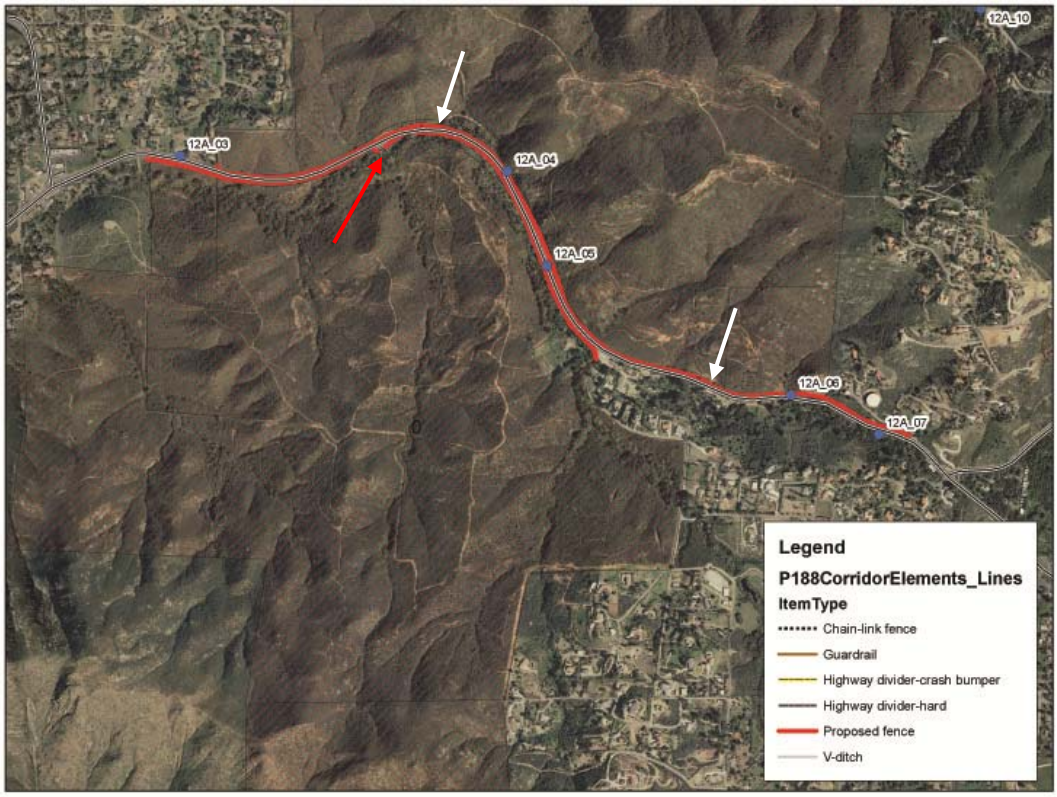
Wildlife Linkages within the San Diego County Preserve System.



Data Summary

Prepared for:

San Diego Association of Governments

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY
WESTERN ECOLOGICAL RESEARCH CENTER

Wildlife Linkages within the San Diego County Preserve System.

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MSCP Linkage Evaluation

In support of the MSCP Connectivity Strategic Plan, the U.S. Geological Survey performed a preliminary assessment of the potential linkages between the core conserved wildlife areas within San Diego County. In coordination with the San Diego Management and Monitoring Program (SDMMP), ten of the possible linkages were identified as priority areas and evaluated for the likelihood that focal wildlife species would be able to move from one core area to the next.

This effort is a continuation of the on-going development of the MSCP wildlife connectivity goals. In 1996, Ogden identified 29 points within the MSCP as "Regional Habitat Linkage Monitoring Locations". These 29 points identified general areas where wildlife movements between core conserved lands may have been restricted by roads and development, but did not include specific locations or obstacles. Since the development of these 29 points in Ogden 1996, there has been much construction and urbanization in San Diego County that was unknown or not accounted for in the original planning. Additionally, there has been considerable build out of the reserve system. As a result, not all of the 29 points in the Ogden 1996 plan are discussed here, some would now be considered to serve internal connectivity functions within core conserved areas and others were not part of the ten priority linkages identified for consideration for this evaluation. Conservation Biology International (CBI) visited many of the original 29 points in 2003 and made their own recommendations for future monitoring. In some cases, CBI 2003 went one step further and identified specific structures and locations that should be considered for future monitoring actions. With the build-out that has occurred between the time of the Ogden 1996 and the CBI 2003 evaluations and 2012, it was decided that the linkages needed to be re-evaluated before extensive management actions were initiated.

Methods

As a starting point, a small portion of the existing data on these wildlife linkage areas was reviewed and transcribed into digital format. The descriptions, recommendations, and survey results from the CBI (2003) field efforts were entered into a Microsoft Access 2003 database specifically built to store these data. Rudimentary data entry forms were built should there be a need to enter any additional data into this database in the future. Basic reporting tools were also included. Ideally, this effort will facilitate the future migration of these data into the regional multi-taxa database currently in development. In their report, CBI recommended two data sheets for data collection during site visits, "MSCP Linkage Description Log: Part A" and "Crooks' Measurements for Carnivore Sampling Stations". Both of these data sheets have been re-built in Microsoft Excel 2003 should they be needed for future field survey efforts. (The MS Access database only includes tables, forms, and reports for the "MSCP Linkage Description Log: Part A". The CBI 2003 report did not include any data collected using the "Crooks' Measurements for Carnivore Sampling Stations" and so no supporting database structure was developed.)

The CBI 2003 report was also used to develop GIS data files using ArcMap 10. All of the mapped points were re-created, including the 29 "Regional Habitat Linkage Monitoring Locations" described in Ogden 1996. In addition to their site visits to these points, CBI also provided information on several points where the San Diego Tracking Team had conducted wildlife surveys; these were also included in the GIS layer. The original linkage points from Ogden 1996 are labeled as the original linkage designation with the addition of a Roman numeral, "L-6I" for example. Additional points from CBI are labeled with the original linkage designation with the addition of a letter, "L-6A". San Diego Tracking Team locations included in the CBI 2003 paper were labeled as the original linkage designation with a decimal followed by a number, "L-6.1". (The designations given to the SDTT points in this process most likely do not match SDTT's internal naming conventions for these field survey efforts.) The attributes table for the CBI 2003 points includes Latitude, Longitude, Name1, Name2, Source, and Action.

Latitude: decimal degrees in NAD 83
Longitude: decimal degrees in NAD 83
Name1: designation for the point as given in CBI 2003
Name2: designation for the point as given in this report
Source: what document first described the point, Ogden 1996 or CBI 2003
Action: what activity should be done at the location

- monitoring: linkage monitoring locations described in Ogden 1996
- future: locations recommended for future monitoring in CBI 2003
- tracking: SDTT survey locations included in CBI 2003

The evaluation of the linkages between the conserved core areas was a multi-step process. In order to focus the evaluation, it was decided that only between-core connectivity would be evaluated at this time, within-core connectivity would have to be evaluated separately. Using the "SANDAG_Conserved_Lands" GIS data file, potential routes along the priority linkages were identified. ArcMap imagery, GoogleEarth, GoogleMaps, and the SanDAG Master Culvert file were used to develop and map a series of points between the conserved core areas along which wildlife would have to move, either through, under, or over, to get from one core area to the other. These points included culverts through which animals may pass under roads, potential at-grade crossings where no culvert existed along a roadway, and bridges that would allow wildlife movement. Points where habitat was restricted by surrounding land use and there were no roads as part of the landscape were identified as constriction points. The SanDAG Master Culvert file is a GIS layer and was used to provide detailed measurements on selected structures where it over-lapped with these efforts. Once all of the potential points along a route were identified and marked in a new ArcMap GIS file, the overall linkage was described and then each point was described and evaluated for the potential that focal wildlife species would be able to move through the area.

The overall linkage was described based on the general location within the MSCP, roads, and landscape features. Where previous documents had described each area, the source and name were include. Overview maps were generated showing all of the potential points along the linkage between the conserved core areas.

Each point within the linkage was more thorough described. Again, any previous description of the point was reported, whether or not the point had been identified in Ogden 1996, CBI 2003, or in the SanDAG Master Culvert file. The description of the point was given, including dimensions of the structure or road, and some general information about the surrounding landscape. Where conserved lands existed near one of these point, it was also described. Images of each point were generated in ArcMap and GoogleEarth, and from MapsGoogle when needed. Latitude and longitude coordinates are report for each point, or for each end of a culvert, in NAD 83. General notes about each point were included. For points where a site visit was made, the date of the visit and the survey forms used to document the visit are reported. Potential management recommendations/actions were described that may increase the likelihood of successful wildlife movement through the point or to protect and prevent animals from entering the roadway.

Each point was evaluated for five focal taxa based on the size of the feature and the surrounding habitat. The five focal taxa were mountain lion, coyote, bobcat, deer, and "small terrestrial vertebrates". "Small terrestrial vertebrates" is an extremely broad group that ranges from lizards and mice to skunks and raccoons. It also covers a broad range of behaviors, from raccoons and opossums which are highly commensal to more secretive or cryptic species such as long-tail weasels and rattlesnakes. Each focal species was judged as "yes" or "no" on whether it seems likely that the taxa would be able to successfully cross the point on a regular basis. An answer of "no" does not mean that the taxa will never successfully cross the point, but that there is a low likelihood. A "yes" for the "Small terrestrial vertebrates" does not necessarily mean that all of the species that might be included in this category will successfully be able to cross at the point, but that some portion should be able to utilize the structure.

Sites

The ten linkages identified as priority sites were based on the recommendations of the SDMMP and are listed below. Not all of the linkages proposed in the "Connectivity Monitoring Strategic Plan for the San Diego Preserve System" are included here. Those not described may need to be characterized later or already have known problems. The linkages are identified based on the two conserved core areas that they potentially connect, as listed in the Strategic Plan.

Linkages between MSCP Conserved Core Areas evaluated for wildlife connectivity

1. Linkage 12A:
    a. CA-1: Otay Mountain/Rancho Jamul/San Diego National Wildlife Refuge
    b. CA-2: McGinty Mountain / Crestridge ER/Harbison Canyon
    c. Identified in Ogden 1996 as "L-15: McGinty Mesa/Rancho San Diego (Middle Sweetwater River).
2. Linkage 23B
    a. CA-2: McGinty Mountain / Crestridge ER/Harbison Canyon

    b. CA-3: El Capitan Reservoir
    c. Identified in Ogden 1996 as “L-13: Harbison Canyon at Interstate-8).
3. Linkage 513
    a. CA-5: Gooden Ranch/Sycamore Canyon
    b. CA-13: Mt. Woodson
    c. Identified in Ogden 1996 as “L-8: Central Poway).
4. Linkage 58
    a. CA-5: Gooden Ranch/Sycamore Canyon
    b. CA-8: Torrey Pines/Del Mar Mesa/Carmel Mesa/Los Peñasquitos Canyon
    c. Identified in Ogden 1996 as “L-10: Los Peñasquitos Canyon/South Poway (Beeler Canyon).
5. Linkage 810
    a. CA-8: Torrey Pines/Del Mar Mesa/Carmel Mesa/Los Peñasquitos Canyon
    b. CA-10: Black Mountain
    c. Identified in Ogden 1996 as “L-6: McGonigle Canyon).
6. Linkage 910
    a. CA-9: Del Mar Lagoon
    b. CA-10: Black Mountain
    c. Identified in Ogden 1996 as “L-6: McGonigle Canyon).
7. Linkage 910B (alternate to Linkage 910)
    a. CA-9: Del Mar Lagoon
    b. CA-10: Black Mountain
    c. Not identified in Odgen 1996 as a “Regional Habitat Linkage Monitoring Location”.
8. Linkage 1011
    a. CA-10: Black Mountain
    b. CA-11: Lake Hodges/Del Dios
    c. Not identified in Odgen 1996 as a “Regional Habitat Linkage Monitoring Locations”.
9. Linkage 1112
    a. CA-11: Lake Hodges/Del Dios
    b. CA-12: Ramona Grasslands/Boden Canyon
    c. Identified in Ogden 1996 as “L-2: Lake Hodges/San Pasqual Valley).
10. Linkage 1213
    a. CA-12: Ramona Grasslands/Boden Canyon
    b. CA-13: Mt. Woodson/Blue Sky ER
    c. Not identified in Odgen 1996 as a “Regional Habitat Linkage Monitoring Locations”.

Results

The majority of linkages connecting the MSCP conserved core areas are extremely complicated or fragmented, some to the point of being non-functional. Some of the linkages have little infrastructure in place to successfully move wildlife from one area to the next. Without sufficient paths, animals may be forced to attempt risky at-grade crossings of roadways or choose to avoid crossing the road all together. Much of the

infrastructure associated with San Diego is not sufficiently fenced to discourage animals from entering roadways where they encounter dangerous situations with vehicles. Well designed fencing would help reduce wildlife access to roads and at the same time direct animals to appropriate crossing locations. In some cases, the linkage between two core areas rests solely on a single impassible barrier that may require an extensive reconstruction to even begin to function as a wildlife movement route. The following is the overall evaluation of each linkage with a few brief notes. A more detailed description of each point within the linkage is given in the Appendix.

1. Linkage 12A: <u>non-functional</u>
   -The current configuration of SR-94 through Jamul makes this an unlikely area and dangerous crossing point for wildlife. Major work on SR-94 and Jamul Drive would be needed to create safe alternatives to the at-grade crossing conditions. The current conditions along the Sweetwater River through the Cottonwood Golf Course provide little vegetative cover for wildlife and would require extensive re-vegetation efforts to restore the riparian habitat along this route. In the short term, fencing along SR-94 needs to be installed to reduce wildlife/vehicle interactions and guide animals to the existing structures.
2. Linkage 23B: <u>non-functional</u>
   -the convergence of Alpine Blvd, I-8, Arnold Road, and Peutz Valley Road effectively block all movement between the conserved lands around El Capitan Reservoir and those to the south along Harbison Canyon. A major overhaul of this intersection is recommended if wildlife are to move back and forth between these areas. The existing tunnel under this intersection is fatally flawed from the perspective of wildlife movement, it is 200 meters long. Before any work is done here, the permeability of Galloway Valley and Harbison Canyon should be considered.
3. Linkage 513: <u>functional but needs improvements</u>
   -the purpose built wildlife tunnel existing between Gooden Ranch/Sycamore Canyon and Mt. Woodson likely functions to allow most species to successfully move under Scripps-Poway Parkway. This tunnel is currently being evaluated for small terrestrial vertebrates, using remote trigger cameras. The goal of this study is to understand if the addition of internal structure can improve the use of the tunnel by small animals. The SPP tunnel could be improved with additional fencing to reduce wildlife access to the roadway above. To increase the function of this overall linkage, work should be done along Poway Road to the north, which currently has little to no wildlife safety structures.
4. Linkage 58: <u>non-functional</u>
   -the complex matrix of urban development that exists between the east end of Los Peñasquitos Canyon and Gooden Ranch make this linkage unlikely to function for all but the most tolerant species, such as coyotes, raccoons, and opossums. No suggestions could be developed that would improve this linkage. The large tunnel under the intersection of Scripps-Poway

Parkway and Pomerado Road is likely rendered useless by the housing at the north-west end.

5. Linkage 810: functional but needs improvement
   -of the ten linkages evaluated here, the linkage between Los Peñasquitos Canyon and the region including Black Mountain seems the most likely to support wildlife movement, including mule deer and most small terrestrial vertebrates. The three large bridges along this linkage provide ample opportunity for animals to safely move from one area to the next. The potential success of this linkage could be improved through vegetation rehabilitation through the linkage, current conditions are relatively bare and provide little cover.
6. Linkage 910: non-functional
   -the current linkage from Del Mar Lagoon to Black Mountain, through the non-core conserved lands along Carmel Valley Road was judged to be non-functional based on the number of barriers, at-grade crossing, lack of natural habitat, and urban development that exists between the two.
7. Linkage 910B: suggested alternate to be developed
   -a potential connection between CA-9 and CA-10 could be developed along the San Dieguito River. There is currently no conserved land identified along the river, but the landscape along the river may be more appealing to wildlife than the fragmented landscape directly between these two areas. Coordination with the golf course management may be necessary to open up the path along the river.
8. Linkage 1011: functional but needs improvement
   -of the three potential routes connecting the Black Mountain region to the Lake Hodges/Del Dios area, only the western route along the San Dieguito River seems likely to function. The non-core conserved lands at the eastern end and near the middle offer little native cover, lots of development, and few safe road crossings. Conserving the lands along the San Dieguito River should be considered for the future connectivity of these two areas.
9. Linkage 1112: non-functional/function (depending on water level)
   -conditions at the I-15 bridge over Lake Hodges may provide limit connectivity between the Lake Hodges/Del Dios area and the Ramona Grasslands and Boden Canyon to the east. All movement between these core areas hinges on this one point. High water levels in the reservoir during previous years have blocked this route for all of the focal taxa. Recent low water levels have opened up a wide area for wildlife movement. Managing the water level in the reservoir to allow multiple years of low water may benefit wildlife by producing a riparian forest, as has happened in the past.
10. Linkage 1213: functional but needs improvement
    -the rural sprawl that exists between Mt. Woodson and the Ramona Grasslands complicates much of the interface between these two areas, but there does appear to be some potential for wildlife movement in the vicinity of Starvation Mountain. Little to no wildlife infrastructure exists

in this area currently, additional work is needed to identify potential improvements.

Discussions and Recommendations

Based on a preliminary review of the wildlife linkages within San Diego County, there are several early actions that can be taken to protect wildlife and promote connectivity across the preserve. Many of the recommendations here involve fencing to guide wildlife away from roadways and towards appropriate crossing structures where they exist. Due to the wide ranging characteristics of the intended focal species, fencing should include design elements to exclude both large and small animals from the roadway, while still allowing continued vehicle and pedestrian access. And, where possible, fencing should incorporate some level of fire ignition reduction technique. Fence design may include a Jersey rail with chain-link fence above. The Jersey rail along the lower edge would prevent small wildlife from entering the roadway. And the fencing along the upper portion should deter larger animals. Additionally, the Jersey rail should intercept sparks from passing cars and potentially blowing embers, reducing the number of ignitions along the roadside. An alternate fence design may include a chain-link fence with 36 inches of metal flashing along the lower edge, with six inches of both buried below the surface. Neither of these fencing designs has been confirmed to reduce ignitions along roadsides, further research into the practicality of fences as barriers to fire is needed. Surface drainage from the roadway should include structural elements that would reduce the likelihood that wildlife could access the road through drainage structures.

Vehicle and pedestrian access across the wildlife fencing can be accomplished with cattle grates and self closing gates where needed. Where driveways join the main road, cattle grates should be installed to deter wildlife from going around the end of the fence onto the road. Visual and real cattle grates should be considered and evaluated for effectiveness, but the expectation is that real cattle grates should be more effective across the range of animals sizes the fences are expected to protect. Where real cattle grates are used, the design should include a mechanism to return any animal that falls into the grate to the correct side of the fence. The pedestrian gates should include steps on the road side of the fence to go over the height of the metal flashing while maintaining the flashing as a barrier on the wildlife side of the fence.

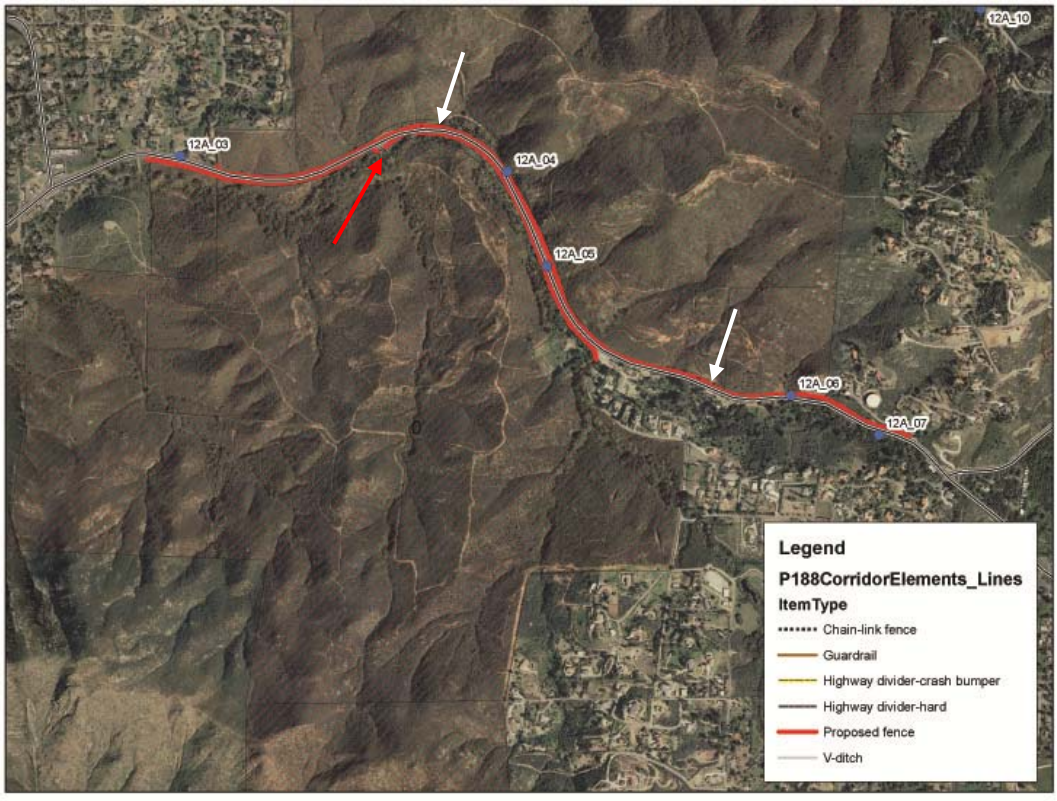
In addition to fencing, several properties have been identified for future purchase to ensure the long term connectivity of the preserve. Between two of the core areas, parcels of open land have been identified for possible acquisition. These lands may already be serving to connect the core areas, but they should be purchased or managed to provide a continued linkage.

The data used to evaluate the conserved lands of San Diego County need to be verified and updated. Some lands currently listed as conserved may have no biological value and perhaps should be removed from the system. Other lands that are already publicly owned have not been labeled as protected or conserved. Knowing the correct status of the properties within the preserve will result in a clearer picture of what is and is not functioning as wildlife corridors.

Linkage 1 – 2A

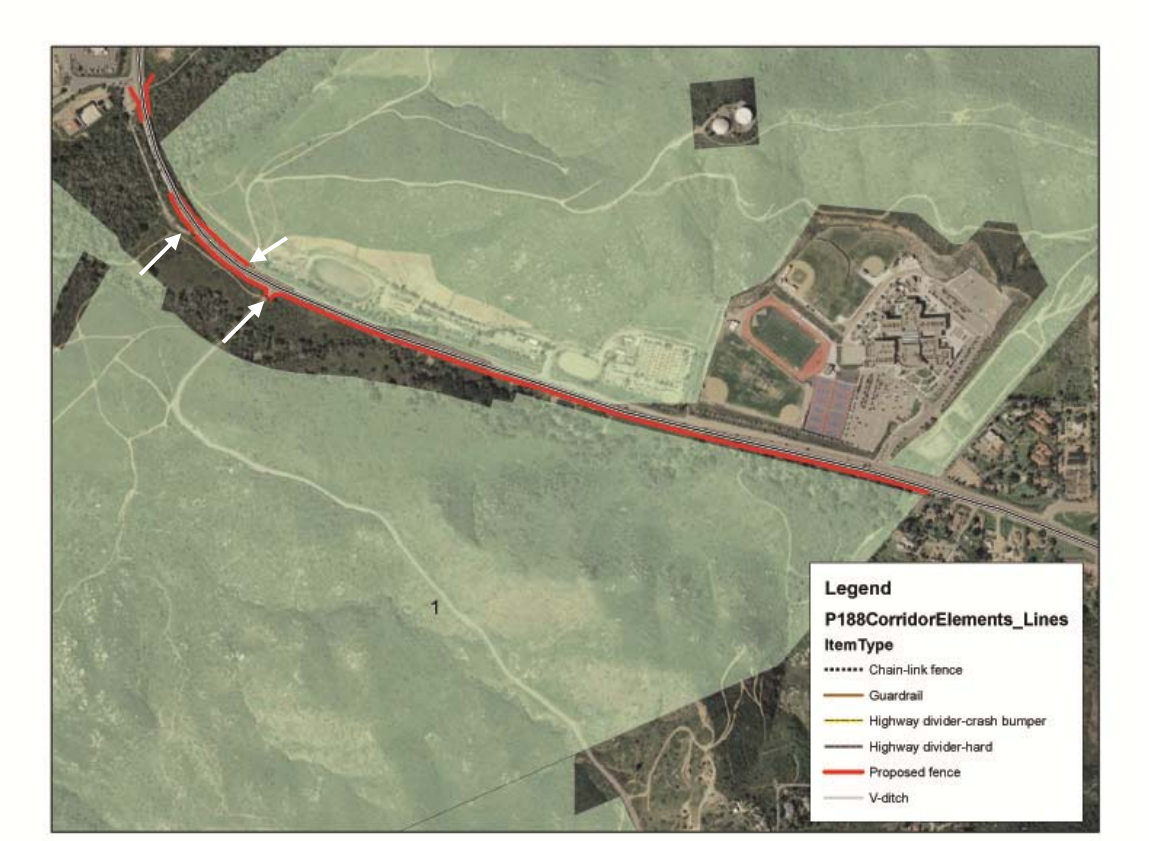
East End

There are two possible lines of improvements that could be made in the area of Rancho Jamul to increase the success of the linkage between Core Area 1 and 2 along SR-94, near the U.S. Fish and Wildlife Services' Las Montañas property. As an early action item, fencing should be installed along both sides of the roadway to reduce the likelihood of wildlife – automobile interactions and to funnel animal movements towards any existing culverts and tunnels. The red arrow shows where the fencing will need to be tied into the water station. The white arrows indicate access points along SR-94 that will need cattle grates to prevent wildlife from enter the road at driveways. The vegetation at both ends of culvert 12A_04 needs to be cleared to increase the usefulness of this passage. A more extensive project would be the re-alignment of SR-94, straightening out the curve and adding several bridges to carry traffic over the riparian habitat and allow passage for wildlife underneath (see Appendix for image of possible re-alignment).



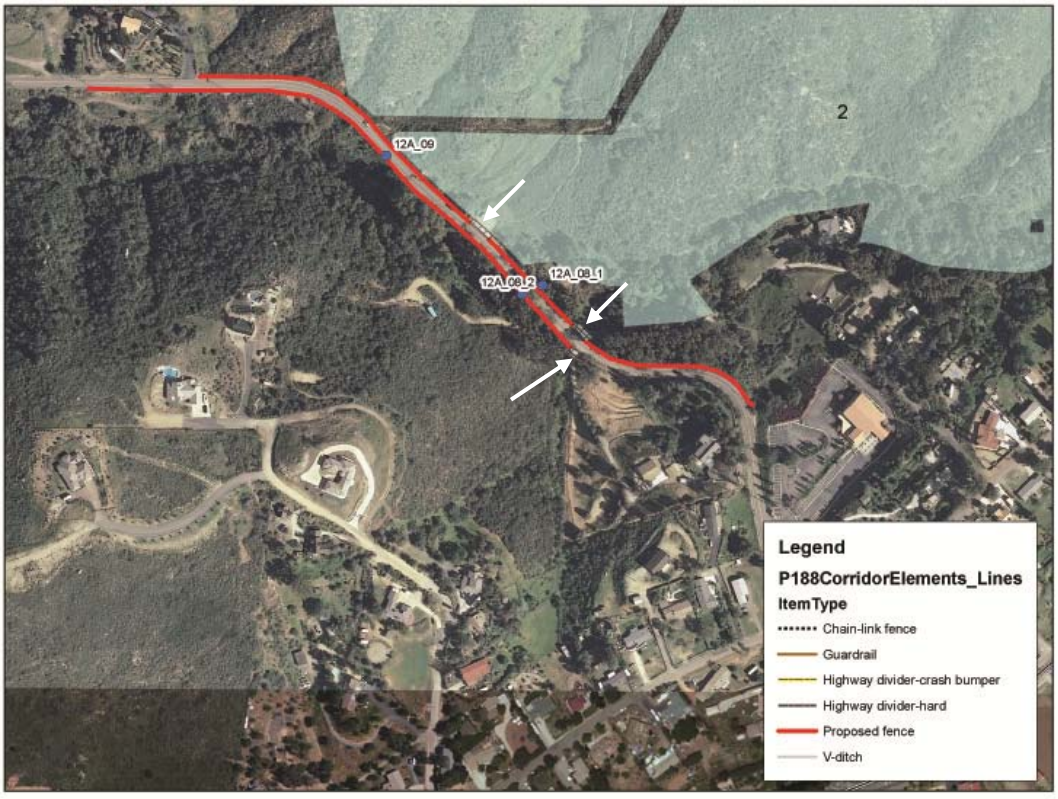
West End

Along SR-94, near the U.S. Fish and Wildlife Services' National Wildlife Refuge – Steele Bridge site, wildlife exclusion fencing needs to be installed to prevent wildlife access to the road way. Any wildlife movement along this portion of SR-94 will have to occur at the Sweetwater Bridge. The white arrows indicate access points along SR-94 that will need cattle grates to prevent wildlife from entering the road at driveways. Barbed wire fencing exists along portions of this road, but something more substantial is needed. The County owned property on the north side of SR-94 with the horse ranch should be re-evaluated to determine if it should continue to be identified as part of the core conserved area.



Mexican Canyon

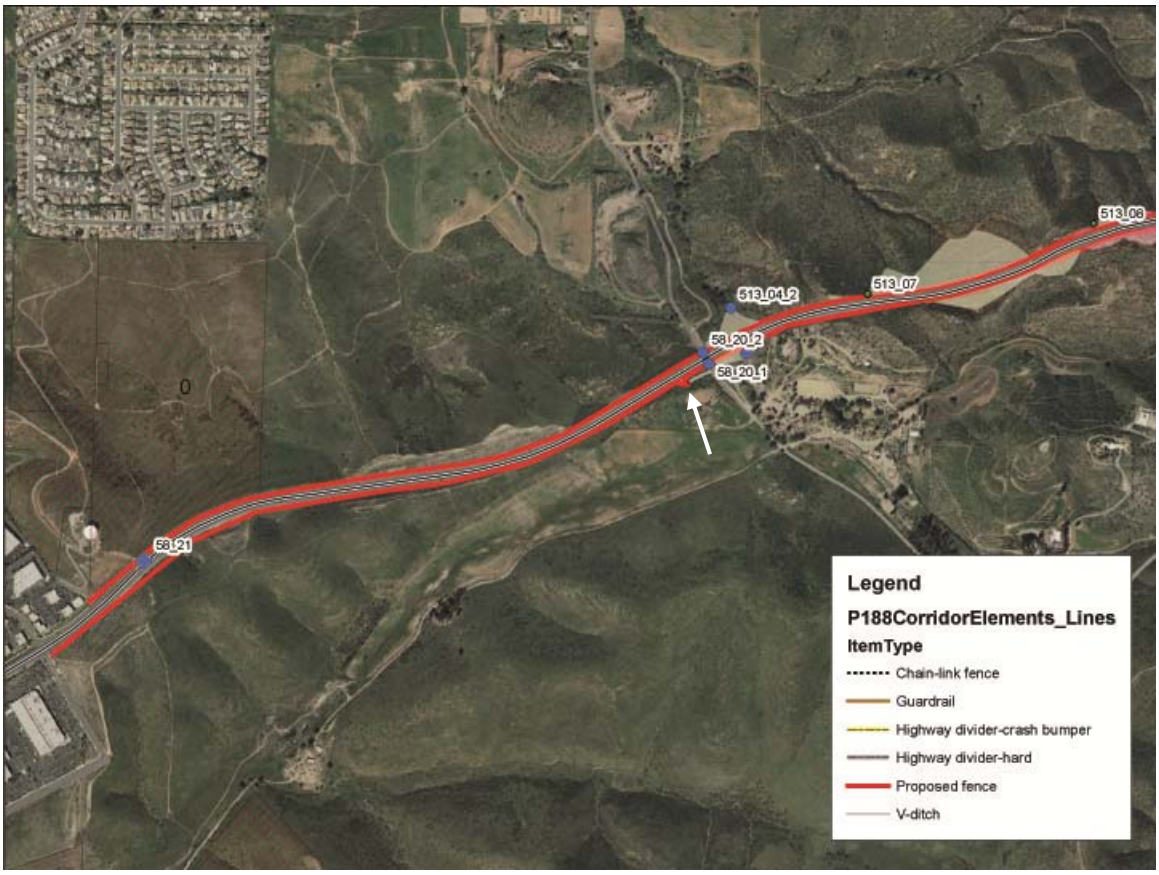
Jamul Drive near Mexican Canyon already has some fencing on both sides of the road, but this needs to be extended and upgraded to prevent wildlife – automobile interactions in the area. The white arrows indicate access points along Jamul Drive that will need cattle grates to prevent wildlife from enter the road at driveways. The double box culvert at 12A_08 will need to have the vegetation at both ends thinned. Within the culvert, the sediment depth should be evaluated and cleared out if it is excessively deep. A more extensive project would be to rebuild the bridge at the stream crossing. The roadway could be raised with the installation of a more significant bridge, this would remove the dip in the road as it crosses the creek and allow for a more open passage underneath. The addition of a larger structure would also allow for a widening of the riparian zone.



Linkage 5 – 13

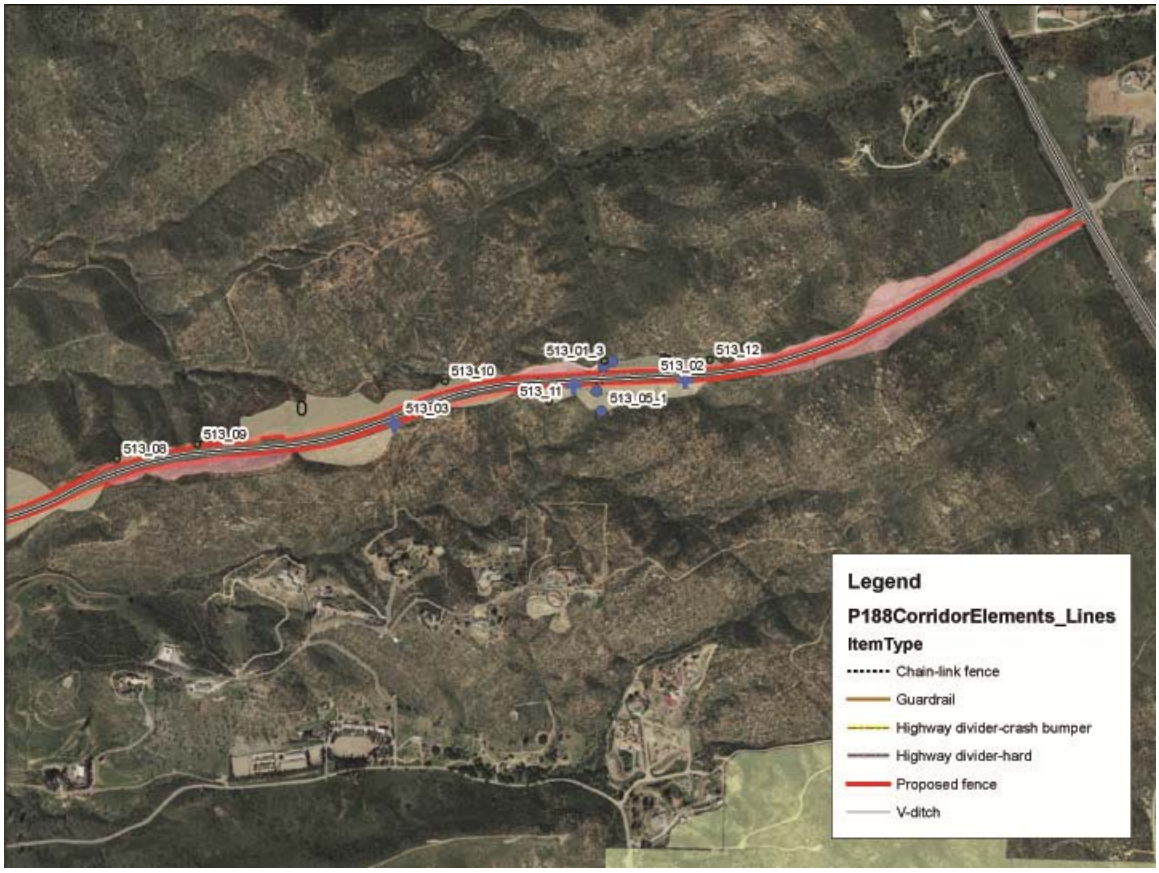
West End

Scripps-Poway Parkway should have wildlife exclusion fencing along most of the length of the road east of the Poway industrial / commercial area. The white arrow indicates where an access road connects to Scripps – Poway Parkway from Sycamore Canyon Road that will require a cattle grate. In newer imagery, the southwest end of this stretch of road has been graded which should reduce the length of fencing required in this area. The Sycamore Canyon Road undercrossing should be evaluated should be evaluated to assess how much wildlife movement occurs through it. The two lane paved road and surrounding ranches may deter most wildlife from attempting to cross Scripps-Poway Parkway through this structure.



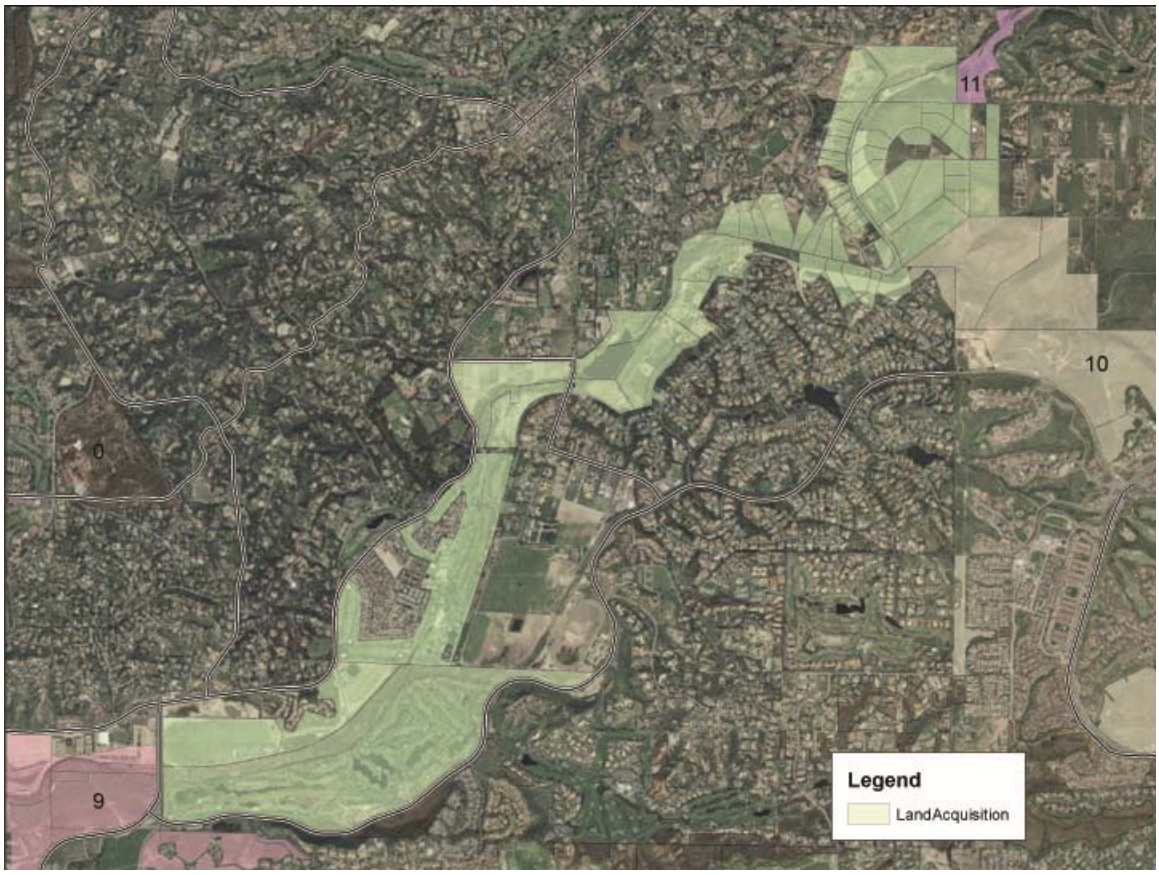
East End

The east end of Scripps – Poway Parkway near the wildlife tunnel needs to have additional fencing. The purpose built wildlife tunnel at 513_01 has some fencing, but it is insufficient to prevent wildlife movement onto the road way. The fencing along Scripps – Poway Parkway should extend well beyond the immediate vicinity of the tunnel to ensure that wildlife are guided away from the road and through the tunnel. Fencing in the area of the tunnel will also require accommodations for human use, such as horse back riders and hikers, but should include self closing gates where possible. Just east of the tunnel, there is space to install a deer jump out ramp on the south side of the road to allow wildlife to escape the road if needed. The north side of the road should also be evaluated for an appropriate location for a deer jump out ramp. SR-67 in the upper right of the image will also require more substantial fencing eventually.



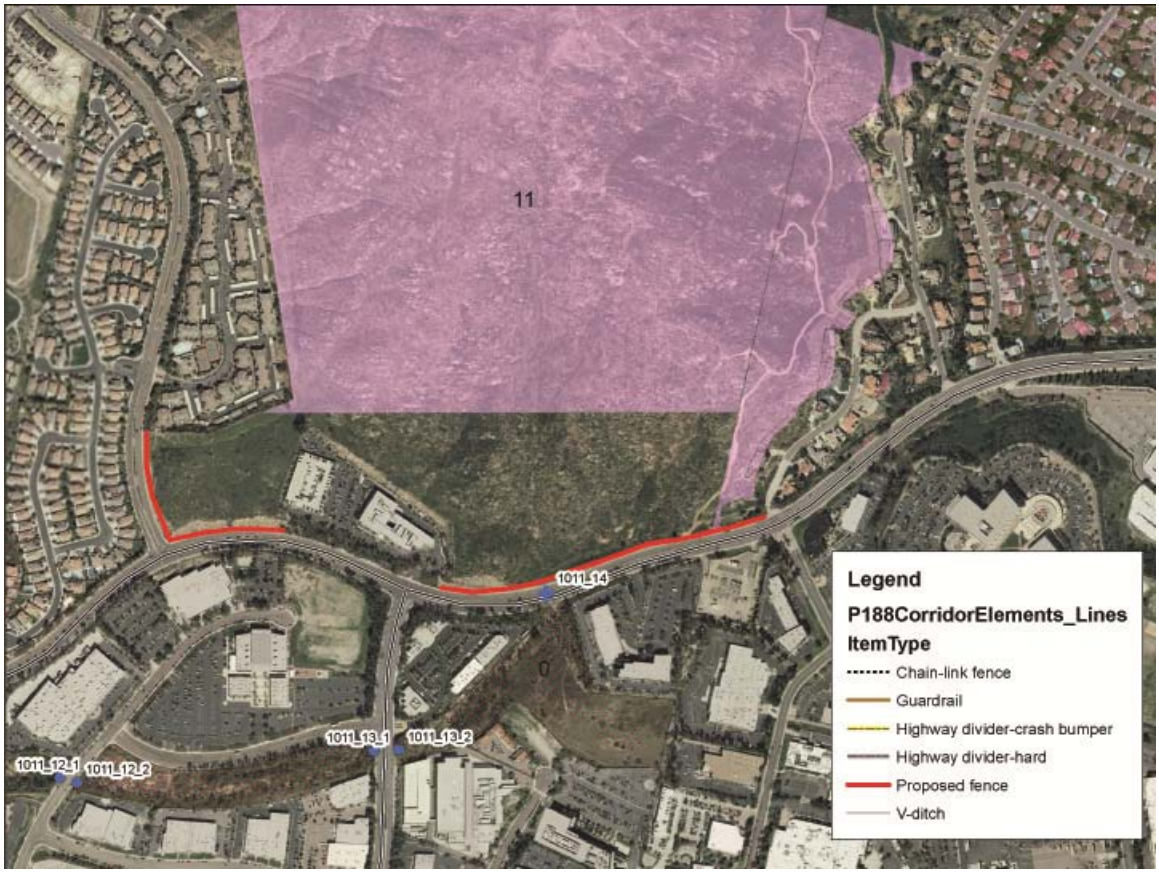
Linkage 9 – 10 and Linkage 10 – 11 Land Acquisition

To secure and improve the connectivity between Core Area 9, Core Area 10, and Core Area 11, lands along the San Dieguito River should be acquired or managed for wildlife. The connectivity between CA-10 and CA-11 in this area may be functioning, but the lands are not in conservation. While many of the properties in this area have homes on them, they have large backyards that may be useable. The connection between CA-9 and CA-10 is more complicated, there are several golf courses along the river channel that may impede movement. But there is potential that management policies within the golf courses will provide enough vegetative cover to allow movement along this corridor. The golf course at the lower left of the figure is identified as being owned by the City of San Diego, but it has no identified conservation status.



Linkage 10 – 11

The linkage between Core Area 10 and Core Area 11 through the chain of non-core conserved lands is most likely non-functional for any species except the most commensal, disturbance tolerant species. The section of Rancho Bernardo Road just south of CA-11 at the east end should be fenced to prevent wildlife access to the roadway. There is no significant wildlife crossing structure at this location to guide wildlife towards, the fence would solely be to keep animals away from the road. If the undesignated open land just to the north of Rancho Bernardo Road is slated for development, fencing may not be necessary.



Linkage 2 – 3B

If this location is going to function as a wildlife corridor, a major overhaul of the infrastructure would be needed. One possibility would be to re-align Peutz Valley Road and Alpine Blvd to include bridges over Chocolate Canyon. See the description of this location in the Appendix for more details on a possible realignment. Before any extensive effort is begun at this site, the permeability and connectivity through Galloway Valley and Harbison Canyon should be evaluated. If the connectivity south of this point is compromised, there may be little reasoning in attempting to fix this corridor at this intersection.

Based on the current situation with feral pigs in San Diego County, it may be beneficial to reduce connectivity between Core Area 2 and Core Area 3 at Peutz Valley Road. At Peutz Valley Road, where it crosses under Interstate 8, a survey needs to be done to determine if the feral pigs north of I-8 are moving through this corridor into the lands to the south. If the pigs are using this route, crossing either at grade along the road surface or through the underground tunnel, temporary modifications may be required to reduce the chance of pigs moving south. At the road surface, there may be the possibility that this can be done with the installation of a cattle grate. Blocking the underground culvert to pigs but still allowing water to flow may require the building of a waterfall type barrier that is impassible to the pigs.

Linkage 5 – 8

The culvert crossing diagonally under the intersection of Scripps-Poway Road and Pomerado Road is most likely non-functional, but should be evaluated based on field data that may be available through the research efforts of the San Diego Tracking Team or M. Jennings. The south-east end of the culvert is choked with vegetation and may need clearing if it seems that wildlife is getting to this point and then being forced to turn around. At the time that this site was visited, all of the tunnels had flowing water. If there are signs that this may be functional, adding an elevated, dry walkway through the length of the culvert would allow animals a dry route to pass through the tunnel.

The bridge that carries Black Mountain Road over Los Peñasquitos Canyon needs additional fencing. The southeast side of the bridge has approximately 50 feet of chain link fence between the sidewalk and the vegetation, going all the way to the structure. The other three corners of the bridge have no fencing to prevent movement from the vegetated areas onto the roadway. Any fencing in this area will need to include accommodations for human recreational use.

Linkage 8 – 10

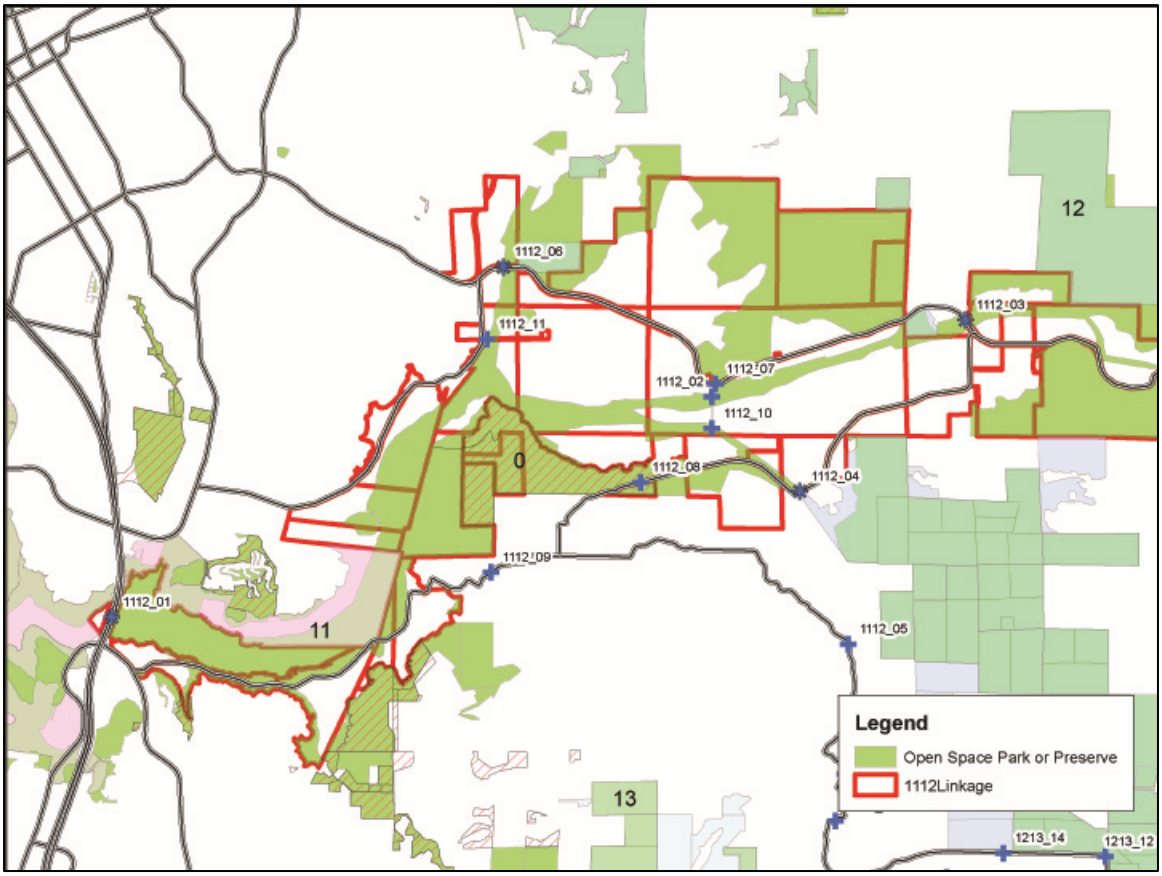
The Camino Ruiz bridge over McGonigle Canyon provides ample space for wildlife movement but has very limited vegetative cover directly under the bridge. While much of the lands both to the north and south of this bridge are identified as “undisturbed open

land", "valley and foothill grassland", or "non-native grassland", they visually look like the land has been plowed or under some level of agriculture.

Carmel Valley Road over McGonigle Canyon needs additional fencing and gates to properly separate the wildland areas from the roadway. The chain link fencing along the road side comes to within 2 meters of the bridge structure but is not tied into the bridge, leaving a gap. A self closing gate should be installed to allow continued human access to the area but reducing wildlife access to the road.

GIS, Conservation Designation, and Land Management Plans

Our understanding of the linkages within the reserve system would be improved by a thorough review of the available information. There are many properties that are identified as conserved that may hold little to no value to wildlife. These should be evaluated and a decision made as to whether or not we continue to include these in the reserve design. There are also many properties that are publicly held lands with "Open space park or preserve" status that are not included in the Conserved Lands files. Including these properties will help evaluate what is protected and what isn't. San Pasqual Valley is an example. There are many properties held by the City of San Diego or the County of San Diego (outlined in red in the map) where the land use is categorized as open space. If these lands can be identified and managed as conserved lands, the



linkage between Core Area 11 and Core Area 12 would appear more robust and easily identifiable.

Site Visits and Data Collection

The evaluations of the points and linkages presented here are based on available GIS and review of aerial imagery, field visits should be conducted to verify the conditions on the ground. Very few actual site visits were conducted during this portion of the project, with no formal data collection. This exercise focused on identifying points within each linkage that may be a potential barrier to wildlife movement between the core areas. Future efforts will include visiting selected points and collecting data.

Conclusion

Nine linkages within the San Diego conservation network were evaluated for their likelihood of connecting the core conserved lands for a subset of species. Five of the nine were estimated to be non-functional in their ability to allow wildlife to move successfully from one core habitat area to the next. In several cases, the limitations of the linkage fell on a single point or barrier along the route, making the entire route unlikely to function. Where possible, recommendations were made for changes that may improve the ability of wildlife to move through the county. The majority of recommendations included adding fencing to the roadways along the linkage to exclude wildlife from the road surface and to guide them towards appropriate crossing sites. For one corridor that was judged to be non-functional, an alternate path was suggested and land parcels were identified for purchase or management that should help to increase the ability of wildlife to cross the landscape. The recommendations presented here are not a guaranty to solve all of the connectivity issues for all of the focal species, but are possible considerations to improve the reserve network or protect wildlife from dangerous situations on roadways.

When and if modifications to the roadways are implemented to improve connectivity, there is also the potential that these actions can also include considerations for fire management. Many of the conserved areas within San Diego are divided by roads, often with vegetation coming right up to the road's edge. Roads and housing density have been shown to be highly correlated with fire ignition sources. If possible, the barriers intended to keep wildlife off the roads should also serve to prevent ignition sources from moving from the roads into the wildlands.

This evaluation of wildlife linkages across San Diego is on-going and expanding. The remainder of the linkages identified in the "MSCP Connectivity Strategic Plan" are scheduled to be assessed in the same manner as those considered here. In addition, field visits will be conducted to further evaluate the linkages described here.

Products

1. CBI 2003 – GIS layers
    a. File name: CBIPoints
    b. File format: ArcMap 10 - point shape file

    c. Description: digital reconstruction of all mapped points from the CBI 2003 report, including the "Regional Habitat Linkage Monitoring Location" points first described in Ogden 1996.
2. CBI 2003 – Report Database
    a. File name: CBI2003Report
    b. File format: MS Access 2003 database
    c. Description: digital version of the results from the CBI 2003 field survey effort in a relational database structure.
3. CBI 2003 - MSCP Linkage Description Log (Part A)
    a. File name: CBI_DataSheet
    b. File format: MS Excel 2003 spreadsheet
    c. Description: digital reconstruction of CBI 2003 field survey datasheets
4. CBI 2003 - Crook's Measurements for Carnivore Sampling Stations (Part B)
    a. File name: Crooks'Measurements
    b. File format: MS Excel 2003 spreadsheet
    c. Description: digital reconstruction of CBI 2003 field survey datasheets
5. USGS Linkage Evaluation – GIS layer
    a. File name: MSCP Linkage Evaluation
    b. File format: ArcMap 10 – point shape file
    c. Description: locations of potential barriers, constrictions, and under passes between the major core conserved wildlife areas within the MSCP in San Diego
6. USGS Linkage Evaluation – Report
    a. File name: MSCP Linkage Evaluation (### pages)
    b. File format: MS Word 2003 document
    c. Description: preliminary assessment of each point in the Linkage Evaluation

Appendix