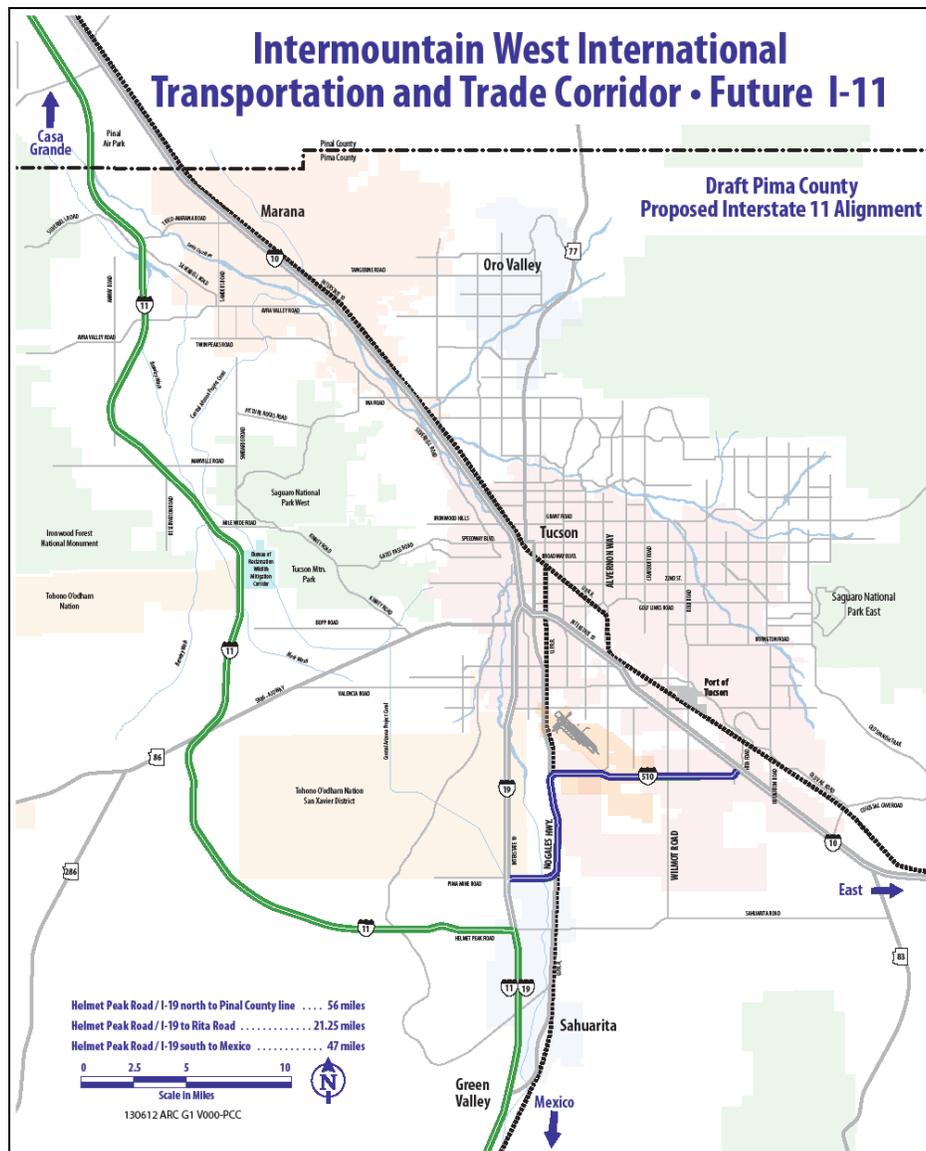


Intermountain West Corridor in Pima County

A Preliminary GIS-Based Roadway Alignment and Impact Study



Pima County Department of Transportation
June 21, 2013

Study Purpose and Background

The purpose of this alignment study and impact report is to develop and analyze an alternative roadway alignment for a theoretical new interstate route through Avra Valley that could connect to Interstate 10 in Pinal County and to Interstate 19 south of Tucson. Several local and state transportation plans and studies have suggested similar bypass routes, but no detailed analysis has ever been conducted. This report identifies a conceptual corridor and provides some initial quantitative evaluation of impacts based on existing GIS data and analysis. Much further study would be required to determine if such a route is feasible and if so, the full extent of impacts that could be expected. Future analysis would likely develop alternative alignments based on multiple criteria. The presented route is simply one alternative that may be used as a starting point for further evaluation.

Corridor Description

This corridor extends from the Pima/Pinal County line on the north to the Sahuarita Road interchange on Interstate 19 to the south as shown in Figure 1. The route is approximately 56 miles long and travels through Avra Valley, across State Route 86, and connects to I-19 south of the San Xavier District of the Tohono O'odham Nation.

This route was located to traverse undeveloped State Trust Lands and to avoid populated areas as much as possible. It avoids Ironwood National Forest, Saguaro National Park, the Tohono O'odham Nation, and the Town of Marana. Other considerations, such as cultural resources, wildlife habitat and floodplains for example, were analyzed briefly but were not used as the basis for this particular route. On the north, the corridor runs parallel to portions of Trico Road, Avra Valley Road, and Anway Road and it follows a portion of Sandario Road. To the south, the corridor runs parallel to Sierrita Mountain Road, then heads east across undeveloped state land before aligning with Helmet Peak Road and Interstate 19.

The 56-mile long corridor was analyzed with a 300 foot wide right-of-way, which is typical for an interstate facility. A formal roadway alignment study would typically define a wider corridor for planning purposes and to study impacts. Assuming a final right of way of 300 feet, the roadway corridor encompasses 2,035 acres of land. The entire corridor is within unincorporated Pima County, except the last 1,500 linear feet within the Town of Sahuarita along Helmet Peak Road. Engineering requirements, not considered in this analysis, would affect the length and right of way requirements.

Study Methodology

The 56-mile long corridor was mapped and analyzed very generally using the Pima County Geographic Information Systems (GIS), which provides numerous types of geographic spatial data. Several GIS data files were selected to identify basic types of impacts, such as land use and ownership as well as several environmental categories. No field studies were conducted and a full inventory and analysis of corridor conditions and impacts is not within the scope of this study and report. The resulting maps and summary data are presented in the remainder of the report. The following key statistics summarize the draft roadway corridor:

- 56 miles long, 300' wide right of way
- 2,035 acres of right of way required
- 179 parcels of land impacted
- All lands unincorporated, except 4 acres in the Town of Sahuarita
- 111 private parcels, 492 acres impacted

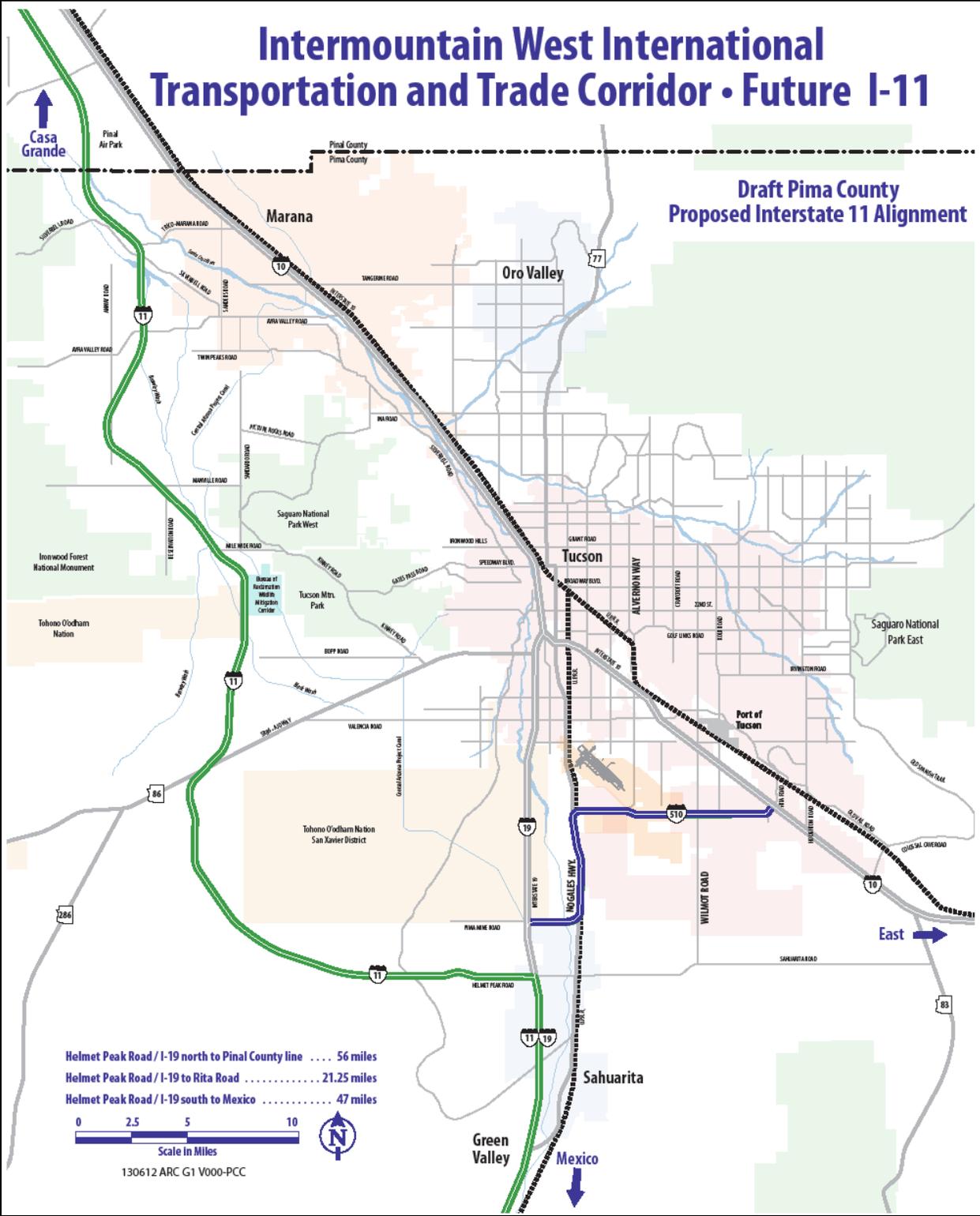


Figure 1: Draft Intermountain West Corridor Alignment

Right of Way Challenge

One of the most significant physical challenges to locating an interstate roadway facility through Avra Valley is the lack of available right of way in one key 2-mile section, adjacent to the Tohono O’odham Nation (Garcia Strip) and the Bureau of Reclamation (BOR) Wildlife Mitigation Corridor (Figure 2). The Garcia Strip is approximately 2.5 miles wide north to south and 13 miles long east to west and connects to the main Tohono O’odham Nation. The BOR Mitigation Corridor is a 4.25 square mile conservation area located adjacent to the Garcia Strip and east of Sandario Road. It was created by the BOR in 1990 as mitigation for environmental impacts caused by the Central Arizona Project (CAP) and it is managed by Pima County.

Sandario Road runs north-south between the Garcia Strip and the BOR Mitigation Corridor, but the existing roadway right of way is only 80 feet wide. The draft alignment is shown running along portions of Sandario Road, but additional right of way would be required for a typical 300-wide interstate right of way. One alternative is for either the T.O. Nation or the Bureau of Reclamation to provide additional right of way. Another concept is to elevate the roadway and use only the existing right of way for all piers and supporting infrastructure. In either case, maintaining the functionality of the wildlife corridor and support from the Nation, the Bureau of Reclamation, the City of Tucson, Arizona State Land Department, and other stakeholders would be required.

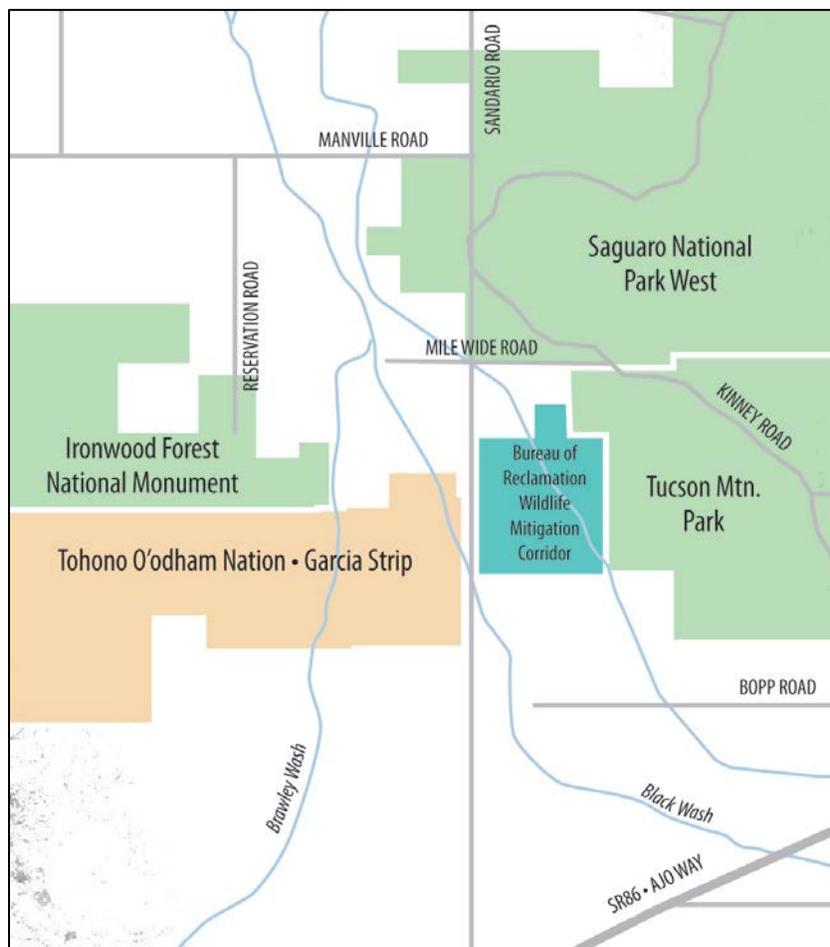


Figure 2. Garcia Strip and Wildlife Mitigation Corridor

Land Use Impacts

The roadway corridor impacts 179 parcels of land which range in size from a fraction of an acre up to 132 acres, but the average parcel size is 11 acres. The primary land use of these parcels (classified by the Pima County Assessor’s Office) is vacant (66%), followed by agricultural (15%), mining (6%), roadways (4%), commercial (4%), retired farm (3%), and residential (3%). Most of the 1,348 acres of impacted vacant land is State Trust Lands (61%) followed by federal and City of Tucson (13% each), private (10%) and Pima County (2%). A summary of land use and vacant land data is shown in Tables 1 and 2 below and on the accompanying Land Use maps at the end of this report.

Table 1: Land Use Impacted

Land Use	Parcels	Acres	Percent Acres
Vacant	90	1,348	66%
Agricultural	30	296	15%
Mining	6	116	6%
Commercial	2	82	4%
Roadways	NA	72	4%
Residential	47	67	3%
Retired Farm	3	54	3%
Total	179	2,035	100%

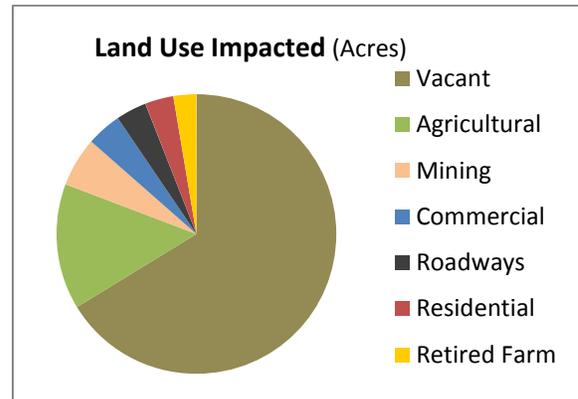
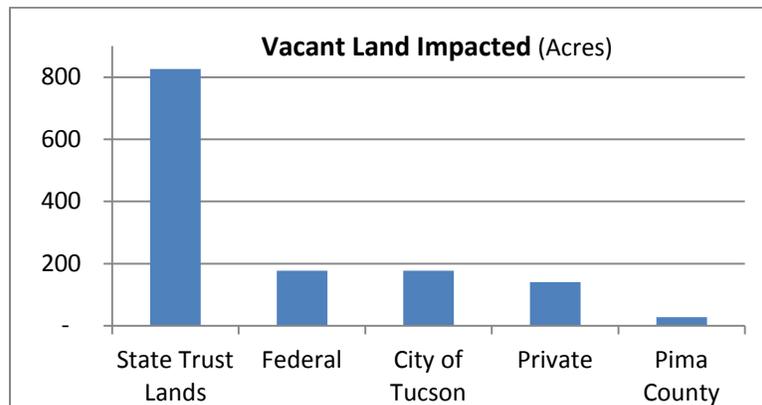


Table 2: Vacant Land Impacted

Land Use	Type	Parcels	Acres	Percent Acres
Vacant	State Trust Lands	30	826	61%
	Federal	11	177	13%
	City of Tucson	10	177	13%
	Private	36	140	10%
	Pima County	2	28	2%
	Commercial	1	0.2	<1%
TOTAL		90	1,348	100%

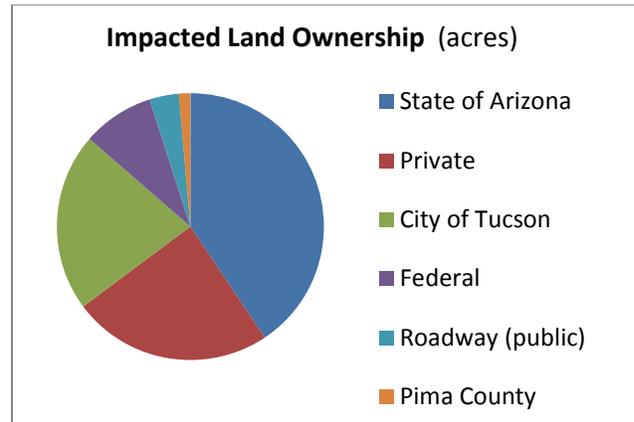


Land Ownership Impacts

The 179 parcels and 2,035 acres of land impacted by the roadway are primarily owned by the State of Arizona (41%) followed by private land holders (24%), City of Tucson (22%), federal (9%), and Pima County (2%). Existing roadways comprise 4% of the total. Land ownership is shown in Table 3 below and on the Land Ownership maps at the end of the report.

Table 3: Land Ownership Impacts

Parcels	Ownership	Acres	Percent
30	State of Arizona	826	41%
111	Private	492	24%
25	City of Tucson	440	22%
11	Federal	176	9%
NA	Roadway (public)	72	4%
2	Pima County	28	1%
179	TOTAL	2,035	100%



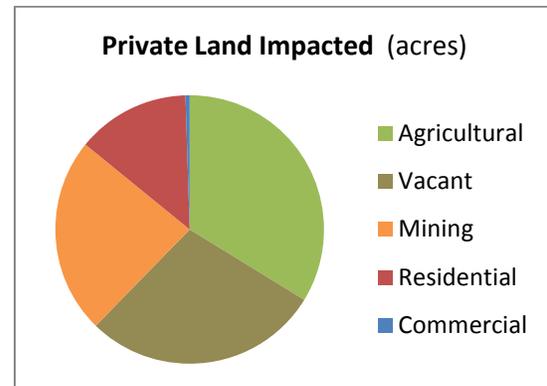
Private Land Impacts

Of the 111 parcels of private land totaling 492 acres, about one-third is agricultural use (34%), followed by vacant (28%), mining (24%) and residential (14%). There are many more small land parcels impacted than large land parcels, however the parcels larger than 10 acres in size comprise a higher amount of land (298 acres) than the numerous small parcels (198 acres). A summary of the private lands impacted are shown in Table 4 below.

Table 4: Private Land Ownership

Parcels	Land Use	Acres	Percent
19	Agricultural	166	34%
36	Vacant	140	28%
6	Mining	116	24%
47	Residential	67	14%
1	Commercial	2	1%
2	Other	0.2	<1%
111	TOTAL	492	100%

Parcel Size	Parcels	% Parcels	Acres	% Acres
< 10 acres	95	86%	194	39%
> 10 acres	16	14%	298	61%
TOTAL	111	100%	492	100%



Residential Impacts and Mitigation

As stated in the beginning of the report, avoiding residential areas was one of the primary considerations in locating this roadway. In fact, residential land use accounts for only 3% of the impacted lands. As shown in the Land Use Map included later in this report, the alignment avoids concentrations of residential areas (shown in blue) in northern and central Avra Valley and south of State Route 86. Where residential impacts are unavoidable are near the intersection of Mile Wide Road and Sandario Road because Sandario Road is the only route which avoids impacting the Tohono O’odham Nation (Garcia Strip). South of the Garcia Strip, the roadway also impacts residential areas west of Sandario Road. West of Interstate 19, the roadway also impacts several residential parcels located west of Mission Road generally along the Helmet Peak Road alignment.

According to GIS analysis, 47 residential parcels representing 67 acres of land are impacted by this alternative alignment, shown in Table 1 and Table 4 above. However, a visual survey of aerial photos suggests that this number could be smaller. If this alignment were selected, more detailed analysis and engineering studies would determine exactly which parcels would be impacted and which could be avoided. Some parcels would need to be purchased altogether and the owners relocated, while other owners could sell or dedicate a portion of their property to accommodate the roadway. Alternative alignments could increase or decrease the number of impacted residences.

Conservation Land System Impacts and Mitigation

Avra Valley includes a high percentage of biologically important conservation lands that are identified in the Sonoran Desert Conservation Plan (SDCP). These lands are associated with the Brawley and Black Washes and generally represent habitat that is valuable to the conservation of biological diversity based on numerous SDCP studies. The SDCP land categories include Special Species Management Areas, Biological Core Management Areas, Important Riparian Areas, Multiple-Use Management Areas and Agricultural Inholdings.

Because this route traverses Avra Valley, it is not surprising that most of the corridor (94%) impacts one or more categories of the Conservation Land System (CLS). The largest impacts are to the Multiple-Use Management Area (49%) followed by the Special Species Management Area (17%) Biological Core Management Area (17%), and Important Riparian Area (2%). As stated in the beginning of the report, conservation lands were not used as the primary consideration in locating this roadway. Adjustments to the route could reduce, but not eliminate, direct impacts to some of the more valuable conservation lands. As shown in Table 5, nearly 5,000 acres of other conservation lands would be necessary to mitigate for direct impacts to the CLS. Maps of Conservation Land System impacts are included at the end of this report.

Table 5: County Conservation Land System (CLS) Impacts

Conservation Land Category	Acres	Percent	Multiplier	Mitigation Acres
Multi-Use Management Area	1,003	49%	2	2,006
Special Species Management Area	347	17%	4	1,390
Biological Core Management Area	345	17%	4	1,382
Agricultural inholdings	170	8%	NA	0
Outside Conservation Land System	121	6%	NA	0
Important Riparian Area	47	2%	4	187
TOTAL	2,035	100%		4,964

City of Tucson Conservation Lands and Preserve Impacts

In addition to impacts to the Pima County Conservation Land System, the roadway alignment also impacts the City of Tucson's proposed Avra Valley Habitat Conservation Plan (AVHCP) permit area. The AVHCP permit area includes 22,000 acres of former agricultural lands in Avra Valley purchased by the City in the 1970s and 1980s for water rights. It is estimated that the roadway impacts 440 acres of proposed AVHCP lands. In fact, it appears that all the impacted City-owned land in Avra Valley is designated for the AVHCP. As stated earlier, avoiding conservation lands was not the primary consideration in locating this conceptual roadway. Further study could evaluate alignments that could reduce, but probably not eliminate, impacts to the City's AVHCP. A map of the Avra Valley Habitat Conservation Plan permit area is included at the end of this report.

Besides the County and City conservation land systems, the roadway alignment avoids most other designated preserve lands in Avra Valley and south of State Route 86. The roadway impacts three preserves: the BOR Wildlife Mitigation Corridor (62 acres), the Diamond Bell Ranch (44 acres), and a small Pima County floodplain preserve (8 acres). As discussed earlier in the report, this roadway alignment impacts the BOR Mitigation Corridor because of right of way constraints along Sandario Road. East of Sierrita Mountain Road, the corridor cuts through the Diamond Bell Ranch preserve to avoid the adjacent Diamond Bell Ranch subdivision. A map showing designated preserve lands is included at the end of this report.

Wildlife Corridor Impacts

The roadway alignment crosses through areas known for their importance to the movement of biological resources between the Tohono O'odham Nation, the Tucson Mountains, the Santa Cruz River, and across the Avra Valley. Within Avra Valley, these corridors follow the West Branch of the Brawley Wash, the Santa Cruz River basin, and broad areas of lowlands that connect the Tucson Mountains to the Ironwood National Monument and mountain ranges west and south of Avra Valley. The CAP canal has numerous land bridges, tunnels and other features to facilitate wildlife crossings. The BOR Mitigation Corridor was established specifically to enhance and facilitate wildlife movement. In some cases the roadway crosses wildlife corridors and in others it follows alongside the corridors. As stated earlier, the roadway follows a portion of Sandario Road which would impact the BOR Wildlife Mitigation Corridor. In total, approximately 389 acres of wildlife corridors are impacted, or 19% of the entire route. A map of wildlife linkages is included at the end of this report.

The principal environmental impact of the roadway would be to further isolate and fragment the Tucson Mountains from Avra Valley and adjacent mountain ranges. It is possible that adjustments to the route and other mitigation could reduce but not eliminate direct impacts to some of the wildlife corridors. Strategically-located wildlife crossing structures, tunnels, raised roadways and other features would be important components of wildlife mitigation for such a large-scale transportation project.

Floodplain Impacts

Avra Valley is characterized by many drainages and floodplains associated with the Brawley and Black Washes, which are braided and meander from State Route 86 north to the Pinal County line. The Santa Cruz River also runs northwest from Tucson and crosses Avra Valley at the county line. The draft alignment crosses through and runs alongside floodways several times from State Route 86 up to the Pinal County border. The west and east branches of the Brawley Wash, Black Wash, and the Santa Cruz

River are large washes with flows in excess of 10,000 cubic feet per second. These watercourses are distributary and have high potential for lateral migration and sediment mobility. As stated earlier, floodplain impacts were not the primary consideration in determining this alignment. Alternative routes could reduce floodplain impacts.

On the northern Pima County border, the roadway alignment crosses the broad riparian floodplain of the Santa Cruz River which is nearly ½ mile across. Moving southward, the corridor traverses current and former agricultural lands between the Santa Cruz River and Brawley Wash. South of Silverbell Road and just east of Trico Road, the alignment crosses the West Branch of Brawley Wash which is nearly ¼ mile wide. Further south, the roadway crosses the same wash again twice in the vicinity of Mile Wide Road. Continuing south, the corridor crosses the Black Wash on Sandario Road about 2.2 miles south of the intersection of San Joaquin Road. To the west of Sandario Road and north of State Route 86, the alignment again crosses large floodplains. A floodplain map is included at end of this report. Also included for historical reference is a map showing the aerial extent of flooding in 1962, the largest known flood and perhaps 10 times greater than any documented flood in Avra Valley.

Cultural Resource Impacts

Avra Valley is characterized by areas of high, medium and low cultural resource sensitivity associated with Hohokam culture and earlier inhabitants. Modeling suggests that about one-third of the draft alignment crosses areas of low sensitivity (39%), one-third crosses areas of high sensitivity (37%), and slightly lower than one-third crosses areas of moderate sensitivity (25%). Although only 326 acres of the roadway right of way has been surveyed, eight sites dating from the Pleistocene, Archaic, Hohokam, and historic periods are recorded. The alignment affects a total of 32 acres of known site areas. These sites include:

AZ AA:11:12(ASM) – Known as the “Hog Farm Site,” this extensive site is comprised of five settlement areas or loci characterized by dense concentrations of features and artifacts that represent the remains of a long-occupied Hohokam village (AD 750-1200) with a ball court, burial areas, trash mounds, pit houses, roasting pits, and other domestic features. More than 18 acres of this site would be directly impacted by this draft alignment.

AZ AA:11:2(ASM) -This site is recorded as a Sedentary Hohokam village on a low ridge near the Brawley Wash floodplain. There is a low trash mound which has a high density artifact scatter in the center. More than four acres of this site would be impacted by the road alignment.

AZ AA:16:305(ASM) - A total of about 100 artifacts are at this site, mostly stone flakes, a few sherds, and ground stone. Two rock features are exposed in the banks of the adjacent wash.

AZ AA:16:311(ASM) - A very large Hohokam site with four large loci linked by a light scatter of artifacts, this site contains extensive artifact concentrations, at least 8 roasting pits and 4 trash mounds, 2 rock cairns, a cleared area, possible ball court and other features. Thousands of artifacts are present. A fifth small locus seems to be an outlier to the site, linked by a faint trail, possibly prehistoric. Nearly 4 acres of this site would be impacted.

AZ AA:16:377(ASM) - State Route 86 is recorded as the Tucson-Ajo Highway on the 1929 State Highway map and follows the historic route shown on 1893 Roskruge Map of Pima County.

AZ AA:16:39(ASM) – “Werner Site” is a broad area of scattered lithics with some concentrated areas with charcoal stains and clusters of fire-cracked rocks. Ceramics are relatively rare. The cultural features were all on sheet wash-eroded surfaces near arroyos. Pleistocene mammoth and horse bones occur in strata exposed beneath the 1+ m thick, upper floodplain silt layer; but their contemporaneity with cultural materials is uncertain. Diagnostic projectile points are mostly Late Archaic styles, but some Pinto, Gypsum and Hohokam points are found. No Paleo-Indian spear points were seen. More than four acres of this site would be impacted.

AZ AA:16:473(ASM) – This is a small Hohokam artifact scatter near Brawley Wash comprised of a concentration of plain brown ceramics, a single piece of flaked stone and a ground hand stone. The site is interpreted as a limited activity area.

AZ DD:4:156(ASM) - This site is a resource processing site comprised of a light scatter of sherds, flakes, a ground stone fragment, and a pestle around two small granite bedrock outcrops that each contain mortars. The systematic sample of pottery from the site indicates Hohokam occupation during the Early or Middle Rincon sub-phase. The mortars suggest that the site was utilized for harvesting and processing wild resources such as the mesquite that is abundant in the area.

As mentioned in the beginning of the report, avoiding cultural resources was not the primary consideration in locating this conceptual roadway. Only 16 percent of the draft alignment has been surveyed, and a full survey would undoubtedly identify additional sites affected by the roadway. If an alignment was selected, a complete inventory survey would be conducted to determine which site locations would be impacted by the route and whether it would be possible to adjust the route to reduce these direct impacts. Maps showing cultural resource sensitivity areas are included at the end of the report, along with a map showing where previously recorded surveys have been conducted.

Tucson Water Recharge Facility Impacts

The City of Tucson uses several large water recharge facilities in central and southern Avra Valley to store and recover Colorado River water from the Central Arizona Project. The Central Avra Valley Storage and Recovery Project (CAVSARP) is located on City-owned land near Sandario Road and Mile Wide Road. The Southern Avra Valley Storage and Recovery Project (SAVSARP) will be constructed on former agricultural land near the intersection of Sandario Road and Snyder Hill Road.

This draft alignment avoids the CAVSARP water recharge basins, but it does intersect pipeline and production well infrastructure related to the recharge facilities. Figure 3, provided by Pima Association of Governments (PAG), shows the roadway corridor and Tucson Water facilities in the Avra Valley area.



Central Avra Valley Storage and Recovery Project

Tucson Water Recharge Facility Impacts (continued)

The roadway corridor intersects two Colorado River water delivery pipelines as it crosses the northern half of the CAVSARP facility. A recharge recovery pipeline parallels Sandario Road between the Tohono O’odham Nation and the Bureau of Reclamation Tucson Mitigation Corridor property, which is also parallel with the roadway corridor. As the route crosses the SAVSARP facility, it appears to intersect 2 to 3 potable production wells and the potable distribution line along Sandario Road. The roadway corridor may also intersect a proposed recharge recovery pipeline and a proposed Colorado River water delivery pipeline.

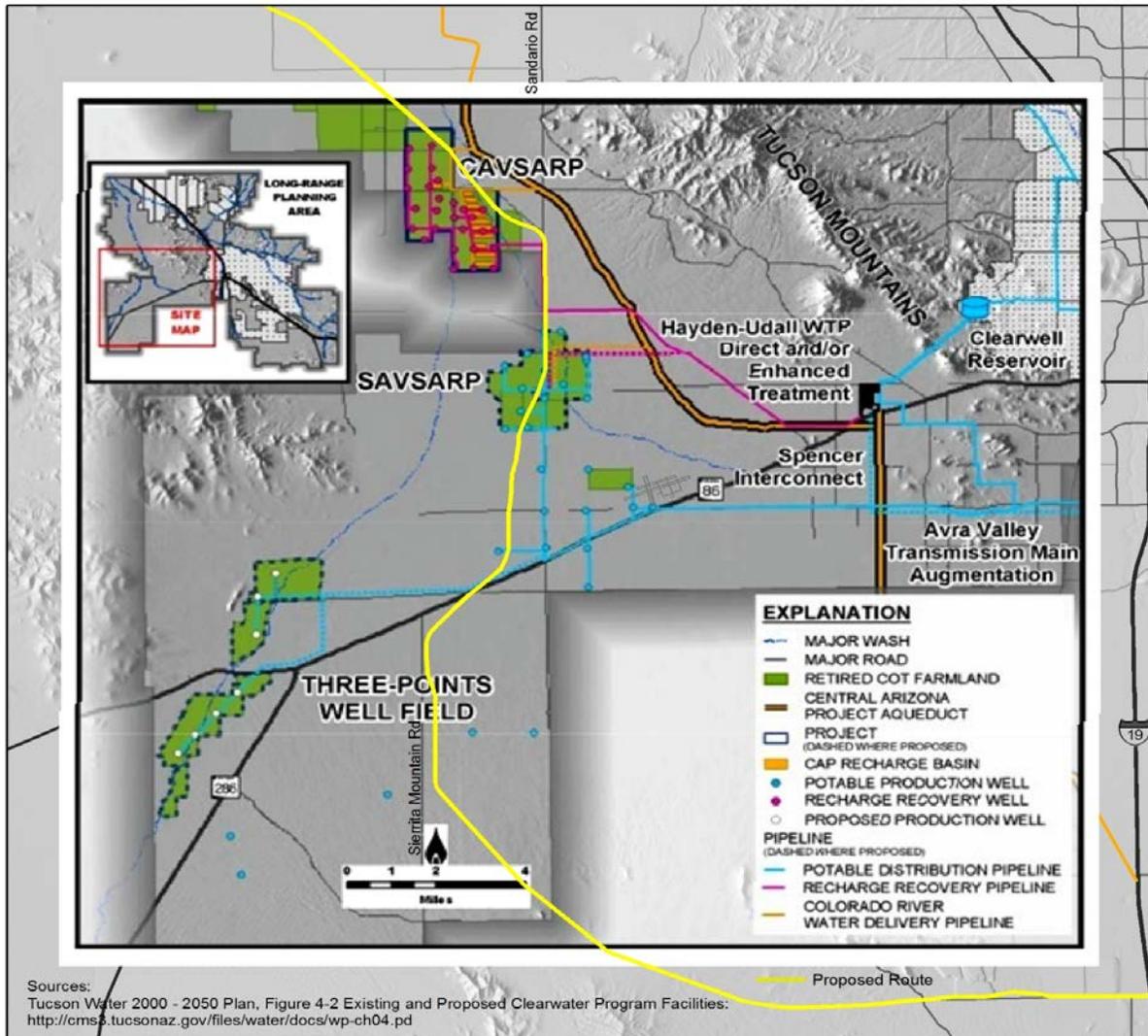


Figure 3: Tucson Water Infrastructure

Natural Gas Pipeline Impacts

The draft alignment crosses and runs parallel to two collocated underground natural gas pipelines 30" and 26" in diameter. These pipelines are a major connection for the region to the national natural gas distribution network and are operated by El Paso Natural Gas, now part of Kinder Morgan, Inc. These lines run northwesterly from Sandario Road to Trico Road, crossing Mile Wide, Manville, and Trico Roads. The alignment could be adjusted to avoid running directly above the collocated pipelines. The roadway crosses another natural gas pipeline in the vicinity of Trico Road and Trico Marana Road. Along State Route 86, the roadway crosses the proposed 36" diameter Kinder Morgan Sierrita pipeline which would serve Mexico. Figure 4, provided by Pima Association of Governments, shows the roadway corridor and natural gas facilities in the Avra Valley area.

Electrical Transmission Impacts

The draft alignment does not impact any known electrical transmission facilities, i.e. substations, but at three locations it crosses a transmission line that runs along Trico Road. The roadway avoids a sub-station facility located east of Trico Road and south of Marana Road. At several locations, the alignment also crosses a larger transmission line that connects a sub-station north of Ajo Way and west of Sierrita Mountain Road to another sub-station on Pima Mine Road east of I-19. Figure 4 shows the roadway corridor and known electrical transmission facilities.

Conclusion

This alignment study and impact report identifies and analyzes an alternative roadway alignment for a theoretical new interstate route through Avra Valley that could connect to Interstate 10 in Pinal County and to Interstate 19 south of Tucson. Preliminary analysis of the route and impacts based on existing GIS data are presented. One of the key challenges to this route is the lack of available right of way along Sandario Road between the Tohono O'odham Nation (Garcia Strip) and the Bureau of Reclamation Wildlife Mitigation Corridor. Environmental impacts in general are a key challenge given that the route intersects designated and proposed conservation lands. In addition to support from the Nation and Bureau of Reclamation, this roadway would also require the support of the City of Tucson, Arizona State Land Department, and other local, regional, and federal agencies and stakeholders.

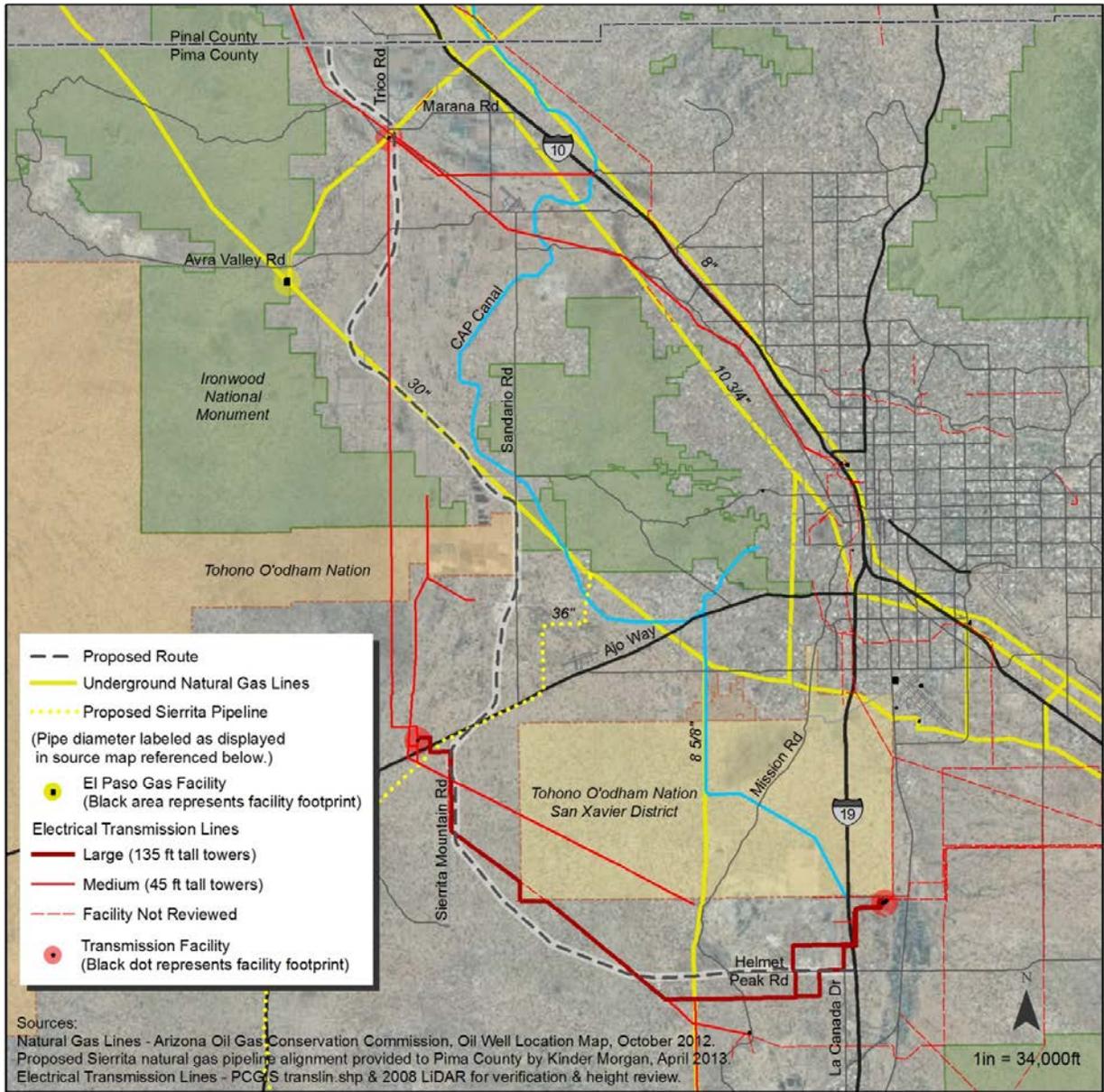


Figure 4: Natural Gas and Electrical Transmission Facilities