Preliminary Wildlife Corridor Evaluation

San Bernardino County, California

High Desert Corridor Project

LA and SB New Highway

EA: 2600U0

September 2011

STATE OF CALIFORNIA
Department of Transportation

Prepared By: AMEC Environment & Infrastructure, Inc. Date: 09/23/2011
(858) 300-4332
9210 Sky Park Court, Suite 200
San Diego, CA 92123

Recommended
for Approval By: ______________________________ Date: 09/27/2011
Jeff Johnson, Associate Environmental Planner, Natural Sciences
213-897-0404
Division of Environmental Planning
California Department of Transportation, District 7

Approved By: ______________________________ Date: 09/27/2011
Paul Caron, Senior District Biologist
213-897-0610
Division of Environmental Planning
California Department of Transportation, District 7

PRELIMINARY WILDLIFE CORRIDOR EVALUATION
FOR THE PORTION OF THE HIGH DESERT CORRIDOR PROJECT
LOCATED WITHIN DISTRICT 8
CALIFORNIA DEPARTMENT OF TRANSPORTATION
SAN BERNARDINO COUNTY, CALIFORNIA

Submitted to:
California Department of Transportation, District 8
464 West 4th Street, 6th Floor MS-1162
San Bernardino, California 92401-1400

Attn: Aaron P. Burton
Senior Environmental Planner
Environmental Studies "B" Branch Chief

Submitted by:
AMEC Earth & Environmental, Inc.
Riverside, California

23 September 2011

AMEC Project No. 1055402015

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF APPENDICES

W:\2011\Projects\10-554-02015 Caltrans\R0911-207\R0911-207 Wildlife Corridor Evaluation 9.23.11.doc

ACRONYMS AND ABBREVIATIONS

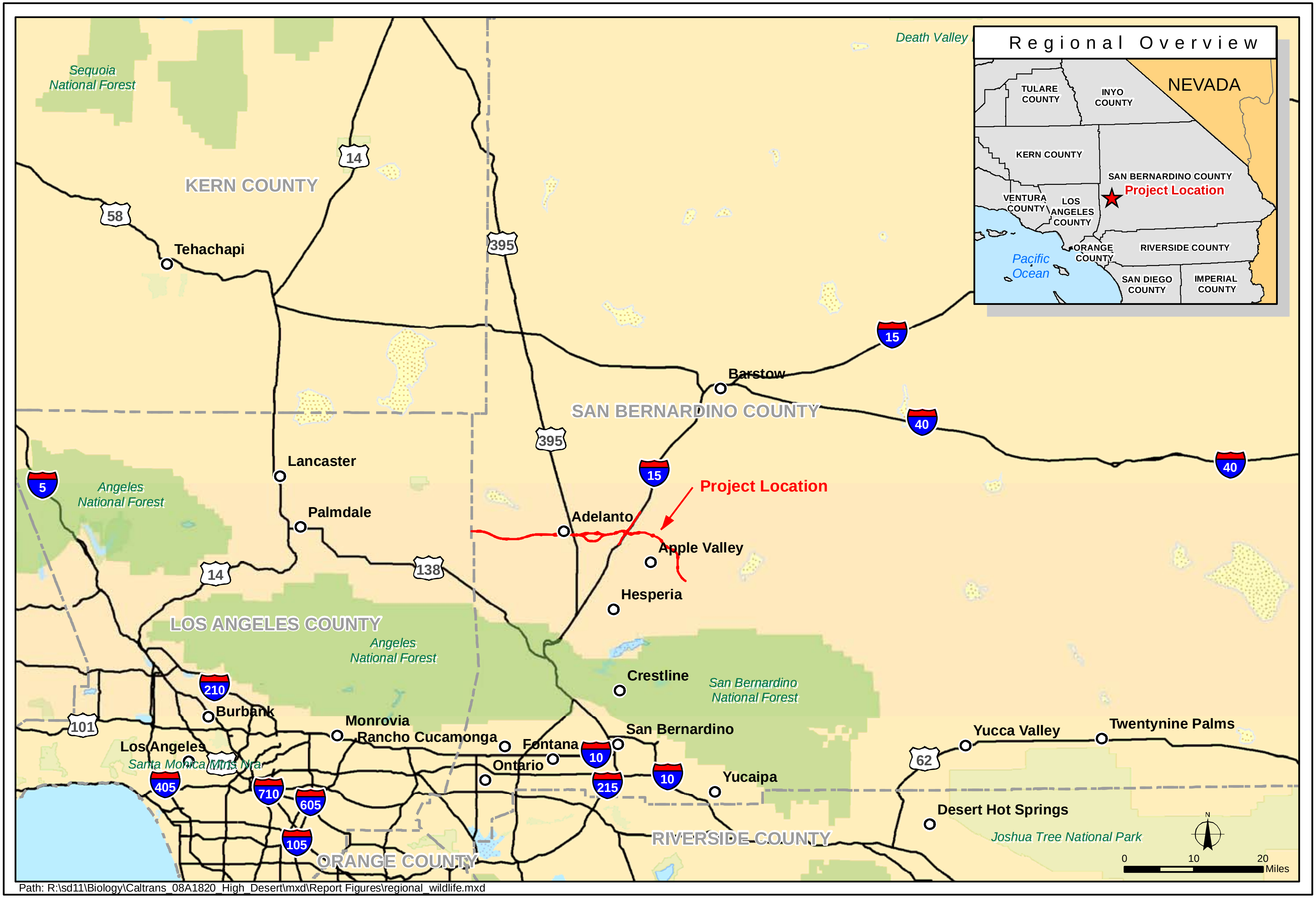
AMEC	AMEC Earth & Environmental, Inc.
Caltrans	California Department of Transportation
CNDDB	California Natural Diversity Database
I-15	Interstate 15
project	High Desert Corridor Project
SR-18	State Route 18

1.0 INTRODUCTION

The California Department of Transportation (Caltrans) proposes to construct the High Desert Corridor Project (project), which would include construction of an approximately 63-mile new freeway/expressway and possible toll way between SR-14 in the City of Palmdale, Los Angeles County, and SR-18 just east of the Town of Apple Valley, San Bernardino County. Caltrans has tasked AMEC Earth & Environmental, Inc. (AMEC) to perform a focused wildlife corridor/movement study for the proposed project to assess potential significant impacts to wildlife corridors that may result from project implementation and to identify mitigation measures, if necessary, to reduce these impacts to below a level of significance.

To inform this wildlife movement/corridor study, AMEC performed a preliminary wildlife corridor evaluation within and adjacent to the portion of the proposed project alignment that runs from the Los Angeles/San Bernardino County border east through the City of Adelanto to Interstate 15 (I-15) and then southeast to State Route 18 (SR-18) just east of the Town of Apple Valley (Figures 1 and 2). The purpose of this preliminary wildlife corridor evaluation was to provide a broad-scale analysis of the local and regional movement potential along the proposed alignment, to suggest potential target species for the wildlife corridor/movement study, and to suggest appropriate methodologies (e.g., track stations, tracking transects, remote cameras, culvert analysis, road kill surveys) to most efficiently obtain the maximum wildlife movement data for the project vicinity.

This report provides a summary of the background research, field survey methodology, field survey results, and recommendations (e.g., target species, survey methodologies) for implementation of the wildlife corridor/movement study. Once Caltrans reviews the information included in this report, AMEC would like to meet with Caltrans to discuss our recommendations and determine an appropriate study design for the wildlife corridor/movement study. AMEC can then provide Caltrans with a scope of work and fee estimate to implement the wildlife movement/corridor study.

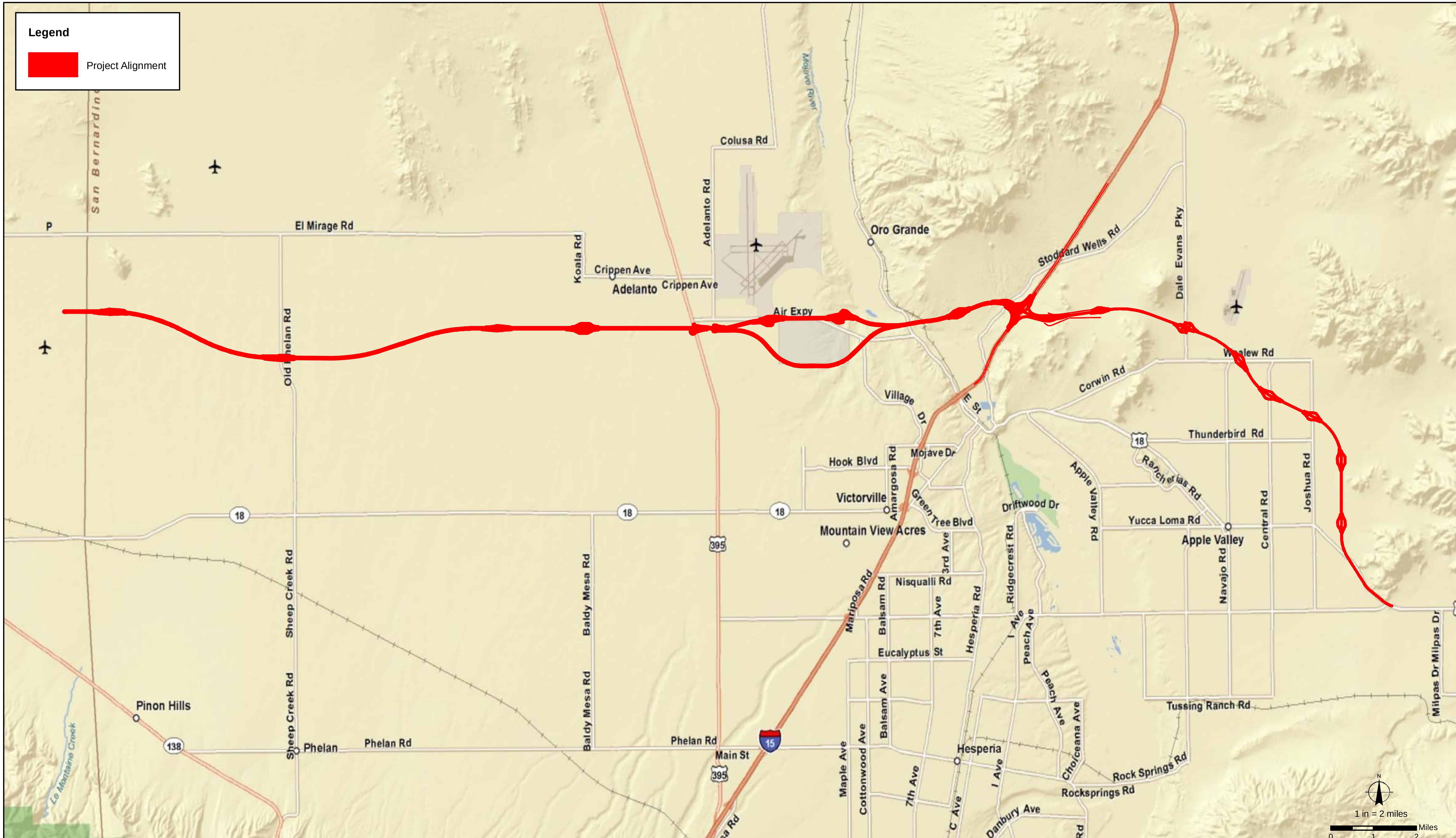


Path: R:\sd11\Biology\Caltrans_08A1820_High_Desert\mxd\Report Figures\regional_wildlife.mxd

Regional Location
High Desert Corridor Project Wildlife Corridor Study
San Bernardino County, California

FIGURE

1



Path: R:\sd11\Biology\Caltrans_08A1820_High_Desert\mxd\Report Figures\overview_wildlife.mxd

Project Alignment in Caltrans District 8
High Desert Corridor Project Wildlife Corridor Study
San Bernardino County, California

FIGURE
2

2.0 WILDLIFE CORRIDOR BACKGROUND

Wildlife corridors are essential to maintain populations of healthy and genetically diverse plant and wildlife species. At a minimum, wildlife corridors promote colonization of habitat and genetic variability for both plant and wildlife species by connecting fragments of habitat that are separated by otherwise foreign or inhospitable habitats. Because the isolation of plant and wildlife populations can have many harmful effects on local and regional species' populations and may contribute significantly to local species extinctions, wildlife corridors are important to sustain individual species distributions within these habitat fragments. Studies have concluded that many wildlife species would not likely persist in these habitat fragments over time because isolation through fragmentation would prohibit the infusion of new individuals and genetic information into the population (MacArthur and Wilson 1967; Soule 1987; Harris and Gallagher 1989; Bennett 1990). While the debate over the value of corridors has been extensive (Simberloff and Cox 1987, Noss 1987, Beier and Loe 1992, Beier and Noss 1998, Haddad et al. 2000, Beier and Noss 2000), most leading wildlife corridor biologists agree that, if corridors are used in appropriate situations and designed properly, they can be useful tools in conservation.

Wildlife corridors are considered sensitive by local, state, and federal resource and conservation agencies because these corridors allow wildlife to move between adjoining open space areas that are becoming increasingly isolated as open space becomes fragmented from urbanization, rugged terrain, and/or changes in vegetation (Beier and Loe 1992). In southern California, habitat fragmentation is one of the main concerns for the maintenance of healthy wildlife populations because natural areas are often scarce and maintaining connectivity between these habitats is perhaps one of the best feasible options for preventing localized extinctions and enhancing biodiversity (Penrod and Merrifield 2000). In addition, roadway mortality must be considered when evaluating the importance of maintaining habitat connectivity and providing well-designed wildlife crossings (e.g., over/underpasses). If animals are inclined to move between habitat patches, a narrow road or even a wider highway isn't an absolute barrier. However, if these animals choose to cross these roadways, the likelihood of mortality increases and potentially could depress regional species' populations if these failed crossing attempts become a common occurrence.

Wildlife corridors can be classified as either regional corridors or local corridors. Regional corridors are defined as those linking two or more large areas of natural open space and local corridors are defined as those allowing resident animals to access critical resources (e.g., food, cover, water) in a smaller area that might otherwise be isolated by some form of urban development (e.g., roads, housing tracts). Both regional and local wildlife corridors reduce the effects of habitat fragmentation by (1) allowing wildlife to move between remaining habitat fragments, thereby permitting depleted populations to be replenished and promoting genetic exchange; (2) providing escape routes from fire, predators, and human disturbances, thus reducing the risk of catastrophic events (such as fire or disease) on a population that may cause local species extinction; and (3) serving as travel routes for individual animals as they move within their home ranges in search of food, water, mates, and other life cycle requirements (Noss 1983; Farhig and Merriam 1985; Simberloff and Cox 1987; Harris and Gallagher 1989).

Within these wildlife corridors, wildlife movement activities typically fall into one of three movement categories: (1) dispersal (i.e., juvenile animals from natal areas or individuals extending range distributions), (2) seasonal migration, and (3) movement related to home range activities (e.g., foraging for food or water, defending territories, searching for mates). A number of terms have been used in various wildlife movement studies, such as "travel route", "wildlife corridor", and "wildlife crossing" to refer to areas in which wildlife move from one area to another. To clarify the meaning of these terms and facilitate this discussion on wildlife movement in this evaluation, these terms are defined as follows:

- *Travel Route*. A travel route is a landscape feature - such as a ridgeline, drainage, canyon, or riparian strip - within a larger natural habitat area that is used frequently by animals to facilitate movement and provide access to necessary resources (e.g., water, food, cover, den sites). The travel route is generally preferred because it provides the least amount of topographic resistance in moving from one area to another. It contains adequate food, water, and/or cover for wildlife moving between habitat areas and provides a relatively direct link between suitable habitat areas.
- *Wildlife Corridor*. A wildlife corridor is a piece of habitat, usually linear in nature, which connects two or more habitat patches that, otherwise, would be fragmented or isolated from one another. Wildlife corridors are often bounded by urban land uses or other areas that are unsuitable for wildlife. A corridor generally contains suitable cover, food, and/or water to support species and facilitate movement while in the corridor. Larger, landscape-level corridors (often referred to as habitat or landscape linkages) can provide both transitory and resident habitat for a variety of species.
- *Wildlife Crossing*. A wildlife crossing is a small, narrow area, relatively short in length and generally constricted in nature that allows wildlife to pass under, over, or through an obstacle or barrier that otherwise hinders or prevents movement. Crossings typically are manmade and include culverts, underpasses, overpasses, drainage pipes, and tunnels that provide access across or under roads, highways, pipelines, or other physical obstacles.

As discussed above, wildlife corridors provide routes for migration and dispersal. In addition, several studies have demonstrated the importance of corridors in preventing extinctions and increasing species diversity (Fahrig and Merriam 1985, Crooks 2002, Crooks and Soulé 1999, Soulé et al. 1988). Wildlife corridors also play a very important role in linking reserves and reducing the negative effects of fragmentation. While corridors are not reserves themselves, they can be viewed as a means to effectively increase reserve size. To some wide-ranging animals such as bobcat (*Felis rufus*), coyote (*Canis latrans*), and mountain lion (*Felis* concolor), even a relatively large isolated reserve may not be capable of sustaining populations. However, by allowing these and other species to disperse to and move between reserves via wildlife corridors, these animals have more space to utilize and are more likely to maintain stable populations.

3.0 PRELIMINARY WILDLIFE CORRIDOR EVALUATION METHODOLOGY

AMEC conducted a preliminary wildlife corridor evaluation for the portion of the proposed project alignment that runs from the Los Angeles/San Bernardino County border east through the City of Adelanto to I-15 and then southeast to SR-18 just east of the Town of Apple Valley (Figures 1 and 2). This section provides a summary of the background research and field evaluation methodology used for this wildlife corridor evaluation.

3.1 Wildlife Corridor Background Research

Prior to conducting the field evaluation, AMEC reviewed pertinent wildlife movement/corridor literature and data, including a variety of articles pertaining to southern California wildlife and ecosystems. AMEC also conducted a search of the California Natural Diversity Database (CNDDB) to determine which sensitive species are known to occur within the project vicinity to better understand the existing conditions and potential impacts of the proposed project.

AMEC used the information provided on several websites, including the California Department of Fish and Game's *California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California* and the Caltrans' *Wildlife Crossings Guidance Manual*, to better understand the most current wildlife movement/corridor information for the proposed project vicinity. For the California Essential Habitat Connectivity Project, CDFG and Caltrans collaborated with a variety of agencies and wildlife movement/corridor experts to use the most current information and methodologies to develop a statewide assessment of essential habitat connectivity, identifying large blocks of remaining, intact habitat or natural landscape patches and modeling linkages that will help facilitate wildlife movement between these patches. The Caltrans' *Wildlife Crossings Guidance Manual* provides an interactive website that allows wildlife movement/corridor information to be shared between agencies, stakeholders, and other interested parties to encourage a more comprehensive and collaborative understanding of available information as well as strategies for considering wildlife movement/corridors and related crossings associated with existing and proposed transportation facilities. In addition, AMEC used the information presented in the final report for the South Coast Missing Linkages project, titled *South Coast Missing Linkages: A Wildland Network for the South Coast Ecoregion* (South Coast Wildlands 2008) for supplemental information on wildlife movement/corridors within the vicinity of the proposed project.

AMEC also analyzed aerial imagery for the proposed project alignment for both local and regional context, including existing conditions that may currently limit wildlife movement within and adjacent to the proposed project alignment as well as areas that may be considered local and/or regional wildlife movement corridors. Maps included in the final *California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California* report (Caltrans and CDFG 2010) along with text from applicable documents were used to identify areas within and adjacent to the proposed project alignment that have been categorized as Natural Landscape Blocks, Essential Connectivity Areas, Interstate Connections, Potential Riparian Connections, and Missing Linkages.

3.2 Wildlife Corridor Field Evaluation Methodology

Two AMEC Senior Wildlife Biologists – Ms. Melissa Busby and Mr. Erik LaCoste – conducted the wildlife movement/corridor field evaluation. Both Ms. Busby and Mr. LaCoste have extensive background designing and implementing wildlife movement/corridor studies specifically for transportation projects (e.g., road improvement projects, road rehabilitation projects, new roadway construction projects), including previous work on projects for Caltrans. Ms. Busby and Mr. LaCoste also have experience with the development, design, implementation, and monitoring of appropriate mitigation measures (e.g., wildlife movement overpasses, directional fencing) as well as development and implementation of appropriate adaptive management measures to improve the effectiveness of these mitigation measures.

Ms. Busby and Mr. LaCoste used the information gathered during the wildlife corridor background research during the field evaluation that was conducted within and adjacent to the proposed project alignment. The field evaluation was performed on 11 and 12 July 2011. For this preliminary wildlife corridor evaluation, Ms. Busby and Mr. LaCoste completed a broad scale assessment of the proposed project alignment from the Los Angeles/San Bernardino County border east through the City of Adelanto to I-15 and then southeast to SR-18 just east of the Town of Apple Valley (Figures 1 and 2). Ms. Busby and Mr. LaCoste drove this portion of the proposed project alignment, evaluated selected areas on foot, and used aerial imagery along with observations in the field to identify potential local and regional wildlife movement/corridor areas. Areas were roughly classified into low, medium, and high quality habitats and mapped accordingly, by hand, onto a field map. Other factors that may limit wildlife movement (e.g., large tracks of fencing) were also mapped, and existing roadways were surveyed for sign of road kill. All species detected, either through direct observation or indirect sign (e.g., scat, tracks, vocalizations) were recorded. In addition, Ms. Busby and Mr. LaCoste evaluated the proposed project alignment to determine the most appropriate focal species as well as the most effective methodology to use for the focused wildlife movement/corridor study.

4.0 RESULTS OF THE PRELIMINARY WILDLIFE CORRIDOR EVALUATION

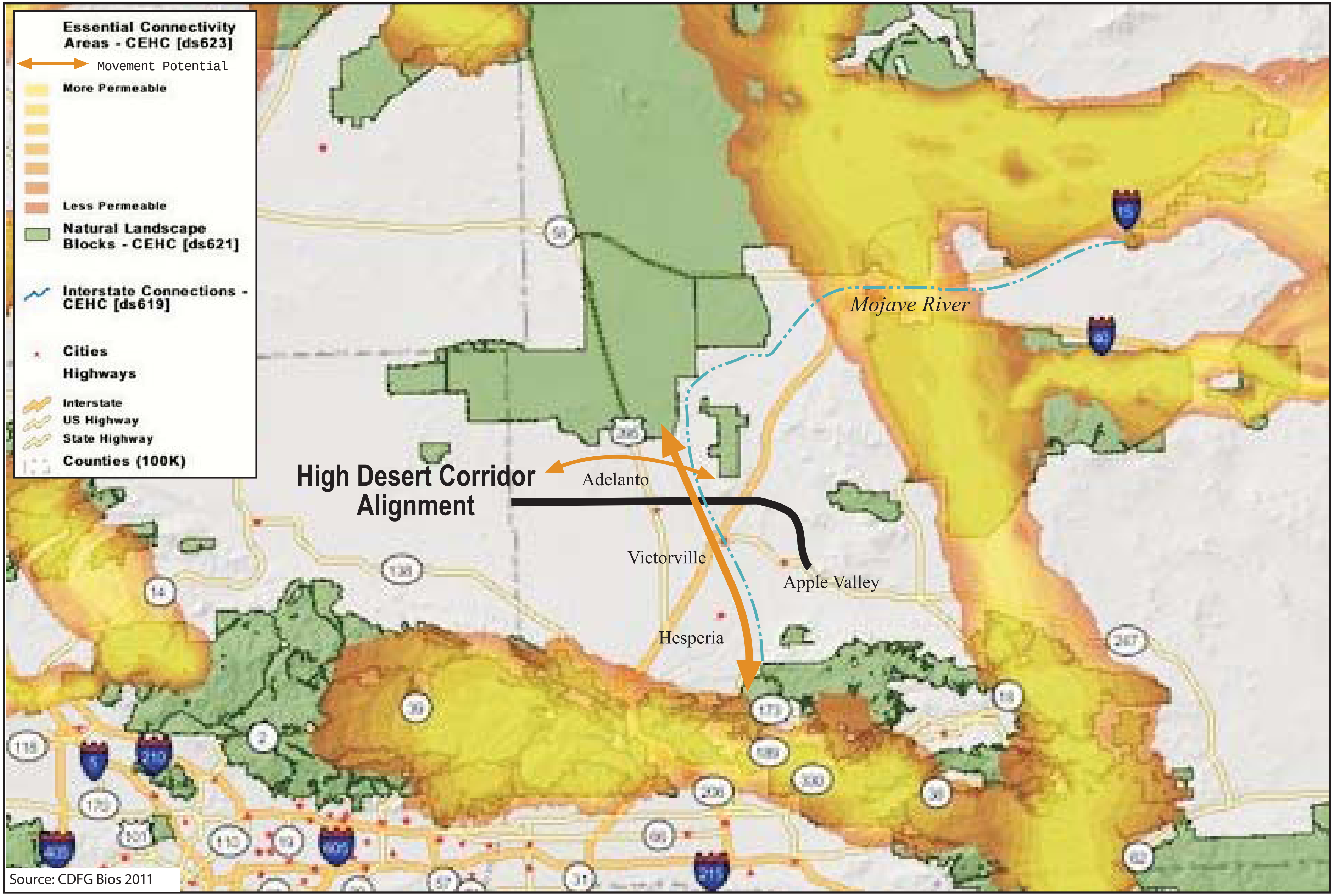
This section provides a summary of the results of the background research and field evaluation.

4.1 Wildlife Corridor Background Research Results

AMEC used the results of the wildlife corridor background research to better understand the existing conditions within and adjacent to the proposed project alignment. Review of applicable wildlife movement/corridor literature, especially articles pertaining specifically to southern California, provided information that helped refine and interpret the data obtained during the field evaluation. In addition, the results of the CNDDB search identified 29 sensitive wildlife species that have been reported within the vicinity of the proposed project alignment (Appendix A), including 2 invertebrates, 1 fish, 1 amphibian, 3 reptiles, 10 birds, and 6 mammals. The CNDDB results along with the wildlife species list compiled during the field evaluation (Appendix B) will be used to determine appropriate focal species and methodologies for the focused wildlife movement/corridor study.

AMEC also evaluated maps included in the final *California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California* report (Caltrans and CDFG 2010) as well as text in several wildlife corridor/movement documents to understand the variety of landscape classifications that were assigned to areas within the project vicinity (Figure 3). These classifications were based on distinguishing habitats that maintain ecological integrity rather than habitats that meet the needs of individual species and were classified based on their size, physical characteristics, biological characteristics, ownerships, and the roads that cross them, and were classified into several categories, including Natural Landscape Blocks, Essential Connectivity Areas, Interstate Connections, Potential Riparian Connections, and Missing Linkages. These categories are defined as follows:

- *Natural Landscape Blocks*. Natural Landscape Blocks include relatively natural landscape blocks that support native biodiversity. These include areas that are greater than 2,000 acres and that meet the ecoregion-specific criteria for the Ecological Condition Index, which was computed based on the degree of land conversion, residential housing impacts, and road impacts, as well as the degree of conservation protection and known high-biological value (e.g., designated Critical Habitat, species endemism).
- *Essential Connectivity Areas*. Essential Connectivity Areas include areas that are essential for connectivity between Natural Landscape Blocks that are greater than 10,000 acres in most regions and greater than 2,000 acres in more developed ecoregions (i.e., San Francisco Bay Area, Great Central Valley, South Coast, and Northern Sierra Nevada). These areas were delineated using wildlife corridor models based on the relative permeability of the landscape to wildlife movements, the naturalness of the landcover, and the conservation status.



amec

Regional Wildlife Corridors
High Desert Corridor Project Wildlife Corridor Study
San Bernardino County, California

FIGURE
3

- *Interstate Connections*. Interstate Connections include areas that are needed for connectivity between Natural Landscape Blocks in California and GAP 1 and GAP 2 lands in adjacent states (i.e., Oregon, Nevada, Arizona). GAP 1 lands are lands permanently protected for biodiversity, such as nature reserves, research natural areas, and wilderness areas, while GAP 2 lands are lands that are permanently protected to maintain a primarily natural state, such as National Wildlife Refuges, State Parks, and National Parks. No formal corridor modeling was performed to identify the Interstate Connections; however, these are considered placeholders for future efforts that may identify Essential Connectivity Areas and/or other types of wildlife corridors between California and neighboring states.
- *Potential Riparian Connections*. Potential Riparian Connections were mapped using broad-scale, stream-based hydrography mapping that covers all of California. Based on this data, rivers and streams that are at least 50 miles long were added to the Essential Connectivity Areas described above to show Potential Riparian Connections. These Potential Riparian Connections include rivers, streams, and adjacent vegetation that provide both aquatic and terrestrial connectivity and, in many areas, provide the best option for sustaining or improving connectivity between Natural Landscape Blocks and other important habitat patches.
- *Missing Linkages*. Missing Linkages include areas that have been identified through the South Coast Missing Linkages Project (South Coast Wildlands 2008) as areas necessary to maintain or restore habitat connectivity to conserve essential biological and ecological processes at a landscape-level. These classifications were made based on the most current biological data available and considered both the habitat and movement impediments and opportunities for a variety of native focal species within each ecoregion.

Based on the BIOS maps provided on the CDFG *California Essential Habitat Connectivity Project* website and in the final *California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California* report (Caltrans and CDFG 2010), the proposed project alignment crosses the Mojave River, which is considered a Potential Riparian Connection, and there are two “missing linkages” designated within or immediately adjacent to the proposed project alignment (Figure 3) that provide movement potential within and adjacent to the proposed project alignment, one that runs north-south along the Mojave River and one that runs west-east located north of the proposed alignment. No Interstate Connections, Essential Connectivity Areas, or Natural Landscape Blocks occur within the proposed project alignment (Figure 3). The closest Interstate Connection is located approximately 120 miles east of the proposed project alignment; the closest Essential Connectivity Area is located approximately 12 miles south of the proposed project alignment; and the closest Natural Landscape Block is located approximately 2.5 miles north of the proposed project alignment.

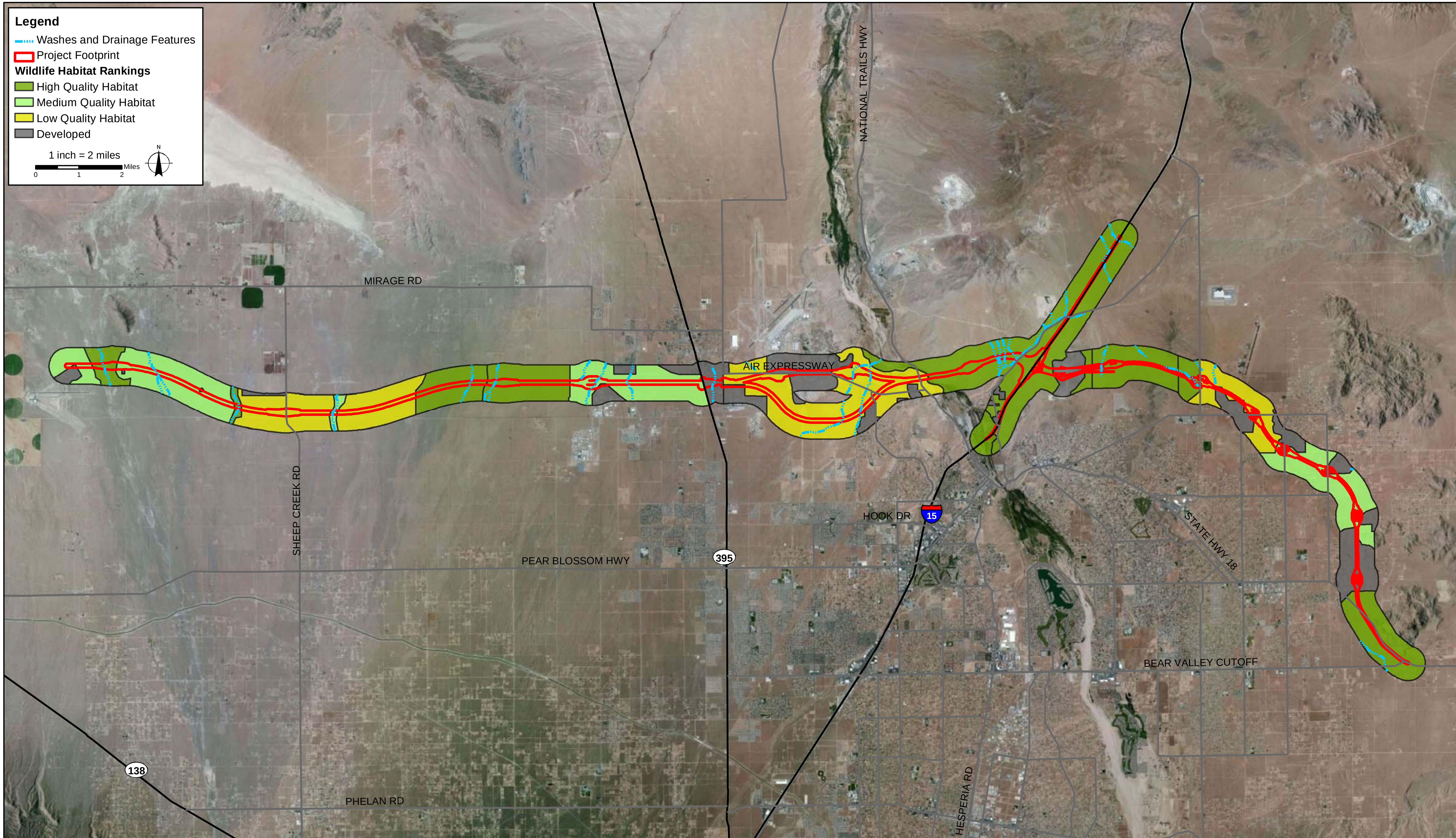
4.2 Wildlife Corridor Field Evaluation Results

AMEC Senior Wildlife Biologists – Ms. Busby and Mr. LaCoste – conducted a broad scale assessment of the proposed project alignment from the Los Angeles/San Bernardino County border east through the City of Adelanto to I-15 and then southeast to SR-18 just east of the Town of Apple Valley on 11 and 12 July 2011.

During the field evaluation, Ms. Busby and Mr. LaCoste roughly classified the alignment into low, medium, and high quality habitat for potential medium to large mammal movement. These areas were mapped by hand onto a field map and were later digitized by an AMEC GIS analyst (Figure 4). While several portions of the proposed project alignment are dominated by developed land and would not promote medium to large mammal activity, the majority of the habitat within and immediately adjacent to the proposed project alignment is classified as low, medium, or high quality habitat and would warrant further investigation. Further, numerous washes and drainage features occur within the proposed project alignment and could facilitate wildlife movement, especially in more urbanized, developed areas.

In addition to mapping habitat quality, Ms. Busby and Mr. LaCoste also used aerial imagery to assess potential local and regional wildlife movement corridors while also mapping features, such as large tracks of fencing, which could potentially limit wildlife movement. These data along with the habitat quality classifications were used to generate a map showing existing limitations and potential local and regional movement corridors (Figure 5).

While no road kill was noted during the field evaluation, 32 wildlife species were detected either through direct observation or indirect interpretation of sign (e.g., scat, tracks, vocalizations), including 1 invertebrate, 4 reptiles, 20 birds, and 7 mammals. A complete list of wildlife species detected during this field evaluation is included as Appendix B.

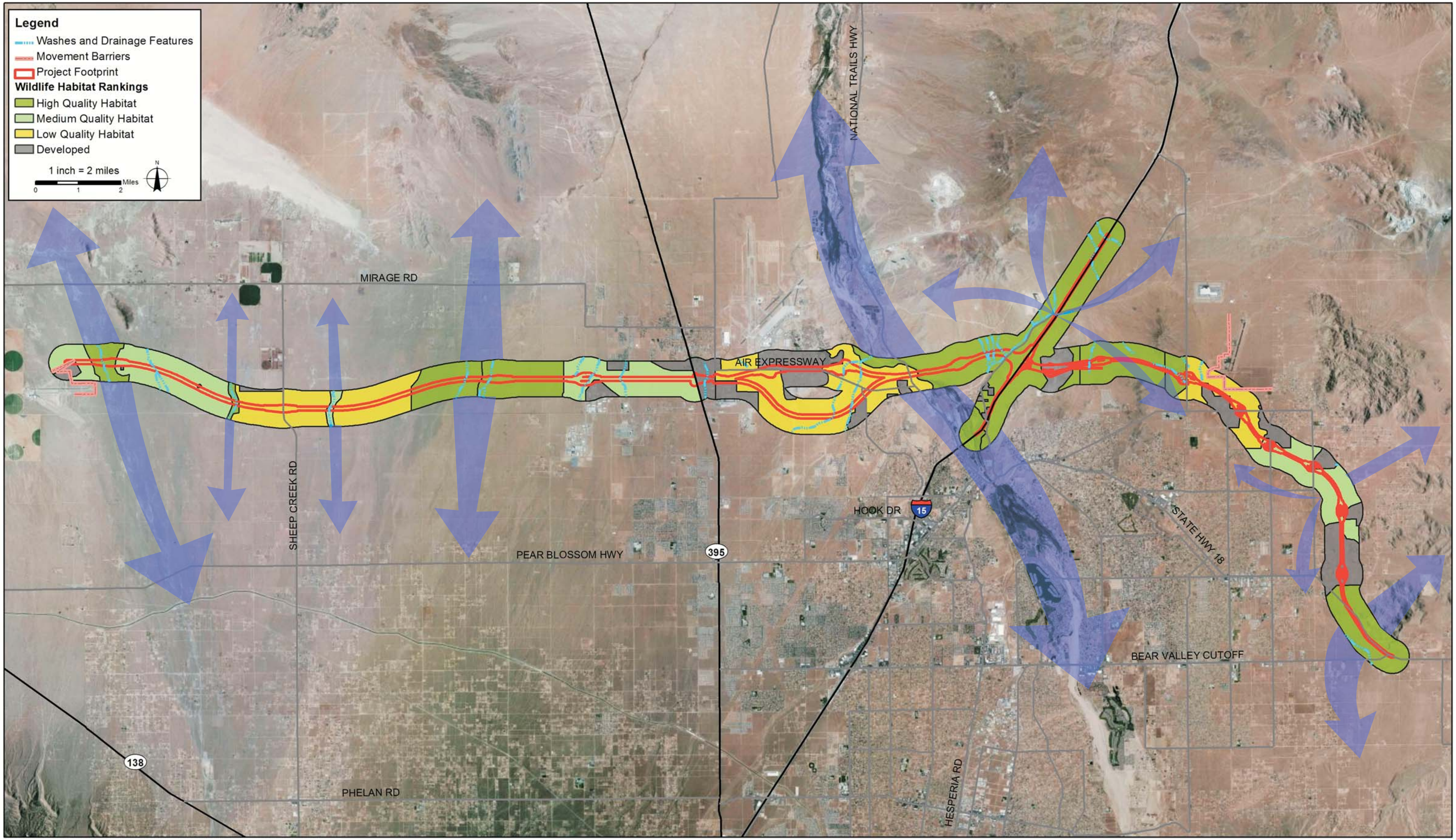


Path: R:\sd11\Biology\Caltrans_08A1820_High_Desert\mxd\Report Figures\wildlife_veg.mxd

amec

Habitat Ranking
High Desert Corridor Project Wildlife Corridor Study
San Bernardino County, California

FIGURE
4



Potential Wildlife Movement Corridors
High Desert Corridor Project Wildlife Corridor Study
San Bernardino County, California

FIGURE 5

amec

GRAPHICS/Biology/CaltransHDC/habitatrankingflows.fh8

5.0 RECOMMENDATIONS

This section summarizes AMEC's focal species selection and wildlife corridor sampling methodology.

5.1 Focal Species Selection

The ultimate goal of maintaining habitat connectivity and wildlife movement corridors is to conserve ecosystem function; however, habitat linkages – including both natural and man-made wildlife passages – need to meet the requirements of particular species that are found within the local and regional ecosystem. Because species move through and utilize habitats in a wide variety of ways, selection of project-specific focal species is an important step in designing an appropriate survey methodology to analyze wildlife movement, determine potential project-related impacts, and design appropriate mitigation and adaptive management measures to reduce these impacts to below a level of significance.

Focal species typically cover a wide range of habitat and movement needs within a region and are selected because designing appropriate mitigation and adaptive management measures for these species is expected to cover the habitat and connectivity needs for other species within the ecosystem that these focal species represent.

Large wildlife movement and connectivity studies often include focal species from several taxonomic groups, such as plants, invertebrates, fish, amphibians, reptiles, birds, and mammals. While planning for species within all taxonomic groups is important to maintain ecological integrity, including such a diversity of species would lead to an extremely labor intensive and costly wildlife corridor study. Thus, AMEC recommends using the results of the field evaluation along with historical data for the region (e.g., CNDDB results, results of recent focused surveys) to understand the types of species that are known to use the habitats within the vicinity of the proposed project alignment and to conduct a more focused wildlife corridor study for a select group of focal species that will represent the habitats and movement needs at an ecosystem level.

Many common plant and wildlife species as well as several sensitive species of plants, invertebrates, amphibians, reptiles, birds, and small mammals are known to occur within the vicinity of the proposed project alignment. In addition, focused surveys will be required for a variety of sensitive species that are known to occur or have a potential to occur within the proposed project alignment. Existing species data along with the results of the focused surveys that have yet to be conducted will provide additional data required to design and implement appropriate mitigation and adaptive management measures for project-related wildlife movement/corridor impacts.

While the ultimate mitigation and adaptive management measures will address the needs for a variety of species at an ecosystem level, AMEC recommends that the wildlife corridor study focus on the detection of medium to large mammals whose habitat preferences, food and/or cover requirements, breeding behaviors, and other life history characteristics make them particularly sensitive to habitat fragmentation and, thus, are important umbrella species to consider when determining appropriate habitat linkage/connectivity design.

AMEC will work closely with Caltrans to determine appropriate focal species and will use these to design an appropriate sampling methodology.

5.2 Wildlife Corridor Sampling Methodology

A variety of methodologies can be used to evaluate wildlife usage at a local and regional level. The four methodologies most frequently used for wildlife corridor studies include:

- *Track Station Surveys*. Track station surveys typically include evaluation of species sign at a defined track station location. Track stations usually are located based on the surrounding environmental conditions and generally yield the best results if they are placed (1) along natural wildlife trails where wildlife movement is restricted and species have few options to avoid the track station; (2) in areas where the substrate, either natural or modified (e.g., gypsum powder, chalk), allows for maximum detection of animal tracks; and (3) in areas with limited development and public access, which reduces the probability of vandalism or other activities that can affect the integrity of data collected during these surveys. The dimensions of the track station are clearly defined, and only animal sign that is observed within these boundaries is included as part of the dataset. To increase the likelihood of species detections, bait – such as commercial cat food – is sometimes placed at the center of the track station, especially in more wide-open spaces where wildlife have more movement options.
- *Camera Station Surveys*. Camera station surveys typically include the use of motion-censored or remote sensing cameras to detect and/or verify wildlife species usage of a particular survey point. Camera stations are most effective when used in conjunction with (1) an established track station; (2) a known wildlife travel route, corridor, or crossing location such as an existing culvert, riparian corridor, or other restricted movement area; (3) in areas with limited development and public access, which reduces the probability of vandalism or other activities that can affect the survey equipment and the integrity of data collected during these surveys.
- *Tracking Transect Surveys*. Tracking transect surveys typically entail evaluation of species sign along a defined tracking transect. Tracking transects usually are located based on the surrounding environmental conditions and generally yield the best results if they are placed along natural wildlife trails with natural substrate that allows for maximum detection of animal tracks. The start and end points as well as the transect width are clearly defined, and only wildlife sign observed within these boundaries is included as part of the dataset.
- *Road Kill Surveys*. Road kill surveys typically entail driving slowly or walking along major roadways and recording the number and types of wildlife presumably killed by vehicle collisions found on and within a defined buffer along the roadway. Road kill surveys usually yield the most data along roadways with a high level of traffic and in areas where wildlife are likely to attempt crossing these roadways (e.g., adjacent to areas with open space, access to limited habitat, along riparian corridors). The results of road kill surveys not only provide information on which species occur in the area but also provide valuable data for determining areas along an existing roadway where wildlife

frequently attempt but fail to cross safely, which is useful information for determining the design and location of wildlife crossings to mitigate for potential project-related impacts.

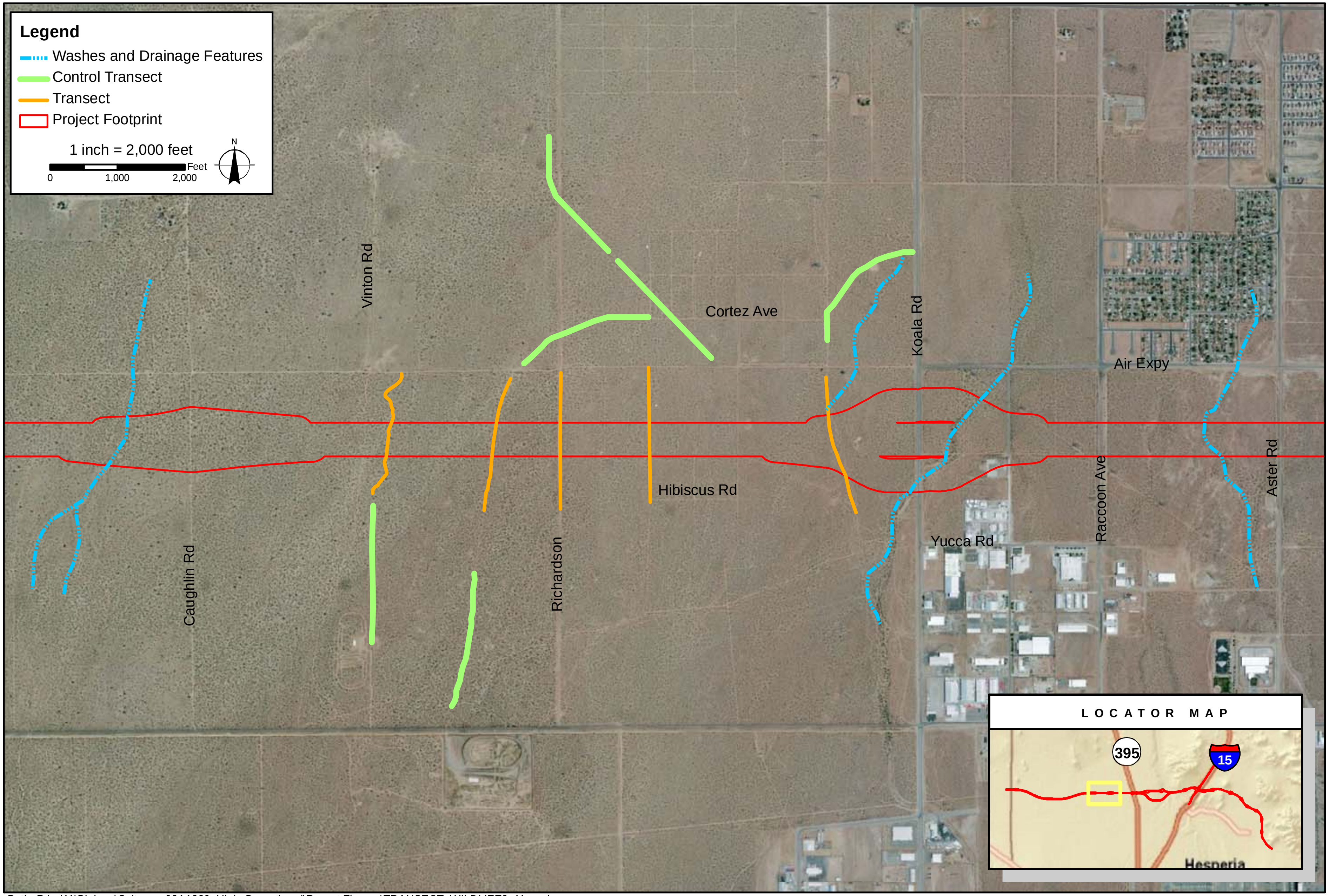
For the proposed project, AMEC does not recommend using track station or camera station surveys because the majority of the proposed project area is either within areas of wide open space or in areas with existing development. The western portion of the proposed alignment passes through open desert scrub and Joshua tree woodland. Because there are many wildlife movement options within this area, wildlife may be deterred by the presence of an established track station and use an alternate travel route to avoid using a track station area all together. The middle and eastern portions of the proposed alignment pass through areas with increased development, such as commercial and residential areas. While wildlife movement in these areas may be more restricted and appropriate locations for track stations and/or camera stations may be more easily identified, AMEC does not recommend placing track stations and/or camera stations in these areas because of the probability of study interference (e.g., equipment vandalism, stolen cameras) by local residents and others using the area.

To obtain the wildlife movement data for the area, AMEC recommends using tracking transects supplemented by data from roadkill surveys. AMEC would coordinate with Caltrans to discuss an appropriate study design prior to implementation; however, a description of our recommended approach is provided here.

5.2.1 Proposed Tracking Transect Methodology

AMEC would establish tracking transects within and/or adjacent to the proposed alignment as well as at control areas that would not be affected by project construction. There are many potential transect locations within and adjacent to the proposed project alignment; a few examples of possible transect locations are provided on Figures 6 and 7. The location of the study transects would be determined based on the surrounding conditions, and all tracking transects would be established along natural wildlife movement trails and in areas with substrate that would allow for maximum detection of animal tracks. The start and end points for each tracking transect would be recorded using a GPS unit with submeter accuracy to maintain consistency in tracking transect surveys over the duration of the wildlife monitoring study, and the length and width of each tracking transect would be standardized and would be determined prior to implementation.

Qualified AMEC wildlife biologists would perform tracking transect surveys under appropriate survey conditions.. During periods of poor lighting when tracks are harder to distinguish, a flashlight or mirror would be used to better identify the tracks occurring on the tracking transect.

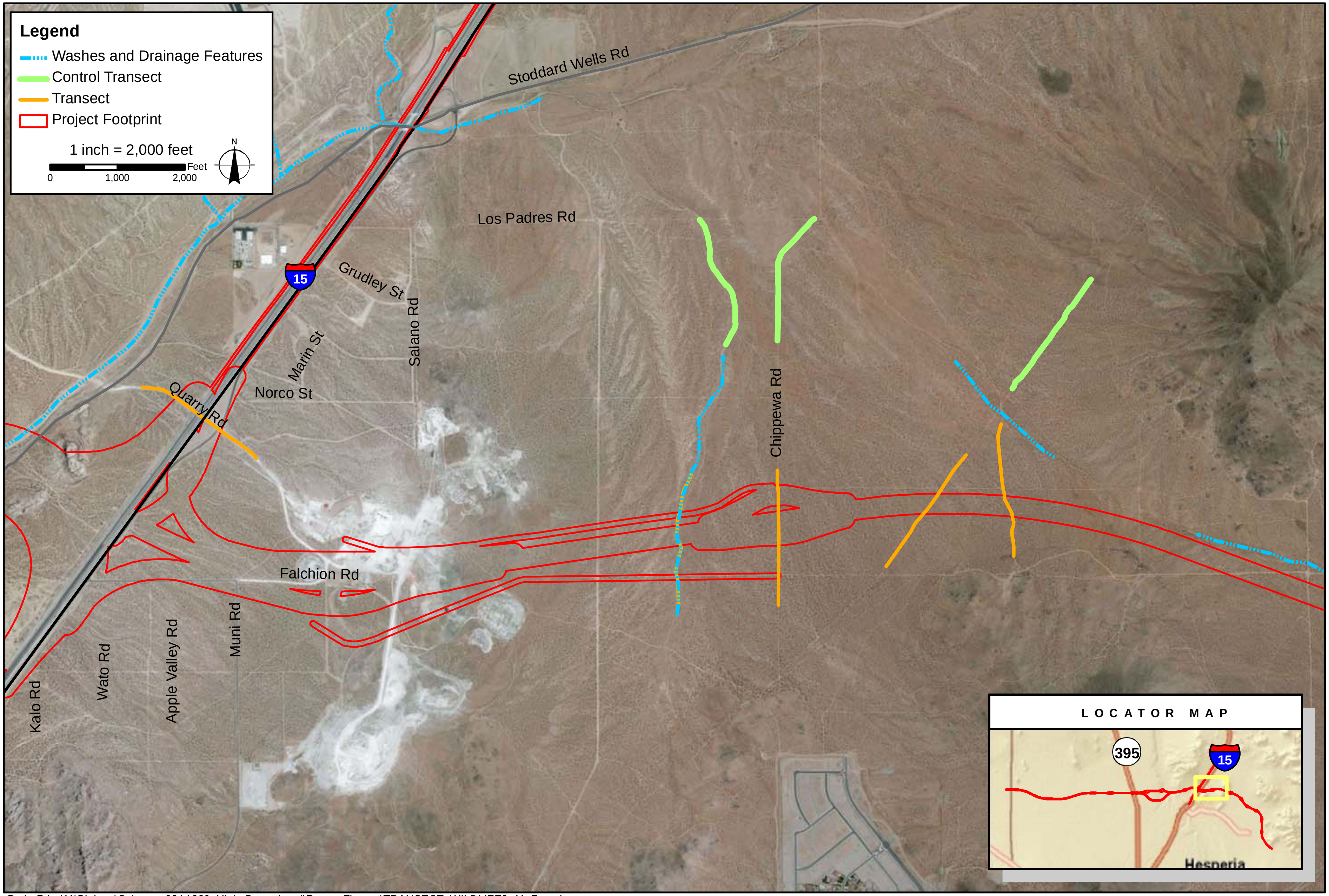


Path: R:\sd11\Biology\Caltrans_08A1820_High_Desert\mxd\Report Figures\TRANSECT_WILDLIFE8x11.mxd

amec

Potential Transect Locations
High Desert Corridor Project Wildlife Corridor Study
San Bernardino County, California

FIGURE
6



Path: R:\sd11\Biology\Caltrans_08A1820_High_Desert\mxd\Report Figures\TRANSECT_WILDLIFE8x11_7.mxd

amec

Potential Transect Locations
High Desert Corridor Project Wildlife Corridor Study
San Bernardino County, California

FIGURE
7

During the tracking transect surveys, general information (e.g., date, observer, start/finish time, start/finish weather conditions) would be recorded before beginning the tracking transect surveys and after completion of all tracking transect surveys. During each tracking transect survey, only the sign located on the transect would be considered part of the dataset. To be considered "on the tracking transect", at least part of the sign must be within the boundaries of tracking transect. Biologists would record all species detected on the tracking transect, including the type of sign used to identify the species (e.g., tracks, scat), the number of sign, and the direction of travel (for tracks only). If the number of tracks exceeds 15 and/or are too difficult to count (e.g., mouse tracks, squirrel tracks, lizard tracks), an estimate of the number of tracks would be recorded. In addition, biologists would keep a list of all incidental species observations/detections within and adjacent to the tracking transect that aren't part of survey data and would note any additional information that may be relevant to the surveys.

A field data sheet would be designed specifically for the tracking surveys associated with this wildlife monitoring study. Data collected in the field would be recorded by hand on this data sheet. This information would then be added to the main geodatabase for this study. This data would be used to document the medium to large mammal population within the study area and, if enough data is obtained, could be used to determine changes in the medium to large mammal population during the course of the study.

5.2.2 Proposed Road Kill Survey Methodology

To supplement the tracking transect data, AMEC recommends conducting road kill surveys along the major roadways located within and adjacent to the proposed project alignment. Road kill surveys would be performed by driving slowly or walking along the designated survey routes, which would be determined during study design. The start and end points of the road kill routes would be recorded using a GPS unit to maintain consistency in road kill surveys over the duration of the wildlife monitoring study. While the length of each road kill survey route may vary based on the target roadway, a defined survey area would be established that includes both the roadway and an appropriate buffer area immediately adjacent to the roadway boundary.

Qualified AMEC biologists would perform road kill surveys by driving slowly or walking along the designated road kill survey route. Because these routes include main road ways, these surveys would be scheduled during times with lighter traffic flow to increase the safety of both the AMEC surveyors and the motorists using the roadways.

During the road kill surveys, general information (e.g., date, observer, start/finish time, start/finish weather conditions) would be recorded before beginning the road kill survey route and after completing the road kill survey route. During each road kill survey, only the road kill located on the defined road kill survey route would be considered part of the data set. Biologists would record the location and species of all road kill within the survey route. Each identified road kill would be marked with orange construction grade paint to avoid double counting on subsequent surveys. In addition, biologists would keep a list of all incidental species observations/detections within and adjacent to the road kill survey route that aren't part of survey data and would note any additional information that may be relevant to the surveys. As such, the type and location of any road kill that is observed outside of a designated survey route, whether during a road kill survey or other surveys being performed for the proposed project, would be recorded as an incidental observation.

A field data sheet would be designed specifically for the road kill surveys associated with this wildlife monitoring study. Data collected in the field would be recorded by hand on this data sheet. This information would then be added to the main geodatabase for this study. This data would be used to distinguish areas where wildlife crossing attempts tend to fail, and – depending on the amount of data obtained during this study – may be used to inform appropriate wildlife mitigation, such as installation of wildlife crossings and/or directional fencing.

6.0 DISCUSSION

AMEC would work with Caltrans to finalize the focal species for this study and to determine an appropriate number of tracking transects to include based on the schedule and budget limitations for the wildlife movement study. Once we have determined an appropriate level of effort, AMEC will provide Caltrans with a scope of work and cost estimate to implement the wildlife corridor study.

7.0 REFERENCES

Atwood, J. L. and D. R. Bontrager. 2001. California Gnatcatcher (*Polioptila californica*). In The Birds of North America, No. 574 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D.C.

Beier, P. 1995. Dispersal of juvenile cougars in fragmented habitat. Journal of Wildlife Management 59:228-237.

Beier, P. 1993. Determining minimum habitat areas and corridors for cougars (PDF). Conservation Biology 7:94-108.

Beier, P., and R. F. Noss. Do habitat corridors provide connectivity? Conservation Biology. 12:1241-1252.

Beier, Paul, and S. Loe. 1992. A Checklist for Evaluating Impacts to Wildlife Movement Corridors. *Wildlife Society Bulletin 20*. Pages 434-440.

Beier, P., D. Choate, and R. H. Barrett. 1995. Activity patterns of cougars during different behaviors (PDF). Journal of Mammalogy 76:1056-1070.

Bennett, A.F. 1990. Habitat corridors and the conservation of small mammals in the fragmented forest environment. *Landscape Ecology*. 4. Pages 109-122.

Bolger, D. T., T. A. Scott, and J. Rotenberry. 2001. Use of corridor-like landscape structures by bird and small mammal species. Biological Conservation 102:213-224.

Brown, Bryan T. 1993. Bell's Vireo (Vireo bellii). The Birds of North America, No. 35 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA, and The American Ornithologists' Union, Washington, D. C.

California Department of Fish and Game's *California Essential Habitat Connectivity Project: A Strategy for Conserving a Connected California* http://www.dfg.ca.gov/habcon/connectivity/.

Caltrans' *Wildlife Crossings Guidance Manual* http://www.dot.ca.gov/hq/env/bio/wildlife_crossings/.

Cleavenger, A. P., B. Chruszcz, and K. Gunson. 2001. Drainage culverts as habitat linkages and factors affecting passage by mammals. Journal of Applied Ecology 38:1340-1349.

Crooks, K. R. 2002. Relative sensitivities of mammalian carnivores to habitat fragmentation. Conservation Biology 16:1-15

Crooks, K. R., and M. E. Soulé. 1999. Mesopredator release and avifaunal extinctions in a fragmented system. Nature 400:563-566.

Crooks, K. R., A. V. Suarez, D. T. Bolger, and M. E. Soulé. 2001. Extinction and colonization of birds on habitat islands. Conservation Biology 15:159-172.

Crother, B., D.T. Bolger and P.J. Mock. 1991. Baldwin Otay Ranch Wildlife Corridor Study: Phase I Report. ERC Environmental and Energy Services Co., Inc. for The Baldwin Company and City of Chula Vista.

Dickson, B. G., and P. Beier. 2002. Home range and habitat selection by adult cougars in southern California. Journal of Wildlife Management 66(4):1235-1245.

Fahrig, L. and G. Merriam. 1985. Habitat patch connectivity and population survival. Ecology. 1985; 661762-1768.

Haas, C. D. 2000. Distribution, relative abundance, and roadway underpass responses of carnivores throughout the Puente-Chino Hills.

Harris, L.D. and P.B. Gallagher. 1989.New initiatives for wildlife conservation: the need for movement corridors. *Defenders of Wildlife*. (In Defense of Wildlife: Preserving Communities and Corridors, Washington, D.C.). Pages 11-34.

Jameson, E.W., Peeters, H.J. California Mammals (California Natural History Guides, No 52). 1988. University of California Press, Berkeley.

Lingle, S. 2002. Coyote predation and habitat segregation of white-tailed deer and mule deer. Ecology. 83(7): 2037-2048

MacArthur, R.H., and E.O. Wilson. 1967. The theory of island biogeography. *Princeton University Press*, NJ. 203 pp.

Meffe et al. 1997. Principles of Conservation Biology, 2nd edition.

Ng, S. J., J.W. Dole, R.M. Sauvajot, S.P.D. Riley, and T. J. Valone. In Press - 2003. Use of highway undercrossings by wildlife in Southern California.

Noss, R. F. 1987. Corridors in real landscapes: A reply to Simberloff and Cox.Conservation Biology 1:159-164.

Noss, R. F. 1983. A regional landscape approach to maintain diversity. *BioScience 33(11).* Pages 700-706.

Penrod, K. 2000. Missing Linkages: Restoring connectivity to the California landscape. in Missing Linkages. South Coast Wildlands Project, San Diego.

Riley, S. P. D., R. M. Sauvajot, T. K. Fuller, E. C. York, D. A. Kamradt, C. Bromley, and R. K. Wayne. 2003. Effects of urbanization and habitat fragmentation on bobcats and coyotes in southern California. Conservation Biology 17:566-576.

Riverside County Multiple Species Habitat Conservation Plan (June 2003). http://www.rcip.org/conservation.htm

Rogers, C. M. and Caro, M. J. (1998) Song sparrows, top carnivores and nest predation: a test of the mesopredator release hypothesis. Oecologia, 116, 227-233.

Rosenberg, D. K., R. R. Noon, and E. C. Mellow. 1997. Biological corridors: Form, function and efficacy. Bioscience 47.

Simberloff, D.S., and J. Cox. Consequences and costs of conservation corridors.Conservation Biology 1.

Simberloff, D.S., J.A. Farr, J. Cox, and D. W. Mehlman. 1992. Movement Corridors: Conservation bargains or poor investments? Conservation Biology 4:493-504.

Soule, M. 1987. Viable populations for conservation. *Cambridge Univ. Press*, Cambridge.

South Coast Wildlands. 2008. South Coast Missing Linkages: A Wildland Network for the South Coast Ecoregion. Produced in cooperation with partners in the South Coast Missing Linkages Initiative. Available online at http://www.scwildlands.org.

United States Fish and Wildlife Service. 1998. Draft recovery plan for the least Bell's vireo. U.S. Fish and Wildlife Service, Portland, OR. 139 pp.

Wayne, R. K. 2003. Effects of urbanization and habitat fragmentation on bobcats and coyotes in southern California. Conservation Biology 17:566-576.

APPENDIX A

CALIFORNIA NATURAL DIVERSITY DATABASE SEARCH RESULTS WILDLIFE SPECIES

Appendix A
California Natural Diversity Database Search Results
Wildlife Species

COMMON NAME	SCIENTIFIC NAME
Invertebrates	
Victorville shoulderband	*Helminthoglypta mohaveana*
San Emigdio blue butterfly	*Plebulina emigdionis*
Fish	
Mohave tui chub	*Siphateles bicolor mohavensis*
Herpetofauna	
California red-legged frog	*Rana draytonii*
western pond turtle	*Emys marmorata*
desert tortoise	*Gopherus agassizii*
coast horned lizard	*Phrynosoma blainvillii*
Birds	
Cooper's hawk	*Accipiter cooperii*
prairie falcon	*Falco mexicanus*
western yellow-billed cuckoo	*Coccyzus americanus occidentalis*
burrowing owl	*Athene cunicularia*
southwestern willow flycatcher	*Empidonax traillii extimus*
loggerhead shrike	*Lanius ludovicianus*
least Bell's vireo	*Vireo bellii pusillus*
Le Conte's thrasher	*Toxostoma lecontei*
yellow-breasted chat	*Icteria virens*
summer tanager	*Piranga rubra*
Mammals	
Townsend's big-eared bat	*Corynorhinus townsendii*
hoary bat	*Lasiurus cinereus*
western mastiff bat	*Eumops perotis californicus*
Mohave ground squirrel	*Xerospermophilus mohavensis*
pallid San Diego pocket mouse	*Chaetodipus fallax pallidus*
Mohave river vole	*Microtus californicus mohavensis*

APPENDIX B

WILDLIFE SPECIES DETECTED DURING WIDLIFE CORRIDOR FIELD EVALUATION

Appendix B
Wildlife Species Detected During Wildlife Corridor Field Evaluation

COMMON NAME	SCIENTIFIC NAME
Invertebrates	
dentate stink beetle	*Eliodes dentipes*
Herpetofauna	
collard lizard	*Crotaphytus* sp.
desert iguana	*Dipsosaurus dorsalis*
zebra-tailed lizard	*Callisaurus draconoides*
whiptail sp.	*Cnemidophorus* sp.
Birds	
northern harrier	*Circus cyaneus*
red-tailed hawk	*Buteo jamaicensis*
American kestrel	*Falco sparverius*
prairie falcon	*Falco mexicanus*
mourning dove	*Zenaida macroura marginella*
great horned owl	*Bubo virginianus*
Say's phoebe	*Sayornis saya*
ash-throated flycatcher	*Myiarchus cinerascens*
western kingbird	*Tyrannus verticalis*
loggerhead shrike	*Lanius ludovicianus*
common raven	*Corvus corax*
European starling	*Sturnus vulgaris*
northern mockingbird	*Mimus polyglottos*
cactus wren	*Campylorhynchus brunneicapillus*
northern rough-winged swallow	*Stelgidopteryx serripennis*
horned lark	*Eremophila alpestris*
house sparrow	*Passer domesticus*
house finch	*Carpodacus mexicanus*
black-throated sparrow	*Amphispiza bilineata deserticola*
Brewer's blackbird	*Euphagus cyanocephalus*
Mammals	
coyote	*Canis latrans*
gray fox	*Urocyon cinereoargenteus californicus*
kit fox	*Vulpes macrotis*
white-tailed antelope squirrel	*Ammospermophilus leucurus*
kangaroo rat sp.	*Dipodomys* sp.
black-tailed jackrabbit	*Lepus californicus*
desert cottontail	*Sylvilagus audubonii*