the pools fill for the season they act as sinks on the landscape, storing surface water and keeping it from flowing out of the system. Once they are full it becomes a flow through system, where water that falls up watershed makes its way down through the system via a flowpath nework that includes both riverine and depressional wetlands.

The description of the depressional hydrologic system is achieved by using a flow masking technique. The flow masking technique allows the modeler to treat the edges of the depressional wetlands like a hydrologic sink. This method assumes that water that enters the wetland never exits the wetland. By defining the limits of the wetlands as a sink the hydrologic tools used to identify the upper limits of a rivers watershed can be applied. This allows the automation of the calculation of the watershed for each individual depressional wetland. This method for establishing the watersheds of each depressional wetland works well because it establishes the outer boundary of the area that drains into each wetland and tabulates the total water contribution of both surface sheet flow and flow from swales and other riverine features. It also allows the storage of the wetlands and their corresponding watersheds' physical characteristics within a database for later analysis. Once the watersheds have been computed for each wetland, the sink based, masked flow model can be reevaluated and run as a flow through model. The flow through model can then be used to create a flowpath network, which allows for additional parameterizing and characterizing of the system.

Project Hydrologic Model

The hydrologic model for the project was computed from a combination of field collected wetland data and the DEM created from the LIDAR based topography. The model was generated by creating a hydrologically correct DEM using the field collected depressional wetland boundaries as a mask. Flow direction was computed allowing the creation of an accumulated flow GRID. Each cell in this dataset contains the value of the total aggregated upstream area. Cells with higher values have larger watersheds and are more likely to represent drainage features, while cells with lower values have smaller watershed areas. Most importantly cells with a value of 0 represent the upper hydrologic boundary of at least one depressional wetland feature. These values are aggregated and converted to flow paths and watershed boundaries, depicted in yellow and red Figure 6. Once the watershed boundaries were created the spatial distribution was computed for each wetland feature and its corresponding micro-watershed.

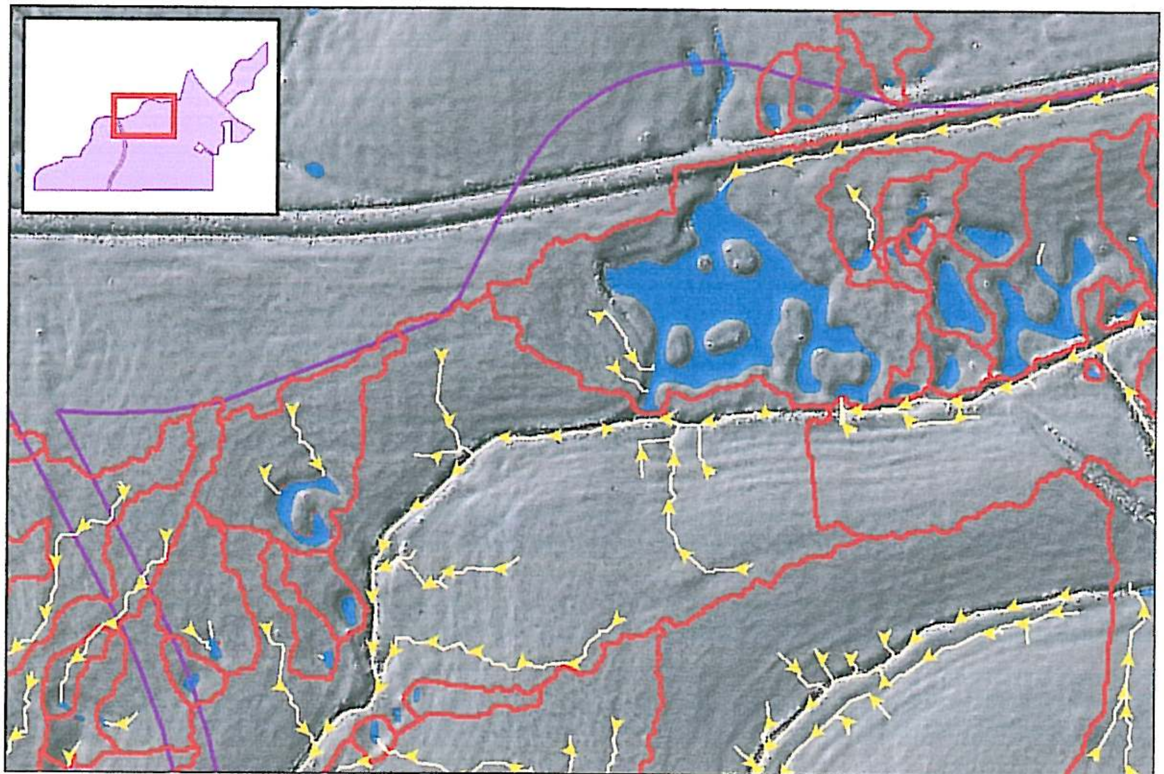


Figure 6. Shaded Relief Model with flowpaths and watershed boundaries

Spatial Analysis

A sub-data set was generated that compiled the area (size) of each wetland feature and its corresponding micro-watershed. ECORP's fluvial geomorphologist then evaluated the distribution of the data to determine appropriate wetland size classes for subsequent evaluation. Each wetland size class was then analyzed to determine the minimum watershed area to sustain current runoff inundation levels. Each wetland size class was further evaluated to determine the watershed/wetland ratio (WWR). The WWRs were then statistically analyzed to determine the mean WWR for each wetland size class. The overall analysis consisted of the following steps.

1. Sort the existing wetland data set based on wetland area
    a. Using Flownet analysis tools within GIS the LiDAR data were coupled with the wetland delineation to determine the number, type, and acreage of each wetland feature and its corresponding watershed area.
2. Determine the appropriate wetland size classes
    a. The wetland data set was stratified based on discrete size classes. Twelve size classes were defined for the Rio del Oro site based on wetland acreages.
3. Determine the minimum watershed area for each wetland size class
    a. The smallest watershed area within each wetland size class represents the minimum watershed area require to sustain wetlands within the size class.
4. Determine the WWR for each wetland within each wetland size class based on the minimum watershed acreage.

   a. The WWR was determined for each wetland with each wetland size class by dividing the minimum watershed acreage for each wetland size class by the acreage of each individual wetland.
5. Determine the mean WWR for each wetland size class.
   a. WWR results from individual wetland size classes were statistically analyzed to determine the minimum, maximum, mean, variance, standard deviation, and 95 % confidence interval (CI).
6. Determine the watershed area required for each wetland within each wetland size class based on the mean WWR for each wetland size class.
   a. The watershed area for each wetland within each wetland size class was determined by multiplying the wetland area by the mean WWR.
7. Adjust the area of the existing wetland watersheds to correspond with the watershed area determined through the GIS and statistical analysis.
   a. Each wetland watershed area was adjusted to correspond to the value determined by the mean WWR (step 6 above).
8. Determine potential impacts to existing wetlands due to preserve configuration.
   a. The impacts to each wetland were determined utilizing the WWR value for each wetland size class.
9. Determine the total watershed area required for current wetlands within the Rio del Oro preserve.
   a. The adjusted wetland watershed sizes were summed to determine the total area within the Rio del Oro preserve necessary to sustain the current hydrologic functions of the wetlands within the preserve.
10. Determine the potential indirect impacts due to the construction of the proposed road through the Rio del Oro preserve.

Results and Discussion

In order to determine the appropriateness of utilizing the Rio del Oro preserve as a suitable site for the construction of mitigation wetlands, a series of analyses were conducted. These analyses looked at the size of the proposed preserve, the amount of watershed area required to support the existing wetlands within the preserve, the potential impacts due to the construction of Rancho Cordova Parkway through the preserve, the required acreages of mitigation wetlands to be constructed within the preserve, and the watershed area necessary to support the hydrologic function of each mitigation wetland. The process and justification for each step will be discussed individually.

Watershed Area Required to Support Existing Wetlands

The analysis combined data collected from the wetland delineation with the LiDAR data. The wetland delineation provided the aerial extent of the existing wetlands in accordance with the verified wetland delineation. LiDAR data allowed for the development of high resolution topography. This analysis utilized the LiDAR data to construct a topographic map with a 0.5-ft contour interval. The 0.5-ft contour interval allowed the GIS software to delineate micro-watersheds for each individual wetland within the project site.

GIS tools tabulated the number of wetlands within the site, type of each wetland, size of each wetland, and the size of the corresponding micro-watershed for each wetland. Wetland data were sorted by type and then size (area). The data were further stratified based on wetland size classes. Size classes were based on appropriate size classes and natural breaks in the data. Analysis of the data yielded 14 wetland size classes, 12 for vernal pools and 2 for seasonal wetlands (Table 1.0).

Wetlands within each wetland size class were sorted based on the size of the wetland watershed (micro-watershed). The smallest watershed within each wetland size class represents the minimum watershed area required to support hydrologic function of wetlands within the size class. The minimum watershed size was then used to determine the amount of watershed area needed to support each wetland with the size class. This was accomplished by dividing the minimum watershed value for each wetland size class by the size of the wetland to determine the watershed-to-wetland ratio (WWR). The WWR values for each wetland size class were then statistically analyzed to determine the mean watershed size required to sustain wetlands within each size class. This analysis was determined at the 95 % confidence interval (CI).

Table 1.0. Wetland size class distribution for Rio del Oro project site with associated mean watershed/wetland ration (WWR) at the 95 % CI.

Wetland Type	Wetland Size Class (acres)	Mean Watershed Size Required per Acre of Wetland	Sample Size
Vernal Pool	0.004 – 0.01	1.829, +/- 0.201	19
	0.011 - 0.02	2.855, +/- 0.142	68
	0.021 - 0.03	1.829, +/- 0.059	54
	0.031 - 0.04	3.557, +/- 0.085	38
	0.041 - 0.05	2.173, +/- 0.056	28
	0.051 - 0.06	2.270, +/- 0.064	15
	0.061 - 0.07	4.387, +/- 0.100	16
	0.08 – 0.10	2.911, +/- 0.164	17
	0.11 – 0.20	3.781, +/- 0.487	14
	0.21 – 0.37	2.016, +/- 0.261	12
	0.47 – 0.81	3.172, +/- 0.482	8
	1.40 – 2.60	5.598, +/- 1.408	6
Seasonal Wetland	0.01 – 0.05	2.194, +/- 1.020	8
	0.10 – 0.55	5.147, +/- 2.463	6

Impacts to Existing Wetlands Due to Preserve Boundary

All wetlands directly impacted by the proposed Rio del Oro preserve boundary are included in the mitigation wetland total. The proposed preserve boundary indirectly impacts the watersheds of sixty (60) wetlands[1]. The analysis indicates that the loss of watershed area due to the preserve boundary will impact the hydrologic functions of of one existing wetland (XVP-633). Upon further investigation the proposed preserve boundary conserves almost 100 % of the original watershed area (Table 2.0). Wetland XVP-633 falls into the largest vernal pool wetland size class (1.40 – 2.60). this size class has a WWR of 5.598 +/- 1.408. Wetland XVP-633 has a wetland area of 2.05 acres with an actual WWR of 4.74, which is greater then the 95 % CI WWR of 4.19. The WWR for the remaining fifty-nine (59) wetlands are all greater than the required WWR indicating the proposed Rio del Oro preserve boundary will not negatively impact the hydrologic function of these wetlands.

Table 2.0. Impact totals for wetland XVP-633.

Wetland ID	Wetland Acreage	Original Watershed Acreage	Truncated Watershed Acreage	Percent Watershed Preserved
XVP-633	2.047	9.698	9.625	99.25 %

Impacts due to Rancho Cordova Parkway

The proposed road (Rancho Cordova Parkway) through the Rio del Oro preserve impacts a total of fourteen wetlands. Because the proposed road follows a local ridge (topographic high) through the preserve, direct impacts are limited to one wetland (XVP-329). This wetland impact is part of the project mitigation. The indirect impacts to the remaining thirteen (13) wetlands are minimal and do not negatively impact the hydrologic functions of the wetlands. The WWR for the thirteen (13) wetlands are all greater than the required WWR for each wetland indirectly impacted by the proposed road (Table 3.0).

Table 3.0. Change in watershed/wetland ratio (WWR) to wetlands indirectly impacted by Rancho Cordova Parkway.

Wetland ID #	Wetland Acreage	Original WWR	Final WWR	Required WWR
XVP-267	1.3285	8.659	7.653	5.598
XVP-334	0.0039	130.773	128.77	1.829
XVP-341	0.0051	172.522	70.560	1.829
XVP-345	0.0052	120.236	108.067	1.892
XVP-347	0.0200	137.948	88.363	2.855
XVP-354	0.0306	133.531	46.345	3.557
XVP-605	0.0182	13.945	5.389	2.855
XVP-606	0.0193	55.581	52.369	2.855
XVP-610	0.0188	81.997	77.436	2.855
XVP-613	0.1677	15.400	8.900	3.781
XVP-623	0.0692	63.710	42.906	4.387
XVP-629	0.5770	20.007	9.482	3.172

[1] See Attachment A for a full-site image of all impacts due to the proposed preserve boundary.

For example, Figure 7[2] illustrates how wetlands XVP-354 and XVP-629 are both indirectly impacted by the proposed Rancho Cordova Road[1]. XVP-354 has a vernal pool area of 0.031 acres with an original watershed size of 4.08 acres. XVP-354 will lose 2.64 total acres from its watershed. Of this 1.66 acres are directly from the road and 0.97 acres are the upland area separated by the construction of the road. XVP-629 has a vernal pool area of 0.58 acres with an original watershed size of 10.80 acres. XVP-629 will lose 5.50 total acres from its watershed. Of this 3.44 acres are directly from the road and 2.06 acres are the upland area separated by the construction of the road.

Total watershed area removed from wetland 354: [.097 ac + 1.66 ac] = 1.76 ac
Total watershed area removed from wetland 629: [2.06 ac + 3.44 ac] = 5.50 ac

The wetland size class for vernal pool XVP-354 (0.03 – 0.039 acres) has a WWR of 2.919. Using this ratio indicates that 0.09 acres of watershed are required for the 0.03 acre vernal pool. The wetland size class for vernal pool XVP-629 (0.47 – 0.81 acres) has a WWR of 3.339. Using this WWR indicates that 1.93 acres of watershed are required for the 0.58 acre vernal pool.

Watershed area required for XVP-354: [2.919 ac wetland x 0.03 WWR] = 0.09 ac watershed
Watershed area required for XVP-629: [3.339 ac wetland x 0.58 WWR] = 1.93 ac watershed

The remaining watershed area for wetlands XVP-345 and XVP-629 are 1.45 acres and 5.30 acres respectively. These are 1.36 and 3.37 acres greater than the required watershed size (Table 4.0) for the respective wetlands. This illustrates how the proposed Rancho Cordova Parkway through the Rio del Oro preserve will not negatively impact the watersheds of these vernal pools or their hydrologic function.

Table 4.0. Impacts to vernal pools due to Rancho Cordova Parkway.

Wetland ID	Original Wetland Size (ac)	Truncated Watershed Size (ac)	Watershed/ Wetland Ratio	Required Watershed Size (ac)	Watershed Size Difference (ac)
354	0.03	1.45	2.919	0.09	+ 1.36
629	0.58	5.30	3.339	1.93	+ 3.37

Suitability of Preserve for Construction of Mitigation Wetlands

To determine the feasibility of constructing mitigation wetlands within the Rio del Oro preserve boundary the WWRs for the current wetlands within the preserve were calculated. The current mitigation preserve area is 510 acres with 28.85 acres of vernal pools and waters of the US. The greatest WWR calculated for existing wetland size classes within the Rio del Oro project site is 5.598, +/- 1.408. This means that 5.598 acres of watershed are required for every 1.0 acre of wetland. Using the conservative

[2] See attachment B for a full-site image of the road impacts.

WWR value of 7.01 (5.598 + 1.408) acres with the present wetland total within the preserve of 28.85 yields a total watershed size of 202.24 acres.

[28.85 wetlands acres x 7.01 WWR] = 202.24 ac of watershed

The Rio del Oro preserve is 510 acres in area. Removing the 28.85 acres of wetlands and waters of the US from the total preserve area results in 481.15 acres of watershed area. The construction of Rancho Cordova Parkway within the proposed Rio del Oro preserve will eliminate an additional 30.33 acres leaving 450.82 acres. Existing wetlands within the Rio del Oro preserve require 202.24 acres of watershed, leaving a total of 248.58 acres for the construction of mitigation wetlands and their required watersheds within the Rio del Oro preserve. Elliot Homes Inc. and GenCorp Real Estate propose to build 13.449 acres of mitigation wetlands within the Rio del Oro preserve[3]. Using the conservative WWR of 7.01 acres indicates a total of 94.28 acres of watershed are required to support the hydrologic function of 13.449 acres of mitigation wetlands within the proposed Rio del Oro preserve. This is 154.30 acres less than the available 248.58 acres and represents less than half (37.92%) of the available area within the proposed Rio del Oro preserve for the construction of mitigation wetlands.

Acres of watershed required to support the construction of 13.45 acres of mitigation wetlands: [13.45 wetland acres x 7.01 WWR] = 94.28 acres watershed

Conclusions

The proposed Rio del Oro preserve is 510 acres in size. LiDAR and flow analysis of the preserve indicate that 202.24 acres are required to sustain the hydrologic function of the existing wetlands. Elliot Homes Inc. and GenCorp Real Estate propose to build an additional 13.449 acres of mitigation wetlands within the proposed Rio del Oro preserve. The proposed mitigation acreages will only require less than fifty percent of the available watershed area within the preserve for the construction of mitigation wetlands. This analysis indicates that the proposed Rio del Oro preserve can support the construction of an additional 13.449 acres of mitigation wetlands without negatively impacting the hydrologic function of the 28.85 acres of existing wetlands within the proposed Rio del Oro preserve.

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[3] See attachment C for a full-site layout of the proposed mitigation wetlands.

Location: J:\GIS_Maps\2002-009_Rio_Del_Oro\H20_MODEL\LIDAR\EIR_Inset_Graphics\SubshedBoundaries.mxd

Attachment A. Proposed Mitigation Preserve with Existing Wetlands, Watersheds and Flow Paths

2002-009 Rio del Oro

ECORP Consulting, Inc.
ENVIRONMENTAL CONSULTANTS

Location: J:\GIS_Maps\2002-009_Rio_Del_Oro\H20_MODEL\LIDAR\EIR_Inset_Graphics\RoadImpacts.mxd

Attachment B. Rancho Cordova Parkway - Affects on Watersheds

2002-009 Rio del Oro

ECORP Consulting, Inc.
ENVIRONMENTAL CONSULTANTS

J:\GIS_Maps\2002-009_Rio_Del_Oro\H20_MODEL\LIDAR\EIR_Inset_Graphics\PostConstructionSheds_v2(2009-06-08).mxd

Attachment C. Proposed Mitigation Preserve with Existing and Proposed Compensatory Wetlands and Watersheds

2002-009 Rio del Oro

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ATTACHMENT C

Rio Del Oro Monitored Vernal Pool Locations

Location: J:\GIS_Maps\2002-009_Rio_Del_Oro\WetlandMitigation\Onsite\Monitoring_Pool_Selection\Monitoring_Pool_Detail_DRAFT_2009-06-02_ANSI-D.mxd

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Rio del Oro Monitored Vernal Pool Locations

2002-009 Rio del Oro

ECORP Consulting, Inc.
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ATTACHMENT D

Rio Del Oro Vernal Pool Monitoring Schedule – Years 1-10

Attachment D - Rio Del Oro Vernal Pool Monitoring Schedule - Years 1-5

VERNAL POOLS	Hydrology	Invertebrates	Vegetation	Photo Documentation	General Preserve Monitoring
First Year	Yes - All of the Constructed Pools qualitatively monitored by an experienced biologist.	Yes - All 30 selected Constructed Pools and all 30 selected Nearest Neighbor pools will be sampled twice for vernal pool branchiopods. All 30 selected Reference Pools will also be monitored to provide comparison data for the Constructed Pools.	Yes - All Constructed Pools qualitatively monitored by an experienced biologist/botanist.	Yes - Aerial Photos and on-site photo points	Yes - Meet with grazing contractor
Second Year	Yes - All of the Constructed Pools qualitatively monitored by an experienced biologist.	Yes - All 30 selected Constructed Pools and all 30 selected Nearest Neighbor pools will be sampled twice for vernal pool branchiopods. All 30 selected Reference Pools will also be monitored to provide comparison data for the Constructed Pools.	Yes - All Constructed Pools qualitatively monitored by an experienced biologist/botanist.	Yes - Aerial Photos and on-site photo points	Yes - Meet with grazing contractor
Third Year	Qualitative hydrology monitoring will be conducted for all vernal pools found to underperform in Years 1 and 2. Pools that appear to be functioning poorly will be considered for remediation. Remediation, if implemented, will occur during summer of the third year following qualitative floristic monitoring.	Yes - All 30 selected Constructed Pools and all 30 selected Nearest Neighbor pools will be sampled twice for vernal pool branchiopods. All 30 selected Reference Pools will also be monitored to provide comparison data for the Constructed Pools.	Qualitative floristic monitoring will be conducted for all vernal pools found to underperform in Years 1 and 2. Pools that appear to be functioning poorly will be considered for remediation. Remediation, if implemented, will occur during summer of the third year.	Yes - Aerial Photos and on-site photo points	Yes - Meet with grazing contractor
Fourth Year	None	None	None	Yes - Aerial Photos and on-site photo points	Yes - Meet with grazing contractor
Fifth Year	Yes - All 30 selected Constructed Pools and all 30 Nearest Neighbor pools will be hydrologically monitored for depth and ponding duration. All 30 selected Reference Pools will also be monitored to provide comparison data for the Constructed Pools.	Yes - All 30 selected Constructed Pools and all 30 selected Nearest Neighbor pools will be sampled twice for vernal pool branchiopods. All 30 selected Reference Pools will also be monitored to provide comparison data for the Constructed Pools.	Yes - All 30 selected Constructed Pools and all 30 Nearest Neighbor Pools will be qualitatively monitored for vernal pool floristics. All 30 selected Reference Pools will also be monitored to provide comparison data for the Constructed Pools. If all 30 Constructed Pools meet all success criteria, no further monitoring is required until Year 10.	Yes - Aerial Photos and on-site photo points	Yes - Meet with grazing contractor

Attachment D - Rio Del Oro Vernal Pool Monitoring Schedule - Years 6-10

VERNAL POOLS	Hydrology	Invertebrates	Vegetation	Photo Documentation	General Preserve Monitoring
Sixth Year	None	None	None	Yes - Aerial Photos and on-site photo points	Yes - Meet with grazing contractor
Seventh Year	Yes - All 30 selected Constructed Pools and all 30 Nearest Neighbor Pools will be hydrologically monitored for depth and ponding duration. All 30 selected Reference Pools will also be monitored to provide comparison data for the Constructed Pools.	Yes - All 30 selected Constructed Pools and all 30 selected Nearest Neighbor Pools will be sampled twice for vernal pool branchiopods. All 30 selected Reference Pools will also be monitored to provide comparison data for the Constructed Pools.	None	Yes - Aerial Photos and on-site photo points	Yes - Meet with grazing contractor
Eighth Year	Yes - All 30 selected Constructed Pools and all 30 Nearest Neighbor Pools will be hydrologically monitored for depth and ponding duration. All 30 selected Reference Pools will also be monitored to provide comparison data for the Constructed Pools.	None	Yes - All Constructed Pools that do not meet the hydrology and vegetation success criteria in the Year 5 will be qualitatively monitored for vernal pool floristics. All 30 selected Reference Pools will also be monitored to provide comparison data for the Constructed Pools.	Yes - Aerial Photos and on-site photo points	Yes - Meet with grazing contractor
Ninth Year	None	None	Yes - All Constructed Pools that do not meet the hydrology and vegetation success criteria in the Year 8 will be monitored for vernal pool vegetation. All 30 selected Reference Pools will also be monitored to provide comparison data for the Constructed Pools.	Yes - Aerial Photos and on-site photo points	Yes - Meet with grazing contractor
Tenth Year	Yes - All 30 selected Constructed Pools and all 30 Nearest Neighbor Pools will be hydrologically monitored for depth and ponding duration. All 30 selected Reference Pools will also be monitored to provide comparison data for the Constructed Pools.	Yes - All 30 selected Constructed Pools and all 30 selected Nearest Neighbor Pools will be sampled twice for vernal pool branchiopods. All 30 selected Reference Pools will also be monitored to provide comparison data for the Constructed Pools.	Yes - All 30 selected Constructed Pools and all 30 Nearest Neighbor pools will be monitored for vernal pool vegetation. All 30 selected Reference Pools will also be monitored to provide comparison data for the Constructed Pools.	Yes - Aerial Photos and on-site photo points	Yes - Meet with grazing contractor

ATTACHMENT E

Example of Vernal Pool Floristic Monitoring Data Sheet

ECORP Consulting, Inc.

VERNAL POOL MONITORING DATA SHEET

Wetland No.: ____________________ Date: ____________________ ***% Aerial Cover*** ~ Veg: __________
Location: ____________________ Biologist(s): ____________________ Bare Ground: __________
( ) Constructed ( ) Neighbor ( ) Reference ( ) Trash ( ) Erosion ( ) Tire Marks Rocks: __________
Overall Habitat Function: ( ) Excellent ( ) Good ( ) Fair ( ) Poor ( ) Unknown Plant Litter: __________
Other (specify) __________: __________
TOTAL: ***100%***

% ABSOLUTE COVER: PLANTS OBSERVED

______	Achyrachaena mollis	______	Geranium spp.	______	Plantago elongata
______	Aira caryophyllea	______	Glyceria declinata	______	Plantago erecta
______	Alisma plantago-aquatica	______	Glyceria occidentalis	______	Plantago lanceolata
______	Alopecurus saccatus	______	Gnaphalium palustre	______	Plantago spp.
______	Ammannia coccinea	______	Gnaphalium spp.	______	Poa annua
______	Amsinckia spp.	______	**Gratiola ebracteata**	______	Pogogyne douglasii
______	Anagallis arvensis	______	Gratiola heterosepala	______	Pogogyne zizyphoroides
______	Anthemis cotula	______	Hemizonia fitchii	______	Polygonum arenastrum
______	Avena barbata	______	Holocarpha virgata	______	Polygonum lapathifolium
______	Avena fatua	______	Hordeum brachyantherum	______	Polygonum punctatum
______	Blennosperma nanum	______	**Hordeum marinum**	______	Polygonum spp.
______	Brassica nigra	______	Hordeum murinum	______	**Polypogon monspeliensis**
______	Briza minor	______	**Hypochaeris glabra**	______	Populus fremontii
______	Brodiaea spp.	______	Isoetes howellii	______	**Psilocarphus brevissimus**
______	Bromus diandrus	______	Isoetes nuttallii	______	Psilocarphus oregonus
______	Bromus hordeaceus	______	Isoetes orcuttii	______	Psilocarphus tenellus
______	Calandria ciliata	______	Isoetes spp.	______	Raphanus ssp.
______	Callitriche heterophylla	______	Juncus balticus	______	Ranunculus aquatilis
______	**Callitriche marginata**	______	Juncus bufonius	______	**Ranunculus bonariensis**
______	Capsella bursa-pastoris	______	Juncus capitatus	______	Ranunculus muricatus
______	Cardamine oligosperma	______	Juncus uncialis	______	Rumex conglorematus
______	Carex spp.	______	Juncus xiphiodies	______	Rumex crispus
______	Castilleja attenuata	______	Juncus spp.	______	Rumex pulcher
______	Castilleja campestris	______	Lactuca serriola	______	Senecio vulgaris
______	Castilleja exserta	______	**Lasthenia fremontii**	______	Sidalcea calycosa
______	Centaurea solstitialis	______	**Lasthenia glaberrima**	______	Sidalcea malvaeflora
______	Centaurium muehlenbergii	______	Layia fremontii	______	Sonchus asper
______	**Centunculus minimus**	______	Lathyrus hirsutus	______	Sonchus oleraceus
______	Cerastium glomeratum	______	Legenere limosa	______	Spergula arvensis
______	Chamomilla suaveolens	______	Lepidium latipes	______	Spergularia ruba
______	Cicendia quadrangularis	______	**Leontodon taraxicoides**	______	Stellaria media
______	Convolvulus arvensis	______	Lepidium latifolium	______	Taeniatherum caput-medusae
______	Cotula coronopifolia	______	Lepidium nitidum	______	Trichostema lanceolatum
______	**Crassula aquatica**	______	**Lilaea scilloides**	______	Trifolium depauperatum
______	Crypsis schoenoides	______	Limnanthes alba	______	**Trifolium dubium**
______	Cuscuta howelliana	______	Limnanthes douglasii	______	Trifolium fucatum
______	Cynodon dactylon	______	Limosella acaulis	______	Trifolium glomeratum
______	Cynosurus echinatus	______	**Lolium multiflorum**	______	Trifolium hirtum
______	Cyperus spp.	______	Lolium perenne	______	Trifolium subterraneum
______	**Deschampsia danthonioides**	______	Lotus corniculatus	______	Trifolium variegatum
______	Downingia bicornuta	______	Lotus purshianus	______	Trifolium willdenovii
______	Downingia cuspidata	______	Lupinus bicolor	______	Trifolium spp.
______	Downingia ornatissima	______	Ludwigia peploides	______	Triphysaria eriantha
______	Downingia pusilla	______	Lythrum hyssopifolium	______	Triphysaria versicolor
______	Downingia spp.	______	Marsilea vestita	______	Triteleia hyacinthina
______	Echinochloa crus-galli	______	Medicago polymorpha	______	Typha spp.
______	**Elatine spp.**	______	Mentha pulegium	______	Verbena bonariensis
______	Eleocharis acicularis	______	Mentha spp.	______	Veronica anagalis-aquatica
______	**Eleocharis macrostachya**	______	Microseris spp.	______	Veronica peregrina
______	Epilobium brachycarpum	______	Mimulus guttatus	______	Vicia sativa
______	Epilobium ciliatum	______	Mimulus tricolor	______	Vicia villosa
______	Epilobium cleistogamum	______	Montia fontana	______	Vicia spp.
______	Epilobium densiflorum	______	Navarretia intertexta	______	Vulpia bromoides
______	Epilobium pygmaeum	______	**Navarretia leucocephala**	______	Vulpia microstachys
______	Epilobium spp.	______	Paspalum dilatatum	______	Vulpia myuros
______	Eremocarpus setigerus	______	Paspalum distichum	______	Vulpia spp.
______	Erodium botrys	______	Phalaris lemmonii	______	Xanthium strumarium
______	Erodium cicutarium	______	Phalaris spp.	______	______________
______	Erodium moschatum	______	Phyla nodiflora	______	______________
______	Erodium spp.	______	Picris echioides	______	______________
______	**Eryngium vaseyi**	______	Pilularia americana	______	______________
______	Eschscholzia californica	______	Plagiobothrys greenei	______	______________
______	Eschscholzia lobbii	______	Plagiobothrys nothofulvus	______	______________
______	Filago gallica	______	**Plagiobothrys stipitatus**	______	______________
______	Geranium dissectum	______	Plagiobothrys stipitatus var. micranthus	______	______________
______	Galium spp,	______	Plagiobothrys stipitatus var. stipitatus	______	______________
______	Geranium molle	______	Plantago coronopus	______	______________

NOTES / COMMENTS: ____

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Wetland Mitigation and Monitoring Proposal

For

Rio Del Oro

Sacramento County, California

26 June 2009

Prepared For:
Elliott Homes, Inc.
and
GenCorp Real Estate

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Rio Del Oro Wetland Preserve, Impact and Compensation Plan

ATTACHMENT B

Watershed Analysis of the Hydrologic Function of the Rio Del Oro Preserve for Preservation for Existing Wetlands and Construction of Mitigation Wetlands

ATTACHMENT C

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ATTACHMENT E

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