APPENDIX J

Quino Checkerspot Butterfly Recovery Component

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QUINO CHECKERSPOT BUTTERFLY RECOVERY COMPONENT

Introduction

This appendix to the City of Chula Vista's Multiple Species Conservation Program (MSCP) Subarea Plan presents a comprehensive, unified description of the suite of recovery actions the City intends to undertake in order to assist in the conservation and recovery of the Quino checkerspot butterfly (*Euphydryas editha quino*; QCB). The information contained in this appendix is also summarized, as appropriate, throughout the Subarea Plan.

The actions in this component are based on the recommendations contained in the QCB Draft Recovery Plan (January 2001), prepared by the U.S. Fish and Wildlife Service (USFWS; Service) in consultation with the Recovery Team. The Draft Recovery Plan presents the tasks necessary to ultimately reclassify the QCB to threatened and ensure the species' long-term conservation, based on the best available scientific information and expert opinions. Although this plan has not yet been adopted, it represents the best currently available direction on the actions required for the conservation and recovery of the species.

The City of Chula Vista intends to implement actions that will provide for the long-term conservation and recovery of the QCB. Additionally, these actions are consistent with the Draft Recovery Plan. In summary, the include the following actions: (1) preserve 98 percent of the area within the proposed QCB critical habitat designation; (2) maintain connectivity along key habitat linkages within the City's boundaries; (3) manage the Preserve for the benefit of the QCB (along with other Covered Species); (4) restore/enhance QCB habitat; and (5) minimize project impacts to QCB. This suite of recovery actions provides an extraordinary net biological benefit to the species when weighed against anticipated impacts.

Background Information

This section presents general background information regarding the QCB, which was not a Covered Species under the MSCP Subregional Plan; an explanation of how Chula Vista intends to address the issues raised in this section is provided in subsequent sections of this appendix. This information is largely based on the Draft Recovery Plan, which compiled the best available information about the species at the time of its preparation. The information in the Draft Recovery Plan has been augmented with additional sources and updated information where appropriate. For more detailed information, the reader is referred to the Draft Recovery Plan.

Status

The QCB was federally listed as endangered on January 16, 1997 (62 FR 2313). The best available information indicates that it is highly endangered, as evidenced by the following: it was at such low densities prior to listing that it was thought to possibly be extinct (62 FR 2315), populations have been reduced in number and size by more than 95 percent range-wide, it is known to undergo large population fluctuations related to weather (Murphy and White 1984), and most current populations are threatened by ongoing development and invasion of non-native plant species (USFWS 2001).

Recovery priorities are assigned to species based on degree of threat, recovery potential, taxonomic distinctness and presence of an actual or imminent conflict. This priority, in conjunction with recovery task priorities outlined in the Recovery Plan, is used to guide recovery, which in turn guides the allocation of available recovery funding. The Recovery Priority for the species is 6C, based on its being a subspecies (rather than a full species) with a high degree of threat, a moderate to low potential for recovery, and existing conflict between the species' conservation and development. This Subarea Plan provides the basis for the implementation of the Draft Recovery Plan within the City of Chula Vista Subarea.

Physical Characteristics and Taxonomy

The QCB is the southernmost subspecies of a widely distributed butterfly (*Euphydryas editha*) that ranges from British Columbia to northern Baja California, Mexico (Bauer 1975). The QCB differs from other subspecies of *Euphydryas editha* in a variety of characteristics including size, wing coloration, and larval and pupal phenotype (Mattoni et al. 1997).

The adult QCB has a wingspan of approximately 1.5 inches. The top sides of the wings have a red, black and cream colored checkered pattern; the bottom sides are dominated by red and cream. The abdomen has red stripes across the top. Larvae are black with a row of nine orange tubercles (fleshy/hairy extensions) on their back. Pupae are mottled black on a pale blue-gray background, and extremely cryptic (USFWS 2001).

Distribution and Habitat Considerations

This butterfly was formerly widespread in the coastal plains and inland valleys of southern California, including Los Angeles, Orange, Riverside, San Diego and San Bernardino counties, and northern Baja California, Mexico (Mattoni et al. 1997, USFWS database). As recently as the 1950s, collectors described the QCB as occurring on every coastal bluff, inland mesa top, and lower mountain slope in San Diego County and coastal northern Baja California (USFWS 2001).

Throughout most of southern California, the native habitats of this butterfly have disappeared incrementally as development has progressed and undeveloped areas have been invaded by non-native plant species. More than 75 percent of the QCB's historic range has been lost (Brown 1991, USFWS database), including more than 90 percent of the coastal mesa and bluff distribution. Current information suggests that the butterfly has been extirpated from Los Angeles, Orange and San Bernardino counties (USFWS 2001).

QCB show a preference for relatively open areas with cryptogamic crust and few vascular plants, surrounded by low-growing vegetation (Osborne and Redak 2000). Appropriate generalized habitat types include early and middle successional grasslands, open scrub communities, broken chaparral, and vernal pools (Murphy 1990). Specific habitat patch suitability is determined primarily by larval host plant density, topographic (and associated microclimate) diversity, nectar resource availability and climatic conditions (Singer 1972, Murphy 1982, Weiss et al. 1988, Murphy et al. 1990). Male QCB, and to a lesser extent females, are frequently observed on hilltops and ridgelines, even in the absence of larval host plants (USFWS 2001).

The primary larval host plants are dwarf plantain (*Plantago erecta*) and purple owl's clover (*Castilleja exserta*) (Ehrlich et al. 1975; Mattoni et al. 1997). Egg clusters and/or pre-diapause larvae have also been documented on woolly plantain (*Plantago patagonica*), Bird's beak (*Cordylanthus rigidus*) (USFWS 2001) and white snapdragon (*Antirrhinum coulterianum*).

Euphydryas editha butterflies use a much wider range of plants for adult nectar feeding than for larval foliage feeding. The butterflies frequently take nectar from lomatium (*Lomatium* spp.), goldenstar (*Muilla* spp.), mulfoil or yarrow (*Achillea millefolium*), fiddleneck (*Amsinckia* spp.), goldfields (*Lasthenia* spp.), popcorn flowers (*Plagiobothrys* and *Cryptantha* spp.), gilia (*Gilia* sp.), California buckwheat (*Eriogonum fasciculatum*), onion (*Allium* spp.), and yerba santa (*Eriodictyon* spp.) (USFWS 2001). Other nectaring plants include *Linanthus dianthiflora*, annual *Lotus* spp. (Mattoni et al. 1997) and chia (*Salvia columbariae*) (Orsak 1977).

Southwestern San Diego Region

Within southwestern San Diego County, QCB have been observed north, east and south of Otay Lakes, the southwestern slope of Otay Mountain, on the San Diego National Wildlife Refuge northeast of Sweetwater Reservoir, along the mesa rim above the Otay River and at the Salt Creek confluence (USFWS 2001). The Otay Lakes area historically supported a large population that extended south to Otay Mesa and across the international border (Murphy and White 1984). The southwestern San Diego region contains one Recovery Unit designated in the Draft Recovery Plan, centered around Otay Mountain, bounded to the south by the international border, to the north by State Route 94, to the west by Interstate 805 and associated urban areas, and to the east by the City of Tecate (Figure 1). The western portion of this Recovery Unit extends into the City of Chula Vista Subarea.

Habitat in this region primarily consists of low rounded hills and gently sloped open southern exposures. Historically, the QCB widely used grasslands associated with vernal pools and mima mounds, ridge tops, and mountain slopes supporting stands of dwarf plantain. QCB habitats in this region are largely clay soil openings in coastal sage scrub, chamise chaparral and vernal pools. Most current QCB occupancy is found along the upper rounded ridgelines. Soils in this region most often observed to support QCB are red or gray clay soils. Dwarf plantain is the primary hostplant in this region. The most commonly observed nectar sources in the region include onion, goldfields and linanthus (USFWS 2001).

Life History

The species generally has one generation per year. Females are usually mated on the day they emerge from pupae and lay one to two egg clusters per day for most of their adult life. *Euphydryas editha* egg clusters typically contain 20 to 150 eggs (USFWS 2001) and hatch in 10 to 14 days. Destruction of eggs by predators and physical disturbance can be substantial. The species normally requires a year or more to complete its life cycle (egg to adult), with larvae spending much of the time in diapause (a state of dormancy) (Ballmer et al. 1998).

Pre-Diapause Larval Stage

Normally, pre-diapause larvae consume the plant on which they hatch, and then migrate in search of new plants. During the first two instars (periods between shedding skin), prediapause larvae cannot move more than a foot and are usually restricted to the plant on which the eggs were laid (primary hostplant species). During the third instar (about 10 days after hatching), larvae are able to move up to 3.3 feet among individual hostplants (USFWS 2001), and may switch from feeding on the plant on which they hatched to another plant of the same species, or another hostplant species (secondary hostplant). Due to the limited ability of larvae to move among host plants, high local host density is necessary for larval survival (Osborne and Redak 2000). Areas with hostplant populations that do not remain edible for sufficient time after eggs are laid cannot provide suitable habitat that season. If larvae have accumulated sufficient reserves by the time their hostplants become inedible, they are able to enter diapause (USFWS 2001).

Diapause

Diapause is a low-metabolic resting state that enables larvae to survive for months during the summer without feeding. While in diapause, larvae are much less sensitive to climatic extremes. Larvae are able to re-enter diapause several times before maturing, which may extend their life cycle for several years (Singer and Ehrlich 1979). This occurs when larvae emerge from diapause, feed, and then re-enter diapause, postponing development until the next year if food resources are exhausted. Because QCB larvae can re-enter diapause, it is possible that an adult flight period may only include a portion of the original larval population or may not occur at all in some occupied sites under adverse conditions. From the perspective of judging whether a population has been extirpated, it is important to know that a robust population may generate no adults at all under poor environmental conditions (USFWS 2001).

Post-Diapause Larval Stage

Sufficient rainfall, usually during November or December, causes larvae to break diapause. Rain stimulates germination and growth of the hostplants fed upon by postdiapause larvae, which can crawl up to several yards in search of food. Postdiapause larvae seek microclimates with high solar radiation, which helps speed development (White 1975, Weiss et al. 1987, Osborne and Redak 2000). Because of variable weather during winter and early spring, the time between diapause termination and pupation can range from two weeks if conditions are warm and sunny,

to two to three months if cold, rainy conditions prevail (USFWS 2001). Adults emerge from pupae after approximately 10 days, again depending on weather (Mattoni et al. 1997).

Adult Stage

Adults are active during a four-to-six week flight period beginning between late February and May, depending on weather conditions (Emmel and Emmel 1973). An unusual set of climatic events or rainfall from a Mexican tropical storm can sometimes stimulate adult emergence in the fall (Mattoni et al. 1997). Adults live from 10 to 14 days; however, adult emergence from pupae is staggered, resulting in the longer overall flight season.

Adult QCB spend time searching for mates, basking in the sun, feeding on nectar, defending territories, and (in the case of females) searching for oviposition sites and depositing eggs. QCB use air temperatures and sunshine to increase their body temperature to the level required for flight. Adults remain hidden during fog, drizzle or rain, and usually avoid flying in windy conditions (sustained winds greater than 15 miles per hour). QCB generally fly close to the ground in a relatively slow, meandering flight pattern, and tend to avoid flying over trees, buildings, or other objects taller than six to eight feet. Their thermodynamic requirements and natural avoidance of shaded areas deters flight in densely wooded areas and other types of closed-canopy vegetation (USFWS 2001).

Most *Euphydryas editha* subspecies exhibit generally sedentary behavior, with adults frequently remaining in the same habitat patch in which they developed as larvae (Ehrlich 1961, 1965; Boughton 1999, 2000). Data from mark-recapture studies indicate that long-distance dispersal (greater than 0.6 mile) in *Euphydryas editha* is rare (USFWS 2001). Murphy and White (1984) suggested that long-distance dispersal events associated with population outbreaks may contribute significantly to colonization or recolonization of unoccupied areas, and hence to long-term survival of the QCB. Long-distance habitat patch colonization may be achieved within a single season through long-distance dispersal of individual butterflies, or over several seasons through stepping-stone habitat patch colonization events. A model, which was conservative with respect to extinction, predicted habitat patches at a distance greater than four to five miles from the primary source population were not likely to support populations (Harrison et al. 1988).

Metapopulation Dynamics

Metapopulation Structure

Murphy (1990) suggested that the human-induced decline in the distribution and abundance of the QCB is exacerbated by the complex "metapopulation dynamics" which affect the persistence of this butterfly. In metapopulation dynamics, butterflies exist in an assemblage of individual demographic units or populations that periodically exchange individuals. Metapopulation dynamics occur when (1) patches of habitat support local breeding populations; (2) no single population is large enough to ensure long-term survival; and (3) habitat patches are not too isolated to preclude simultaneous extinction of all populations. A metapopulation is a "population of populations" which is dependent on a persistent "reservoir population" to provide colonists to habitats supporting "satellite populations" which would frequently go extinct due to

natural environmental causes such as drought or fire (D. Murphy, pers.comm.).

Metapopulations perpetuate themselves by balancing local extirpations with colonization. Local habitats alone are generally not sufficient to ensure the long-term persistence of the butterfly. A local population may be expected to persist on the time scale of years. The combination of larval host plant density, topographic diversity, nectar resource availability and climatic conditions result in local butterfly population density fluctuations and periodic extirpation events within patches of habitat (Ehrlich 1965). Persistence for longer terms derives from the interaction of sets of local habitat patch populations at larger geographic scales. Specifically, it depends on maintenance of sets of habitat patches or rare long-distance dispersal events that link larger metapopulations together (USFWS 2001).

The extirpation of a single, large reservoir population of QCB may effectively deny other habitats necessary recruits (Murphy and White 1984). The loss of particular satellite populations may interrupt the natural "stepping stone" recolonization process to other outlying populations (USFWS 2001). Furthermore, destruction, isolation or disturbance of habitat patches temporarily not occupied by larvae can disrupt metapopulation structure, reducing the likelihood of recolonization and making extirpation events more permanent (Hanski 1999). The probability that suitable habitat patches not occupied by larvae will be recolonized is decreased as metapopulation distributions become smaller (fewer occupied larval habitat patches) and habitat becomes more fragmented. Low population densities also reduce dispersal rates and generally make metapopulations more vulnerable to extirpation (USFWS 2001).

Implications of Metapopulation Dynamics for Reserve Design

Many areas that may have once provided habitat refugia supporting more persistent populations have been lost to agriculture, suburbanization and invasion by non-native plant species; many habitat areas that once supported smaller populations continue to provide resources but have remained unoccupied for many years. These observations suggest a disrupted source-sink metapopulation dynamic and indicate a need to focus conservation efforts on remaining habitat patches that exhibit the greatest current extent, topographic diversity, and resource availability (D. Murphy pers.comm.).

Metapopulation stability requires a minimum number of habitat patches connected by dispersal corridors (landscape connectivity) (USFWS 2001). Habitat areas that need protection include patches of larval hostplants and sites used by adults during breeding, oviposition, nectaring and dispersal. Some habitat areas that would not be considered essential if geographically isolated are, in fact, essential when situated in locations where they facilitate continued connectivity between surrounding populations or play a significant role in maintaining metapopulation viability (66 FR 9475). Reserves should be designed to provide sufficient numbers of habitat patches such that (1) only a small number of habitat patches will likely be extirpated in a single year and (2) patches are close enough so that natural recolonization can occur at a rate sufficient to maintain a relatively constant number of patches occupied by larvae. In general, the more frequent the extirpations, the more patches that are necessary to support a metapopulation for a

given length of time. Environmental diversity among habitat patches should reduce the probability of simultaneous extirpation of habitat patches (Harrison and Quinn 1989).

Habitat linkage areas should connect as many habitat patches as possible to optimize metapopulation dynamics (Thomas 1994). Habitat patches with fewer and/or longer distance linkages to other patches have lower probability of natural recolonization following local extirpation events. Linkages greater than 0.6 mile are not likely to be used by dispersing *Euphydryas editha* adults (Harrison and Quinn 1989). Linkage areas must be free of dispersal barriers (artificial structures, dense stands of trees or tall shrubs) and mortality sinks (e.g., high-traffic roads). Habitat networks should also be buffered (i.e., embedded in natural areas as large as possible) to reduce indirect impacts of development and the need for future or ongoing restoration in occupied habitat.

Reasons for Decline and Current Threats

QCB populations have been reduced in number and size by more than 95 percent range-wide primarily due to direct and indirect human impacts including habitat loss and fragmentation, invasion of non-native plant species, and disrupted fire regimes. Disturbances that have compromised QCB metapopulation integrity include conversion of habitat by development or invasion by non-native plant species, grazing, trampling, fragmentation of habitat, and reduction or constriction of the landscape connectivity that facilitates habitat recolonization. High-traffic roads are obstacles of particular concern. Undeveloped lands infused with or completely surrounded by development experience direct and indirect human disturbance including trampling, off-road vehicle use, dumping, pollution, and enhanced non-native species invasion, all impacts that reduce population stability (USFWS 2001). According to the Draft Recovery Plan, QCB population decline likely has been, and will continue to be, caused in part by direct effects such as elevated atmospheric carbon dioxide concentrations (Coviella and Trumble 1998), and indirect effects such as enhanced nitrogen deposition (Allen et al. 1998), and climate change (Parmesan 1996, Field et al. 1999). Other potential threats include predation by Brazilian fire ants (Porter and Savignano 1990) and Argentine ants, illegal trash dumping (USFWS 2001) and overcollection by butterfly collectors (62 FR 2313). Finally, climate change is believed to be a threat to the species (USFWS 2001).

Conversion from native vegetation to non-native annual grassland will be the greatest threat to QCB reserves based on observations of the large-scale invasions throughout the range (Freudenberger et al. 1987, Minnich and Dezzani 1998, Stylinski and Allen 1999). The increased dominance of non-native species is reducing the abundance of QCB foodplants (Dodero pers. comm.), and habitat fragmentation exacerbates vegetation type conversion. Corridors of human activity through unfragmented natural areas such as unpaved roads, trails and pipelines are also conduits of non-native seed dispersal (Zink et al. 1995). Other causes of vegetation type conversion include fire, grazing, off-road vehicle activity, and increased nitrogen deposition (Allen et al. 2000).

Discussion of how the City intends to address these threats within its jurisdiction is provided below.

Quino Checkerspot Butterfly Recovery Component of Chula Vista Subarea Plan

Assessment of Habitat Suitability within the City of Chula Vista Subarea

Historically, the QCB almost certainly occurred throughout the coastal plain and foothills of Chula Vista, and would have occurred in highest densities around vernal pools. Much of the land within the City's Subarea has already been built out, and much of the remaining area (almost 7,000 acres) is either disturbed or agricultural land. Limited vernal pool complexes remain in the Subarea, and potential QCB habitat within the City has been degraded by previous agricultural activities and by invasion of non-native plant species. While there are some remaining areas of appropriate habitat and several QCB have been observed within the Subarea, the QCB is considered to have minimal potential for occurrence of large populations within the City in the absence of habitat enhancement.

The City of Chula Vista and the Wildlife Agencies have worked together to assess the potential of extant habitat within the Subarea to support QCB. QCB populations fluctuate substantially from year to year. In addition, surveys are not available for all areas and those surveys that are available contain differing amounts of detail. Where available, detailed habitat assessment and protocol survey information has informed the decision-making process and has been used to define potential impacts and anticipated conservation of QCB habitat.

Where detailed information was not available, analysis of anticipated impacts and conservation was based on a broader "landscape-level" habitat assessment. Actual QCB habitat utilization under current conditions is typically limited to small patches, and depends heavily on habitat quality, particularly related to the extent of non-native plant invasion. As such, the total acreage of areas designated as "potential habitat" exceeds by orders of magnitude the areal extent of currently occupied habitat, or areas that are truly likely to support QCB in the future without significant habitat restoration/enhancement.

A number of areas were immediately excluded from the habitat suitability analysis, based either on regulatory factors or habitat type considerations and are graphically depicted on Figure 2. Only the portion of the City within the designated 2000 survey area was assessed for habitat potential. The total 2000 QCB survey area within the City equals approximately 14, 174 acres. State Route 125, Sempra Energy rights-of-way and facilities, City of San Diego Cornerstone Lands, Otay Water District lands and the Otay Landfill were excluded because the City is not seeking take authorization in those areas under the Subarea Plan. These areas are designated "Not a Part" and shown in brown on Figure 2 and total approximately 1,619 acres. In addition, consistent with the remainder of the Subarea Plan, the quarry is considered a minor amendment area. The quarry totals approximately 136 acres and is designated "Minor Amendment" and graphically depicted in gray on Figure 2. Because they do not provide suitable habitat for QCB, developed, agricultural and riparian areas were excluded as potential habitat. Agricultural and riparian areas total approximately 9,522 acres; they are designated as "Excluded Areas" and shown in tan on Figure 2.

Non-excluded lands were assigned to habitat suitability Categories A through C and are also shown on Figure 2. These categories represent decreasing potential to support QCB, relative to other areas within the City only, not relative to the region as a whole.

Detailed 2001 habitat assessment and protocol survey information was available for Rolling Hills Ranch (HELIX 2001), Bella Lago (Klein-Edwards Professional Services 2001) and Otay Ranch Village 11 (Dudek 2001). Because 2001 was considered a good flight season, it is considered relatively unlikely (though not impossible) that butterflies will occur in areas with negative surveys in 2001 without habitat enhancement.

Four QCB were observed on Rolling Hills Ranch during 2001 protocol surveys. The approximate area believed to be occupied by these butterflies was drawn based on vegetation and topography. These areas were assigned to Category A. The area on Rolling Hills Ranch considered occupied did not extend as far to the north as to the south because the areas to the north lacked any host plants in 2001, and cryptogamic soils were more limited. The areas not considered occupied (and not excluded because of their agricultural use) were assigned to Category B because although no QCB were observed, these areas were in close proximity to observed QCB locations. No butterflies were observed during protocol surveys on Bella Lago; therefore, that property also was assigned to Category B for the same reasons noted on Rolling Hills Ranch.

The remaining areas have been assigned habitat suitability categories based on habitat quality/connectivity and distance from known QCB locations. Areas surrounded by agriculture or developed land and narrow linear strips of vegetation surrounded by development on three sides were considered isolated. Based on edge effects and the likelihood of dispersing QCB to travel through the surrounding uses to encounter such an area, the likelihood of these areas supporting QCB was considered low. Similarly, areas known to consist of low quality habitat (i.e., high percentage of exotic plant species or subject to extensive human activity) are unlikely to support QCB and these areas were also placed in Category C. Proximity to known QCB locations was based on a 0.6-mile (1-kilometer) radius. This radius was selected because data from mark-recapture studies indicate that dispersal greater than this distance is rare in *Euphydryas editha* (USFWS 2001, page 20).

Category C includes isolated or low quality habitat.

Category B includes

- areas with a negative 2001 protocol survey, within 0.6 mile of a known QCB location; and
- areas with no 2001 protocol survey, outside 0.6 mile of a known QCB location

Category A includes

- areas with a positive 2001 survey; and
- areas with no 2001 protocol survey, within 0.6 mile of a known QCB location

Total area within the City was approximately 1485 acres in Category A, 2,398 acres in Category B, and 633 acres for Category C (see Figure 2).

Proposed Impacts and Conservation Measures

Protection of suitable habitat patches and landscape connectivity are essential for preservation of the QCB. Approximately 62 percent (2,806 of 4,516 acres) of the identified potential habitat within the City will be conserved and managed as part of the Preserve. Furthermore, as described below, this area is primarily composed of areas with higher habitat suitability, includes 98 percent of the area within proposed critical habitat for the species within the City, and maintains crucial linkages identified in the Recovery Plan. Given the extent of non-native plant invasion, long-term viability of the preserved habitat patches will depend heavily on habitat management, restoration and enhancement. The following subsections describe the relevant objectives identified in the Proposed Critical Habitat Designation and Draft Recovery Plan, followed by a description of how the City of Chula Vista proposes to conserve the species within its jurisdiction.

Habitat Protection

The USFWS has developed proposed critical habitat areas for the QCB (66 FR 9475). Critical habitat is defined in Section 3 of the Endangered Species Act (Act) as (i) the specific areas within the geographic area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection; and (ii) specific areas outside of the geographic area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. Critical habitat designations identify, to the extent known using the best scientific and commercial data available, habitat areas that provide essential life cycle needs of the species. The proposed critical habitat designation (PCHD) has been configured to provide for dispersal and migration corridors, as well as allowing room for population expansion. As described in the Federal Register notice, these areas "are designed to provide sufficient habitat to maintain self-sustaining populations of Quino checkerspot butterflies throughout its range." It should be noted, however, that the PCHD does not necessarily capture all areas which may be important to the persistence and recovery of the species. The City considered this and has included additional lands outside of the PCHD necessary for conservation of QCB.

The habitat needs of the species are addressed in the Draft Recovery Plan. Protection of habitat within the distribution of described habitat complexes has been identified as Recovery Task 1.1 of the Draft Recovery Plan. Task 1.1.5 calls for protection and management of as much remaining undeveloped suitable and restorable linked habitat patches within and between the six habitat complexes of the Southwest San Diego Recovery Unit as possible. This includes protection and management of as much remaining undeveloped suitable and restorable habitat that is part of the known historic population distribution as possible in the Otay Lakes habitat complex, in a configuration designed to support a stable population.

Within the City of Chula Vista Subarea, the PCHD extends onto lands held by independent agencies, Otay Ranch (and small areas immediately to the east) and small portions of Rolling Hills Ranch and Bella Lago (Figure 3). Virtually all of the PCHD within the City of Chula Vista is conserved in the Preserve. In addition, seven of eight known QCB locations in the City will be conserved. Minor differences between the PCHD and proposed Preserve on Rolling Hills Ranch, Otay Ranch and Bella Lago reflect the mapping methodology, and are not considered deviations from the PCHD. Minor incursions into the PCHD/Preserve will be made for Planned and Future Facilities, which are listed in Section 6.0 of the Chula Vista Subarea Plan. These facilities would result in impacts within the Preserve totaling up to 66 acres. In relation to the 3,021 acres of proposed critical habitat within the Subarea, the total of up to 66 acres (two percent) of potential incursion associated with all private and public projects in the City would not be considered substantial. It is very conservatively assumed that all (50 acres) of the Future Facilities would be constructed within Category A habitat. In addition, the Planned Facilities would impact four acres in Category A, nine acres in Category B and three acres in Category C, for a total impact of 16 acres. Total infrastructure impacts in the Preserve from Planned and Future Facilities could therefore total a maximum of 66 acres. However, impacts from Planned and Future Facilities will be minimized, while still allowing for their construction, through the following requirements of the Subarea Plan.

1. A habitat assessment will be conducted in potential facility locations as part of the project siting and design process.

2. QCB surveys will be conducted in appropriate habitat by a qualified biologist in accordance with the most recent survey protocol adopted by the Wildlife Agencies.

3. If QCB are observed within the proposed Project Area, the project will be designed to avoid impacts to QCB habitat to the maximum extent practicable.

4. The following avoidance criteria will be applied specifically to Preserve Habitat-Category A areas located east of SR 125:

a. For Preserve Habitat-Category A areas east of SR 125 that are within the Salt Creek drainage and the Otay River Valley and associated with the property known as the New Millennium Property, the following patches of QCB habitat, as mapped in the habitat assessment prepared by Dudek and Associates (Figure J-1) will be considered "significant QCB habitat patches": 2, 5, 12, 18, 22, 23, 24, 26, 30, and 33.

b. For Preserve Habitat-Category A areas located east of SR 125 that are within the Salt Creek drainage and the Otay River Valley and outside of the New Millennium Property, a detailed habitat assessment will be conducted, including mapping patches of *Plantago erecta* and other host plants, if applicable. In this area, if dense patches of plantago greater than 50 square meters in area are found on ridgelines or mesa tops, in a matrix of sage scrub or grassland that has not been subject to extensive invasion by non-native plant species, such patches shall be considered "significant QCB habitat patches." In addition, if dense patches of plantago greater than 150 square meters in area are found in canyonsides or drainage bottoms, in a matrix of sage scrub or grassland that has not been subject to extensive invasion

by non-native plant species, such patches shall be considered "significant QCB habitat patches."

c. Projects shall be designed to avoid "significant QCB habitat patches" to the maximum extent practicable, regardless of whether QCB are observed. If impacts to these habitat patches cannot be avoided, the City will consult with the Wildlife Agencies and the Wildlife Agencies will cooperatively work with the City to site the proposed facility in a location that will best minimize impacts to QCB habitat. The City will submit a written request for input to the Wildlife Agencies. The Wildlife Agencies will meet and confer with the City and, no later than 60 days of receipt by the Wildlife Agencies of written notice from the City, resolution on the appropriate location of the proposed facility will be completed.

d. During joint review of a project proposing to impact one or more "significant QCB habitat patches", a cooperative assessment will be made by the City and Wildlife Agencies to determine the overall significance of the proposed impacts to "significant QCB habitat patches". The assessment will be made within the context of the quality and location of other QCB habitat within the Preserve at the time of the assessment. Evaluation of proposed project impacts to significant habitat patches shall also take into consideration all of the other components of the City's QCB program. In particular, if the planned QCB habitat restoration/enhancement component has demonstrated success, the City and the Wildlife Agencies shall consider the restoration/enhancement component in their evaluation of the individual project's impacts.

e. When the City has successfully completed, as determined by the Wildlife Agencies, at least 10 acres of QCB restoration/enhancement within the Preserve in the Salt Creek/Otay River Valley area, the provisions of Section 5.2.8.1 (4)(a-d) will no longer be applicable.

5. For construction in areas adjacent to occupied habitat, dust control measures (i.e., watering) will be applied during grading activities.

6. As part of the overall Preserve management strategy, a weed control program will be established for all water/sewer line access roads built through potential QCB habitat. This will include road construction using a concrete-treated base material with aggregate rock to prevent vegetation growth on the road surface, while allowing sufficient percolation to minimize flows. The zone of influence to be subject to the weed control program will be determined by the City's Habitat Manager based on site-specific conditions.

Overall, conformance with the PCHD would result in the preservation of 62 percent of the potential Category A, B and C QCB habitat in the City. While much of the proposed development would occur in areas with lower potential to support QCB, much of the proposed preservation would occur in areas with higher potential to support QCB. The following table illustrates that 1,091 acres (73 percent) of Category A, 1,447 acres (60 percent) of Category B and 268 acres (42 percent) of Category C would be conserved. Expressed as a ratio, the conservation compared to impacts of Category A lands (those with the highest relative potential to support QCB) is 2.75:1; the ratio for Category B is 1.48:1.

Quino Checkerspot Butterfly Habitat Conservation[1]				
	Category A	**Category B**	**Category C**	**Total**
Potential Habitat Total by Category	1,485	2,298	633	4,516
Anticipated Impacts	394	951	365	1,710
Anticipated Conservation	1,091	1,447	268	2,806
Conservation Percentage	73 %	60 %	42 %	62 %

By conserving 98 percent of the PCHD within its jurisdiction, the suite of recovery actions proposed by the City of Chula Vista will make a significant contribution to the persistence and recovery of the QCB. Furthermore, these lands form important links in all of the

[1] Contains impact associated with Planned and Future Facilities in the Preserve.

corridors identified in the Southwestern San Diego Recovery Unit in the Recovery Plan, as described below.

It should also be noted that, in addition to lands anticipated to be conveyed to the City as part of its Preserve, the Service has acquired lands within the City (on San Miguel Ranch and a portion of the Inverted "L" parcel) and is anticipated to acquire other lands within or adjacent to the City. The Service is responsible for managing these lands for the benefit of all listed species. These lands, therefore, provide additional benefit to the QCB within the Subarea and Chula Vista MSCP Planning Area without requiring management funding from the City.

Maintaining Connectivity

Protection of linkage areas between habitat patches is crucial to conserving existing metapopulations. This paragraph describes the tasks contained in the Draft Recovery Plan; Chula Vista's proposed maintenance of connectivity is described immediately below. Recovery Task 1.2 calls for the enhancement of landscape connectivity within and between the distribution of the habitat complexes. In order to enhance or restore landscape connectivity, those linkage areas that would most effectively connect occupied habitat patches are to be determined, and any barriers are to be removed. Conversely, vegetative barriers should be erected to prevent dispersal from habitat patches into adjacent high-traffic surface roads (Recovery Task 1.3). Specifically, maintenance and enhancement of connectivity in the Southwestern San Diego Recovery Unit is to include (1) protection and management of landscape connectivity through Proctor Valley between the habitats in the San Diego National Wildlife Refuge (SDNWR) and the Otay Lakes area in the SDNWR habitat complex; (2) enhancement of landscape connectivity along the western and eastern margins of Otay Lake in the Otay Lakes habitat complex; and (3) enhancement of landscape connectivity between the north rim (above the Otay River) and western mesa top of Otay Mesa (see Figure 4). This Subarea Plan contributes to the preservation and enhancement of portions of these three critical areas.

Habitat near the Sweetwater River (now in the SDNWR) was historically, and appears to still be, connected to Proctor Valley, San Miguel Mountain, and thus to currently occupied habitat around Otay Lakes. Lands not known to be occupied between the SDNWR and Otay Lakes are considered important because they may provide landscape connectivity between these two areas that allows for a low rate of genetic exchange and recolonization events, and therefore, the long-term stability of both (USFWS 2001). The habitat set aside across the northern portions of the Rolling Hills Ranch and Bella Lago projects provides an east-west linkage through a portion of this area. Importantly, the open space on these parcels is contiguous with a large core block of open space surrounding Mount Miguel to the north, and the open space set aside on Rolling Hills Ranch conserves a major ridgeline which is perpendicular to prevailing breezes, so ideal for QCB movement and hilltopping. The corridor across the northern portions of these properties connects potential habitat on portions of San Miguel Ranch being placed in the SDNWR and the Otay Water District Habitat Management Area to the partially USFWS-owned Inverted "L" parcel. This parcel is in turn connected to lands planned for conservation by the City and County of San Diego around Otay Lakes.

Landscape connectivity along the western margin of Otay Lake is constrained by the Olympic

Training Center and other development, although some habitat remains along the Salt Creek drainage (USFWS 2001). The Subarea Plan will provide a linkage up Salt Creek on the Otay Ranch site north of the eastern portion of the University site to open space edging the Lower Otay Lake, just south of the Olympic Training Center (Figure 4). Other connectivity along the western edge of the reservoir would be provided through City of San Diego Cornerstone Lands, and would not be affected by this Subarea Plan. The Eastlake Vistas project, within Chula Vista, would provide additional open space along its eastern edge, immediately west of the Cornerstone Lands, widening the potential corridor.

Landscape connectivity on the mesas northeast of Brown Field and southwest of Lower Otay Lake has been reduced through historical disturbance, although no significant dispersal barriers exist. The Draft Recovery Plan asserts that landscape connectivity could be restored where distance between habitat patches is now too great to provide adequate linkage (USFWS 2001). The southern extent of Otay Ranch will be preserved, providing a linkage from Otay Mesa, across the Otay River Valley, to the southern end of Lower Otay Lake. The preserve configuration also maintains existing connectivity along the Otay River Valley to western Otay Mesa.

By conserving landscape linkages in these three critical areas, the City's Subarea Plan will contribute to potential dispersal of the QCB, including genetic exchange between existing populations and potential recolonization of suitable, but currently unoccupied, habitat. This conservation is consistent with of the Draft Recovery Plan. As described above, maintenance and enhancement of such linkages is critical to the stability of QCB metapopulations.

In addition to maintaining linkages where appropriate, the City will implement the Recovery Plan goal to prevent population sinks along high-traffic roads. Selected roads that represent potential population sinks will be landscaped with shrubbery that will mature to at least five feet in height. Native shrubbery will be considered preferable, but non-invasive non-native landscaping will also be acceptable. This requirement is to apply to the following road segments: Main Street between Paseo Ranchero and Rock Mountain Road, La Media Road crossing the Otay River Valley, Rock Mountain Road crossing Wolf Canyon, Olympic Parkway crossing Salt Creek, and Proctor Valley Road crossing the southeast corner of Rolling Hills Ranch (Figure 4).

Preserve Management

Preserve management also is a critical component for conservation and recovery of the QCB. The second recovery criterion of the Draft Recovery Plan is to "permanently provide for and implement management of described habitat complexes to restore habitat quality, including maintenance of hostplant populations, maintenance of diverse nectar sources and pollinators, control of non-native plant invasion, and maintenance of internal landscape connectivity" (USFWS 2001: page 69). This paragraph describes the tasks contained in the Draft Recovery Plan; Chula Vista's proposed management program is described immediately below. Management measures are to include removal of cattle and phasing in of weed control where habitat is currently grazed (Recovery Task 1.2.2), reduction of off-road vehicle activity within the distribution of described habitat complexes (Recovery Task 1.4), management of activity on

trails where habitat occurs in recreational use areas (Recovery Task 6), and reduction of fire frequency and illegal trash dumping in habitat areas (Recovery Task 8).

A number of general preserve management considerations outlined in the Subarea Plan (Section 7.0) would provide benefit to the QCB. Management activities will be initiated upon conveyance of lands to the Preserve, in association with project development. Open space within the North City and Otay Ranch Preserve Management Areas (PMAs) is of relevance to QCB conservation. Framework Management Plans (FMPs) have been completed for both PMAs, and are incorporated into the Subarea Plan (see Section 7.0). The FMPs outline principal Preserve maintenance activities and requirements; provide specifications to limit "edge effects" and impacts from adjacent development; furnish a framework to address potential impacts to the Preserve from invasive, exotic species; and create a blueprint for managing public access, trails and recreational uses within the Preserve. In addition to the FMPs, the Subarea Plan identifies compatible, conditionally compatible, and incompatible uses.

A number of uses and activities have been determined to be incompatible with the biological objectives of the MSCP Subregional Plan, and therefore not allowed in the Preserve. Incompatible uses include agriculture and public off-highway recreational vehicle activity. Grazing is also considered incompatible unless it is deemed to have a neutral or positive impact on habitat values by the City with concurrence by the Wildlife Agencies.

Limited public access and passive recreation are permitted uses within the Preserve. Access points, new trails and facilities, and control of public access will be consistent with the City Planning Component FMP or the Otay Ranch Resource Management Plan (RMP). Specifically, within the City Planning Component FMP, trails, view overlooks and staging areas are to be located in the least sensitive areas of the Preserve, and trail widths are to be minimized to reduce impacts to critical resources. Similarly, the Otay Ranch RMP includes a requirement that trails be sited and designed to be compatible with resource protection. Throughout the City's Preserve, the appropriate managing entity is authorized to close selected areas of the Preserve to public use, temporarily or permanently, if public access has resulted in, or is expected to result in, significant negative impact to sensitive species. This may manifest itself in closure of occupied QCB habitat during the flight season (see Section 6.2.1 of the Subarea Plan).

The City Planning Component FMP establishes two levels of priority of management activities for the Preserve. Priority 1 measures include those management tasks that are necessary to ensure that the Covered Species are adequately protected. These management directives will be included in each area-specific management plan, which will be completed for each project prior to the issuance of a grading permit. Priority 1 activities which will benefit the QCB address litter and off-road vehicle activities; public access, trails and recreation (as described above) and invasive exotics control and removal. Litter and trash are to be removed on a regular basis. Posting signage, providing and maintaining trash cans and bins at trail access points, and imposing penalties for littering and dumping are intended to discourage such activities. Preserve areas are to be monitored to prevent illegal activities such as off-road vehicle use. No invasive non-native plant species are to be introduced into areas immediately adjacent to the Preserve. Invasive non-native plant species within the Preserve are to be monitored and removed as necessary, pursuant to the area-specific management directives.

The City Planning Component FMP (Subarea Plan Section 7.3) includes a requirement for dissemination of educational information to residents and landowners adjacent to and inside the Preserve to heighten environmental awareness of the Preserve's goals and purpose, and inform residents of adjacency issues. For new communities, this will be required as part of SPA or Precise Plan approvals and will be implemented as Priority 1; elsewhere in the City, it will be implemented as Priority 2, as funding becomes available. This educational information will include information about the QCB, consistent with Recovery Task 4 (Priority 2) of the Draft Recovery Plan to initiate and implement an educational outreach program.

Responsibilities of the Otay Ranch Preserve Owner/Manager (see Subarea Plan Section 7.4 and Otay Ranch Resource Management Plan, City of Chula Vista 1993) include maintenance of existing high quality resources through the prevention of further disturbance, including controlling access to the Preserve, prohibiting off-road traffic, enforcing "no trespassing" rules, and curtailing activities that degrade resources, such as grazing, shooting and illegal dumping; implementation of maintenance activities including removal of debris and control of exotic plant species; and development of educational facilities and interpretive programs. As described in Section 5.2.5 of the Subarea Plan, prior to the issuance of Take Authorization, the City will adopt a Grazing Ordinance which codifies the Otay Ranch Range Management Plan in the Otay Ranch Planning Component. This ordinance includes restrictions on the location and timing of grazing on the Otay Ranch prior to conveyance to the Preserve, and would permit no grazing once lands are conveyed, unless it were deemed to have a neutral or positive impact on habitat values by the City, with concurrence by the Wildlife Agencies.

The above-described overall Preserve management requirements are anticipated to provide a benefit to the QCB. Importantly, the Preserve management framework established by the MSCP provides a structure, along with specific funding (Section 8.0 of the Subarea Plan), to implement required Preserve management activities, including weed control. Because the administrative structure is already in place, additional funds allocated for restoration and enhancement activities to benefit the QCB (see below) will be allocated directly to field efforts.

Habitat Restoration/Enhancement

In addition to management of existing habitat restoration and enhancement of potential habitat is critical to the persistence and recovery of the QCB. Recovery Task 1.2 also calls for the restoration of those habitat patches which would most effectively connect occupied habitat patches. This paragraph describes the tasks contained in the Draft Recovery Plan; Chula Vista's proposed restoration/enhancement program is described immediately below. According to the Recovery Plan, the ultimate goal of restoration efforts should be self-sustaining functional native ecosystems similar to those that historically supported QCB metapopulations. Efforts can range from a minimum, such as adding seed of larval food and adult nectar plants to enhance existing resources, to extensive, such as reestablishing native plant communities in fallow agricultural fields. Site-specific ecosystem restoration planning should include data on natural vegetation community composition and physical habitat structure in the vicinity, as well as soils and associated plant and animal populations. Natural physical and biological attributes must be restored, including nectar plants, pollinators and appropriate larval diapause and pupation sites (USFWS 2001, Osborne and Redak 2000).

The City of Chula Vista proposes, in the context of its MSCP Subarea Plan and management program, to fund and implement a program that will provide restoration and/or enhancement (hereinafter referred to as "restoration/enhancement") of QCB habitat. This program will be in addition to any project-specific restoration required for temporary impacts. As discussed in detail below, restoration/enhancement will include both focused removal of non-native plant species and re-establishment of native annuals that serve as nectar sources and larval host plants. The City Habitat Manager, in consultation with the QCB Scientific Advisory Committee (QSAC), will determine on an annual basis how best to apply the available funds, in accordance with an adaptive management program. The QSAC will consist of one representative each from USFWS and CDFG, along with two to three representatives selected by the City from the academic and/or consulting arena, with experience in QCB and/or habitat management issues. The QSAC will meet twice per year to review the annual management report and provide recommendations to the City Habitat Manager.

Site Selection. Specific locations for habitat restoration/enhancement will be selected by a qualified restoration biologist in consultation with the QSAC, upon conveyance of Preserve lands to the City (see Timing, below). This plan establishes criteria for the selection process, aimed at ensuring that the benefit of the enhancement program is maximized. Restoration/enhancement activities will not be undertaken in the vicinity of Planned or Future Facilities. The best scientific information currently available indicate that the following criteria should be considered in the selection of restoration/enhancement sites:

- Connect to or enhance known populations;
- Consist predominantly of native habitat with a low to moderate non-native component;
- Support other Covered Species;
- Have mima mound topography (if available); and
- Are defensible from re-invasion by non-native plant species.

The above criteria may be modified as additional information from area-specific enhancement experience or general QCB research becomes available. Under these criteria, areas that would expand or provide "stepping-stones" between known populations would be prioritized. Restoration/enhancement areas would typically be located in areas identified as Category A habitat, as such areas are within 0.6 mile of a known QCB location and provide habitat generally considered to be better quality within the context of the City of Chula Vista.

In order to be most cost-effective, the restoration/enhancement program would not focus on restoration/enhancement of areas that have been completely overtaken by invasive non-native species and would attempt to use areas that are appropriate for QCB restoration/enhancement but may also support other Covered Species as well. One of the most significant threats to the QCB is the invasion of non-native species into otherwise suitable habitats; this program would address this issue by ensuring that lands in the Preserve maintain or improve suitability for occupation. Several sensitive, covered plant species provide indicators of areas that may be suitable for the QCB. In addition, focusing on such areas allows the City to maximize the number of sensitive species that benefit from the limited public funds available for species conservation.

Anecdotal accounts indicate that areas with mima mound topography historically supported the highest densities of QCB. Areas with deep soils may have been subject to greater weed invasion because of their fertility, while areas with less fertile soils support remnant QCB populations. Areas that previously supported the most productive habitat for the species are likely to do so again given appropriate enhancement efforts.

As described by Mark Dodero in Appendix II, Habitat Restoration Methods, of the Draft Recovery Plan, non-native plant removal strategies should take advantage of habitat breaks (e.g., large shrub patches, canyon edges, rock outcrops, roads) to serve as buffer zones from adjacent areas that are dominated by non-native plants. Again, this will allow the City Habitat Manager to use available funds most efficiently.

Implementation. Three different levels (high, moderate and low intensity) of restoration/enhancement may occur within the Preserve. High-intensity restoration involves de-thatching, weeding and spraying, as well as planting/relocation of native plant species, annually over a five-year period. The high intensity restoration program (described below) is based on the De-thatch and Repeat Spray Method, developed by Mark Dodero of Recon and outlined in Appendix II of the Quino Checkerspot Butterfly Draft Recovery Plan, as slightly modified through subsequent personal communication. It would be employed in areas that have significant numbers of native plant species present, but contain moderate to high levels of non-native plants. The moderate and low intensity programs would be used for areas that have significant numbers of native plant species present, but contain moderate or low levels of non-native plants. The moderate and low intensity program costs were developed by Mark Dodero specifically to address the individual requirements of a QCB program in the City of Chula Vista.

Appropriate timing of non-native plant removal should result in decreasing effort over a period of years. All areas that have been subject to enhancement will eventually be included as areas targeted for focused weeding on an appropriate rotating basis (i.e., every two to six years, depending on need). The following outlines the high- intensity restoration program, representing the maximum amount of effort that is expected to be undertaken. This methodology may be modified or scaled back to suit the conditions at the selected site, at the discretion of the QSAC.

Thick thatch associated with dead mustard or annual grasses can prevent native species from germinating and/or competing successfully for light and space with non-natives. In areas with this problem, dethatching will be used to enhance the areas. This will include removal of dead plant thatch using hand tools and "weed eaters," and return visits for spraying with glyphosate. Timing of non-native plant control efforts is crucial to success. Non-native plants will be killed prior to seed set, so that removal effort and cost will decrease over time. Another crucial component of the non-native plant removal method described below is that workers must be trained to distinguish between native and non-native plants for restoration to be successful.

The high-intensity restoration program is as follows:

- Cut thatch and dead non-native plants with "weedeaters." This cutting can be done during the summer or early fall.
- Rake up and collect non-native plant thatch.

- Remove thatch from site and dispose of it in dumpsters, a landfill, or an area where it can be composted nearby to reduce disposal costs.
- Return to site and spray Roundup (or more selective herbicide, or selective weed-whacking) on non-native plant seedlings after sufficient rains have fallen in winter and spring.
- Repeat spraying (or selective weed-whacking) as necessary to prevent seed set. Other options include the use of pre-emergent herbicide prior to the first significant rain.
- Repeat spraying (or selective weed-whacking) as necessary to maintain non-native plant density to a low level.

Frequent site visits are necessary during the growing season to assess non-native plant removal efforts and to determine whether changes are needed in the strategy being used or the intensity of non-native plant removal efforts. In particular, the non-native plant removal process must be carefully monitored to ensure that new non-native plant species do not flourish as the formerly dominant non-native species are removed. Up to five herbicide (or weed-eating) applications per season may initially be required. The amount of spray will be reduced as the season progresses and fewer non-native plants are present. After the first two years, weeding requirements decrease each year if the spraying program is timed to kill non-native plants before they set seed. Removal of non-native plants by hand may be required around small populations of herbaceous natives.

Populations of native annuals (larval host plants and nectar resources) may be enhanced or re-established in and between existing habitat patches by hand seeding. According to the Draft Recovery Plan, restoration plantings should include nectar-producing plant species with overlapping flowering periods that extend throughout the typical Southern California growing season. Seeds of native plant species used in each restoration/enhancement project should be collected within five miles of the site, or as close as possible within the same general climate zone. To ensure that adequate seed is available, seed bulking (growing seed in cultivation to increase the amount of seeds) of annuals, including *Plantago* and nectar plants, will be necessary. This seed bulking should be done at growing areas that can provide reproductive isolation from related plants from different regions. The Otay Ranch Resource Management Plan (City of Chula Vista and County of San Diego 1993) calls for the construction of a native plant nursery and/or botanic garden to be used for public education and restoration activities. This could provide an appropriate place to accomplish seed bulking for QCB habitat restoration/enhancement activities in the Otay Ranch area.
In order to support a diverse assemblage of potential pollinators and native plant species, the Recovery Plan calls for areas of open ground within associated native plant communities to be restored to support ground nesting bees and other invertebrates. The goal of having open ground for pollinators is compatible with QCB restoration efforts because QCB larval food and adult nectar plants require open ground for successful reproduction and long-term persistence. Brush piles, scattered sticks, branches and rock cobbles can be brought to the restoration site to increase the available cover for many animals, and will provide potential diapause and pupation sites for QCB.

Periodic maintenance of restoration areas will likely be required at low levels in perpetuity. Adaptive management strategies would be used to address unanticipated circumstances.

Maintenance needs are likely to include control of non-native species and measures to slow or reverse plant community succession (increased shrub density). Until the appropriate QCB larval food and adult nectar plants are fully established, monitoring and control of aggressive native species may be required, so that they do not dominate the vegetation and exclude QCB food plants through competition.

Funding

A cost evaluation model was prepared by the City to analyze the funding requirement for the QCB restoration/enhancement program. Costs associated with removing thatch and spraying non-native plants with a selective herbicide yearly among restoration sites vary, but depend primarily on the degree to which the natural habitat has been degraded, including the extent of non-native plant invasion. The QCB cost evaluation model applied per-acre annual costs for three levels of QCB restoration. Cost estimates for high, moderate and low intensity restoration efforts have been developed in conjunction with Mark Dodero, a member of the QCB Recovery Team. The cost estimates presented below reflect the average cost per acre for weed control in the overall rotation program (e.g., long-term management costs are $1,000 per acre actually treated in a given year, but only $200 per acre averaged over all lands in the management program, assuming treatment is rotated so that a particular patch is treated only once every five years).

The following table identifies the per acre costs of the high, moderate, and low intensity QCB programs being proposed by the City.

Dethatching and Weeding Costs						
Program Type	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Maintenance**
High Intensity	$5,000 -5,600	$2,500 -3,600	$1,000 -2,700	$500 -1,800	$250 -1,200	$200
Moderate Intensity	$3,000	$1,500	$500	$250	$250	$200
Low Intensity	$1,500	$1,000	$500	$250	$200	$200

As illustrated by the above table, the high, moderate, and low intensity programs are most costly in the first year, with costs dropping each year through year five. The assumption is that the level of required weeding will decrease annually as fewer non-native plants are present, due to the practice of removal prior to seed set. After implementation of each five-year program per acre, the costs stabilize at a fixed cost of $200 per acre, per year for periodic nonnative plant control activities and other habitat management tasks.

An additional cost for completing enhancement of QCB habitat is the cost of seed for native annuals (nectar sources and larval host plants). Mark Dodero has proposed a seed collection and propagation program for the first six years of the City's QCB program and then an annual miscellaneous seed-stocking program commencing in the seventh year and running for the life of the program. The following table identifies the additional seed costs.

Annual Seed Costs			
Year	**Seed Collection**	**Seed Propagation**	**Misc. Seed Stock**
2003	$6,000	$6,800	
2004	$6,000	$6,000	
2005	$6,000	$6,000	
2006	$0	$6,000	
2007	$0	$3,600	
2008	$0	$2,400	
2009 & beyond	$0	$0	$2,000

The QCB habitat restoration/enhancement program will be funded through the Preserve Management Enhancement Fund (PMEF), a non-wasting endowment program. The PMEF is anticipated to generate, over time, a perpetual annual budget of between $50,000 and $92,000 (2002 dollars). The endowment will add approximately $33.00 per acre of additional funding to the Otay Ranch and North City PMAs, creating a total available budget of approximately $87.00 per acre dedicated to Preserve management activities in these areas. Additional information regarding the PMEF is contained in Subarea Plan Section 8.3.2.4.

The QCB habitat restoration/enhancement program would be funded through a portion of the revenue stream generated by the endowment. Priority for PMEF expenditures will be given first to the QCB habitat restoration/enhancement program. Irrespective of funding sources, or anything to the contrary, coverage for the QCB is based on the habitat conservation and Preserve management provided through the Subarea Plan and 50 acres of QCB restoration/enhancement that collectively comprise the Chula Vista QCB program.

The allocation of funds available for the restoration/enhancement program will be at the discretion of the City Habitat Manager, in consultation with the QSAC, and will depend upon the quality of the habitat available for restoration.

Timing

The timing of initiation of implementation of the City's proposed QCB habitat restoration/enhancement program is related to two factors: (1) availability of suitable land and (2) availability of funds. This section addresses those two issues, and describes the anticipated progress of the proposed program relative to the timing of anticipated impacts.

Availability of Land. The City's ability to conduct QCB habitat restoration/enhancement activities is directly dependent upon the conveyance of land to the Preserve. The areas tentatively identified as the highest priority for QCB habitat restoration/enhancement are located in the Salt Creek/Otay River Valley area of the Preserve. Approximately 185 acres of Preserve-Category A land in the Salt Creek/Otay River Valley has been dedicated into Preserve conservation as part of development entitlements approved by the City for BSO. Based on conveyance of this high priority land, the City will be able to begin enhancement/restoration efforts in 2003, if it receives Take Authority from the Wildlife Agencies before December 31,2002.

Other conservation areas containing Category A habitat are located within the Rolling Hills Ranch and Bella Lago project areas. Conveyance of these habitat areas will be accomplished in conjunction with development approvals for these North City projects.

Availability of funding. Another key element to timing of implementation of the proposed QCB habitat restoration/enhancement program is the establishment of the PMEF. The PMEF will be funded incrementally, simultaneous with the commencement of construction of four key Planned Facilities: the Salt Creek trunk sewer line, the Wolf Canyon trunk sewer line, Main Street and La Media Road. Construction on the Salt Creek and Wolf Canyon sewers is anticipated to commence in 2002 and 2005 respectively. Main Street and La Media Road are planned to be built later, in 2010 and 2015. Funding amounts are Salt Creek Sewer, including access roads and trails ($1 million); Wolf Canyon Sewer, including access road and a trail along an existing dirt road ($500,000); Main Street between Paseo Ranchero and Rock Mountain Road ($250,000); and La Media Road ($100,000).

As described above, the actual allocation of funding available for the QCB habitat restoration/enhancement program will be determined in the field at the discretion of the City Habitat Manager, in consultation with the QSAC, depending upon the quality of the habitat selected for restoration activities. The first year of the program would be devoted to establishing the program, seed collecting and propagating the seed of larval host and nectar resource plants, and determining the initial areas to be restored/enhanced. Thereafter, seed costs would continue as illustrated in the above table. The restoration/enhancement will begin in year two and continue to approximately year ten (when the 50 acre minimum commitment is reached). As each acre completes the final year (moderate and high intensity or four-year (low intensity) restoration/enhancement program, it will enter into a program of perpetual maintenance.

The City's cost evaluation model was used to evaluate if planned funding is sufficient to address two potential field conditions. Program I assumes that lands within the program will require a combination of high- and moderate-intensity restoration efforts. The QCB cost evaluation model

projects that if Program I is necessary, the endowment will have funded the completion of 15 acres of high-intensity restoration and 35 acres of moderate-intensity restoration, for a total of 50 acres, by 2013.

Program II assumes that field conditions will allow for a successful program with a combination of moderate- and low-intensity restoration/enhancement efforts. This would reduce overall costs and potentially allow for restoration/enhancement of additional acres of QCB habitat. Any permutation of these acreages would be possible based on the decisions made by the City Habitat Manager, in consultation with the QSAC, regarding funding allocation on an annual basis.

As each acre completes the five-year restoration/enhancement program, it will enter a program of perpetual maintenance, using funds generated from the endowment. Funds generated which are in excess of necessary maintenance costs would be available to enhance other areas of the Preserve, or to expand the QCB program, at the direction of the City Preserve Manager and the Director of Planning and Building.

Relationship of Restoration/Enhancement to Impacts. The proposed program is front-loaded to provide restoration/enhancement of Category A habitat areas within the Preserve, simultaneously with construction of infrastructure projects in the Preserve, and in advance of projects in Category A habitat in the development areas.

The following table provides information about the projected construction of private development projects in the City of Chula Vista as well as projected construction of Planned Facilities (infrastructure) in the Preserve. It should be noted that the phasing of many private development projects is tied directly to the availability of infrastructure, including the four infrastructure projects to which the PMEF establishment is tied. The projected phasing of village development in Otay Ranch was taken from the Otay Ranch Service/Revenue Plan. The estimated construction dates for Rolling Hills Ranch and Bella Lago are taken from the "Master Land Use Phasing Table" used for traffic allocation planning by the City. The estimated construction dates for infrastructure are based on the village projections.

Otay Ranch Development Area			
Phase	**Villages**	**Estimated Construction Dates**	**QCB Habitat Potential "A"**
Phase 1	1	1999-2002	Not in QCB planning area
	5	1998-2000	Not in QCB planning area
Phase 2	2	2002-2005	No
	6	2004-2007	No
	11	2002-2006	No
Phase 3	3	2006-2007	No
	4	2008-2011	No
	7	2009-2014	No
Phase 4	8	2013-2016	Yes
	9	2015-2021	Yes
	10	2012-2014	Yes

North City Development Area		
Development Project	**Estimated Construction Dates**	**QCB Habitat Potential "A"**
Rolling Hills Ranch – Eastern Area	2004-2006	Yes
Bella Lago	2010-2012	No
Preserve		
Infrastructure Project	**Estimated Construction Dates**	**QCB Habitat Potential "A"**
Salt Creek Sewer	2003	Yes
Wolf Canyon Sewer	2005	No
Main Street between Paseo Ranchero and Rock Mountain Road	2010	No
La Media Road	2015	Yes

The development areas of Otay Ranch villages within Category A habitat include a small portion of Village 8 and Villages 9 and 10. Construction in Village 8 is projected to occur between 2013 and 2016. Villages 9 and 10 comprise the City's University site. It is difficult to project when development of the University site would occur. Based on the City's progress in assembling land for the University site, the university could be constructed sometime between 2010 and 2020. If the University project did not materialize, the secondary land use for Villages 9 and 10 would be developed. The projected timeframe for completion of the secondary land uses would be 2012-2021. The only way the secondary land uses in Villages 9 and 10 could be constructed earlier than 2012 is if 75 percent of the development in phases 1, 2 and 3 were built out.

As discussed above, it is anticipated that collection of QCB larval host and nectar resource plants would begin in 2003, and appropriate lands and funding would be available to initiate restoration/enhancement activities in 2004. Thus the program would be initiated at approximately the same time the first potential habitat impacts occur, in association with Rolling Hills Ranch and the Salt Creek Sewer. Based on the example of Program I presented above, 50 acres of moderate- to high-intensity restoration/enhancement would be nearly complete when the next impacts to Category A habitat from private development projects are anticipated (2013). If restoration/enhancement efforts are more weighted to moderate- and low-intensity restoration/enhancement, an even greater number of acres would be treated by this time. Thus, the proposed restoration/enhancement program would occur in advance of, or simultaneous with, anticipated impacts to Category A potential QCB habitat. Similarly, potential QCB habitat designated for open space will be conveyed to the Preserve in conjunction with approvals for the associated developments, such that conservation and habitat impacts proceed in rough-step.

Monitoring

Conservation with the USFWS Five-Point Policy (65 FR 35242), Chula Vista will provide information necessary to assess habitat impacts and conservation, and to verify progress toward the stated biological goals and objectives. To meet this policy, the City of Chula Vista will undertake monitoring and reporting activities to assess both compliance with its permit requirements, and effectiveness of its QCB habitat management and enhancement activities. As described in Section 4.5 of the Subarea Plan, the City will prepare and provide to the Wildlife Agencies an annual report of total habitat area lost and habitat area conserved within the Chula Vista Subarea, by vegetation type. This vegetation type information will allow the Wildlife Agencies to make generalized determinations of potential QCB habitat impacted and conserved in the Subarea each year. The report will also include the number of acres subject to the QCB habitat restoration/enhancement program, as well as a status report on the QCB restoration/enhancement and monitoring programs described in this appendix.

The Recovery Plan (USFWS 2001) states that monitoring should be used to define management strategies, through an adaptive management process. The City proposes to implement this objective through a three-pronged effort: (1) monitoring of overall habitat quality in the Preserve, (2) monitoring effectiveness of QCB habitat restoration/enhancement efforts and (3) limited census monitoring of QCB populations.

Both the City Planning Component FMP and Otay Ranch RMP include provisions for monitoring sensitive biological resources, to ensure proper adaptive management (see Subarea Plan Sections 7.3 and 7.6). Such monitoring activities would primarily benefit the QCB through monitoring of overall habitat quality in the Preserve.

The Otay Ranch Biota Monitoring Program establishes performance standards and a monitoring methodology for both existing vegetation and restoration sites for a number of habitat types. The City proposes to use this monitoring program as a basis upon which to establish monitoring activities specifically directed at QCB habitat. A qualified restoration biologist, selected by the City Habitat Manager, will establish a baseline percentage of exotic weed species in QCB habitat restoration/enhancement areas through surveys. Locations of invasive non-native plant species will be mapped and scheduled for removal, monitoring or control as necessary. These areas will then be monitored for the occurrence of exotic invasive plants before and after enhancement, to determine the effort's level of success. An adaptive management program will be implemented based on the results of the monitoring program.

In addition to monitoring the effectiveness of QCB habitat restoration efforts, the City will conduct limited annual census monitoring. Census monitoring for the QCB will have the primary goal of assessing the QCB population within the context of the QCB population throughout southern San Diego County. The methodology for census monitoring will be phased dependent upon the number of QCB occurring within the City.

Because there are a limited number of QCB locations currently known from the City, and because access is not available for preserve lands until such lands are conveyed, initial monitoring efforts will consist of surveying on such conveyed lands that include all known QCB

locations, all known suitable but currently unoccupied habitat, and all sites on which QCB restoration activities have been initiated. This survey will be conducted during the second or third week of the QCB flight season to maximize the potential for detection, and will be conducted only during optimal weather conditions. The biologist conducting the surveys shall have a valid permit from the USFWS for conducting QCB surveys. This census methodology will be conducted until the observed QCB population in the City reaches 25 individuals for two consecutive years.

The data collected will be compared with population trends for the QCB in southern San Diego County. For example, if 100 QCB are observed in southern San Diego County in 2002 and 100 QCB are observed in 2003, the baseline against which the City's census data is compared does not change. If, however, the number of observed QCB increased to 200 individuals, the City's baseline would change from 8 to 16 individuals. Because of the limited number of currently known QCB locations in the City, and the high variability typically found in its population numbers, interpretation of the results of these surveys will need to be broad in nature, especially during poor flight years for the QCB. Population estimates within 50 percent of the baseline (established as described above) will be considered acceptable variations in the City QCB population. For example, if all eight QCB locations were surveyed in 2003 and only four QCB were observed, and the baseline surveys for 2003 in southern San Diego County were no different than the previous year, then the City QCB population would be considered to be within acceptable variability limits. If, however, the baseline in southern San Diego County doubled from the previous year, then the City QCB population would not be meeting the 50 percent criterion (eight sightings would meet the 50 percent criterion). If the criterion is not met for two consecutive years, the City would meet with the QSAC to determine appropriate adaptive management measures to address the apparent decline.

Once the QCB population in the City reaches 25 individuals, a more intensive censusing effort will be conducted at the two locations within the City with the highest QCB densities (based on surveys from previous years). It is anticipated that these areas will be censused four times annually during the flight season using census techniques developed by the QCB Recovery Team. Similar to the program described above, these data will be compared with other population trend data within southern San Diego County to determine if the 50 percent criterion is being met. If the criterion is not met for two consecutive years, the City would meet with the QSAC to determine appropriate adaptive management measures to address the apparent decline.

The City would fund these efforts within the funding allocated for its MSCP Preserve management and habitat restoration/enhancement program, as discussed in Section 8.0 of the Subarea Plan. Biological monitoring within the Subarea will be the responsibility of the City, although monitoring within the Otay Ranch PMA will be assumed by the POM or its designee, and the City may assign a designee to conduct monitoring within Central City and/or North City PMAs. As described in the Subarea Plan, although local agency Preserve managers will collect field data, the Wildlife Agencies will assume primary responsibility for coordinating the monitoring programs, analyzing data and providing information and technical assistance to the jurisdictions throughout the MSCP Subregion.

Anticipated Impacts within the City of Chula Vista Subarea

Impacts to potential habitat within the Subarea are anticipated to total 394 acres (27 percent) of Category A, 951 acres (40 percent) of Category B and 365 acres (58 percent) of Category C. It is important to remember, however, that very little of the identified potential habitat acreage is actually likely to be appropriate habitat.

In association with the anticipated habitat impacts, only one of the eight known QCB observation locations within the City would be taken. It is possible that QCB may occur in additional areas in the Subarea in the future. Take of any such future locations is also authorized by this Subarea Plan.

Impact Minimization

The City of Chula Vista has undertaken, or has committed to undertake upon issuance of take authority, a number of measures to minimize potential impacts to the QCB. As noted in the Background section of this document, the Draft Recovery Plan identifies carbon dioxide as a potential threat to QCB relative to plant and insect development, as well as global climate change. The City of Chula Vista adopted a Carbon Dioxide Reduction Plan on November 14, 2000. This plan includes a number of completed or ongoing measures, such as purchase of alternative fuel vehicles, green power public education program, traffic signal and system upgrades, and municipal building upgrades and trip reduction.

Subsequent to conditional adoption of the Subarea Plan by the City Council in October 2000, the City of Chula Vista immediately initiated preparation and processing of amendments to the City's Grading Ordinance for MSCP implementation. The ordinance amendments include regulations on clearing and grubbing of Sensitive Biological Resources to ensure compliance with the Chula Vista MSCP Subarea Plan. Specifically, impacts associated with Planned and Future Facilities within the Preserve and other development outside of the Preserve will be minimized according to the measures described below.

Infrastructure in the Preserve. Impacts will not be permitted within the Preserve except in association with Planned and Future Facilities. Infrastructure projects constructed within the Preserve will be subject to the Facilities Siting Criteria contained in Section 6.3.3.4 of the Subarea Plan. Impacts to QCB habitat in the Preserve will be minimized, while allowing for construction of Planned and Future Facilities as provided for in the Subarea Plan. To the extent practicable as determined by the City, impacts to occupied QCB habitat will be avoided during the planning, design and construction of Planned and/or Future Facilities. The physical and engineering requirements of new roads and infrastructure shall be considered during the siting procedure. Road and/or right-of-way width may be narrowed from existing City design and engineering standards where necessary to avoid impacts to occupied QCB habitat, to the maximum extent practicable.

Although siting facilities along existing dirt roadways or disturbed areas is typically considered preferable to siting in vegetated areas, the edges of such areas are frequently the locations of QCB observations. To the extent that such areas in a given project footprint are demonstrated to

be occupied by QCB, avoidance of them will be prioritized over avoidance of vegetation not occupied by the QCB or other Covered Species. The prioritization for avoidance of QCB versus other Covered Species will be determined in consultation with the Wildlife Agencies on a project-specific basis. Unoccupied, but potentially suitable, QCB habitat should also be avoided if possible; areas with higher likelihood of supporting QCB represent a higher priority for avoidance. If grading must occur in areas within or adjacent to occupied habitat, a number of minimization measures will apply.

1. A habitat assessment will be conducted in potential facility locations as part of the project siting and design process.

2. QCB surveys will be conducted in appropriate habitat by a qualified biologist in accordance with the most recent survey protocol adopted by the Wildlife Agencies.

3. If QCB are observed within the proposed Project Area, the project will be designed to avoid impacts to QCB habitat to the maximum extent practicable.

4. The following avoidance criteria will be applied specifically to Preserve Habitat-Category A areas located east of SR 125:

    a. For Preserve Habitat-Category A areas east of SR 125 that are within the Salt Creek drainage and the Otay River Valley and associated with the property known as the New Millennium Property, the following patches of QCB habitat, as mapped in the habitat assessment prepared by Dudek and Associates (Figure J-1) will be considered "significant QCB habitat patches": 2, 5, 12, 18, 22, 23, 24, 26, 30, and 33.

    b. For Preserve Habitat-Category A areas located east of SR 125 that are within the Salt Creek drainage and the Otay River Valley and outside of the New Millennium Property, a detailed habitat assessment will be conducted, including mapping patches of *Plantago erecta* and other host plants, if applicable. In this area, if dense patches of plantago greater than 50 grassland that has not been subject to extensive invasion by non-native plant species, such patches shall be considered "significant QCB habitat patches." In addition, if dense patches of plantago greater than 150 square meters in area are found in canyonsides or drainage bottoms, in a matrix of sage scrub or grassland that has not been subject to extensive invasion by non-native plant species, such patches shall be considered "significant QCB habitat patches."

    c. Projects shall be designed to avoid "significant QCB habitat patches" to the maximum extent practicable, regardless of whether QCB are observed. If impacts to these habitat patches cannot be avoided, the City will consult with the Wildlife Agencies and the Wildlife Agencies will cooperatively work with the City to site the proposed facility in a location that will best minimize impacts to QCB habitat. The City will submit a written request for input to the Wildlife Agencies. The Wildlife Agencies will meet and confer with the City and, no later than 60 days of receipt by the Wildlife Agencies of written notice from the City, resolution on the appropriate location of the proposed facility will be completed.

d. During joint review of a project proposing to impact one or more "significant QCB habitat patches", a cooperative assessment will be made by the City and Wildlife Agencies to determine the overall significance of the proposed impacts to "significant QCB habitat patches". The assessment will be made within the context of the quality and location of other QCB habitat within the Preserve at the time of the assessment. Evaluation of proposed project impacts to significant habitat patches shall also take into consideration all of the other components of the City's QCB program. In particular, if the planned QCB habitat restoration/enhancement component has demonstrated success, the City and the Wildlife Agencies shall consider the restoration/enhancement component in their evaluation of the individual project's impacts.

e. When the City has successfully completed, as determined by the Wildlife Agencies, at least 10 acres of QCB restoration/enhancement within the Preserve in the Salt Creek/Otay River Valley area, the provisions of Section 5.2.8.1 (4)(a-d) will no longer be applicable.

5. For construction in areas adjacent to occupied habitat, dust control measures (i.e., watering) will be applied during grading activities.

6. As part of the overall Preserve management strategy, a weed control program will be established for all water/sewer line access roads built through potential QCB habitat. This will include road construction using a concrete-treated base material with aggregate rock to prevent vegetation growth on the road surface, while allowing sufficient percolation to minimize flows. The zone of influence to be subject to the weed control program will be determined by the City's Habitat Manager based on site-specific conditions.

Development Projects. All areas outside of the hardline Preserve will have unlimited Take Authorization for the QCB. For areas adjacent to Preserve Habitat - Category A, a qualified biological monitor will be on site during clearing, grubbing and/or grading activities to ensure that the approved limits of disturbance are not exceeded and that dust control measures are being implemented. Specifically, the monitor will be on site constantly during clearing or grubbing operations where such operations occur adjacent to the edge of Category A habitat in 100% Conservation Areas. Thereafter, if high-visibility fencing that clearly demarcates the limits of disturbance is erected, the monitor will visit the site weekly during rough grading operations to ensure that it is still in the appropriate location. If the limits of disturbance are simply staked or flagged, the monitor will check the site daily during rough grading operations to ensure that the approved limits of disturbance are not exceeded. Upon completion of rough grading activities, monitoring will no longer be required.

As a means of reducing impacts to potential QCB habitat and other sensitive habitats from development allowed by the Subarea Plan, the City of Chula Vista will continue its practice of requiring soil, seed and plant salvage on a project-by-project basis (see Subarea Plan Section 5.2.7). Project review and CEQA analysis will identify appropriate salvage opportunities. Mitigation measures and conditions of project approval would specify the soils, seed and plant material to be salvaged, identify the procedures for salvage, and specify locations and time frames for use of material, as appropriate.

Rationale for Identifying the Species as Covered

The conservation, restoration/enhancement and management program proposed for the QCB in the City's Subarea provides an extraordinary biological benefit to the species when weighed against anticipated impacts. As described above, there is minimal potential for QCB to occur in significant numbers in the City of Chula Vista Subarea in the absence of habitat restoration/enhancement efforts. In fact, it is anticipated that without effective management, especially weed control, habitat quality and the potential for long-term persistence of the QCB in the City of Chula Vista will continue to decline. Any impacts associated with the development of projects in the City are therefore anticipated to be minimal.

The City is proposing to provide for the long-term conservation and recovery of the species by implementing the actions described in this appendix, and summarized below. These actions are consistent with the Draft Quino Checkerspot Butterfly Recovery Plan through (1) protection of 98 percent of the area within the proposed critical habitat designation, as well as significant conservation outside of, but connected to, critical habitat, which will also enhance the long-term conservation of QCB; (2) preservation of 7 of the 8 documented QCB locations in the City; (3) maintenance of a potential landscape linkage along the western edge of Lower Otay Lake, per Priority 1 Recommendation 1.1.5.2 of the Recovery Plan; (4) maintenance of connectivity through the northeastern portion of the City from SDNWR to Otay Lakes, per Priority 1 Recommendation 1.1.5.1 of the Recovery Plan; (5) reestablishment of viable habitat that maintains connectivity with existing populations, per Priority 1 Recommendation 1.1.5.3 of the Recovery Plan; (6) management of Preserve areas for the QCB and other Covered Species; and (7) minimization of impacts resulting from Planned and Future Facilities in the Preserve and development projects adjacent to the Preserve, including salvage of habitat constituents and monitoring.

Through implementation of the Subarea Plan, seven of the eight QCB observation locations in the Subarea would be conserved. All eight known locations of QCB within the Subarea were single individual sightings. None of the eight locations are considered critical populations; thus, no critical populations of QCB would be impacted by Take Authorization. The seven conserved known QCB locations are within the boundaries of the Preserve. Planned Facilities that must cross the Preserve are located to avoid all seven known QCB locations. In addition, all Planned and Future Facilities within the Preserve would be required to conduct QCB surveys based on the most recent protocols adopted by the Wildlife Agencies and demonstrate impact avoidance/minimization. Pursuant to the Subarea Plan, overall, 1.61 acres of potential QCB habitat would be protected for each acre of potential QCB habitat impacted. Impacts are predominantly in areas in Category B and C, while conservation predominantly occurs in Categories A and B. For Category A habitat, that with the highest likelihood to support QCB, the ratio of habitat preserved to impacted is 2.75:1.

In addition to the conservation of a majority of the habitat in the City with potential to support QCB, the City proposes a restoration/enhancement program designed to result in additional high-quality QCB breeding and dispersal habitat. Such activities would be directed to areas that provide for long-term viability of the species through connectivity with and between existing populations. Both habitat conveyance and restoration/enhancement of potential QCB habitat

would occur in advance of, or simultaneous with, anticipated impacts to Category A potential QCB habitat.

Areas identified for preservation are also in proximity to preserve areas (including other high-potential enhancement areas) under the control of others, including the USFWS, City of San Diego, County of San Diego, and Otay Water District. The efforts proposed by this Subarea Plan could therefore offer a springboard for efforts directed by these multiple jurisdictions at recovery of the QCB, providing a substantially increased benefit. Regardless of any potential future efforts by others, the City of Chula Vista is proposing a suite of actions designed to effectively implement the portion of the Recovery Plan relevant to its jurisdiction. In comparison with the minimal anticipated potential impacts to QCB, this Subarea Plan provides an extraordinary net biological benefit, contributing to the long-term persistence and recovery of the subspecies.

LITERATURE CITED

Allen, E. B., P. E. Padgett, A. Bytnerowicz, and R. Minnich. 1998. Nitrogen deposition effects on coastal sage vegetation of southern California. Proceedings of the International Symposium on Air Pollution and Climate Change Effects on Forest Ecosystems, Riverside, CA. February 5-9, 1996. USDA Forest Service, Pacific Southwest Research Station, PSW-GTR-166, 131-140. [http://www.rfl.psw.fs.fed.us/pubs/psw-gtr-164/fulltext/allen/allen.html#anchor1473574].

Allen, E. B., S. A. Eliason, V. J. Marquez, G. P. Schultz, N. K. Storms, C. D. Stylinski, T. A. Zink, and M. F. Allen. 2000. What are the Limits to Restoration of Coastal Sage Scrub in Southern California? In J. E. Keeley, M. B. Keeley and C. J. Fotheringham (eds.) 2nd Interface Between Ecology and Land Development in California. USGS Open-File Report 00-62, Sacramento, CA.

Ballmer, Greg, David Hawks, Ken Osborne, and Gordon Pratt. 1998. The Quino checkerspot butterfly Euphydryas editha quino. Unpubl. Report.

Bauer, D. 1975. Tribe Melitaeini. In W. Howe (ed.) The Butterflies of North America, pp. 139-195. Doubleday and Company, Inc., Garden City, New York. 633 pp.

Boughton, D. A. 2000. The Dispersal System of a Butterfly: A test of source-sink theory suggests the intermediate-scale hypothesis. American Naturalist 156: 131-144.

_____. 1999. Empirical evidence for complex source-sink dynamics with alternative states in a butterfly metapopulation. Ecology 80: 2727-2739.

Brown, J. W. 1991. Sensitive and declining butterfly species in San Diego County, California. Manuscript. Available from Dudek and Associates, Inc.

Coviella, C. E. and J. T. Trumble. 1998. Effects of elevated atmospheric carbon dioxide on insect-plant interactions. Conservation Biology 13: 700-712.

Dodero, M. RECON, Inc. San Diego, CA. Personal communication.

Ehrlich, P. R. 1965. The population biology of the butterfly, Euphydryas editha. II. The structure of the Jasper Ridge colony. Evolution 19: 327-336.

_____. 1961. Intrinsic barriers to dispersal in a checkerspot butterfly. Science 134: 108-109.

_____, R. R. White, M. C. Singer, S. W. McKechnie, and L. E. Gilbert. 1975. Checkerspot butterflies: a historical perspective. Science 118: 221-228.

Emmel, T. C. and J. F. Emmel. 1973. The Butterflies of Southern California. Natural History Museum of Los Angeles County, Science Series 26: 1-148.

Field, C. B., G. C. Daily, F. W. Davis, S. Gaines, P. A. Matson, J. Melack, and N. L. Miller. 1999. Confronting Climate Change in California: Ecological Impacts on the Golden State. Union of Concerned Scientists, Cambridge, MA and Ecological Society of America, Washington, D.C.

Freudenberger, D. O., B. E. Fish, and J. E. Keeley. 1987. Distribution and stability of grasslands in the Los Angeles basin. Bulletin of Southern California Academy of Sciences 86: 13-26.

Hanski, I. 1999. Metapopulation Ecology. Oxford University Press, Oxford.

Harrison, S., D. D. Murphy, and P. R. Ehrlich. 1988. Distribution of the bay checkerspot butterfly, *Euphydryas editha bayensis*: Evidence for a metapopulation model. American Naturalist 132: 360-382.

Harrison, S. and J. F. Quinn. 1989. Correlated environments and the persistence of metapopulations. Oikos 56: 293-298.

Mattoni, Rudi, Gordon F. Pratt, Travis Longcore, John Emmel, and Jeremiah George. 1997. The endangered Quino checkerspot butterfly, Euphydryas editha quino (Lepidoptera: Nymphalidae). J. Res. Lepid. 34: 99-118.

McNeely, C. and M. C. Singer. Contrasting roles of learning in butterflies foraging for nectar and oviposition sites. Animal Behaviour, in press.

Minnich, R. A. and R. J. Dezzani. 1998. Historical decline of coastal sage scrub in the Riverside-Perris Plain, California. Western Birds 29: 366-391.

Murphy, D. D. 1990. A report on the California butterflies listed as candidates for endangered status by the United States Fish and Wildlife Service. Draft report for CDFG, Contract No. C-1755. 60 pp.

_____. 1982. Nectar sources as constraints on the distribution of egg masses by the checkerspot butterfly *Euphydryas chalcedona* (Lepidoptera: Nymphalidae). Environmental Entomology 12: 463-466.

_____ and R. R. White. 1984. Rainfall, resources, and dispersal in southern populations of Euphydryas editha (Lepidoptera: Nymphalidae). Pan-Pacific Entomologist 60: 350-354.

_____. University of Nevada, Reno. Reno, Nevada. Personal communication.

Orsak, L. J. 1977. The Butterflies of Orange County, California. Center for Pathobiology: Misc. Publ. 3 and Museum of Syst. Biolo.: Res. Ser. 4. University of California, Irvine. 349 pp.

_____ and R. A. Redak. 2000. Microhabitat conditions associated with the distribution of post-diapause larvae of Euphydryas editha quino (Behr) (Lepidoptera: Nymphalidae). Annals of the Entomological Society of America 93: 110-114.

Parmesan, C. 1996. Climate and species' range. Nature 382: 765-766.

Porter, S. D. and D. A. Savignano. 1990. Invasion of polygyne fire ants decimates native ants and disrupts arthropod community. Ecology 71: 2095-2106.

Pratt, G. 2000. Silverado Ranch Survey 2000: Survey and Monitoring of the Quino checkerspot. Report submitted to the Carlsbad Fish and Wildlife Office.

Singer, M. C. and P. R. Ehrlich. 1979. Population dynamics of the checkerspot butterfly *Euphydryas editha*. Fortschritte der Zoologie 25: 53-60.

Stylinski, C. D and E. B. Allen. 1999. Lack of native species recovery following severe exotic disturbance in southern California shrublands. Journal of Applied Ecology 36: 544-554.

Thomas, C. D. 1994. Extinction, colonization, and metapopulations: Environmental tracking by a rare species. Conservation Biology 8: 373-378.

United States Fish and Wildlife Service (USFWS). 2001. Draft Recovery Plan for the Quino Checkerspot Butterfly (Euphydryas editha quino). Portland, Oregon.

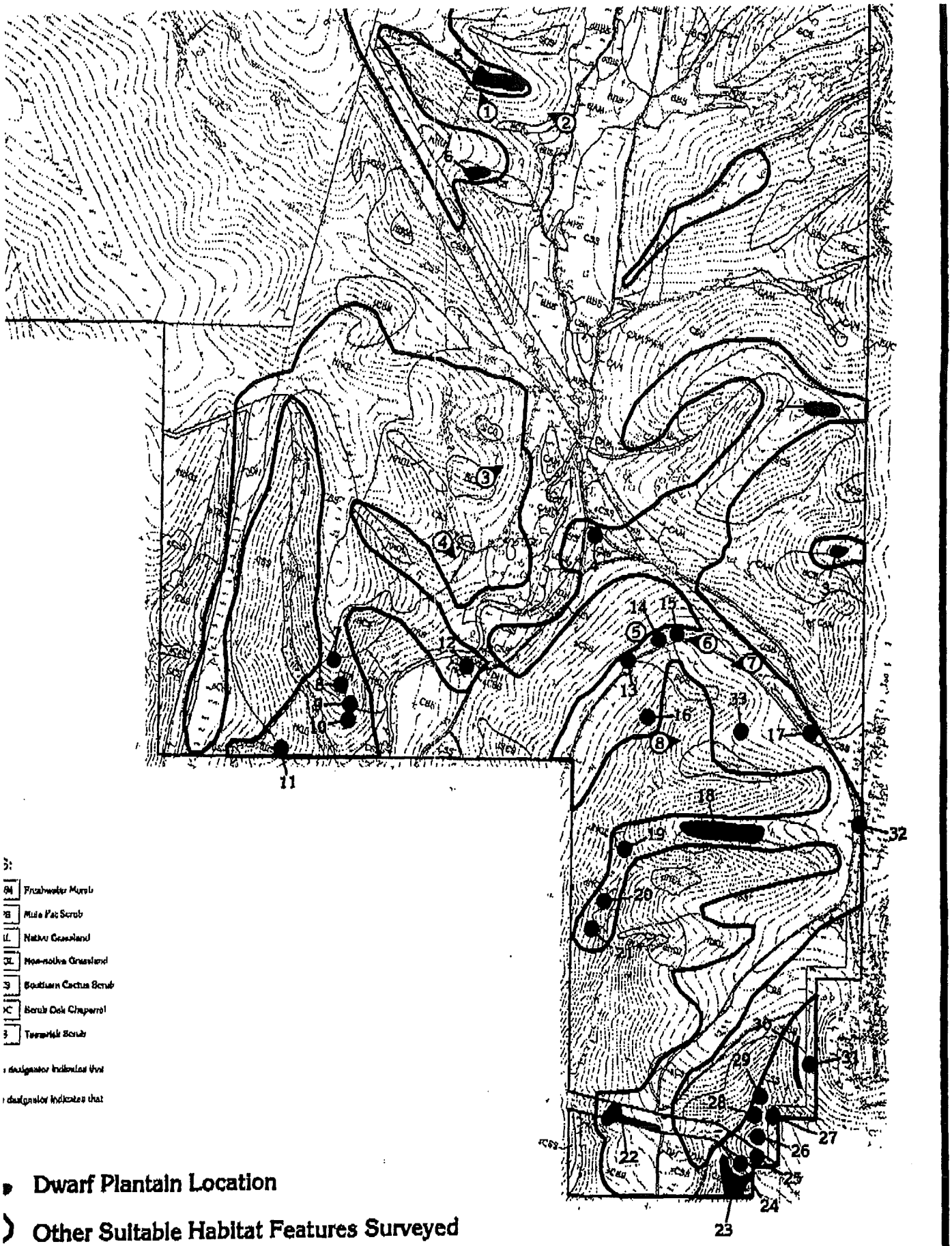
Weiss, S. B., D. D. Murphy, and R. R. White. 1988. Sun, slope, and butterflies: Topographic determinants of habitat quality for *Euphydryas editha*. Ecology 69: 1486-1496.

Weiss, S. B., R. R. White, D. D. Murphy, and P. R. Ehrlich. 1987. Growth and dispersal of larvae of the checkerspot butterfly *Euphydryas editha*. Oikos 50: 161-166.

White, R. R. 1975. Food plant defoliation and larval starvation of *Euphydryas editha*. Oecologia 14: 307-315.

Whittaker, J. B. 1999. Impacts and responses at population level of herbivorous insects to elevated CO_2. European Journal of Entomology 96: 149-156.

Zink, T. A., M. F. Allen, B. I. Heindl-Tenhunen, and E. B. Allen. 1995. The effect of a disturbance corridor on an ecological reserve. Restoration Ecology 3: 304-311.



New Millenium - Quino Checkerspot Butterfly Report
Source: Dudek and Associates, 1999

Figure J-1