Lake Mathews Multiple Species Habitat Conservation Plan and Natural Community Conservation Plan

Volume 2
Biological Resources

July 1995

Prepared by
The Metropolitan Water District of Southern California
and Riverside County Habitat Conservation Agency

Lake Mathews Multiple Species Habitat Conservation Plan and Natural Community Conservation Plan

Volume 2

Biological Resources

July 31, 1995

Prepared by

The Metropolitan Water District of Southern California

Riverside County Habitat Conservation Agency

Cover Photographs:

B. "Moose" Peterson/Wildlife Research Photography (wildlife)

Patrick Knisely/Metropolitan Water District of Southern California (Lake Mathews)

Contents

Appendices

Figures

Tables

Part 2. Target Species Habitat Conservation Plans

Tables

Preface

The Metropolitan Water District of Southern California (Metropolitan) conducted a comprehensive biological review of its properties at Lake Mathews as part of the preparation of this Multiple Species Habitat Conservation Plan and Natural Community Conservation Plan (Lake Mathews MSHCP/NCCP or the Lake Mathews Plan). This volume presents the results of that review.

Volume 2, Biological Resources, has two parts:

- Part 1, the Biological Technical Report, locates the Plan Area, describes the biological resources of the Plan Area and the methods used to survey those resources, provides quantitative data on vegetation and wildlife and cumulative inventory lists for species observed, presents the results of a quantitative Habitat Quality Assessment (HQA) of Lake Mathews properties, and concludes with a discussion of the biological values of the Plan Area in regional perspective.

- Part 2 contains Habitat Conservation Plans (HCPs) for each of the 65 Target Species in Groups 1, 2, and 3 identified in Volume 1. The Target Species HCPs provide a review of each species' biology, the conservation and mitigation measures to be implemented for that species under the Lake Mathews MSHCP/NCCP, and an assessment of the overall implementation of the Lake Mathews Plan on the species.

Part 1

Biological Technical Report

Introduction

Biological Technical Report
Chapter 1

1. Introduction

Extensive biological surveys were conducted on Metropolitan's properties at Lake Mathews (Plan Area) to provide biological information on which to base the Lake Mathews Multiple Species Habitat Conservation Plan/Natural Communities Conservation Plan (MSHCP/NCCP). Part 1, Biological Technical Report, describes results of that work, including:

- Descriptions of the biological resources of Metropolitan's lands at Lake Mathews and the methods used to survey them,
- Quantitative data on vegetation and wildlife,
- An historic perspective on vegetation and wildlife,
- The results of surveys for sensitive species including maps of species occurrence and tables summarizing sensitivity status,
- The results of a quantitative Habitat Quality Assessment (HQA), and
- A discussion of the biological values of the Plan Area in regional perspective.

Cumulative inventory lists of observed species are included in the appendices along with detailed information on survey personnel, dates, and routes.

A. The Study Area

The study area for the Lake Mathews Biological Resources report is identical to the Plan Area identified in Volume 1 of the Lake Mathews MSHCP/NCCP. The Plan Area consists of 5,993.5 acres owned by Metropolitan in northwestern Riverside County at the northern toe of the Gavilan Hills (Figure 1-1). Of this land, 2,565 acres are currently an ecological reserve under an existing agreement with the California Department of Fish and Game (CDFG). The lands not within this existing ecological reserve (Existing Reserve) currently serve to protect water quality at Lake Mathews by buffering the lake from surrounding land uses. These lands are proposed as an addition to the Existing Reserve and as biological mitigation banks (Mitigation Bank) for the RCHCA and future Metropolitan projects.

The topography of the Plan Area is generally low, with rolling hills and a series of distinct taller hills, or knobs, and short ridges. Lake Mathews was formed by construction of a dam on Cajalco Creek. Cajalco Creek enters the Plan Area at the eastern end where it forms a wide, shallow, braided stream system fed by natural flows and agricultural runoff. Downstream from the lake, the creek continues to flow west in the deep and narrow Cajalco Canyon fed by both high groundwater and seepage from the dam.

Three existing public roadways border and/or cross the property: La Sierra to the west, Cajalco Road to the south, and El Sobrante Road to the north and east (Figure 1-2). Fences with locked gates encompass nearly all of the Existing Reserve and also separate key reservoir operations areas from other lands in the Plan Area. Surveys

conducted to collect biological data emphasized the Mitigation Bank lands but occurred throughout the Plan Area.

The Plan Area consists of two primary components:

- A 5,110.4-acre multiple species reserve (Multiple Species Reserve), which includes the Existing Reserve and Mitigation Bank and

- Areas excluded from the Multiple Species Reserve, including 728.6 acres designated for the operation of the reservoir and ancillary facilities (Operations) and 154.5 acres designated for water facility improvements and related projects inside the Plan Area (Plan Area Projects).

The reservoir itself is not included in the Plan Area.

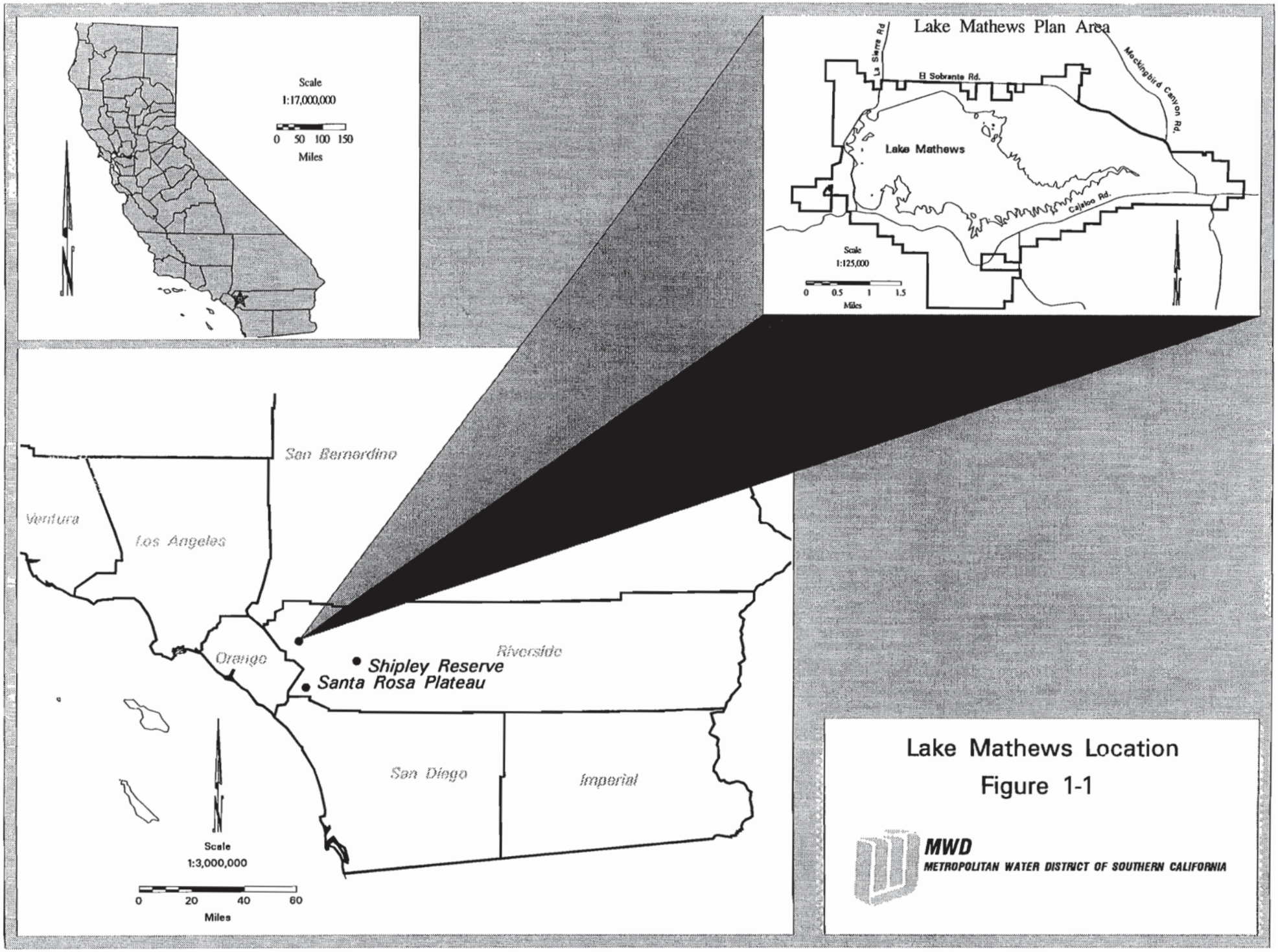
The Lake Mathews Plan Area supports a variety of natural habitats, wildlife, and sensitive species. The prevalent natural vegetation communities are non-native grassland and Riversidian sage scrub, which provide habitat for many sensitive animals such as the endangered Stephens' kangaroo rat (*Dipodomys stephensi*) and the threatened coastal California gnatcatcher (*Polioptila californica californica*). Riparian vegetation types are much more limited but have a diverse habitat structure important to many sensitive birds, including the tricolored blackbird (*Agelaius tricolor*), blue grosbeak (*Guiraca caerulea*), and many species of raptors. Nonvegetated habitats on the site, such as the lake and geomorphic habitats (rock outcrops), provide additional habitat diversity. Waterfowl use the lake as a resting site and the shore as a rookery, bats forage over the lake edges and use rock outcrops for roosting, and many species of herpetofauna and birds use the tall rock outcrops for sunning and perching.

B. Biological Surveys

In 1992, when the biological surveys were being planned and conducted, the boundaries of the Plan Area components were still being refined. However, the approximate boundaries of the Existing Reserve and Operations Areas were estimated based on previous agreements between Metropolitan and CDFG, and the locations of Plan Area Projects were estimated based on planning documents and discussions with project planners. For the purpose of surveys, it was decided to treat the entire Plan Area as an ecological unit rather than subdividing it into Plan Area components.

Two types of field surveys were conducted: quantitative and focused. Quantitative surveys of all vegetation types present in the Plan Area were conducted to provide information on plants and wildlife. The protocols followed for the quantitative surveys were quite specific; most surveys were completed over a 3-day period for each habitat type. Data from these surveys were incorporated into an HQA of Lake Mathews' ecological communities. The HQA procedure is a quantitative approach to compare the relative value of biological resources areas and mitigation sites as well as to determine mitigation needs and credits.

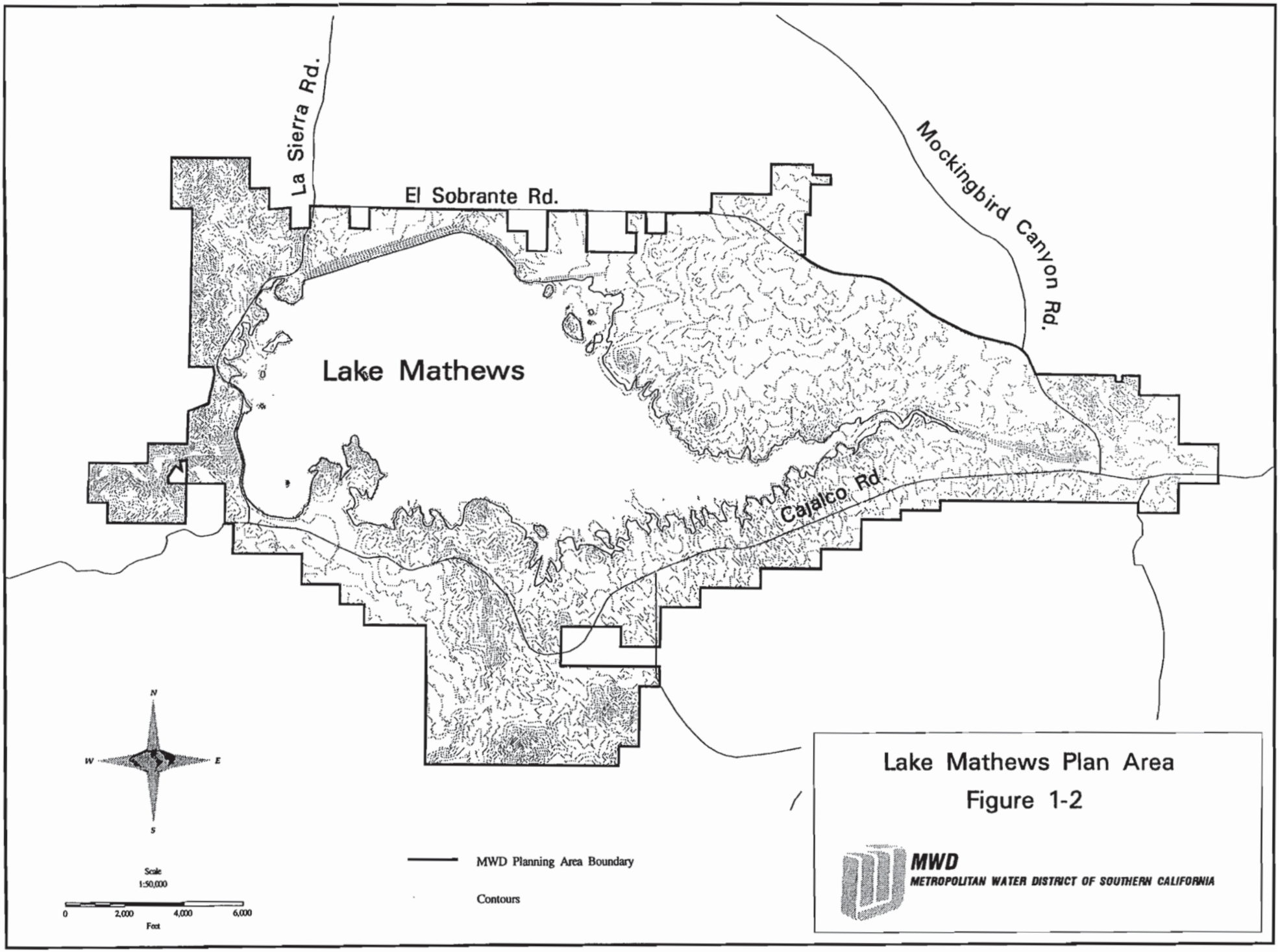
Focused surveys were conducted for all taxonomic groups. These surveys were intensive and extensive; some lasted as long as 4 months. Focused surveys identified sensitive species present in the Plan Area and formed the basis for the selection of Group 1 and Group 2 Target Species listed in Volume 1 and Part 2 of this volume.



Lake Mathews Location

Figure 1-1

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA


La Sierra Rd.
El Sobrante Rd.
Mockingbird Canyon Rd.
Lake Mathews
Cajalco Rd.
N
W
E
S
Scale
1:50,000
0
2,000
4,000
6,000
Feet
MWD Planning Area Boundary
Contours
Lake Mathews Plan Area
Figure 1-2
MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Survey methods are described in Chapter 2. Details of survey times and routes may be found in the appendices to this volume. The majority of both quantitative and focused surveys took place in 1992; additional focused surveys for plants were conducted in 1993. Species or species signs observed at Lake Mathews outside survey protocols or by qualified observers since completion of the 1992/1993 surveys have been incorporated into the comprehensive species list. For example, due to the timing of the surveys, bald eagles and other wintering birds were not recorded during the surveys, yet eagles are known to overwinter at Lake Mathews. The 1992 and 1993 Audubon Christmas Bird Counts were reviewed for incidental sightings of wintering raptors as well as CDFG records of yearly bald eagle counts.

C. Organization of the Report by Chapter

Chapter 2 provides a detailed description of the methods used to survey Plan Area properties. Further information on surveys—lists of survey personnel, survey dates, and maps of survey locations—are provided in Appendices A and B.

Chapters 3, 4, and 5 present the results of the surveys. Chapter 3 is a discussion of soil types and plant and animal communities within the Lake Mathews Plan Area. A vegetation map of the Plan Area is included as Figure 3-1. Each community discussion includes a general description and a profile of that community's characteristics at Lake Mathews. An historic perspective on Plan Area ecology is provided through a discussion of the Weislander plant community mapping of the area in the 1930s as well as a brief discussion of other earlier surveys of Lake Mathews biota. Quantitative data which underpin the discussions in Chapter 3 are provided in Appendices E and F.

Chapter 4 describes the results of focused surveys for sensitive species. It describes the species observed and their locations. For animal species these results are presented by habitat type. Chapter 4 also includes a brief discussion of species not observed but which potentially could occur at Lake Mathews.

Chapter 5 describes the results of a quantitative HQA based on the results of the surveys. The HQA methodology is discussed and is an example of how it has been used in previous studies. HQA results for the Plan Area are presented by habitat type.

The discussion in Chapter 6 attempts a regional perspective on the quality of habitats at Lake Mathews by comparing the Plan Area's HQA results with other Metropolitan-owned or studied sites of similar habitat type.

Appendices C and D are cumulative lists of plant and animal species observed at Lake Mathews.

Survey Methods

2. Survey Methods

This section describes the methodology used for assessing baseline biological resources present within the Lake Mathews Plan Area. Biological surveys were conducted from March through July of 1992 (Appendix A). Investigations included literature and database searches, consultation with experts and resource agencies, and quantitative and qualitative field surveys.

A. Vegetation Mapping and Habitat Classification

The habitat classification scheme for the Lake Mathews biological surveys was based on vegetation descriptions currently incorporated into the California Natural Diversity Data Base (CNDDB) (Holland 1986). Other vegetation descriptions for the region were also consulted to aid in habitat identification.

Initial mapping of vegetation types was done by analysis of 1:4,800 (1" = 400') scale color aerial photos of the Plan Area. (Photography was conducted in January 1992.) These preliminary outlines of Plan Area vegetation types were field checked and revised as necessary in March, April, and May 1992. Final vegetation maps were transferred to same-scale topographic maps, and the data were entered into a geographic information system (GIS) database. The maps produced provide the base for maps included in this document. Fourteen habitat categories were used in the maps produced:

- Non-native grassland
- Riversidian sage scrub
- Juniper woodland
- Mule fat scrub
- Southern willow scrub
- Sycamore riparian woodland
- Freshwater marsh
- Disturbed
- Agriculture
- Exotic trees
- Natural barren
- Ruderal
- Saltbush stand
- Open water (excluding lake)

Acreage of each vegetation type was calculated planimetrically by the GIS. Those acreage calculations form the basis for the Mitigation Bank acreages used in Volume 1.

B. Survey Techniques

Two types of surveys were conducted: quantitative surveys and focused surveys. Quantitative vegetation and wildlife survey techniques follow previously established methodology developed for the Eastside Reservoir Project (Metropolitan 1991a), with

the exception of small mammal survey techniques. (Differences in small mammal survey techniques are described below in Section B2(b).) The quantitative surveys provide the majority of data used in HQA calculations. Transect locations and biological resources identified were mapped on 1:4,800 (1" = 400') scale aerial photos and topographic maps. Quantitative methods are described in Sections B1 and B2 of this chapter.

Focused surveys were conducted by specialists for each taxonomic group. These surveys provided the initial inventory of sensitive species present in the Plan Area. Focused surveys involved thorough explorations of the Lake Mathews Plan Area and recording and mapping observed individuals (or signs, such as scat or tracks) within each vegetation type onto 1:4,800 (1" = 400') scale color aerial photos or topographic maps. In addition to recording the presence of sensitive species on the site, qualitative analyses of habitat suitability were also conducted. These methodologies are presented in Section C.

1. Quantitative Vegetation Survey Methods

Quantitative vegetation surveys were conducted during May and June of 1992 (for dates and personnel see Appendix A). A stratified sampling scheme was developed to determine general transect locations. Final sampling locations were chosen in the field to capture the variability within vegetation types (transect location and survey route maps are included in Appendix B).

The number of transects chosen for each vegetation type depended on the areal extent of and variability within each type. Relatively homogeneous areas were sampled less intensively than areas with more internal variation. Approximately one sampling location was chosen for each 500 acres of non-native grassland (NNG) and Riversidian sage scrub (RSS) habitats for a total of 12 vegetation transects for NNG and 10 vegetation transects for RSS. Three to six vegetation transects were chosen for the riparian and woodland vegetation types due to the smaller quantity of these habitats present (Figure B-1). Due to its small size, two transects were conducted through freshwater marsh habitat.

The characteristics of each habitat were measured using the techniques described below. Three vegetation layers—terrestrial surface, shrub, and tree canopy—were evaluated according to criteria slightly modified from Short (1984) (Table 2-1).

The results of the quantitative vegetation surveys are presented by vegetation type in Appendix E. A cumulative plant species list is presented in Appendix C.

a. Line-intercept and Quadrat Methods

Percent cover of individual plant species, vegetation layers, total plant cover, and non-vegetative surface categories were measured using either a line-intercept or quadrat method. The line intercept method was used in all plant communities except non-native grassland, where the quadrat method was used. Percent cover data are presented in Appendix E.

Table 2-1
Criteria for Determining Vegetation Layers

Layer	Criteria
Tree canopy	Vegetation or structure extends upwards from 4 m (12 ft.)
Tree bole	Diameter at breast height (dbh) ≥15 cm (6 inches). Minimum density of boles ≥12/hectare or 5/acre
Shrub	Vegetation or structure extends from 0.5 m (20 inches) up to, but not including, 4 m (12 ft) in height. Provides at least 5% cover when projected to the surface.
Terrestrial surface	Layer extends from 10 cm (4 inches) below the apparent surface up to, but not including, 0.5 m (20 inches) above the apparent surface. Provides at least 2% cover when projected to the surface.

A 50-meter line-intercept method was used for shrub- and tree-dominated vegetation types, and percent cover was calculated as:

$$\text{Percent Cover Species A} = \frac{\Sigma \text{ Total intercept for plant species A (cm)}}{5{,}000 \text{ cm}} \times 100$$

In non-native grassland, cover was estimated in twenty 0.1-meter-square plots along a 40-meter line. Cover classes were defined as:

Class (%)	Mean (%)
Trace (<1)	0.5
1 to 5	3.0
5 to 25	15.0
25 to 50	37.5
50 to 75	62.5
75 to 95	85.0
95 to 100	97.5

The cover class for each species or other surface characteristic within each plot was recorded. The percent cover value for each species was calculated as:

$$\text{Percent Cover Species A} = \frac{\Sigma \text{ (number of records for each class} \times \text{the class mean value)}}{20}$$

Cover data were summarized by structure category to indicate presence of vegetative layers. Total overlay cover was defined as the total cover measured for all plant species in all layers and often exceeded 100%, indicating overlap of layers (i.e., a shrub and the understory of grasses and forbs occupy the same linear space on the transect but occupy different vertical space).

$$\text{Total \% Overlay Cover} = \begin{matrix}\text{Total}\\ \text{Tree}\\ \text{Canopy}\\ \text{Percent}\\ \text{Cover}\end{matrix} + \begin{matrix}\text{Total}\\ \text{Shrub}\\ \text{Percent}\\ \text{Cover}\end{matrix} + \begin{matrix}\text{Total}\\ \text{Terrestrial}\\ \text{Surface}\\ \text{Percent}\\ \text{Cover}\end{matrix}$$

Total projective cover was defined as 100% minus the total percent cover of other nonvegetated surface characteristics on the transect, such as rock, bare ground, and vegetation litter.

$$\text{Total Projective Cover} = 100\% - \begin{matrix}\text{Bareground}\\ \text{Percent}\\ \text{Cover}\end{matrix} - \begin{matrix}\text{Rock}\\ \text{Percent}\\ \text{Cover}\end{matrix} - \begin{matrix}\text{Litter}\\ \text{Percent}\\ \text{Cover}\end{matrix}$$

b. Circular Plot Method

Relative abundance, species richness, and proportion of native plants versus introduced plants were estimated within a 200-square-meter circular plot at each sample location. This plot was centered on the line-intercept or quadrat transect. Relative abundance was determined by identifying the relative abundance category which best described the abundance of the species being assessed. Relative abundance data are presented in Appendix E. The scale for estimating relative abundance of each species was:

Relative Abundance Category	Cover Value	Abundance Value
Very Rare	1-2 individuals/plot or <0.02% cover	1
Rare	>0.2% to 2% cover	2
Common	>2% to 20% cover	3
Abundant	>20% to 40% cover	4
Very Abundant	>40% cover	5

These abundance categories were rated numerically from 1 to 5 (very rare = 1, very abundant = 5) in order to calculate the mean abundance.

$$\begin{matrix}\text{Mean Abundance}\\ \text{Value}\\ \text{for Species A}\end{matrix} = \frac{\Sigma \text{ abundance values}}{\begin{matrix}\text{number of plots in which species was}\\ \text{recorded}\end{matrix}}$$

Species richness was evaluated in two ways: (1) unadjusted species richness (total number of species along a transect) and (2) adjusted species richness (total number of species adjusted for total area survey).

Unadjusted species richness was calculated as the total number of species observed in the 200-square-meter circular plots in each habitat and does not account for differences in sample sizes.

$$\text{Unadjusted Species Richness} = \text{Total number of species recorded in all sample plots}$$

The total adjusted species richness was defined as the species richness value adjusted for the sample size. The adjusted plant species richness was used in the HQA analysis.

$$\text{Adjusted Species Richness} = \frac{\text{Total number species recorded in all sample plots}}{\text{In (total survey area)}}$$

The proportion of native plant species was determined by summing the number of native species present divided by the unadjusted species richness value or total number of species present, including introduced species. Species identified to genus only defaulted to non-native status in the calculation.

$$\text{Proportion of Native Plant Species} = \frac{\text{Total number of native species}}{\text{Total number of native and introduced species}} \times 100$$

c. Point-centered Quarter Method

The point-centered quarter method was employed to estimate density and percent composition of trees and large shrubs. Where the vegetation community was narrow, such as along a stream course, a direct count of individuals in a known plot size was made.

$$\text{Density of Shrubs and trees over 1 m tall} = \frac{\text{Total number of individuals}}{\text{Known area (in hectares)}}$$

Species, height, and diameter at breast height (dbh) were recorded for each individual encountered in the sample. Percent composition of each species in the shrub and tree canopy layers, total density, and density of tree boles was calculated and is presented in Appendix E.

$$\text{Percent Composition Species A} = \frac{\text{Total records species A}}{\text{Total records all species}} \times 100$$

$$\text{Density of tree boles} = \frac{\text{Total number of tree boles}}{\text{Known area (in hectares)}}$$

2. Quantitative Wildlife Survey Methods

The number of wildlife species and individuals of those species utilizing a given habitat is one indicator of habitat quality. Therefore, calculations for the HQA include estimates of species richness and relative densities of terrestrial vertebrates. Many techniques are available to sample terrestrial vertebrate populations. However, it is often impractical to obtain complete species lists or absolute density figures for wildlife populations due to cost and personnel limitations in addition to the inherent difficulties in detecting many species. In practice, direct and indirect indices of species richness and abundance are used for comparative purposes (Overton 1971, Brower and Zar 1984). Separate methodologies were designed for each animal group: large mammals, small mammals, birds, and herpetofauna. Consideration was taken of activity patterns, behavior, and detectability. The details of methodologies employed for each major vertebrate group are provided below.

Transects were established within each habitat type (transect location and survey routes are included in Appendix B). Three 500-meter transects were established in both the non-native grassland and Riversidian sage scrub habitat types, the two most abundant and highly variable habitat types present in the Plan Area. Attempts were made to select areas which reflect the structural and species variation which occur within the Plan Area. Transects were marked at 100-meter intervals with 18-inch wooden stakes marked with aluminum tags.

Some habitats at Lake Mathews do not occur in contiguous blocks of sufficient size to accommodate 500-meter transects. In these cases, transects were either divided into two segments or abbreviated to conform to the available habitat. Two juniper woodland transects were established, one 300 meters long and one 200 meters long. Two 200-meter mule fat scrub transects were used. The sycamore riparian woodland habitat on site was only large enough to accommodate a single 400-meter transect. The freshwater marsh transect consisted of a series of four transects through narrow marshes which totaled approximately 500 meters. Results of wildlife transects were combined for partial transects within each habitat. Results from abbreviated transects were extrapolated for comparison with 500-meter transects.

Survey methodologies require a sampling area of 30 meters of suitable habitat on either side of the center of the transect for large mammals, 125 meters for birds, and 90 meters for herpetofauna. However, several habitat types at Lake Mathews (southern willow scrub, sycamore riparian woodland, mule fat scrub, and freshwater marsh) occur in linear configurations which are too narrow to accommodate these sampling areas. To correct for this, measurements of the limits of the habitats in question were taken in the field. These areas were then divided by the standardized transect size (3 hectares for large mammals, 40 hectares for birds, and 9 hectares for herpetofauna) to generate adjustment factors which were used to extrapolate data collected in abbreviated transects. Small mammal trapping grids were altered to conform to the size and shape of the habitat type, and since abundance is expressed as individuals per trap-night, no adjustment factors were necessary.

a. Large Mammals

The large mammal species targeted by the methodology outlined below include carnivores (canids, procyonids, mustelids, and felids), hoofed animals, marsupials, lagomorphs, and those rodent species which are not included in live-trapping surveys. Most of these species are chiefly nocturnal and many are wide-ranging, so one cannot

rely on direct counts to provide accurate measurements of species richness or relative density. Therefore, indirect measures were used to generate estimates of these figures (Overton 1971, Brower & Zar 1984).

Two methods were used to identify the large mammals. First, each transect was surveyed visually on three consecutive days. All evidence of large mammals within 30 meters of the centerline was recorded, including tracks, scat, and burrows. All individuals observed were also recorded. One hour was spent at each transect on each day, generally in the late morning and evening hours and under good weather conditions. The area sampled at each wildlife transect was 3 hectares. Second, a single track station was established at each wildlife transect. Each station consisted of a 1-meter square of flour, compressed with a sheet of plastic to provide a smooth medium to record mammal tracks. The stations were baited with sardines for three consecutive evenings and checked on the following mornings. Surveys at non-native grassland and Riversidian sage scrub transects were conducted in April 1992 and at all other habitats in May.

Calculation of density (number of individuals per unit area) from indirect indices requires consideration of each species' home range and behavioral patterns, which may vary with season, age, sex, and sexual condition or a combination of all of these factors. This type of analysis is beyond the scope of this project and is not possible given the methodologies employed. Therefore, results will be expressed in terms of relative abundance (number of individuals per transect, which is outlined above). For those species detected only by sign, a single individual is included in abundance calculations. For those species which were physically observed on the transect, the highest number of individuals from any single survey day is used. Therefore, abundance figures are based on a minimum number of individuals present and probably underestimate actual densities, especially for smaller species such as rabbits, gophers, and ground squirrels.

b. Small Mammals

Each transect for small mammals consisted of 100 Stoddard live traps arranged in four lines of 25 traps each, with 15-meter spacing between stations. Each grid was sampled for three consecutive nights for a total of 300 trap-nights per grid. All small mammals captured were identified to species, weighed, measured, sexed, aged, and marked. Marking of animals allowed for identification of individuals for purposes of relative abundance calculations. Abundance was expressed as numbers of individuals trapped per 100 trap-nights. In those habitats which were not large enough to accommodate the grid pattern described above, the grid configuration was altered to conform to the shape and size of the habitat. The trapping grid in the sycamore riparian woodland contained only 80 traps, which yielded a total of 240 trap-nights. These methods sampled the surface-active, nocturnal rodent species only.

The recently developed Stoddard live traps were used because they have proven to be more effective than Sherman live traps in terms of both numbers of individuals and species captured. In general, these traps result in capture rates (number of individuals/trap-night) up to four times greater than Sherman traps (O'Farrell 1992, personal communication). These factors should be considered when comparing these results to previous studies which utilized Sherman traps. Recent trapping comparisons indicate that not only are the capture rates increased with the Stoddard traps, but the number of species trapped also increases, often resulting in higher species richness values. Thus, no meaningful comparisons may be drawn between the current study

and any previous studies using Sherman traps (O'Farrell 1992, personal communication).

c. Birds

Birds utilizing each habitat were censused using variable-width transects. Numerous modifications of the method developed by J. T. Emlen (1971) have been proposed, but all allow for sampling of large areas with relative efficiency and provide data which are comparable between surveys as long as the sources of error are identified and minimized (Franzreb 1981).

Each transect was walked slowly, and all birds seen or heard within 125 meters of the centerline were recorded on data sheets. The lateral distance from the centerline of each detection was estimated. Prior to walking transects, surveyors measured lateral distances to known landmarks to aid in estimation of distances. Whenever possible, the sex and age of each bird was recorded. Singing males were identified as such. Length of surveys varied with habitat type but generally took between 45 minutes and 2 hours. Surveys were begun at least one-half hour after sunrise and completed within 4 hours after sunrise. Each transect was sampled twice during the spring season using these methods. (For the purposes of habitat quality assessment [Chapter 5], data from the May surveys were utilized because this represented the most complete data set and was the most accurate for resident and breeding status.)

Estimates of relative density were calculated in the following manner. Species utilizing each habitat for nesting, roosting, or foraging were identified. Species observed flying over the transect were not included in analyses. Only adult birds were used in calculations. Family groups observed together were counted as a pair. Using the above criteria, the number of detections within each 10-meter band lateral to the centerline was tallied. Numbers of detections were plotted against distance from the centerline. This curve, or "lateral-detectability profile," was used to determine the point at which detections of birds decreased. This distance is a function of a number of factors including the structural components of the habitat, topography, time of day, weather, observer experience, and the inherent detectability of various bird species (Emlen 1971, Hutto & Mosconi 1981, Dawson 1981). The distance at which detections decrease was used to calculate the effective survey area. This figure was divided by 40 hectares to generate an adjustment factor which was then used to extrapolate numbers of detections to a standardized relative density figure, expressed as individuals per 40 hectares.

As with all sampling schemes, the methodology outlined above is based on a number of assumptions. Some of these are satisfied for the current study, while others are not. It is important to review these latter assumptions, because they represent sources of error and should be minimized if possible. Several assumptions concerning the behavior of birds in relation to the observer are routinely violated while performing surveys of this sort (i.e., the behavior of birds in one portion of the transect does not influence those in another, birds do not move in response to the observer's presence, prior to being detected, the response behavior of individuals does not change through the sampling period, and the response behavior of a species is similar regardless of sex or age) (Franzreb 1981). However, these responses can be expected to be relatively constant for any given species, and should not affect figures used for comparative purposes.

It is also assumed that no bird is counted more than once. This can be minimized by careful observation. A possible source of error is accurate estimation of lateral distances to detections, which is critical for the determination of effective sampling area. Distance estimation is a skill best developed by practice in the field and may be aided by measuring and flagging lateral distances along wildlife transects.

The determination of effective survey area from lateral detection profiles is complicated by the low sample sizes typically generated during the surveys. Ideally, 30 to 40 detections per transect are necessary to provide a clear inflection point at which detections decline (Franzreb 1981, Hutto & Mosconi 1981). There were several surveys which had fewer detections than this.

Species differ in their inherent detectability. Consequently, the effective survey area varies for different species, and counts of different species should not be added together to calculate sampling area (Dawson 1981). However, this procedure is often followed, and in this study sample sizes for individual species were invariably too small to allow for calculations for each species.

For those habitats which tend to attract high numbers of birds in relatively small areas (freshwater marsh, southern willow scrub, sycamore riparian woodland, and mule fat scrub), results expressed as individuals per 40 hectares may be artificially high due to the high degree of extrapolation necessary to standardize the figures. A more appropriate measure to quantify avifauna in these habitats is the Shannon Diversity Index. The general equation is:

$$H' = - \Sigma p_i \ln p_i$$

where p_i is the proportion of individuals of species *i* of the overall number of individuals. H' will increase as diversity increases (i.e., when all species are present in roughly equal proportions and no one species is present in overwhelming numbers).

d. Amphibians and Reptiles

To quantify the amphibians and reptiles utilizing each habitat, wildlife transects were surveyed for 3 consecutive days and all reptiles and amphibians observed within 90 meters of the centerline were recorded.

Surveys were conducted when the air temperature exceeded 75°F. One hour was spent at each transect on each day. The area sampled at each transect was 9 hectares. On the first day the centerline was walked slowly and all herpetofauna were recorded on data sheets. On the second day a meandering route was followed in order to identify and investigate those areas which provided preferred microhabitats for reptiles and amphibians. On the third day surveys were concentrated in these microhabitats.

Some reptilian species are underrepresented by this study due to their inherent low detectability. This is particularly true of most snake species. In addition, the timing of surveys was such that few amphibians were active. Quantitative surveys for amphibians and reptiles were not conducted in the freshwater marsh.

The methodology outlined above has been used in previous HQAs (Metropolitan 1991a, b). Without the ability to identify individuals, however, determination of density figures (individuals per unit area) is not possible. The methodologies employed provide an

index of relative abundance which will be expressed as individuals per transect. The maximum number of individuals of each species observed on any given day was used to calculate relative abundance. These figures can be used for comparative purposes using the standardized conditions and procedures detailed above.

C. Focused Surveys

Focused surveys for sensitive plants, birds, amphibians and reptiles, and invertebrates were conducted according to the methods described below (survey teams, dates, location, and routes are presented in Appendices A and B). To assist the survey efforts, lists of sensitive species known to occur in the region were prepared prior to the field surveys. In addition to species noted during focused surveys for a particular taxonomic group, incidental sightings of species in other groups were also noted but tracked separately. No general focused surveys for mammal species were conducted. Wildlife biologists conducting quantitative mammal surveys recorded the presence of some species and provided input for evaluation of the potential of other sensitive mammalian species. Surveys had been conducted in previous years for Stephens' kangaroo rat (*Dipodomys stephensi*) (SKR). Focused surveys were conducted for sensitive bat species.

1. Plants

a. 1992 Surveys

A list of sensitive species known to occur in the region was prepared prior to the survey (Chambers Group, Inc. 1992a) based on the CNDDB (CDFG 1992) and the California Native Plant Society's (CNPS's) Inventory of Rare and Endangered Vascular Plants of California (Smith and Berg 1988). A search for historical collections of the species also was conducted at the Rancho Santa Ana Botanic Garden (RSA).

Surveys for sensitive plants were conducted in April, May, and June 1992 (Appendix A). Across the large areas of non-native grassland habitat, the survey consisted of a series of parallel belt transects approximately 50 meters apart, with each person walking one transect (Appendix B). In more diverse habitats, such as coastal sage scrub and rock outcrops, the survey personnel walked in a zigzag fashion, covering all potential microhabitat locations for sensitive species. Other areas which appeared to be poor habitats (e.g., dense grassland and grazed or disturbed areas) were scanned using binoculars; good habitats were subsequently investigated more closely.

The 1992 survey was focused primarily on late spring-flowering species such as the spineflowers and searches for vegetative individuals of summer-flowering species. Attention was focused on looking for dried inflorescences of early spring-flowering sensitive species, including those of many-stemmed dudleya (*Dudleya multicaulis*). When appropriate habitat for each sensitive species was present, search efforts intensified with the assumption that the species, if present, would be past flower and easy to overlook. Sensitive species identifications were verified by Steven Boyd, herbarium manager of the RSA.

b. 1993 Surveys

Supplemental botanical surveys were conducted in March, April, May, and June 1993. The suite of sensitive species surveyed for in 1993 derived from two sources: a set

of species seen in surveys of Lake Mathews in 1985 but not seen in 1992 and a set of species noted in general surveys in 1992 whose status was under revision in 1993 and that potentially could become listed as sensitive. Surveys were conducted in that portion of the Plan Area on the north and south side of Cajalco Road (Sections 7, 9, 10, 11, 16, 17, 18, 19, and 20 in T4S R6W of the Lake Mathews 7.5-minute Quadrangle and 12 and 13 [east half only] in T4S R5W of the Lake Mathews Quadrangle [Appendices A and B]).

Review of Previous Studies. The Lake Mathews Plan Area was surveyed in 1985 (LaPre and Krantz 1985) to document biological resources and develop recommendations for a management plan for the Existing Reserve.

Four plant species of special interest not relocated in 1992 were noted in that study: Pala spineflower (*Chorizanthe procumbens* ssp. *albiflora*), Palmer's grappling hook (*Harpagonella palmeri*), hill sun cup (*Camissonia graciliflora*), and great valley (a.k.a. clay) phacelia (*Phacelia ciliata*). Unfortunately, other than mapping the localities where these species were observed, no information on population size or associated species was provided in this report.

Subsequent to the 1985 study, specimens of Pala spineflower collected in the Gavilan Hills were determined by Reveal (1989) to have been misidentified and actually were specimens of the Parry's spineflower (*Chorizanthe parryi* var. *parryi*). Three additional species, clay bindweed (*Convolvulus simulans*), large-leaved filaree (*Erodium macrophyllum*), and small-flowered microseris (*Microseris douglasii* ssp. *platycarpha*) were also searched for in 1993 because they were under consideration at the time of the survey for listing as sensitive by CNPS. All sensitive species searched for in 1992 were also searched for again in 1993.

Methods. Specimens at the University of California, Riverside, herbarium and RSA were examined for previous collections of these species in the study region. Steven Boyd, herbarium manager at RSA, confirmed that all collections previously identified as the Pala spineflower from the Gavilan Hills had been annotated as the Parry's spineflower by Reveal (Boyd 1993).

Since many of these species are affiliated with clay soils, the soil map for the western Riverside County (Knecht 1971) was examined to determine the location of clay soils in the Plan Area. Two large areas of Porterville cobbly clay and Bosanko clay are found at Lake Mathews, principally on the west portion of the Plan Area. The larger areas of clay soil were noted. Field surveys, especially those in the early part of the season, were directed to these soil types.

Natural color aerial photographs of the Plan Area at a scale of 1:4,800 (1"=400'), taken in February 1993, were used to locate potential survey areas and to determine the location of each survey route. Clear acetate was placed over the photos, and the survey route and location of the species of special interest were noted on the overlay.

The field surveys usually consisted of short loops from the existing access roads. During these examinations the different communities, aspects, and soil types in an area were examined. Particular attention was paid to any habitat features, such as clayey areas within grasslands, that would be preferred habitat for any of the plant species of special interest. Field notes recorded both the dominant species for each community and all other plant species observed in each "loop" surveyed. Voucher specimens were collected for each plant species of special interest located. Several other species were

collected, either because they represented unusual records for the Lake Mathews region or because the identification of the plant was uncertain at the time of the survey.

The information on the acetate overlays was transferred to equal-scale topographic maps and entered into the Lake Mathews GIS database.

Species Potentially Within the Plan Area. The following section provides a summary of the background information on general distribution, taxonomic problems, and known occurrence within the Plan Area for each of the species potentially occurring on Metropolitan lands within the Plan Area (Table 2-2). These species were looked for during the 1993 surveys but were not found. These include:

Allium munzii
(*A. fimbriatum* var. *munzii*)
Munz's onion

This herbaceous perennial is found on the slopes and flats of clay soil deposits, often associated with Palmer's grappling hook. Due to continued loss of habitat and historic populations, the plant has been listed by the CDFG as endangered. Historically, it has been known from the Gavilan Hills, Alberhill, Bachelor Mountain, Lake Skinner (extirpated), and Skunk Hollow areas. In the Gavilan Hills this species has been found on the north and south sides of Ida Leona Road, in and just south of Harford Springs County Park, on the northwest summit of Estelle Mountain, on the south flank of Dawson Canyon, and 0.5 mile west of the junction of Lake Mathews Road and Gavilan Road (extirpated).

Camissonia graciliflora
Hill sun cup

Camissonia graciliflora ranges from San Diego County to southern Oregon and is located in both cismontane grassland and Joshua tree woodlands in the Mojave Desert. However, this species is very uncommon in southern California and has been considered a species of local concern by botanists in the region (Boyd 1993).

In western Riverside County this species is known to occur at the Gavilan Plateau, especially in the understory of juniper woodlands, on Miller Mountain on clay patches, and in Bautista Canyon. A single locality was located in the Plan Area, in the southeast corner of Section 9 (LaPre and Krantz 1985); however, no details on this locality were provided.

Caulanthus heterophyllus* var. *pseudosimulans
False Payson's jewelflower

This species is found on xeric slopes, especially if granitic in origin. It often occurs in between large boulders in chaparral or coastal sage scrub. This species is generally a fire follower and is generally only found in large numbers in the first few years after a fire. However, it has been located in large numbers in seasons with unusual rain patterns (e.g., late winter rains). This species has been found throughout western Riverside County from the Beaumont area to Vail Lake on the east side and within the Santa Ana Mountains. It is also known to occur within the foothill areas in the main part of the valley including the Gavilan, Lakeview, Domenigoni Mountains, and other foothill areas. In the Gavilan Hills the species has been found in the granitic outcrops of Harford Springs County Park and in the Dawson Canyon area.

Table 2-2
Plant Species of Special Interest Potentially Occurring in the Plan Area

Species	Status	Locations
Allium munzii Munz's onion	CNPS 1B, CT, C1 [RFI]	Harford Springs, Alberhill, Estelle Peak, Temescal Terrace
Camissonia graciliflora Hill sun cup	LC	Gavilan Plateau, Miller Mountain, Bautista Canyon
Caulanthus heterophyllus var. *pseudosimulans* False Payson's jewelflower	LC	Gavilan Hills, Vail Lake, Domenigoni Hills, Lakeview Mountains, Bachelor Mountain, Potrero
Chorizanthe parryi var. *parryi* Parry's spineflower	CNPS3, C2	Lake Mathews, Domenigoni Hills, Double Butte, Potrero Bachelor Mountain
Chorizanthe polygonoides ssp. *longispina* Knotweed spineflower	CNPS 1B, C2	Lake Mathews, Crown Valley, Bachelor Mountain, Vail Lake, Murrieta
Convolvulus simulans Clay bindweed	CNPS 4	Lake Mathews, Bachelor Mountain, Murrieta
Dudleya multicaulis Many-stemmed dudleya	CNPS 1B, FC2	Gavilan Hills, Alberhill
Erodium macrophyllum Large-leaved filaree	LC	Lake Mathews, Bachelor Mountain, Big Oak Mountain
Harpagonella palmeri var. *palmeri* Palmer's grappling hook	CNPS 2, C2	Lake Mathews, Vail Lake, Bachelor Mountain
Hemizonia pungens ssp. *laevis* Smooth tarplant	CNPS 1B, C2 [RFI]	San Jacinto Valley, Perris Valley, Auld Valley, Gavilan Hills, Temecula
Lepidium virginicum ssp. *robinsonii* Robinson's peppergrass	CNPS 1B	Riverside, Corona, Pomona
Microseris douglasii ssp. *platycarpha* Small-flowered microseris	CNPS 4	Lake Mathews, Vail Lake Murrieta, Bachelor Mountain
Myosurus minimus var. *apus* Little mousetail	CNPS 3, C2	Gavilan Hills, Menifee, W. of Hemet, Santa Rosa Plateau
Phacelia ciliata Great valley (a.k.a. clay) phacelia	CNPS 1B	Lake Mathews, San Jacinto River, Mystic Lake
Romneya coulteri Coulter's matilija poppy	CNPS 4	Temescal Wash

Table 2-2 (continued)
Plant Species of Special Interest
Potentially Occurring in the Plan Area

Abbreviations:

California Native Plant Society:

CNPS 1A - Plants presumed extinct in California
CNPS 1B - Plants considered rare, threatened or endangered in California and elsewhere
CNPS 2 - Plants rare, threatened or endangered in California but more common elsewhere
CNPS 3 - Plants about which we need more information - A review list
CNPS 4 - Plants of limited distribution - A watch list

State Status:

CE - Listed as endangered by the state of California
CT - Listed as threatened by the state of California

Federal Status:

FE - Listed as federally endangered
FPE - Currently proposed for federal listing
C1 - Candidate for federal listing, substantial information for listing at this time
C2 - Candidate for federal listing, insufficient information for listing at this time
RFI - A request for information has been issued on this species, initiating the federal listing process

Other:

LC - Local Concern

Previously, this taxa had been identified as *Caulanthus simulans,* but recent taxonomic work on this group had noted that *C. simulans* was restricted to the desert edge and the material in the interior Riverside Valley had been misidentified. The recent treatment in the *Jepson Manual* (Hickman 1992) now considers that taxa as a new variety of *C. heterophyllus*. The potential sensitivity of this taxa is unknown at this time, since it is unclear what plant is covered under the federal ranking. The false Payson's jewelflower has been considered one of the more common of the rare species in western Riverside County (Nelson et al. 1989).

Chorizanthe parryi* var. *parryi
Parry's spineflower

This small, white-flowered spineflower is found in the openings of chaparral, sage scrub, alluvial fan sage scrub, and juniper woodland. This species is known to occur in Los Angeles, San Bernardino, and Riverside Counties, principally in the alluvial fan areas along the San Gabriel and San Bernardino Mountains and in Riversidian sage scrub/chaparral habitats in the inland Riverside area.

Previously, the Pala spineflower had been recorded for the county (County of Riverside 1990), including the Gavilan Hills (Boyd 1983, LaPre and Krantz 1985). However, recent studies by Reveal and Hardham (1989b) determined that the identifications were

incorrect and that these specimens were actually the Parry's spineflower. Concerns raised in this paper on the limited distribution of this species resulted in its inclusion as a federal candidate species (USFWS 1990). The species is included on List 3 in the revision of the CNPS rare and endangered plant inventory (CNPS 1994).

In the inland Riverside-San Bernardino area, the species is known to occur from the Gavilan Hills to Banning-Palm Springs and from the San Bernardino Mountains to the Vail Lake area. In the Gavilan Plateau it is found on granitic substrates, mostly in the eastern portion of the plateau (Boyd 1983).

The Lake Mathews botanical survey (LaPre and Krantz 1985) located three sites of the Parry's spineflower (noted in the report as *Chorizanthe procumbens* var. *albiflora*) on the southern portion of the ecological reserve. Two sites were located in the southwest corner of Section 10, and another was found in the northwest corner of Section 16. The plants appear to have been found in either Terrace escarpments or Gorgonio loamy sand. This species was not observed on the south side of the lake in the 1992 field surveys, although a single locality was found on the north side (Impact Sciences 1992).

Chorizanthe polygonoides* var. *longispina
Knotweed spineflower

This prostrate, sprawling spineflower is identified by the three large involucres with hooked awns and its reddish color. This species is generally restricted to clay soil or clayish outcrops in western Riverside and San Diego Counties, extending into northern Baja California. In Riverside County it is known from the Gavilan Plateau, Temescal Canyon, Lake Skinner, Temecula, Vail Lake-Aguanga, Garner Valley, and Miller Mountain.

Due to the limited distribution of this species and continuing development threats, it is currently recommended as a federal candidate (List 2) for potential future listing (USFWS 1992) and is a CNPS List 1B species (CNPS 1994).

This species was found in the 1985 botanical survey, but no specific localities or habitat descriptions were provided since this species had no "sensitive" status at that time.

The 1992 botanical surveys (Impact Sciences 1992) found a total of 15 populations of this species comprising some 1,603 plants.

Convolvulus simulans
Clay bindweed (small-flowered morning-glory)

This small native bindweed is restricted to clay soil areas from central California and extending into Baja California. Although there are historical collections of this species from Whittier, there are few recent records from the Los Angeles-Orange Counties area. Therefore, this species is included on the CNPS watch list (List 4) (CNPS 1994).

Currently, most of the recent populations known from inland Riverside County include the Gavilan Hills (Lake Mathews), Lake Skinner, Murrieta, and Vail Lake areas. In the Gavilan Hills it was located at the northwest portion of the range and on the Gavilan Plateau (Boyd 1983). It was also located during the 1992 quantitative transects (NNG 10) in Section 18, but no information on the exact locality or number of plants found in this area was recorded.

Dodecahema leptoceras
Slender-horned spineflower

This very small annual spineflower occurs in alluvial washes and is both federally and state endangered. The species is usually restricted to old bench habitats in Riversidian alluvial fan sage scrub. It is usually found on open sandy areas associated with leathery spineflower *(Lastarriaea coriacea)* and loeflingia *(Loeflingia squarrosa)*. The species has been known from the Santa Ana River, San Jacinto River, Cajon Wash, Bautista Canyon, and Temescal Creek in the San Bernardino-Riverside area. It is also known from Tujunga Wash and Bee Canyon in Los Angeles County. In 1989 populations of this species were found on Kolb and Arroyo Seco Creeks and some minor tributaries to these drainages. Currently, it is estimated that these recently discovered sites represent some 78% of the populations of all the currently known sites.

In the Gavilan Hills region this species is known from a population on a terrace above Temescal Wash and another on Indian Wash. It would not be anticipated to occur on the Gavilan Plateau due to lack of suitable habitat.

Dudleya multicaulis
Many-stemmed dudleya

This small, vernal live-forever is found on rocky outcrops or in clay soils. The species is known to occur in Los Angeles, Orange, and Riverside Counties. The major center of distribution appears to be in major population centers found in the northern portion of the Santa Ana Mountains. In Riverside County the species range is restricted to the Gavilan Hills and Alberhill areas. This species is currently on the CNPS 1B list and is a federal candidate for potential future listing (List 2).

The typical sites in Riverside County are on andesitic outcrops or clay soils (Boyd 1983). In the Gavilan Hills it has been found on Estelle Mountain and Temescal Wash and in the canyons near the El Sobrante Landfill (Pacific Southwest Biological 1992). However, there are no records for this species within the Plan Area.

Erodium macrophyllum
Large-leaved filaree

This native filaree is a wide-ranging species, extending from the Sacramento Valley to northern Baja California and in portions of Arizona and southern Utah. However, the species has declined throughout California and is rarely found in southern California. This species was considered for inclusion in the revision of the CNPS inventory but was rejected due to its widespread distribution in central California. It is a very uncommon species in southern California and should be considered a species of local concern (Boyd 1993).

In Riverside County it is known from the area south of Lake Mathews (Section 18), Lake Skinner, and Big Oak Mountain in the Vail Lake area. There were no reports of this species from the botanical survey of 1985 or the studies in 1992.

Harpagonella palmeri
Palmer's grappling hook

This is a widely distributed, small annual species which occurs from Los Angeles County to Baja California. It generally occurs on clay slopes and burns in lower elevations. It is often associated with the Munz's onion and in the Gavilan Hills with the many-stemmed dudleya.

In Riverside County it is found in the Gavilan Hills, Lake Skinner, Vail Lake, and Miller Mountain. In the Gavilan Hills Boyd (1983) notes this species as occurring on clay soils on the Gavilan Plateau and in the Temescal Wash. This species was also located in the 1985 botanical survey of the Lake Mathews Reserve in Section 18. No localities of this species were recorded during the surveys in 1992 (Impact Sciences 1992).

Hemizonia pungens* ssp. *laevis
Smooth tarplant

This species occurs in damp, alkaline areas extending from a few localities in San Bernardino County, scattered in a number of localities in inland Riverside County, and extending into San Diego County and northern Baja California. This species is often found in alkaline meadows and fallow fields and beside old irrigation ditches or existing flood control channels.

In the inland Riverside valleys it is known from the Gavilan Hills; Santa Ana River, Moreno Valley; San Jacinto Valley, including the Lakeview-Nuevo area to Perris; Hemet-Winchester region, including the Domenigoni Valley and Auld Valley; Murrieta, in the Murrieta Creek area; and Temecula. In the Plan Area this species has been collected by Boyd in the Temescal Canyon and on the Gavilan Plateau in damp swales within the Harford Springs Park.

There have been no records for this species within the Lake Mathews reserve or on the buffer lands south of Cajalco Road.

Lepidium virginicum* ssp. *robinsonii
Robinson's peppergrass

This species of peppergrass occurs from Los Angeles County to Baja California and is found on the Channel Islands. Due to its limited range and occurrence in areas that are rapidly being developed, this species is on the 1B list of the revision of the CNPS rare plant inventory (CNPS 1994). However, this species is not easily distinguished from the non-native wild peppergrass (*L. v.* ssp. *pubescens*). It is interesting to note that few recently collected specimens have been identified as Robinson's peppergrass and that all of the specimens identified to this taxa were annotated by Hitchcock (the botanist studying this group of plants).

In Riverside County the Robinson's peppergrass has been found in the city of Riverside (Fairmont Park) and 5 miles south of Corona. There are other collections from the Santa Ana Canyon, Pomona, and Altadena that would indicate that this taxa is in the general region. However, collections in the Temescal Canyon by Boyd in 1986 (No. 1760) and Munz in 1920 were all identified as the wild peppergrass.

Microseris douglasii* ssp. *platycarpha
Small-flowered microseris

The small-flowered microseris is restricted to clay soils and has a limited distribution in southern California. It is currently known to occur on the Channel Islands and at a single locality in the mainland of Los Angles County and at only a few restricted sites in Orange County. In Riverside County the species is known from three major concentrations of clay soils: the Gavilan Hills, Bachelor Mountain and surrounding areas, and Big Oak mountain in the Vail Lake region. In contrast, Beauchamp (1986) notes this species as frequent in open grasslands of San Diego County, although it is not known if this refers to the current status of this species or the historic distribution of this species. The small-flowered microseris is also found in coastal portions of Baja California.

The only records of this species for the Gavilan Hills was from the Alberhill area by Boyd in 1986 (No. 1387); however, it is likely that this species has been overlooked in other parts of the Plan Area, since it is often found in mixed populations with the derived microseris.

There were no reports of this species from the 1985 or 1992 survey of the ecological reserve or the adjacent buffer lands.

Myosurus minimus* var. *apus
Little mousetail

This small annual is normally associated with vernal pool habitats and is known to occur in San Bernardino, Riverside, and San Diego Counties. It also extends into northern Baja California. In Riverside County this species is well documented from the Santa Rosa Plateau, and there are also historic records for the Menifee area, March Field, and Edgemont. Recently, large populations were located in alkali grasslands and vernal pools in the Old Salt Creek drainage, west of Hemet.

Boyd (1983) reported finding this species in a small vernal pool on the Gavilan Plateau; however, there have been no further observations of this species in the Plan Area.

Phacelia ciliata
Great valley (a.k.a. clay) phacelia

The great valley (a.k.a. clay) phacelia is known to occur from central California to northern Baja California; however, it is very uncommon in southern California. There are no known records for Orange or San Diego Counties, and in Riverside County this species is known only from the Gavilan Plateau, Mystic Lake, and the San Jacinto River area. Currently, this species is included on List 1B of the CNPS inventory (CNPS, 1994). Previous studies in the Gavilan Hills (Boyd 1983) have recorded this species only for the area south of Lake Mathews (Section 17).

Romneya coulteri
Coulter's matilija poppy

The Coulter's matilija poppy is found from the Santa Ana Mountains to San Diego County and is associated with alluvial washes and burned areas in chaparral. In Riverside County this species is generally restricted to the southern portion of the Gavilan Hills, Temescal Wash, and the Santa Ana Mountains. In the Plan Area this

species has been reported from the Temescal Wash and in chaparral burns in the southern part of the Gavilan Hills.

2. Mammals

a. Bats

Roosting sites and foraging habitats are the focus of surveys for sensitive bat species. Roosting habitats vary among bat species but generally include rock crevices, caves, and trees. The sensitive bat species likely to occur at Lake Mathews are either cave- or crevice-roosting species. Bats that normally roost in rock crevices sometimes find refuge in man-made crevices in buildings and bridges, and cave-roosting species may utilize pseudo-caves such as mines and barns. Diurnal surveys were made of potential roosting habitat around Lake Mathews for both bats and guano. Because no man-made structures or caves exist within the Plan Area, the survey focused on rock crevices in the numerous areas of granite boulders surrounding the lake. Major outcrops, including those on the islands, were visited and searched for obvious bat sign such as urine staining or guano on the ground beneath the crevice. Crevices that were potential bat roosting sites were probed with "bat grabbers" (mechanics' retrievers) and peered into with flashlights or reflected sunlight from pocket mirrors. Nighttime sampling was conducted with the aid of vision equipment to watch for bats exiting roost sites. Mist nets were also spread near the potential roost sites during evening hours.

Foraging habitat was surveyed at night by listening to the echolocation signals that bats emit while flying (see Appendix B for locations). The sounds that are lower in frequency are audible to humans, while ultrasonic bat detectors were employed to identify species with inaudible signals. Listeners were stationed in areas of rock outcrops at dusk and remained in a fixed location for at least 90 minutes after dark. If a bat was heard shortly after dark, it was assumed that it had exited from a nearby rock crevice. Within two hours, surveyors often moved to another location, listening until at least midnight. Audible vocalizations were often detected while driving between listening locations. The location of the observer was recorded on 1:4,800 (1" = 400') scale aerial photos for each bat detection.

In addition to listening, mist nets were employed in the evening in an attempt to catch bats that might be flying low to drink or catch ground-dwelling insects. Mist nets have the best success when set over isolated water sources or areas that funnel or concentrate flying bats. Although no particular areas existed within the Lake Mathews Plan Area that appeared to concentrate flying bats, nets were set in six locations along inlets in the shoreline and over the stream below the dam.

b. Stephens' Kangaroo Rat

The presence of SKR on the lands surrounding Lake Mathews has been well documented (O'Farrell 1992, unpublished data; RCHCA 1994). O'Farrell has been conducting long-term research on the ecology of the SKR at Lake Mathews. During these previous studies, O'Farrell conducted a distribution survey in which he generated a map of the general abundances of SKR within the Plan Area. The limits of SKR-occupied habitat were established by the presence of sign and mapped on a 1" = 200' scale Riverside County Flood Control topographic map. The acreage occupied by SKR was determined at this scale by using a Planix 7 digital planimeter. Abundance was estimated subjectively based on visible surface sign (O'Farrell and Uptain 1987). The

entire study site was traversed on foot by five observers to allow a complete examination of the habitats. All potential habitat was examined for sign of SKR. A thorough search was made for diagnostic surface sign including burrows, scat, runways, tracks, and dust baths following the methodology developed by O'Farrell and Uptain (1987). Results of this distribution study are discussed in Section 4A1(c).

Each section of land was completely examined by arranging observers in a straight line, approximately 15 meters apart, and then walking the length of the section. The workers then moved to another position 15 meters from the end person, and a parallel swath was traversed. This was continued until all acreage was examined. Mapping within the Existing Reserve was conducted from October through December 1990. Lands outside the existing fence in the Plan Area were surveyed and mapped between January and March 1991 and December 1991 through February 1992.

c. Other Mammals

Another sensitive small mammal species, the northwestern San Diego pocket mouse (*Chaetodippus fallax fallax*), was sampled only during the quantitative small mammal trapping inventory. Additional focused surveys for small and large sensitive mammal species, namely the San Diego black-tailed jackrabbit (*Lepus californicus bennettii*), the American badger (*Taxidea taxus*), and the San Diego desert woodrat (*Neotoma fuscipes intermedia*), were not conducted. However, all incidental sightings of sensitive mammal species were recorded during surveys for other sensitive resources as well as during the general quantitative wildlife surveys and mapped on 1:4,800-scale color aerial photos or topographic maps. The thorough coverage of the site by qualified wildlife biologists during surveys precluded the need for specific surveys for these animals.

3. Birds

a. Coastal California Gnatcatcher

Focused searches for coastal California gnatcatchers (*Polioptila californica californica*) were conducted within the Plan Area using USFWS-recommended guidelines (dated September 21, 1990) with the exception of survey frequency. A single intensive sweep of the suitable habitats on the site was made (Appendix B). Guidelines proposed by the NCCP Scientific Review Panel (SRP) recommend a minimum of three surveys at least 7 days apart. For potential impact areas such as Western Metropolitan Water District's tank site, focused surveys for coastal California gnatcatchers followed SRP guidelines. The level of confidence in the single intensive survey for coastal California gnatcatchers is high, as the additional surveys completed in the potential impact areas did not reveal additional birds.

Focused surveys for coastal California gnatcatchers consisted of relatively slow and methodical pedestrian surveys through all presumed coastal California gnatcatcher habitat (i.e., all sage scrub habitats with shrub cover exceeding 15%). Surveys were conducted between one-half hour before sunrise and noon. Teams generally consisted of two biologists. At appropriate intervals, usually every 50 meters, a tape recording of coastal California gnatcatcher songs and other vocalizations was played to aid in detection of the birds. When coastal California gnatcatchers were detected, the sex, breeding status, and location of nest sites were determined. Home range and nest site data were mapped on acetate overlaying 1:4,800-scale aerial photographs.

b. Least Bell's Vireo

Riparian corridors within the Plan Area capable of supporting the federally and state-listed least Bell's vireo (*Vireo bellii pusillus*) were surveyed weekly (eight times) from April 15 to June 15, 1992, according to the following USFWS guidelines:

1. All riparian areas or potential vireo habitats should be surveyed at least once a week from April 1 to July 31. These dates encompass the period during which most vireo nesting activity occurs. If additional information on vireo habitat utilization is needed, these surveys should be extended to August 31. Information typically collected after July 31 will reflect a broader extent of the riparian habitat and other adjacent habitat types that the vireo utilizes during the latter phase of the breeding season, especially when the young become independent of the adults.

2. Surveys must be conducted by a qualified biologist(s) familiar with the songs, calls, scolds, and plumage characteristics of the vireo.

3. Surveys shall be conducted between dawn and 11:00 a.m. Surveys shall avoid periods of excessive or abnormal heat, wind, rain, or other inclement weather.

4. All vireo detections (e.g., vocalization points, areas used for foraging) should be used to estimate the location and extent of individual home ranges. These data should be mapped on a large-scale aerial photograph.

5. Data on vireo breeding status (e.g., number and location of paired or unpaired territorial males, nest building efforts, feeding of nestlings, location of vireo nests) should be noted during each survey.

6. All sightings of brown-headed cowbirds (*Molothrus ater*) and their numbers in vireo territories should be noted during each survey.

7. No attempts should be made to closely approach or examine vireo nests unless authorized by permits issued by CDFG and USFWS.

8. A final report (including maps) should be prepared that describes or depicts survey dates, methods, locations, and information identified in Items 4, 5, and 6 above.

9. The final report should be provided to USFWS and CDFG.

The areas surveyed in the Plan Area included Cajalco Canyon west of the dam; several patches and corridors of habitat near the shoreline of Lake Mathews within the Existing Reserve; a corridor at the southwest end of the Plan Area; a patch of woodland west of Lake Mathews Drive; and the moderate to good vireo-quality habitat along Cajalco Creek on the north and south sides of Cajalco Road, east of El Sobrante Road, and on the north side of Cajalco Road west of El Sobrante Road (Appendix B). The surveys were conducted between one-half hour before dawn and noon and not during periods of excessive wind or rain. Each riparian corridor or stand was traversed on foot at a slow pace. A tape recording of songs and other vocalizations of the least Bell's vireo was played at regular intervals to solicit responses from any males present. A general qualitative description of the vegetative composition and quality of each surveyed location was compiled.

c. Other Birds

In addition to the coastal California gnatcatcher, five additional avian species are associated with coastal sage scrub and considered sensitive species by the SRP.

Bell's sage sparrows (*Amphispiza belli belli*), San Diego cactus wrens (*Campylorhynchus brunneicapillus couesi*), and southern California rufous-crowned sparrows (*Aimophila ruficeps canescens*) occur in Riversidian sage scrub habitat and often share all or part of their home ranges with coastal California gnatcatchers. Consequently, focused surveys for coastal California gnatcatchers included surveys for these three species. The search for San Diego cactus wrens was further concentrated in easily identified sage scrub areas with adequate cactus patches, where cactus wren brooding and roosting nests as well as vocalizations could be detected.

The tricolored blackbird (*Agelaius tricolor*) and the California horned lark (*Eremophila alpestris actia*) do not occur primarily in Riversidian sage scrub and were detected during other surveys. Tricolored blackbird nesting colonies occur in riparian/freshwater marsh areas and were recorded during repeated focused surveys for the least Bell's vireo. The horned lark was surveyed in two ways. In areas where dirt roads and non-native grassland habitat were interspersed among patches of Riversidian sage scrub, California horned larks were recorded during the focused coastal California gnatcatcher survey. California horned larks were also incidentally observed and recorded while en route by vehicle or foot to survey areas throughout the survey period.

A checklist of bird species and number of individuals observed during surveys was compiled each field day. For sensitive birds and all other nonsensitive species for which less than 10 individuals were observed, the actual number of birds seen was recorded. A plus (+) or plus plus (++) was recorded for other nonsensitive species for which 10 to 49 or 50 or more individuals were observed, respectively. After May 15, when breeding and vocalizing activity had slowed and it was not possible to accurately estimate densities passively, the actual number of sensitive birds observed was recorded, and only presence or absence was noted for all other avian species. The total number of avian species observed was calculated daily.

The avian checklist/data sheet also contained the following information: observer's name, date, the time, temperature, Beaufort wind force, cloud cover at survey start and stop, a description of the area surveyed, a description of the habitat types and vegetative composition in the area surveyed, a list of sensitive or otherwise noteworthy plant and animal species incidentally observed, and comments regarding special conditions or occurrences. Finally, a USGS 7.5-minute topographic field map was attached showing any sensitive species observed and that day's survey limits.

4. Amphibians and Reptiles

Prior to conducting the survey, a list of sensitive reptiles and amphibians potentially occurring in the project area was compiled. This list is based on several sources of data, including the CNDDB (CDFG 1992) and results of an initial reconnaissance sweep of the project area (Chambers Group, Inc. 1992a). Additionally, Stebbins (1985) was reviewed to determine distributional ranges and habitat associations of the species of concern in this survey.

Surveys consisted of a series of parallel linear transects 500 feet apart running north-south through the Plan Area (Appendix B). Surveys assessed the presence of sensitive species. Uniformly distributed transects allowed each habitat type to be visited and provided thorough coverage of the survey area. Surveyors were usually not able to walk transects entirely in one sweep due to boundaries such as fences or waterways. Surveys were conducted along the transect routes until a boundary was reached, then continued at the same point on the other side of the boundary at a later time or date. Individual sightings of sensitive reptiles were noted, and evidence of lizard presence, including fecal material, animal tracks, burrows, and potential food sources (e.g., harvester ant mounds), were also recorded during field surveys. Observations were recorded on 1:4,800-scale topographic maps.

Surveys were only conducted during the appropriate weather conditions. All daytime surveys were conducted when ambient temperatures were greater than 65°F and when prevailing winds were less than 10 miles per hour. Night surveys for reptiles were conducted in habitats most likely to support nocturnally active reptilian species such as rocky outcrops and along paved roadsides (Stebbins 1985). Spring is a productive time to survey for amphibian and reptile species. Activity periods of adult snakes and lizards usually peak during this season, as mating behavior is most often exhibited during this time.

5. Invertebrates

During late March and April 1992, the Plan Area was surveyed for habitat suitability and presence of Quino checkerspot butterfly (*Occidryas editha quino*), a sensitive butterfly that subsequently has been proposed for federal listing as endangered (*Federal Register,* Aug. 4, 1994). Surveying was conducted first by inspecting sites by automobile for habitat suitability and then on foot for close-range observations of checkerspots and their larval foodplant plantain (*Plantago erecta*). Dense patches of plantain judged to be suitable for viable colonies of Quino checkerspot butterflies were mapped as "potential habitat" on 1:4,800-scale color aerial photos.

Field work in May and early June 1992 was devoted to systematically surveying (as described above) for the presence of the cuckoo bee species, *Holcopasites ruthae*, and suitable habitat (Appendix B). Assessing habitat suitability for the cuckoo bee included searching for the known host bee, andrenid bees (*Calliopsis pugionis*), its nesting sites, and the known nectar source for both bees, brittlebush (*Encelia farinosa*) (Visscher, Danforth and Barnes, unpublished data). Bees visiting *Encelia californica* were also investigated, as it is an alternative nectar plant in the Lake Mathews Plan Area. Habitat suitable for the cuckoo bee (judged by the presence of *C. pugionis*) was mapped onto 1:4,800-scale color aerial photographs.

Description of Resources

3. Description of Resources

This chapter describes the biological resources identified in the Plan Area, including soils, vegetation, and wildlife. Sensitive species are discussed in Chapter 4.

A. Soils

Soils in the Plan Area are described in the U.S. Soil Service's survey for western Riverside County (Knecht 1971). Most of the area contains the Monserate-Arlington-Exeter association, which ranges from well-drained, moderately deep sandy loams to loamy soils found on old alluvial terraces and washes. These soils are shallow to deep and often have a calcareous hardpan. The eastern portion of the Plan Area contains the Cajalco-Temescal-Las Posas association, which ranges from moderately deep and shallow loam to clay loam developed on gabbro. This association also has a number of clay soils including Porterville, Bosanko, and others as minor soils of this group.

Nine soil series occur in the area: Porterville cobbly clay, Bosanko clay, Cieneba rocky sandy loam, Gorgonio loamy sand, Handford coarse sandy loam, Las Posas stony loam, Monserate sandy loam, Temescal rocky loam, and Terrace escarpments.

1. Porterville Cobbly Clay

Porterville cobbly clay is a well-drained clay soil found on alluvial fans. It is considered a brown clay with 20% to 25% of the surface covered in embedded cobblestones. The soil is very hard and has a slow permeability, medium runoff, and slight erosion hazard. Large areas of this soil are found on the western edge of the Plan Area.

2. Bosanko Clay

The Bosanko clay is a grayish-brown upland soil that has developed from igneous parent materials. Generally this soil consists of 23 inches of grayish-brown clay underlain by a layer of grayish-brown sandy clay to a depth of 32 inches, where the parent material is located. This soil has a moderately slow permeability, runoff is medium, and the erosion hazard is moderate.

3. Cieneba Rocky Sandy Loam

Cieneba rocky, sandy loam is an excessively drained soil found on moderate to steep slopes. The soil has a surface layer of brown sandy loam, 14 inches deep with rock outcrops comprising up to 10% of the soil surface. Beneath the surface is a layer of yellow-brown coarse sand. Weathered granodiorite, the parent material, is found at a depth of 22 inches. Rock outcrops are occasionally found in this soil type.

4. Gorgonio Loamy Sand

Gorgonio loamy sand is excessively well-drained soil that has developed in granitic alluvium. It has a loamy sand surface layer up to 3 feet deep, with a layer of sandy loam from 36 to 60 inches deep. This soil has rapid permeability with slow runoff and a slight erosion hazard.

5. Handford Coarse Sandy Loam

Handford coarse sandy loam is a well-drained soil found on alluvial fans and is developed from granitic parent materials. This soil typically has a layer of grayish-brown, coarse, sandy loam some 18 inches deep. Underneath this topsoil is a subsoil of coarse sandy loam or loamy sand. The permeability of the Handford sandy loam is moderately rapid, runoff is slow, and the erosion hazard is slight.

6. Las Posas Stony Loam

Las Posas stony loam is a well-drained soil that has developed on a gabbro parent material. Generally, the surface is a stony, reddish-brown loam with some clay loam underneath and is approximately 10 to 36 inches deep. A subsoil layer of dark red clay and clay loam is found to a depth of 40 to 50 inches, where the yellowish-red gabbro parent material is found. This soil has a moderate permeability, medium runoff, and moderate erosion hazard.

7. Monserate Sandy Loam

Monserate sandy loam is a well-drained soil developed from granitic materials. The topsoil is a brown and yellowish-red sandy loam about 10 inches deep. A dark brown cemented iron-silica hardpan is found at a depth of 28 inches. Permeability is moderately slow, and runoff and erosion hazards are moderate. Three mapping units of this association were found in the Plan Area, including soils on 5% to 8% eroded slopes, 8% to 15% slopes, and 15% to 25% slopes. On the steeper slopes the subsoil is often exposed, and the erosion hazard is very high.

8. Temescal Rocky Loam

Temescal rocky loam is a well-drained soil found in upland areas, where up to 10% of the area is covered by rock outcrops. The soil is derived from gabbro or laterite porphyry. The soil is a grayish-brown loam some 17 inches deep and contains some cobblestones. Beneath this layer is the laterite porphyry parent material. The permeability of this soil is moderate, the runoff is rapid, and the erosion hazard high.

9. Terrace Escarpments

Terrace escarpments consist of variable alluvial material found in terraces or washes. This alluvial material may vary from sandy deposits to cobbles or boulders. Generally, at least one-quarter of these sites have eroded areas or active gullies.

B. Vegetation

The vegetation communities of southern California are adapted to a Mediterranean-type climate. Cool winter rains initiate the growing season with peak biomass production in spring. As the soil dries in the absence of rain during the late spring and summer, growth slows and many species enter dormancy as drought-deciduous shrubs or as seeds (Barbour and Major 1988). Vegetation communities are generally associated with topographic and soil patterns. Low valley bottoms with deep, alluvial soils rich in clays support non-native grasslands. Slopes of mountains and hills generally have rocky soils

and support shrub-dominated communities. Vegetation assemblages requiring more soil moisture, such as freshwater marsh and riparian scrub, are found in drainages. Variations in substrate, water regime, and disturbance frequency along drainages result in the diversity of vegetation communities (Warner 1985). These communities generally occur in a continuum along stream courses, with the trend towards dominance by hydrophytic species with increasing proximity of the water table to the ground surface. Unlike the upland communities, these wetland or riparian communities generally continue growth later into the summer months due to the increased soil moisture availability. Wetland and riparian communities represent a relatively small area in the semiarid southwest region. In contrast to their relatively small size, they are of great importance in ecosystem functions. They support more diverse vegetation than the drier surrounding uplands and provide a critical source of floristic and structural diversity. The vegetation in stream systems dissipates the energy of floodwater and aids in the removal of sediments and pollutants. In addition, these habitats provide food and cover for an abundance of wildlife. Many of these habitats have undergone severe biological, physical, and hydrological changes, primarily caused by human interference.

In addition to the upland and riparian vegetation communities, other habitats are present which increase overall biological diversity, such as rock outcrops and disturbed areas. They are discussed in this section as habitat types, although some are characteristically devoid of vegetation.

As shown in Table 3-1 and Figure 3-1, the primary plant communities in the Lake Mathews Plan Area include non-native grassland, Riversidian sage scrub, juniper woodland, and several riparian habitats (mule fat scrub, southern willow scrub, sycamore riparian woodland, and freshwater marsh). Other habitat types also occur, including disturbed and ruderal areas, stands of exotic trees, natural barren areas, and open water.

In the descriptions below, vegetation categories follow Holland (1984); species names follow Hickman (1993). General characteristics of each habitat type are presented first, followed by a description of the habitat as it occurs in the Plan Area. Supplemental information on the occurrence of habitat types on Porterville and Bosanko cobbly clay soils follows the description of other habitat types. The last vegetation section includes descriptions from earlier surveys of the Plan Area.

Data cited for vegetation transects in each habitat type are taken from Appendix E and are summarized in Table 3-2. Location of transects cited in the discussion are shown in Appendix B.

1. Non-native Grassland

Annual grassland habitat occurs on 2,957 acres within the Plan Area (Table 3-1 and Figure 3-1). This habitat is generally characterized by dense stands of naturalized annual grasses and forbs; it also includes clay soil grasslands that contain a unique diversity of native plant species.

a. General Characteristics

This plant community is widespread throughout southern California on low hills and valley floors with fine-textured, often deep clay soils. It occurs adjacent to many riparian communities and intergrades with Riversidian sage scrub and juniper woodland.

Table 3-1
Vegetation Types in the Plan Area
(acres)

Habitat Type	Multiple Species Reserve		Operations Areas	Plan Area Projects	Total Plan Area
	Existing Reserve	Mitigation Bank			
Non-native grassland	1,648.0	1,073.6	193.8	41.6	2,957.0
Riversidian sage scrub	727.7	921.5	303.2	40.9	1,993.3
Mule fat scrub	18.1	29.9	1.0	7.3	56.3
Southern willow scrub	8.1	20.5	0.5	8.9	38.0
Juniper woodland	42.5	40.0	0.0	2.4	84.9
Sycamore riparian woodland	0.0	1.9	0.0	0.2	2.1
Disturbed	108.0	126.2	213.4	30.6	478.2
Agriculture	0.0	324.4	7.0	11.5	342.9
Exotic trees	9.1	2.5	7.8	0.8	20.2
Natural barren*	0.5	0.4	0.0	0.0	0.9
Ruderal	1.4	3.8	0.8	8.9	14.9
Freshwater marsh	1.0	0.0	0.0	0.2	1.2
Saltbush stand	1.1	0.2	0.0	1.2	2.5
Water (excluding lake)	0.0	0.0	1.1	0.0	1.1
TOTAL	**2,565.5**	**2,544.9**	**728.6**	**154.5**	**5,993.5**

* Does not include rock outcrops (approximately 122 acres) which occur within the other habitat types.

Vegetation structure is generally low, and terrestrial surface cover is usually less than 0.5 meter in height and varies from sparse to dense cover of introduced annual grasses and native annual forbs, or wildflowers (Holland 1986). The growing season for the annuals coincides with the soil moisture availability. Germination of seed occurs with the onset of winter rains, and growth occurs through late spring. The plant species survive the summer dry period as seed. Species composition varies throughout the growing season, as each species has different growth and maturation rates. Also, the species composition of non-native grassland varies from year to year depending on the amount and timing of rainfall and temperature regimes. Thus, each year many species may be unrepresented in the aboveground biomass, as they remain dormant in the seed bank (Major and Pyott 1966). Typically on the Gavilan Plateau, annual grassland is characterized by red brome (*Bromus madritensis*), ripgut grass (*Bromus diandrus*), slender wild oat (*Avena barbata*), foxtail fescue (*Vulpia myuros*), and occasionally foxtail barley (*Hordeum murinum*). Common forbs in this community consist of red-stem filaree (*Erodium cicutarium*), common fiddleneck (*Amsinckia menziesii*), summer mustard (*Hirschfeldia incana*), vinegar weed (*Trichostema lanceolatum*), rattlesnake weed (*Chamaesyce albomarginata*), tidy-tips (*Layia platyglossa*), California popcornflower (*Plagiobothrys collinus*), fascicled tarweed (*Hemizonia fasciculata*), white-stemmed filaree (*Erodium moschatum*), miniature lupine (*Lupinus bicolor*), dove