Wildlife Movement Studies

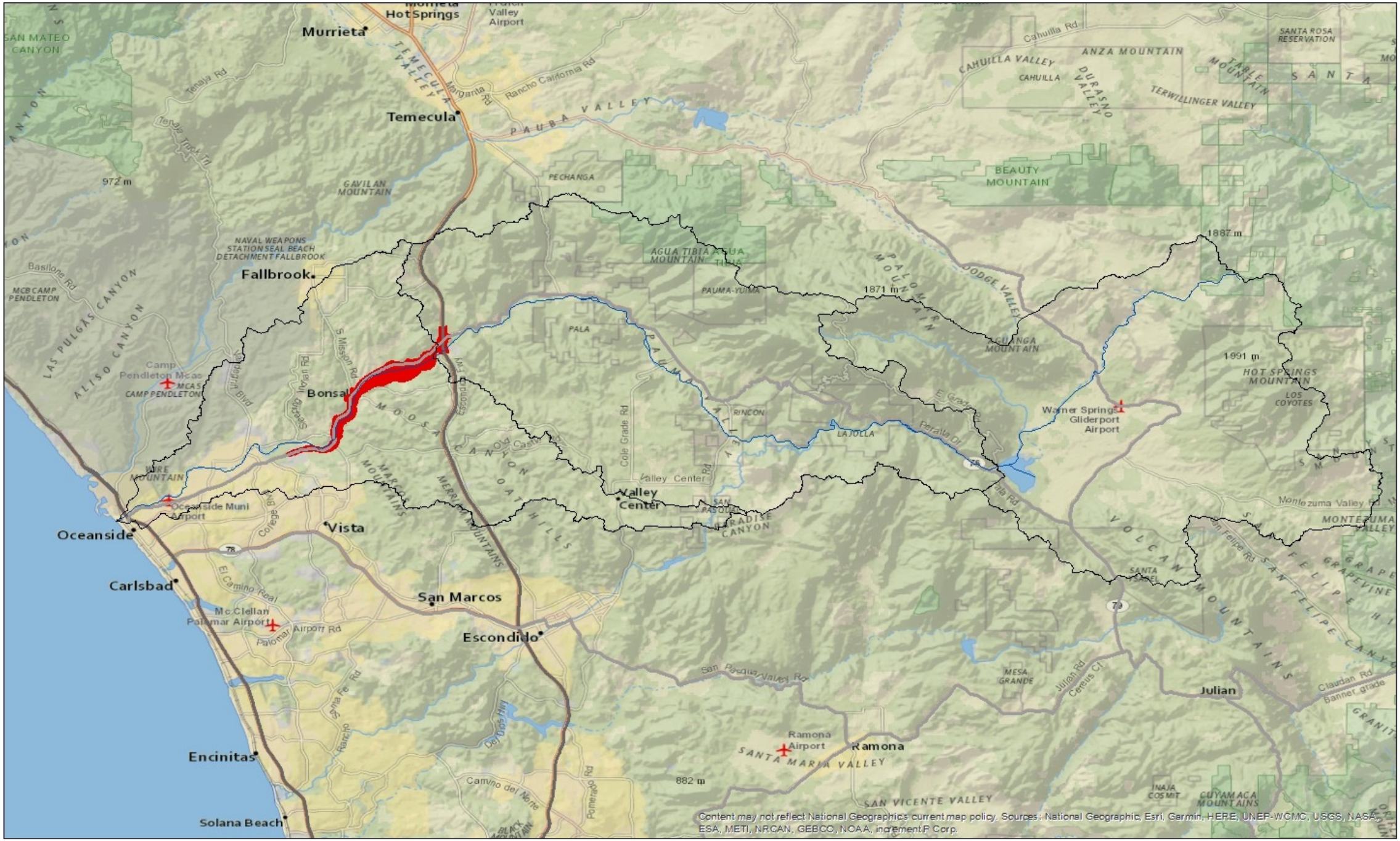
SAN DIEGO COUNTY SR-76 PM 7.3-17.6

2007-PRESENT

Where

San Diego County

Project Vicinity

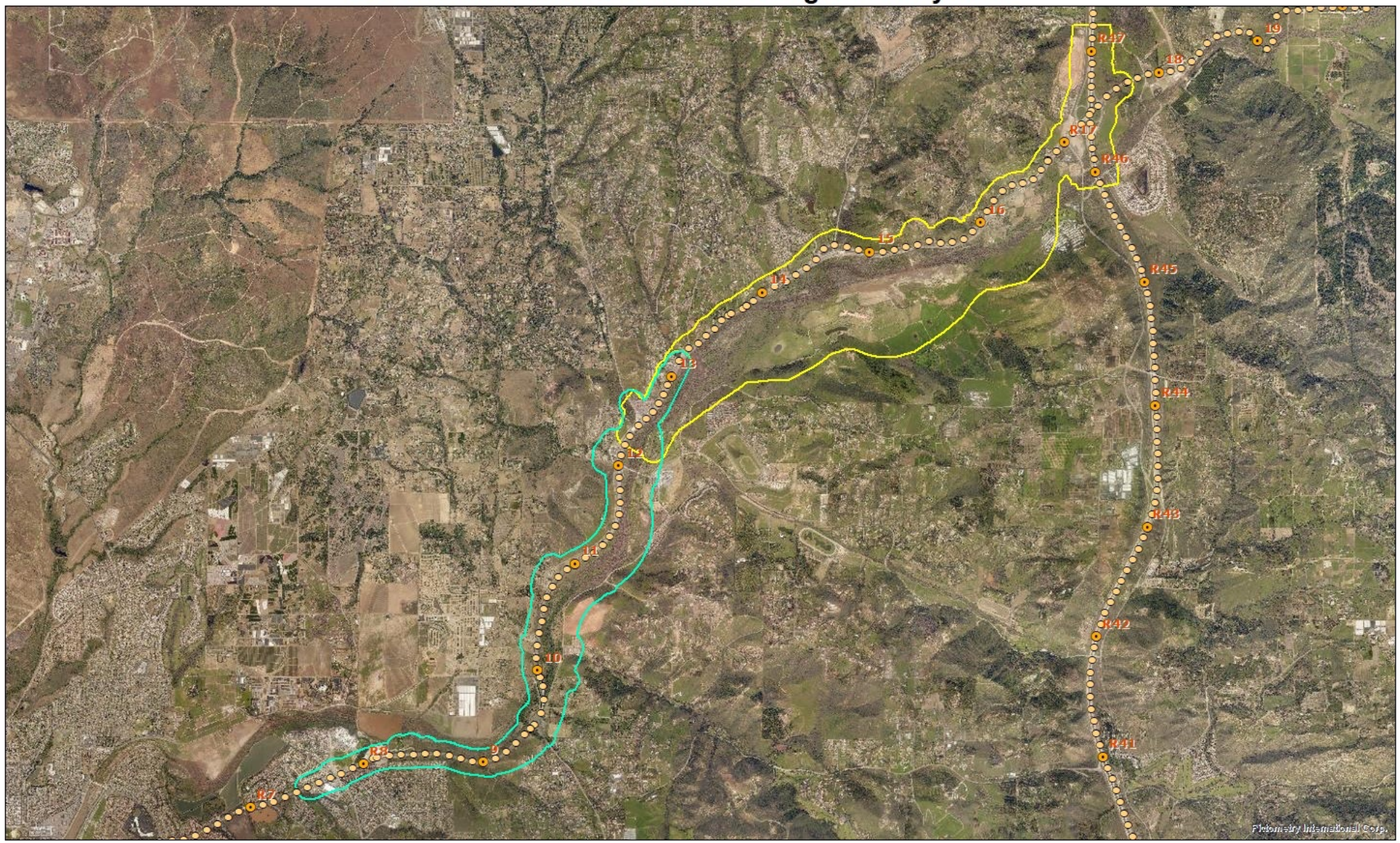

Murrieta
Hot Springs
Temecula
Fallbrook
Bonsall
Oceanside
Vista
Carlsbad
San Marcos
Escondido
Valley Center
Encinitas
Solana Beach
Ramona
Julian
Warner Springs Gliderport Airport
Oceanside Muni Airport
McClellan Palomar Airport
Ramona Airport
Camp Pendleton Mcas
MCAS CAMP PENDLETON
NAVAL WEAPONS STATION SEAL BEACH DETACHMENT FALLBROOK
MCB CAMP PENDLETON
PECHANGA
PALA
RINCON
LAJOLLA
PAUMA-YUIMA
AGUA TIBIA MOUNTAIN
GAVILAN MOUNTAIN
BEAUTY MOUNTAIN
PALOMAR MOUNTAIN
QUINGA MOUNTAIN
HOT SPRINGS MOUNTAIN
LOS COYOTES
MESA GRANDE
SANTA YSABEL
SANTA ROSA RESERVATION
CAHUILLA VALLEY
CAHUILLA
ANZA MOUNTAIN
DURASNO VALLEY
TERWILLINGER VALLEY
TABLE MOUNTAIN
PAUBA VALLEY
TEMECULA VALLEY
DODGE VALLEY
PAUMA VALLEY
MOOSA CANYON
OAT HILLS
MERRIAM MOUNTAINS
MARIAN MOUNTAINS
WIRE MOUNTAIN
LAS PULGAS CANYON
ALISO CANYON
SAN MATEO CANYON
PARADISE CANYON
SAN FELIPE CANYON
VOLCAN MOUNTAINS
SANTA MARIA VALLEY
SAN VICENTE VALLEY
INAJA COSMIT
CUYAMACA MOUNTAINS
MONTEZUMA VALLEY
SAN FELIPE HILLS
GRAPEVINE HILLS
GRANITE HILLS
882 m
972 m
1871 m
1887 m
1991 m
Content may not reflect National Geographics current map policy. Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Two Highway Projects:

- SR-76 PM 7.3-13.1 (SR-76 Middle).
  - 5.8 miles. Included a new bridge across the San Luis Rey River. Construction 2010-2013. Five wildlife crossings.
- SR-76 PM 12.4-17.6 (SR-76 East).
  - 5.2 miles. Included a new interchange at SR-76/I-15. Construction 2014-2017. Includes 7 wildlife crossings and 7 wildlife escape ramps.

- The projects realigned and widened SR-76 from 2 lanes to 4 and improved the SR-76/I-15 interchange.
- Purpose: Relieve congestion, improve safety, while minimizing environmental impacts.
- Need: Traffic congestion was occurring as a result of population growth and development.

SR-76 Middle and SR-76 East Biological Study Areas



Additional Information

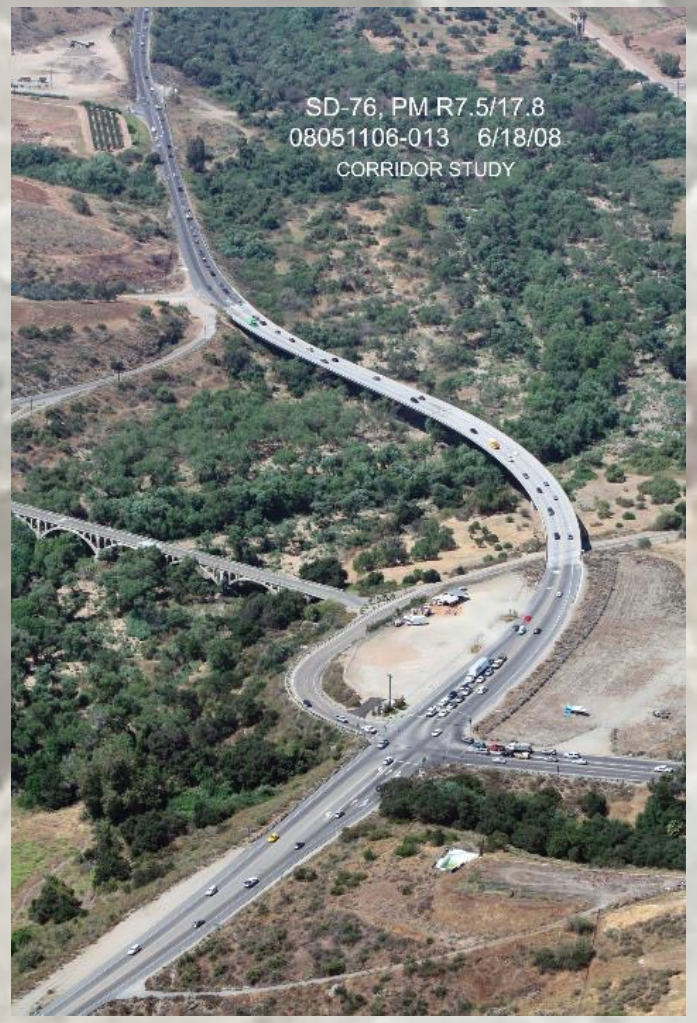
Threatened and Endangered Species and Critical Habitat

Six species and five critical habitats located within the highway project:

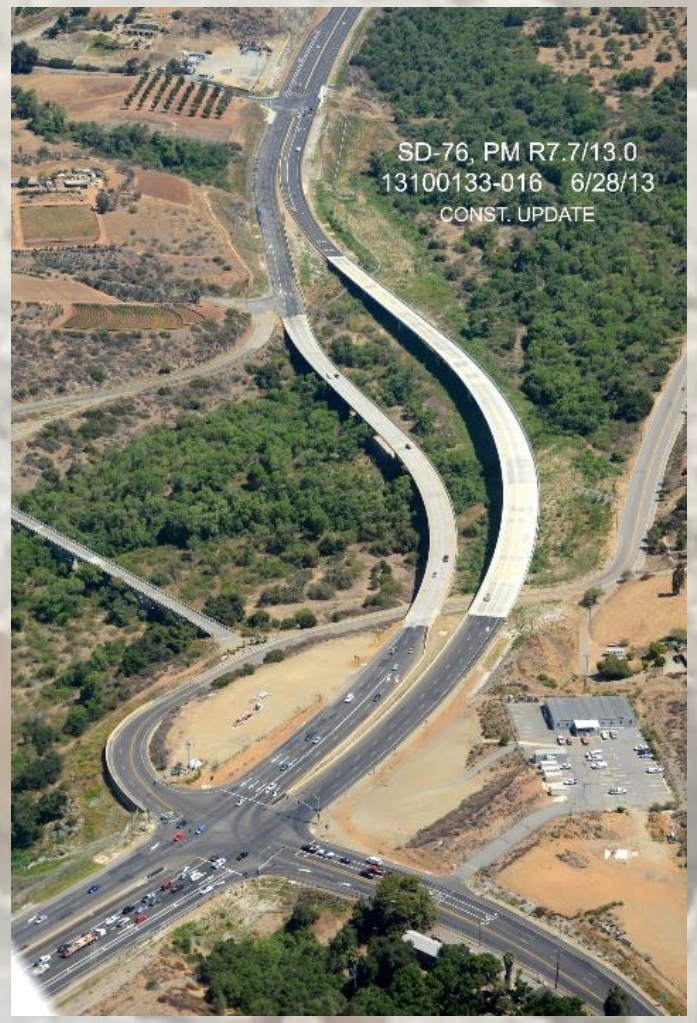
1. Coastal California gnatcatcher (*Polioptila californica californica*)
2. Least Bell's vireo (*Vireo bellii pusillus*)
3. Southwestern willow flycatcher (*Empidonax trailii extimus*)
4. Arroyo toad (*Anaxyrus californicus*)
5. San Diego ambrosia (*Ambrosia pumila*)
6. Southern California steelhead (*Oncorhynchus mykiss*)(SR-76 Middle) DPS

Before and After: SR-76 San Luis Rey River Bridge

2008

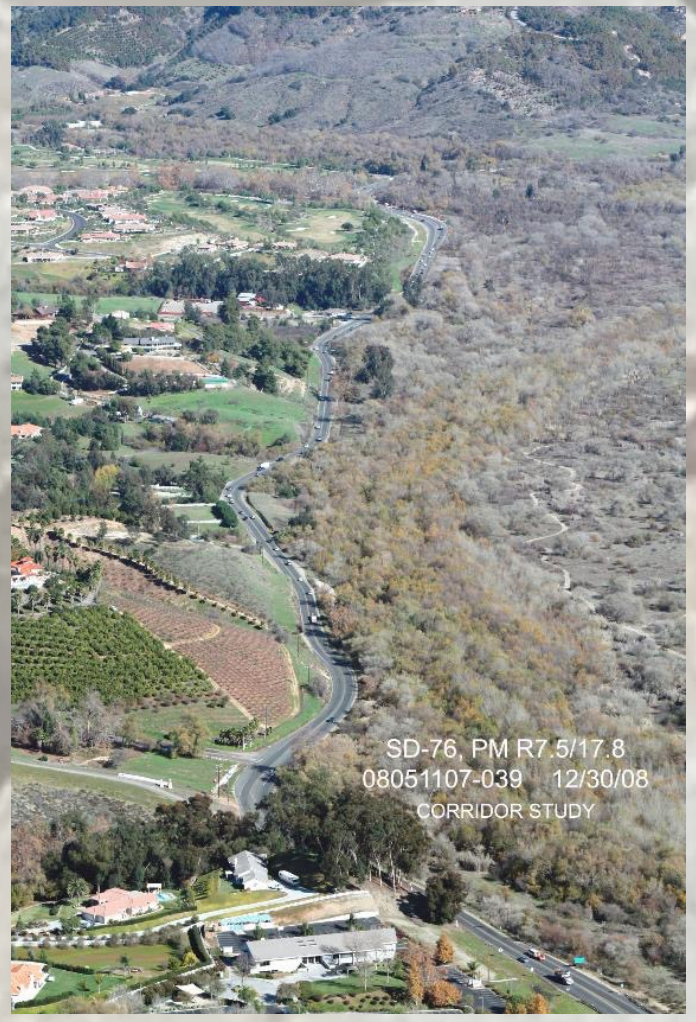


2013

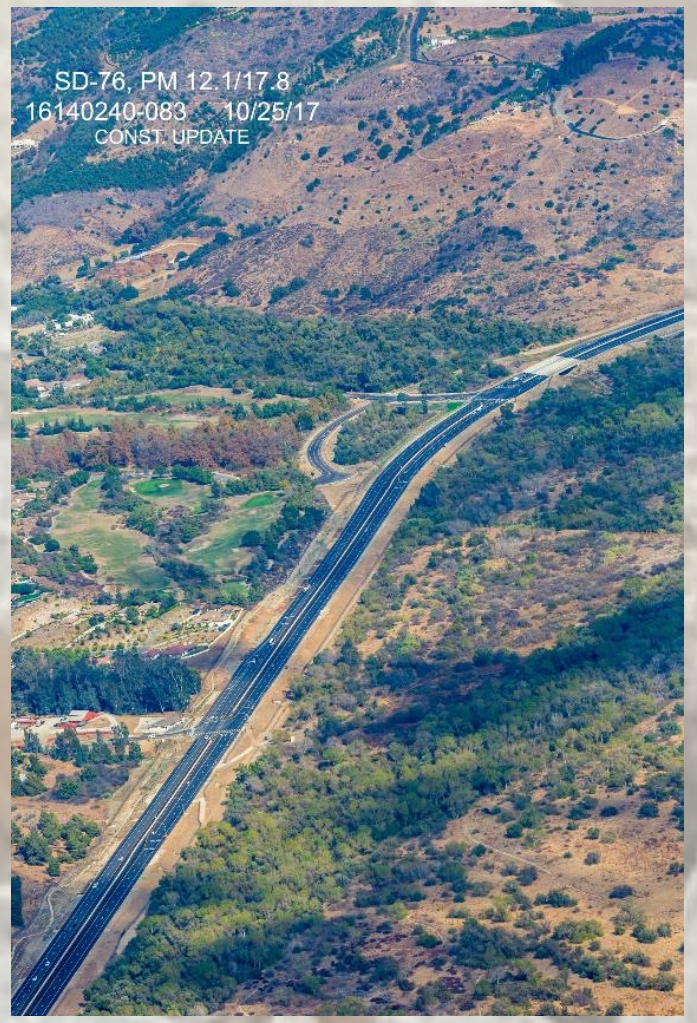


Before and After: SR-76 East

2008



2017



Agency and Group Contributors

Cooperating Agencies

- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- U.S. Environmental Protection Agency
- National Oceanic and Atmospheric Administration Natural Marine Fisheries Service (NMFS)

Responsible Agencies

- California Department of Fish and Wildlife
- California Transportation Commission
- County of San Diego
- California Water Resources Board – Region 9

Consultants and Contractors

- Ames Construction
- Flatiron Construction
- EDAW/AECOM – Biological Consulting

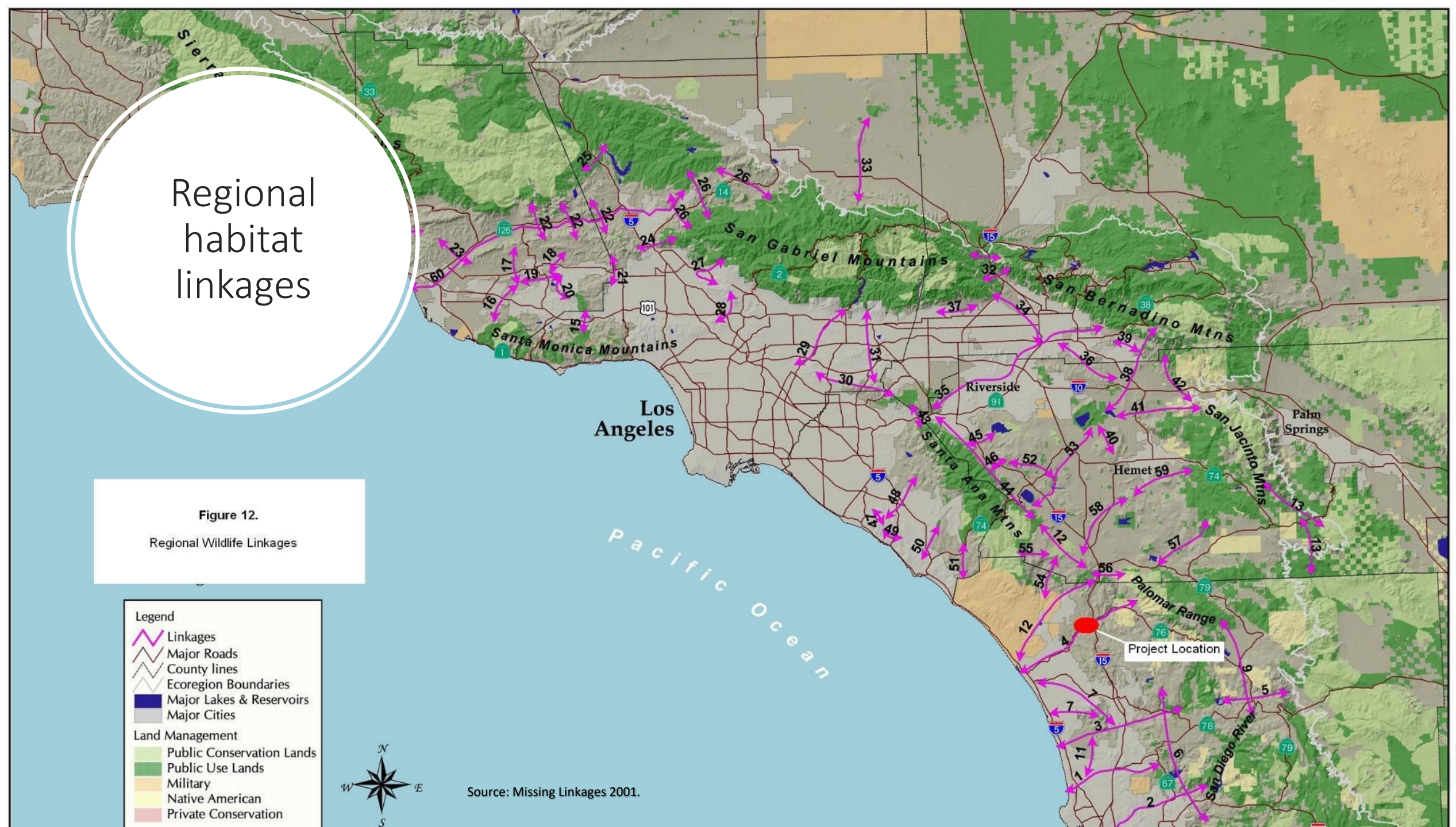
GATHERING DATA FOR WILDLIFE CROSSINGS

Methodology: Determine Location, Size of Wildlife Crossings and Wildlife Fencing Using:

- Known habitat linkages- Regional and Local
- Existing Land Use
- Landscape – topography, vegetation
- Proposed project design
- Wildlife Movement Study
- Animal size and behavior

Identifying Regional and Local Connectivity Issues

Regional habitat linkages



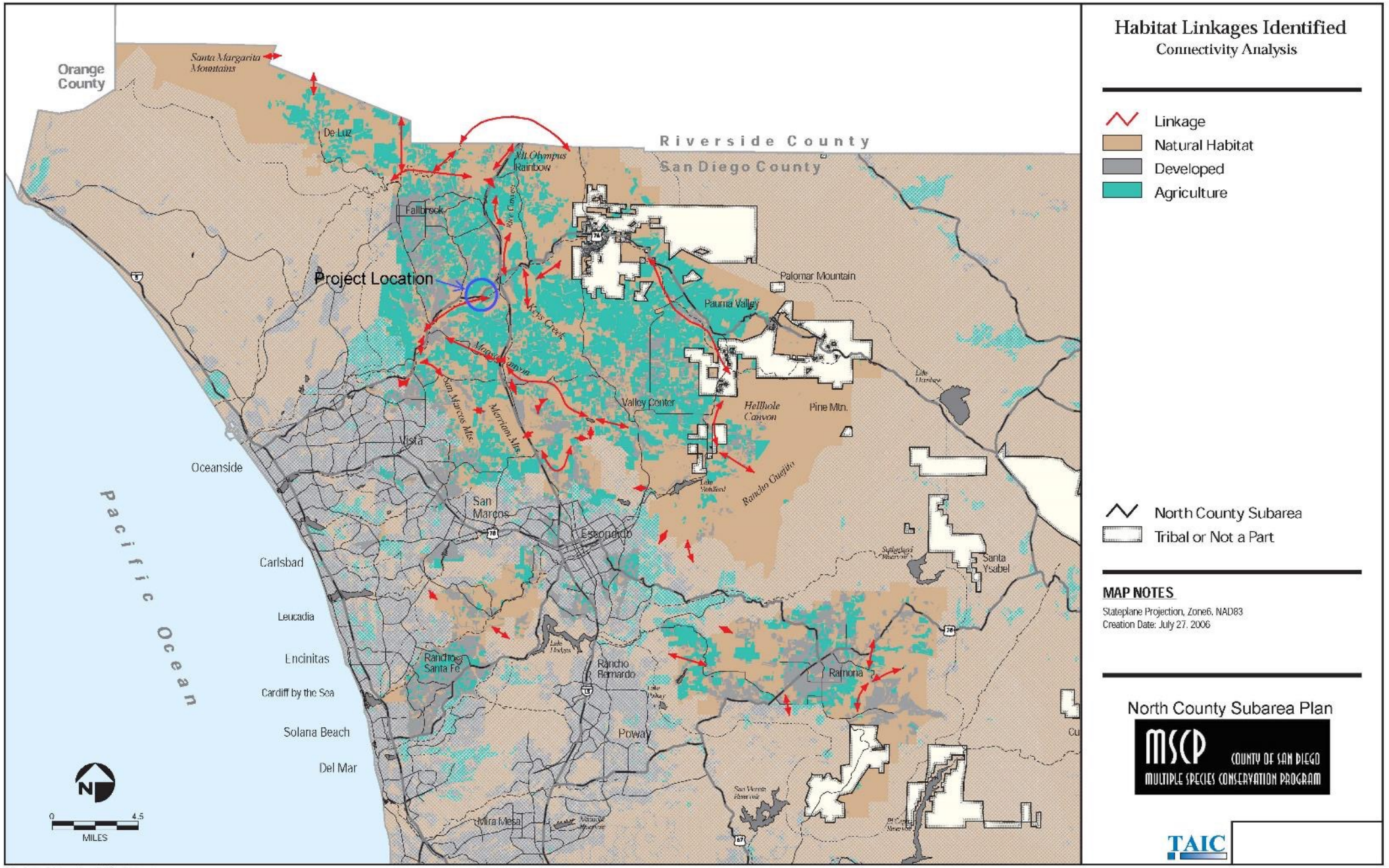

Habitat Linkages Identified
Connectivity Analysis
Linkage
Natural Habitat
Developed
Agriculture
North County Subarea
Tribal or Not a Part
MAP NOTES
Stateplane Projection, Zone6, NAD83
Creation Date: July 27, 2006
North County Subarea Plan
MSCP
COUNTY OF SAN DIEGO
MULTIPLE SPECIES CONSERVATION PROGRAM
TAIC
Project Location
Orange County
Riverside County
San Diego County
Santa Margarita Mountains
De Luz
Mt Olympus
Rainbow
Fallbrook
Keys Creek
Moosa Canyon
San Marcos Mts.
Merriam Mts.
Palomar Mountain
Pauma Valley
Valley Center
Hellhole Canyon
Pine Mtn.
Rancho Guejito
Vista
Oceanside
San Marcos
Escondido
Carlsbad
Leucadia
Encinitas
Rancho Santa Fe
Cardiff by the Sea
Solana Beach
Del Mar
Rancho Bernardo
Poway
Mira Mesa
Ramona
Santa Ysabel
Pacific Ocean
0
4.5
MILES

Figure 5. Topography

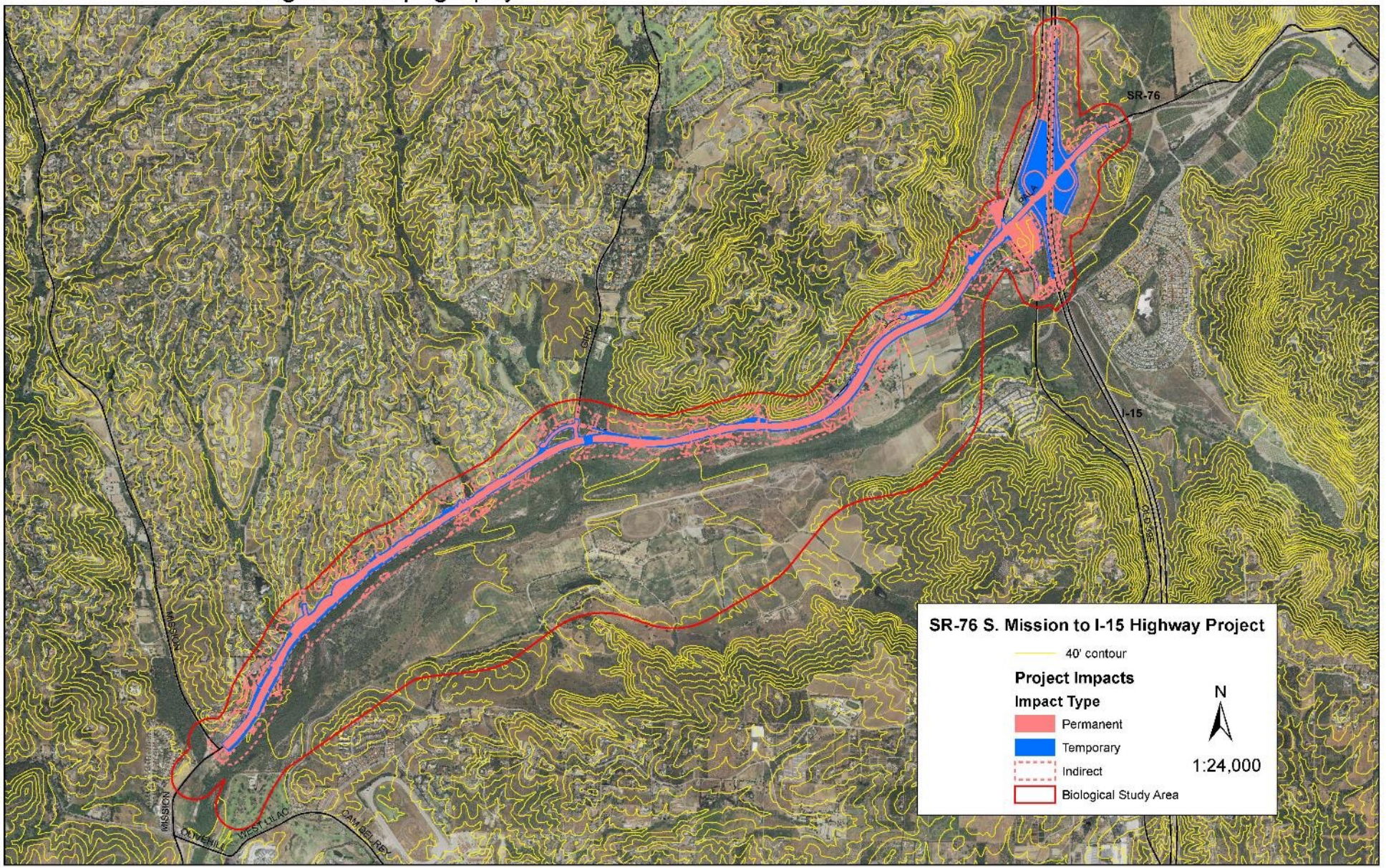


Figure 7. Vegetation

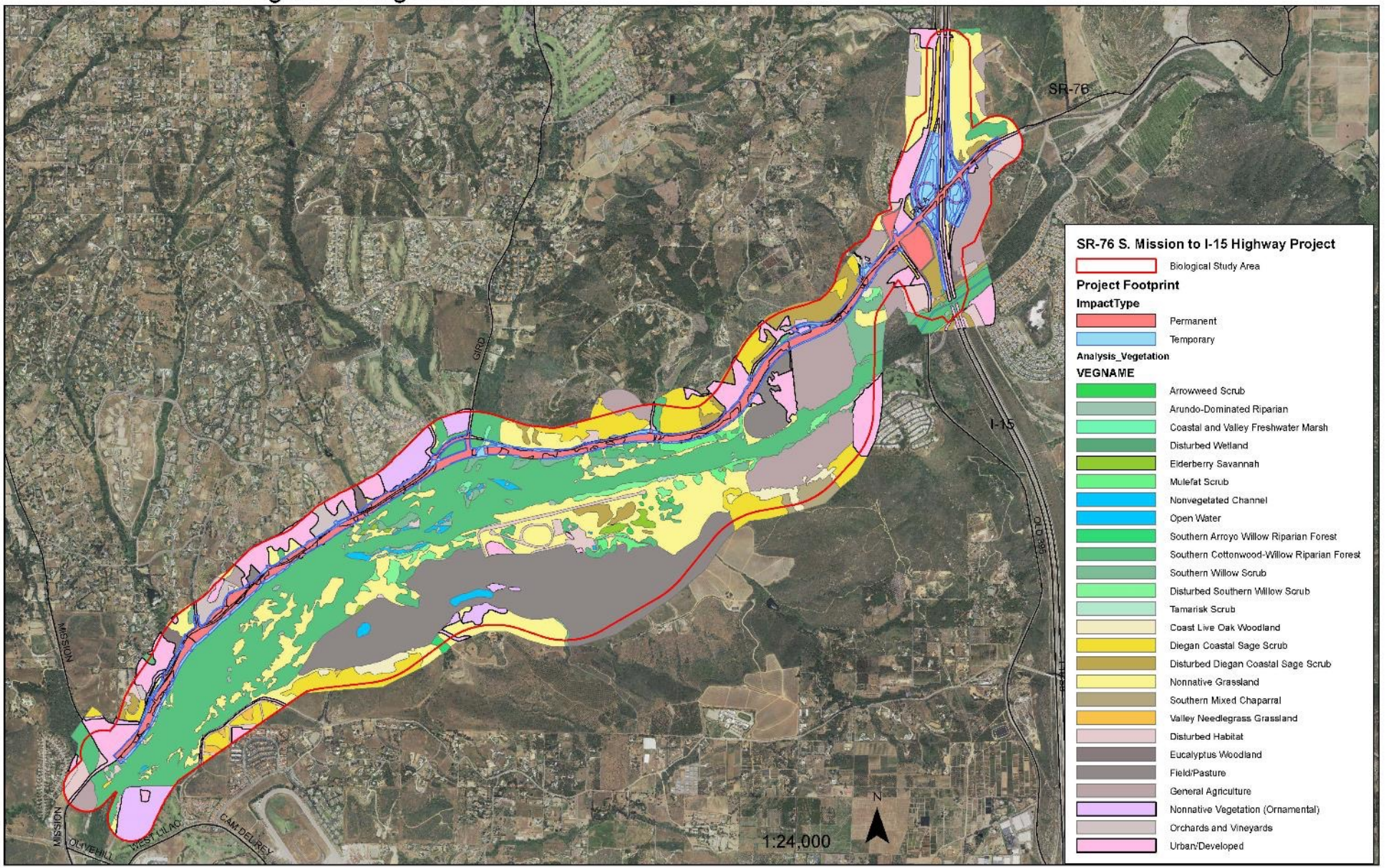


Figure 3.6 Wildlife Movement Opportunities and Constraints

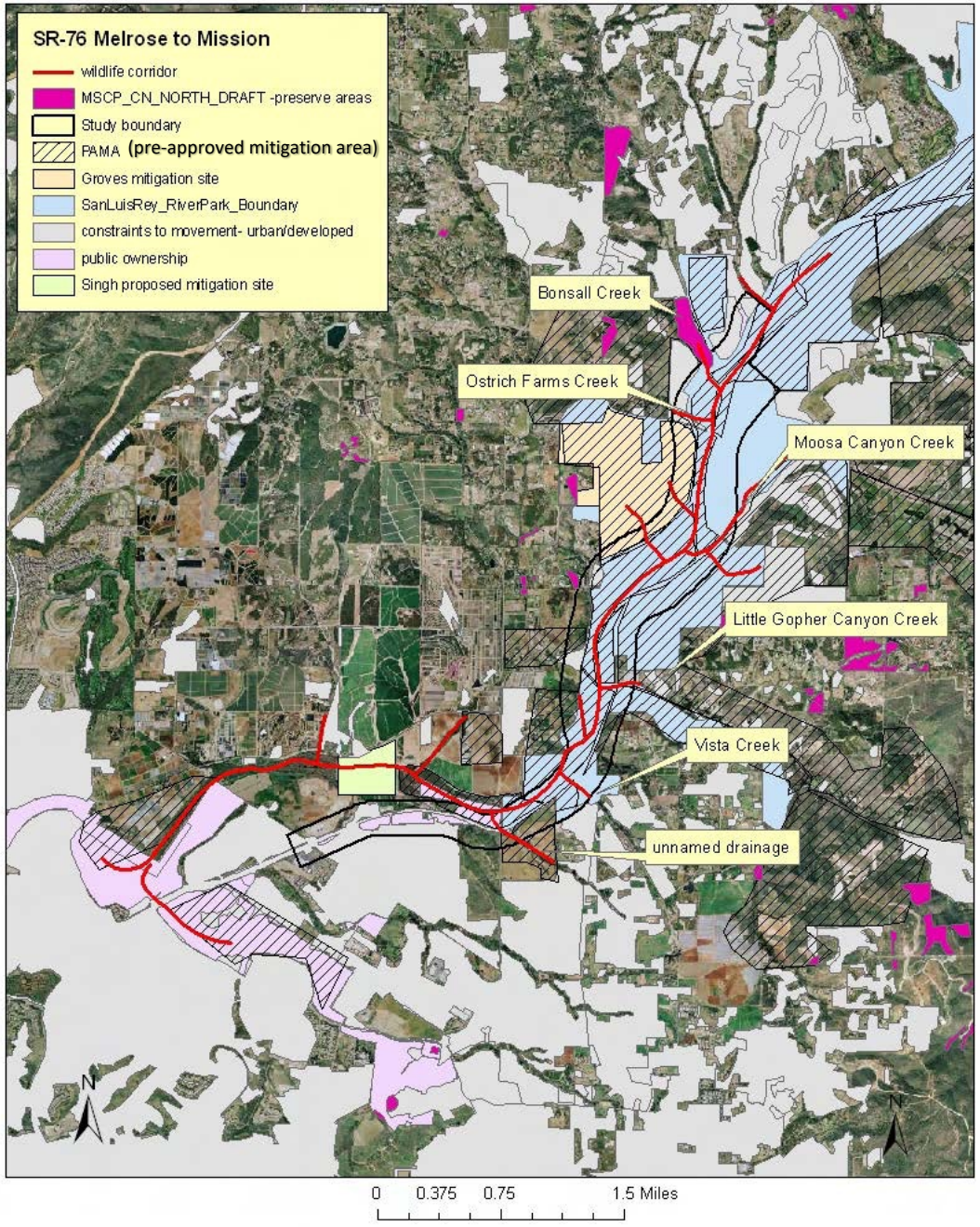
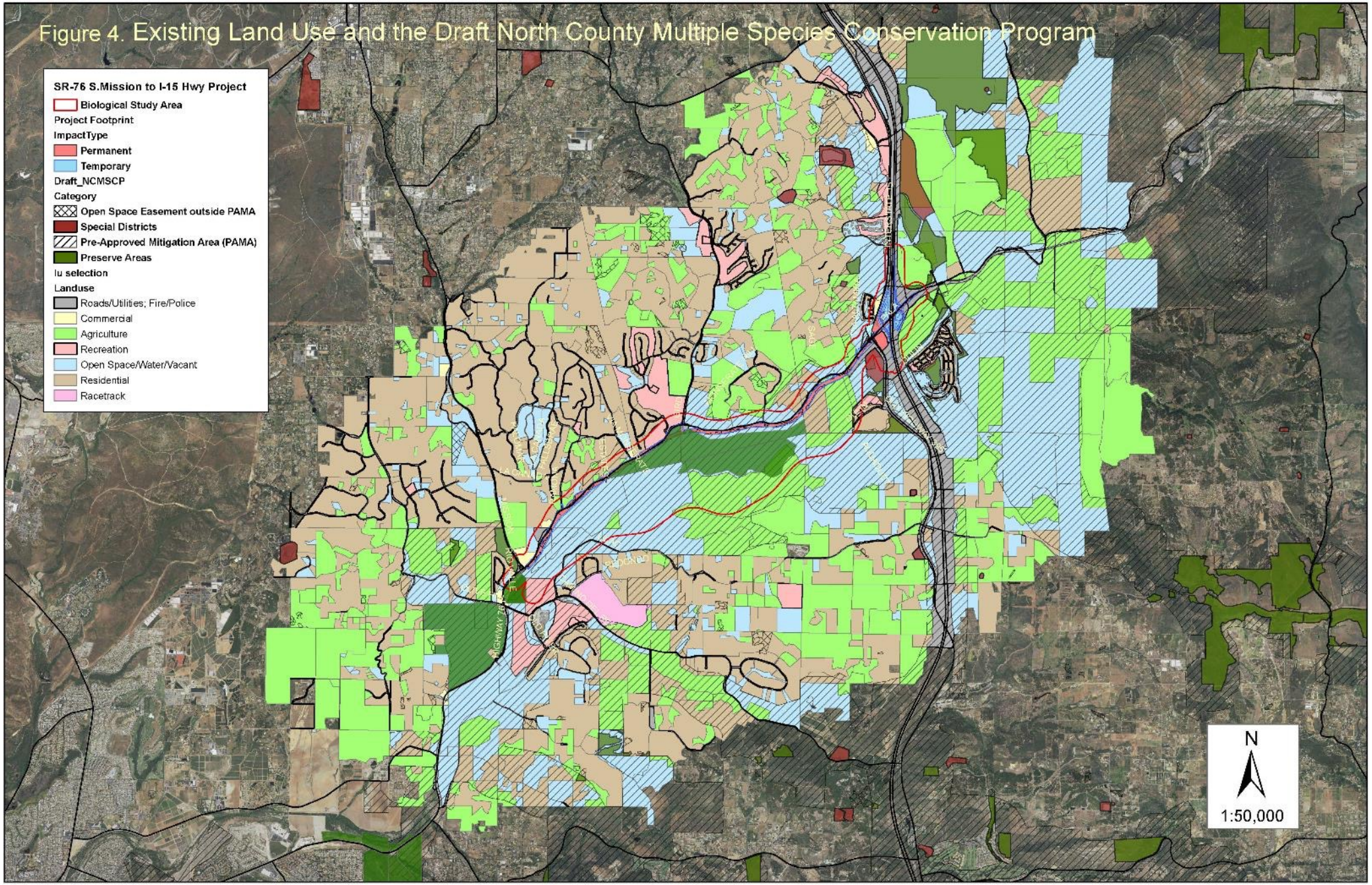


Figure 4. Existing Land Use and the Draft North County Multiple Species Conservation Program

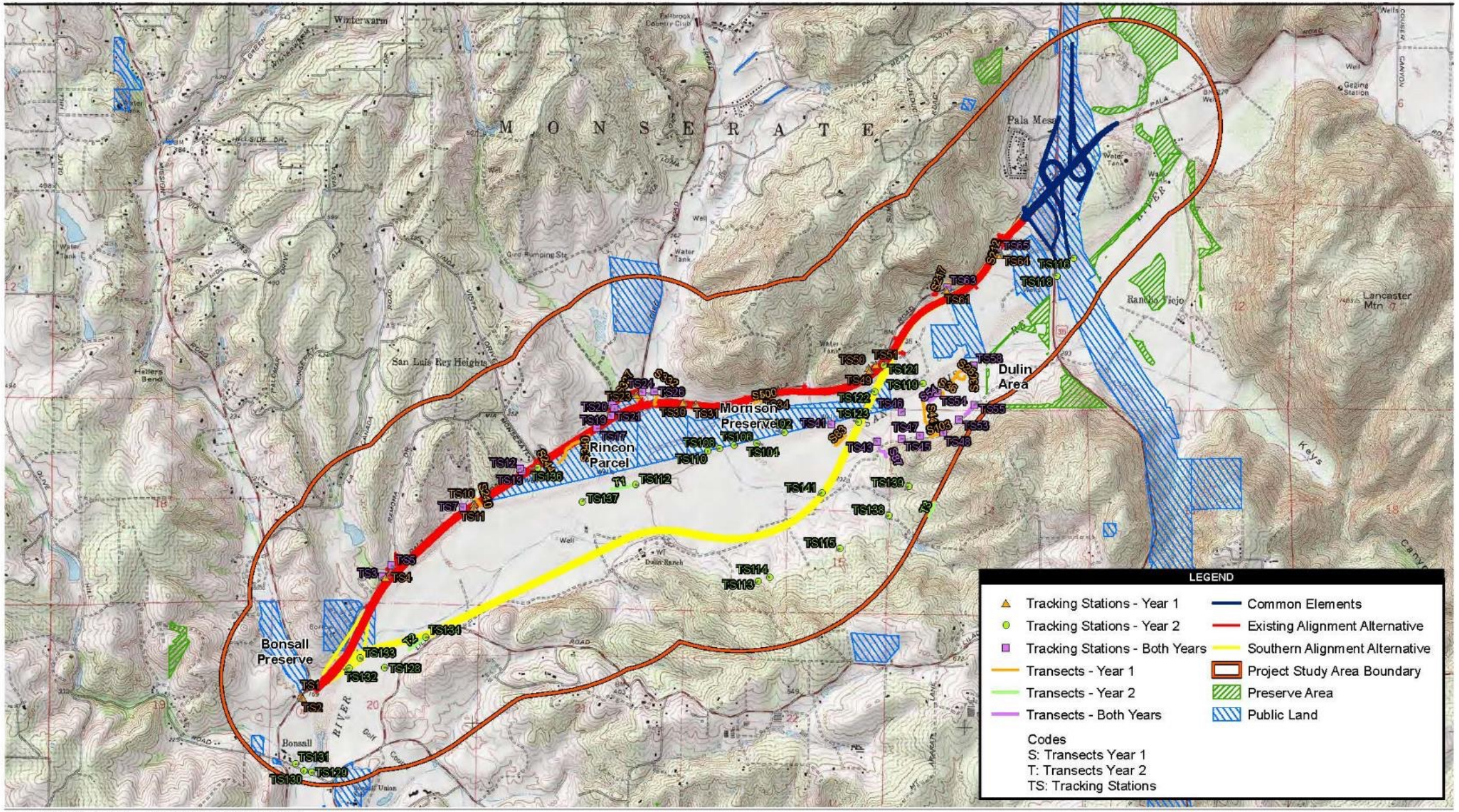


DESIGN OF PRE-CONSTRUCTION WILDLIFE MOVEMENT STUDY

- 1 Year Roadkill Survey of a 1 mile stretch along SR-76 East; adjacent to SR-76 Middle. Surveys 2 times per month from July 2007-June 2008.
- Tracking Stations at drainages/bridges
- Tracking Transects within SR-76 East BSA

Details of Wildlife Movement Study Methods

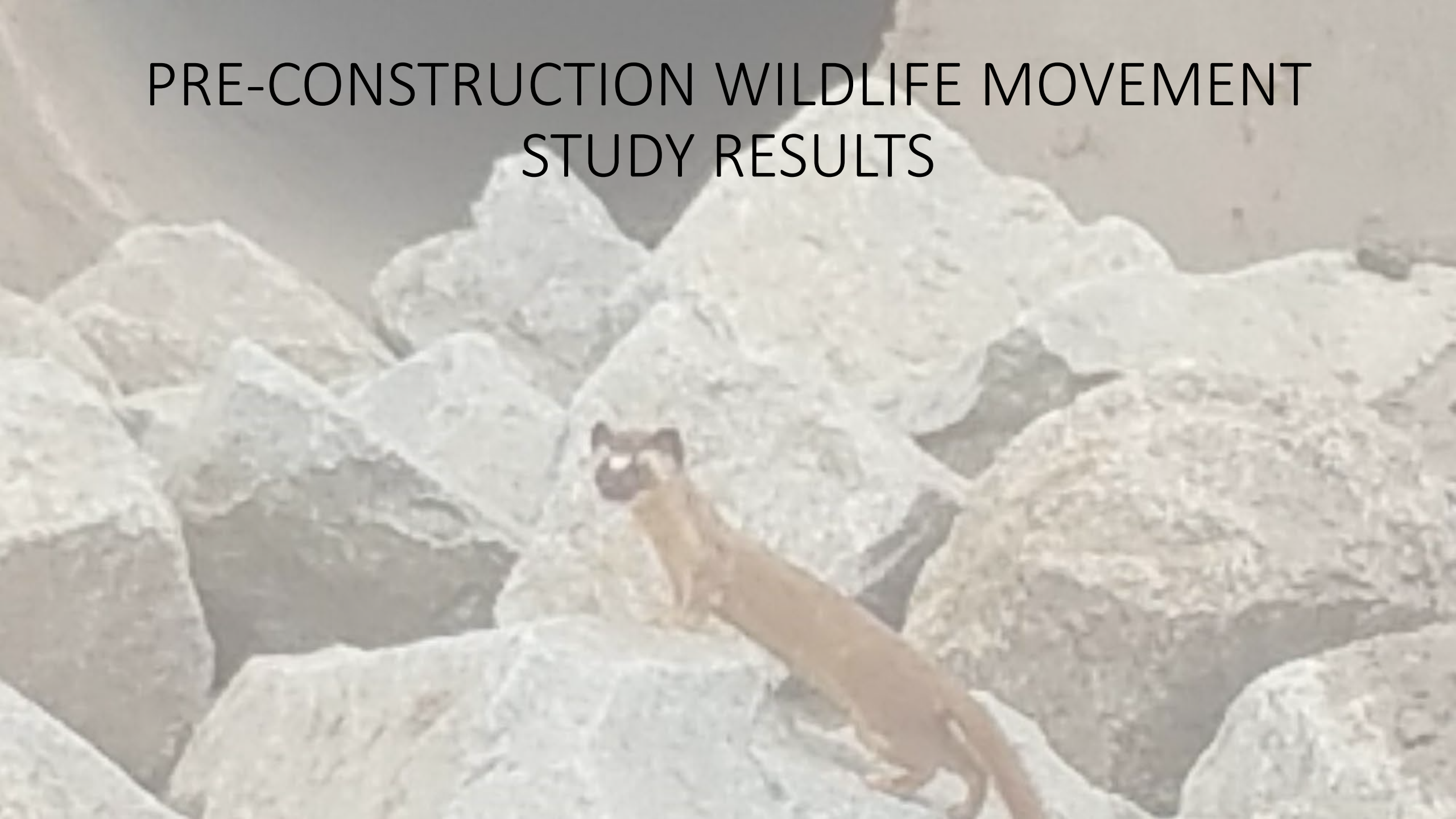
- Roadkill survey were conducted on a 1-mile segment of the existing SR-76 roadway.
  - All evidence of roadkill was identified and marked, and location was recorded.
  - The 1-mile area survey was repeated on 3 consecutive days, twice each month from July 2007 through June 2008.
- Tracking station surveys: consisted of creating track plates with sifted dirt at multiple established tracking stations.
  - Tracking stations were then surveyed for 4 consecutive days to document species activity.
- Transect surveys: consisted of walking 100-meter segments of game trails and recording species activity.
  - Transect surveys were conducted one time during each tracking station survey week.
- Tracking station and transect surveys were conducted every other month in year 1 and once each season in Year 2.
  - Survey results were evaluated using geographic information systems and a variety of statistical analyses.



Wildlife Transects and Tracking Stations

Figure 5
Project Study Area

PRE-CONSTRUCTION WILDLIFE MOVEMENT STUDY RESULTS



ROADKILL DATA

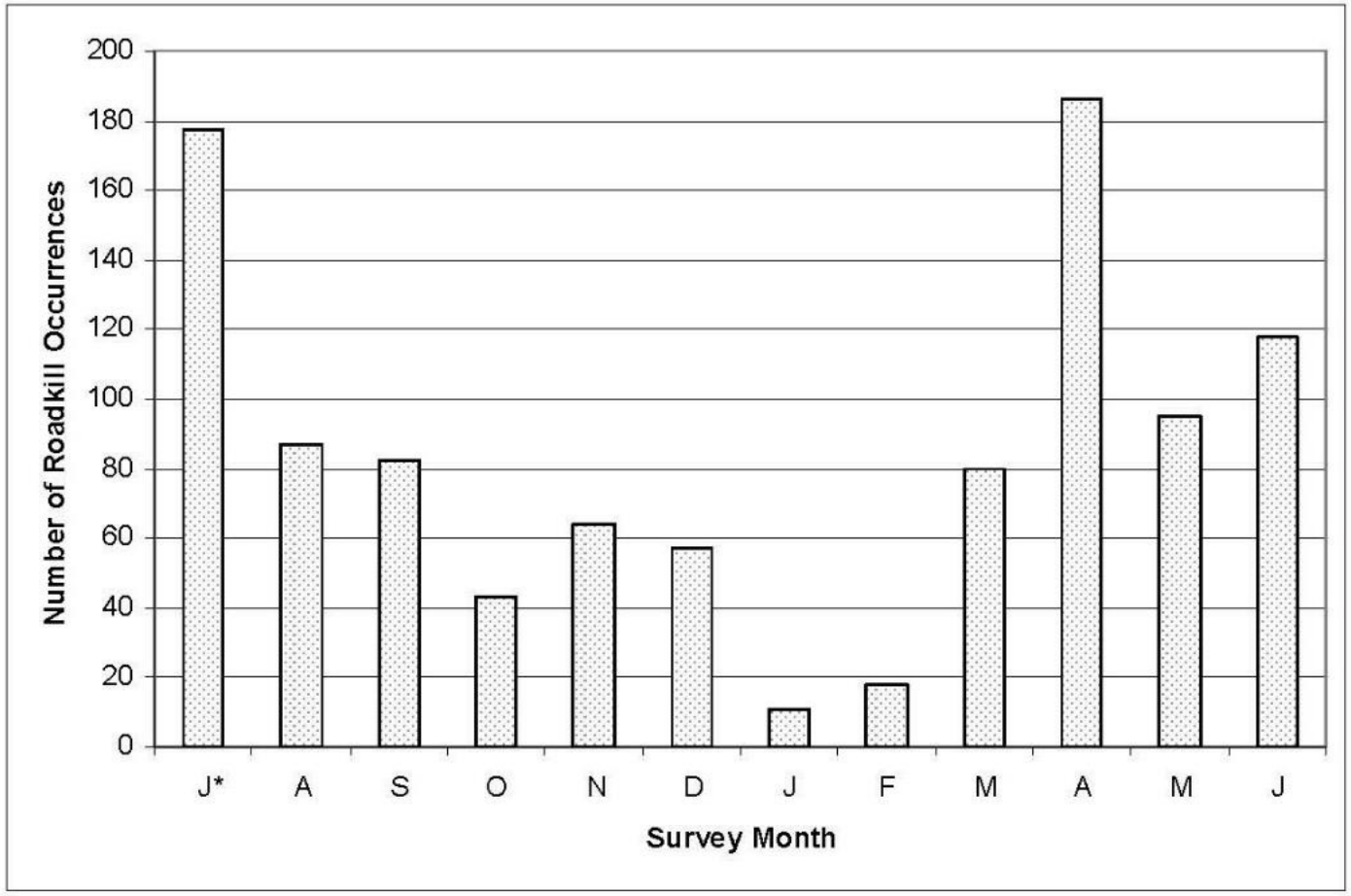
Table 4. Roadkill Occurrences for Taxa Groupings and Mammal Focal Species, July 2007–June 2008

TAXA	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
Amphibian	2	2			1	20	1	4	3	9	1	7	50
Bat	11	1	1		1					1			15
Bird	5	10	1	4	10	19	3	4	6	7	4	6	79
Carnivore	4	1		2			2		2	2	3	2	18
coyote	2			2			1		1	1	1		8
bobcat	1						1						2
long-tailed weasel		1								1	1	2	5
raccoon	1								1				2
Lizard	75	28	24	22	24	1		2	26	61	19	16	298
Mammal	18	3	31	7	5	4			3	9	2	6	88
Marsupial	3	1	2						1	2	1	6	16
Rabbit	4	6	3			2	2	5	9	10	2	7	50
brush rabbit		2					1	1	5				9
desert cottontail							1	1	2	2		3	9
Rodent	32	32	14	8	19	11	3	3	27	79	47	57	332
woodrat	3				1				5	1	1		11
California ground squirrel	3		1		1		1	2	3	5	6	3	25
kangaroo rat	6	12	3	2	6	3	1		11	23	7	21	95
Snake	8	3	6		3				2	4	12	11	49
Unknown	15				1				1	2	4		23
TOTAL	177	87	82	43	64	57	11	18	80	186	95	118	1018

Bolded items are taxa groups for cluster analyses.

Pre-Construction Wildlife Movement Study Results

Table 3. Total Roadkill Occurrences by Month (July 2007–June 2008).



* July 2007 was the first set of surveys for the roadkill segment. Number of occurrences represents a longer sampling period than other months as there were many historic occurrences recorded.

Pre-construction Wildlife Movement Study Results

Table 5. Grouping of Focal Species for Analyses

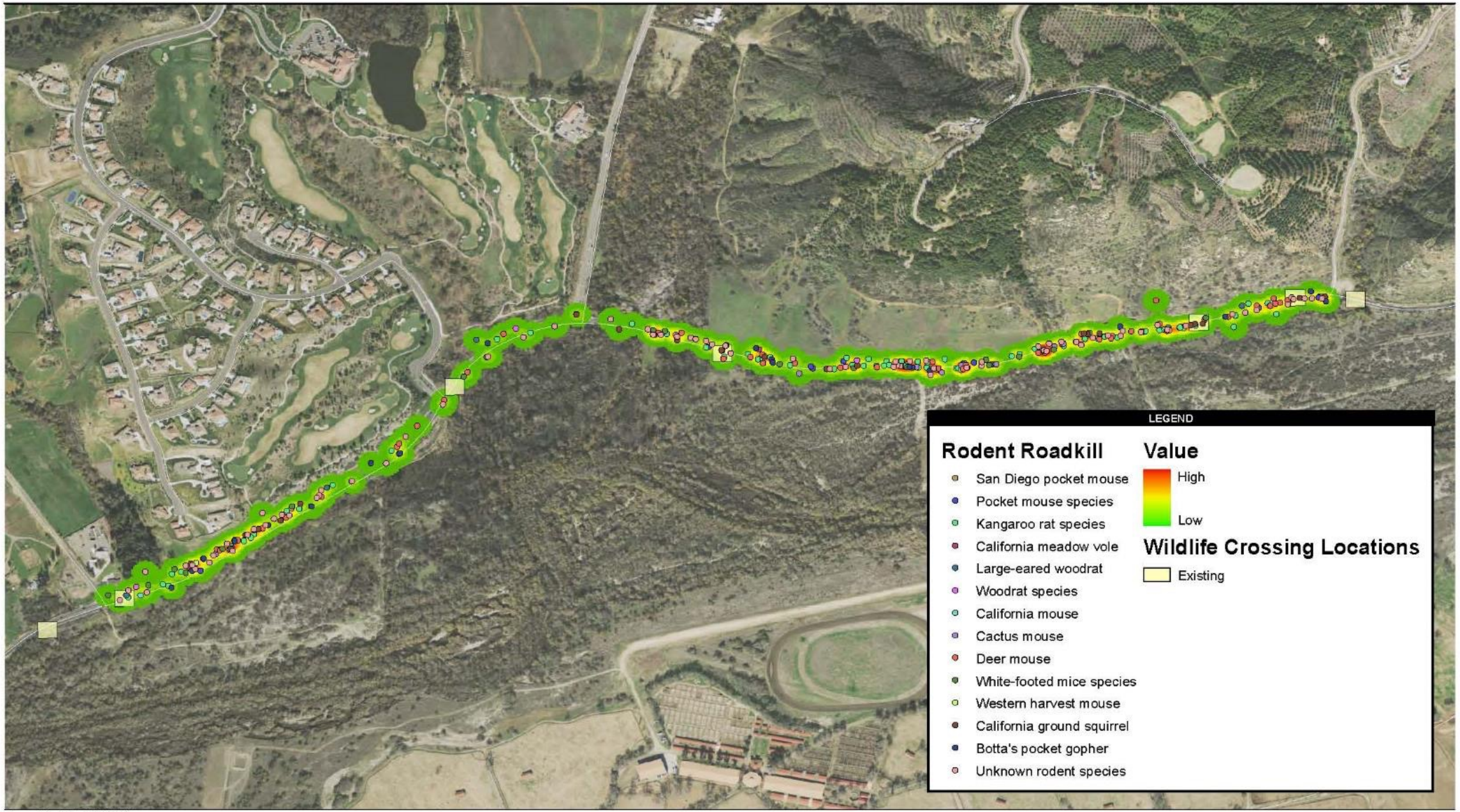
Size Class	Species	Directional Observations (Year 1)	Activity Observations (Year 1)	Directional Observations (Year 2)	Activity Observations (Year 2)
Large	Coyote	136	92	343	188
	Mountain lion	2	3	2	3
	Bobcat	16	21	13	11
	Mule deer	1	1	0	2
	Badger	0	0	0	1
	Total	**155**	**117**	**358**	**205**
Medium	Gray fox	10	13	7	9
	Striped skunk	16	11	44	30
	Spotted skunk	0	0	1	2
	Raccoon	149	40	75	50
	Total	**175**	**64**	**127**	**91**
Small	Long-tailed weasel	5	8	0	1
	Rodent	32	125	43	198
	Ground squirrel	5	14	40	74
	Rabbit	265	160	199	342
	Total	**307**	**307**	**282**	**615**
Grand Total		**637**	**488**	**767**	**911**

SR-76 South Mission to I-15 Highway Improvement Project Wildlife M

Path: P:\2006\06080047 SR76 Mission to I-15 CEQA NEPA studies\GIS\Mxd\Wildlife Movement\Report 2009\Figure7a_Amphibianroadkill

SR-76 South Mission to I-15 Highway Improvement Project Wildlife

Path: P:\2006\06080047 SR76 Mission to I-15 CEQA NEPA studies\15GIS\Mxd\Wildlife Movement\Report 2009\Figure 7d_Carnivore RoadK


LEGEND
Rodent Roadkill
San Diego pocket mouse
Pocket mouse species
Kangaroo rat species
California meadow vole
Large-eared woodrat
Woodrat species
California mouse
Cactus mouse
Deer mouse
White-footed mice species
Western harvest mouse
California ground squirrel
Botta's pocket gopher
Unknown rodent species
Value
High
Low
Wildlife Crossing Locations
Existing
Source: DigitalGlobe 2008; EDAW

Pre-construction condition of Wildlife Crossings

Live Oak Creek Bridge

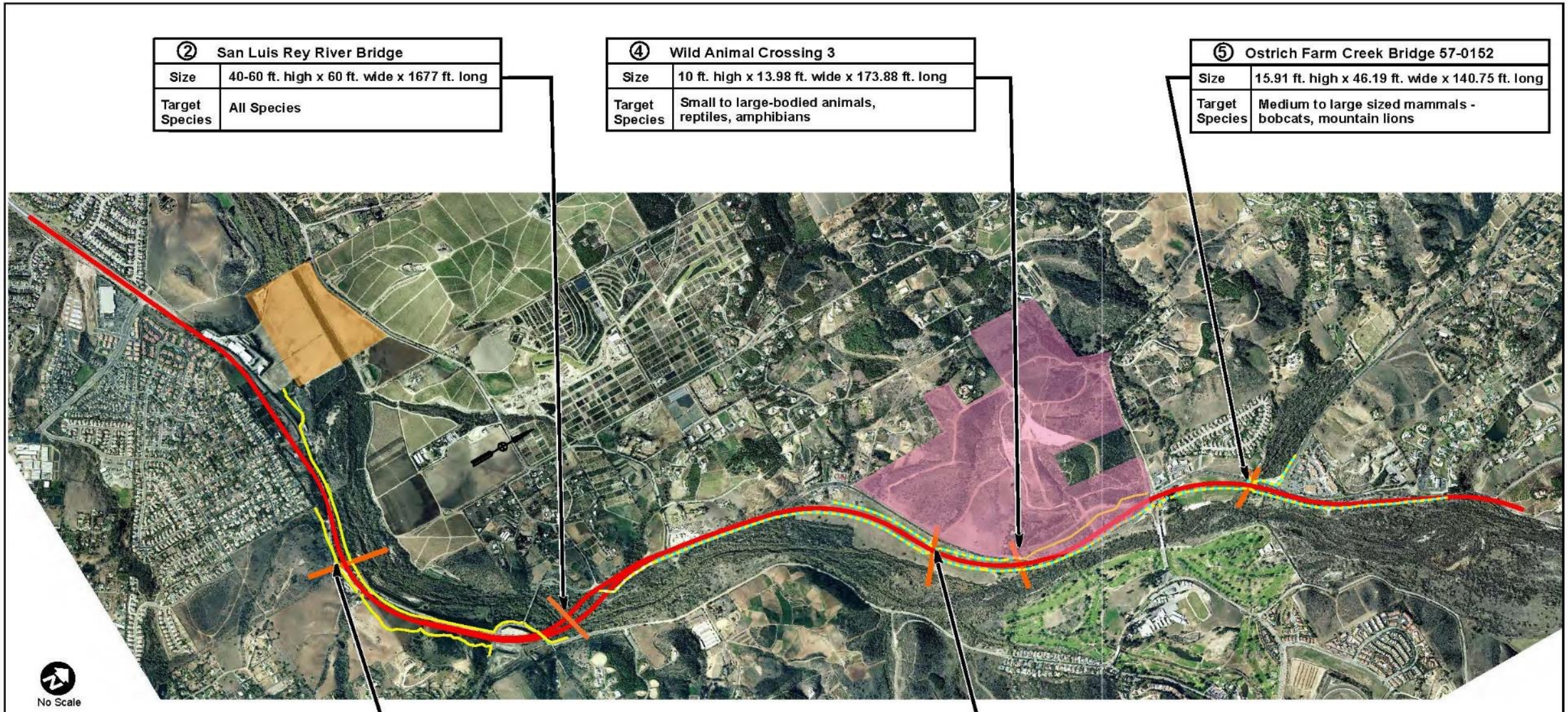
Ostrich Farm Creek Bridge

Preconstruction condition of Wildlife Crossings

Box culvert at Flowerwood Lane

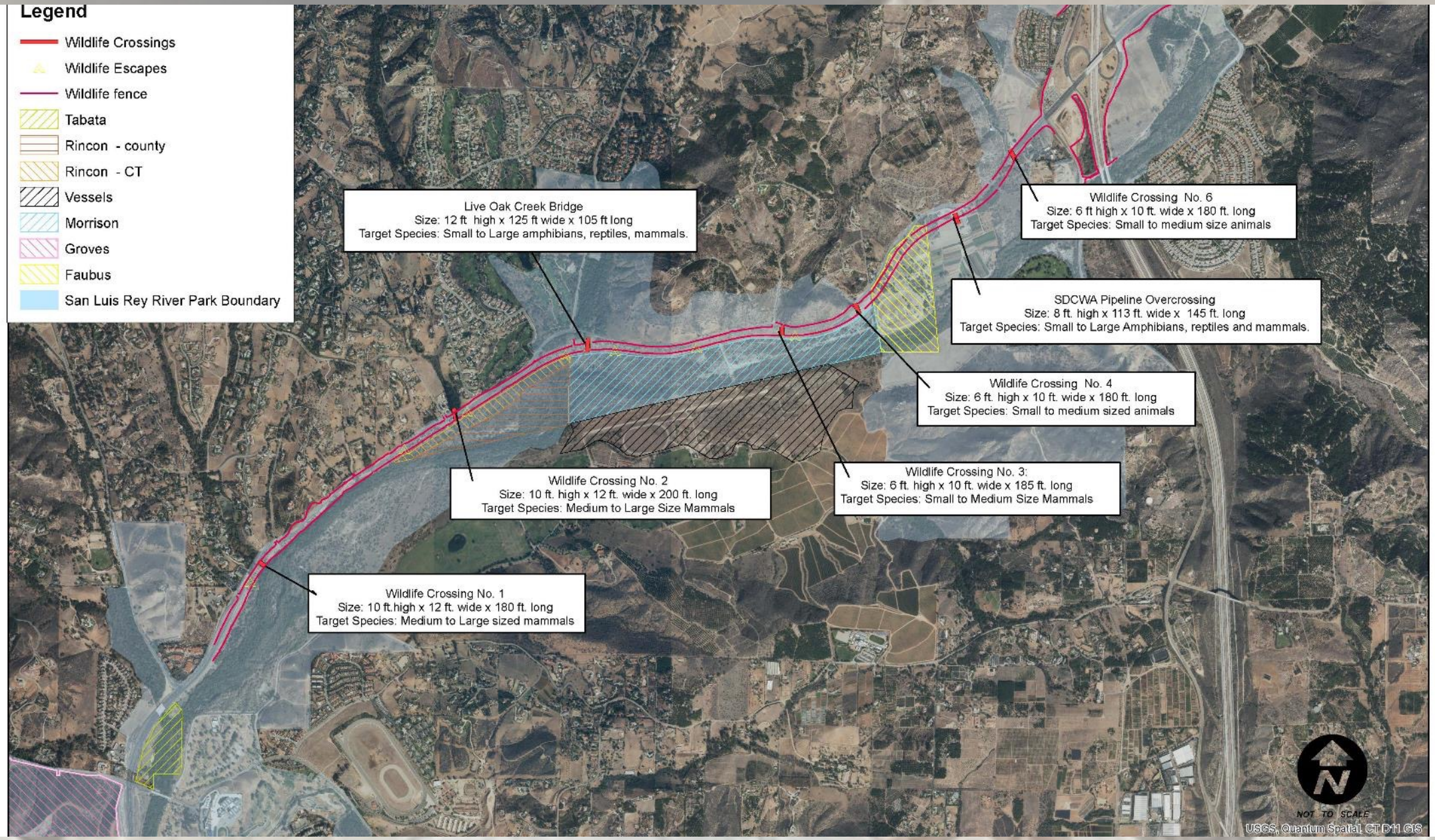
Pipe culverts at SR-76 and Gird Road

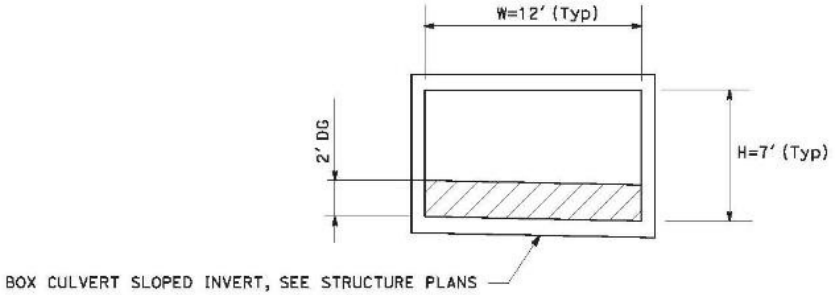
RESULT: WILDLIFE CROSSINGS, ESCAPE RAMPS AND FENCING



Wildlife Crossing Locations and Sizes

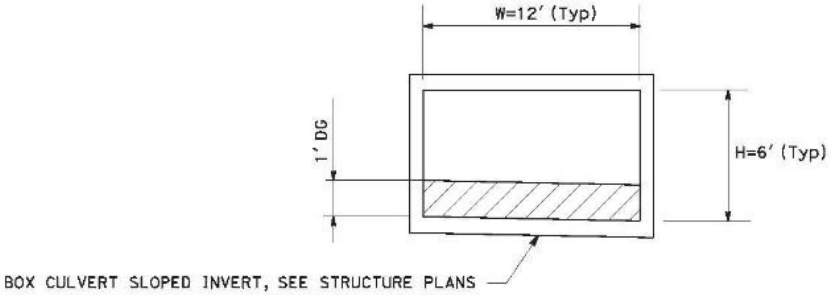
Wildlife Crossing Locations and Sizes





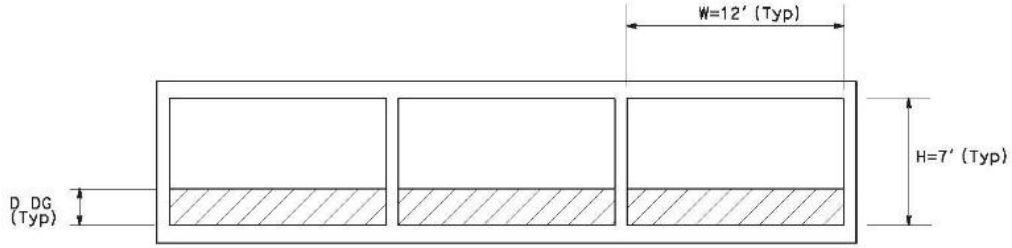
SINGLE REINFORCED CONCRETE BOX CULVERT CROSS SECTION
WILD ANIMAL CROSSING No.2,3,4

12' (W) X 7' (H) AT STATION 180+70 "A"
254+15 "A"
272+00 "A"



SINGLE REINFORCED CONCRETE BOX CULVERT CROSS SECTION
WILD ANIMAL CROSSING No.6

12' (W) X 6' (H) AT STATION 318+40 "A"

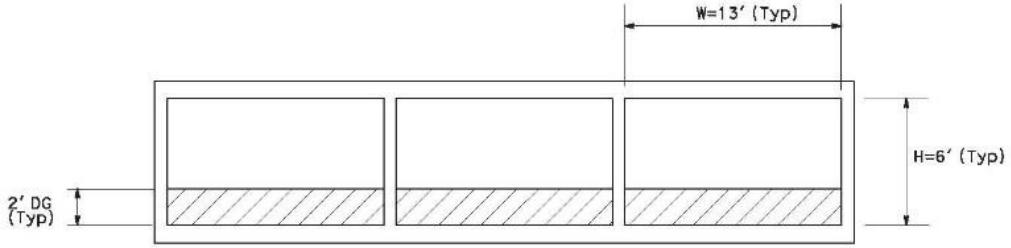


TRIPLE REINFORCED CONCRETE BOX CULVERT CROSS SECTION
WILD ANIMAL CROSSING No.1 (BRIDGE No. 57-1236)

12' (W) X 7' (H) AT STATION 129+70 "A", D = 1'

TRIPLE REINFORCED CONCRETE BOX CULVERT CROSS SECTION
DRAINAGE SYSTEM 38 3 X 12' (W) X 7' (H) AT STATION 203+00

12' (W) X 7' (H) AT STATION 203+00 "A", D = 2'



TRIPLE REINFORCED CONCRETE BOX CULVERT CROSS SECTION
DRAINAGE SYSTEM 39 3 X 13' (W) X 6' (H) AT STATION 11+80 "FLWR"

OPENNESS RATIO FOR UNDERCROSSINGS:
Culvert width/culvert length
x Culvert height ≥ 0.1 (m)

DECOMPOSED GRANITE (DG) LIMITS

03-24-14
PLANS APPROVAL DATE

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

REGISTERED PROFESSIONAL ENGINEER
KHATIB
No. C63411
Exp. 09-30-14
CIVIL
STATE OF CALIFORNIA

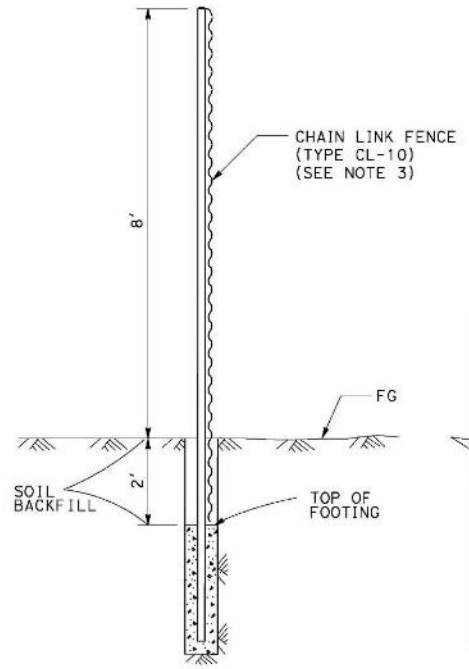
DEPARTMENT OF TRANSPORTATION
PROJECT DEVELOPMENT

FUNCTIONAL SUPERVISOR: CARL SAVAGE

CALCULATED-DESIGNED BY: MOHAMAD KHATIB
CHECKED BY: ROBERT WILLIARD

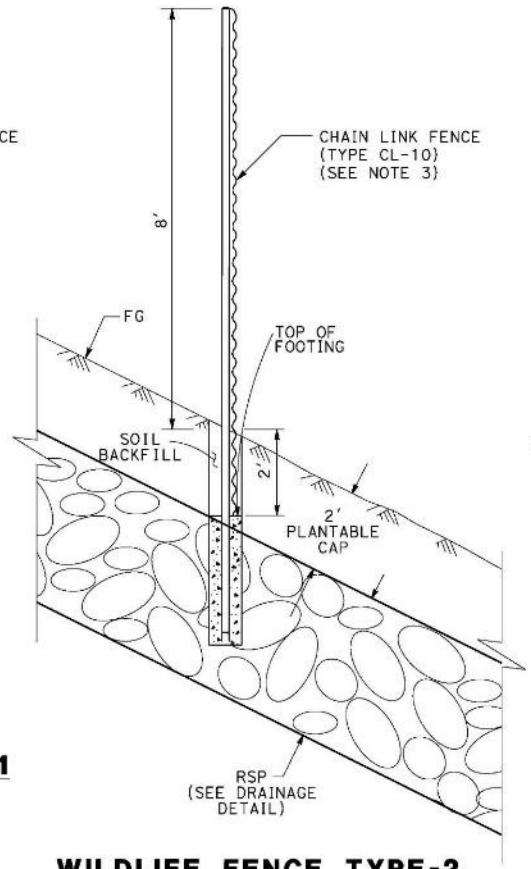
REVISED BY
DATE REVISED

PLOTTED => 20-MAR-2014
PLOTTED => 14:12



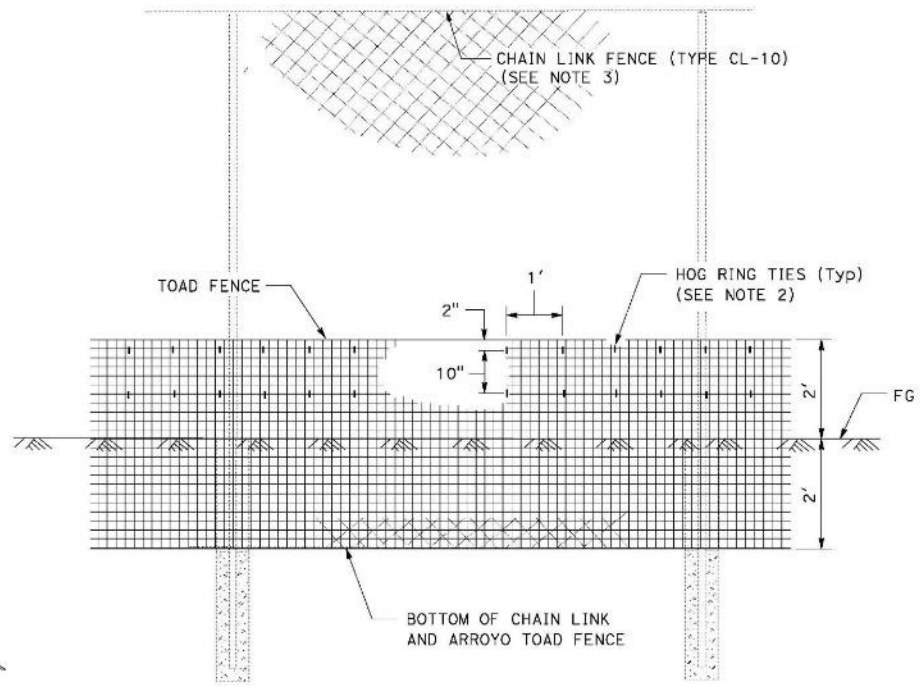
WILDLIFE FENCE TYPE-1

SECTION VIEW
Typ INSTALLATION

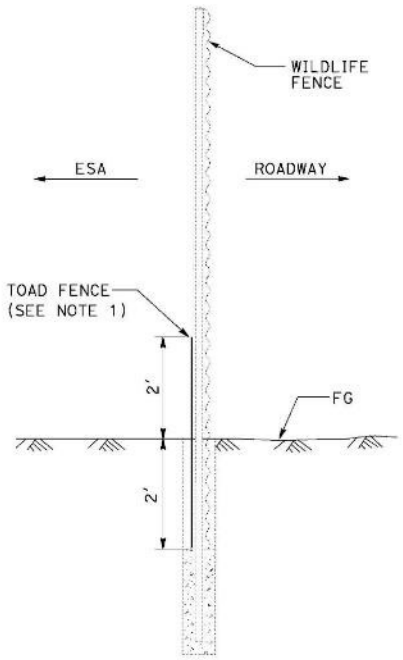


WILDLIFE FENCE TYPE-2

SECTION VIEW
RSP INSTALLATION



ELEVATION



ARROYO TOAD FENCE

SECTION VIEW

WILDLIFE AND ARROYO TOAD FENCE

CONSTRUCTION DETAILS

NO SCALE

C-51

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION
Caltrans PROJECT DEVELOPMENT
FUNCTIONAL SUPERVISOR: CARL SAVAGE
CALCULATED-DESIGNED BY: MOHAMAD KHATIB
CHECKED BY: ROBERT WILLIARD
REVISED BY
DATE REVISED

AS1 REVISION
DATE PLOTTED => 20-MAR-2014
TIME PLOTTED => 14:12
12-31-13

BORDER LAST REVISED 7/2/2010
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DGN FILE => 11000204891rw051.dgn
RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3
UNIT 2765
PROJECT NUMBER & PHASE 11000204891

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
11	SD	15,76	R46.2/R46.8 R12.1/R17.7		

REGISTERED CIVIL ENGINEER DATE

PLANS APPROVAL DATE

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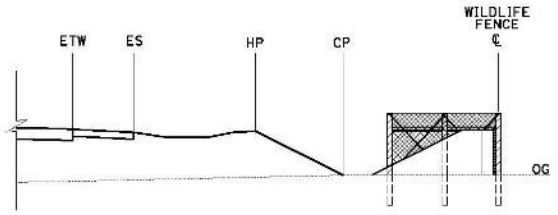
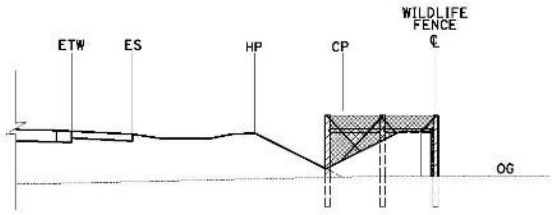
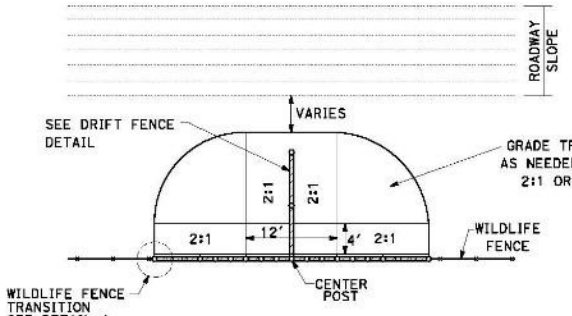
REGISTERED PROFESSIONAL ENGINEER No. Exp. CIVIL STATE OF CALIFORNIA



SIDE VIEW

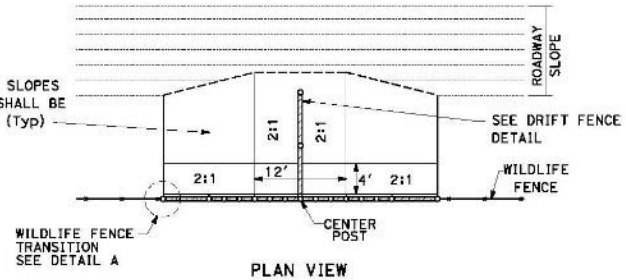


SIDE VIEW



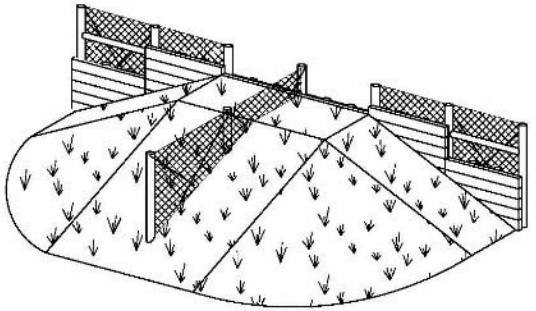
PLAN VIEW

METHOD 1

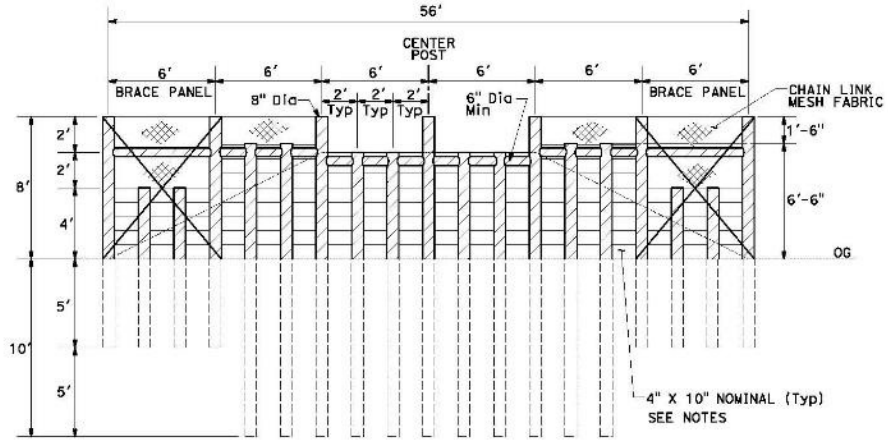


PLAN VIEW

METHOD 2



ISOMETRIC VIEW



ELEVATION VIEW

WILDLIFE ESCAPE RAMP

WILDLIFE ESCAPE RAMP CENTER POST LOCATIONS

STATION	OFFSET	METHOD
125+00	108.5' R+	1
165+50	82.0' R+	1
183+50	97.5' R+	1
208+00	96.5' R+	2
222+50	99.4' R+	2
234+50	100.8' R+	1
257+00	115.4' R+	2

NOTES:

1. USE 4" X 10" TIMBER FOR ALL HORIZONTAL AND LONGITUDINAL LAGGING.
2. LAGGING SHALL BE CONNECTED WITH LAG BOLTS RATHER THAN NAILS.

CONSTRUCTION DETAILS

NO SCALE

C-51

REVISED BY | DATE REVISED

CALCULATED/ DESIGNED BY | CHECKED BY

FUNCTIONAL SUPERVISOR

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

Caltrans

LAST REVISED 00-00-00 | DATE PLOTTED => 30-APR-2013 | TIME PLOTTED => 12:10

BORDER LAST REVISED 7/2/2010 | USERNAME => s127584 | DGN FILE => Wildlife Escape Ramp Wood v01.dgn | RELATIVE BORDER SCALE IS IN INCHES 0 1 2 3 | UNIT 0000 | PROJECT NUMBER & PHASE 00000000001

Bridge Construction Beginning at Live Oak Creek

Live Oak Creek Bridge During Construction

Bridge over the San Diego Regional Water Authority Pipeline

Wildlife Crossing Under Construction at Via Montellano

Aerial View of Completed Wildlife Crossing and Fencing at Via Montellano

Aerial View of Wildlife Crossing and Fencing at Morrison Mitigation Site

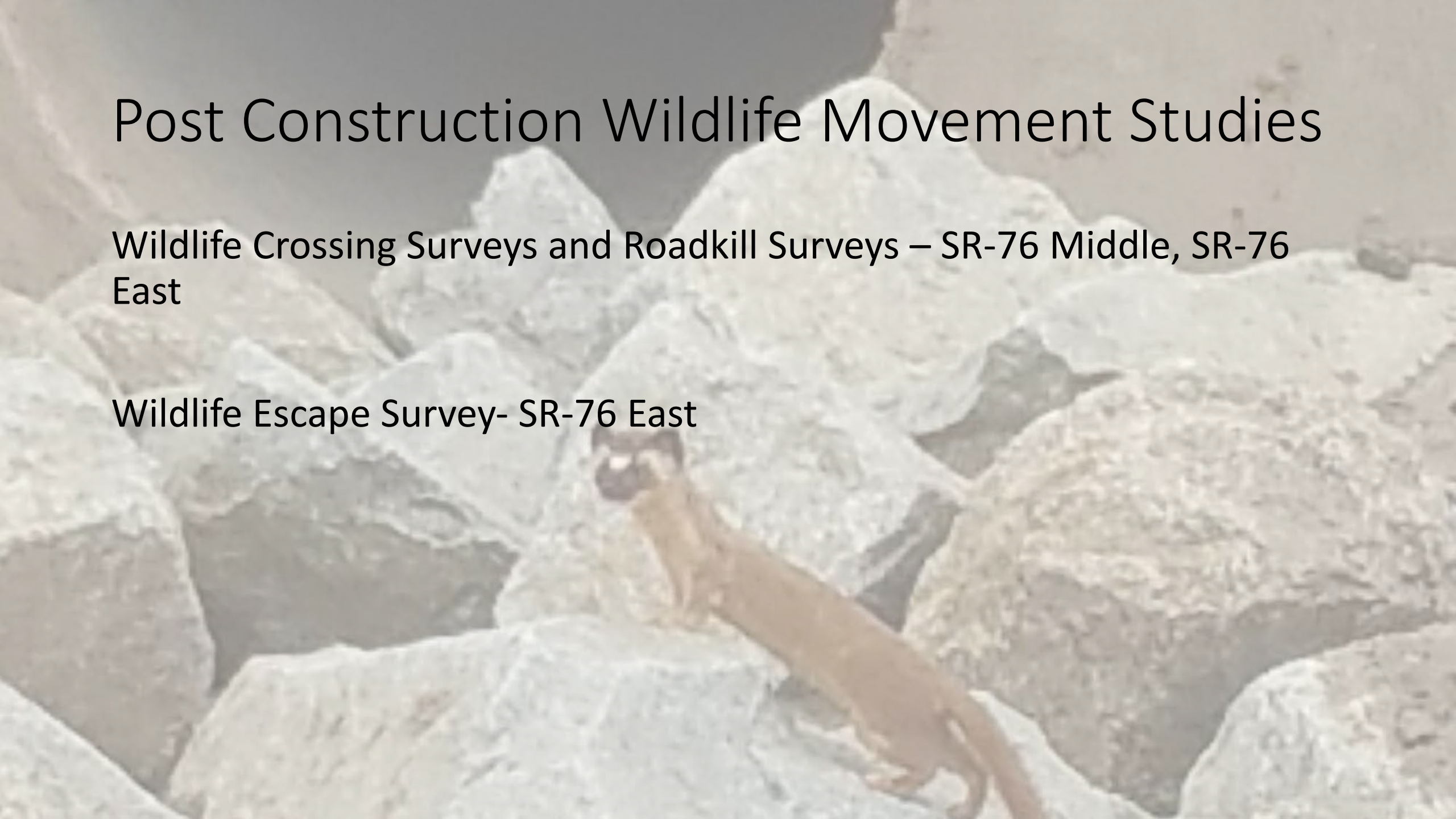
Ostrich Farm Creek Bridge Wildlife Crossing

Completed Wildlife Escape Ramp

Post Construction Wildlife Movement Studies

Wildlife Crossing Surveys and Roadkill Surveys – SR-76 Middle, SR-76 East

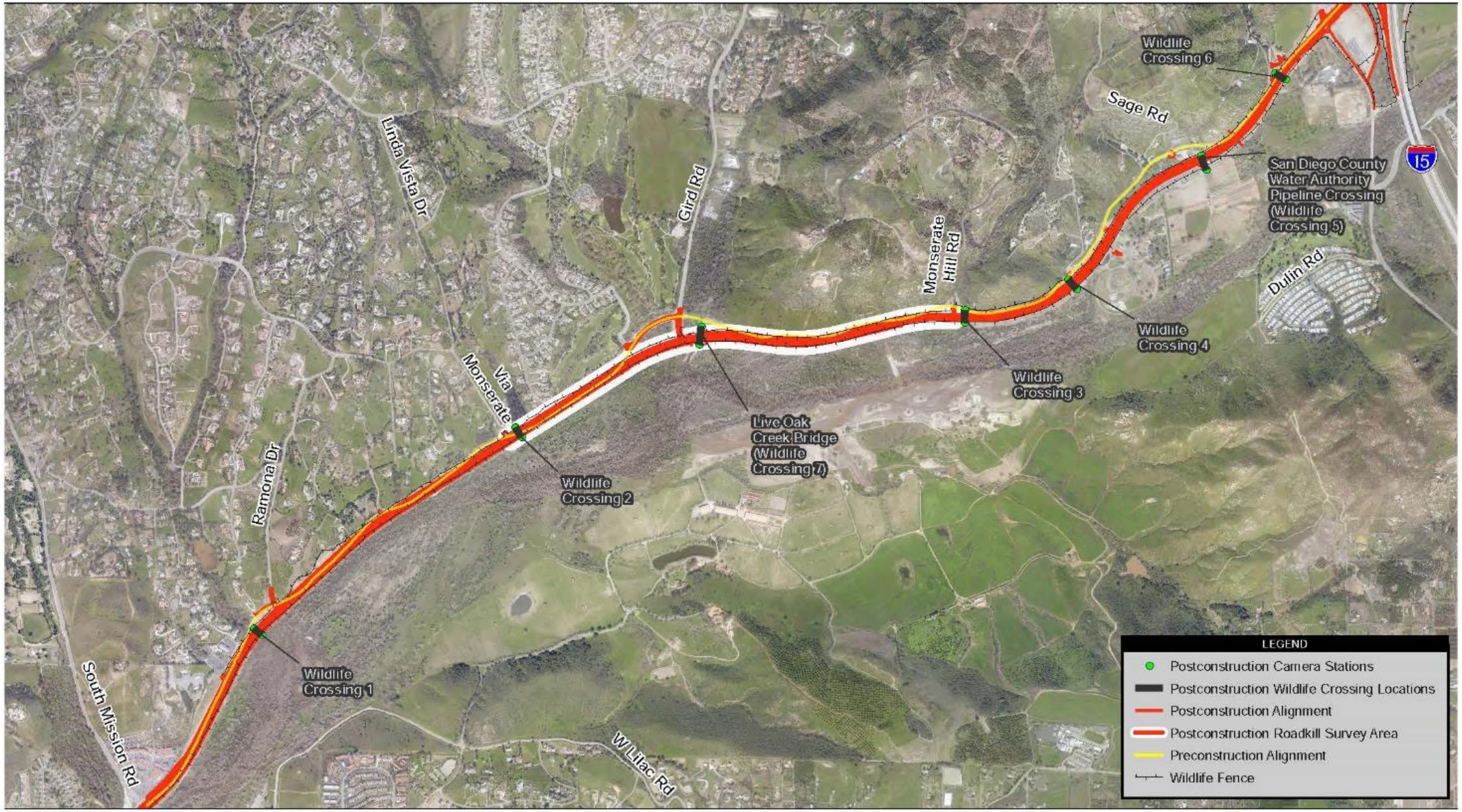
Wildlife Escape Survey- SR-76 East



Post –construction Wildlife Movement Study Methodology

- Mimic methodology of the pre-construction movement study
- Use of wildlife cameras at each end of wildlife undercrossings
- Camera set ups and settings
- Data compilation

POST CONSTRUCTION STUDY AREA



Source: SANDAG 2017

1,500 750 0 1,500 Feet

Scale: 1:18,000; 1 inch = 1,500 feet

Figure 4
Postconstruction Project Study Area

State Route 76 South Mission to Interstate 15 Highway Project
Postconstruction Wildlife Movement Study Year 1 Report
Path: P:_6060\60602148_SR76E_Post\900-CAD-GIS\920 GIS\map_docs\mxd\Report\PostCon_BAC\Figure4_ProjectStudyArea_postcon.mxd 3/11/2020, AugelloP

POST CONSTRUCTION SURVEY METHODS

- Postconstruction surveys utilized camera technology instead of tracking stations to evaluate wildlife activity at crossings.

- Cameras were set up at both ends of each of the seven newly constructed wildlife crossings.

- Postconstruction camera surveys were conducted over a 1-month period, during mid-May to mid-June, July, September, and December 2019, for a total of four postconstruction camera surveys.

- Additional camera studies included wildlife escape ramps.

CAMERA STATION AT ESCAPE RAMP

CAMERA STATION AT WILDLIFE CROSSING

Relative Activity

- To compare wildlife activity levels between preconstruction and postconstruction, a relative activity (RA) index was calculated for medium- and large-sized mammals at each wildlife crossing.
- RA was calculated as the proportion of days the target group was detected at least once at a wildlife crossing, divided by the number of days the crossing was surveyed (i.e., the proportion of survey dates the group was documented as being present at the crossing).
- An average RA value was calculated for each wildlife crossing evaluated during preconstruction and postconstruction based on the values calculated for each survey.
- RA scores of large-sized, but not medium-sized mammals at wildlife crossings were significantly higher during postconstruction, and mammal diversity was lower in postconstruction compared to preconstruction.

Roadkill

Postconstruction surveys were conducted over a 3-day period twice per month during four 1-month periods including May, July, mid-September to mid-October, and December 2019, for a total of eight postconstruction roadkill surveys.

To compare preconstruction and postconstruction roadkill rates, the number of roadkill occurrences detected per survey during each period was calculated for various groups of wildlife, including birds, bats, reptiles, amphibians, and various mammal groups including carnivores, rodents, and others.

Roadkill rates were found to be lower during postconstruction compared to preconstruction for all groups except bats and amphibians.

Findings

Activity at wildlife crossings increased while roadkill rates decreased from preconstruction to postconstruction, which supports the hypothesis that the addition of crossings and directional fencing would reduce wildlife mortality.

Bobcat with prey

Bobcat wading thru crossing during high water flow

Long-tailed weasel

Spotted skunk

Striped skunk

Coyote and barn owl interaction

Coyotes

Badger (rear view)

RoadRunner

Squirrel

RECOMMENDATIONS

Crossings with high levels of anthropogenic use should be blocked with a single arm metal gate permeable to wildlife.

Sediment build up within crossings, specifically box culverts, should be monitored and reduced as necessary to sustain crossing dimensions as originally constructed.

Heavy gauge fine wire mesh or a metal plate should be installed 1 foot underground and 2 feet above ground at gates along the directional fencing to block wildlife from digging under these gates and entering the roadway.

Beware of vandalism in areas where humans use the crossings. Protect cameras with bear boxes, locks and chains and securing them to solid structures.

*In southern California, don’t build wildlife escape ramps out of wood.

Gate is off ground

Coyote climbing wildlife escape ramp onto road

Coyote on escape ramp facing road