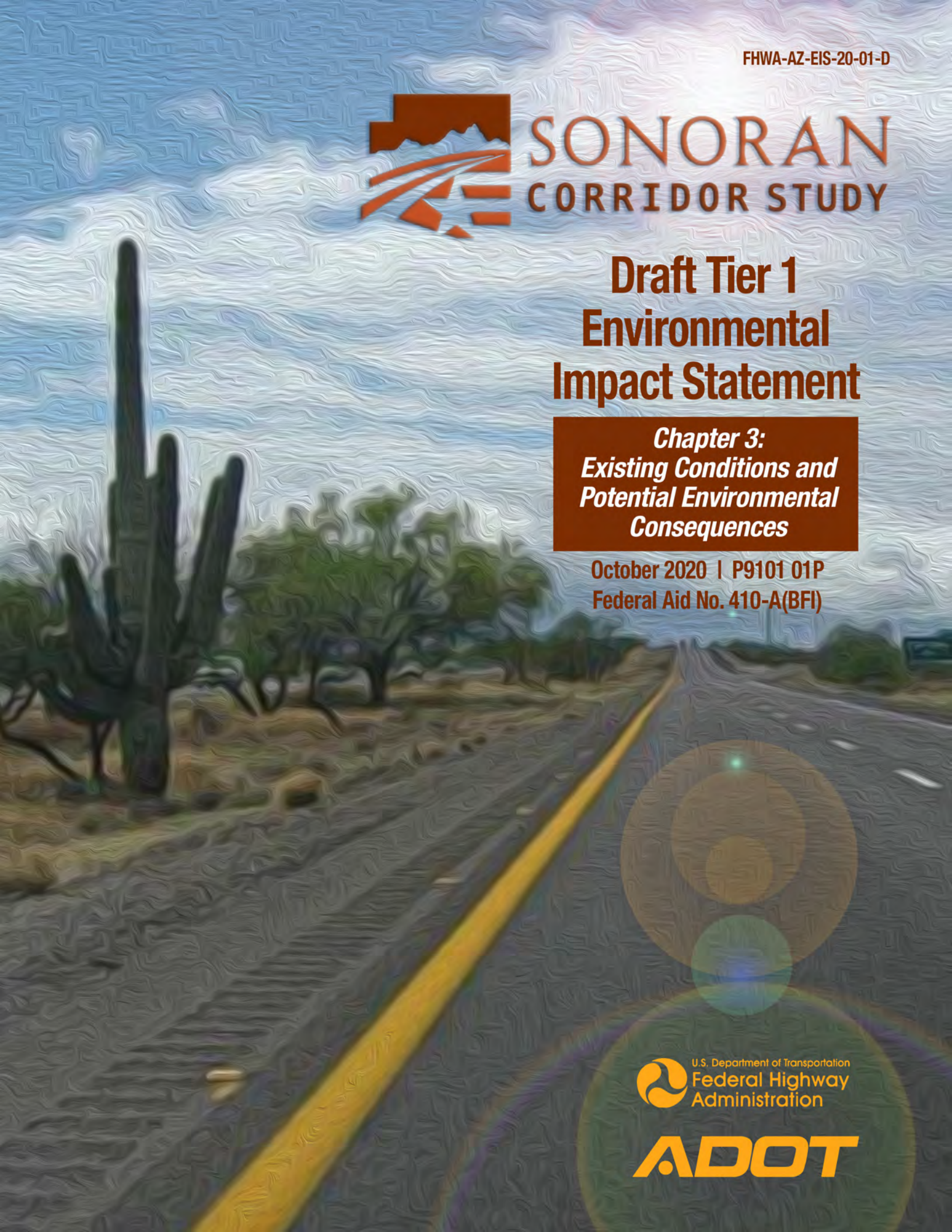
FHWA-AZ-EIS-20-01-D

SONORAN CORRIDOR STUDY

Draft Tier 1 Environmental Impact Statement

Chapter 3: Existing Conditions and Potential Environmental Consequences

October 2020 | P9101 01P
Federal Aid No. 410-A(BFI)



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SONORAN CORRIDOR STUDY

Sonoran Corridor

Pima County, Arizona

Draft Tier 1 Environmental Impact Statement

Project No. P9101 01P / Federal Aid No. 410-A(BFI)
Submitted pursuant to 42 U.S.C. § 4332(2)(c), 49 U.S.C. § 303, and 33 U.S.C. § 1251

By the

FEDERAL HIGHWAY ADMINISTRATION

and

ARIZONA DEPARTMENT OF TRANSPORTATION

With the following Cooperating Agencies

FEDERAL AVIATION ADMINISTRATION

US ARMY CORPS OF ENGINEERS

US BUREAU OF RECLAMATON

US ENVIRONMENTAL PROTECTION AGENCY

ARIZONA GAME AND FISH DEPARTMENT

John S. Halikowski, Director
Arizona Department of Transportation

October 27, 2020
Date of Approval

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Federal Highway Administration, Arizona

October 27, 2020
Date of Approval

ADOT

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Federal Highway Administration

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SONORAN CORRIDOR STUDY

ABSTRACT

This Draft Tier 1 Environmental Impact Statement (Draft Tier 1 EIS) evaluates alternatives for the Sonoran Corridor located in Pima County, Arizona. The purpose of this study for the Sonoran Corridor is to identify a high-priority, high-capacity, access-controlled transportation corridor south of the Tucson International Airport that will improve access to high growth areas and existing activities; improve future traffic levels of service by reducing congestion levels anticipated by 2045; and provide a system linkage for regional, interstate, and international mobility needed for the study area. The Draft Tier 1 EIS evaluates a Reasonable Range of Corridors, which includes three corridor alternatives and the No-Build Alternative to characterize the potential effects of each on the social, economic, and natural environment. The No-Build Alternative represents the existing transportation system, with committed improvement projects that are programmed for funding.

The objective of this Draft Tier 1 EIS is to provide sufficient information for the public, agencies, and Tribes to comment on the overall analysis used to identify the Preferred Alternative for the Sonoran Corridor. Based on the analysis presented in this Draft Tier 1 EIS, Corridor Alternative 7 has been identified as the Preferred Alternative. After consideration of public and stakeholder input received during the Draft Tier 1 EIS public comment period, the Federal Highway Administration (FHWA) and Arizona Department of Transportation (ADOT) will identify a Selected Alternative in the Final Tier 1 EIS. The Record of Decision (ROD) will describe the basis for the decision, and provide strategies to avoid or minimize environmental impacts.

The FHWA will issue a single document that consists of the Final Tier 1 EIS and ROD pursuant to 49 U.S.C. 304a(b) and 23 U.S.C. 139(n)(2) unless FHWA determines that statutory criteria or practicability considerations preclude issuance of such a combined document. Should a corridor alternative be selected, further project design would take place, allowing more specific analysis of potential environmental impacts to be documented through a Tier 2 NEPA study.

Title VI of the Civil Rights Act of 1964 and the Americans with Disabilities Act

Pursuant to Title VI of the Civil Rights Act of 1964, the Americans with Disabilities Act (ADA), and other nondiscrimination laws and authorities, ADOT does not discriminate on the basis of race, color, national origin, sex, age, or disability. Persons that require a reasonable accommodation based on language or disability should contact Joanna Bradley, ADOT Community Relations Project Manager, at 520.388.4200 or JBradley@azdot.gov. Requests should be made as early as possible to ensure the State has an opportunity to address the accommodation.

De acuerdo con el Título VI de la Ley de Derechos Civiles de 1964, la Ley de Estadounidenses con Discapacidades (ADA por sus siglas en inglés) y otras normas y leyes antidiscriminatorias, el Departamento de Transporte de Arizona (ADOT) no discrimina por motivos de raza, color, origen nacional, sexo, edad o discapacidad. Las personas que requieran asistencia (dentro de lo razonable) ya sea por el idioma o discapacidad deben ponerse en contacto con la Joanna Bradley al 520.388.4200 o JBradley@azdot.gov. Las solicitudes deben hacerse lo más antes posible para asegurar que el Estado tenga la oportunidad de hacer los arreglos necesarios.

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Draft Tier 1 EIS Public Comment Period

ADOT, in conjunction with the FHWA, have made the Draft Tier 1 EIS available for public review and comment. The Draft Tier 1 EIS was published in the Federal Register on November 6, 2020. Submit your comments on the Sonoran Corridor Draft Tier 1 EIS during the public review and comment period: November 6, 2020 through January 8, 2021. All comments received during the comment period will be documented and responded to in a combined Final Tier 1 EIS/ROD. All comment methods listed below are considered equal. After reading the Draft Tier 1 EIS, please provide specific written or spoken comments on its contents.

Comments can be provided in the following manner:

- During the public hearing or virtual public engagement event
- Online: https://azdot.gov/planning/transportation-studies/sonoran-corridor-tier-1-environmental-impact-statement/documents
- Phone: 1.855.712.8530 (bilingual)
- Mail: Sonoran Corridor Tier 1 EIS Study Team
  c/o Joanna Bradley
  1221 S. Second Avenue, MD T100
  Tucson, AZ 85713
- Email: Projects@azdot.gov

The Draft Tier 1 EIS is available at https://azdot.gov/planning/transportation-studies/sonoran-corridor-tier-1-environmental-impact-statement/documents, and for review only and at no charge at the following locations:

Repositories for the Public Review of the Draft Tier 1 EIS

- ADOT Southcentral District Office, 1221 S. Second Ave., Tucson, AZ 85713, by appointment only between 8 a.m. and 5 p.m. weekdays. Call 520.235.3494 to make an appointment. Call at least 48 hours in advance to view the document. Only one person at a time will be granted access to the document. Please wear a mask and gloves to your appointment.
- Sahuarita Town Hall, Clerk's Office, 375 W. Sahuarita Way, Sahuarita, AZ, 520.822.8801 between 8 a.m. and 5 p.m. weekdays.
- Joyner-Green Valley Library, 601 N. La Canada Dr., Green Valley, AZ, 85614, 520.594.5295.
- Joel D. Valdez Main Library, 101 N. Stone Ave., Tucson AZ, 85701, 520.594.5564.

Vendor Locations for Purchase of the Draft Tier 1 EIS

- Hard copy versions of the Draft Tier 1 EIS are available for purchase and pick up at The UPS Store, 2004 E. Irvington Road, Tucson, AZ 85714, 520.889.0077. Contact the store for cost and details.
- A hard copy version can be ordered online at www.FedEx.com, with delivery at requestor's expense.

Public Hearing and Virtual Public Engagement events on the Draft Tier 1 EIS

A Public Hearing will be held to provide project information and accept formal comments on the Draft Tier 1 EIS. Date and location of the Public Hearing is provided below. Because of public health concerns and government requirements, attendance will be limited to provide for adequate social distancing. Participants must pre-register to reserve time to attend the Public Hearing in person. Please sign up at https://tinyurl.com/SonCor or call (520) 327-6077 (bilingual) to reserve a time slot to attend the Public Hearing event.

- ***PUBLIC HEARING***
  - **Tuesday, December 1, 2020**, 5p.m.–8 p.m.
    DoubleTree Suites – Tucson International Airport
    Ballroom Royale
    7051 South Tucson Boulevard
    Tucson, AZ 85756

In addition, you can participate in the Virtual Public Engagement event either online or by phone. The Virtual Public Engagement event supplements the Public Hearing, and it provides another opportunity for you to give official, recorded comments on the Draft Tier 1 EIS. To participate in the Virtual Public Engagement event, click on the online access link or call the phone access number provided below.

- ***VIRTUAL PUBLIC ENGAGEMENT EVENT***

  Thursday, December 3, 2020, 5p.m. – 8p.m.

  - **Online Access:** bit.ly/SCEIS2020 (or you can use the full webex link: https://meethdr.webex.com/meethdr/onstage/g.php?MTID=e755bc109da6c91bac638939e717a2837)
    - Meeting Number (Access code): 146 242 8979
    - Event Password**:** SCEIS2020
  - **Phone Access:** 1 (408) 418-9388
    - Meeting Number (Access code): 146 242 8979

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3 EXISTING CONDITIONS AND POTENTIAL ENVIRONMENTAL CONSEQUENCES

The Draft Tier 1 analysis identifies and compares the potential impacts of the corridor alternatives and the No-Build Alternative, as described in Chapter 2, *Alternatives Development*. The corridor alternatives have several common features. Each corridor alternative is a 2,000-foot-wide corridor within which a future Tier 2 alignment could be located. The assumed typical cross-section for the future alignment in future Tier 2 analyses would be approximately 400 feet wide. The specific alignment and width of the highway facility would be refined as part of the Tier 2 analyses. The analysis applied in Tier 1 is sufficient to compare corridor alternatives in Tier 1, and the flexibility within any given corridor would allow the development of alignments during future Tier 2 analyses.

The level of analysis for the Draft Tier 1 EIS is qualitative and programmatic, reflecting the broad definition of the corridor for the Draft Tier 1 EIS. The analysis relies on readily available data, mapped information from resource and regulatory agencies, previously completed environmental studies, measurement and modeling of traffic noise, aerial imagery, and public input.

Based on early coordination, scoping, and a review of the study area, the proposed project would have no impact on wild and scenic rivers, outstanding waters, wilderness areas, national natural landmarks, scenic roads and parkways, and coastal zones or barriers, because these resources do not exist in the study area.

3.1 Corridor Alternatives

The three Sonoran Corridor alternatives consist of five discrete longitudinal segments, two of which are common to two or all three corridor alternatives. To reduce repetition of text describing existing conditions and potential environmental consequences along the corridor alternatives, the corridor descriptions are broken down into five segments, which are described below:

- **Segment 1**—From the proposed El Toro South terminus on I-19, proceeds east and then north to its common endpoint with Segment 2. Segment 1 is common to Corridor Alternatives 7 and 8A.
- **Segment 2**—From the proposed SXD terminus on I-19, proceeds generally east carrying Corridor Alternative 1 to its common endpoint with Segment 1. Segment 2 is unique to Corridor Alternative 1.
- **Segment 3**—From the junction of Segments 1 and 2, proceeds north along the Alvernon Way alignment to the point where Corridor Alternative 8A turns east. Segment 3 is common to all three corridor alternatives.
- **Segment 4**—From the northern endpoint of Segment 3, proceeds east carrying Corridor Alternative 8A to its terminus on I-10 at Houghton Road. Segment 4 is unique to Corridor Alternative 8A.
- **Segment 5**—From the northern endpoint of Segment 3, proceeds north and then east along Old Vail Connection Road to its terminus on I-10 at Rita Road. Segment 5 is common to Corridor Alternatives 1 and 7.

A written narrative of existing conditions within each segment for a given environmental resource category is only presented once. As subsequent corridor alternatives are documented, descriptions of common segments already described are referenced. For example, in describing existing conditions/ potential environmental consequences for Corridor Alternative 7, Segment 1 is described, while for Segments 3 and 5 (the other two segments in Corridor Alternative 7), the descriptive text is reduced to "see description under Corridor Alternative 1," or similar. Table 3-1 and Figure 3-1 illustrate which segments are included in each corridor alternative.

Table 3-1. Corridor Segments by Alternative

CORRIDOR SEGMENT NUMBER	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
1		X	X
2	X		
3	X	X	X
4			X
5	X	X	

Figure 3-1. Corridor Analysis Segments

3.2 Land Use and Jurisdiction

This section describes the existing and future (planned) land use, land use plans and policies, and any special designated lands within the study area. The study area encompasses portions of the City of Tucson, the Town of Sahuarita, the SXD, and unincorporated areas of Pima County (Figure 3-2).

3.2.1 Regulatory Setting

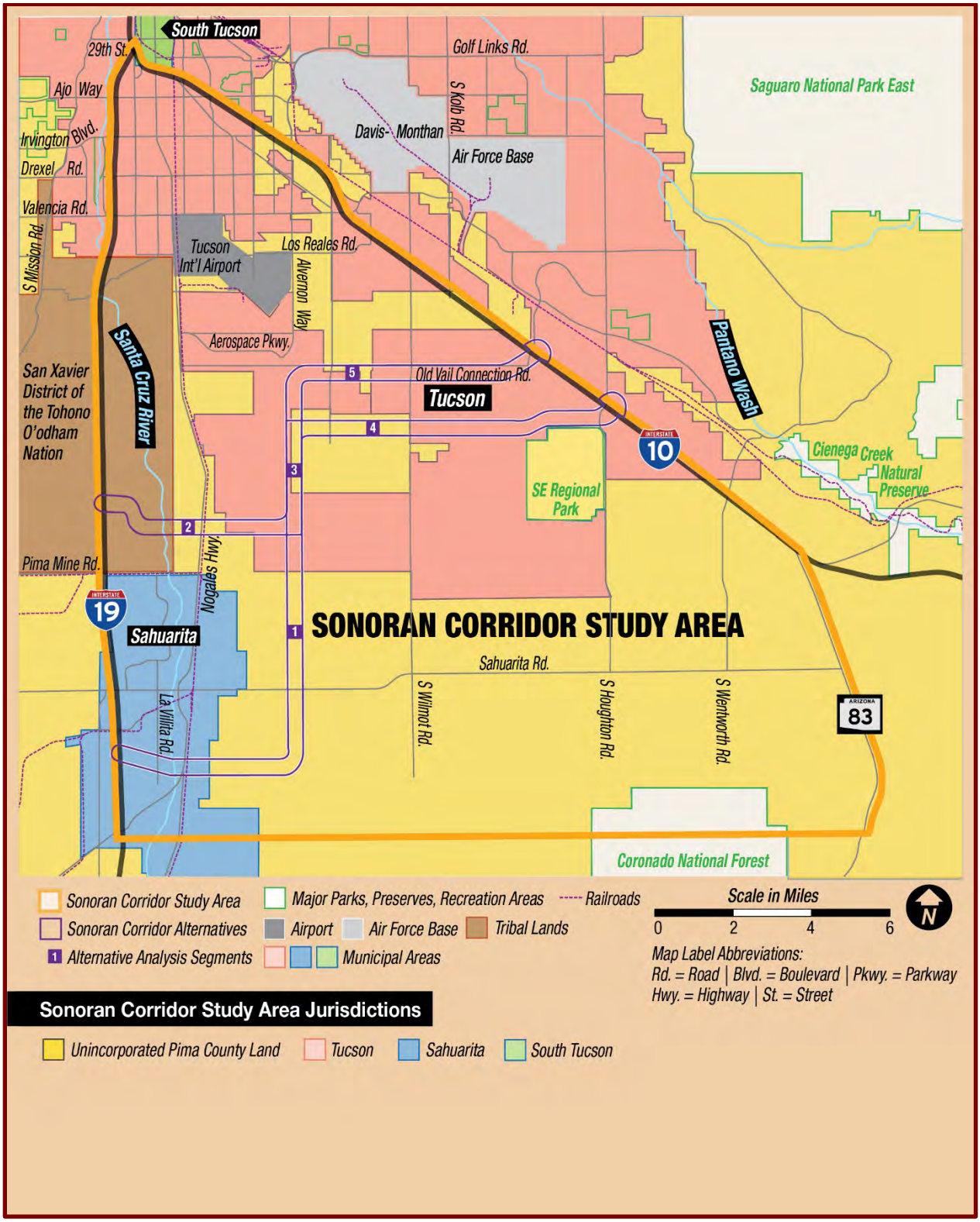
Arizona state law requires that communities update their general or comprehensive plan every 10 years (Arizona Revised Statutes 9-461.05 for incorporated municipalities; Arizona Revised Statutes 11-804 for counties). These plans establish a long-range blueprint and goals and policies to guide future growth and development, mapping a future envisioned 20 or more years ahead. The Arizona Growing Smarter/ Growing Smarter Plus state legislation outlines the statutory requirements of general and comprehensive plan documents. These requirements are based on population size and whether the jurisdiction is an incorporated municipality or county, dictating a minimum series of elements. An element is a specific section of the plan that discusses a particular planning topic, such as land use, transportation, housing, economic development, energy, and public services. All plans must present existing and planned land uses and transportation strategies as well as related regulations.

Cities and towns regulate land planning within the municipal planning area, while counties are responsible for planning in the unincorporated areas. While both lay out circulation plans for their jurisdictions, Metropolitan Planning Organizations (MPO) such as PAG lead multimodal transportation planning throughout urbanized areas, in collaboration with their member agencies, which typically include all cities, towns, counties, airport authorities, and Tribal governments within the planning area.

This section of the Draft Tier 1 EIS documents existing and planned land uses from available data and information provided by local governments. No formal local land use approvals would occur as the result of this Tier 1 EIS. The requirements for subsequent Tier 2 evaluations, including compliance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (URA), are described further in the applicable Available Mitigation Measures sections later in Chapter 3.

From a land management perspective, each agency has varying laws and regulations governing use, management, land disposal, and protection of character and values. The potential direct impact to these lands will be discussed, as will the potential acres of land conversion under each of the corridor alternatives. However, in this Tier 1 study, these conversion impacts should be viewed as high-level estimates rather than detailed calculations. As required, ADOT will pursue coordination and mitigation activities, such as development of memoranda of understanding, programmatic agreements, and updates to resource management plans with individual agencies when a specific alignment is developed in Tier 2 studies. See Chapter 5, Preferred Alternative, for further discussion of mitigation strategies.

Figure 3-2. Study Area Jurisdictions



3.2.2 Methodology

The planning process for the Draft Tier 1 EIS documents land use considerations at a programmatic level (qualitative) with respect to the impacts of a new high-capacity transportation corridor on existing and future land uses within the three corridor alternatives as well as the No-Build Alternative. The study corridor analyzed for land use impacts is the 2,000-foot-swath of land for each corridor alternative.

The adopted general or comprehensive plans within each jurisdiction, and TAA Master plan, as well as meetings with the SXD were used as sources of information. Local plans and ordinances, along with private development plans, were consulted to establish the affected environment, potential environmental consequences, and proposed mitigation measures. Land use trends, goals, and objectives of relevant city, county, and regional plans were reviewed to determine if construction of the Sonoran Corridor would be consistent with these jurisdictions' and recognized subdivisions' applicable goals and policies. Potential impacts to special land management designations were also reviewed. Another source of information was PAG for its land use projections, various websites, and meetings with agency staff. Geographic information system (GIS) software was used to pinpoint land uses and land ownership in the study area and to measure the acreage of various land uses. Field verification was undertaken as needed to understand existing land uses.

Land use planning is an ongoing activity. Therefore, information related to land use topics in the Draft Tier 1 EIS will be updated during Tier 2 studies to provide the most up-to-date information.

From a land management perspective, underlying land ownership patterns were analyzed for their potential impacts to federally and state-managed lands, in addition to related legislation or planning documents that might guide future development opportunities.

3.2.3 Affected Environment

The following sections provide summary-level findings.

3.2.3.1 Land Use Plans and Policy

Land use elements vary among the study area jurisdictions' general and comprehensive plans. The study area encompasses portions of the planning areas of Sahuarita, Tucson, and Pima County, as well as the TAA and the SXD. TAA is recognized as a legal independent entity within the State of Arizona and is vested with all rights, privileges, and benefits, and entitled to the immunities and exemptions granted municipalities. It has a master plan document similar in nature to a comprehensive plan that includes goals and objectives focused on land use, implementation, forecasting needs, transportation, and the environment, and as such has been included.

Typically, land use goals relate to growth and development that takes advantage of transportation infrastructure while creating appropriate transitions between urban and rural land use as well as being responsive to the physical environment. The transportation elements include goals related to improving circulation and reducing congestion, enhancing public transit, and creating alternatives to automobile transportation for localized travel. Economic development and growth respond to transportation patterns, with other land uses planned in a compatible manner. For example, it is

common for jurisdictions to plan major employment centers along high-capacity highways, with industrial growth anticipated near freeways, rail lines, and airports.

Pima County's comprehensive plan, *Pima Prospers*, contains multiple goals and policies relating to the implementation of the Sonoran Corridor. PAG discusses the Sonoran Corridor's role in future transportation planning in the RMAP. The Town of Sahuarita's general plan, *Aspire 2035*, also recognizes the Sonoran Corridor. These goals, policies and discussions are not based on this Tier 1 EIS study but a 2015 Pima County study for the Sonoran Corridor. Pima County, PAG and the Town of Sahuarita recognize that the study area is likely to see increased development regardless of the construction of a Sonoran Corridor. This is due, in part, to the growth of renewable energy projects and permanent jobs associated with the aerospace, defense and logistics industries in the study area, particularly around TUS and the UA Tech Park. These fields typically necessitate high capacity vehicular infrastructure or risk overburdening existing and planned roadway capacities. The inclusion of the Sonoran Corridor in long-range planning documents is a direct response to the continued growth anticipated in these industries.

In these scenarios, transportation-compatible land uses are planned in the vicinity of expected transportation corridors, and such land uses will provide a built environment that is well suited for a new high-capacity transportation corridor.

Existing Land Use

The following narrative summarizes existing land use patterns, as shown on Figure 3-3.

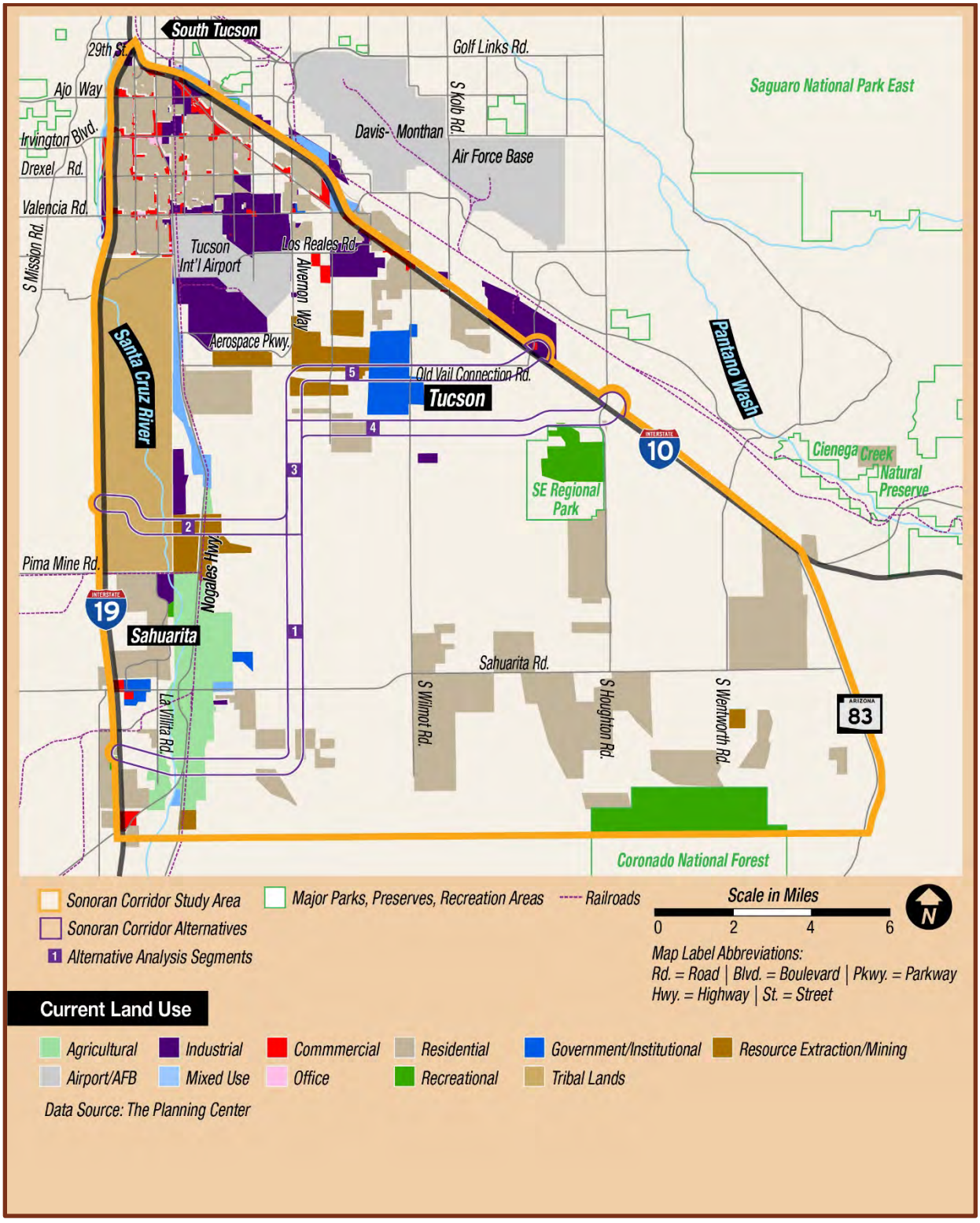
The illustrated land uses reflect categorizations in municipal and county general and comprehensive plans. They do not always reflect underlying land *management* patterns, which will be discussed further in the next section. Therefore, some areas that are *managed* as open space or recreation areas may not be shown as such on Figure 3-3.

Land uses within the study area are primarily categorized as agricultural, existing residential, or undeveloped, with pockets of industrial and commercial at the Rita Road TI. A cluster of resource extraction/mining activities exists along the Old Vail Connection Road ROW south of TUS. In Sahuarita, the existing uses are primarily residential and agricultural. Most of the residential areas are low-density and can be found in small clusters with varying numbers of residences. The clusters are located within Sahuarita and unincorporated Pima County; however, most of unincorporated Pima County within the study area is undeveloped land.

Planned Land Use

Planned land uses in the study area reflect the 20-year future land use scenario envisioned in municipal and county general and comprehensive plans. Future land uses are speculative, and development patterns can quickly change to respond to new opportunities and constraints, such as a new transportation corridor, changing demographics, or the attraction of a major employer. Additionally, planned land uses are the best vision of a comprehensive coordinated development pattern. However, that does not guarantee that uses would be developed precisely as planned or within the time period envisioned. Furthermore, new residential development in any of the state's five Active Management Areas (including Pima County, within which the Sonoran Corridor study area is located) must demonstrate a 100-year water supply under the Arizona Department of Water Resources' Assured Water Supply Program.

Figure 3-3. Current Land Use



The following narrative summarizes the land uses planned in current general and comprehensive plans. The *2014 Tucson International Airport (TUS) Master Plan Update* is discussed as well. Planned land uses are shown on Figure 3-4. Noted land use features are labeled for context. See Section 3.2.4, Environmental Consequences, which discusses the land use implications for each of the corridor alternatives in more detail.

The land within the study area has not been significantly planned by the City of Tucson, Town of Sahuarita, SXD, or Pima County. The Town of Sahuarita has engaged in a long-range planning effort within its planning area, the Southeast Conceptual Area Plan (SECAP), which is considered a Special Planning Area within *Aspire 2035*, the Sahuarita General Plan. The entirety of SECAP is located outside of the Town of Sahuarita limits in unincorporated Pima County, including State Trust and BLM land. Special Planning Areas do not carry traditional land use designations (e.g., commercial, industrial, residential) and therefore do not require major general plan amendments prior to rezoning for highest and best use of the land. Specific plan zoning to promote master planning of large areas is also encouraged. Pima County acknowledged Sahuarita's SECAP planning effort by designating it a Planned Development Community in *Pima Prospers*, Pima County's Comprehensive Plan. A significant portion of the land adjacent to Sahuarita and in the south central portion of the study area is within the SECAP and will likely be master planned. Higher-density residential growth is generally anticipated within the jurisdictional boundaries of Sahuarita in the southwestern portion of the study area.

The Verano Specific Plan, considered a Planned Development Community by Pima County, is in the central portion of the study area, generally south of TUS. Planned Development Communities typically develop as a mix of uses that include varying residential densities with commercial centers located at major intersections, but much of the southern portion of this Planned Development Community is developing as a large-scale solar array. Industrial uses are planned around TUS and in the northeastern portion of the study area.

TUS actively plans their property with the intent of utilizing land assets for enhanced revenue generation and community economic development, while securing its aviation programming needs and supporting aeronautical activity. Both the "Near Term Development Scenario" and the "Long Term Development Scenario" envision the land south of TUS and in the northeastern portion of the study area as industrial property. Additional commercial nodes are envisioned where planned roadways intersect.

Master Planned Communities

In addition to the previously mentioned Verano Specific Plan, Rancho Sahuarita and Sahuarita Farms are large-scale master planned communities within the study area and represent a primary cluster of new anticipated growth. Rancho Sahuarita and Sahuarita Farms are within the Town of Sahuarita. Communities of these sizes may take 25 to 30 or more years to buildout, spanning multiple economic cycles. Sahuarita Farms has not started developing, while Rancho Sahuarita is developing as planned. A generalized map of the master planned community locations is shown on Figure 3-5. Note that locations are approximate and do not illustrate parcel boundaries.

Figure 3-4. Planned Land Use

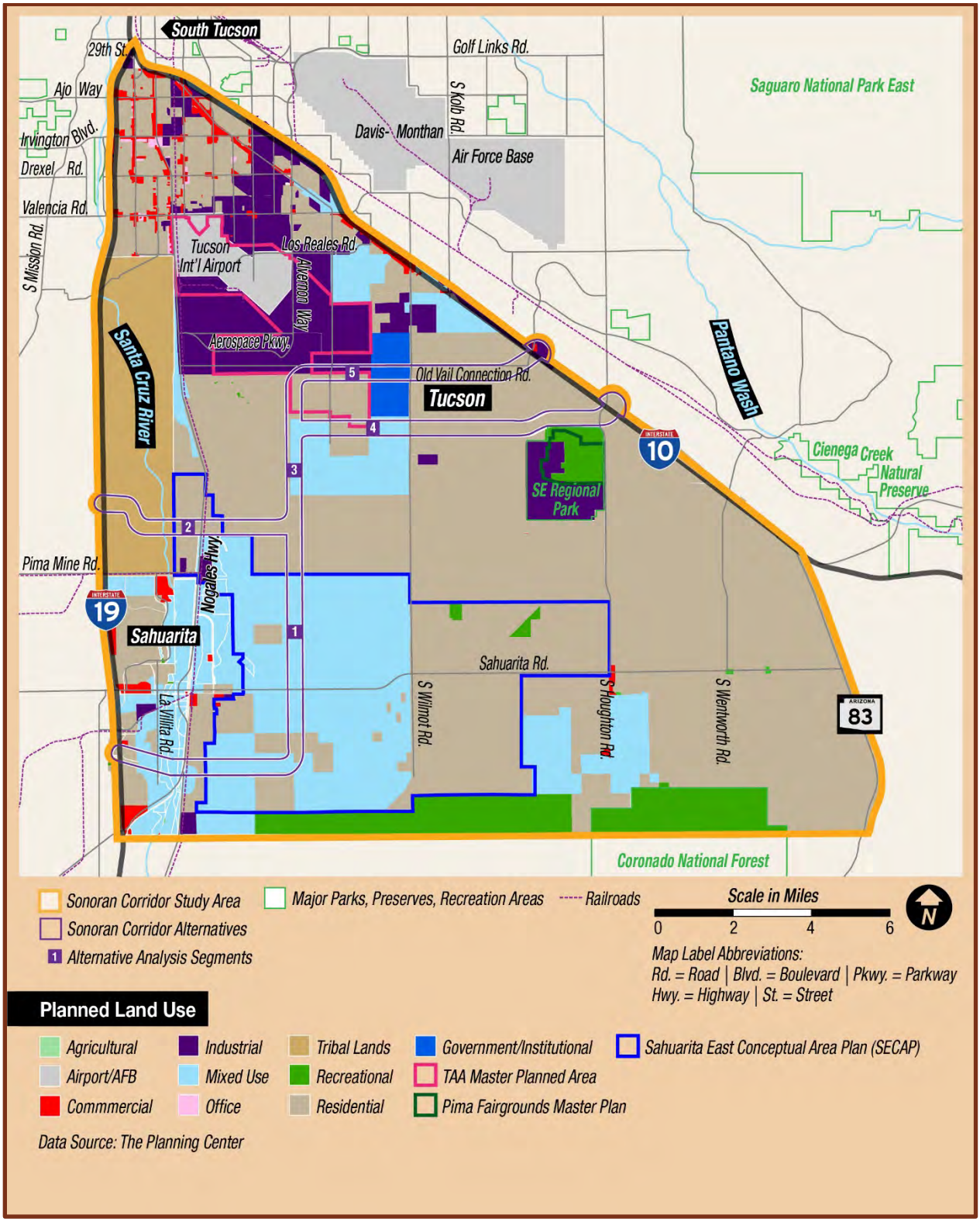
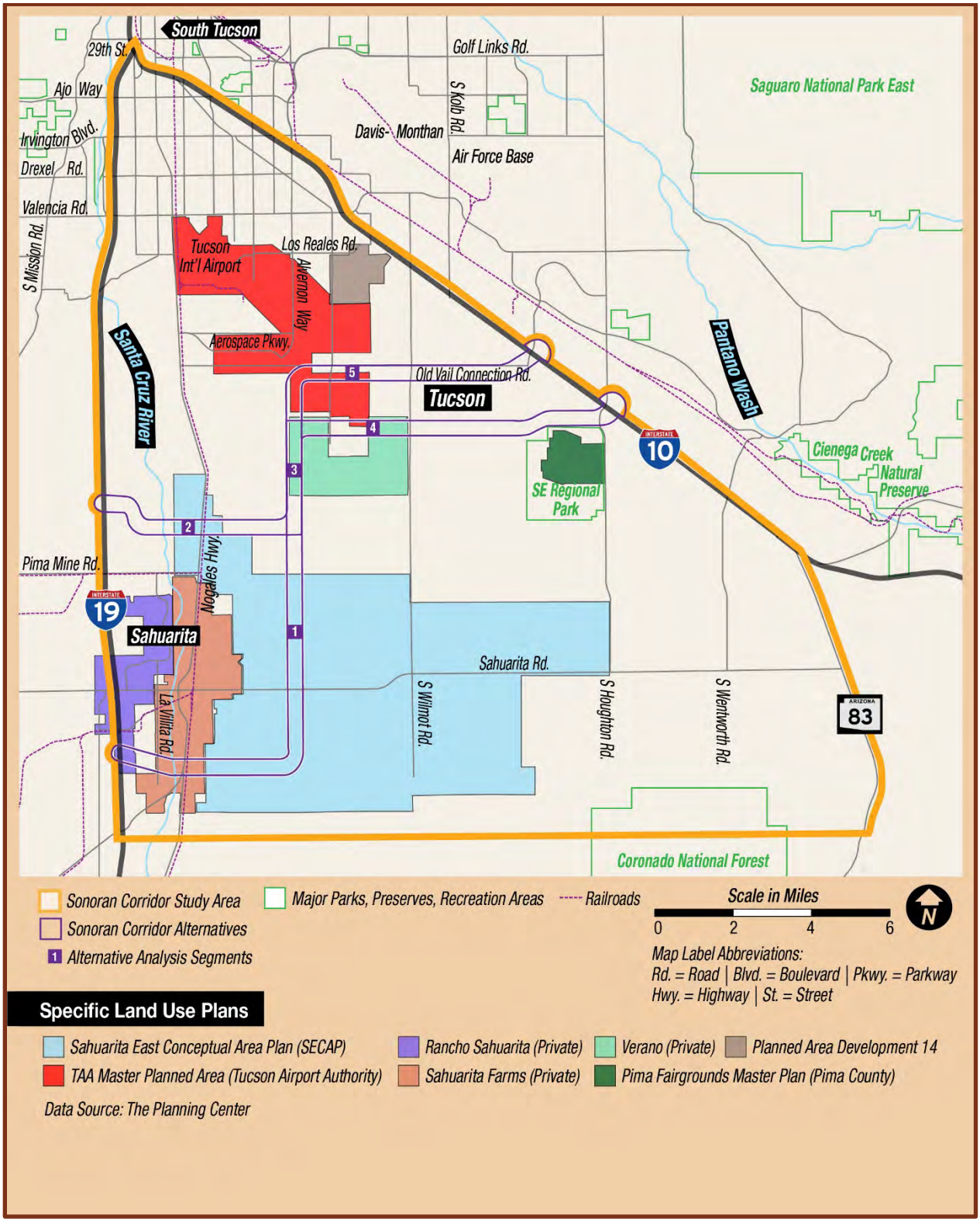


Figure 3-5. Specific Land Use Plans



Land Management and Special Designated Lands

This section discusses major land management in the study area and special designated lands, such as wildernesses, national monuments, areas of critical environmental concern, designated roadless areas, and other deeded properties. Less than half the study area is private land, and differing land regulations apply to use of the other lands for transportation purposes. Some land managers, like ASLD, may see a new transportation corridor as a benefit and asset to their properties, providing access to developable, non-sensitive lands. Others may feel a high-capacity highway would have negative impacts, such as increased traffic, noise, pollution, or wildlife habitat fragmentation.

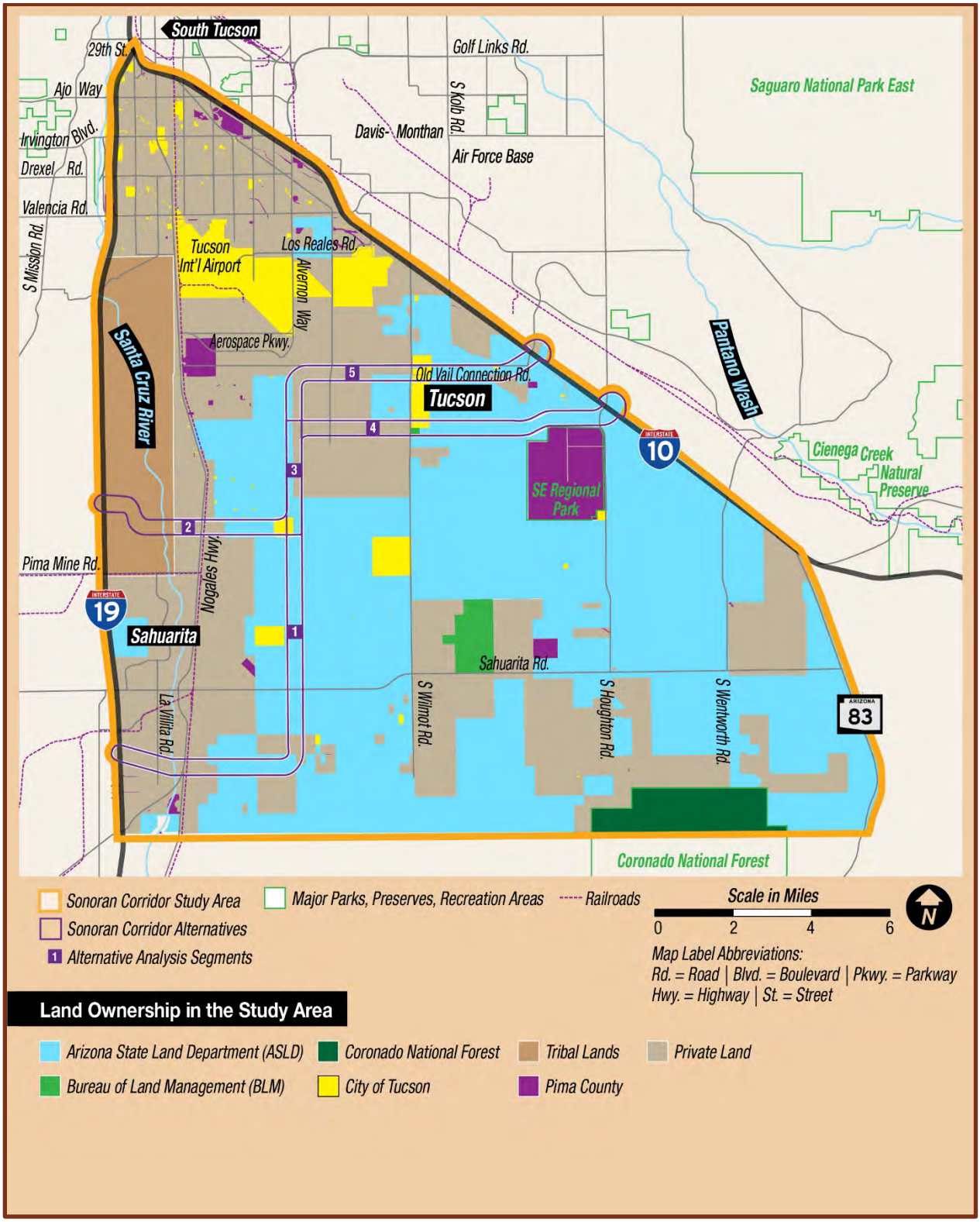
State statute 9-461.05: General Plans; Authority; Scope requires that general plans be adopted every twenty years and updated every ten years. At each point in time, land management plans and their associated land use plans are incorporated into the long-range planning document. ASLD future land use plans are required to be incorporated by state statute. As such, recently adopted plans and updates reflect current land management plans.

The following narrative summarizes major land management patterns, as shown on Figure 3-6.

The study area is nearly half State Trust Land and one-third private land. Smaller parcels of land are managed by BLM, US Forest Service, SXD, City of Tucson, and Pima County. No US Forest Service Coronado National Forest lands are within any of the corridor alternatives.

Generally, land directly adjacent to existing Interstate highways and within the corridor alternatives is either privately or state-owned, except for Corridor Alternative 1, which traverses SXD for about 2 miles between I-19 and Tucson.

Figure 3-6. Land Management in the Study Area



3.2.4 Environmental Consequences

For this Tier 1 EIS, potential environmental consequences are evaluated within each 2,000-foot-wide corridor alternative. To accommodate a new transportation facility, portions of the corridor alternatives may need to be rezoned through the local development process, which could alter adjacent planned land uses from what is currently envisioned. A higher probability exists for changes in planned land uses or displacement of existing uses where new corridor development would occur. This would be the case under any of the corridor alternatives and would be developed with a project alignment during Tier 2 studies.

A future transportation facility ultimately could be located anywhere within one of the 2,000-foot-wide corridor alternatives and is expected to generally occupy an approximately 400-foot ROW footprint. A new highway could lead to improvements within existing and proposed ROW, which could result in changes to existing uses in newly acquired lands. Specific land uses or properties that could be affected, and the extent to which they could be affected, cannot be adequately determined until Tier 2, when a detailed alignment would be identified.

Indirect land use impacts of a new transportation facility would likely extend beyond the associated new ROW and might affect accessibility, community cohesion, economics, air quality, biology, noise, and cultural and visual resources, among others. Other sections of this Draft Tier 1 EIS discuss these potential impacts related to land use (see Section 3.20, Indirect and Cumulative Effects).

This section identifies the key locations along each corridor alternative where major land use impacts are likely to occur due to creation of new transportation junctions or new development activity. This section will also identify planned land uses along the corridor alternatives that could be avoided when determining a specific Sonoran Corridor alignment, so depending on the alignment location within the 2,000-foot-wide corridor alternative, consequences to planned land uses could vary.

This section also provides a qualitative assessment of which segments of each corridor alternative are more likely to be impacted based on whether the segment provides the opportunity for collocation within transportation plans; an assessment of areas within the study area that should be avoided, if possible; and a discussion of areas along the alternative that are more likely to benefit from a future Sonoran Corridor.

Table 3-2 shows the acreages of land under various types of ownership or responsibility within the three corridor alternatives. Table 3-3 shows acreages of land within the three corridor alternatives per jurisdiction.

Table 3-2. Potential Land Management (Owned or Maintained by) Conversion Impacts by Corridor Alternative (in acres)

LAND MANAGEMENT	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
Private Land	1,067	1,544	1,654
State Trust Land	1,550	3,021	3,436
City of Tucson	234	167	102
Allottee-held Property	577	0	0
Bureau of Land Management	0	0	35
Tucson Airport Authority	422	422	57

Table 3-3. Potential Land Management (by Jurisdiction) Conversion Impacts by Corridor Alternative (in acres)

LAND MANAGEMENT	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
City of Tucson	2,041	1,949	2,074
San Xavier District	577	0	0
Pima County	813	2,178	2,549
Town of Sahuarita	0	605	605
Tucson Airport Authority	422	422	57

3.2.4.1 Corridor Alternative 1

Corridor Alternative 1 is comprised of corridor Segments 2, 3, and 5. Existing and planned future land use designations were reviewed to quantify types of planned land uses within the study area that could be impacted (Table 3-4 and Table 3-5).

Table 3-4. Potential Existing Land Use Conversion Impacts by Corridor Alternative (in acres)

LAND USE	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
Agriculture	0	257	257
Industrial	149	149	0
Public or Private Institution	262	262	0
Residential	17	122	301
Resource Extraction/Mining	653	364	0
Vacant	2772	4001	4728

Table 3-5. Potential Planned Land Use Conversion Impacts by Corridor Alternative (in acres)

LAND USE	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
Commercial	0	15	0
Industrial	394	394	15
Mixed Use	269	1,980	2,406
Public or Private Institution	249	249	0
Recreation	0	132	132
Residential	2,365	2,384	2,733
Resource Extraction/Mining	0	0	0
San Xavier District	577	0	0

Planned Land Use

The land near the existing Rita Road interchange at I-10 is comprised of a planned business park, industrial, and commercial development known as the Rita 244/Target Distribution Center development, and the UA Tech Park.

No known land development plans exist for the SXD property within the study area, and no trends can be detected since the land remains undeveloped. Future development of this land is difficult to predict in part due to the ownership pattern, as it is divided up among several allottees (owners of land allotments on the SXD Reservation); however, it is anticipated that a new transportation facility through the currently undeveloped property could result in an increase in viability for more intense land uses than agriculture or residential.

The terminus at Rita Road has the potential to attract more intensive uses, which is consistent with the current and planned development patterns in this location. New development surrounding TUS is also anticipated.

Corridor Alternative 1 is almost entirely comprised of undeveloped and resource extraction/mining land; however, it is mostly planned as future residential, with portions planned for additional industrial uses south of TUS and around the UA Tech Park.

Segment 2 is aligned in an east/west manner from its terminus with I-19 in the SXD to the Alvernon Way alignment. Approximately 2.5 miles and 577 acres of Segment 2 are located within the SXD. This land is undeveloped and currently not planned beyond an irrigation support system for an extension of the San Xavier Cooperative Farms associated with the Bureau of Reclamation (BOR)'s assessment of Central Arizona Project (CAP) reliability alternatives. The balance of Segment 2 is located within unincorporated Pima County and the City of Tucson. It is approximately 3 miles long and covers approximately 770 acres. Currently, this land is undeveloped or being utilized for resource extraction and mining. Future land use plans for Pima County designate this area as residential. The property located within the City of Tucson is designated as the Southlands, which is a long-range growth area for the city. The Southlands are predominantly formed by large tracts of undeveloped state land held in trust by ASLD. Prior to releasing these lands for sale, the state will initiate planning efforts that reflect the existing conditions relevant to the property. The Sonoran Corridor could be a factor in ASLD's future land planning and therefore would not likely impact subsequent land use plans.

Segment 3 is aligned in a north/south manner from the convergence of the 3 corridor alternatives along the Alvernon Way alignment until it meets the east-west Segment 4 of Corridor Alternative 8A. It is approximately 2.5 miles in length and encompasses approximately 730 acres of property in Pima County and the City of Tucson. The property in Segment 3 is currently undeveloped. A 269-acre portion of the property in Segment 3 is located within the Verano Specific Plan. A significant portion of this specific plan is currently in the process of developing as a large-scale solar array. It is anticipated that the balance of the specific plan will also develop as industrial and commercial property, with a very small portion possibly being developed as residential. It is not anticipated that a future transportation facility in Segment 3 would have adverse effects on current and future land use plans.

Segment 5 continues in a north/south manner along the Alvernon Way alignment for approximately 1 mile until it reaches the Old Vail Connection Road alignment and turns east for approximately 6 miles until it reaches its terminus with I-10 at Rita Road. Segment 5 encompasses approximately 1,725 acres in the City of Tucson and Pima County. Currently, this segment is primarily comprised of undeveloped land and resource extraction/mining. State and federal prison facilities are also located within Segment 5 and would need to be avoided by any future transportation facility. Future land use plans south of TUS identify additional industrial and commercial growth patterns that support the need of a major transportation corridor, as do the UA Tech Park and existing industrial land east of I-10 and Rita Road.

End-to-End Considerations

A new transportation facility within Corridor Alternative 1 would not be likely to cause major adverse effects to land uses along the corridor and, in many respects, would respond to them. In two of the three segments, this corridor alternative mirrors planned roadways which makes it already consistent with planning efforts. Throughout the corridor alternative, impacts may occur to the extent that a new Sonoran Corridor would promote different, non-residential uses in areas currently planned for rural residential uses. The precise determination of likely impacts depends on the timing of Sonoran Corridor construction versus the pace of future development in local communities.

Land Management and Special Designated Lands

Land management designations were reviewed to quantify land within the corridor alternatives with special designations that could be impacted and converted to a transportation use (Table 3-2). Figure 3-6 displays study corridor land management patterns; noted features are labeled for context.

3.2.4.2 Corridor Alternative 7

Corridor Alternative 7 is comprised of corridor Segments 1, 3, and 5. Existing and planned future land use designations were reviewed to quantify types of planned land uses within the study corridor that could be impacted (Table 3-4 and Table 3-5).

Planned Land Use

Currently, Corridor Alternative 7 is almost entirely comprised of undeveloped land with smaller areas of residential and agricultural uses. Within the jurisdictional boundaries of the Town of Sahuarita and within the SECAP, it is mostly within master planned areas.

Segment 1 is aligned in an east/west manner for approximately 4 miles from its terminus with I-19 in Sahuarita until it reaches the Alvernon Way alignment and begins a north/south alignment for approximately 6 miles, where it transitions to Segment 3. Approximately 2 miles and 575 acres of Segment 1 are located within the Town of Sahuarita. The land is currently undeveloped or used for agricultural purposes, but most of this area is located within existing specific plans and intended to be master planned with a mix of uses. Segment 1 transitions from west-east to south-north in unincorporated Pima County, in a location with existing low-density residential properties. The balance of Segment 1 in the county and the City of Tucson is undeveloped.

Future land use plans for Segment 1 primarily include specific plans (e.g., Sahuarita Farms and Rancho Sahuarita) and the Town of Sahuarita's SECAP long-range planning effort. A new specific plan entitlement request is underway within the Town of Sahuarita adjacent to the west side of the southern terminus of La Villita Road. If this plan is approved, additional planned residential and commercial uses may be impacted. This plan has an anticipated buildout completion date of 2030. Many of the areas are currently planned for residential uses at varying densities, but the built-in flexibility of these planning efforts and longer anticipated timeframe for full buildout would allow the plans to accommodate the Sonoran Corridor, should a corridor alternative that consist of Segment 1 be selected and constructed. The balance of Segment 1, located within the City of Tucson, currently accommodates low-density residential but is part of the Southlands future planning area, which will be planned by ASLD in response to infrastructure and land uses in place at the time of public auction.

For planned land uses for Segments 3 and 5, see the description above under Corridor Alternative 1 Planned Land Use.

End-to-End Considerations

A new transportation facility within Corridor Alternative 7 is not likely to cause major adverse effects to land uses along the corridor. In two of the three segments, this corridor alternative mirrors planned roadways and is already consistent with local planning efforts. The precise determination of impacts would depend on the timing of construction of a potential future Sonoran Corridor versus the pace of future development in the study area.

Land Management and Special Designated Lands

Land management designations were reviewed to quantify land with special designations within the study area that could be converted to a transportation use (Table 3-2). Figure 3-6 displays study area land management patterns; noted features are labeled for context.

3.2.4.3 Corridor Alternative 8A

Corridor Alternative 8A is comprised of corridor Segments 1, 3, and 4. Existing and planned future land use designations were reviewed to quantify types of planned land uses within the study corridor that could be impacted (Table 3-4).

Planned Land Use

New development may occur where the new transportation junctions are created with I-19 in Sahuarita and at I-10 and Houghton Road. Land development within Sahuarita in the vicinity of Corridor Alternative 8A is comprised of undeveloped, agricultural, and residential land, with land use plans that support a future mix of uses that could accommodate development that is typically associated with a high-capacity corridor and interchange. The terminus at Houghton Road could potentially attract more intensive uses, which is consistent with the planned development patterns in this location. Pima County's Southeast Employment and Logistics Center is a major employment hub planned around the existing Pima County Fairgrounds.

Corridor Alternative 8A is almost entirely comprised of undeveloped land with smaller areas of residential and agricultural land. Within the jurisdictional limits of the Town of Sahuarita and within the SECAP, the corridor alternative is mostly through undeveloped master planned areas much like Corridor Alternative 7. The land use flexibility of master planned areas and the SECAP is designed to respond to infrastructure changes. The portions of Corridor Alternative 8A located on land held in trust by ASLD will be planned as the land goes to auction, as required for the sale of the property. The areas of the corridor alternative in unincorporated Pima County are planned for industrial uses.

Along with Segments 1 and 3, Corridor Alternative 8A incorporates Segment 4 which is unique to this corridor alternative. For planned land uses for Segments 1 and 3, see the descriptions above under Corridor Alternative 1 and Corridor Alternative 7 Planned Land Use, respectively. Segment 4 is aligned in an east/west manner from the endpoint of Segment 3 to its terminus with I-10 at Houghton Road. The first 3 miles of Segment 4 are within unincorporated Pima County and of those 3 miles, 2 are located within the Verano Specific Plan. The specific plan originally called for mixed-use development capable of providing commercial services supportive of residential development; however, it is currently developing as a large-scale solar array. This solar array is anticipated to spur additional commercial and industrial uses in the northwest corner of the specific plan. Approximately 240 acres of Segment 4 within unincorporated Pima County are currently developed as low-density residential property. The final 5 miles of Segment 4 are primarily comprised of City of Tucson Southlands designated property. Property in the Southlands held in trust by ASLD will be planned as the land goes to auction, as required for the sale of the property.

Land Management and Special Designated Lands

Land management designations were reviewed to quantify land with special designations within the study corridor that could be converted to a transportation use (Table 3-2). Figure 3-6 displays study area land management patterns; noted features are labeled for context.

End-to-End Considerations

A new transportation facility within Corridor Alternative 8A is not likely to cause major adverse effects to land uses along the corridor. On one of the three segments, this corridor alternative mirrors planned roadways and is already consistent with local planning efforts. Throughout the corridor alternative, impacts may occur to the extent that the Sonoran Corridor would promote different, non-residential uses in areas currently planned for rural residential use. The determination of likely impacts would depend on the timing of construction for a Sonoran Corridor versus the pace of future development in local communities.

3.2.4.4 No-Build Alternative

The No-Build Alternative would include the programmed improvements to the regional transportation system that are in PAG's Metropolitan Transportation Improvement Programs (TIPs) and RMAP. The No-Build Alternative would not accommodate the increase in travel demand resulting from the development anticipated in the long-term land use plans in long-range planning documents (general and comprehensive plans) by not providing access to the regional transportation system.

Development because of local planning efforts will occur in the future. The No-Build Alternative would generally not directly impact land management agencies in the study area, as improvements are programmed for existing transportation facilities within or near current ROW boundaries or planned streets.

Ultimately, the No-Build Alternative would be unresponsive to forecasted population and employment growth, increased congestion, and reduced efficiency in the movement of people and goods as forecasted for the study area.

3.2.5 Available Mitigation Measures

Future construction of the Sonoran Corridor would result in physical impacts that could require mitigation. At this study stage, potential mitigation measures can only be described in general terms, such as minimizing impacts to residential and sensitive environmental areas. Once a specific alignment is defined during Tier 2 studies, if property acquisition is necessary, the provisions of the URA, as amended, and the Civil Rights Act of 1964 would be followed. Additionally, the specific alignment and locations of TIs would be planned in coordination with local government entities and with public input to minimize the potential for land use conflicts and to develop appropriate mitigation specific to each location.

Understanding the potential for indirect and cumulative land use effects from the Sonoran Corridor, ADOT would be an active partner in a broader effort with PAG, local jurisdictions, resource agencies, private stakeholders, and the general public to cooperatively plan development in the study area. The effort would coordinate wildlife connectivity, local land use planning, and context-sensitive design for the Sonoran Corridor. During a Tier 2 analysis, once an alignment has been determined, further development of indirect effects would be undertaken. At that time, there would be more information about locational questions and a better opportunity to engage affected stakeholders in preparing for and planning for the effects of the Sonoran Corridor on Study Area resources.

3.2.6 Conclusion

Overall, constructing a high-capacity transportation facility within one of the corridor alternatives would be expected to benefit commercial, industrial, and related land uses by improving the capacity of the transportation system and retaining or granting new local access, especially to large existing and future regional facilities (e.g., shopping centers, business parks, and industrial parks) located near access points. Proposed improvements would reduce travel time and delay in urban areas and shorten periods of congestion to make travel times more predictable, which would meet the Sonoran Corridor's Need and Purpose. Additionally, these transportation benefits would increase the prosperity and economic competitiveness of large employers and businesses while supporting new economic development—both on existing and new corridors.

A new high-capacity transportation facility within any of the corridor alternatives would have land use impacts. The actual effects and their magnitude cannot be precisely determined at this stage. They would largely depend on the timing of future construction and other factors, such as the overall rate of urban development within the study area. A review of local planning efforts shows that communities are already planning for residential and employment growth which supports the need to provide a high-capacity transportation facility within the study area, and shows that future growth is going to occur within the study area regardless if the Sonoran Corridor is constructed or not.

Future Tier 2 studies would address specific effects to property, zoning regulations, neighborhoods, and community facilities. The approach to determining acquisitions, easements, and displacements, including ownership (public or private), would be determined as part of project-level Tier 2 environmental studies. These project-level studies also would address compliance with the URA. URA compliance ensures that property owners (residential and business) receive fair market value for their property and relocation benefits, and that displaced persons receive fair and equitable treatment and do not suffer disproportionate hardships because of programs designed for overall public benefit.

3.3 Socioeconomic Conditions, Displacements/Relocations

This section generally discusses the socioeconomic effects of the corridor alternatives, including population, community, and potential displacement/relocation. It provides an overview of community characteristics and resources as well as strategies for mitigation and recommended continuing targeted public engagement efforts for future Tier 2 environmental reviews.

Due to the inherently broad nature of socioeconomic conditions, several sections within this Draft Tier 1 EIS may provide information relevant to this section. Demographic and income information is presented later in Section 3.4, Environmental Justice, Title VI. Land Use was discussed earlier in Section 3.2, Land Use and Jurisdiction. Employment and other economic impacts are discussed in Section 3.5, Economic Resources. Community parks, trails, and traditional cultural properties are considered at length in Section 3.7, Section 4(f) Resources; Traditional cultural properties are also addressed in Section 3.6, Cultural Resources.

3.3.1 Regulatory Framework

NEPA requires that a federal lead agency consider social and economic effects related to proposed federal actions. The *CEQ Regulations for Implementing the Procedural Provisions of the National Environmental Policy* Act (40 CFR 1500-1508) defines "effect" to include economic and social factors, whether direct, indirect, or cumulative in nature (40 CFR 1508.8). Additionally, the *Federal-Aid Highway Act of 1970* (23 United States Code [U.S.C.] 109(h)), requires that USDOT "assure the possible adverse economic, social, and environmental effects relating to any proposed project on any Federal-aid system have been fully considered in developing such project, and that the final decisions on the project are made in the best overall public interest."

3.3.2 Methodology

For purposes of this Tier 1 analysis, communities were identified within the study area using the US Census Bureau's data on Populated Place Areas and Tribal Subdivisions. Populated Place Areas typically represent concentrations of individuals in a geographic location and includes census designated places (CDP), cities/towns, and incorporated places in the US. However, it should be noted that the geographic boundaries of a Populated Place Area as designated by the US Census Bureau may not always correspond with how those boundaries are understood from a local perspective. It should also be noted that Populated Place Areas were used as a proxy to show general broad scale community characteristics and that individual residences are present outside the identified Populated Place Areas. Individual level data was also collected for the study area and is presented in Section 3.4, Environmental Justice, Title VI, and Other Nondiscrimination Statutes.

General economic and household demographics of Populated Place Areas were retrieved from the US Census Bureau, in particular the 2010 decennial US Census and the 2013–2017 American Community Survey.

An inventory of community resources, such as places of worship, libraries, and hospitals, were gathered and serves as an indicator of community interactions and connections. Locations of community resources were gathered from several sources, including PAG, City of Tucson, Homeland Infrastructure Foundation-Level Data, and Pima County. ArcGIS, a geographic information system, was used to overlay community resource locations with the corridor alternatives to analyze proximity and potential disruption to services.

GIS data was used to review each corridor alternative and any structures within and adjacent to their 2,000-foot-wide sections. Structures include residential, commercial, and agricultural facilities. Aerial imagery, in conjunction with Pima County Assessor's Parcel data, was used to conduct physical counts of these structures and assess the likelihood of potential displacements.

3.3.3 Affected Environment

3.3.3.1 Population Growth and Patterns

Pima County was established in 1864 with a population estimated at approximately 5,716 residents. The discovery of silver and gold brought about a migration of prospectors and led to an expansion of mining and ranching operations, causing a jump in population. As new migrants arrived in Tucson, they settled along the northern and southern corridors of then US 89 through the area. Growth continued at a rapid pace, and by 1970 Pima County was home to approximately 351,667 residents. During this time, development began to spread northwest due to constraints by surrounding federal lands, and much of the population was concentrated in the area around and close to UA. In 2010, the population of Pima County was estimated to be 981,653, with 53 percent concentrated in the City of Tucson. According to PAG, a noticeable southern shift in Tucson's center of population is occurring and is expected to continue, with future development strongly oriented around the I-10 and I-19 corridors.

As discussed earlier in Section 3.2, Land Use and Jurisdiction, large portions of the study area are vacant, with development mostly consisting of residential, agricultural, and commercial uses. Population density drastically plunges south of TUS, with spaced-out concentrations of residential development. Planned future land use in the region is highly geared toward residential. Based on counts from PAG transportation analysis zones (TAZ), the study area population is expected to increase severalfold. Figure 3-7 and Figure 3-8 illustrate a side-by-side comparison of the 2015 population and employment densities within the study area compared to the future projected 2045 estimates.

3.3.3.2 Communities

Five Populated Place Areas and one Tribal Subdivision were identified within the study area: City of Tucson, Town of Sahuarita, Summit (CDP), Vail (CDP), Corona de Tucson (CDP), and the SXD. Table 3-6 conveys general socioeconomic characteristics for each community and Figure 3-9 illustrates the proximity of these identified communities to the corridor alternatives.

Table 3-6. General Socioeconomic Composition of Communities within the Study Area

COMMUNITY	POPULATION	MEDIAN HOUSEHOLD INCOME (ANNUAL)	COLLEGE DEGREED[1]	UNEMPLOYMENT RATE
Tucson	530,905	$39,617	35.2%	9.4%
Sahuarita	28,257	$73,174	49.1%	3.5%
Summit	5,349	$36,563	8.1%	19.5%
Vail	11,735	$76,974	42.7%	3.8%
Corona de Tucson	7,583	$93,017	58.3%	6.9%
San Xavier District (SXD)	2,285	$41,550	17.9%	15.8%

[1] Population 25 years and older

Based on data collected from the U.S. Census Bureau, the communities appear to be varied and range in size from large metropolitan hubs (City of Tucson) to smaller rural communities to Native American communities (SXD).

Figure 3-7. Population Densities in the Sonoran Corridor Study Area, 2015 and 2045

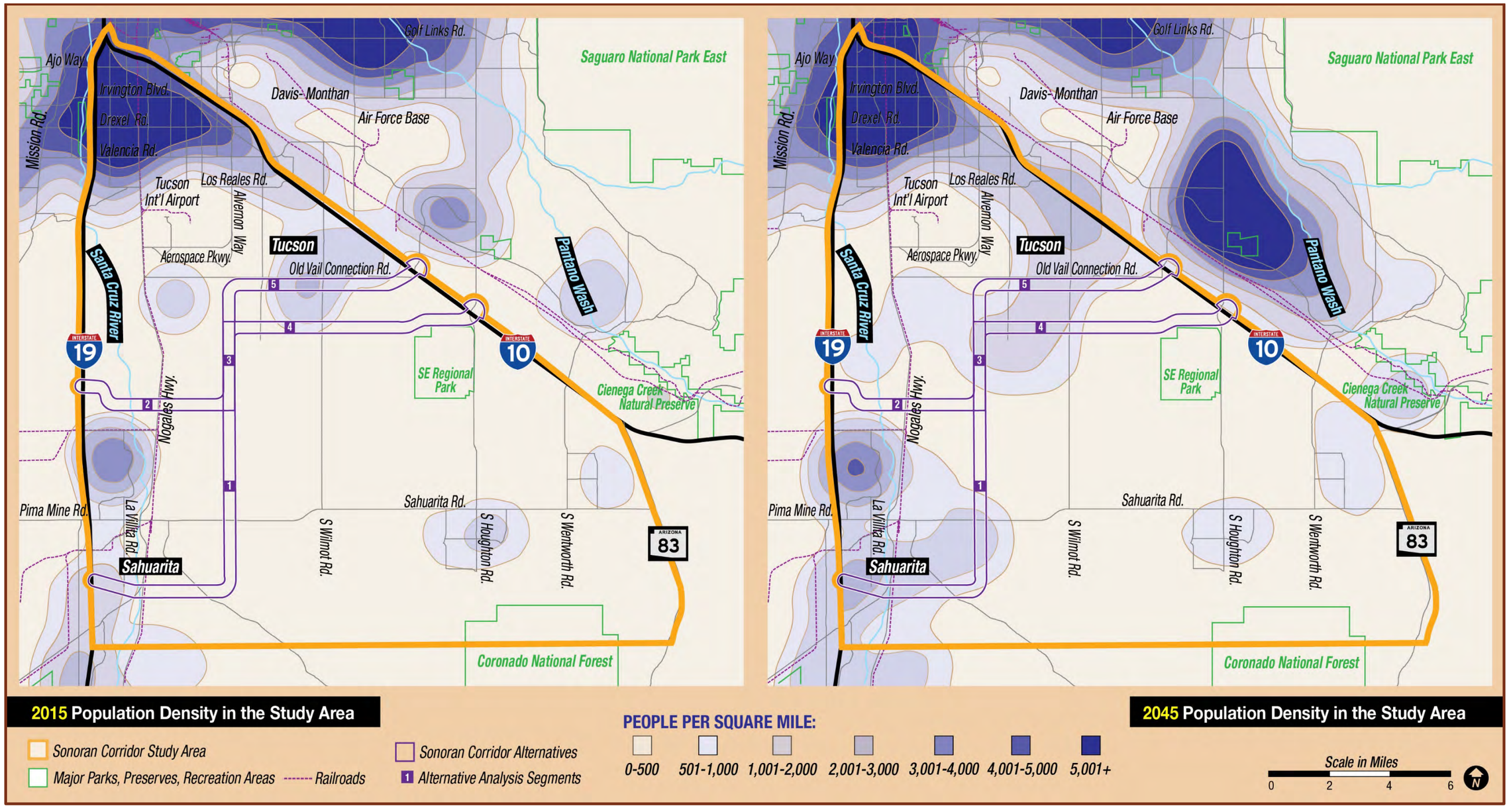


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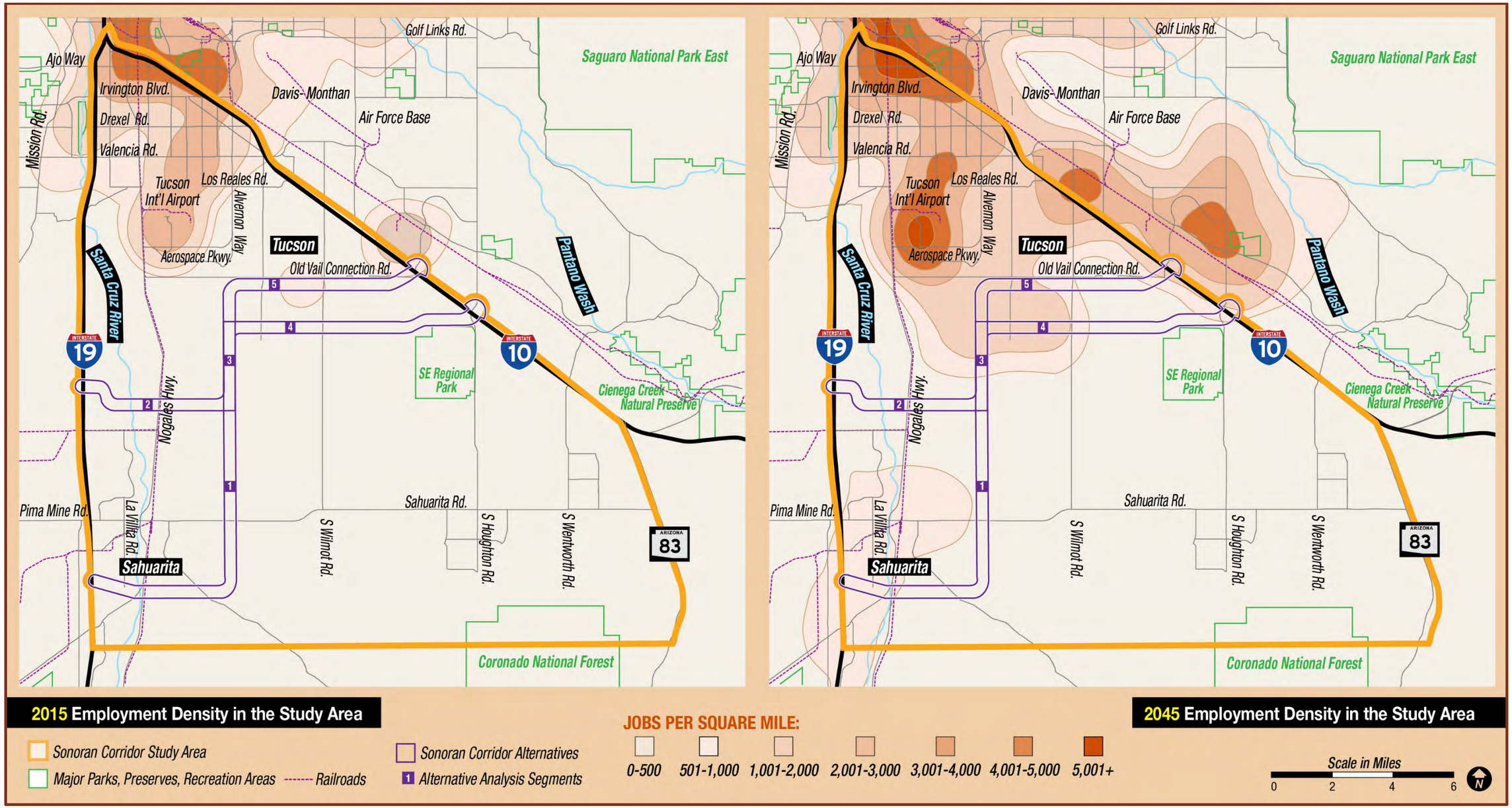
Figure 3-8. Employment Densities in the Tucson Metropolitan Region, 2005 and 2045



Source: http://www.pagregion.com/Programs/TechnicalServices/GISDataandMaps/tabid/84/Default.aspx

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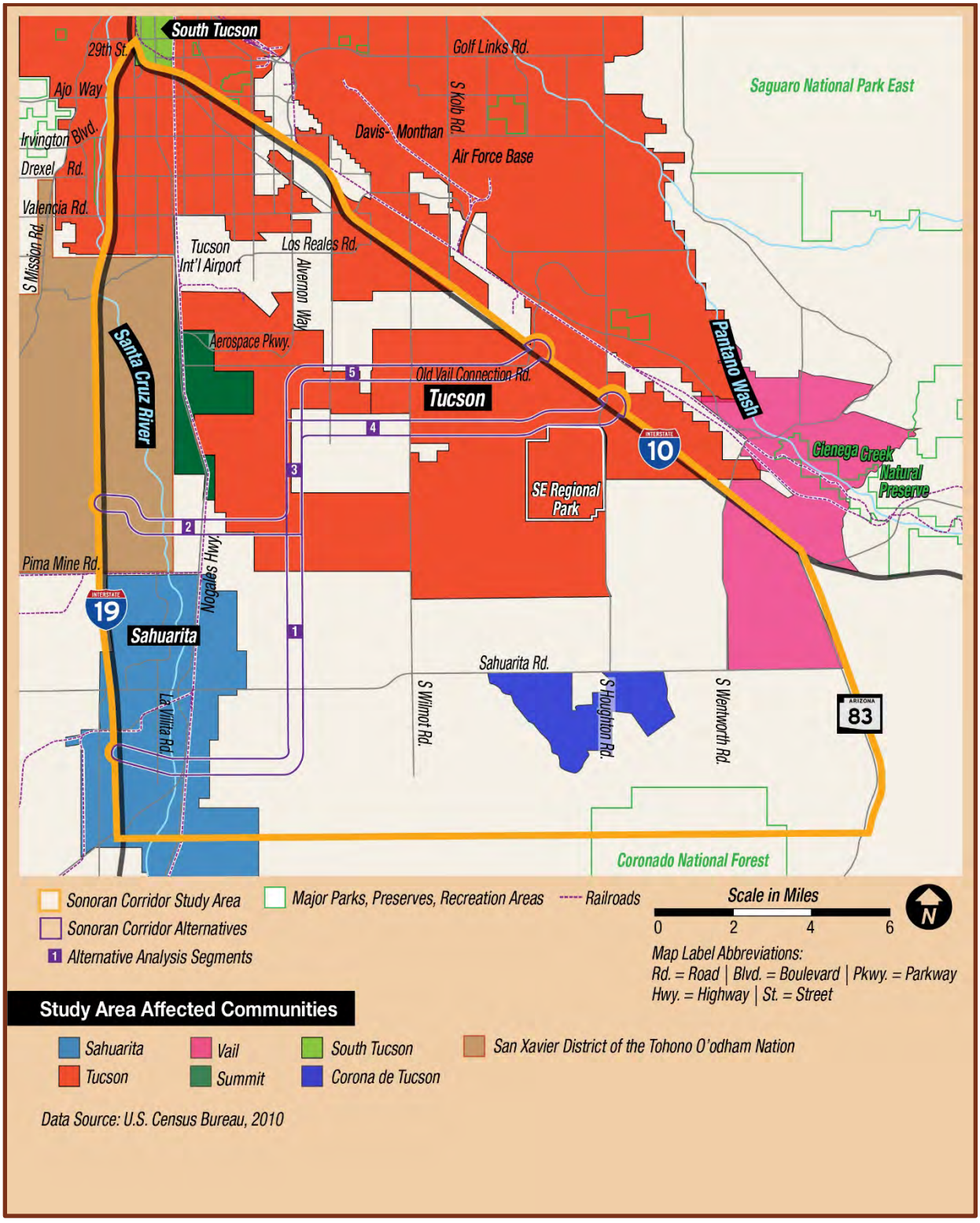
Figure 3-9. Study Area Affected Communities



3.3.3.3 Community Facilities and Services

An inventory of community resources, such as emergency services, parks, schools, and places of worship, was collected for the study area and is shown on Figure 3-10. Community facilities are mostly concentrated in areas of higher population density and along existing roadway.

3.3.4 Environmental Consequences

Analyzing socioeconomic consequences on communities is an iterative process and would need to be re-evaluated as refinements are made if a corridor alternative were selected. Potential direct impacts would vary between corridor alternatives and may include, but are not limited to, business and residential relocations and displacements, noise increases, visual changes to the landscape, disruptions to community cohesion and public services, and changes to regional travel patterns. Because of the relatively small population currently residing within the study area, community facilities and services are fairly limited in number and variety, thus reducing the likelihood of these facilities conflicting with the corridor alternatives, but also giving these community resources more weight due to their scarcity.

The potential impact of a major transportation facility on the socioeconomic environment would depend on its specific location and alignment within a corridor alternative. Because no specific alignment has been identified in this Tier 1 analysis, potential socioeconomic impacts are described generally for each corridor alternative.

3.3.4.1 Potential Relocation and Displacement

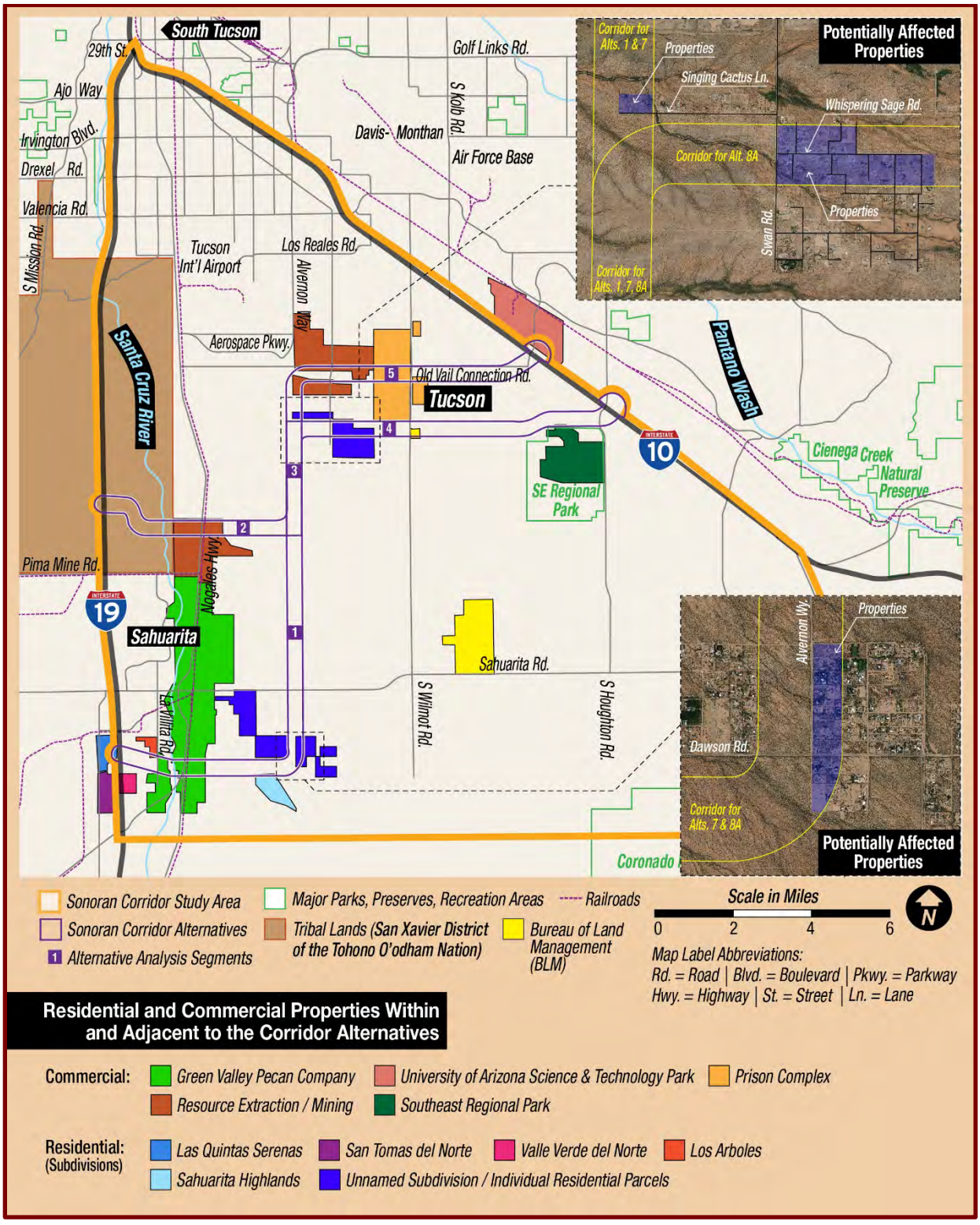
In addition to discussions on general socioeconomic conditions, this section also identifies residences and businesses that fall within and adjacent to the corridor alternatives that could potentially be affected (see Figure 3-11).

Land acquisition would be necessary for the construction of a future transportation facility within any of the proposed corridor alternatives. The acquisition of new ROW would occur in Tier 2 and could result in full or partial takes of properties on which residences or businesses are located. Any federal or federally assisted projects that result in displacements are subject to the URA, which requires that relocation services and payments be made available to all those affected by the project. An impact is considered adverse under NEPA if housing, people, and businesses are displaced. The objective of the act is to provide for a uniform, fair, and equitable treatment of persons being displaced and ensuring individuals are not displaced unless suitable housing is available within their means.

It should be noted that the corridor alternatives under review this Tier 1 study are much wider than what would be required if a corridor alternative is selected and a Tier 2 specific alignment is constructed, allowing for some degree of flexibility within each corridor alternative. Avoidance of impacts to residences and businesses is preferred wherever possible. The analysis presented in this section regarding the potential relocation and displacement of businesses and residences that could occur in Tier 2 reflects existing conditions and would need to be reevaluated as the study area continues to develop over time and after Tier 2 specific alignment is identified.

Figure 3-10. Community Facilities within the Study Area

Figure 3-11. Residential and Commercial Properties within and Adjacent to the Corridor Alternatives



Corridor Alternative 1

Corridor Alternative 1 is comprised of Segments 2, 3, and 5. At approximately 16.06 miles in length, Corridor Alternative 1 is the shortest and most direct route of all three corridor alternatives, requiring less in terms of ROW during Tier 2. This alternative would provide a direct connection from the SXD to the UA Tech Park. This corridor alternative responds to projected growth in and around the Study Area and would provide better access to major employment centers. The improved access would likely increase the economic activity in these regions and could expand employment opportunities for nearby communities and beyond. According to TAZ 2045 "Adopted" data, access to an estimated 75,448 jobs within a 2-mile radius of Corridor Alternative 1 would be created (Figure 3-8). Corridor Alternative 1 would also provide a system linkage that improves interstate, international, and regional mobility. The vast majority of Corridor Alternative 1 is currently undeveloped, with future land use mainly planned for residential development.

Segment 2 is predominantly comprised of undisturbed land, with the exception of approximately 6,500 linear feet currently used for mining operations by ASARCO Inc (Figure 3-11). The entire span of the 2,000-foot-wide corridor intersects the operation, making avoidance of these areas unlikely. No additional businesses or homes were identified within Segment 2.

Segment 3 is entirely undeveloped. No active businesses or dwelling units were identified within this segment.

Segment 5 intersects two areas of active mining, which are generally separated along the north and south sides of E. Old Vail Connection Road (Figure 3-11). An approximate 2,5000-linear-foot section of one mining operation spans the entire width of the corridor alternative, lending to the possibility of partial ROW acquisitions from this enterprise. Segment 5 would create a larger divide between these operations than what is currently imposed by E. Old Vail Connection Road.

Segment 5 also intersects a grouping of correctional facilities and police/fire facilities located north and south of E. Old Vail Connection Road in the vicinity of Wilmot Road (Figure 3-11). The Arizona State Prison Complex, located south of E. Old Vail Connection Road, is on ASLD Land and contains physical structures that abut eastbound E. Old Vail Connection Road. The Federal Bureau of Prisons structure, north of E. Old Vail Connection Road, is set back approximately 1,300 feet from the roadway, with undeveloped land in between. Given the setback of the Federal Bureau of Prison building, avoidance of the physical structures by a potential new highway is possible; however, a partial property acquisition is anticipated to be necessary. Though the prison complex is already separated by E. Old Vail Connection Road, construction of a Sonoran Corridor would further bifurcate the complex and increase the existing physical separation between the facilities.

Five residential structures were identified within Segment 5. These homes are grouped together on the north side of E. Singing Cactus Lane, with approximately 800 linear feet to the west as undeveloped ASLD land. Avoidance of these residences is possible if a future Sonoran Corridor were to be developed within this corridor alternative.

No community facilities or services were identified to be impacted as a result of constructing a new highway within Corridor Alternative 1.

Corridor Alternative 7

Corridor Alternative 7 is comprised of Segments 1, 3, and 5 and is approximately 20.47 miles in length. Corridor Alternative 7 would connect the Town of Sahuarita with the UA Tech Park and major employment centers. In addition to increasing access to major employment centers, Corridor Alternative 7, similar to Corridor Alternative 1, is likely to spur development at both termini and increase economic activity along its route. According to TAZ 2045 "Adopted" data, access to an estimated 91,118 jobs within a 2-mile radius of Corridor Alternative 7 would be created (Figure 3-8). Corridor Alternative 7 would mostly require ROW from private landowners and ASLD land. Large portions of Corridor Alternative 7 are undeveloped, with future land use mainly planned for residential and mixed-use development. For Segments 3 and 5, see the description under Corridor Alternative 1. The remainder of this section will focus primarily on Segment 1.

Segment 1 crosses and is adjacent to the highest number of housing developments and individual residences of all the segments. At the westernmost edge, the corridor's traffic interchange intersects the community of Las Quintas Serenas, where approximately 14 parcels are located directly within the alternative (Figure 3-11). The residential structures are dispersed throughout the length of the corridor, making it unlikely to avoid some of these residents.

Segment 1 also intersects the southern edge of the Los Arboles Mobile Home Community located at S. La Villita Road (Figure 3-11). The 20-acre community is home to approximately 101 mobile homes, 15 of which fall within Segment 1. The mobile home community is located along the northern edge of the corridor and only extends approximately 200 feet into its limits. Land south of the mobile home community is primarily undeveloped, making it very likely for a future transportation facility to avoid this subdivision.

Segment 1 in the vicinity of E. Dawson Road and S. Alvernon Way intersects a grouping of 34 mixed single-family and manufactured homes on rural lots (Figure 3-11). These lots are mostly developed and lay on the east side of S. Alvernon Way. Undeveloped rural land lie to the west of S. Alvernon Way which would allow for avoidance of the identified housing units if a future transportation facility were to be constructed.

The Green Valley Pecan Company is located within Segment 1 and spans the entire width of Corridor Alternative 7 from approximately S. La Villita Road going east to the Town of Sahuarita border (Figure 3-11). Established in 1948, the Green Valley Pecan Company is locally owned and is amongst the world's largest irrigated pecan orchards. The company has a strong community presence in the Town of Sahuarita and often holds local community events, such as an annual pecan festival and charity races. Avoidance of the Green Valley Pecan Company is unlikely and ROW acquisitions are anticipated to be necessary.

One community facility, the Drikung Kagyu Buddhist Center of Tucson, is located within Segment 1 (Figure 3-10). The center is a non-profit member-supported religious organization that holds events and religious teachings for the community. Full and/or partial ROW acquisitions are anticipated to be necessary from this community facility.

Corridor Alternative 8A

Corridor Alternative 8A is comprised of Segments 1, 3, and 4 and is the longest of the alternatives at approximately 21.04 miles in length. Corridor Alternative 8A would link the Town of Sahuarita to employment centers and areas of major development. Similar to the previous alternatives, a new highway within Corridor Alternative 8A would likely spur development at both termini and increase economic activity along its route. According to TAZ 2045 "Adopted" data, access to an estimated 53,548 jobs within a 2-mile radius of Corridor Alternative 8A would be created (Figure 3-8). Corridor Alternative 8A would mostly require ROW from private landowners and ASLD Trust land as well as a small section from the BLM. Large portions of Corridor Alternative 8A are undeveloped, with future land use mainly planned for residential and mixed-use development. For Segments 1 and 3, see the descriptions under Corridor Alternatives 1 and 7, respectively. The remainder of this section will focus primarily on Segment 4.

Segment 4 intersects approximately 51 parcels east of S. Swan Road and south of E. Singing Cactus Lane that are classified as residential and appear to be used as such (Figure 3-11). The parcels span the width of the corridor, creating a high likelihood that some residences would need to be relocated.

Along Wilmot Road within Segment 4 exists a small parcel of public land managed by BLM containing a power-generating facility (Figure 3-11). The facility rests at the southern boundary of the segment, with much of the land directly to its north undeveloped, avoidance of this facility is possible.

No community facilities or services would be impacted as a result of constructing a new highway within Segment 4.

No-Build Alternative

Under the No-Build Alternative, no corridor alternative would be chosen, nor a highway constructed. Population and economic growth would continue to increase, but the transportation infrastructure required to sustain such growth would not be in place. Regional transportation demands would increase, and the existing transportation infrastructure would remain limited and become stressed with the additional capacity.

The economic drivers of the communities within the study area and beyond are highly dependent on adequate transportation infrastructure to support the region's economic growth potential. Therefore, under the No-Build Alternative, with the economies of these communities experiencing deficiencies in transportation capacity, economic growth would be hindered, and socioeconomic conditions could be adversely affected.

3.3.5 Available Mitigation Measures

The full potential impact on the socioeconomic environment cannot fully be understood until a specific Tier 2 alignment is identified if a corridor alternative was to be selected. The environmental analysis for the Tier 2 alignment would include a detailed analysis of the socioeconomic impacts of a selected alignment. Negative impacts could be avoided or mitigated through design by avoiding disruption to community features or resources; planning and locating new facilities outside the proposed alignment; building structures, such as pedestrian overpasses, to maintain existing neighborhood connections; or modifying existing facilities to maintain access and function. Actual mitigation would be identified and implemented as part of subsequent Tier 2 analyses. If during the Tier 2 analysis it is found that displacements are unavoidable, any displacements would occur in accordance with the URA.

Potential impacts to public services could include route changes and increased access to public transportation, route changes for school buses, and increased mobility for emergency response teams. Temporary disruption to these services could also occur for any chosen alignment as a result of construction impacts. Construction-related impacts could be mitigated using best management practices, such as maintaining active public involvement, providing clearly marked detour routes for vehicles and pedestrians and maintaining access to adjacent businesses and community facilities. Public involvement and agency coordination would continue throughout the planning stages to identify areas of concern.

3.3.6 Conclusion

Residences and businesses exist within all of the corridor alternatives. As design details are further defined and delineated during Tier 2 analysis if a corridor alternative was to be chosen, an update of the socioeconomic profile of the communities impacted would be included in addition to identification of potential impacts on socioeconomic conditions and strategies on how to avoid or mitigate these impacts.

Tier 2 NEPA analyses would include a detailed quantitative analysis of the socioeconomic impacts of the corridor alternative. The analyses would focus on the elements of the human environment that could be affected by the development of a major transportation facility. Resources and trends that may be studied further include, but are not limited to, population changes, labor force changes, businesses and establishments, community characteristics, and economic development initiatives. Design details and ROW needs would be better understood at the Tier 2 analysis stage, allowing a better understanding of socioeconomic impacts and benefits. As part of Tier 2, specific mitigation measures would be developed in coordination with local communities and agencies.

3.4 Environmental Justice, Title VI, and Other Nondiscrimination Statutes

3.4.1 Regulatory Framework

3.4.1.1 Title VI and Environmental Justice

Title VI of the Civil Rights Act of 1964 (Title VI) prohibits discrimination based upon race, color, and national origin. Specifically, 42 USC 2000 (d) states that *"No person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance.*" The use of the word "*person*" is important as the protections afforded under Title VI apply to anyone, regardless of whether the individual is lawfully present in the United States or a citizen of a State within the United States.

Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority and Low-income Populations,* directs Federal agencies to take the necessary steps to identify and address adverse effects of Federal projects on minority and low-income populations. EO 12898 is included in FHWA policy as a "requirement that identifies and addresses disproportionately high and adverse human health or environmental effects of [their] programs, policies, and activities on minority populations and low-income populations. This includes the full and fair participation by all potentially affected communities in the transportation decision-making process." In the context of transportation, USDOT Order 5610.2(a) requires USDOT programs to consider Environmental Justice (EJ) policies, with a focus on three fundamental principles:

1) To avoid, minimize, or mitigate disproportionally high and adverse human health and environmental effects, including social and economic effects, on minority and low-income populations.
2) To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
3) To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority and low-income populations.

Under the FHWA Title VI Program, all activities receiving FHWA assistance must take appropriate actions to identify any unequitable treatment. FHWA provided additional guidance by way of Order 6640.23A, in which the identification and avoidance of disproportionately high and adverse effects on minority and low-income populations would be taken by:

- Identifying and evaluating environmental, public health, and interrelated social and economic effects of FHWA programs, policies and activities.
- Proposing measures to avoid, minimize, or mitigate disproportionately high and adverse environmental or public health effects and interrelated social and economic effects, and providing offsetting benefits and opportunities to enhance communities, neighborhoods, and individuals affected by FHWA programs, policies, and activities, where permitted by law and consistent with EO 12898.

- Considering alternatives to proposed programs, policies, and activities where such alternatives would result in avoiding or minimizing disproportionally high and adverse human health or environmental impacts, where permitted by law and consistent with EO 12898.
- Providing public involvement opportunities and considering the result thereof, including providing meaningful access to public information concerning the human health or environmental impacts and soliciting input from the affected minority populations and low-income populations in considering alternatives during the planning and development of alternatives and decisions

Limited English Proficiency

Title VI's reach also extend to those who are determined to have Limited English proficiency (LEP) on the grounds of national origin. Persons who do not speak English as their primary language and who have a limited ability to read, speak, write, or understand English are considered LEP. EO 13166, *Improving Access to Services for Persons with Limited English Proficiency,* requires Federal agencies develop and implement processes to ensure adequate opportunities for participation in Federal projects by LEP populations. The order requires that Federal agencies identify any need for services for LEP populations and provide services to foster meaningful participation. Identifying LEP populations helps ensure that everyone has an equal opportunity to participate in the public process and that language barriers do not prevent certain groups from being able to provide their input about the study.

EJ Indicators

In addition to minority and low-income populations, FHWA's Environmental Justice Reference Guide (2015) and ADOT's NEPA EA/EIS Guidance (2019) also direct projects to provide consideration to the disabled, elderly and female-heads-of-household. This project considered these other groups as indicators of potentially disadvantaged factors (known as EJ indicators) that are separate from bases covered under EO 12898. EO 12898 does not require these populations be included in the analysis; however, their inclusion can improve decision making and lead to a better understanding of the needs of impacted communities. They are defined more in Section 3.4.2.

3.4.1.2 Other Nondiscrimination Statutes

In addition to Title VI, there are other Nondiscrimination statutes that afford legal protection. These statutes include the following: Section 162 (a) of the Federal-Aid Highway Act of 1973 (23 USC 324) (sex), Age Discrimination Act of 1975 (age), and Section 504 of the Rehabilitation Act of 1973/Americans With Disabilities Act of 1990 (disability). Table 3-7 provides a summary of these regulations.

Table 3-7. Other Nondiscrimination Statutes

STATUTE, EXECUTIVE ORDER, OR REGULATION	PROVISION
Section 504 of the Rehabilitation Act of 1973	29 USC 790 provides: "No qualified handicapped person shall, solely by reason of his handicap, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity that receives or benefits from Federal financial assistance."
Age Discrimination Act of 1975	USC 6101, provides: "No person in the United States shall, on the basis of age, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance."
23 USC 324	23 USC 324 provides: "No person shall on the ground of sex be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal assistance under this Title or carried on under this title."
The Civil Rights Restoration Act of 1987	Specifies that recipients of federal funds must comply with civil rights laws in all areas, not just in the particular program or activity that received federal funding.
Title II of the Americans with Disabilities Act of 1990	P.L. 101-336 provides: "No qualified individual with a disability shall, by reason of such disability, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination by a department, agency, special purpose district, or other instrumentality of a State or local government."

3.4.2 Methodology

The purpose of this Tier 1 EIS analysis is to conduct a broad-scale comparative review of the corridor alternatives. Because community impacts are location specific, precise impacts would be unknown until a specific alignment is identified. Data presented in this section represents a general overview of the demographic makeup of the study area to illustrate what could potentially be found within each corridor alternative. Impact evaluations are not being made at this time; therefore, community impact assessment evaluations to identify and address disproportionate benefits and burdens on the various communities along the corridor, as well as their demographic character, would be necessary during Tier 2 analyses.

Population and demographic data are reported by the US Census Bureau in the decennial US Census and the American Community Survey. Demographic data from the 2010 Census and 2013–2017 American Community Survey was gathered at the county, city/town and Census block group level. GIS mapping was used to identify where relatively high percentage of minority and low-income populations are along each corridor alternative.

Real-time demographic data was collected during on-going public outreach efforts. Self-Identification Surveys were provided during two separate public meetings held on September 26, 2018 and March 7, 2019. Two surveys were completed during the September 26th public meeting, both of which self-identified as "White". Three surveys were completed during the March 7th meeting, two of which self-identified as "White" and one as "Native Hawaiian/Other Pacific Islander".

The minority population as well as other secondary EJ indicator populations in the study area were compared to the general populations of Pima County, the City of Tucson, and the Town of Sahuarita as the units of geographic analysis. Low-income populations were identified where the median household income of each Census block group was below the poverty guideline, as established by the US Department of Health and Human Services, for the household size of each respective Census block group.

USDOT and FHWA, with guidance from CEQ, established definitions pertaining to minority and low-income groups and evaluation of a project's impacts to those populations. Those definitions are as follows:

- **Minority**—An individual who self identifies as (1) Black: a person having origins in any of the black racial groups of Africa; (2) Hispanic or Latino: a person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture of origin, regardless of race; (3) Asian American: a person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent; (4) American Indian and Alaskan Native: a person having origins in any of the original people of North, South, or Central America, and who maintains cultural identification through tribal affiliation or community recognition; or (5) Native Hawaiians and other Pacific Islander: a person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.
- **Low-Income**—a person whose median household income is at or below US Department of Health and Human Services poverty guidelines.
- **Adverse Effect**—refers to the totality of significant individual or cumulative human health or environmental effects, including interrelated social and economic effects.
- **Disproportionately High and Adverse**—refers to adverse effect that (1) is predominantly borne by a minority population or low-income population; or (2) will be suffered by the minority population or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority population or non-low-income population.

Data was also collected for EJ indicators. The following definitions were applied to those groups:

- **Elderly**—an individual who is 60 years of age and older.
- **Female Head of Household**—a family household (household that consists of two or more individuals who are related by birth) in which the householder is a female adult, children under the age of 18 are present, and there is an absence of a partner.
- **Disabled**—an individual who has self-care limitations or has serious difficulties with one or more of the following areas of functioning: hearing, vision, cognitive, ambulatory, or independent living.

See Section 4.2.2 for a description on outreach methods used by FHWA and ADOT to ensure compliance with Title VI, LEP and other nondiscrimination statues listed in Table 3-7. As previously discussed, LEP populations are those who do not speak English as their primary language and who have limited ability to read, speak, write, or understand English. Data on LEP communities were collected via the American Community Survey and were defined as those who spoke English less than "well."

3.4.3 Affected Environment

The affected environment is determined to be those Census block groups that intersect the study area (Figure 3-12). As previously discussed, Census block groups are designated by the US Census Bureau; therefore, the limits of those areas do not fully align with the study area, resulting in several block groups extending outside of the study area boundary. Each corridor alternative was analyzed for areas with high concentration of minority or low-income population as well as the three groups identified as secondary EJ indicators. The alternatives were analyzed to the block group level and their results based on the average of those block groups.

Census data to the block group level was also used to identify the presence of LEP communities within the study area as well as primary languages spoken. Obtaining data on LEP populations and their primary languages will reveal if there is a need to implement specific public outreach strategies to non-English speaking groups and to inform what types of strategies should be put in place to facilitate meaningful engagement of those LEP communities (see Section 4.2.3). Identified LEP populations and the primary languages spoken within the study area can be found later in Section 3.4.3.4.

3.4.3.1 Minority Population

Table C-1 in Appendix C is a comprehensive table on race and ethnicity within the study area. Pima County, City of Tucson, and Town of Sahuarita averages are also listed to demonstrate demographic trends from a wider lens. As can be seen in Figure 3-13, minority populations are present throughout the entire project area. Greater minority populations are generally found west of Wilmot Road and north of Sahuarita Road, with the highest concentrations of minority populations generally found north of TUS and on the SXD, with many of the block groups equating to over 86 percent of the total population.

Those that identify as Hispanic or of Latino origin make up the largest minority group(s) within the study area. Native American populations are more highly concentrated on the SXD. Higher than average black populations are found north of Irvington Road and around TUS. The overall presence of Asian and Native Hawaiian or Other Pacific Islander groups within the study area is low.

Figure 3-12. Census Block Groups within the Study Area

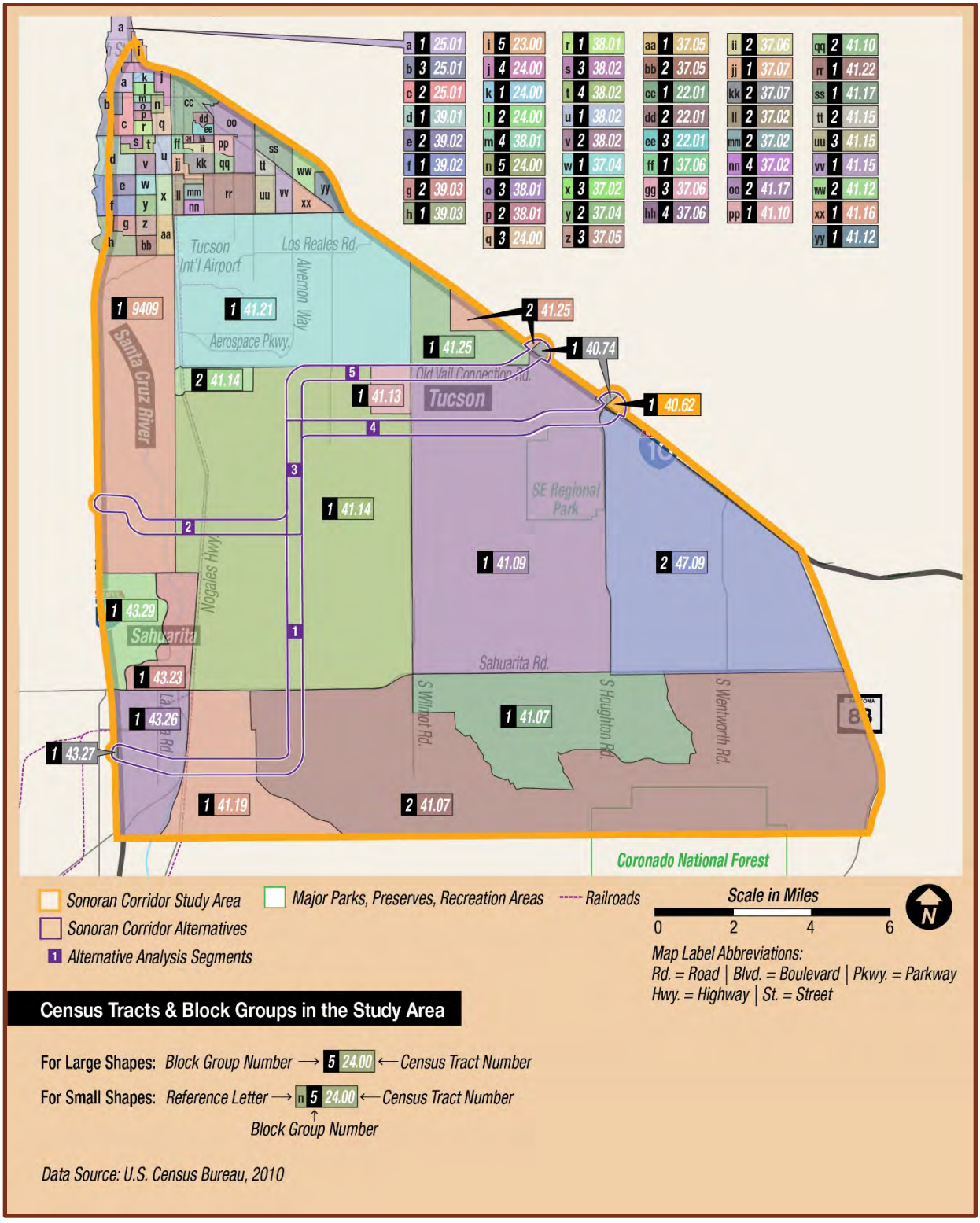
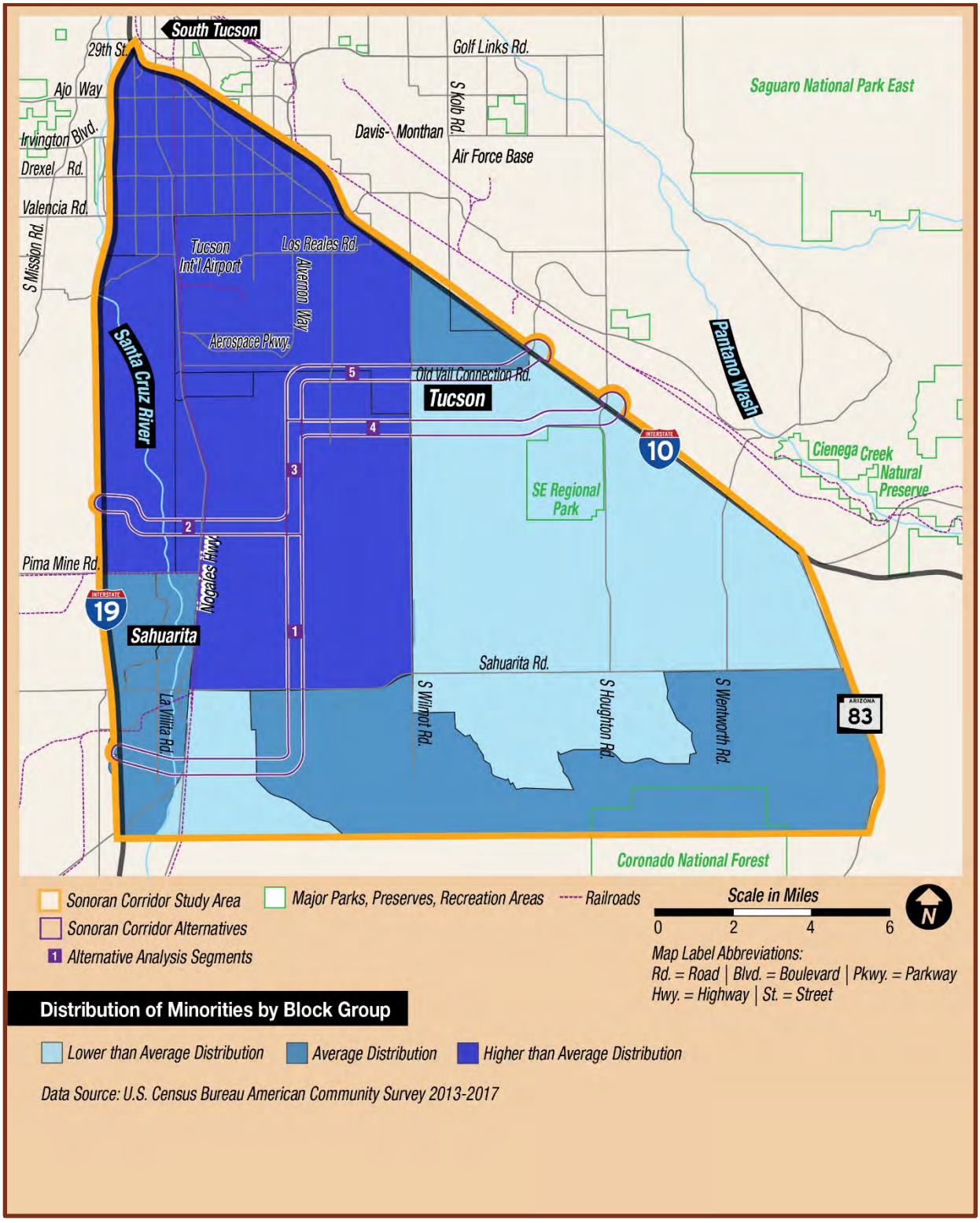


Figure 3-13. Generalized Distribution of Minorities by Block Group



3.4.3.2 Low-Income Population

Table C-2 in Appendix C and Figure 3-14 show the general distribution of low-income individuals by block groups within the study area. With the exceptions of Tract 41.13 Block Group 1, low-income individuals are present throughout the study area, with higher concentrations found north and west of TUS and in Tract 41.14 Block Group 2, just south of Aerospace Parkway. Overall, the study area appears to generally have a comparatively average to low number of low-income individuals, particularly in several block groups east of Wilmot Road and south of Sahuarita Road.

3.4.3.3 EJ Indicators

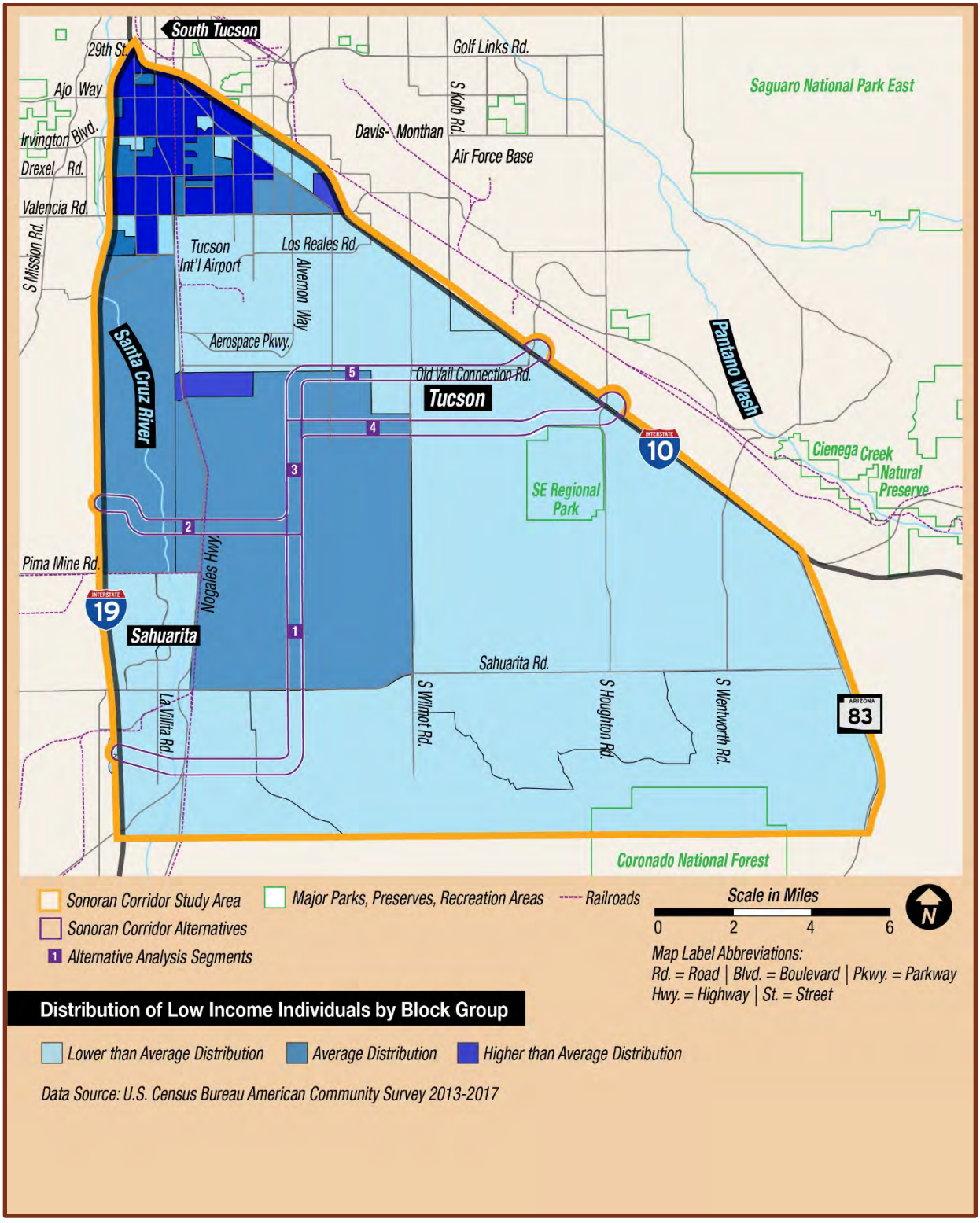
Data on the general distribution of elderly, disabled, and female-head-of-household populations can be found in Table C-2 in Appendix C. These population characteristics are historically considered EJ indicators, but are not covered under EO 12898.

Elderly – Elderly populations are found throughout the Study Area. Fifty-four percent of the population of tract 41.19 block group was determined to be elderly, which is a significantly higher percentage than average. Higher than average elderly populations were also found in tract 41.09 block group 1. The remainder of the Study Area appears to be comparable or lower than the surrounding averages (Pima County, City of Tucson, and Town of Sahuarita).

Disabled – With the exceptions of tracts 41.09 block group 1 and 41.13 block group 1, disabled individuals were found throughout the Study Area. Higher than average disabled populations were found north of TUS and on the SXD; however, the Study Area as a whole is comparable to the surrounding averages.

Female-head-of-household – With the exceptions of tract 41.09 block group 1 and 41.13 block group 1, female-head-of households were found throughout the Study Area in moderate numbers, with the highest concentration north of TUS and on the SXD; however, the Study Area as a whole is comparable or lower than the surrounding averages.

Figure 3-14. Generalized Distribution of Low-Income Individuals by Block Group



3.4.3.4 Limited English Proficiency

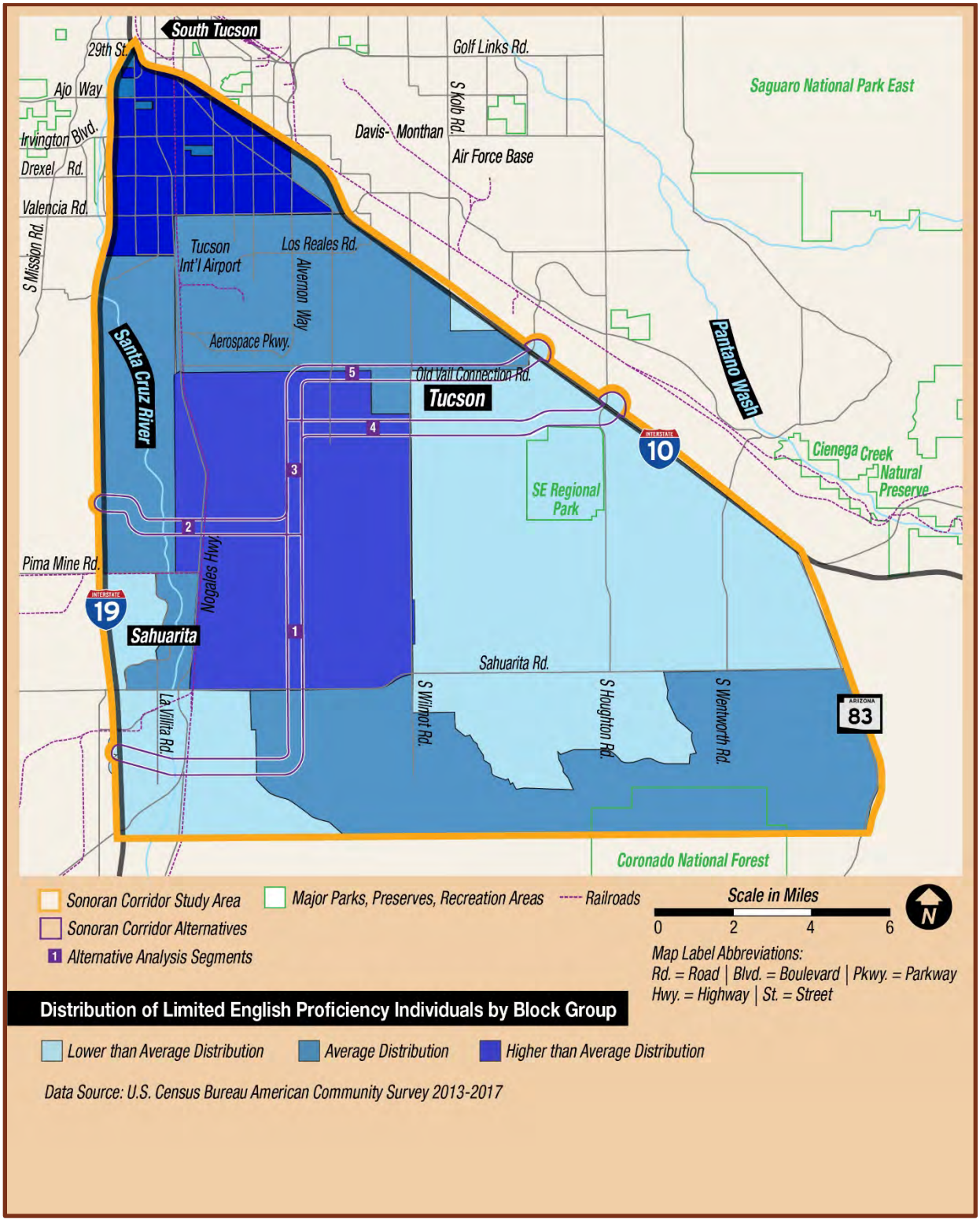
The general distribution of LEP individuals can be found in Table C-2 in Appendix C and Figure 3-15. LEP populations are present within the Study Area to varying degrees. No LEP individuals were identified in Tract 41.07 Block Group 1 and Tract 41.09 Block Group 1, while a relatively high number are found north of TUS and south of Aerospace Parkway. Table 3-8 lists the languages found to be spoken within the Study Area.

Table 3-8 Languages other than English Spoken in the Study Area

LANGUAGE SPOKEN AT HOME	NUMBER	PERCENT OF TOTAL STUDY AREA POPULATION
Spanish	54,996	54%
Other Indo-European	304	Less than 1%
Chinese	213	Less than 1%
Korean	31	Less than 1%
Vietnamese	172	Less than 1%
Other Asian	246	Less than 1%
Tagalog	48	Less than 1%
Other and non-specified	655	1%

Source: 2010 Census data

Figure 3-15. Generalized Distribution of Limited-English Proficiency Individuals by Block Group



3.4.4 Environmental Consequences

Title VI, LEP, and other nondiscrimination statutes

Census data was reviewed to identify the presence of Title VI, LEP, and other nondiscrimination statute populations within the corridor alternatives and is presented in the following sections. The corridor alternatives were reviewed by segments and those segments were analyzed to the block group level. The results were based on the average of those block groups.

A variety of resources have been made available to allow collection of public comment throughout the environmental review process, as detailed in Section 4.2.2, and with Title VI, LEP, and other nondiscrimination protected populations (see Section 4.2.3). To ensure compliance with Title VI, LEP, and other nondiscrimination statutes, ADOT has developed a *Language Access Plan* (LAP) as well as a *Public Involvement Plan* (PIP) to outline ways to better engage those populations. Based on the results of the census data, and in accordance with the LAP and PIP, it was determined that Spanish language translation and interpretation services would be necessary throughout the public involvement process. Several measures have been implemented by ADOT and FHWA to provide resources to Spanish language speakers, as outlined in Section 4.2.3. In addition to language services, Section 4.2.3 highlights other measures and techniques that were implemented to engage Title VI, LEP and other nondiscrimination statute populations throughout the public process.

Environmental Justice

Similar to Title VI, LEP, and other nondiscrimination statutes, each segment was analyzed for areas with high concentration of minority or low-income populations. The segments were analyzed to the block group level and their results based on the average of those block groups.

3.4.4.1 Corridor Alternative 1

Corridor Alternative 1 is made up of Segments 2, 3, and 5. Segment 2 makes up approximately 31.45-percent of the corridor, while Segment 3 makes up 19.60-percent, and Segment 5 makes up 48.95-percent. Of the three corridor alternatives, Corridor Alternative 1 traverses through areas of the block groups with the highest combined overall percentage of minority populations. Segment 2 cuts through the SXD, which correlates with the higher than average American Indian/Alaskan Native population. Segments 2 and 3 have over a 50-percent higher minority population compared to that of the City of Tucson, while segment 5 is approximately 9-percent higher. On average, Corridor Alternative 1 has approximately an 18-percent higher minority population than the City of Tucson and a 38-percent increase over Pima County as a whole (Table 3-9).

Table 3-9. Minority Populations within Corridor Alternative 1

AREA	WHITE	AFRICAN AMERICAN	AMERICAN INDIAN	ASIAN	HAWAIIAN	OTHER	TWO OR MORE	HISPANIC	MINORITY
Segment 2	48.40%	0.17%	33.22%	0.00%	0.15%	12.92%	5.14%	53.03%	86.84%
Segment 3	68.92%	0%	4.40%	0.00%	0.00%	25.25%	1.43%	81.63%	83.83%
Segment 5	64.12%	9.87%	3.09%	1.70%	0.44%	14.14%	6.53%	43.89%	60.53%
Total	62.34%	8.03%	7.10%	1.38%	0.37%	14.63%	6.05%	47.27	65.32%
Pima County	76.89%	3.46%	3.45%	2.78%	0.16%	8.77%	4.49%	35.60%	47.38%
City of Tucson	73.07%	4.99%	3.16%	3.13%	0.18%	10.61%	4.86%	42.95%	55.08%
Town of Sahuarita	87.87%	3.23%	0.16%	2.21%	0.08%	2.87%	3.58%	32.78%	40.45%

While Segments 2 and 3 intersect areas with the highest concentration of low-income individuals compared to the other segments at 27.39-percent and 27.94-percent, respectively, these segments are still comparable to what is calculated for the City of Tucson (24.1-percent) overall, yet somewhat higher than Pima County (18.3-percent). However, as a whole, the population within Corridor Alternative 1 has fewer low-income individuals than either the City of Tucson or Pima County (Table 3-10).

Table 3-10. Low-Income, LEP and EJ Indicator Populations within Corridor Alternative 1

AREA	LOW-INCOME	ELDERLY[1]	DISABLED[1]	FEMALE HEAD-OF-HOUSEHOLD[1]	LIMITED ENGLISH PROFICIENCY[2]
Segment 2	27.39%	15.67%	17.30%	31.83%	9.20%
Segment 3	27.94%	12.98%	10.16%	18.44%	14.83%
Segment 5	7.45%	9.39%	10.26%	14.68%	4.96%
Total	12.60%	10.42%	11.47%	17.82%	6.06%
Pima County	18.3%	24.4%	17.87%	20.91%	4.24%
City of Tucson	24.1%	19.2%	18.30%	28.59%	5.62%
Town of Sahuarita	6.5%	23.8%	14.23%	9.51%	1.51%

[1] Historically considered EJ indicators but not covered under Title VI or EJ
[2] Title VI requires federal programs take reasonable measures to engage and serve these populations

LEP populations are present within all segments. Corridor Alternative 1 also appears to fall below the average in terms of elderly, disabled, and female-head-of-household populations.

3.4.4.2 Corridor Alternative 7

Corridor Alternative 7 is comprised of Segments 1, 3, and 5. Segment 1 makes up approximately 50.66-percent of the corridor, while Segment 3 makes up 12.35-percent, and Segment 5 makes up 36.99-percent. As discussed during Corridor Alternative 1, Segment 3 has a higher concentration of minority and low-income populations than the comparative groups. Segment 1 is lower in both minority and low-income groups and Segment 5 is moderately higher in minority populations but lowest in low-income. LEP populations are present in all segments for Corridor Alternative 7. The results indicate that the overall corridor alternative totals are lower for minority, low-income, and the majority of the EJ indicators than the City of Tucson and are comparable to what is found for Pima County. See Table 3-11 and Table 3-12.

Table 3-11. Minority Populations within Corridor Alternative 7

AREA	WHITE	AFRICAN AMERICAN	AMERICAN INDIAN	ASIAN	HAWAIIAN	OTHER	TWO OR MORE	HISPANIC	MINORITY
Segment 1	90.58%	1.67%	0.53%	1.50%	0.00%	9.37%	1.39%	37.45%	41.62%
Segment 3	68.92%	0%	4.40%	0.00%	0.00%	25.25%	1.43%	81.63%	83.83%
Segment 5	64.12%	9.87%	3.09%	1.70%	0.44	14.14%	6.53%	43.89%	60.53%
Total	74.52%	6.24%	2.13%	1.55%	0.25%	12.71%	4.30%	42.88%	54.03%
Pima County	76.89%	3.46%	3.45%	2.78%	0.16%	8.77%	4.49%	35.60%	47.38%
City of Tucson	73.07%	4.99%	3.16%	3.13%	0.18%	10.61%	4.86%	42.95%	55.08%
Town of Sahuarita	87.87%	3.23%	0.16%	2.21%	0.08%	2.87%	3.58%	32.78%	40.45%

Table 3-12. Low-Income, LEP, and EJ Indicator Populations within Corridor Alternative 7

AREA	LOW—INCOME	ELDERLY[1]	DISABLED[1]	FEMALE HEAD-OF-HOUSEHOLD[1]	LIMITED-ENGLISH PROFICIENCY[2]
Segment 1	10.16%	35.48%	15.75%	17.11%	3.56%
Segment 3	27.94%	12.98%	10.16%	18.44%	14.83%
Segment 5	7.45%	9.39%	10.26%	14.68%	4.96%
Total	17.72%	19.80%	9.92%	16.08%	4.80%
Pima County	18.3%	24.4%	17.87%	20.91%	4.24%
City of Tucson	24.1%	19.2%	18.30%	28.59%	5.62%
Town of Sahuarita	6.5%	23.8%	14.23%	9.51%	1.51%

[1] Considered EJ indicators but not covered under Title VI or EJ
[2] Title VI requires federal programs take reasonable measures to engage and serve these populations

3.4.4.3 Corridor Alternative 8A

Corridor Alternative 8A is comprised of Segments 1, 3, and 4. Segment 1 makes up approximately 49.61 percent of the corridor, while Segment 3 makes up 12.09-percent, and Segment 4 makes up 38.30-percent. Although Segment 3 has a higher concentration of minority populations than the comparative groups, the overall corridor alternative totals are lower for minority, low-income, and the majority of the EJ indicators than both the City of Tucson and Pima County (Table 3-13 and Table 3-14).

Table 3-13. Minority Populations within Corridor Alternative 8A

AREA	WHITE	AFRICAN AMERICAN	AMERICAN INDIAN	ASIAN	HAWAIIAN	OTHER	TWO OR MORE	HISPANIC	MINORITY
Segment 1	90.58%	1.67%	0.53%	1.50%	0.00%	9.37%	1.39%	37.45%	41.62%
Segment 3	68.92%	0%	4.40%	0.00%	0.00%	25.25%	1.43%	81.63%	83.83%
Segment 4	85.59%	1.77%	1.47%	0.90%	0.14%	7.83%	2.08%	32.96%	38.40%
Total	87.06%	1.62%	1.13%	1.17%	0.06%	9.60%	1.67%	38.01%	42.59%
Pima County	76.89%	3.46%	3.45%	2.78%	0.16%	8.77%	4.49%	35.60%	47.38%
City of Tucson	73.07%	4.99%	3.16%	3.13%	0.18%	10.61%	4.86%	42.95%	55.08%
Town of Sahuarita	87.87%	3.23%	0.16%	2.21%	0.08%	2.87%	3.58%	32.78%	40.45%

Table 3-14. Low-Income, LEP and EJ Indicator Populations within Corridor Alternative 8A

AREA	LOW—INCOME	ELDERLY[1]	DISABLED[1]	FEMALE HEAD-OF-HOUSEHOLD[1]	LIMITED-ENGLISH PROFICIENCY[2]
Segment 1	10.16%	35.48%	15.75%	17.11%	3.56%
Segment 3	27.94%	12.98%	10.16%	18.44%	14.83%
Segment 4	7.98%	14.47%	9.98%	12.41%	3.28%
Total	10.24%	25.57%	13.23%	15.27%	4.05%
Pima County	18.3%	24.4%	17.87%	20.91%	4.24%
City of Tucson	24.1%	19.2%	18.30%	28.59%	5.62%
Town of Sahuarita	6.5%	23.8%	14.23%	9.51%	1.51%

[1] Considered EJ indicators but not covered under Title VI or EJ.
[2] Title VI requires federal programs take reasonable measures to engage and serve these populations

3.4.4.4 No-Build Alternative

Under the No-Build Alternative, impacts to communities with a high percentage of minority or low-income populations would include those related to projects already planned and programmed. No direct project impacts would result from the No-Build Alternative, including physical or constructed. Beneficial impacts of the corridor alternatives, such as improved travel times, reduced congestion, economic developments, and improvements to regional mobility, would not occur under the No-Build Alternative.

3.4.5 Available Mitigation Measures

The identification of disproportionately high and adverse effects on minority or low-income populations cannot be determined until a specific Tier 2 alignment is identified if a corridor alternative is chosen. While a determination of disproportionately high and adverse effects on identified minority and low-income populations have not been included in this Draft Tier 1 EIS, these populations were found to exist within all corridor alternatives. Community impact assessment evaluations would be necessary during the Tier 2 study when more project details become available. Community impact assessment evaluations help identify the effects of a transportation action on a specific community and its quality of life.

Additionally, during Tier 2 project studies, input from minority or low-income populations potentially affected would need to be considered before making any future disproportionately high and adverse effect determinations or identifying offsetting benefits. Subsequent Tier 2 actions would include a reevaluation of demographic data. As there are minority and low-income populations within the corridor alternatives, if a corridor alternative is identified as the Preferred Alternative, specific EJ outreach plans would be developed and implemented for Tier 2 project studies.

3.4.6 Conclusion

Minority or low-income populations exist within the study area; however, effects to these population cannot be quantified until a Tier 2 specific alignment is chosen. Refinements in design could occur in a Tier 2 analysis that may help avoid, minimize, or mitigate disproportionate high and adverse effects on minority or low-income populations.

For Title VI, LEP, and other nondiscrimination statues, public involvement activities and communications for the study would be conducted to ensure full and fair participation. For example, ADOT will continue use its LEP Plan as stated in Chapter 4, which took into account the USDOT's LEP DOT Four-Factor Analysis during its development, to inform the public outreach process to identify language needs and ensure assistance is available to provide meaningful public involvement during Tier 2 Studies. A Tier 2 NEPA document would include full analysis to ensure impacts are addressed and compliance with EJ, Title VI and other nondiscrimination statues at the project level is achieved.

3.5 Economic Resources

The implementation of the Sonoran Corridor would influence the region by affording substantially improved system connectivity to both existing and proposed activity centers within the study area. Better access to transportation facilities and services would contribute to an expansion of economic activity and employment growth that is needed in the Tucson area. This section provides an overview of the economic landscape of the Tucson Metropolitan Statistical Area (MSA) and focuses on the influence of the construction and operation impacts of the Sonoran Corridor alternatives in the economic context of the region. The Tucson MSA covers all of Pima County.

The economic impacts of the Sonoran Corridor are estimated for the No-Build and construction and operation scenarios within the three Corridor Alternatives, 1, 7, and 8A. Potential impacts are presented for three major economic variables: output, labor income, and employment.

The Regional Input-Output Model System (RIMS II) impact model produced the impacts presented here. Developed by the Bureau of Economic Analysis, RIMS II is used to project impacts on a region's industrial output, earnings, and employment that result from changes in final demand due to factors outside the region. As with any impact model, the impacts devolve into three major components: direct, indirect, and induced. Direct impacts include construction expenditures, as well as maintenance and operations spending. Indirect and induced impacts are generated by the direct spending according to the specifications and characteristics of the RIMS II model.

This section presents the regulatory setting, analyzes the current economic landscape and characteristics of the Tucson MSA economy, and presents economic impacts of the construction and ongoing maintenance and operations expenditures of a Sonoran Corridor.

3.5.1 Affected Environment

3.5.1.1 Output and Employment: Growth and Industry Mix

The Eller School of Management at the UA has found that the Tucson economy has steadily expanded during the 10 years since the end of the Great Recession.[1] However, Tucson's growth has tended to lag behind economic gains posted by Arizona, the Phoenix MSA, and the nation.

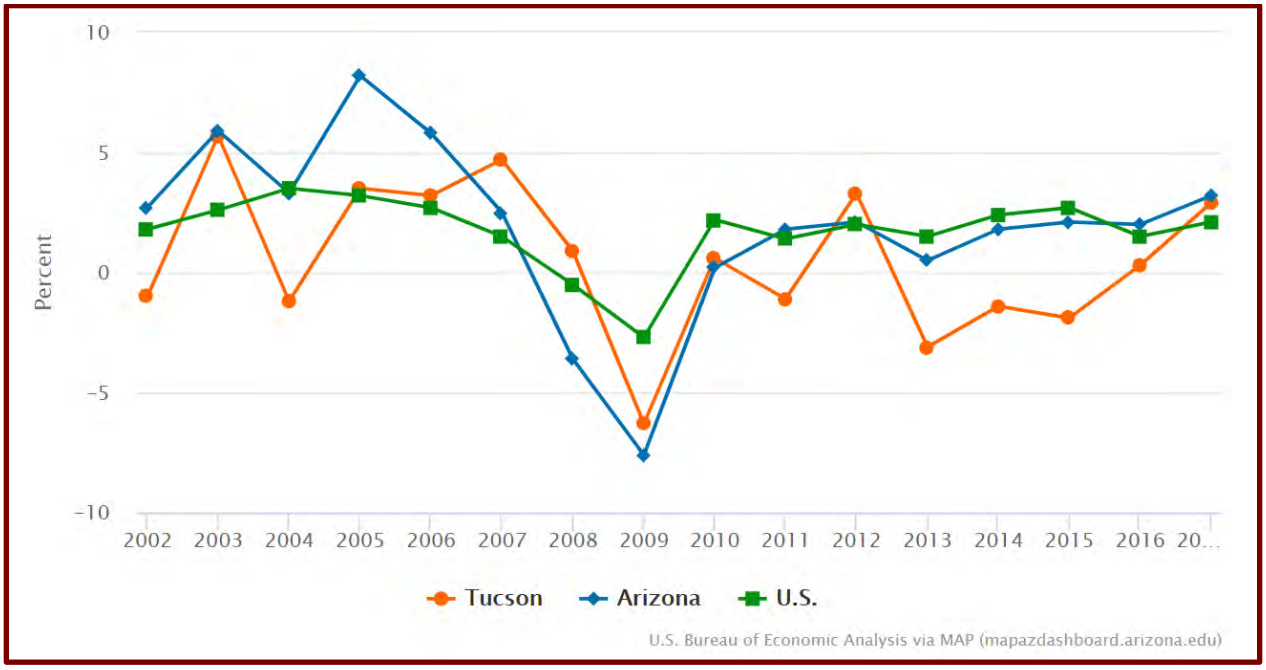
One key to understanding the Tucson economy is to explore its output and employment mix. This analysis highlights which industries are the most important from different perspectives.

The most recent year for which the output mix measured by gross domestic product (GDP) is available is 2017. Tucson's real GDP growth improved significantly from 0.3 percent in 2016 to 2.9 percent in 2017. That ranked Tucson seventh among the 12 western metropolitan areas tracked on the Making Action Possible Dashboard[2] and exceeded the national rate of 2.1 percent.

[1] December 2007 to June 2009
[2] https://mapazdashboard.arizona.edu

Figure 3-16 shows real GDP growth in Tucson from 2002 to 2017 compared to the state and the nation. Since 2011, Tucson's growth has been below the comparable rates for Arizona and the US for 5 out of 7 years.

Figure 3-16. Real GDP Growth Rate Trends, 2002-2017



Overall, the real GDP data suggest that Tucson's output growth has been very slow since the end of the Great Recession. While a new Sonoran Corridor by itself would not dramatically change the economic character of the region, it would open opportunities for additional activity that could be a significant employment and economic catalyst in the future.

While the real GDP data give a rough approximation of local growth trends, they are more useful in understanding industry mix. Tucson's GDP totaled $37.3 billion in 2016 and $39.0 billion in 2017. Figure 3-17 shows GDP shares by industry in 2016 for Tucson and the US and Figure 3-18 shows the breakdown of employment in the region. (These are the latest detailed data available.) The GDP figure shows that government was by far the largest North American Industry Classification System supersector, accounting for 21.7 percent of local GDP in 2016, followed by healthcare and education. By contrast, the government output share for the nation was just 12.3 percent in 2016. The Sonoran Corridor could have a major beneficial effect on government spending by enhancing access to military contracting activity in the study area as well as education/research centers on the edge of the study area.

Figure 3-17. Industry Shares of GDP, 2016

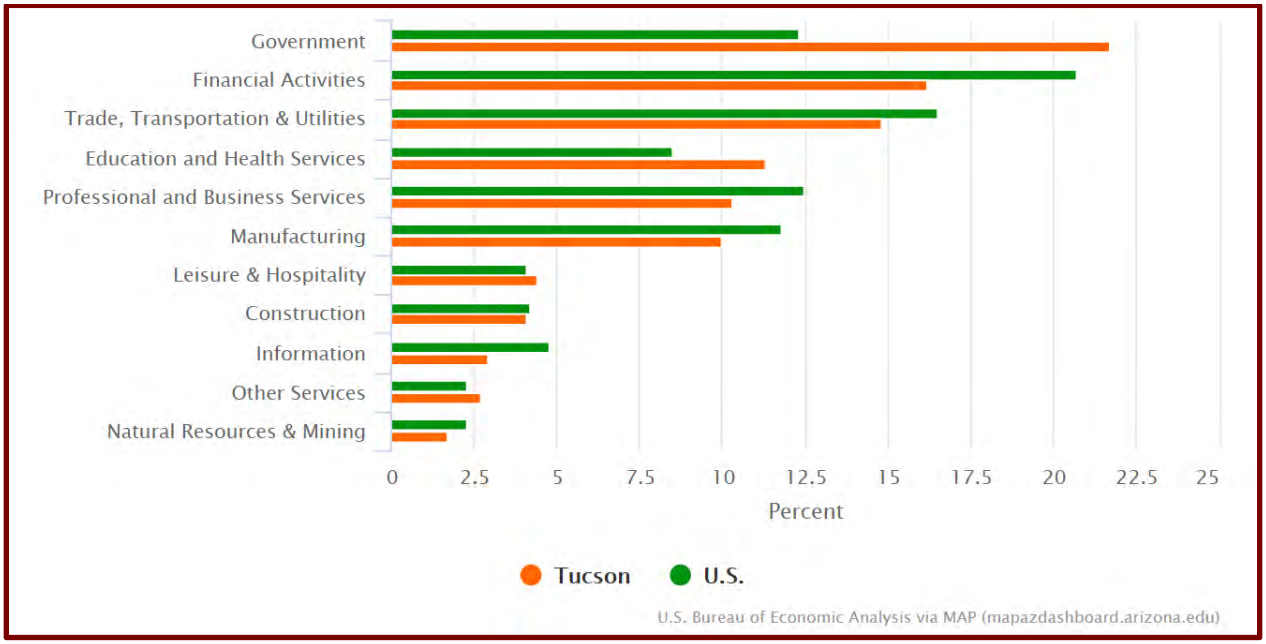
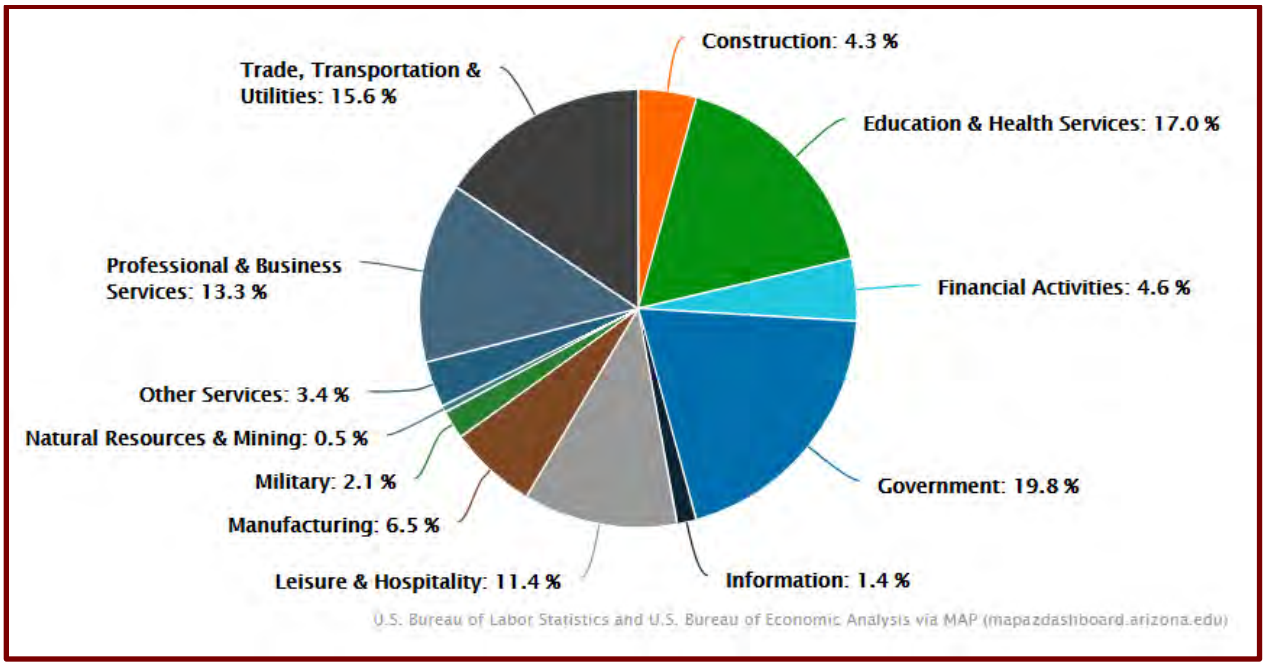


Figure 3-18. Tucson Employment Shares by Industry, 2018



3.5.1.2 International Trade

Infrastructure matters for international trade. Efficient border ports of entry and supporting highways and roads, such as the proposed Sonoran Corridor, can make a large difference in determining trade flows. According to data from the Arizona-Mexico Economic Indicators project,[3] the value of Arizona's merchandise exports to the world hit $22.5 billion in 2018. That was up by $2.7 billion dollars from 2008, which translated into an increase of 13.8 percent. Arizona's largest export destination was Mexico, which accounted for 34.0 percent of total exports, followed by Canada at 10.0 percent. While merchandise exports are an important component of Arizona's international trade picture, exports of services matter as well, particularly services provided to international visitors.

While Arizona's merchandise exports in 2018 were well above their 2008 level, they declined from 2015. Indeed, state exports to the world dropped by 7.7 percent. As shown on Table 3-15, the decline in exports to the world was primarily driven by a drop in exports to Mexico. Exports to Canada declined as well but by a much smaller amount. Exports to Asia, Europe, and the rest of the world increased modestly[4].

Table 3-15. Arizona Merchandise Exports to Mexico by Industry (millions of dollars)

CATEGORY	2015	2018	%CHANGE
Computer and Electronic Products	1419	1728	21.8
Electrical Equipment, Appliances, and Components	1090	1188	9.0
Minerals and Ores	2509	1028	-59.1
Transportation Equipment	793	589	-25.7
Plastics and Rubber Products	468	474	1.3
Machinery, Except Electrical	422	446	5.6
Fabricated Metal Products, NESOI	289	360	24.6
Primary Metal Manufacturing	282	321	14.0
Chemicals	293	294	0.1
Agricultural Products	183	204	11.6
Oil and Gas	380	179	-52.8
Remaining Industries	1034	841	-18.6

NESOI = Not Elsewhere Specified or Included

[3] https://azmex.eller.arizona.edu/about-project
[4] UArizona Economic and Business Research Center

3.5.2 Environmental Consequences

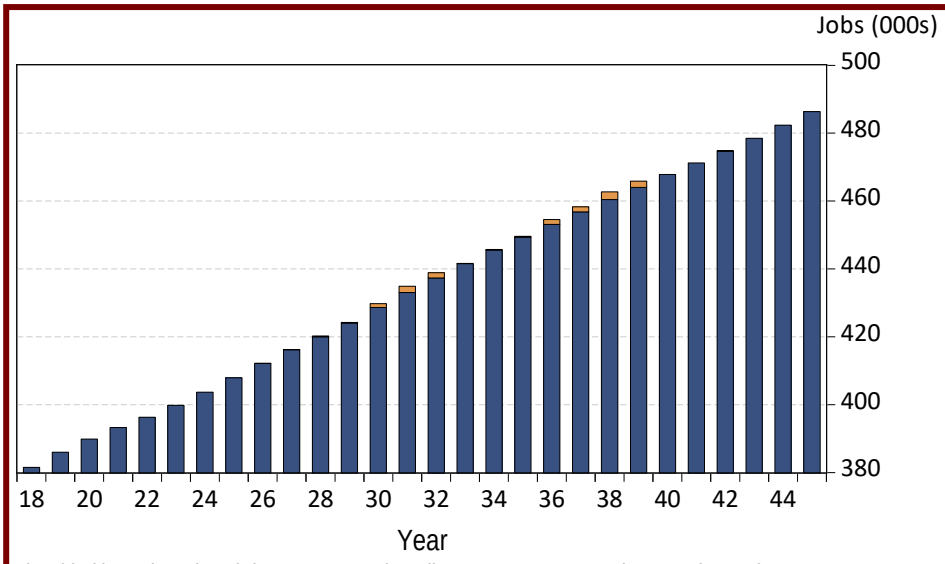
The construction and operation impacts of a highway project within one of the Sonoran Corridor alternatives on the Tucson MSA has been assessed for each corridor alternative in the Draft Tier 1 EIS compared to each other and the No-Build Alternative.

3.5.2.1 Corridor Alternative 1

Based on the RIMS II impact model, a highway project within this corridor alternative is expected to generate 11,300 total job years in the Tucson MSA during the 2026 to 2045 period, including capital/ construction and maintenance and operations activities. Because the Sonoran Corridor is very likely to be built in phases given the need and funding, employment impacts spike during the first construction phase, which is estimated to occur between 2030 and 2032 and again during later construction phases (2036–2039).

Figure 3-19 shows the effect of the total estimated employment impacts by year from 2018 to 2045. (Note: job-year estimates have been converted to full-and-part-time employment using the US ratio of full-time equivalent employment to full-and-part-time employment in 2018 from the US Bureau of Economic Analysis).

Figure 3-19. Impact of Corridor Alternative 1 on Tucson MSA Employment



Blue (dark) section of each bar represents baseline Tucson MSA Employment for each year.
Gold (light) section of each bar represents additional jobs created by construction and operation of a Sonoran Corridor.

Table 3-16 summarizes the economic impacts created by a highway project within Corridor Alternative 1. The total output impact is $1,848.8 million. The labor income impact is $587.8 million. The labor income impact per job year is $52,208, which is well above the 2018 wage per job in Pima County of $47,222.

Table 3-16. Economic Impact, 2026–2045—Corridor Alternative 1

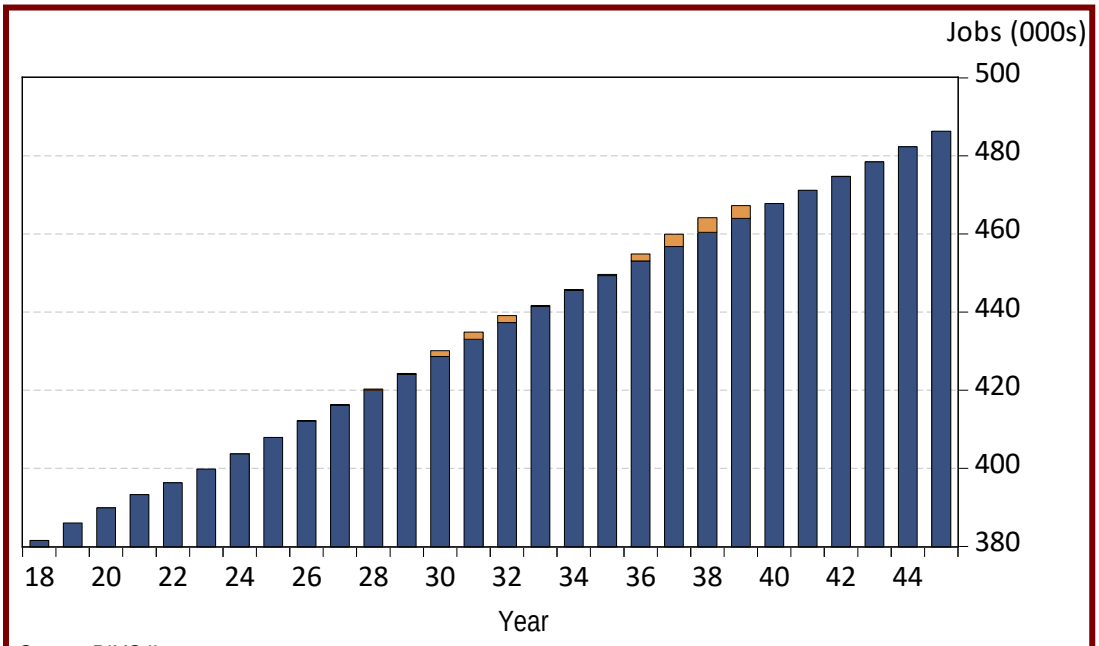
IMPACT METRICS	CORRIDOR ALTERNATIVE 1
Output (millions of 2019 dollars)	$1,848.8
Labor Income (millions of 2019 dollars)	$587.8
Employment (thousands of job years)[5]	11.3

3.5.2.2 Corridor Alternative 7

Based on the RIMS II impact model, a highway project within this corridor alternative is expected to generate 16,600 total job years in the Tucson MSA during the 2026 to 2045 period, including capital/ construction and maintenance and operations activities. Employment impacts spike during the first construction phase (2030–2032) and again during the second construction phase (2036–2039).

Figure 3-20 shows the effect of the total estimated employment impacts by year. Table 3-17 summarizes the economic impacts created by a highway project within Corridor Alternative 7. The total output impact is $2,725.0 million. The labor income impact is $866.3 million. The labor income impact per job year is $52,208, which is well above the 2018 wage per job in Pima County of $47,222.

Figure 3-20. Impact of Corridor Alternative 7 on Tucson MSA Employment



Source: RIMS II
Blue (dark) section of each bar represents baseline Tucson MSA Employment for each year.
Gold (light) section of each bar represents additional jobs created by construction and operation of a Sonoran Corridor.

[5] A job year is the employment equivalent of one job that lasts one year, or two jobs that last a half year, or one half-time job that lasts two years

Table 3-17. Economic Impact, 2026–2045—Corridor Alternative 7

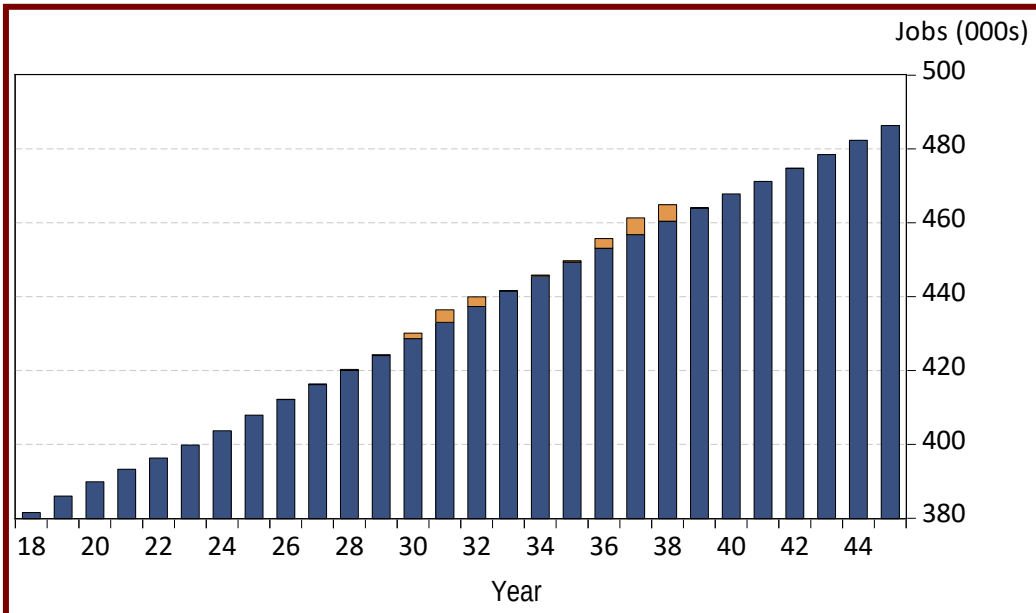
IMPACT METRICS	CORRIDOR ALTERNATIVE 7
Output (millions of 2019 dollars)	$2,725.0
Labor Income (millions of 2019 dollars)	$866.3
Employment (thousands of job years)	16.6

3.5.2.3 Corridor Alternative 8A

Based on the RIMS II impact model, a highway project within this corridor alternative is expected to generate 20,700 total job years in the Tucson MSA during the 2026 to 2045 period, including capital/construction and maintenance and operations activities. Employment impacts spike during the first construction phase (2030-2032) and again during the second construction phase (2036-2039).

Figure 3-21 shows the effect of the total estimated employment impacts by year. Table 3-18 summarizes the economic impacts created by a highway project within Sonoran Corridor Alternative 8A. The total output impact is $3,040.6 million dollars. The labor income impact is $966.6 million. The labor income impact per job year is $52,208, which is well above the 2018 wage per job in Pima County of $47,222.

Figure 3-21 Impact of Corridor Alternative 8A on Tucson MSA Employment



Source: RIMS II
Blue (dark) section of each bar represents baseline Tucson MSA Employment for each year.
Gold (light) section of each bar represents additional jobs created by construction and operation of a Sonoran Corridor.

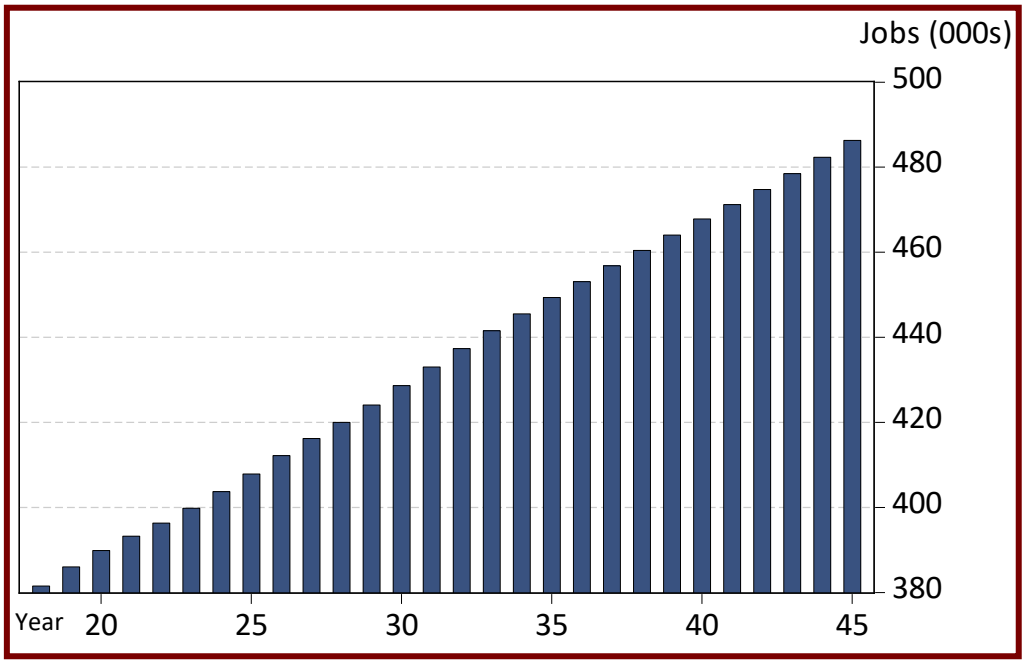
Table 3-18. Economic Impact, 2026-2045—Corridor Alternative 8A

IMPACT METRICS	CORRIDOR ALTERNATIVE 8A
Output (millions of 2019 dollars)	$3,040.6
Labor Income (millions of 2019 dollars)	$966.6
Employment (thousands of job years)	20.7

3.5.2.4 No-Build Alternative

Under this alternative, a highway project within the Sonoran Corridor would not be built. Figure 3-22 provides the latest job growth forecasts from the UA's Economic and Business Research Center from 2019 to 2045. These forecasts exclude any possible impacts of a highway project within the Sonoran Corridor. The forecasts call for non-farm payroll job growth to average 0.9 percent per year during the next 26 years, which translates into an average of 3,900 jobs per year. That is well below average growth during the prior 26-year period of 1.5 percent per year. Even so, Tucson's job growth is forecast to exceed the forecast national pace of 0.6 percent per year. Demographic forces, the aging of the baby boom generation, drive slower growth during the next 30 years, both in Tucson and nationally.

Figure 3-22. Tucson MSA Job Growth Under the No-Build Alternative



3.5.3 Conclusion

The economic effect of the Sonoran Corridor is relatively small compared to the region as a whole, but it provides a measurable benefit in areas that are important to the local economy. In support of activities such as international trade and military investment, a Sonoran Corridor can offer improved connectivity over the existing transportation network and an improvement in travel reliability and efficiency. Further analysis would be required in any subsequent Tier 2 studies to determine any adverse economic impacts.

Note: These figures were developed prior to the onset of the COVID-19 pandemic and reflects information consistent with the data available at that time.

3.6 Cultural Resources

3.6.1 Regulatory Framework

Cultural resources are physical remains of past human activity; they include artifacts and objects, records, sites, structures, landscapes, and natural or built features that are of significance to a group of people traditionally associated with it. This section discusses applicable regulations, presents methods of identification and evaluation, and summarizes existing conditions. A qualitative analysis of potential effects to cultural resources within the corridor alternatives and possible mitigation measures follows.

Two federal laws guide the cultural resource analysis presented in this section, NEPA (42 U.S.C. 4321 et seq.) and the National Historic Preservation Act (NHPA) (54 U.S.C. 300101). Additional federal, state, and local laws may apply to project implementation. This regulatory framework is explained in the following sections.

3.6.1.1 National Environmental Policy Act

NEPA established a policy for the federal government to use practicable means to preserve important historic and cultural aspects of our national heritage. The development of this Draft Tier 1 EIS follows the regulatory guidelines set forth in Section 102(2)(C) of NEPA, and initiated compliance with NHPA. Under Section 102(2)(C), federal agencies must consider the potential impacts of their actions on the environment, including cultural resources. This Tier 1 EIS evaluates the likelihood of potential impacts to cultural resources. As is often the case for large-scale projects, the approach to this EIS is a tiered analysis. The Tier 1 analysis considers 2000 foot wide corridors that would be narrowed to a smaller footprint during the Tier 2 evaluation.

3.6.1.2 National Historic Preservation Act

The NHPA is the second federal law that guides the analysis presented in this section of the Draft Tier 1 EIS. Section 106 of the NHPA requires federal agencies to consider the effects of their undertakings (or actions) on *historic properties*, which are defined as any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (National Register). The NHPA implementing regulations codified at 36 CFR 800 outline a process that federal agencies must follow to identify historic properties and evaluate the effects of their undertakings. Central to this process is consultation with the Advisory Council on Historic Preservation (ACHP), SHPO, Tribes, other interested parties, and the public. The goal of the Section 106 process is to promote preservation of important aspects of our national heritage via avoidance or mitigation of adverse effects to historically significant cultural resources.

3.6.1.3 National Register of Historic Places

To qualify as eligible for the National Register, a property must be at least 50 years of age (except in circumstances where a property has attained exceptional historic significance in a shorter period of time); be significant at the national, state, or local level in American history, architecture, archaeology, engineering, or culture (36 CFR 60). They must also retain sufficient integrity of location, design, setting, materials, workmanship, feeling, and association to convey their importance in history. Additionally, a property must meet at least one of the four criteria:

- Criterion A: Associated with events that have made a significant contribution to the patterns of our history
- Criterion B: Associated with the lives of persons significant in our past
- Criterion C: Embodies the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components lack individual distinction
- Criterion D: Has yielded, or may be likely to yield, information important in prehistory or history

As defined under 36 CFR 800, *Historic Properties* are those cultural resources that are eligible for listing or are listed on the National Register in accordance with these criteria.

3.6.1.4 Traditional Cultural Properties

Traditional cultural properties (TCP) are a category of historic properties that are "eligible" for inclusion on the National Register because of their association with the cultural practices, traditions, beliefs, or lifeways of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community" (Parker and King, 1998:1). In Arizona, TCPs are most commonly associated with Native American communities and are generally identified through Tribal consultation.

3.6.1.5 Other Laws, Regulations, and Policies Relevant to Cultural Resources

Other laws may apply depending on land status within each corridor. Laws such as the *American Indian Religious Freedom Act, Archaeological Resource Protection Act,* and *Native American Graves Protection and Repatriation Act* govern federal and Tribal lands, whereas land owned or controlled by the state of Arizona are subject to applicable state laws. Table 3-19 summarizes the applicable laws, regulations, and executive orders that pertain to the treatment of cultural resources.

Table 3-19. Cultural Resource Laws, Regulations, Executive Orders, and Other Authorities

REGULATION	SUMMARY
National Environmental Policy Act of 1969 (P.L. 91-190; U.S.C. 4321 et seq.)	Encourages harmony between humans and the environment by requiring federal agencies to consider impacts of their action on the environment.
National Historic Preservation Act of 1966, as amended (P.L. 89-665; 54 U.S.C. 300101) Section 106 implementing regulations are at 36 CFR 800 36 CFR 60 lists criteria for eligibility	Requires federal agencies to take into account the effects of their undertakings on cultural resources eligible for listing in the National Register. This process includes initiating consultation with the State Historic Preservation Office, tribes, and other interested parties; identifying and evaluating historic properties; assessing project effects; and resolving adverse effects through development of an agreement document.
American Indian Religious Freedom Act of 1978, as amended (P.L. 95-341; 42 U.S.C. 1996 and 1996a)	Protects and preserves the right of Native Americans to believe, express, and practice their traditional religions by unrestricting access to sites, the use and possession of sacred objects, and the freedom to worship through ceremonies. Adherence to AIRFA involves consultation between federal agencies and Native Americans.
Archaeological Resource Protection Act of 1979 (P.L. 96-95; 16 U.S.C. 470aa-470mm, as amended) 43 CFR 7	Ensures protection of archaeological resources on federal and tribal lands from destruction or unlawful removal. ARPA requires the issuance of a permit for any excavation or form of alteration to archaeological resources and establishes penalties for violations.
Archaeological Resource Protection Ordinance (Tohono O'odham Tribal Code Title 8, Chapter 1 of 1984 and Chapter 2 of 2009) Ordinance No. 06-84	Protects and preserves archaeological resources associated with the traditional or sacred values and beliefs of the Tohono O'odham on Tohono O'odham Nation lands. The ordinance additionally establishes the right of the Tohono O'odham Chairperson to file repatriation claims for archaeological resources and human remains within ancestral lands.
Native American Graves Protection and Repatriation Act of 1990 (P.L. 101-601, 25 U.S.C. 3001 et seq., as amended) 43 CFR 10	Establishes the responsibility of federal agencies and institutions to repatriate Native American human remains, funerary objects, sacred objects, and objects of cultural patrimony to rightful descendants. Also provides criteria for the excavation and inadvertent discovery of human remains and affiliated objects on federal and Indian lands, and imparts protection against the illegal possession and trafficking of Native American human remains and sensitive cultural items.
Religious Freedom Restoration Act of 1993 (P.L. 103-141, 42 U.S.C. 2000bb-2000bb-4)	Prevents the enactment of federal laws that restrict the free exercise of religion.
Executive Order 13007: Indian Sacred Sites of 1996 61 FR 26771	Protects and preserves Native American religious practices by accommodating access to and use of sacred sites, as well as avoiding activities that will adversely affect the integrity of said sites. Federal agencies are responsible for providing notice to tribes when their actions will restrict access to or affect sacred sites.

Table 3-19. Cultural Resource Laws, Regulations, Executive Orders, and Other Authorities (continued)

REGULATION	SUMMARY
Executive Order 13175: Consultation and Coordination with Indian Tribal Governments of 2000	Reaffirms the federal government's responsibility to engage in meaningful consultation with Native American tribes on matters that have substantial and direct effects on them. Also emphasizes the importance of tribal sovereignty and reinstitutes a commitment to maintain government-to-government relations.
Arizona Antiquities Act of 1960 (ARS 41-841 through 41-847)	Charges the Arizona State Museum as the authority for managing cultural resources in the state of Arizona and requires the issuance of a permit prior to survey or excavation at archaeological sites on state land or lands controlled by the state, or any agency, county, or municipal corporation of the state.
Arizona State Historic Preservation Act of 1982 (ARS 41-861 through 41-864)	Protects cultural resources from activities of state agencies by requiring state officials to preserve the integrity of historic properties that are under state ownership or control. Also establishes guidelines for the identification, evaluation, protection, and adaptive re-use of historic properties eligible for or listed on the Arizona Register of Historic Places
Arizona Burial Law (ARS 41-844 and 41-865)	Provides protection for human remains and associated funerary objects in unmarked graves and abandoned cemeteries on state and private lands.
Confidentiality of information related to the location of archaeological discoveries, places, or objects included or eligible for inclusion in the Arizona Register of Historic Places (ARS 39-125)	Allows information about the location of archaeological or cultural resources to be withheld if it is determined the action will create a reasonable risk of vandalism, damage or theft to that resource.

3.6.2 Methodology

FHWA and ADOT initiated Section 106 consultation in support of the Draft Tier 1 EIS. Considering this is a Tiered document, FHWA and ADOT adopted a phased approach to inventory, evaluate, and assess effects of Sonoran Corridor on cultural resources. A Class I Survey, *Class I Cultural Resources Inventory for the Sonoran Corridor Tier 1 Environmental Impact Statement Evaluation, Pima County, Arizona* (Langan et al., 2020), that supports this Tier 1 level of conceptual planning involved FHWA and ADOT in consultation with agencies, Tribes, and other interested parties, as well as collection and analysis of data compiled by prior archaeological and historical studies. Surveys that identify and inventory cultural resources, evaluate their National Register eligibility, and assess and address effects would be undertaken during NEPA studies for individual Tier 2 projects.

An inventory of existing records of cultural resource projects and properties was compiled in the survey, *Class I Cultural Resources Inventory for the Sonoran Corridor Tier 1 Environmental Impact Statement Evaluation, Pima County, Arizona* (Langan et al., 2020). The results of this Class I inventory inform the analysis presented herein.

The analysis considers three categories of cultural resources: (1) archaeological sites and historic structures; (2) historic buildings, trails, and landscapes; and (3) TCPs. Archaeological sites are defined as places, features, and associated artifacts representing past human activity that date to the prehistoric, protohistoric, or historic periods. In Arizona, historic structures such as roads, utilities, and canals are documented as a type of archaeological site. Accordingly, historic structures are treated as such for the purposes of this analysis. This section presents a summary of the steps followed in the Section 106 process and an outline of the methods of collection used for each data class.

Information pertaining to historic built resources was compiled for the study corridor plus a 0.25-mile buffer. Requests to identify TCPs did not impose a boundary. Rather, Section 106 consulting parties were provided exhibits and asked to indicate whether any culturally sensitive areas might be within or in proximity to the study corridor. As was done for the analysis of other environmental resource categories, corridor alternatives were divided into five segments.

3.6.2.1 Area of Potential Effects

The Area of Potential Effects (APE) as defined under Section 106 is the geographic area or areas within which an undertaking may result in direct or indirect effects to the character or use of properties listed or eligible for listing in the National Register, if such properties exist (36 CFR 800.16[d]). How the APE is defined is influenced by the scale and nature of the undertaking and the kinds of effects it may cause.

Direct effects are physical alterations to a property while indirect effects—visual, audible, vibration, for example—are secondary and more likely to develop over time. Cumulative effects take into consideration both direct and indirect effects. The APE for direct effects (or direct APE)—defined as the construction footprint where ground disturbance is likely to occur—would include the ROW and any temporary construction easements, whereas the APE for indirect effects might incorporate a buffered area.

For this Tier 1 analysis, the three 2,000-foot-wide Build Corridor Alternatives were considered to be the preliminary APE. This approach provided a basis for generally characterizing and comparing the potential likelihood of impacts on cultural resources. Specific footprints for new highways would not be identified until subsequent Tier 2 projects are planned and designed if a corridor alternative is selected. It is during this time the Tier 1 APE would be redefined, and a determination of effect would be made in conjunction with NEPA studies for each Tier 2 project.

3.6.2.2 Consultation

In accordance with Section 106, federal agencies initiate consultation to provide notice and request input regarding their proposed undertaking. Parties with consultative roles include (1) federal agencies, (2) ACHP, (3) SHPO, (4) Native American tribes and tribal historic preservation officers, (5) local governments, (6) applicants for federal permits, licenses, and other approvals, (7) other parties with a demonstrated interest, and (8) the public.

FHWA and ADOT sent out early Section 106 consultation letters on September 28, 2017. The early consultation letters were intended to identify consulting parties, to introduce the study area and regulatory parameters, and to provide a foundation for continuing the Section 106 consultation. A total of 35 entities were invited to be a Consulting Party at this time (Table D-1 in Appendix D).

On November 30, 2018, FHWA/ADOT sent out continuing early Section 106 consultation letters to provide an update on the project progression, specifically regarding the identification of cultural resources within the study area, and provided an opportunity to comment on corridor alternatives that were to be evaluated in the CSR.

On July 5, 2019, FHWA/ADOT sent out initial Section 106 consultation letters to provide consulting parties with an opportunity to comment on the Reasonable Range of Corridor Alternatives (Corridor Alternatives 1, 7, and 8A), to inform them of the Class I Survey that was to be developed, and to notify them of FHWA and ADOT intent to develop a Section 106 Programmatic Agreement (PA) document. The US Fish and Wildlife Service, San Carlos Apache Tribe, and White Mountain Apache Tribe all opted out from further Section 106 consultation during this time.

On March 24, 2020, FHWA/ADOT sent out continuing Section 106 consultation letters to provide consulting parties with an opportunity to comment on the Class I Survey and to invite them to participate in development of the Section 106 PA. The TAA, Arizona Board of Regents, and the NPS Anza Trail Administrative Office were added as consulting parties during this time. See Appendix D for consultation letters sent to date.

3.6.2.3 Programmatic Agreement

While the determination of effects on cultural resources is not being at this time, the Class I Survey indicates the Sonoran Corridor has the potential to affect cultural resources during the Tier 2 phase. Accordingly, a Section 106 PA is being developed by FHWA and ADOT in coordination with Consulting Parties. The Section 106 PA is a legal document that establishes agreed-upon measures to ensure continued compliance with Section 106 and resolving adverse effects to cultural resources. A draft document of the Section 106 PA is being circulated as part of the Draft Tier 1 EIS for review and comment, and will be executed at the end of this Tier 1 process. Execution of the Section 106 PA demonstrates the commitment to and continued compliance with the Section 106 process, which is necessary prior to the issuance of a ROD. See Appendix E for the Draft PA.

3.6.2.4 Methods for Considering Archaeological Sites

Prior survey coverage and site information was obtained from several sources (Table 3-20) available through online databases, GIS shapefiles, and annotated maps and other paper records housed at state and federal repositories. While some data are accessible to the public, records containing information pertaining to site locations are protected and require authorization.

GIS data were used to estimate the likely presence of additional unidentified cultural resources within portions of the corridor alternatives not covered by prior survey. Combined with the numbers of known sites, this estimate was used to arrive at a total estimated number of resources within each corridor. The results were then used to assess the likelihood of a new transportation facility in each corridor alternative to pose impacts to cultural resources (high, moderate, or low).

Table 3-20. Data Sources for Archaeological Survey and Site Records

SOURCE	DATA
AZSITE	Arizona's online cultural resources GIS database and electronic records
Arizona State Museum Archaeological Records Office (ARO), University of Arizona, Tucson	Annotated maps, site cards, and technical reports
Arizona Department of Transportation Historic Preservation Portal	Online GIS database and electronic records
Arizona Register of Historic Places	Online inventory
National Register of Historic Places	Online GIS database
City of Tucson	No records available
Bureau of Land Management Tucson Field Office	Annotated maps, site cards, and technical reports
Tohono O'odham Nation/San Xavier Community	No records available
Bureau of Land Management General Land Office plat maps	Electronic records
Pima County	Electronic records, GIS files

3.6.2.5 Methods for Considering Historic Buildings, Trails, and Landscapes

Information about known historic-age buildings, trails, and landscapes within 0.25 mile of the study corridor was compiled. In addition to using the sources outlined above, researchers used information from previous historic architectural studies and state archives available at the Arizona State Library, archives, and public records at the Phoenix Burton Barr Library.

Data collection and identification of historic resources included database searches, general research on the historical development of the study area, study of historic US Geological Survey quadrangle maps, and a windshield survey of the study corridor. The windshield survey is a reconnaissance-level, in-field inventory of historic resources. More detailed identification of historic resources and evaluation of their eligibility for the National Register would occur during Tier 2 studies.

The windshield survey identified potential historic properties not documented as a result of previous surveys. The survey was performed within the study corridor where possible and included the corridor alternatives and a 0.25mile buffer.

Historic buildings, trails, and landscapes identified within the study corridor that had not been previously documented were given National Register eligibility recommendations of "likely eligible" or "likely not eligible."

3.6.2.6 Methods for Considering Traditional Cultural Properties

Pursuant to EO 13175, FHWA and ADOT held several government-to-government consultation meetings with members of the Four Southern Tribes (Ak-Chin Indian Community, Gila River Indian Community, Salt River Pima-Maricopa Indian Community, and TON) in an effort to identify TCPs and potential effects to them. During the meetings with the Four Southern Tribes, the project team also provided progress updates and shared exhibits showing the study area and corridor alternatives under consideration at the time. Table 3-21 presents a summary of the meeting dates, locations, and tribes that attended.

Table 3-21. Meetings with Tribes

DATE	LOCATION	TRIBES IN ATTENDANCE
November 15, 2017	2018 San Xavier Road, Tucson	TON
December 12, 2017	1556 N. Arizona Road, Casa Grande	Ak-Chin Indian Community, GRIC, SRP-MIC, TON
January 30, 2018	1556 N. Arizona Road, Casa Grande	GRIC, SRP-MIC, TON
August 30, 2018	2018 San Xavier Road, Tucson	TON
November 8, 2018	1556 N. Arizona Road, Casa Grande	GRIC, TON
January 30, 2019	405 E. 6th Street, Casa Grande	Ak-Chin Indian Community, GRIC, SRP-MIC, TON

GRIC = Gila River Indian Community, SRP-MIC = Salt River Pima-Maricopa Indian Community

The meetings were mainly informative, but no TCPs were identified within the corridor alternatives under consideration. Meeting participants advised that many TON members had expressed concern about impacts to archaeological sites. Alternative 1 was developed in early coordination with the TON THPO in an effort to minimize impacts to archaeological sites within SXD lands. As previously discussed, FHWA and ADOT are developing a Section 106 PA that includes measures for resolving adverse effects to cultural resources. The TON THPO, as well as other tribes, has been invited to participate in the Section 106 PA. No major unresolved concerns remained regarding the current study; however, dialogue with Tribes is ongoing and meaningful consultation must continue.

3.6.3 Affected Environment

This section presents information regarding prior cultural resources surveys and a general description of the types and numbers of cultural resources known to be present within the study corridor.

3.6.3.1 Archaeological Sites and Historic Structures

Survey coverage among the five segments varies considerably (Table 3-22). Prior surveys cover approximately 12 percent of Segment 1, 67 percent of Segment 2, 72 percent of Segment 3, 49 percent of Segment 4, and 45 percent of Segment 5.

Table 3-22. Estimated Total Archaeological Resources per Corridor Alternative

CORRIDOR ALTERNATIVE/ SEGMENT	ACREAGE	PERCENT SURVEYED	ARCHAEOLOGICAL SITES	AVERAGE RESOURCE DENSITY PER ACRE[2]	ESTIMATED TOTAL RESOURCES[3]	TOTAL ACREAGE OF KNOWN ARCHAEOLOGICAL SITES
Corridor Alternative 1						
Segment 2	1,261	67	16	-	-	-
Segment 3	638	72	8	-	-	-
Segment 5	2,018	45	15	-	-	-
Total	3,917	58	39	0.009	52-63	95.83
Corridor Alternative 7						
Segment 1	2,560	12	10	-	-	-
Segment 3	638	72	8	-	-	-
Segment 5	2,018	45	15	-	-	-
Total	5,216	32	33	0.006	58–83	34.39
Corridor Alternative 8A						
Segment 1	2,560	12	10	-	-	-
Segment 3	638	72	8	-	-	-
Segment 4	2,090	49	21	-	-	-
Total	5,288	32	37	0.007	62-78	70.53

Source: Langan et al., 2020

[1] Includes all sites identified through data collection regardless of National Register eligibility status.

[2] Average number of known sites per acre based on previous survey data

[3] Derived from the density of archaeological sites within and near the study corridor found in AZSITE and ARO records

As shown in Table 3-22, the number of known sites in each segment is relatively low overall, and density varies considerably between segments. The low number of resources is most likely due to the small percentage of each corridor alternative's area covered by previous surveys. Site density can vary depending on the terrain—sites being less common on steep slopes, for example. Terrain within the study corridor is fairly uniform, however, with elevations varying between 3,000 feet and 3,110 feet above mean sea level (AMSL).

AZSITE and ARO records for sites within and near the study corridor were used to estimate the probable density of sites in unsurveyed portions of each corridor alternative (Langan et al., 2020). Based on nearby site densities, each segment was assigned a probable density ranking of high (11+ sites per square mile), moderate (5–10 sites per square mile), or low (1–4 sites per square mile). This projected site density range was multiplied by the number of unsurveyed acres in each segment, then added to the number of known sites to arrive at the estimated total sites for each corridor alternative (Table 3-22).

Not all archaeological sites are of equal significance; small scatters of artifacts with no archaeological features (such as pit houses or cooking hearths) are generally less sensitive to project effects than large habitation sites with human burials. Similarly, archaeological sites vary considerably in size, which is a factor that also must be considered. Thus, in addition to the *number* of sites, evaluation of possible project effects must also take into account the *type* of sites present, as well as their *area.* Table 3-23 summarizes the sites by type present within each corridor alternative.

Table 3-23. Known Archaeological Sites per Corridor Alternative by Type

CORRIDOR ALTERNATIVE	PREHISTORIC ARTIFACT SCATTERS	PREHISTORIC FEATURES AND ARTIFACT SCATTER	PREHISTORIC VILLAGES	HISTORIC ARTIFACT SCATTER	HISTORIC FEATURES AND ARTIFACTS	HISTORIC LINEAR INFRASTRUCTURE	PROBABLE HISTORIC RESOURCES
1	7	13	1	1	1	9	12
7	2	11	0	1	0	7	22
8A	3	21	0	0	0	4	24

Segment 1

Four previously recorded sites including a historic dirt road and historic artifact scatter both recommended ineligible for inclusion on the National Register, and two prehistoric Hohokam artifact scatters unevaluated for their eligibility for inclusion on the National Register, are present in Segment 1.

In addition to the cultural resources discussed above, ARO and AZSITE records indicate that two recently recorded sites lie outside but near the limits of Segment 1. The center points of each are situated within 200 meters of the study corridor boundary. The full extent of these sites could overlap Segment 1; however, maps and descriptions of the sites are not yet available.

Segment 2

A total of 13 sites are identified within this segment, including 5 prehistoric artifact scatters, 2 prehistoric rock features with associated artifacts, 1 prehistoric habitation site, 1 historic concrete pad and artifact scatter, 1 historic artifact scatter, 1 historic dirt road, 1 historic highway, and 1 historic railroad. The historic highway, Old Nogales Highway, is recommended eligible for listing on the National Register under Criterion A and programmatically considered eligible under Criterion D as part of the Historic State Highway System (HSHS) in accordance with the *Interim Procedures for the Treatment of Historic Roads* dated November 15, 2002. Of the other sites, 1 has been recommended eligible under unspecified criteria, 3 have been recommended ineligible, and the remaining 8 have not been evaluated for National Register eligibility.

Similarly, the Zanardelli Archaeological Sensitivity Zone, an area within and near a large Hohokam habitation site, lies near Segment 2. While no manifestations of this site are known to extend within the study corridor, buried deposits associated with this site may extend within the study corridor. Associated surface archaeological materials may extend into unsurveyed portions of Segment 2.

Segment 3

A total of 8 sites have been documented within Segment 3, including 6 with prehistoric rock features with associated artifacts, 1 historic dirt road, and 1 site for which no descriptive information was available. Of these, 5 sites have been recommended eligible under Criterion D, 1 has been recommended ineligible, 1 has not been evaluated for National Register eligibility, and the eligibility recommendation for 1 site is unknown.

Segment 4

Prior survey within Segment 4 identified 20 sites, including 13 prehistoric rock features with associated artifacts, 1 prehistoric lithic material procurement site, 1 prehistoric scatter of fire-cracked rock and ash, 2 prehistoric rock features of indeterminate temporal/cultural affiliations, 1 historic transmission line, 1 historic highway, and 1 site for which no descriptive information is available. Of these, 1 is considered eligible for listing on the National Register under Criterion D as part of the HSHS in accordance with the *Interim Procedures for the Treatment of Historic Roads* dated November 15, 2002; 16 have been recommended eligible under Criterion D; 2 have been recommended ineligible; and the eligibility status of 1 site is unknown, as records are not yet available.

The historic highway listed above is Historic US Highway 80. This route is a state-designated historic highway, pursuant to an application prepared by Tucson Historic Preservation Foundation (Clinco, 2016).

Segment 5

A total of 15 cultural resources, including 4 prehistoric rock features and artifacts, 2 prehistoric rock features, 1 historic dirt road, 1 historic road, 1 historic highway, 1 historic natural gas pipeline, 1 historic transmission line, and 4 sites for which only locational information is available at this time Of these, 1 is considered eligible for listing on the National Register under Criterion D as part of the HSHS in accordance with the *Interim Procedures for the Treatment of Historic Roads* dated November 15, 2002; 3 have been recommended eligible under Criterion D; 1 has been recommended eligible under unspecified criteria, 3 have been recommended ineligible; 2 sites have not been evaluated for National Register eligibility, and eligibility recommendations pertaining to 4 sites were not yet available at ARO at the time that research was conducted. The historic natural gas pipeline, El Paso Natural Gas (EPNG) Line 1100, has been recommended eligible under criteria A and C; however, until the pipeline is decommissioned this feature is exempt from Section 106 review under ACHP guidance published in the Federal Register (FR) under 67 FR 16364.

The historic highway listed above is Historic US Highway 80. This route is a state-designated historic highway, pursuant to an application prepared by Tucson Historic Preservation Foundation (Clinco, 2016).

3.6.3.2 National Register Eligibility of Archaeological Sites and Historic Structures

As shown in Table 3-24, Corridor Alternative 8A has the highest number of National Register-eligible archaeological sites and historic structures, followed by Corridor Alternative 1 and Corridor Alternative 7. Other than two historic state highways, both of which are programmatically considered to be eligible under Criterion D, the eligibility status of all properties considered in Table 3-24 is a recommendation and may be subject to change as a result of Section 106 consultation. Only one archaeological site or historic structure has been recommended as National Register-eligible under criteria other than D, the historic EPNG Line 1100. This property was recommended eligible under Criteria A and C, but such in-use historic pipelines are exempt from Section 106 review under ACHP guidance published under 67 FR 16364. There are no National Register-listed properties within the study corridor.

Table 3-24. National Register Eligibility of Archaeological Sites and Historic Structures

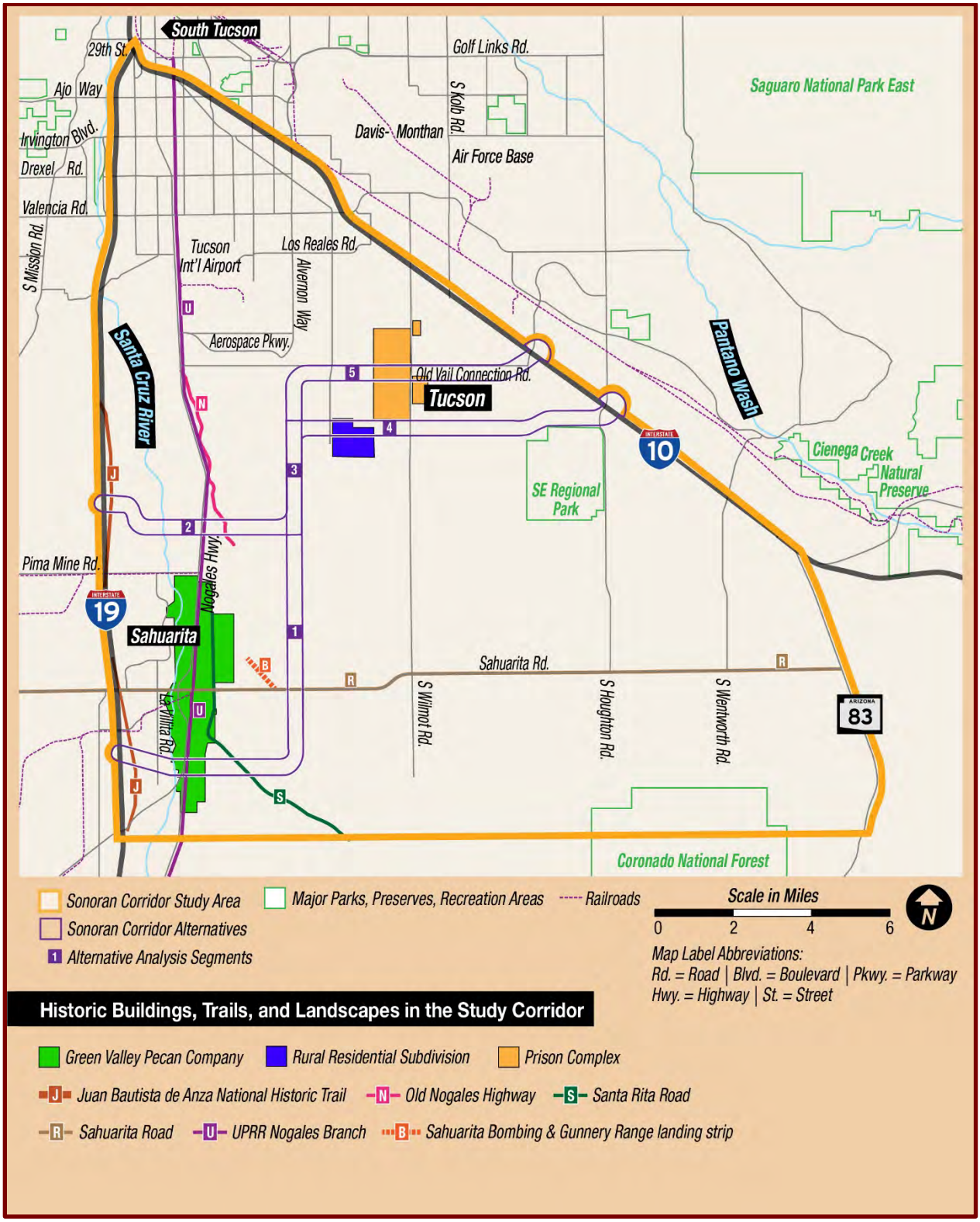
NATIONAL REGISTER ELIGIBILITY	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
Eligible, Criteria A/B/C	0	0	1[1]
Eligible, Criterion D	10	9	19
Eligible, Criterion Unknown[2]	3	1	0
Total Eligible	13	11	20
Not Eligible	7	6	5
Total Evaluated	20	17	25
Percent Evaluated as Eligible	65%	65%	80%
Not Evaluated	17	11	5
Total	37	28	30
Percent Evaluated	67%	61%	83%

[1] Although it has been recommended eligible for inclusion on the National Register under criteria A and C, the EPNG Line 1100 is exempt from Section 106 review until it is decommissioned, per 67 FR 16364.
[2] includes properties assessed to be "likely eligible" during the windshield survey of historic buildings and structures

3.6.3.3 Historic Buildings, Trails, and Landscapes

The windshield survey identified only 10 historic resources spread across a very large study corridor (Figure 3-23). Further research may identify other properties or features; however, any additional potentially age-eligible properties not identified during this survey are common property types that lack any known historical significance and would not likely be eligible for listing in the National Register.

Figure 3-23. Historic Buildings, Trails, and Landscapes in the Study Corridor



Segment 1

The Green Valley Pecan Company orchards were evaluated as a potential historic landscape. These orchards are contiguous and comprise a megablock that is almost 6 miles long, stretching south from Pima Mine Road, and between 1 and 1.25 miles wide.

A portion of the Juan Bautista de Anza National Historic Trail runs along the Santa Cruz River within Segment 1. This property is a National Historic Trail designated to commemorate the route used by Spanish explorer Juan Bautista de Anza's 1774 and 1775 overland expeditions from Tubac to California. The exact route taken by de Anza is not known, and the designated trail follows the approximate route he is thought to have taken. The trail does not consist of intact historic features. As such, it is properly considered a recreational and interpretive trail rather than a historic property subject to consideration under Section 106 of the NHPA.

The remains of the Sahuarita Bombing & Gunnery Range landing strip are located within the study corridor near Segment 1. This landing strip no longer possesses integrity.

Segment 2

A Portion of the Juan Bautista de Anza National Historic Trail is located within Segment 2. As described under the discussion of Segment 1, this is a recreational trail that is not subject to consideration under Section 106 of the NHPA.

Segment 3

This part of the study corridor is undeveloped land with sparse desert vegetation. No historic resources were identified in Segment 3 (Figure 3-23).

Segment 4

Most of this part of the study corridors undeveloped land with sparse desert vegetation. Existing development within or adjacent to the study corridor includes the Federal Correctional Institution, 8901 S. Wilmot Road; the Arizona Department of Corrections Whetstone Unit, 1000 S. Wilmot Road; the Pima County Fairgrounds; and several paved and unpaved roads of relatively recent construction.

A rural residential subdivision within Corridor Alternative 8A between Swan Road and Wilmot Road was developed gradually over the past 50 years. Houses are situated on large lots and represent a variety of architectural styles and construction materials, but no exceptional examples of architectural design or construction were noted, and as a property type, undistinguished rural subdivisions with a broad range of construction dates do not possess enough significance to be eligible for listing in the National Register (Figure 3-23).

Segment 5

Most of this part of the study corridor is undeveloped land with sparse desert vegetation. Existing development within or adjacent to the study corridor includes the Federal Correctional Institution, 8901 S. Wilmot Road; the Arizona Department of Corrections Whetstone Unit, 1000 S. Wilmot Road; a modern pumping plant; and a large gravel mining operation. No historic resources were identified in Segment 5.

3.6.3.4 Preliminary National Register Evaluation of Unrecorded Historic Buildings, Trails, and Landscapes

None of the historic buildings, trails, or landscapes identified during this analysis have previously been evaluated for National Register eligibility. This section presents preliminary recommendations regarding National Register eligibility. All other historic resources identified as part of this analysis are recommended as likely not eligible for the National Register. Table 3-25 reflects this assessment.

Table 3-25. Estimated Total Historic Buildings, Trails, and Landscapes and Recommended Eligibility by Corridor Alternative

CORRIDOR ALTERNATIVE/ SEGMENT	TOTAL HISTORIC RESOURCES	TOTAL LIKELY ELIGIBLE	TOTAL LIKELY INELIGIBLE
Corridor Alternative 1			
Segment 2	3	1	2
Segment 3	0	0	0
Segment 5	0	0	0
Total	3	1	2
Corridor Alternative 7			
Segment 1	7	2	5
Segment 3	0	0	0
Segment 5	0	0	0
Total	7	2	5
Corridor Alternative 8A			
Segment 1	7	2	5
Segment 3	0	0	0
Segment 4	1	0	1
Total	8	2	6

3.6.3.5 Traditional Cultural Properties

During a meeting with the Four Southern Tribes, one of the participants mentioned a TCP within vicinity of the study area but did not divulge the location. No TCPs have been identified to date within any of the corridor alternatives. As the study advances and the corridor is further refined, the project team will continue to consult with Tribes to identify TCPs and any potential effects to them.

3.6.4 Environmental Consequences

The Tier 1 study is broad in approach. This level of analysis is qualitative and programmatic. Therefore, information presented in this section is to be used for planning purposes rather than applied pursuant to the Section 106 process as a means of assessing effects of a new Sonoran Corridor on cultural resources.

An adverse effect would occur when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative. Impacts on cultural resources would vary depending on the future location of a freeway alignment within the selected corridor alternative. Avoidance is the preferred way to address cultural resources, and decisions regarding avoidance methods would be reached through Section 106 consultation during the Tier 2 process when more details regarding the proposed freeway location, design, and operation would be available.

Physical impacts on cultural resources may include direct damage to or destruction of cultural resources within the footprint of the freeway alignment, including any needed nearby staging areas.

Operational impacts on cultural resources could include permanent access restrictions, visual impacts, and noise and vibration impacts on properties close to a future freeway alignment. In addition, direct damage to or destruction of cultural resources (for example, looting) attributable to increased accessibility to previously isolated areas is possible.

Permanent loss or temporary changes in the viewshed of potential TCPs and permanent loss or temporary changes to potential TCP access and use could result. Construction impacts on cultural resources may include direct damage to or destruction of cultural resources and noise and vibration impacts on properties that are close to a future freeway alignment (including staging areas) but would not be permanently incorporated into the freeway facility. Indirect damage may be caused through vibrations from geotechnical testing, use of heavy equipment, or earth moving activities. Construction impacts may also include unanticipated discovery of previously unknown cultural resources (including human burials), permanent loss or temporary changes in the viewshed of potential TCPs, permanent loss or temporary changes in potential TCP access and use, and increased noise and dust.

3.6.4.1 Assessment of Corridor Alternatives

The assessment of potential levels of impacts of construction activities on archaeological sites and historic structures considered all the compiled information about the types and densities of recorded sites and structures in each corridor alternative and the evaluation of the potential for unrecorded archaeological sites and historic structures in unsurveyed areas. The following factors were used to characterize the levels of potential impact.

Potential High Impact

Potential levels of impact were rated high for the parts of corridor alternatives with

- Recorded prehistoric village or habitation sites and multi-component sites with prehistoric village or habitation components.

- Recorded cultural resources determined or recommended eligible for the National Register under Criteria A, B, or C, in addition to or in lieu of Criterion D (information potential), indicating they could warrant efforts for preservation in place.

Potential Moderate Impact

Potential levels of impact were rated moderate for the parts of corridor alternatives with

- Recorded archaeological sites or historic structures determined to be National Register eligible or recommended eligible for their potential to yield important information (Criterion D).
- Recorded archaeological sites or historic structures unevaluated for National Register eligibility; and areas not previously surveyed for cultural resources but assessed as having high potential for unrecorded archaeological sites or historic structures.

Potential Low Impact

Potential levels of impact were rated low for the parts of corridor alternatives with

- No recorded archaeological sites or historic structures that have been determined to be eligible or recommended eligible for the National Register or are unevaluated.
- Areas not surveyed for cultural resources but assessed as having moderate or low potential for unrecorded archaeological sites or historic structures.

Corridor Alternative 1

Corridor Alternative 1 consists of project Segments 2, 3, and 5. In total, portions of this corridor have been inventoried as part of 64 previous projects, which have resulted in survey coverage of 58 percent of the corridor. In total, 39 cultural resources have been documented within Corridor Alternative 1, including 14 that are considered or recommended eligible for inclusion on the National Register, 17 that are unevaluated or have unknown National Register eligibility, and 8 that are considered or have been recommended ineligible for inclusion on the National Register.

Segment 2, one of this corridor alternative's constituent segments, includes the largest and most complex prehistoric site known to exist in Corridor Alternative 1, AZ BB:13:221(ASM). The site has been reported to include a Hohokam village with a ballcourt and numerous other features visible from the ground surface (Hanna 1987). Most of the prehistoric sites within the study corridor represent resource procurement and processing loci that probably experienced temporary, short-term occupation; village sites differ in that they were occupied intensively by comparably large numbers of people over the course of decades or centuries. Consequently, excavation of similar sites in the Santa Cruz River Valley routinely encounter dozens or hundreds of buried features such as pit houses, canals, and burials. The site has been informally inspected recently, and surface features and artifacts appear to remain in good condition but may require updated mapping (TON THPO, personal communication, July 2019).

While Corridor Alternative 1 is the shortest segment and includes the lowest estimated total number of sites (52–63), the density and types of known cultural resources present within this corridor alternative suggest implementation of this option could have the greatest potential impact on cultural resources. Consequently, Corridor Alternative 1 is assessed to have a high potential to impact cultural resources.

Corridor Alternative 7

Corridor Alternative 7 consists of Segments 1, 3, and 5. In total, portions of Corridor Alternative 7 have been inventoried as part of 72 previous projects, which have resulted in survey coverage of 32 percent of the corridor. In total, 33 cultural resources have been documented within Corridor Alternative 7, including 12 that are considered or recommended eligible for inclusion on the National Register, 11 that are unevaluated or have unknown National Register eligibility, and 10 that are considered or have been recommended ineligible for inclusion on the National Register.

Corridor Alternative 7 is estimated to include 58–83 total cultural resources. The alternative crosses the Santa Cruz River Floodplain in Segment 1, an area that could contain buried portions of large prehistoric habitation or agricultural sites; however, no such sites are known to exist within this corridor alternative at this time. The corridor alternative includes at least 12 sites that have been recommended or determined eligible for inclusion on the National Register under criterion D, so it is assessed to have a moderate potential to impact cultural resources.

Corridor Alternative 8A

Corridor Alternative 8A consists of Segments 1, 3, and 4. In total, portions of Corridor Alternative 8A have been inventoried as part of 60 previous projects, which have resulted in survey coverage of 32 percent of the corridor. In total, 37 cultural resources have been documented within Corridor Alternative 8A, including 21 that are considered or recommended eligible for inclusion on the National Register, 5 that are unevaluated or have unknown National Register eligibility, and 11 that are considered or have been recommended ineligible for inclusion on the National Register.

Corridor Alternative 8A is identical to Corridor Alternative 7 for most of its length; Corridor Alternative 8A is different only in that it incorporates Segment 4 rather than Segment 5. This combination of segments makes it the longest corridor alternative. Corridor Alternative 8A is also estimated to include a similar total number of known cultural resources (62–78), which suggests that implementing this corridor alternative would pose similar potential impact to cultural resources as Corridor Alternative 7. The alternative crosses the Santa Cruz River Floodplain in Segment 1, an area that could contain buried portions of large prehistoric habitation or agricultural sites; however, no such sites are known to exist within this corridor alternative at this time. The corridor alternative encompasses at least 21 sites that have been recommended or determined eligible for inclusion on the National Register. It is therefore assessed as having a moderate potential to impact cultural resources. Table 3-26 shows the possible impacts created by each corridor alternative on archaeological and historic sites.

Table 3-26. Potential for Impacts on Archaeological Sites and Historic Structures along the Corridor Alternatives

CORRIDOR ALTERNATIVE/ SEGMENT	POTENTIAL LEVELS OF IMPACT		
	HIGH	MODERATE	LOW
Corridor Alternative 1			
Segment 2	X		
Segment 3		X	
Segment 5		X	
Overall	X		
Corridor Alternative 7			
Segment 1		X	
Segment 3		X	
Segment 5		X	
Overall		X	
Corridor Alternative 8A			
Segment 1		X	
Segment 3		X	
Segment 4		X	
Overall		X	

No-Build Alternative

Under the No-Build Alternative, a future highway would not be constructed within the corridor alternatives. Vehicular travel could continue along the existing transportation network. The No-Build Alternative would include transportation projects that are programmed in PAG's federally approved Metropolitan TIPs. Some of these planned improvement projects could involve ground disturbance, which might include trenching for drainage improvements, earthwork for new local roads or widening existing roads, excavations for sign and guardrail installation, and similar activities. Such projects could have direct effects on cultural resources which would require the inventory, evaluation, and possible mitigation of any National Register-eligible sites in accordance with applicable laws and policies. Overall, the effects of the No-Build Alternative would likely be more localized and discrete compared to the effect of constructing a future highway within one of the corridor alternatives, as other projects included in the TIP involve smaller areas of land.

3.6.5 Available Mitigation Measures

Adverse effects to historic properties would necessitate the development and implementation of a treatment plan to lay out an approach for mitigating those effects prior to construction. In accordance with the Section 106 PA that's being developed in conjunction with this Tier 1 EIS, the treatment plan would outline a research design as well as field, laboratory, or archival research methods to ensure data collection and analysis followed applicable guidelines and met requisite standards. While the treatment plan would be developed during the Tier 2 analysis following identification of a preferred alignment, possible mitigation measures might include the following:

- For archaeological sites that could not be avoided
  - Performing eligibility or boundary testing of sites whose National Register eligibility status or extent is unknown
  - Completing phased data recovery investigations at sites previously determined National Register eligible
  - Preparing a technical report on findings
  - Conducting public outreach, publishing results, or installing interpretive signage
- For archaeological sites that could be avoided:
  - Flagging sites in advance of construction
  - Monitoring construction activities
- For inadvertent discoveries encountered during construction
  - Defining extent and assessing eligibility of intact deposits or whether deposits contribute to overall site eligibility; treating National Register-eligible properties or contributing deposits as outlined in the treatment plan
- For historic built properties
  - Completing historic assessment
  - Completing National Register nomination
  - Preparing Historic American Engineering Record
  - Preparing Historic American Buildings Survey document
  - Developing interpretive signage
  - Providing adaptive reuse
- For TCPs
  - Viewshed analysis and compatible project design
  - Timing construction to avoid critical use periods
  - Off-site treatments such as ethnographic study of TCPs, language, or plant use
  - Funding cultural or educational programs

3.6.6 Conclusion

All three corridor alternatives present at least moderate potential to impact cultural resources. Table 3-27 summarizes the findings for cultural resources potentially affected by a new Sonoran Corridor, based on available data. This analysis suggests Corridor Alternative 1 presents the highest potential impact, mainly due to the presence of a large Hohokam archaeological site known to contain habitation features and a ballcourt. If Corridor Alternative 1 were implemented, avoiding this site would be difficult. Furthermore, of the three corridor alternatives, Corridor Alternative 1 contains the highest acreage of known archaeological sites (see Table 3-22).

Table 3-27. Summary of the Potential Impacts on Cultural Resources

TOPICS	NO-BUILD ALTERNATIVE	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
Archaeological Sites and Historic Structures	No resources identified. Other projects in the study corridor will be subject to their own evaluation.	Prior cultural resource surveys covered 55.6 percent of the 2,000-foot-wide corridor and recorded 35 sites and historic structures. The corridor contains an estimated 66 total archaeological sites and historic structures. Selection of this corridor could have high impact to cultural resources due to potential adverse effects to a Hohokam habitation site.	Prior cultural resource surveys covered 30.2 percent of the 2,000-foot-wide corridor and recorded 27 sites and historic structures. The corridor contains an estimated 88 total archaeological sites and historic structures. Selection of this corridor could have moderate impact to cultural resources due to potential adverse effects to archaeological sites eligible for inclusion on the National Register under criterion D.	Prior cultural resource surveys covered 29.6 percent of the 2,000-foot-wide corridor and recorded 29 sites and historic structures. The corridor contains an estimated 111 total archaeological sites and historic structures. Selection of this corridor could have moderate impact to cultural resources due to potential adverse effects to archaeological sites eligible for inclusion on the National Register under criterion D.
Historic buildings, trails, and landscapes	No resources identified. Other projects in the study corridor will be subject to their own evaluation.	Potential high impacts on one historic resource preliminarily evaluated as likely National Register eligible.	No impacts to historic resources preliminarily evaluated as likely National Register eligible.	No impacts to historic resources preliminarily evaluated as likely National Register eligible.
Traditional Cultural Properties	No resources identified. Other projects in the study corridor will be subject to their own evaluation.	No resources identified.	No resources identified.	No resources identified.

Table 3-27. Summary of the Potential Impacts on Cultural Resources (continued)

TOPICS	NO-BUILD ALTERNATIVE	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
Indirect Effects	Programmed transportation improvements and projected population and employment growth could • Result in land use conversion with associated loss of historic properties	Construction of a new highway within this corridor alternative could • Result in visual, auditory, or atmospheric effects at nearby historic properties • Result in land use conversion with associated loss of historic properties • Result in increased public access to previously hard-to-reach areas and lead to a concomitant increase in vandalism, looting, and recreational impacts to historic properties. • Encourage additional developments near the highway by other entities, including private developers, that may affect historic properties	Construction of a new highway within this corridor alternative could • Result in visual, auditory, or atmospheric effects at nearby historic properties • Result in land use conversion with associated loss of historic properties • Result in increased public access to previously hard-to-reach areas and lead to a concomitant increase in vandalism, looting, and recreational impacts to historic properties. • Encourage additional developments near the highway by other entities, including private developers, that may affect historic properties	Construction of a new highway within this corridor alternative could • Result in visual, auditory, or atmospheric effects at nearby historic properties • Result in land use conversion with associated loss of historic properties • Result in increased public access to previously hard-to-reach areas and lead to a concomitant increase in vandalism, looting, and recreational impacts to historic properties. • Encourage additional developments near the highway by other entities, including private developers, that may affect historic properties

The lack of survey coverage makes comparisons between Corridor Alternatives 7 and 8A difficult; however, available data suggests Corridor Alternative 8A could affect the highest number of archaeological sites and the highest number of eligible historic properties.

Based on available data, Corridor Alternative 7 appears to present the lowest potential for impacts to cultural resources. However, this finding must be considered provisional. While Corridor Alternative 1 contains the only *known* village archaeological site, all three corridors have the potential to include undiscovered archaeological sites of this type, possibly in buried contexts that no longer have a surface manifestation. All three corridors span the Santa Cruz River flood plain and adjacent terraces, areas where such sites are relatively more common than surrounding uplands.

Corridor Alternatives 7 and 8A are both longer than Corridor Alternative 1 and have higher estimated numbers of archaeological sites (see Table 3-22). In combination with the potential to encounter undiscovered habitation sites along the Santa Cruz River, Corridors 7 and 8A have the potential to present greater impacts to cultural resources than Corridor Alternative 1.

3.7 Section 4(f) Resources

This section provides an assessment of resources protected under Section 4(f) of the Department of Transportation Act of 1966 (49 U.S.C. 303, 23 U.S.C. 138, and 23 CFR 774) (Section 4(f)). This Tier 1 analysis only identifies Section 4(f) resources within the Study Area and corridor alternatives. ADOT and FHWA are not making any Section 4(f) "use" determinations or approvals at this time. If a corridor alternative is chosen, future Section 4(f) "use" determinations and approvals would be made as part of the Tier 2 analysis, when more-detailed and specific information is available regarding a project's location and design (such as the location of alignments, duration and extent of construction, specific construction methods, and staging areas) and information regarding the location, boundaries, and significance of Section 4(f) resources are known.

Pursuant to 23 CFR 774, Section 4(f) applies to the use of significant public parks, recreation areas, wildlife and waterfowl refuges, and historic sites. Significance is usually determined in consultation with Official(s) with Jurisdiction (OWJ) over those properties. For this Tier 1 analysis, all public parks, recreation area, wildlife and waterfowl refuges in the Study Area were considered significant. For historic sites, a site that is either eligible for or listed in the National Register is considered significant and is eligible for protection under Section 4(f). National Register eligibility is determined during consultation under Section 106 of the NHPA. The Section 106 consultation process is described in more detail in Section 3.6 Cultural Resources.

The regulations define the entities and individuals who are considered the OWJ for various types of property in 23 CFR 774.17. For public parks, recreation areas, and wildlife and waterfowl refuges the OWJs are the official(s) of an agency or agencies that own and/or administer the property in question and who are empowered to represent the agency on matters related to the property. For historic sites, the OWJ is the SHPO. If the historic site is located on tribal land the THPO is considered the OWJ. If the property is located on tribal land but the tribe has not assumed the responsibilities of the SHPO (i.e. THPO), as provided for in the NHPA, then the representative designated by the tribe shall be recognized as an OWJ in addition to the SHPO.

Compliance under Section 4(f) is exclusive to projects that are federally funded or require an action (such as an approval) by an USDOT agency, such as FHWA. Projects that do not require an action from an USDOT agency are not applicable to Section 4(f) regulations. While another agency may be considered and consulted with as an OWJ in terms of Section 4(f), FHWA and ADOT are responsible for making final Section 4(f) "use" determinations and approvals. FHWA is responsible for the Section 4f decisions made in this Tier 1 EIS. ADOT would be the agency solely responsible for Section 4(f) "use" determinations and approvals during any Tier 2 study.

3.7.1 Regulatory Framework

Section 4(f) states that FHWA "…may approve a transportation program or project…requiring the use of publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance, or land of an historic site of national, State, or local significance (as determined by the Federal, State, or local officials having jurisdiction over the park, area, refuge, or site) only if:

(1) there is no prudent and feasible alternative to using that land;

(2) the program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use; or

(3) the use of the property will have a de minimis impact (49 USC 303[c]).

3.7.2 Section 4(f) Use Definitions

A "use" of a Section 4(f) property, as defined in 23 CFR 774, occurs: (1) when land is permanently incorporated into a transportation facility; (2) when there is a temporary occupancy of land that is adverse in terms of the statute's preservationist purposes; or (3) when there is a constructive use of the Section 4(f) property.

Permanent Use - Occurs when land from the resource is permanently incorporated into a transportation facility. This occurs when land from a Section 4(f) property is either purchased outright as transportation ROW or when the applicant for Federal-aid funds has acquired a property interest that allows permanent access onto the property such as a permanent easement for maintenance or other transportation-related purpose.

Temporary Use - Occurs when any part of a Section 4(f) property is required for construction-related activities for duration shorter than the project length. The property may not be permanently incorporated into a transportation facility, but the activity may or may not be considered adverse in terms of the preservation purpose of Section 4(f). A temporary occupancy will not constitute a Section 4(f) use when all of the conditions listed in 23 CFR 774.13(d) are satisfied:

1. Duration must be temporary, i.e., less than the time needed for construction of the project, and there should be no change in ownership of the land;
2. Scope of the work must be minor, i.e., both the nature and the magnitude of the changes to the Section 4(f) property are minimal;
3. There are no anticipated permanent adverse physical impacts, nor will there be interference with the protected activities, features, or attributes of the property, on either a temporary or permanent basis;
4. The land being used must be fully restored, i.e., the property must be returned to a condition which is at least as good as that which existed prior to the project; and
5. There must be documented agreement of the official(s) with jurisdiction over the Section 4(f) resource regarding the above conditions."

Constructive Use - Occurs when the transportation project does not incorporate land from a Section 4(f) property, but the project's proximity impacts are so severe that the protected activities, features, or

attributes that qualify a property for protection under Section 4(f) are substantially impaired. For example, a constructive use can occur when:

(a) the projected noise level increase, attributable to the project, substantially interferes with the use and enjoyment of a noise-sensitive facility of a property protected by Section 4(f);

(b) the proximity of the proposed project substantially impairs aesthetic features or attributes of a property protected by Section 4(f), where such features or attributes are considered important contributing elements to the value of the property (an example of such an effect would be the location of a proposed transportation facility in such proximity that it obstructs or eliminates the primary views of an architecturally significant historical building or substantially detracts from the setting of a park or historic site that derives its value in substantial part due to its setting); and/or

(c) the project results in a restriction of access that substantially diminishes the utility of a significant publicly owned park, recreation area, or historic site.

3.7.3 Section 4(f) "Use" Approvals

When FHWA or ADOT determines that a project as proposed may require "use" of a Section 4(f) property, there are three methods available to approve that Section 4(f) "use": 1) Preparing a de minimis impact determination; 2) Applying a programmatic Section 4(f) evaluation; or 3) Preparing an individual Section 4(f) evaluation. For more information on Section 4(f) approvals, please FHWA's Section 4(f) Policy Paper at the following: https://www.environment.fhwa.dot.gov/legislation/section4f/4fpolicy.aspx#assess

3.7.3.1 *De minimis* Use Determination

A *de minimis* "use" determination is made for the net impact on the Section 4(f) property. The final project NEPA decision document must include sufficient supporting documentation for any measures to minimize harm that were applied to the project in order to make the *de minimis* "use" determination (*See* 23 CFR 774.7(b)). A "use" of Section 4(f) property having a *de minimis* impact can be approved by FHWA or ADOT without the need to develop and evaluate alternatives that would avoid using the Section 4(f) property. A *de minimis* "use" determination may be made for a permanent incorporation or temporary occupancy of Section 4(f) property. A *de minimis* "use" involves the project incorporating a small portion of a Section 4(f) property but does not affect the overall use of the property. A *de minimis* "use" is one that, after taking into account any measures to minimize harm (such as avoidance, minimization, mitigation or enhancement measures), results in either:

1. For historic sites, after a Section 106 effect determination of "no adverse effect" or "no historic properties affected" is made; or
2. When determination that the project would not adversely affect the activities, features, or attributes qualifying a park, recreation area, or refuge for protection under Section 4(f). The following steps must take place in order to make this determination:
    - The OWJ over the property is informed of FHWA's or ADOT's intent to make the *de minimis* "use" determination, after which an opportunity for public review and comment must be provided.

- After considering any comments received from the public, if the OWJ concurs in writing that the project will not adversely affect the activities, features, or attributes that make the property eligible for Section 4(f) protection, then FHWA or ADOT may finalize the *de minimis* "use" determination.

3.7.3.2 Programmatic Section 4(f) Evaluation

Programmatic Section 4(f) evaluations are a time-saving procedural option for preparing Individual Section 4(f) evaluations for certain minor uses of Section 4(f) property. Programmatic Section 4(f) evaluations are developed by the FHWA based on experience with many projects that have a common fact pattern from a Section 4(f) perspective. Through applying a specific set of criteria, based upon common experience that includes project type, degree of use and impact, the evaluation of avoidance alternatives is standardized and simplified. An approved programmatic Section 4(f) evaluation may be relied upon to cover a particular project only if the specific conditions in that programmatic evaluation are met.

To date, the FHWA has issued five nationwide programmatic Section 4(f) evaluations:

1. Section 4(f) Statement and Determination for Independent Bikeway or Walkway Construction Projects
2. Programmatic Section 4(f) Evaluation and Approval for FHWA Projects that Necessitate the Use of Historic Bridges
3. Final Nationwide Section 4(f) Evaluation and Approval for Federally Aided Highway Projects with Minor Involvements with Historic Sites
4. Final Nationwide Section 4(f) Evaluation and Approval for Federally Aided Highway Projects with Minor Involvements with Public Parks, Recreation Lands, Wildlife and Waterfowl Refuges
5. Nationwide Programmatic Section 4(f) Evaluation and Approval for Transportation Projects That Have a Net Benefit to a Section 4(f) Property.

3.7.3.3 Individual Project Section 4(f) Evaluations

An individual Section 4(f) evaluation must be completed when approving a project that requires the use of Section 4(f) property if the use results in a greater than *de minimis* and a Programmatic Section 4(f) evaluation cannot be applied to the situation (23 CFR 774.3). The individual Section 4(f) evaluation documents the evaluation of the proposed use of Section 4(f) properties in the project area of all alternatives. The Individual Section 4(f) evaluation requires two findings:

1. That there is no feasible and prudent alternative that completely avoids the use of Section 4(f) property; and
2. That the project includes all possible planning to minimize harm to the Section 4(f) property resulting from the transportation use [*See* 23 CFR 774.3(a)(1) and (2)].

3.7.4 Section 4(f) Evaluations for Tiered Projects

FHWA must comply with Section 4(f) when tiered NEPA documents are used. In a tiered EIS, the project development process moves from a broad scale examination at the Tier 1 stage to a more site-specific evaluation in the Tier 2 stage. During the Tier 1 stage the detailed information necessary to complete the Section 4(f) approval (*De minimis*, Programmatic Evaluation, or Individual Evaluation) may not be available.

If sufficient information is unavailable during the Tier 1 stage, then the EIS may be completed without any preliminary Section 4(f) Approval Evaluations which are explained in Section 3.7.3. The documentation should state why no preliminary approval is possible during the Tier 1 stage and clearly explain the process that would be followed to complete Section 4(f) approval evaluations during subsequent tiers. The extent to which a Section 4(f) approval (preliminary or final) anticipated to be made in a subsequent tier may have an effect on any decision made during the first-tier stage should be discussed. Schedules to complete Section 4(f) evaluations, if available, should also be reported.

3.7.5 Methodology

For this Tier 1 analysis, Section 4(f) properties were identified throughout the study area. For public parks, recreation areas, or wildlife and waterfowl refuges, data obtained to identify Section 4(f) properties included 2018/2019 aerial photograph, GIS data, municipal (City of Tucson and Town of Sahuarita) and Pima County planning documents, and county GIS web application. Existing Section 4(f) resources within the study area were mapped using GIS. The methodology used to identify historic sites eligible for protection under Section 4(f) were identified during Section 106 consultation which is described in more detail in Section 3.6 Cultural Resources. Section 4(f) resources are documented by type (historic sites, parks, recreation areas, and wildlife/waterfowl refuges). The total acreages of Section 4(f) resources within the study area are quantified and reported per corridor alternative.

Although there is currently insufficient data to provide a preliminary Section 4(f) approval as no specific alignment within the corridor alternatives has been determined, this does not relieve FHWA from its responsibility to consider alternatives that avoid the use of Section 4(f) properties during the Tier 1 stage. So, after identifying the Section 4(f) properties in the Study Area, FHWA assessed whether each corridor alternative has the potential to incorporate land from each Section 4(f) property during the Tier 2 phase. To make this determination, the project team identified Section 4(f) properties that were identified partially or entirely within one or more of the 2,000-foot-wide corridor alternatives. Section 4(f) properties that were directly adjacent to corridor alternatives were considered as well.

Then the potential to implement a Tier 2 project within each corridor alternative without permanently incorporating land from each protected property was examined. In this process, three ways to avoid having a need to permanently use a Section 4(f) property during Tier 2 were considered; each would apply professional engineering judgment and consideration of other natural and built environment opportunities and constraints:

- **Accommodate in corridor** – Provide an opportunity for Tier 2 alignments within the 2,000-foot-wide corridor alternative that avoids the protected property;

- **Shift corridor** – Shift the 2,000-foot-wide corridor alternative away from the protected property to accommodate the project without using land from the protected property; or
- **Grade-separated corridor** – In the case of linear properties (such as trails, historic canals and historic railroads), a 2,000-foot-wide corridor alternative would cross over or under the protected property (such as on an elevated structure or depressed roadway section) without using land from the protected property.

3.7.6 Affected Environment

Appendix F provides a summary table (Table F-1. Section 4(f) Resources – Parks and Recreation) and figure (F-1. Section 4(f) Resources) of the parks and recreational areas within the study area. There are no wildlife/waterfowl refuges within the study area. The closest wildlife/waterfowl refuge within the study area is the Santa Rita Experimental Range (SRER), approximately 12 miles southeast of Segment 1 (Corridor Alternatives 7 and 8A). The Pima Regional Trail System Master Plan (May 2012 and revised map February 2015) shows several planned recreation trails throughout the study area. Planned trails include greenways, multi-use trails, paths, and trail parks. Greenways typically feature a path or trail preserving native vegetation and landscaped plantings with pedestrian amenities. Multi-use trails (known in the plan as trails) serve a variety of users: bicyclists, walkers, runners, hikers, equestrians, and others who prefer a soft or native surface. These trails can be located in all types of situations: along roadways, washes, utility corridors, etc. Paths are paved trails for various users and are ADA accessible. Trail parks are large desert open-space properties that contain multiple looped trails located within developed or developing areas. These planned trails are located on currently private or ASLD land and not on public lands. There are numerous planned trails within the study area; however, only trails that cross the corridor alternatives are identified as potential Section 4(f) properties in the table and figure in Appendix F. These planned trails are identified in the table as one property, even though there are several types/segments within the corridor alternatives.

As for historic sites eligible for protection under Section 4(f), they are discussed in more detail in Section 3.6, Cultural Resources and are listed in Appendix F in Table F-2 Section 4(f) Resources – Historic Sites. Figure F-1 shows the historic sites that are not sensitive in nature.

3.7.7 Environmental Consequences

While Section 4(f) "use" determinations and approvals are not being made at this time, FHWA is not relieved from its responsibility to consider alternatives that avoid the use of Section 4(f) properties during the Tier 1 stage. As stated in Section 3.7.5, after identifying Section 4(f) properties FHWA and ADOT assessed whether each corridor alternative has the potential to incorporate land from each Section 4(f) property during the Tier 2 phase, and then considered these three ways to avoid having a need to permanently use a Section 4(f) property during Tier 2: 1) Accommodating the Section 4(f) property by providing an opportunity for Tier 2 alignments within the corridor alternative to avoid the Section 4(f) property; 2) Shifting the corridor alternative away from the Section 4(f) property; and 3) Grade-separating the Tier 2 alignment within corridor alternative from the Section 4(f) property.

The Anamax Park is a resource protected under Section 4f that is located just west of the connection point of Corridor Alternatives 7 and 8A to I-19. Leaving the connection point for Corridor Alternatives 7 and 8A in its original location provided the likelihood of a potential Section 4(f) use of Anamax Park during Tier 2 if one of these two corridor alternatives was to be chosen given the need to construct a system interchange. To avoid the potential Tier 2 Section 4(f) use of Anamax Park, the Corridor Alternatives 7 and 8A connection point at I-19 was moved slightly north to a location just south of El Toro Road. For a similar reason, the easternmost 2 miles of Alternative 8A were moved 1,000 feet north of the initial east-west routing to eliminate potential Tier 2 Section 4(f) use of the Southeast Regional Park, which was identified a Section 4(f) recreation resource as well. As stated in Chapter 2, not only a potential Tier 2 Section 4(f) "use" of Anamax Park is being avoided but this also provides an opportunity for a common connection point with any future westerly corridor development. The final revised corridor routings are shown in Figure 2-5.

The remaining Section 4(f) Resources identified within the corridor alternatives that are listed in Table 3-29. FHWA has determined that this should not have an effect on the decision being made during at this time because there is high likelihood that one of the following situations can apply:

- Project-specific or 400-ft alignments within the corridor alternative can avoid the Tier 2 Section 4(f) use by shifting away or grade-separation; or
- One of the Section 4(f) exemptions listed in 23 CFR 774.13 can be applied during Tier 2. For example, 23 CFR 774.13(b) can be applied for the exemption of a Section 4(f) use of eligible archaeological sites, and 23 CFR 774.13(f) can be applied for the exemption of a Section 4(f) use of trails.

Although FHWA and ADOT initially assessed potential use of Section 4(f) properties from a Tier 1 level, there is currently insufficient data to provide a preliminary Section 4(f) Approval as no specific alignment within the corridor alternatives has been determined. For example, effect finding determinations were not made during Section 106 Consultation as this would be necessary to make Section 4(f) "use" determinations and approvals of historic sites. ADOT would make all final Section 4(f) "use" determinations and approvals during the Tier 2 analysis when more information is available.

For the purposes of this Tier 1, this section only provides an overview of Section 4(f) resources within the corridor alternatives. Table 3-28 provides Section 4(f) properties that fall within the corridor alternatives and identifies the segments in which each of the properties can be found. Figure 3-24 shows the location of each property in relation to the corridor alternatives. The acreage for the property within a corridor alternative is quantified, along with the percentage of the total Section 4(f) property within the corridor alternative. All other Section 4(f) properties within the study area are outside the corridor alternatives and thus a use of that Section 4(f) property is not anticipated.

Table 3-28. Public parks, recreation area, historic sites or wildlife and waterfowl refuge Section 4(f) Resources Within the Study Corridor

PROPERTY # ON FIGURE 3-24	PROPERTY NAME	PROPERTY AREA/PERCENTAGE INSIDE CORRIDOR (ACRES OR MILES [%])	EXISTING PROPERTY ACREAGE (MILES FOR TRAILS)	APPLICABLE CORRIDOR / SEGMENT
Parks and Recreations				
1	Juan Bautista de Anza National Historic Trail	0.39 mile within Segment 1 (3.5%) 0.39 mile within Segment 2 (3.5%)	11.25 miles	Corridor Alternatives 1, 7 and 8A / Segments 1 and 2
2	Planned Trails	Approximately 1.8 miles within Segment 1 (1.5%) Approximately 0.40 mile within Segment 2 (0.3%) Approximately 0.40 mile within Segment 3 (0.3%) Approximately 2.50 miles within Segment 4 (2.1%) Approximately 1.5 miles within Segment 5 (1.3%)	Approximately 120 miles	Corridor Alternatives 1, 7 and 8A / Segments 1, 2, 3, 4, and 5
Historic Sites				
3	Green Valley Pecan Company	Approximately 296.93 acres within Segment 1 (4.2%)	7,000+ acres	Corridor Alternatives 7 and 8A / Segment 1
4	Southern Pacific Railroad (now Union Pacific), including Phoenix Main Line (AZ A:2:40(ASM)	Approximately 0.38 mile within Segment 1 (0.04%) Approximately 0.38 mile within Segment 2 (0.04%)	869.40 miles	Corridor Alternatives 1, 7, and 8A / Segment 1 and 2
5*	AZ BB:13:802(ASM)	Approximately 0.07 acre within Segment 2 (9.4%)	0.74 acre	Corridor Alternative 1/Segment 2
6	Old Nogales Highway (formerly assigned AZ BB:13:653[ASM])	Approximately 1.58 acres within Segment 2 (8.4%)	18.80 acres	Corridor Alternative 1/Segment 2

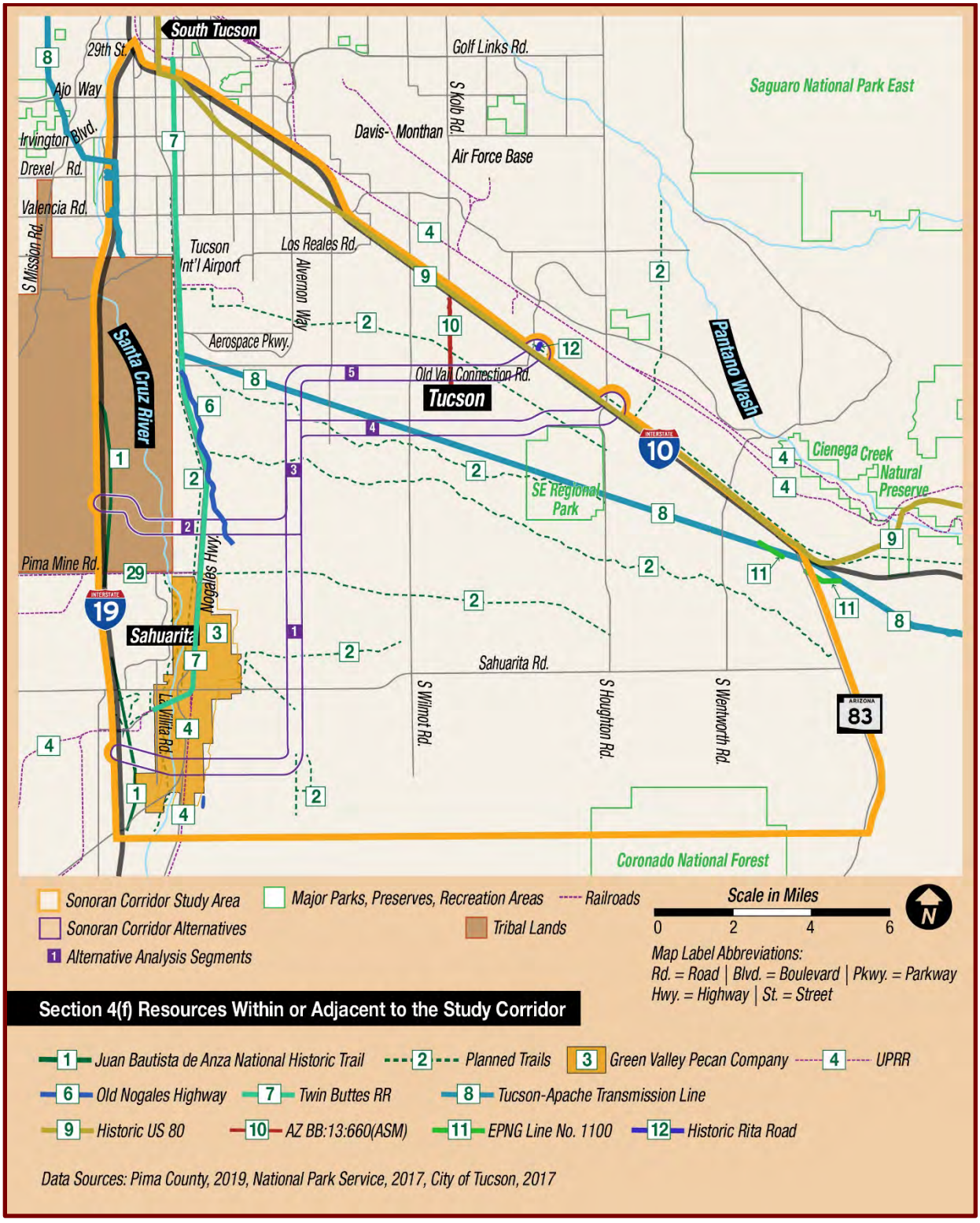
*Property not included on Figure 3-24 due to sensitive nature of the archaeological site

Table 3-28. Public parks, recreation area, historic sites or wildlife and waterfowl refuge Section 4(f) Resources Within the Study Corridor (continued)

PROPERTY # ON FIGURE 3-24	PROPERTY NAME	PROPERTY AREA/PERCENTAGE INSIDE CORRIDOR (ACRES OR MILES [%])	EXISTING PROPERTY ACREAGE (MILES FOR TRAILS)	APPLICABLE CORRIDOR / SEGMENT
7	Twin Buttes Railroad (formerly assigned AZ EE:1:300[ASM])	Approximately 0.60 acre within Segment 2 (1.7%)	35.39 acres	Corridor Alternative 1/Segment 2
8	Tucson-Apache Transmission Line (formerly assigned AZ CC:13:80[ASM])	Approximately 20.92 acres within Segment 4 (1.4%) Approximately 6.51 within Segment 5 (0.4%)	1463.86 acres	Corridor Alternatives 1, 7 and 8A/Segments 4 and 5
9	Historic US 80 (formerly assigned AZ FF:9:17[ASM])	Approximately 4.29 acres within Segment 4 (0.1%) Approximately 4.55 within Segment 5 (0.1%)	3675.92 acres	Corridor Alternatives 1, 7 and 8A/Segments 4 and 5
10	AZ BB:13:660(ASM)	Approximately 6.12 acres within Segment 5 (14%)	44.20 acres	Corridor Alternatives 1 and 7 /Segment 5
11	EPNG Line No. 1100 (formerly designated AZ CC:16:24[ASM])	Approximately 0.05 acre within Segment 5 (0.1%)	36.97 acres	Corridor Alternatives 1 and 7/Segment 5
12	Historic Rita Road (formerly assigned AZ BB:13:698[ASM])	Approximately 0.55 acre within Segment 5 (100%)	0.55 acre	Corridor Alternatives 1 and 7/Segment 5
13*	Unknown archaeological sites	See Table 3-25	See Table 3-25	Corridor Alternatives 1, 7 and 8A/Segments 1,2, 3, 4 and 5

*Property not included on Figure 3-24 due to sensitive nature of the archaeological site

Figure 3-24. Section 4(f) Resources within or adjacent to the Study Corridor



3.7.7.1 Corridor Alternative 1

Corridor Alternative 1 is comprised of corridor Segments 2, 3, and 5. Segments 3 and 5 are undeveloped areas that have no existing parks and recreations Section 4(f) properties; however, planned trails are identified within these segments as discussed above. Unknown archaeological site are further discussed in section 3.6.4.1 Assessment of Corridor Alternatives and protected under Section 4(f) unless exemption 23 CFR 774.13(b) is applied. During Tier 2 Section 106 consultation and effect determinations these unknown archaeological sites would be determined and coordination with OWJ would confirm if a site is protected under Section 4(f). There is a low likelihood of Tier 2 "use" of the unknown archaeological sites, as the freeway could be shifted to avoid sites, or an exemption may apply.

Segment 2 contains a portion of the Juan Bautista de Anza National Historic Trail. Approximately 0.39 mile of the Juan Bautista de Anza National Historical Trail is located within Segment 2 along I-19. Per Pima County's Trails and Outdoor GIS map, there is currently no recreational trail within this portion of the Juan Bautista de Anza National Historical Trail; however, the trail is identified on the National Park Service website map. There is a low likelihood of a Tier 2 "use" of the Juan Bautista de Anza National Trail. The 2000-foot corridor alternative occupies 3.5 percent of the trail; however, the 400-foot freeway footprint could potentially require only 0.7 percent use of the trail. In addition, grade separation can be included in Tier 2 final design as part of mitigation to avoid use of the trail, or a Section 4(f) exception listed under 23 CFR 774.13 could be applied.

The planned trails within Corridor Alternative 1 occupy approximately 2.3 miles within Segments 2, 3, and 5. Similar to the Juan Bautista de Anza National Historic Trail, there is a low likelihood for "use" being identified in Tier 2 as the potential freeway footprint would require only 0.4 percent use for these planned trails. In addition, the freeway footprint could be shifted to avoid the trails and/or grade separation could be implemented to allow continued paths. Finally, depending on the planned trail locations potential exemption 23 CFR 774.13(f)(3) could be applied. As these trails are currently just planned, their exact locations, types, and widths are unknown; thus, further analysis would be required during Tier 2.

Historic sites within this corridor (within Segments 2 and 5) include Southern Pacific Railroad, AZ BB:13:802(ASM), Old Nogales Highway, Twin Buttes Railroad, Tucson-Apache Transmission Line, Historic US 80, AZ:BB:13:660(ASM), EPNG Line No. 1100, and Historic Rita Road. There is a low likelihood of a Tier 2 "use" of these properties, because grade separation can be included in final design to avoid "use" of these properties, or an exception listed under 23 CFR 774.13 could be applied during Tier 2. In addition, Section 106 consultation and effect determinations are required to determine the level of Section 4(f) approval needed, if applicable, or whether a Section 4(f) exception listed under 23 CFR 774.13 can be applied during Tier 2. Below are the 400-foot-wide freeway footprint potential uses of these historic properties if mitigation cannot be applied:

- Southern Pacific Railroad – 0.01 percent
- AZ BB:13:802(ASM) – 1.9 percent
- Old Nogales Highway – 1.7 percent
- Twin Buttes Railroad – 0.3 percent
- Tucson-Apache Transmission Line – 0.08 percent

- Historic US 80 – 0.02 percent
- AZ:BB:13:660(ASM) – 2.8 percent
- EPNG Line No. 1100 – 0.02 percent
- Historic Rita Road – 20 percent

3.7.7.2 Corridor Alternative 7

Corridor Alternative 7 is comprised of corridor Segments 1, 3, and 5. As previously mentioned, no existing parks and recreations Section 4(f) properties are located in Segments 3 and 5. Segment 1 contains the Juan Bautista de Anza National Historic Trail. The trail has been discussed previously in Corridor Alternative 1, and the calculations are the same and there is also low likelihood for "use" in Tier 2. The planned trails with Corridor Alternative 7 equal approximately 3.7 miles, which equals 3.1 percent of potential study corridor impacts, while the future freeway footprint could potentially require only 0.6 percent use of these trails. As discussed above, there would be a low likelihood of "use" for these planned trails as grade separation or exemption could be applied. Historic sites, except for Green Valley Pecan Company, and unknown archaeological have already previously been discussed.

Green Valley Pecan Company historic landscape is located throughout the study corridor within Segment 1. Of the 274.65 acres within the study corridor, the freeway 400-foot right-of-way would potentially use approximately 28 acres (10%). In addition, the working farm would be bisected by the freeway similar to the existing S. Nogales Highway and Sahuarita Road that currently bisect the farm. The Class 1 Cultural Survey completed a preliminary review of the property recommending it not eligible; however, further formal assessment would be required during Tier 2 Section 106 consultation and effect determination to confirm this recommendation. As formal effect determination is still being determined, the Green Valley Pecan Company historic landscape may be protected by Section 4(f). There is a medium likelihood for "use" for this historic landscape if it is determined eligible during the Section 106 Tier 2 process.

3.7.7.3 Corridor Alternative 8A

Corridor Alternative 8A is comprised of corridor Segments 1, 3, and 4. Segments 1 and 3 have been discussed above in Corridor Alternative 1 and Corridor Alternative 7. There are no other existing Section 4(f) properties within this corridor alternative that have not been previously discussed. The planned trails with Corridor Alternative 8A would also have a low likelihood of "use" in Tier 2. The planned trails equal approximately 4.7 miles, which equals 3.9 percent of potential study corridor impacts, while the future freeway footprint would potentially require only 0.8 percent use of these trails. Again, grade separations, shifting of the alignment and exemption may be applied for avoidance of these planned trials. Finally, within Segment 4, the Tucson-Apache Transmission Line historic site future freeway footprint would potentially require only 0.3 percent use and the Historic US 80 future freeway footprint would potentially require only 0.9 percent use. There is a low likelihood of "use" for these two historic properties during Tier 2 as there could be grade separations or an exemption listed under 23 CFR 774.13 could be applied.

3.7.7.4 No-Build Alternative

Under the No-Build Alternative, construction of a highway would not occur, and no impacts to Section 4(f) resources would be anticipated beyond those that could occur due to other, reasonably foreseeable projects. A freeway would not be constructed or operated within any of the corridor alternatives.

3.7.8 Available Mitigation Measures

Potential mitigation measures would be developed on a programmatic scale for consideration in Tier 2 evaluations. In the context of all possible planning to minimize harm, examples of programmatic mitigation measures would include design considerations and alternative construction methods. Additionally, the project team would evaluate the design to determine where it is possible and practical to avoid or minimize impacts.

With the exception of *de minimis* impact findings, a feasible and prudent alternative that avoids resources protected under Section 4(f) would be selected. The identification and implementation of measures to minimize harm at each resource need to be conducted in consultation with the owners of the resources, to ensure that measures to minimize harm do not adversely affect the values of the resources. Examples of potential measures to minimize harm could include the following:

- Design construction modifications to avoid encroaching on or bisecting a Section 4(f) resource
- Provide an alignment within the 2,000-foot-wide study corridor that avoids the protected property
- Provide crossings for trails either under or over the freeway
- Shift the 2,000-foot-wide study corridor away from the protected property to accommodate the project without using land from the protected property
- Use context-sensitive design in future stages of project development
- Incorporate natural design features, such as earthen berms and tree plantings
- Allocate replacement of parkland or open space
- Modify construction methods to minimize impacts
- Develop other measures in consultation with SHPOs, tribes, other consulting parties, and the public

3.7.9 Conclusion

As previously discussed, there is currently insufficient data to provide a preliminary Section 4(f) approval (*De minimis*, Programmatic Evaluation, or Individual Evaluation) as no specific alignment within the corridor alternatives has been determined. If a corridor alternative is chosen, ADOT, in coordination with the applicable OWJ(s), would need to assess the potential use of a Section 4(f) property during Tier 2. ADOT would make Section 4(f) use determinations and complete Section 4(f) approvals during Tier 2 once enough information is available.

3.8 Section 6(f) Resources

This section provides an overview of Section 6(f) resources that may be affected by the Draft Tier 1 EIS Corridor Alternatives 1, 7, and 8A and the No-Build Alternative.

3.8.1 Regulatory Framework

Section 6(f) of the Land and Water Conservation Fund Act (LWCFA), administered by the Interagency Committee for Outdoor Recreation and the National Park Service (NPS), pertains to projects that would cause impacts on or result in the permanent conversion of outdoor recreational property acquired with LWCFA assistance. The LWCFA established the Land and Water Conservation Fund (LWCF), a matching assistance program providing grants paying half the acquisition and development cost of outdoor recreational sites and facilities. Section 6(f) prohibits the conversion of property acquired or developed with these grants to a nonrecreational purpose without approval from the Interagency Committee for Outdoor Recreation and NPS. NPS must ensure replacement lands of equal value, location, and usefulness are provided as conditions of approval for land conversions (16 USC 4601-4 through 4601-11).

NPS delegates many of the roles and responsibilities associated with administering the LWCFA to a department within the state. Arizona State Parks manages the LWCF funds through the Arizona Grant Programs administered by the Arizona State Parks Board.

Section 6(f)(3) of the Act prohibits the conversion of property acquired or developed with grants from this fund to a non-recreational purpose without the approval of the NPS and administering state agency (36 CFR 59.3). If approved, the substitution of other recreation properties of at least equal fair market value and of reasonably equivalent usefulness and location is required. Recreation properties that have received assistance from LWCF are sometimes protected under both Section 6(f) and Section 4(f). Finally, unlike Section 4(f), Section 6(f) applies to all transportation projects involving possible conversion of the property, whether or not federal funding is being utilized for the project.

3.8.2 Affected Environment

Based on review of readily available data—2018 aerial photograph, GIS data, Investigate West database between 1965 and 2011, LWCF website, Arizona Grant Programs, Arizona 2018–2022 Statewide Comprehensive Outdoor Recreation Plan, and municipal planning documents—the study area does not currently contain any Section 6(f) resources. No recreation areas are located within the corridors, and thus replacement of property is not anticipated at this time, but would be reviewed again during Tier 2 studies.

3.8.3 Conclusion

This Tier 1 analysis did not identify potential for effects on Section 6(f) resources based on currently available data. Additional confirmation and data gathering during subsequent NEPA analysis would be required. Analyses conducted as part of a Tier 2 environmental review process would result in a conclusion regarding whether conversion of a Section 6(f) land would be required, including the development of mitigation measures and designs that would avoid or minimize effects on Section 6(f) lands. Because a future alignment could be located anywhere within the corridor alternatives, the specific alignment would need to be reviewed during Tier 2 studies to identify potential impacts to Section 6(f) resources.

3.9 Air Quality

This section describes potential air quality impacts that could result from a new transportation facility within one of the corridor alternatives compared with the No-Build Alternative and provides a summary of the air quality analysis. The following analysis is qualitative and does not include a detailed quantitative evaluation of air quality emissions, which is consistent with a Tier 1 study. Additional analysis would be required for Tier 2.

3.9.1 Regulatory Framework

3.9.1.1 Federal Regulations

Air quality is regulated at the national level by the Clean Air Act of 1970 (CAA) (42 U.S.C. 7401 et seq.), which was last amended in 1990 (CAA). EPA is responsible for establishing National Ambient Air Quality Standards (NAAQS) for the following six criteria pollutants: carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), coarse and fine particulate matter (less than or equal to 10 microns [PM_{10}] and less than or equal to 2.5 microns [$PM_{2.5}$]), and lead (Pb). Of the six NAAQS pollutants, transportation sources contribute to CO, NO_2, $PM_{2.5}$, PM_{10}, and O_3 (EPA, 2017a). EPA works with state and local jurisdictions to monitor ambient air levels for these pollutants. The NAAQS for these criteria pollutants are summarized in Table 3-29.

Geographic areas that violate NAAQS for a criteria pollutant are considered “nonattainment areas” (NA) for that pollutant. Conversely, areas that are below a criteria pollutant standard are considered “attainment” areas. “Maintenance” areas are defined as having previously violated the NAAQS for a criteria pollutant but are currently attaining the standard and have developed a maintenance plan outlining steps for continued attainment over the maintenance period. Specific requirements are placed on the transportation planning process in air quality NAs that do not meet the NAAQS emissions limits and in areas that were reclassified from NAs to maintenance areas.

In addition to the NAAQS for criteria air pollutants, EPA also regulates air toxics under Section 202 of the CAA. Mobile source air toxics (MSAT) are a subset of the 188 air toxics (pollutants suspected or known to cause cancer) defined by the CAA. MSATs are toxic compounds emitted from on-road mobile sources (i.e., vehicles), non-road mobile sources (such as airplanes and locomotives), and stationary sources (such as factories and refineries). In 2007, EPA issued a final rule on controlling emissions of hazardous air pollutants (EPA, 2007).

Table 3-29. National Ambient Air Quality Standards for Criteria Pollutants

POLLUTANT		PRIMARY/ SECONDARY	AVERAGING TIME	LEVEL	FORM
Carbon Monoxide (CO)		primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		primary and secondary	Rolling 3 month average	0.15 µg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide (NO_2)		primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	1 year	53 ppb (2)	Annual Mean
Ozone (O_3)		primary and secondary	8 hours	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	$PM_{2.5}$	primary	1 year	12.0 µg/m^3	annual mean, averaged over 3 years
		secondary	1 year	15.0 µg/m^3	annual mean, averaged over 3 years
		primary and secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		primary	1 hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

Source: EPA

(1) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m^3 as a calendar quarter average) also remain in effect.

(2) The level of the annual NO_2 standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

(3) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standards additionally remain in effect in some areas. Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.

(4) The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2)any area for which an implementation plan providing for attainment of the current (2010) standard has not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO_2 standards (40 CFR 50.4(3)). A SIP call is an EPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS..

ppm = parts per million, µg/m3 = micrograms per cubic meter, ppb = parts per billion.

3.9.1.2 Transportation Conformity

Transportation conformity is required under CAA section 176(c) (42 U.S.C. 7506[c]) to ensure that federally supported highway and transit project activities are consistent with (conform to) the purpose of a state air quality implementation plan (SIP). Conformity to the purpose of the SIP means that transportation activities will not cause or contribute to new air quality violations, worsen existing violations, or delay timely attainment of the relevant NAAQS or required interim milestones. EPA's transportation conformity rule (40 CFR 51.390 and Part 93) establishes the criteria and procedures for determining whether transportation activities conform to the SIP. Transportation Conformity is applicable at both regional level and project level for transportation activities located within a NA or maintenance area for pollutants, including CO, PM_{10}, and $PM_{2.5}$.

Regional conformity would need to be established during Tier 2 studies. The CAA conformity rule requires that all MPO RTPs and TIPs must include a regional emissions analysis that demonstrates conformity to the SIP to comply with CAA before they are approved. These fiscally constrained RTP and TIP must identify all transportation projects that are expected to receive federal funds or that will require FHWA approval. PAG is the MPO responsible for ensuring regional conformity for this planning region of the state. The Sonoran Corridor will need to be consistent with PAG's RTP and TIP before any future activity receives approval for federal funds from FHWA.

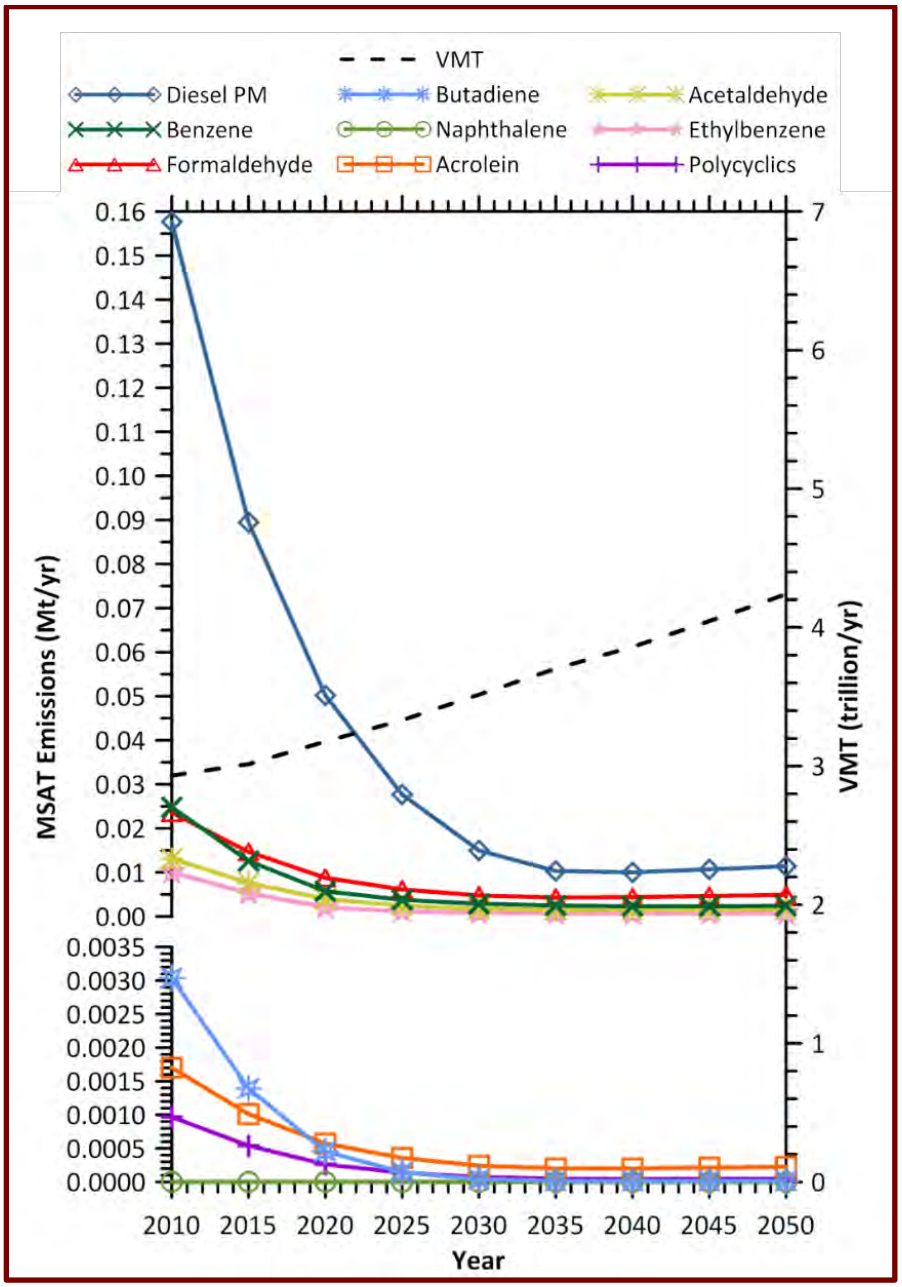
In addition to the regional conformity, project level conformity must be demonstrated if a transportation project is located within NA or Maintenance area. This is achieved by assessing whether the transportation project it will cause a violation of the NAAQS for criteria pollutants in localized areas, known as hotspots. The NAAQS pollutants of concern for transportation hotspots are CO, $PM_{2.5}$, and PM_{10}. CO hotspots would most likely be a concern where traffic is very congested and slow moving, such as at high-volume intersections. $PM_{2.5}$ and PM_{10} hotspot analyses would be required if constructing the project would attract a high number of heavy trucks or other large diesel vehicles to the corridor, which would make it a "project of air quality concern" as described in section 93.123(b) of the conformity rule. The conformity rule spells out criteria for when CO, $PM_{2.5}$, and PM_{10} hotspot analyses are required. The O_3 level is influenced by regional pollutant emissions and is not typically a hotspot concern; therefore, a local analysis is not appropriate for O_3. NAAQS assessment also would occur during Tier 2 studies, as appropriate.

Mobile Source Air Toxics

Controlling air toxic emissions became a national priority with the passage of the CAA of 1990, whereby the US Congress mandated that EPA regulate 188 air toxics, also known as hazardous air pollutants. EPA assessed this expansive list in its rule on the Control of Hazardous Air Pollutants from Mobile Sources (EPA, 2007) and identified a group of 93 compounds emitted from mobile sources that are part of EPA's Integrated Risk Information System (EPA, 2017c). In addition, EPA identified nine compounds with significant contributions from MSATs that are among the national- and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Ambient Air Toxics Assessment (EPA, 2011). These are 1,3-butadiene, acetaldehyde, acrolein, benzene, diesel PM, ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter. While FHWA considers these to be the priority MSATs, the list is subject to change and may be adjusted in consideration of future EPA rules.

EPA's 2007 Final Rule on controlling air toxics emissions mentioned above requires controls that will dramatically decrease MSAT emissions through cleaner fuels and cleaner engines. According to FHWA, analysis using EPA's Motor Vehicles Emissions Simulator model indicates that even if VMT increases by 45 percent by 2050, as assumed, a combined reduction of 91 percent in the total annual emissions rate for the priority MSATs is projected from 2010 to 2050 (FHWA, 2016). Figure 3-25 shows the predicted trends for MSAT levels.

Figure 3-25. FHWA Predicted National MSAT Trends 2010–2050 for Vehicles on Roadways



Air toxics analysis is a continuing area of research. While much work has been done to assess the overall health risk of air toxics, many questions remain unanswered. In particular, the tools and techniques for assessing project-specific health outcomes as a result of lifetime MSAT exposure remain limited. These limitations impede the ability to evaluate how the potential health risks posed by MSAT exposure should be factored into project-level decision-making within the context of NEPA.

Nonetheless, air toxic concerns continue to be raised on highway projects during the NEPA process. Even as the science emerges, the public and other agencies expect the lead agencies to address MSAT impacts in environmental documents. FHWA, EPA, Health Effects Institute, and others have funded and conducted research studies to try to more clearly define the potential risk from MSAT emissions associated with highway projects. FHWA will continue to monitor the developing research in this emerging field.

Greenhouse Gases

Climate change is a critical national and global concern. Human activity is changing the earth's climate by causing the buildup of heat-trapping greenhouse gas (GHG) emissions through the burning of fossil fuels and other human activities. Carbon dioxide (CO_2) is the largest component of human-produced GHG emissions; other prominent emissions include methane, nitrous oxide, and hydrofluorocarbons. These emissions are different from criteria air pollutants because their effects in the atmosphere are global rather than localized and they remain in the atmosphere for decades to centuries, depending on the species.

GHG emissions have accumulated rapidly as the world has industrialized, with concentration of atmospheric CO_2 increasing form roughly 300 ppm in 1900 to more than 400 ppm today. Over this timeframe, global average temperatures have increased by roughly 1.5 degrees Fahrenheit (^{o}F) (1 degree Celsius [^{o}C]), and the most rapid increases have occurred over the past 50 years. Scientists have warned that significant and potentially dangerous shifts in climate and weather are possible without substantial reductions in GHG emissions. They commonly cite 2^{o}C (1^{o}C) beyond warming that has already occurred as the total amount of warming the earth can tolerate without serious and potentially irreversible climate effects. For warming to be limited to this level, atmospheric concentrations of CO_2 would need to stabilize at a maximum of 450 ppm, requiring annual global emissions to be reduced 40 to 70 percent below 2010 levels by 2050 (International Panel on Climate Control [IPCC], 2014). State and national governments in many developed countries set GHG emissions reduction targets of 80 percent below current levels by 2050, recognizing that post-industrial economies are primarily responsible for GHG already in the atmosphere. As part of a 2014 bilateral agreement with China, the US pledged to reduce GHG emissions 26-28 percent below 2005 levels by 2025; this emissions reduction pathway is intended to support economy-wide reductions of 80 percent or more by 2050 (The White House, 2014).

To date, no national standards have been established regarding GHG, nor has EPA established criteria or thresholds for ambient GHG emissions. Currently, no scientific methodology is available for attributing specific climatological changes to a particular transportation project's emissions. Qualitatively, GHG emissions from vehicles using roadways are a function of distance travelled (expressed as VMT), vehicle speed, and road grade. GHG emissions also are generated during roadway construction and maintenance activities. Decreases in travel times, which are associated with improved speeds, can lead to a reduction in emissions of GHG for all motor vehicle types despite increases in distance traveled. The corridor

alternatives are projected to have less travel time as compared to the No-Build Alternative; therefore, decreases in travel times would lead to a GHG emissions benefit in the region.

As part of FHWA's *Climate Change Resilience Pilot Program*, a study was conducted to assess the vulnerability of Arizona Department of Transportation (ADOT)-managed transportation infrastructure to Arizona-specific extreme weather. In the long term, ADOT seeks to develop a multi-stakeholder decision-making framework–including planning, asset management, design, construction, maintenance, and operations–to cost-effectively enhance the resilience of Arizona's transportation system to extreme weather risks.

For the study, ADOT elected to focus on the Interstate corridors connecting Nogales, Tucson, Phoenix, and Flagstaff (I-19, I-10, and I-17). This corridor includes a variety of urban areas, landscapes, biotic communities, and climate zones, which present a range of weather conditions applicable to much of Arizona. The project team examined climate-related stressors including extreme heat, freeze-thaw, extreme precipitation, and wildfire, considering the potential change in these risk factors as the century progresses.

As part of the pilot program, the study leveraged the *FHWA Vulnerability Assessment Framework*, customizing it to fit the study's needs. The project team gathered information on potential extreme weather impacts, collected datasets for transportation facilities and land cover characteristics (e.g., watersheds, vegetation), and integrated these datasets to perform a high-level assessment of potential infrastructure vulnerabilities. Each step of the process drew heavily on internal and external stakeholder input and feedback.

The assessment qualitatively addresses the complex, often uncertain interactions between climate and extreme weather, land cover types, and transportation facilities—with an ultimate focus on potential risks to infrastructure by ADOT District. Preliminary results were presented in focus groups, where ADOT regional staff provided feedback on the risk hypotheses developed through the desktop assessment. The results of the assessment were organized first by ADOT District, then by stressor, and then further delineated by land cover types (e.g., desert), which are considered qualitatively as potential factors that could either alleviate or aggravate the impacts of extreme weather phenomena. The key climate stressors and impacts assessed in the study were extreme temperature and precipitation events and wildfires.

Extreme temperatures were evaluated by assessing the potential increase in the number of days when the temperature was greater than 100^{o}F and the number of days when the temperature was below freezing. Extreme heat events can lead to pavement deformation due to thermal expansion, affect construction schedules and seasons, pose challenges to maintenance and operations activities, and lead to unsafe conditions for workers. The study determined that the number of extreme heat events is likely to increase in the Phoenix and Tucson districts, which could lead to negative effects on the transportation system. The study also evaluated potential changes in the number of freezing events. Freezing events can have a negative effect on the transportation system by increasing operations and maintenance costs. The number of freezing events is projected to decrease, which would have a positive effect in the Phoenix and Tucson districts.

Extreme precipitation can degrade the transportation system by causing flooding/inundation and mudslides. Extreme precipitation was analyzed by evaluating increases in 100-year rainfall events in the districts. The study concluded that extreme precipitation events are likely to have a neutral effect in the Phoenix and Tucson districts; however, it also was noted that there is a lower level of confidence in these conclusions than the extreme temperature assessment. Wildfires can disrupt the transportation system by interrupting operations and aggravating flooding or drainage failures. In the Phoenix District, there is currently a low risk for wildfire events and the study concluded that potential increases related to climate events was likely to be negligible. In the Tucson District, there is an increased risk for wildfire events, but this increase is uncertain over the long-term.

Fugitive Dust

Fugitive dust is PM from unstable or disturbed soil surfaces that becomes airborne due to mechanical disturbance and has the potential to adversely affect human health or the environment. About 50 percent of fugitive dust is PM_{10}. Fugitive dust originates from agricultural, mining, construction, transportation, and manufacturing activities. This study is concerned mostly with fugitive dust generated from construction activities, such as earth moving, paved-road track-out, driving on haul roads, and disturbing surface areas, since such activities would likely be required during construction should a corridor alternative be implemented.

State and Local Regulations

With regard to air quality, the airshed of the study area is regulated by the Arizona Department of Environmental Quality (ADEQ), PAG, and the Pima County Department of Environmental Quality. These agencies regulate air pollution and operate air monitors throughout the county. A transportation project implemented pursuant to this study would need to adhere to the following:

- **ADEQ, Title 18. Environmental Quality, Chapter 2, Air Pollution Control**—This rule defines ambient air quality standards, area designations and classifications, and control of hazardous air pollutants, as well as establishes controls on emissions from new and existing mobile sources and motor vehicle inspection and maintenance programs.
- **Arizona Statutes, Title 49. The Environment, Chapter 3, Air Quality**—This statute establishes the state air pollution control department, including its powers, duties, and enforcement obligations. It also sets motor vehicle emissions standards for the state and defines the state's voluntary travel reduction program.
- **Pima County, Title 17. Air Quality Control**—The rules codified under Title 17 establish the county's ambient air quality standards, establish an air quality monitoring program, set limits on visible emissions, and enact a trip reduction program for major employers.
- **Statewide Monitoring Stations**—ADEQ and local air districts maintain a statewide network of monitoring stations that routinely measure pollutant concentrations in the ambient air. These stations provide data to assess compliance with the NAAQS and evaluate the effectiveness of pollution control strategies.

3.9.2 Methodology

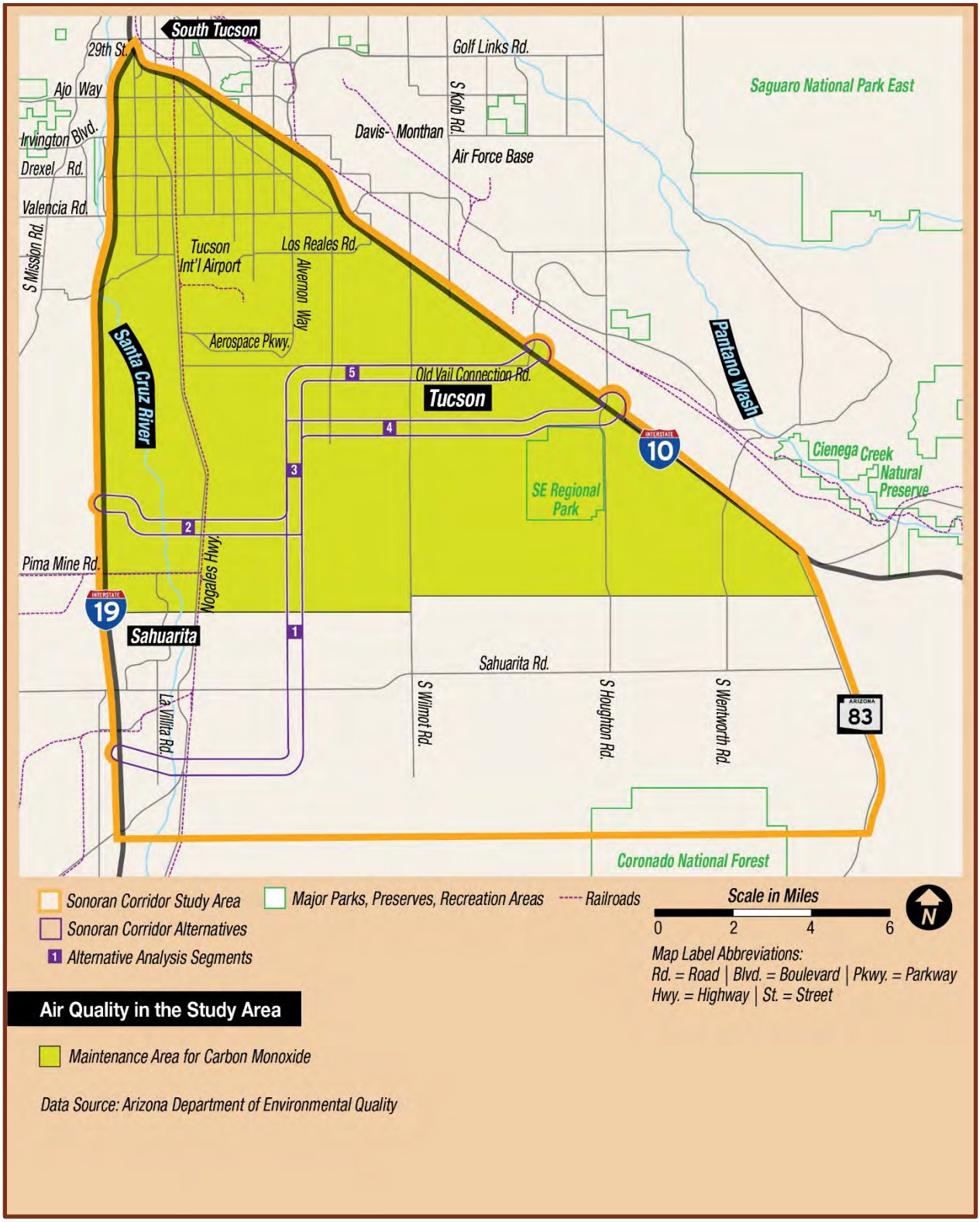
For the purpose of this Tier 1 level analysis, the existing ambient air quality condition was evaluated. Operation and construction emissions as a result of the corridor alternatives and No-Build Alternative and the anticipated effects of each corridor alternative on air quality were qualitatively evaluated. A qualitative general discussion for the potential need for hotspot analyses for future project-specific level analysis was presented. General types of mitigation to reduce or avoid impacts for future project-level analyses were also described.

3.9.3 Affected Environment

The study area is located in Pima County (Figure 3-26). The elevation of the corridor alternatives range from approximately 300 feet to 3,110 feet above mean sea level. The weather is indicative of a desert climate characterized by extremely hot summers, mild winters, and minimal precipitation. Average daily maximum temperatures during the summer in Tucson are in the low 100s (ºF). Tucson experiences mild temperatures in the winter, with lows ranging from the high 30s to low 40s (ºF). In addition, annual precipitation averages 10 inches.

The study area is in the Tucson CO limited maintenance area. EPA designated the Tucson area as being in attainment with the NAAQS for CO on April 25, 2000, and no violations of the NAAQS for CO have been recorded in this area for 20 years. The study area is approximately 6.2 miles away from the Saguaro National Park Class 1 airshed. The proximity of the study area is not considered to be notable as transportation sources do not significantly contribute to visibility impairment in Class I areas (ADEQ, 2011).

Figure 3-26. Air Quality in the Study Area



For overall perspective, there has been a trend of decreasing total pollutant emissions in the study area from mobile sources for several decades, even with the growing number of VMT during that period. These improving results are due to a series of successful emission control regulations. On-road sources account for varying amounts of the overall emissions but tend to be declining even though national VMT has more than doubled over the past 30 years. Advances in vehicle technology and cleaner fuels have been major reasons for the improvements. Recent federal regulations on vehicle emissions are expected to continue the trend of improvement and further lower vehicle emissions in the future. Emissions inventory collected by EPA indicates a downward trend in total statewide highway emissions of CO, nitrogen oxide, volatile organic compounds, and particulate matter over the last 20 years (Figure 3-27, Figure 3-28, and Figure 3-29) (EPA, 2018).

Figure 3-27. Annual Statewide Highway Emissions of Carbon Monoxide

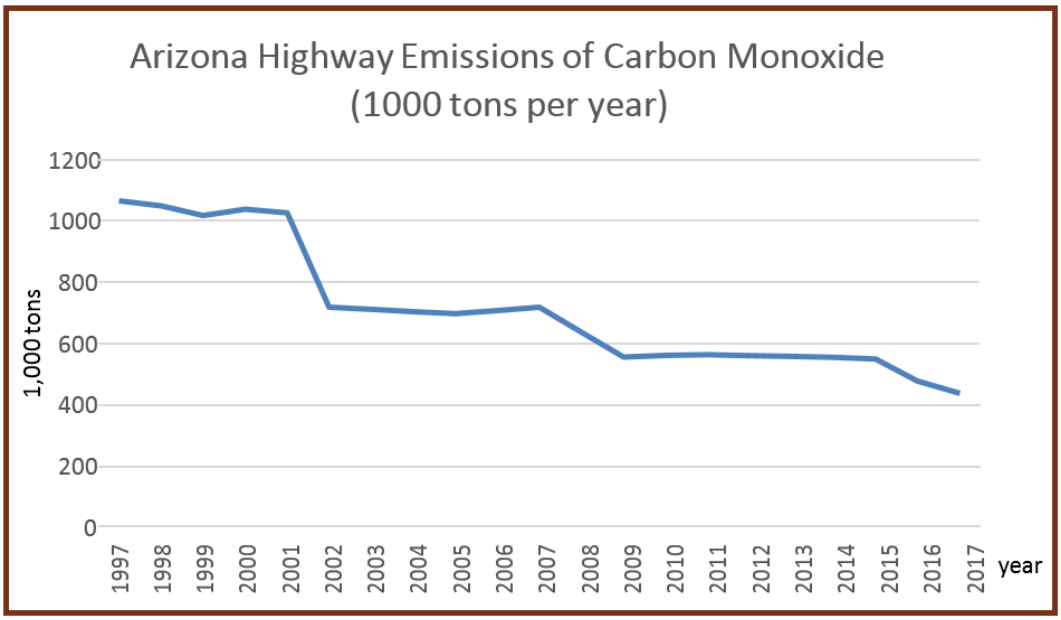


Figure 3-28. Annual Statewide Highway Emissions of Oxides of Nitrogen and Volatile Organic Compounds

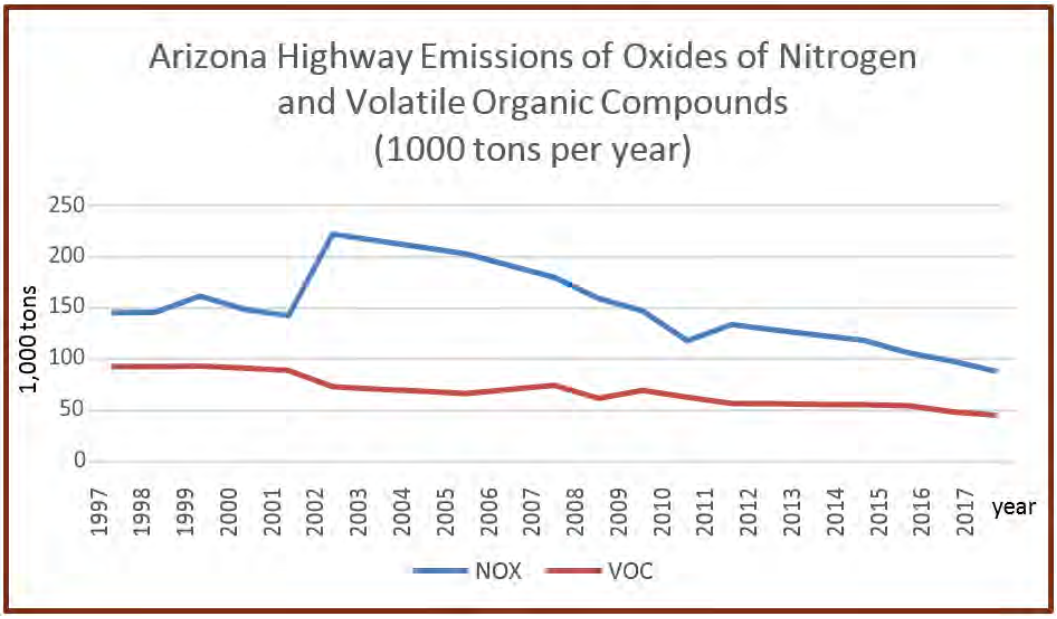
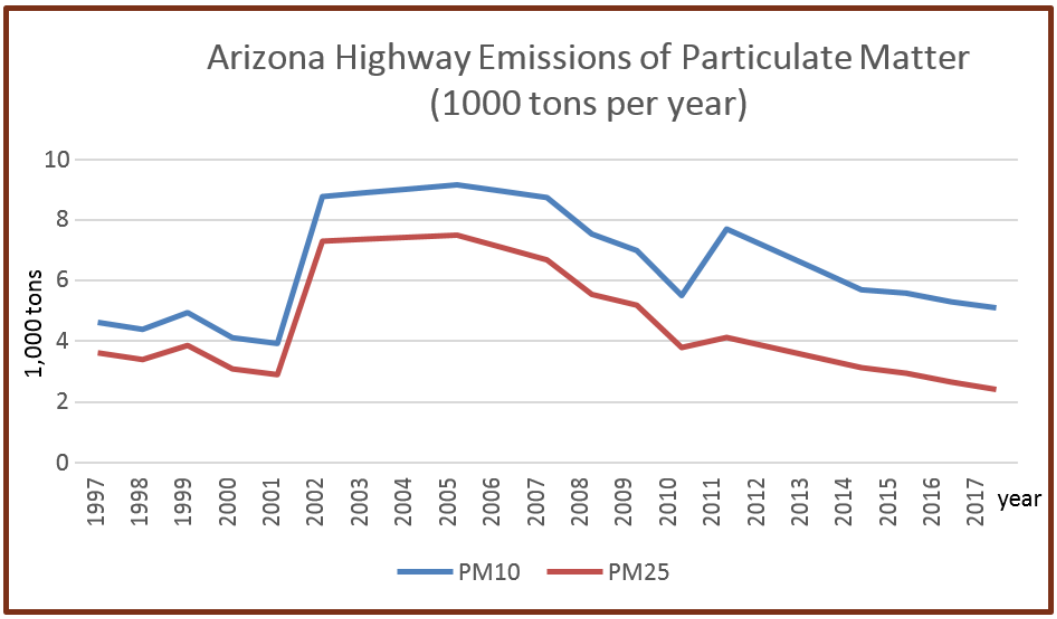


Figure 3-29. Annual Statewide Highway Emissions of Particulate Matter



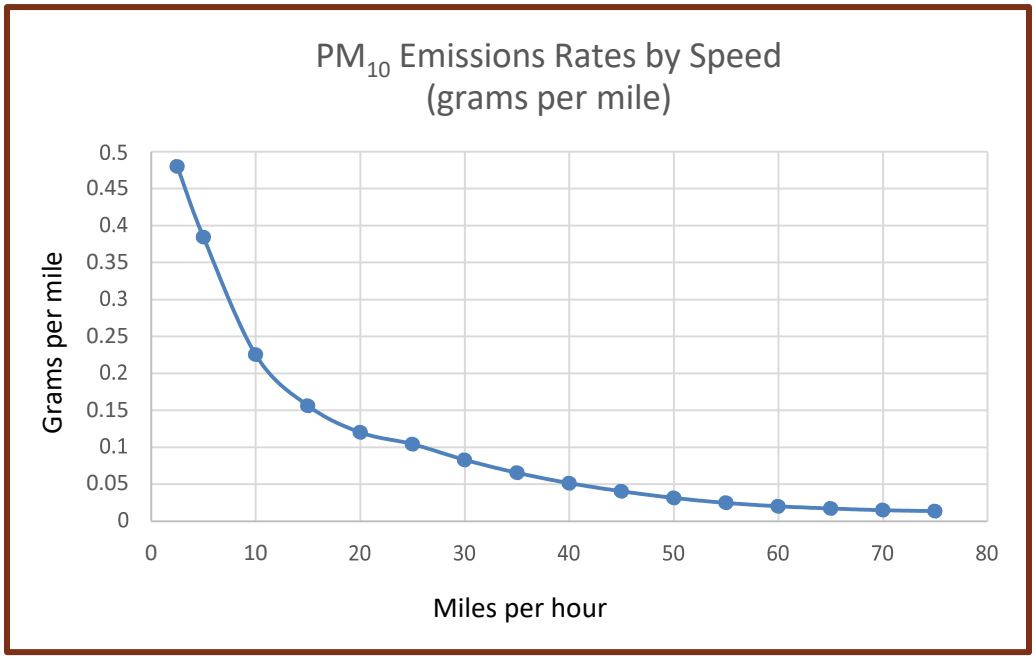
3.9.4 Environmental Consequences

For all corridor alternatives, air quality effects are driven by the behavior of vehicles in the transportation network. Transportation strategies that are implemented through a corridor alternative can have positive benefits on air quality by reducing emissions. Transportation strategies associated with the corridor alternatives generally affect emissions as a result of one or more of the following outcomes:

- Reduced VMT and vehicle trips
- Reduced congestion and vehicle idling
- Improved traffic speeds or traffic flow

The critical transportation strategies associated with the corridor alternatives are reducing congestion and improving traffic speeds. Improvements in speeds generally reduce emissions of criteria pollutants and can even offset increases in VMT (Figure 3-30). Emissions of GHG and MSATs also are generally reduced as speeds improve.

Figure 3-30. FHWA PM_{10} Emissions Factors by Speed for Light-Duty Vehicles and Trucks, 2018



Reductions in emissions of criteria pollutants, GHG, and MSATs from passenger vehicles also can occur from improved speeds and reduced travel times along with reductions in congestion that are anticipated from the corridor alternatives. The corridor alternatives are expected to operate at an improved LOS as compared to the No-Build Alternative. An improvement in LOS from implementing a corridor alternative indicates a reduction in congestion that generally corresponds to a reduction in emissions, particularly for CO, as compared to the No-Build Alternative.

The corridor alternatives fall within the Tucson CO limited maintenance area (Figure 3-26). As discussed in Section 2.6.3, traffic is predicted to operate at an improved LOS under corridor alternatives when compared to the No-Build Alternative. This is likely because corridor alternatives would be on a new alignment, which could reduce the potential for CO violations by shifting traffic away from congested sections of I-19, I-10, and local arterial roads within the study area by 2045.

3.9.4.1 Corridor Alternative 1

Under Corridor Alternative 1, travel time is projected to decrease by 42 percent (Table 8, *Corridor Selection Report*) compared to the No-Build Alternative, which indicates that Corridor Alternative 1 would lead to a GHG and MSAT emissions benefit as compared to the No-Build Alternative once construction is complete. However, Corridor Alternative 1 has the lowest decrease in travel times and V/C reduction among the corridor alternatives. Therefore, Corridor Alternative 1 likely has the least potential to reduce GHG and MSAT emissions as compared to the other corridor alternatives. Corridor Alternative 1 has the least increase in new roadway miles and VMT among the three alternatives and likely has the least GHG and MSAT emissions associated with construction and roadway maintenance. Because of the corridor-wide changes in daily freight travel patterns, the potential for localized CO violations is likely less than the No-Build Alternative for Corridor Alternative 1, and Corridor Alternative 1 has the least potential to result in localized violations of CO among the three alternatives.

3.9.4.2 Corridor Alternative 7

Under Corridor Alternative 7, travel time is projected to decrease by 43 percent (Table 8, *Corridor Selection Report*) compared to the No-Build Alternative, which indicates that Corridor Alternative 7 would lead to a GHG and MSAT emissions benefit as compared to the No-Build Alternative once construction is complete. Corridor Alternative 7 has the greater decrease in travel time and V/C reduction as compared to Corridor Alternative 1. Therefore, Corridor Alternative 7 likely has the larger potential to reduce GHG and MSAT emissions benefit as compared to Corridor Alternative 1. Corridor Alternative 7 has the larger increase in new roadway miles and VMT compared to Corridor Alternative 1 and likely has the larger GHG and MSAT emissions associated with construction and roadway maintenance. Because of the corridor-wide changes in daily freight travel patterns, the potential for localized CO violations is likely less than the No-Build Alternative for Corridor Alternative 7, but Corridor Alternative 7 has the larger potential to result in localized violations of CO than Corridor Alternative 1.

3.9.4.3 Corridor Alternative 8A

Under Corridor Alternative 8A, travel time is projected to decrease by 46 percent (Table 8, *Corridor Selection Report*) compared to the No-Build Alternative, which indicates that Corridor Alternative 8A would lead to a GHG and MSAT emissions benefit as compared to the No-Build Alternative once construction is complete. Corridor Alternative 8A has the greatest decrease in travel times and V/C reduction among the corridor alternatives. Therefore, Corridor Alternative 8A likely has the greatest potential to reduce GHG and MSAT emissions benefit as compared to the other corridor alternatives. Corridor Alternative 8A has the greatest increase in new roadway miles and VMT among the corridor alternatives and likely has the largest GHG and MSAT emissions associated with construction and roadway maintenance. Because of the corridor-wide changes in daily travel patterns, the potential for

localized CO violations is likely less than the No-Build Alternative for Corridor Alternative 8A, which has the greatest potential to result in localized violations of CO among the corridor alternatives.

3.9.4.4 No-Build Alternative

Under the No-Build Alternative, vehicles would continue to utilize the existing transportation network in the study area. The No-Build Alternative could have negative effects on the Tucson CO maintenance area. From an air quality planning perspective, it is possible that the No-Build Alternative could result in regionally adverse effects in air quality as the result of increased levels of congestion and delay that could cause elevated localized levels of CO. Under the No-Build Alternative, travel times from El Toro South at I-19 to Wentworth Road at I-10 are projected to increase by as much as 18 minutes (Table 8, *Corridor Selection Report*) and speeds would decrease due to the growing congestion along existing freeways and arterials. Therefore, the No-Build Alternative is likely to increase emissions of GHG and MSATs as compared to the corridor alternatives.

3.9.5 Available Mitigation Measures

Air quality modeling would likely be a requirement for future Tier 2 NEPA studies to quantify potential emissions for alternatives studied in detail. Mitigation measures also would be identified at that time for any potential air quality effects. All Corridor Alternatives are likely to result in decreased travel times as compared to the No-Build Alternative. Therefore, construction of a Corridor Alternative could be considered a GHG mitigation measure. In addition, temporary construction effects may be quantified, and temporary control measures would be recommended. Typical construction mitigation measures include:

- Minimizing idling time to save fuel and reduce emissions.
- Using the cleanest fuels available for construction equipment and vehicles to reduce exhaust emissions.
- Keeping construction equipment well maintained to ensure that exhaust systems are in good working order.
- Controlling fugitive dust through a Fugitive Dust Control Plan, including watering disturbed areas.
- Controlling blasting and avoiding blasting on days with high winds to minimize wind-blown dust, particularly near community areas.
- Developing a traffic plan to minimize traffic flow interference from construction equipment movement and activities.
- Spacing interchanges to reduce local impacts of idling on sensitive areas near the new corridor.

3.9.6 Conclusion

If a corridor alternative is selected for construction, both regional and project level transportation conformity due to the Tucson CO limited maintenance area within the study area would be required. During the Tier 2 NEPA analysis, a detailed air quality analysis would be conducted once a future alignment or alternative alignments have been selected and advanced for further environmental evaluation. The corridor alternatives under consideration that are in NAs or maintenance areas would need to conform to the NAAQS, requiring an assessment of vehicle emissions within the region.

Further analysis would be required in any subsequent Tier 2 studies to:

- determine any adverse air quality impacts that could be predominantly borne by any low income and/or minority populations
- determine potential localized air quality effects (hotspots) from future construction and operation of a new highway by modeling CO emissions at the project level to
- quantitatively assess GHG emissions using EPA's Motor Vehicles Emissions Simulator model
- develop and refine detailed mitigation measures

3.10 Noise and Vibration

3.10.1 Noise Impact Assessment

This section describes potential traffic noise impacts that could result from implementing one of the corridor alternatives compared to the No-Build Alternative and provides a summary of the noise evaluation.

Noise is generally defined as unwanted or undesirable sound. Some of the most pervasive sources of noise in the environment can come from transportation systems. Noise levels decrease by about 3 to 4.5 decibels for each doubling of the distance from the source roadway. Noise barriers along a highway are most effective for structures within about 500 feet of the highway. Beyond that, noise barriers are less effective, but the natural decrease in noise with distance usually reduces noise levels to acceptable levels. To provide some context for the transportation noise levels provided in this chapter, noise levels associated with various types of sound sources are summarized in Figure 3-31.

3.10.1.1 Regulatory Framework

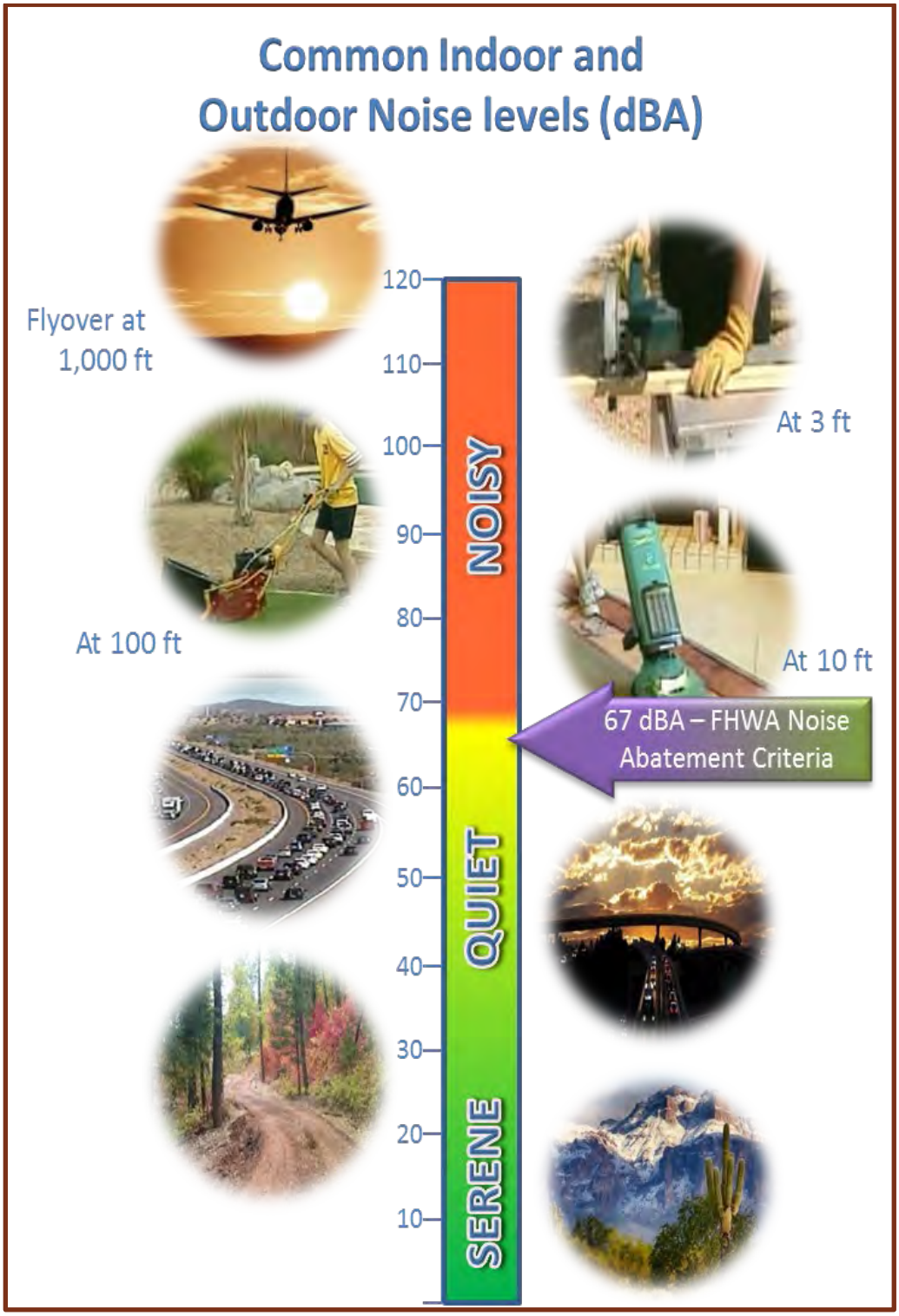
The Federal Noise Control Act of 1972 (P.L. 92-574) requires that all federal agencies administer their programs in a manner that promotes an environment free from noises that could jeopardize public health or welfare. FHWA assesses noise impacts in accordance with 23 CFR 772, *Procedures for Abatement of Highway Traffic Noise and Construction Noise*. The noise evaluation conducted for the Sonoran Corridor is consistent with FHWA guidelines for assessing highway traffic noise (FHWA, 2011) and the most current version of ADOT's *Noise Abatement Requirements* (NAR), May 2017 (ADOT, 2017).

3.10.1.2 Methodology

The analysis areas for the noise evaluation consist of the 2,000-foot-wide corridor alternatives and the adjacent area extending a maximum of 1,000 feet away from the boundaries of the corridor alternatives. This boundary extension was included to conservatively account for any potential impacts. The procedures used to evaluate noise impacts included the following steps:

1. Identify noise-sensitive land uses within the analysis areas. Noise-sensitive land uses are those which fall under Noise Abatement Criteria Land Use Categories A, B, C, D, E, and G in Table 3-30.
2. Establish existing noise levels by conducting measurements in areas along the corridor alternatives. Measurements were conducted in accordance with the standards and guidelines established by FHWA (FHWA, 1996).

Figure 3-31. Common Outdoor and Indoor Noise Levels



Source: ADOT, 2017

Table 3-30. Noise Abatement Criteria

ACTIVITY CATEGORY[1]	DBA $L_{EQ(H)}$[2,3]	COMMON INDOOR NOISE LEVELS
A	57 (exterior)	Lands on which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (exterior)	Residential.
C	67 (exterior)	Active sports areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, churches, playgrounds, public meeting rooms, public or non-profit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings.
D	52 (interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, churches, public meeting rooms, public or non-profit institutional structures, radio structures, recording studios, schools, and television studios.
E	72 (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in categories A–D or F.
F	—	Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	—	Undeveloped lands that have no active construction permits.

Sources: FHWA, 2011; 23 CFR 772; 2017 ADOT NAR
[1] Activity Categories B, C, and E include undeveloped lands permitted for each activity category.
[2] The 1-hour equivalent loudness in dBA, which is the logarithmic average of noise over a 1-hour period.
[3] The $L_{eq(h)}$ activity criteria values are for impact determination only and are not design standards for noise abatement measures.
dBA = A-weighted decibels.

3. Predict future (2045) noise levels using FHWA's Traffic Noise Model, Version 2.5. To do this, a more detailed approach was employed by establishing receivers, or modeled locations, at noise-sensitive land uses within the analysis areas and predicted future traffic noise levels at the receiver locations for each of the corridor alternatives. Roadway alignments are needed to build the Traffic Noise Model predicting future noise levels. The approach utilized the traffic volumes and the typical cross section assumption of a 400-foot wide highway from the Final CSR. The model for each alternative used the typical cross sections placed at the center of the 2,000-foot-wide corridor alternatives. Because this analysis is intended to be a screening-level approach, a simplified model assuming flat earth with no terrain input was used. It is assumed that the ground surface is flat in the model.
4. Determine areas where potential traffic noise impacts at noise-sensitive receivers are expected to occur by comparing predicted noise levels in 2045 with the appropriate noise abatement criteria (NAC), as shown in Table 3-30.
5. Describe where potential noise impacts could occur should any of the corridor alternatives be constructed.
6. Discuss noise mitigation strategies for those areas where noise impacts could potentially occur.

This evaluation represents a preliminary assessment based on generalized assumptions regarding the future facility design (for example, no detailed modeling is included for potential locations of TIs) and traffic information and other related assumptions available at the time of the analysis (June 2019). The assumptions included establishing the highway centerlines in the middle of the 2,000-foot-wide corridor alternatives for the purposes of modeling. Details of the actual construction footprints would be defined, and refined analyses would be conducted during Tier 2 project-level studies. The conclusion of the present analysis and the mitigation considerations described should not be considered final; they would be verified and refined if the project progresses to the implementation of one of the corridor alternatives.

Noise Abatement Criteria

NAC are used to define the noise levels that are considered an impact for each land-use activity category. If future noise levels approach or exceed the NAC, they are considered noise impacts under ADOT's NAR. "Approach" is defined as noise levels within 1 decibel (dB) of the NAC. In addition, a 15-dB increase on the A-weighted scale (dBA) over existing noise levels is considered a substantial increase in noise and would constitute an impact.

3.10.1.3 Affected Environment

Land within the study area is mainly ASLD lands, the SXD, unimproved lands within the City of Tucson and Pima County, and public lands occupied by federal and state prisons, lands managed by the TAA, and private. Existing land uses within the project area mainly consist of residential, agricultural, and unimproved. Activity Category B Land use includes the residential subdivisions of Las Quintas Serenas, Santa Cruz Meadows, Valle Verde Del Norte, Los Arboles Mobile Home Park, and Sahuarita Highlands along Segment 1 (Figure 3-11); and large lot residences along Segments 1, 2, and 4. Activity Category C Land uses include the Anamax Park and the Church of Jesus Christ of Latter Day Saints along Segment 1, and the state and federal prisons along Segment 5. Activity Category E Land use includes a wholesale plant nursery along Segment 2 and the City of Tucson Public Safety Academy along Segment 5.

Existing Noise Environment

Measurements of the existing noise environment were obtained from noise monitoring conducted at locations along or near the corridor alternatives; all noise measurements were conducted in July 2019 with each site monitored for 30 minutes. The monitoring results are shown in Table 3-31.

Table 3-31. Existing Ambient Noise Monitoring Data

NOISE MONITORING SITE #[1]	NOISE LEVEL (DBA)[2]	GPS COORDINATES	LOCATION DESCRIPTION
Mon 1	62	31°56'0.37"N, 110°59'14.56"W	The Anamax Recreation Center, approximately 200 feet from SB I-19
Mon 2	45	31°55'43.08"N, 110°58'54.53"W	Valle Verde Del Norte Subdivision
Mon 3	45	31°56'11.95"N, 110°58'10.93"W	in Los Arboles Mobile Home Park
Mon 4	40	31°55'39.56"N, 110°55'14.50"W	in Sahuarita Highlands Subdivision
Mon 5	51	31°56'20.11"N, 110°54'35.84"W	Along Alvernon Way in a large lot residential subdivision
Mon 6	44	32°3'21.18"N, 110°52'40.26"W	large lot residential subdivision
Mon 7	49	32°3'34.43"N, 110°54'26.54"W	large lot residential subdivision
Mon 8	52	32°4'32.40"N, 110°52'0.42"W	near Arizona State Prison Complex Tucson
Mon 9	57	32°2'50.95"N, 110°47'26.84"W	near fairgrounds
Mon 10	46	32°4'52.87"N, 110°49'26.35"W	Sycamore Park Subdivision
Mon 11	59	32°4'13.76"N, 110°59'32.54"W	I-19 northbound on-ramp

[1] Monitoring site numbers correspond to labels in Figure 3-32.
[2] Equivalent sound level.
dBA = A-weighted decibels.

Measured noise levels ranged from 40 to 62 dBA. In general, measured noise levels were consistent with the prevailing land uses, with higher noise levels in the more urban areas and lower noise levels in rural areas.

General noise receptor locations were identified along the corridor alternatives, with detailed info shown in Table 3-32 and on Figure 3-32.

Table 3-32. Noise Receivers along Study Area

RECEPTOR I.D.	NAC CATEGORY	CORRIDOR ALTERNATIVE	CORRIDOR SEGMENT	DESCRIPTION
1a-S1	B	7 and 8A	1	Las Quintas Serenas Subdivision
1b-S1	B	7 and 8A	1	Las Quintas Serenas Subdivision
1c-S1	B	7 and 8A	1	Las Quintas Serenas Subdivision
2-S1	C	7 and 8A	1	Anamax Recreation Center
3-S1	C	7 and 8A	1	The Church of Jesus Christ of Latter Day Saints
4-S1	B	7 and 8A	1	Santa Cruz Meadows Subdivision
5-S1	B	7 and 8A	1	Valle Verde Del Norte Subdivision
6-S1	B	7 and 8A	1	Los Arboles Mobile Home Park
7-S1	B	7 and 8A	1	Sahuarita Highlands Subdivision
8-S1	B	7 and 8A	1	Residential Subdivision
9-S1	B	7 and 8A	1	Residential Subdivision
10-S1	B	7 and 8A	1	Residential Subdivision
11-S1	B	7 and 8A	1	Residential Subdivision
1-S2	E	1	2	Wholesale Plant Nursery
2-S2	B	1	2	Residence
3-S2	F	1	2	Utility Yard
1-S4	B	1, 7, and 8A	4	Multiple Residences
2-S4	B	8A	4	Residential Subdivision
3-S4	C	8A	4	Arizona State Prison Complex Tucson
4-S4	F	8A	4	Shooting Range
1-S5	C	1 and 7	5	Arizona State Prison Complex Tucson
2-S5	C	1 and 7	5	Arizona State Prison Complex Tucson
3-S5	C	1 and 7	5	Federal Bureau of Prisons
4-S5	F	1 and 7	5	Western States Microwave Co
5-S5	E	1 and 7	5	City of Tucson Public Safety Academy
6-S5	E	1 and 7	5	City of Tucson Public Safety Academy
7-S5	E	1 and 7	5	City of Tucson Public Safety Academy
8-S5	B	1 and 7	5	Sycamore Park Subdivision
9-S5	F	1 and 7	5	Gas Station

Figure 3-32. Noise Sensitive Land Uses within Study Area

Local airports also are a contributing factor to the existing noise environment. Disturbance from aircraft noise can be greater in areas with low background noise than in urban areas. TUS is within the study area and approximately 2 miles from the centerline of Corridor Alternatives 1 and 7. Noise associated with TUS is included in noise measurements taken throughout the study area and contributes to the calculated weighted average of the existing noise conditions.

3.10.1.4 Environmental Consequences

The purpose of the traffic noise analysis is to determine the location of receptors where future noise levels would be expected to approach or exceed the applicable NAC, potentially warranting consideration of noise abatement measures during Tier 2 NEPA evaluations. The noise modeling evaluation focused on noise-sensitive land uses or active, permitted residential developments in the 2,000-foot-wide corridor alternatives or within a 1,000-foot buffer surrounding the corridor alternatives. Given that Traffic Noise Model 2.5 loses prediction accuracy as the receiver is located farther away from the noise source, the results presented are a generalized noise analysis and intended to be representative of potential future scenarios if a corridor alternative is implemented.

Noise modeling results for the corridor alternatives are shown in Table 3-33.

Corridor Alternative 1

Under Corridor Alternative 1, the predicted noise levels of the noise-sensitive receptors range from 57 to 64 dBA and would not be potentially impacted. Two receivers, 3-S2 and 9-S5, showed future noise levels above 66 dBA. However, receiver 3-S2 represents a utility yard and receiver 9-S5 represents a Shell gas station; these are considered NAC Category F Land uses and there is no noise impact threshold associated with that NAC Land use category.

Noise receptors could also be potentially impacted due to substantial noise level increases over existing noise levels. Under Corridor Alternative 1, the Sycamore Park Subdivision represented by receiver 8-S5 may be potentially impacted due to substantial noise level increases.

Corridor Alternative 7

Under Corridor Alternative 7, the predicted noise levels of the noise-sensitive receptors range from 57 to 78 dBA and would result in potential impacts in two areas. Noise receptors along the El Toro Road South TI would be potentially impacted mainly by traffic noise from the existing I-19 freeway. In addition, a cluster of residences with large lot sizes along Alvernon Way would be potentially impacted by this corridor alternative. The future decibel levels of these receptors would likely be in the low 70s.

Noise receptors could also be potentially impacted due to substantial noise level increases over existing noise levels. Under Corridor Alternative 7, residential subdivisions represented by receivers 6-S1, 7-S1, 8-S1, and 8-S5 may also be potentially impacted due to substantial noise level increases.

Table 3-33. Summary of Predicted Future Traffic Noise Levels

RECEPTOR ID	NAC CATEGORY	FUTURE NOISE LEVELS (DBA)[1]	RECEPTOR ID	NAC CATEGORY	FUTURE NOISE LEVELS (DBA)[1]
Corridor Alternative 1					
1-S2	E	59	4-S5	F	62
2-S2	B	62	5-S5	E	59
3-S2	F	70	6-S5	E	57
1-S4	B	57	7-S5	E	60
1-S5	C	64	8-S5	B	62
2-S5	C	58	9-S5	F	70
3-S5	C	59			
Corridor Alternative 7					
1a-S1	B	78	11-S1	B	70
1b-S1	B	78	1-S4	B	57
1c-S1	B	78	1-S5	C	64
2-S1	C	77	2-S5	C	59
3-S1	C	68	3-S5	C	59
4-S1	B	76	4-S5	F	62
5-S1	B	68	5-S5	E	59
6-S1	B	63	6-S5	E	57
7-S1	B	60	7-S5	E	60
8-S1	B	59	8-S5	B	62
9-S1	B	61	9-S5	F	70
10-S1	B	71			
Corridor Alternative 8A					
1a-S1	B	78	8-S1	B	58
1b-S1	B	78	9-S1	B	60
1c-S1	B	78	10-S1	B	70
2-S1	C	77	11-S1	B	69
3-S1	C	68	1-S4	B	58

[1] Noise levels in red indicate potentially impacted sensitive receptors

Table 3-33. Summary of Predicted Future Traffic Noise Levels (continued)

RECEPTOR ID	NAC CATEGORY	FUTURE NOISE LEVELS (DBA)[1]
4-S1	B	76
5-S1	B	68
6-S1	B	63
7-S1	B	59

RECEPTOR ID	NAC CATEGORY	FUTURE NOISE LEVELS (DBA)[1]
2-S4	B	73
3-S4	C	55
4-S4	F	58

[1] Noise levels in red indicate potentially impacted sensitive receptors

Corridor Alternative 8A

Under Corridor Alternative 8A, the predicted noise levels of the noise-sensitive receptors range from 55 to 78 dBA and would result in potential impacts the same two areas as mentioned in Corridor Alternative 7, as well as a residential subdivision along Whispering Sage Road represented by receiver 2-S4.

Noise receptors could also be potentially impacted due to substantial noise level increases over existing levels. Under Corridor Alternative 8A, residential subdivisions represented by receivers 6-S1, 7-S1, and 8-S1 may be potentially impacted due to substantial noise level increases.

No-Build Alternative

Under the No-Build Alternative, a highway would not be constructed. Land uses would remain undeveloped or agricultural until development occurs as planned through zoning by local jurisdictions. There would be no changes in future traffic noise associated with a new highway, although noise levels along existing transportation facilities throughout the study area would likely increase due to the projected population growth and the accompanying increased future traffic volumes on the associated arterial road network.

3.10.1.5 Available Mitigation Measures

Traffic noise levels can be mitigated by a variety of abatement measures, such noise barriers, earthen berms, refinement of horizontal and vertical alignments, and reduced speeds. ADOT NAR has specific procedures for analyzing the feasibility, reasonableness, and cost-effectiveness of noise abatement measures. The abatement evaluation requires specific design details that are not yet available for this Tier 1 analysis. As a result, a detailed barrier evaluation is not possible at this preliminary stage of the project.

ADOT would identify specific mitigation measures during the Tier 2 NEPA process. The goal of this noise study is to identify areas that may be impacted by traffic noise. Using traffic projections, noise levels were predicted at specific distances to provide the best estimation of future noise levels in vicinity of the corridor alternatives.

3.10.1.6 Conclusion

This evaluation is based on assumptions made in the Final CSR. Certain assumptions were made to complete the preliminary noise analysis. As the design for the project is developed further and alignments are refined or eliminated, additional noise analyses would be required.

Noise-sensitive land uses within the analysis area with predicted 2045 traffic noise levels would experience potential noise impacts under all the corridor alternatives (Table 3-33). Sensitive noise receptors along Corridor Alternative 1 would be less potentially impacted while Corridor Alternatives 7 and 8A showed a greater potential for impact to sensitive noise receptors. As a general principle, new highway alignments constructed in a quiet or undeveloped area will typically result in a substantial increase of 15 dBA or greater that would warrant the consideration of noise mitigation. Project-level analysis identifying noise impact locations would occur during a future Tier 2 analysis, which would include a full evaluation of noise mitigation.

For the Tier 2 analysis, updated noise measurements would need to be conducted throughout the entire corridor, especially in rural areas where a substantial noise increase (15 dBA over existing noise levels) may be experienced. Detailed noise modeling would be conducted in accordance with the standards, procedures, and guidelines in place when the Tier 2 studies commence.

3.10.2 Vibration Impact Assessment

This section describes potential traffic vibration impacts that could result from implementing one of the corridor alternatives compared to the No-Build Alternative.

3.10.2.1 Regulatory Framework and Methodology

Per the *FHWA Procedures for Abatement of Highway Traffic Noise and Construction Noise Appendix G*, no Federal requirements directed specifically to highway traffic induced vibration currently exist. All studies highway agencies have conducted to assess the impact of operational traffic-induced vibrations have shown that both measured and predicted vibration levels are less than any known criteria for structural damage to buildings. In fact, normal living activities (e.g., closing doors, walking across floors, operating appliances) within a building have been shown to create greater levels of vibration than highway traffic. Potential concerns regarding vibration are typically addressed on a case-by-case basis as deemed appropriate in the noise analysis or in a standalone vibration analysis report. Vibration criteria and guidance in the *Caltrans Transportation and Construction Induced Vibration Guidance Manual (Vibration Guidance Manual)*, June 2004 can be used as a reference. The following standards are discussed in the Caltrans *Vibration Guidance Manual*:

- 5 millimeters per second (velocity of vibration) is the threshold below which no structural damage will occur.
- 2 millimeters per second is the threshold below which no structural damage to historical buildings or ruins will occur.
- 0.25 millimeters per second is the threshold of perception.

3.10.2.2 Affected Environment

There are potential existing residential uses along the corridor alternatives which are sensitive vibration receptors. As mentioned in the noise section, these residential subdivisions are Las Quintas Serenas, Santa Cruz Meadows, Valle Verde Del Norte, Los Arboles Mobile Home Park, and Sahuarita Highlands along Segment 1; and large lot residences along Segments 1, 2, and 4.

3.10.2.3 Environmental Consequences

Highway traffic vibration impacts on structures during operation from corridor alternatives are "practically non-existent" (*Vibration Guidance Manual* Appendix A, Page 17). At distances beyond 148 feet from the centerline of the closest lane, highway truck traffic impacts will be less than the threshold of perception.

Corridor Alternatives

Under all three Corridor Alternatives (1, 7, and 8A), the nearest residential property is located outside the 400-foot ROW footprint assuming each alternative is placed at the center of the 2,000-foot-wide corridor. Therefore, operational vibrations would be largely imperceptible to the identified receptors.

No-Build Alternative

Under the No-Build Alternative, a highway would not be constructed. Land uses would remain undeveloped or agricultural until development occurs as planned through zoning by local jurisdictions. There would be no changes in future traffic vibration associated with a new highway, and the operational vibration under the No-Build Alternative would be imperceptible to the identified receptors.

3.10.2.4 Available Mitigation Measures

ADOT would identify specific mitigation measures during the Tier 2 NEPA process, to the extent that design information on the alterative(s) under study in the environmental document is available at the time the environmental clearance document is completed, including the consideration of construction noise and vibration.

3.10.2.5 Conclusion

As discussed above, the nearest residential property is located outside the 400-foot ROW footprint assuming each alternative is placed at the center of the 2,000-foot-wide corridor. Therefore, the operational vibrations from the corridor alternatives would be largely imperceptible to the identified receptors.

3.11 Hazardous Materials

3.11.1 Introduction

Following are the applicable federal, state, and local regulations that govern the treatment and handling of materials and substances that present a health risk to human populations, the research methods used to identify the sites and locations of these hazards, the findings, the potential consequences of implementing transportation facilities in each of the Corridor Alternatives, and the future actions required for Tier 2 analysis.

3.11.2 Regulatory Framework

Environmental regulations pertaining to hazardous materials are developed and enforced by federal, state, and local governments. Arizona has enacted some environmental regulations that are at least as strict as the federal regulations and have obtained primacy to enforce those regulations. Other regulations remain federally mandated. Table 3-34 summarizes common regulations that pertain to hazardous materials.

3.11.3 Methodology

The documentation of hazardous materials considerations involves analyzing two types of impacts (known and potential) within the 2,000-foot-wide corridor alternatives. A No-Build Alternative is also considered.

The first type of impact involves the possibility of encountering hazardous materials during construction activities, should a corridor alternative be implemented that includes the construction of a highway. This impact is assessed by identifying the number and general characteristics of known hazardous sites within the 2,000-foot-wide corridor alternatives, taking into consideration the anticipated disturbance area within the corridor alternatives that are collocated with other roadways and the corridor alternatives that occur in new locations. The density of sites and the relative magnitude of the anticipated disruption associated with construction are considered to qualitatively assess the risk of encountering hazardous materials during construction. The second potential impact involves hazardous materials exposure that could result from future spills or accidents on a new Sonoran Corridor freeway associated with the transportation of hazardous materials.

Properties were identified with contamination issues or usage and handling of hazardous materials that have been reported to a regulatory agency. The search radius for these properties used the ASTM International (ASTM) Standard for Phase I Environmental Site Assessments, specified in ASTM E1527-13. This standard varies the search radius for hazardous materials according to the type of site and the governing regulations. Generally, the search identified hazardous materials located within the bounds of the study area, then from the perimeter of the 2,000-foot-wide corridor alternatives. Hazardous materials were identified within 1/8 mile of the study area, 1/8 to 1/4 mile, 1/4 to 1/2 mile, and then 1/2 to 1 mile from the study area perimeter. This analysis area is inclusive of the 2,000-foot-wide Sonoran Corridor alternatives.

Table 3-34. Hazardous Materials Regulations

REGULATION	DESCRIPTION
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), enacted in 1980 (42 United Stated Code [U.S.C.] 9601 et seq.) and subsequently amended by the Superfund Amendments and Reauthorization Act (42 U.S.C. 9601 et seq.) (Superfund)	This law authorized the United States Environmental Protection Agency (USEPA) to identify parties responsible for contamination of closed or abandoned sites and compel the parties to clean up the sites. Sites are reported to USEPA, and based on the results of an investigation, USEPA either determines that no further action is necessary at the federal level (but may refer the site to the state for additional activities) or can place the site on the National Priority List. Sites remain on the National Priority List until cleanup activities have been completed and the site is removed or delisted.
Formerly Used Defense Sites, 10 U.S.C. § 2701 Defense Environmental Restoration Program	The Department of Defense used land to train and test soldiers and weapons to ensure the nation's military readiness. The Department of Defense (DoD) is responsible for environmental restoration (cleanup) of properties that were formerly owned by, leased to, or otherwise possessed by the United States (US) and under the jurisdiction of the Secretary of Defense prior to October 1986. Environmental cleanup of formerly used defense sites is conducted under CERCLA.
Resource Conservation and Recovery Act (RCRA) (42 U.S.C. 321 et seq.), enacted in 1976	RCRA establishes a framework for the management of both solid waste and solid hazardous waste. RCRA Subtitle C authorizes the USEPA to develop regulations for cradle-to-grave management of these wastes.
Arizona State regulation for management of both solid waste (Arizona Revised Statute [ARS] Title 49, Chapter 4 and Arizona Administrative Code [AAC] Title 18, Chapter 13) and hazardous waste (ARS Title 49, Chapter 5 and AAC Title 18, Chapter 8).	The Arizona Department of Environmental Quality (ADEQ) regulates hazardous waste through implementation of the USEPA regulations. State solid waste regulations in Arizona regulate solid waste facilities (landfills), including municipal and non-municipal solid waste landfills; biohazardous medical waste facilities; solid waste transfer stations; waste tire collection sites; special waste transporters and receivers; used oil marketers, processors, and transporters; and battery collection sites.
Water Quality Assurance Revolving Fund (WQARF) (ARS Title 49, Chapter 2 and AAC Title 18, Chapter 16)	The State of Arizona has regulations to address sites potentially impacted by hazardous substances. This program is administered by ADEQ. The model of the WQARF program is similar to CERCLA, with sites investigated and either cleaned up or granted a determination that no further action is necessary.
Underground Storage Tanks (UST) (ARS Title 49, Chapter 6 and AAC Title 18, Chapter 12)	Regulation of USTs that are used to store either gasoline, petroleum products, or certain hazardous substances is the responsibility of ADEQ. USTs are commonly used at retail fueling stations, auto repair facilities, and fleet service operations. Releases from USTs (aka Leaking USTs [LUST]) must be reported to ADEQ and investigated to evaluate whether remedial action is required. Regulations provide guidance for remediation of releases and closure of facilities after remediation is complete.

Table 3-34. Hazardous Materials Regulations (continued)

REGULATION	DESCRIPTION
Voluntary Remediation Program (VRP) and Brownfields	The VRP encourages property owners and other interested parties to voluntarily remediate impacted properties. Ineligible sites include those that are listed on the WQARF registry with the same contaminants of concern; and hazardous waste sites and UST sites undergoing certain remedial actions required by ADEQ, a court of law, or an administrative order. The Brownfields program assists with cleanup and redevelopment of abandoned or underutilized properties where reuse is complicated by actual or perceived environmental contamination. The Brownfields program is administered through ADEQ with funding from the USEPA state response grant.
Other Regulations	Other state and federal regulations exist; however, they are not applicable to this project since there are no identified facilities to which they would apply within the study area.

The analysis outlines the number of potential facilities that occur within and adjacent to the corridor alternatives. The analysis does not include a detailed review of each facility identified, such as whether a release was reported or confirmed, regulatory compliance issues, remediation, or regulatory closure. Therefore, many of the sites recorded may have limited or no remaining environmental conditions. Others may have environmental conditions that require substantial remediation. For this Tier 1 analysis, the number and types of facilities were identified within the ASTM-prescribed search distances and utilized to evaluate the potential for environmental concerns related to hazardous materials.

Federal database listings reviewed include hazardous waste sites, Brownfields sites, National Priority List/Superfund sites, and formerly used defense sites. State database listings reviewed include Declaration of Environmental Use Restriction sites; dry cleaners; above-ground storage tanks (AST); underground storage tanks (UST); leaking underground storage tanks (LUST); open and closed landfills; state hazardous waste sites; voluntary remediation program (VRP) and Brownfields sites; and Water Quality Assurance Revolving Fund (WQARF) sites. Other readily available databases were also searched that include the City of Tucson landfill registry and applicable Tribal databases for USTs, LUSTs, and open dumps. It is possible that a site may be listed on multiple databases (and thus counted more than once for different database findings).

The types of sites can often be used to inform the potential risk a facility may pose. For instance, Superfund sites normally encompass toxic waste that has been left out in the open, and are amongst the most dangerous to human health if left unmanaged. These sites generally carry a high potential environmental liability (and corresponding high project risk) as the criteria for placement within the bounds of a Superfund project area is that the facility have a higher magnitude of contamination, and thus increased potential to negatively affect human health and the environment. Resource Conservation and Recovery Act (RCRA) corrective action sites and WQARF sites (where releases of hazardous substances to the soil or groundwater have been confirmed) may also carry a high potential liability (and corresponding high project risk). In the following list, generally, the risk level descends from highest to lowest, but this is in no way the rule, as risks will vary from facility to facility, and by the type of

disturbance that would occur from the corridor alternatives selected. Using this protocol, the data obtained for this analysis was grouped and compiled into the following types of sites:

- Superfund/WQARF
- Hazardous Materials/Waste
- AST/UST/LUST
- VRP and Brownfields
- Landfill
- Environmental Covenant (restrictions pertaining to hazardous contamination that apply when land is transferred between owners)
- Other

Superfund and WQARF sites present a considerable risk if they are encountered. Often these facilities have complicated, considerable, and costly contamination issues spread over large areas both laterally and below ground and tend to have known impacts that pose high risks to human health and the environment. Hazardous materials/waste facilities under a corrective action program also tend to have complicated environmental releases, and the magnitude of releases could be localized or spread over a large area; thus, the risks can vary, but sometimes may be large. AST/UST/LUST facilities tend to have more localized impacts; however, the magnitude of the number of facilities, particularly along heavily urbanized travel corridors, should not be discounted. VRP/Brownfields, landfills, and environmental covenant facilities occur less frequently throughout the study area and tend to have impacts that are localized at or near the source. Other facilities can be listed as findings as part of the search (such as wastewater treatment facilities, Tribal lands, non-specific, etc.), but also tend to be localized concerns or are general information in nature, with a low probability of impact to the study area.

The database searches supporting the analysis of hazardous materials concerns was performed in July 2019. The database search results, including applicable mapping, are available in Appendix G. It is important to acknowledge that hazardous materials evaluations may be constrained by active or completed remedial actions, reported releases, new or historical facilities that will be identified in the future, and other factors. Therefore, information related to these items would be updated during Tier 2 NEPA documentation to maintain up-to-date information in conjunction with the evaluation of the environmental consequences for a specific alignment, as well as project-specific mitigation measures.

To support the findings of the database search, a reconnaissance of the study area was conducted on July 19, 2019, from existing roadways and other public locations that were collocated with the corridor alternatives.

3.11.4 Affected Environment

Land uses within the 2,000-foot-wide corridor alternatives include agricultural, low-density residential, unimproved desert land, resource extraction/mining operations and prison complexes along the Old Vail Connection Road, industrial and commercial near the Rita Road TI at I-10, and recreation near Harrison Road. In Sahuarita, most of the low-density residential areas can be found in master-planned subdivisions of varying sizes. These residential subdivisions are located both within Sahuarita and in unincorporated Pima County. As discussed previously in Section 3.2, Land Use and Jurisdiction, most of unincorporated Pima County within the study area is unimproved desert land.

A total of 32 regulated sites were identified across the study area within the ASTM-prescribed search radius of 2,000 feet, including the termini locations and all of the corridor alternatives. Table 3-35 and Table 3-36 summarize the results of regulated sites by segment and regulated findings by corridor alternative.

Table 3-35. Regulated Sites by Segment/Corridor

TYPE OF SITE	SEGMENT 1/ CORRIDOR ALTERNATIVE S 7, 8A	SEGMENT 2/ CORRIDOR ALTERNATIVE 1	SEGMENT 3/ CORRIDOR ALTERNATIVE S 1, 7, 8A	SEGMENT 4/ CORRIDOR ALTERNATIVE 8A	SEGMENT 5/ CORRIDOR ALTERNATIVE S 1, 7	TOTAL
Superfund/ WQARF[1]	0	0	0	0	3	3
Hazardous Materials/Waste	3	0	0	0	6	9
AST/UST/LUST[2]	0	0	0	2	4	6
VRP[3] and Brownfields	0	0	0	0	0	0
Landfill	0	0	0	0	0	0
Environmental Covenant	0	0	0	0	0	0
Other	0	1	0	6	26	33
Total	3	1	0	8	39	51

Source: Environmental Data Resources (EDR) Radius Corridor Report, July 31, 2019.
[1] Water Quality Assurance Revolving Fund
[2] Above-ground storage tank/underground storage tank/leaking underground storage tank.
[3] Voluntary Remediation Program.

Table 3-36. Regulated Findings by Corridor Alternative

TYPE OF SITE	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
Superfund/WQARF[1]	3	3	0
Hazardous Materials/Waste	6	9	3
AST/UST/LUST[2]	4	4	2
VRP[3] and Brownfields	0	0	0
Landfill	0	0	0
Environmental Covenant	0	0	0
Other	27	26	6
Total	40	42	11

Source: Environmental Data Resources (EDR) Radius Corridor Report, July 31, 2019.
[1] Water Quality Assurance Revolving Fund
[2] Above-ground storage tank/underground storage tank/leaking underground storage tank.
[3] Voluntary Remediation Program.

In general, the majority of sites and findings were located along Segment 5, and to a lesser extent Segment 4. Most of the findings were for low-priority sites listed as other, followed by hazardous materials/waste sites and then AST/UST/LUST sites. Three sites under the *Comprehensive Environmental Response, Compensation, and Liability Act* program for Superfund/WQARF website were also identified. These sites were located in areas with a longer development history in the southern outskirts of the Tucson Metropolitan Area, which may increase the possibility of releases of hazardous materials/waste having affected surface/subsurface soil and groundwater.

Developed urban areas tend to have more facilities that are riskier in terms of potential project exposure to hazardous materials, such as Superfund sites. Areas where less development has occurred (for example, the unimproved or agricultural areas in the southern portion of the study area) tend to present less risk of containing regulated sites.

More detailed descriptions of the regulated sites and findings are broken down into the corridor alternative sections below. Where appropriate, additional supporting discussion is included from the study area reconnaissance conducted on July 19, 2019.

3.11.5 Environmental Consequences

3.11.5.1 Corridor Alternative 1

Corridor Alternative 1 contains forty regulated findings, including 6 hazardous materials/waste sites, 4 AST/UST/LUST sites, and 3 Superfund/WQARF sites. All of these sites are located in Segment 5. Potential risks associated with the hazardous materials/waste sites and AST/UST/LUST sites are likely localized near those specific facilities depending on the magnitude of the releases, if any. Potential risks associated with the findings under Superfund/WQARF sites may be elevated, as any spills may be more widespread in nature. Evaluation of the findings from the database indicated hazardous waste generators exist, and that a spill had occurred in the past. However, the corrective action process has been terminated as the spill has been managed. Therefore, the risk is not anticipated to be high. The remaining 27 sites are listed in the "Other" category, which includes wastewater treatment plants, industrial sites, and medical facilities as examples, and have a low probability of risk with relation to this corridor alternative.

The reconnaissance of Corridor Alternative 1 on July 19, 2019 indicated that an active AST is present in Segment 5 associated with a backup generator at the Arizona State Prison complex. However, the AST was in good condition, with no staining on the ground observed. Also, within the limits of Segment 5, although not a currently documented environmental concern, a sand and gravel mining operation was observed east of Swan Road that may require additional investigation during a future Tier 2 analysis, given the probability of dumping and contamination associated with this site category. No other environmental concerns were observed.

3.11.5.2 Corridor Alternative 7

Corridor Alternative 7 contains the largest number of regulated findings (42) (refer to Table 3-36) including 9 hazardous materials/waste sites, 4 AST/UST/LUST sites, and 3 Superfund/WQARF sites. In Segment 1, 1 hazardous materials/waste site was identified, with three findings associated with a former air-to-land bombing range. This site was depicted to be near the eastern limits of the 2,000-foot-wide corridor, and may pose a moderate risk associated with undocumented unexploded ordinance. The remaining findings were located in Segment 5 and are described above in the description for Corridor Alternative 1. No other hazardous materials concerns were observed in Segment 1 during the limited reconnaissance.

3.11.5.3 Corridor Alternative 8A

This corridor alternative contains the fewest regulated sites (11) (Table 3-36) and encompasses no Superfund sites. The findings are limited to 3 hazardous materials/waste sites, 2 AST/UST/LUST locations, and 6 sites categorized as "Other." This alternative not only encompasses the fewest known sites, but they are also likely to be of lesser magnitude, given the absence of any Superfund/WQARF designation.

3.11.5.4 No-Build Alternative

The No-Build Alternative does not include the construction of a new freeway; however, the network of arterial streets would still be developed to meet the transportation demands associated with the planned future development discussed in Section 3.2.3.1. Without a new freeway, the arterial street network would likely be built with higher capacity, involve more conversion of land to transportation uses, and potentially could impact a greater number of hazardous materials concerns when compared to a future system that includes a freeway. As would be the case should any of the corridor alternatives be selected, the No-Build Alternative would likely require the avoidance or remediation of hazardous and other regulated materials sites within the study area.

3.11.6 Available Mitigation Measures

The following potential mitigation strategies and best practices for environmental consequences related to hazardous materials for a new Sonoran Corridor should be considered during the future Tier 2 NEPA analysis:

- Before ROW acquisition, conduct Phase I Environmental Site Assessments for those properties identified for acquisition. Based on these assessments, additional subsurface investigation may be required depending on the recognized environmental conditions identified and potential risk to the project.
- Conduct appropriate surveys for asbestos, lead-based paint, and universal wastes prior to demolition of any building structures and bridges or elevated structures. Conduct sampling for pesticide and herbicide to determine if action-level concentrations exist before farmland is disturbed. If these regulated materials are encountered, abate them in accordance with applicable regulations and guidelines.

3.11.7 Conclusion

Based on a review of documented hazards and a limited site reconnaissance, Corridor Alternatives 1 and 7 have similar risks for encountering hazardous and other regulated material sites, should either of these alternatives be selected. Corridor Alternative 8A has fewer known hazards at this time. The No-Build Alternative that would result in actions other than constructing a freeway to improve the transportation network within the study area in the future, would also likely encounter hazardous and other regulated waste sites. Because specific transportation improvements associated with the No-Build Alternative would likely involve numerous arterial street corridors throughout the Study Area occurring over a greater period of time when compared to the corridor alternatives, potential impacts for the No-Build scenario are more uncertain and were not quantified.

During the Tier 2 NEPA analysis, detailed hazardous materials evaluations would be conducted, including review of regulatory agency files; completion of Phase I Environmental Site Assessment reports; subsurface investigations to quantify the vertical and horizontal distribution of hazardous materials; and remediation planning, as needed. Additionally, the identification of practical measures to avoid, minimize, and mitigate the environmental consequences from hazardous materials would be completed.

3.12 Geology, Topography, Soils, and Prime and Unique Farmland

3.12.1 Introduction

The following sections discuss the geologic characteristics of the Study Area and the related subject of the local soils that are cultivated for food and fiber production. In addition to describing government regulation pertaining to these resources, a relative comparison of potential impacts associated with each of the corridor alternatives and the No-Build alternative are provided, along with recommendations for further study of these resources during Tier 2 analyses.

3.12.2 Regulatory Framework

Few specific laws or regulations in Arizona relate to the avoidance of earthquake hazards or govern actions that could impact geologic faults or earthquake-prone areas. *Best Available Demonstrated Control Technology*, the Arizona document for the protection of groundwater under the state's Aquifer Protection Permit program, describes seismic measures to protect groundwater, but concerns mining operations exclusively. Other regulations exist primarily in the form of municipal and county building codes to ensure that human-occupied structures are sufficiently resilient to remain standing during ground-shaking seismic events. For transportation facilities, ADOT uses specifications and design standards derived from the American Association of State Highway and Transportation Officials (AASHTO) and FHWA to ensure bridges can withstand earthquakes sufficiently to limit loss of life and property damage during seismic events, and geotechnical investigations are performed to identify potential seismic hazards, to either avoid them or incorporate countermeasures into highway design.

Similarly, the legal and regulatory requirements for avoiding certain terrain types typically reside in municipal and county development ordinances requiring building construction to avoid slopes above a steepness threshold and topography associated with rivers and flood-prone areas. For the development of transportation facilities, ADOT employs location-specific geotechnical data and AASHTO guidelines to determine acceptable grades, adjacent slopes, drainage requirements, and suitability of underlying soils and bedrock to support a road.

The potential use of federal funds to construct this project invokes the Farmland Protection Policy Act (FPPA) regulations (7 CFR 658). The FPPA requires identification of proposed actions that would affect land classified as prime or unique farmland before federal agency approval of any activity that would convert such farmland to other uses, including right-of-way for transportation facilities.

The Natural Resources Conservation Service (NRCS), part of the U.S. Department of Agriculture (USDA), administers the FPPA as it relates to protection of farmland. Congress passed the FPPA because of a substantial decrease in the amount of open farmland due to ongoing development nationwide. Under the FPPA, the Secretary of Agriculture is required to set criteria to identify and take into account the potential effects of federal agency activities on the preservation of farmland. FPPA regulations (7 CFR 658.5) establish the criteria for such evaluation, with an emphasis on urban aspects of proposed programs. Policy stated in 7 CFR 658.3 seeks to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmland to nonagricultural uses. In 7 CFR

658.4, it is stated that federal programs shall be administered in a manner that, as practicable, would be compatible with state, local government, and private programs and policies to protect farmland. It requires identification of proposed federal actions that would affect any land classified as prime or unique farmland, and the consideration of alternative actions. Pursuant to the FPPA, farmland includes:

- Prime – Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion, as determined by the Secretary of Agriculture. Prime farmland includes land that possesses the above characteristics but is being used currently to produce livestock and timber [7 USC 4201(c)(1)(A)].
- Unique – Land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, fruits, and vegetables. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods [7 USC 4201(c)(1)(B)].
- Other – This encompasses farmland, other than prime or unique farmland, that is of statewide or local importance for the production of food, feed, fiber, forage, or oilseed crops, as determined by the appropriate state or unit of local government agency or agencies, and that the Secretary of Agriculture determines should be considered as farmland [7 USC 4201(c)(1)(C)].

The FPPA regulations (7 CFR 658.2–658.3) provide a description of land not subject to (that is, not protected by) provisions of the FPPA, which includes land that: (1) receives a combined score of less than 160 points from the land evaluation and site assessment criteria, (2) is identified as an urbanized area on U.S. Census Bureau maps, (3) is designated as an urban area and shown as a tint overprint on U.S. Geological Survey topographical maps, (4) is shown as white (not farmland) on USDA Important Farmland Maps, (5) is shown as urban built-up on USDA Important Farmland Maps (according to guidance of the National Resources Inventory, areas 10 acres or larger without structures are not considered urban-built-up and are subject to the FPPA), (6) is used for national defense purposes, or (7) is privately owned and no federal funds or technical assistance are used.

3.12.3 Methodology

Seismic and other geologic hazards in the corridor alternatives were identified using the Arizona Geological Survey Natural Hazards in Arizona webviewer[6] which includes earthquake epicenters, earth fissures, quaternary faults, landslides, and floods. Information for soils identifying farmland under one or more of the FPPA categories was gathered from the USDA NRCS WebSoilSurvey website[7]. Topography and land uses were identified from the land use chapter of this document and web-based viewers of aerial images, as well as a reconnaissance site visit performed on July 23, 2019.

[6] https://uagis.maps.arcgis.com/apps/webappviewer/index.html
[7] https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx

3.12.4 Affected Environment

The study area is located within the broad Santa Cruz Valley and gently slopes to the northwest. The topography along the corridor alternative segments is substantially flat and incised by ephemeral drainages that are tributary to the Santa Cruz River. The Santa Cruz River flows from south to north and intersects corridor alternative Segments 1 and 2. Other than the river, there are no prominent geophysical features along any of the corridor alternative segments.

The review of Arizona Geological Survey Natural Hazards in Arizona did not show any records for the areas within the corridor alternatives pertaining to geology, soils, or farmland. The Santa Rita fault zone is located in the foothills of the Santa Rita Mountains in the southeast portion of the study area, outside of the areas occupied by corridor alternatives. This fault zone is comprised of multiple faults extending from the study area south into Mexico that rupture infrequently, but are capable of producing an earthquake greater than 6.0 on the Richter scale.

Study area soils are documented in the Tucson-Avra Valley Area (AZ668) and Pima County, Eastern Part (AZ669) surveys. The upland soils in the study area are typically loams, including silty, sandy, and gravely varieties. In nearly all cases, these soils are well drained and not conducive to ponding or retaining water. These are not soils associated with expanding clay that present hazards to structures or foundations. Only a small amount of the upland area is suitable for farming, and is characterized as Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season (Figure 3-33).

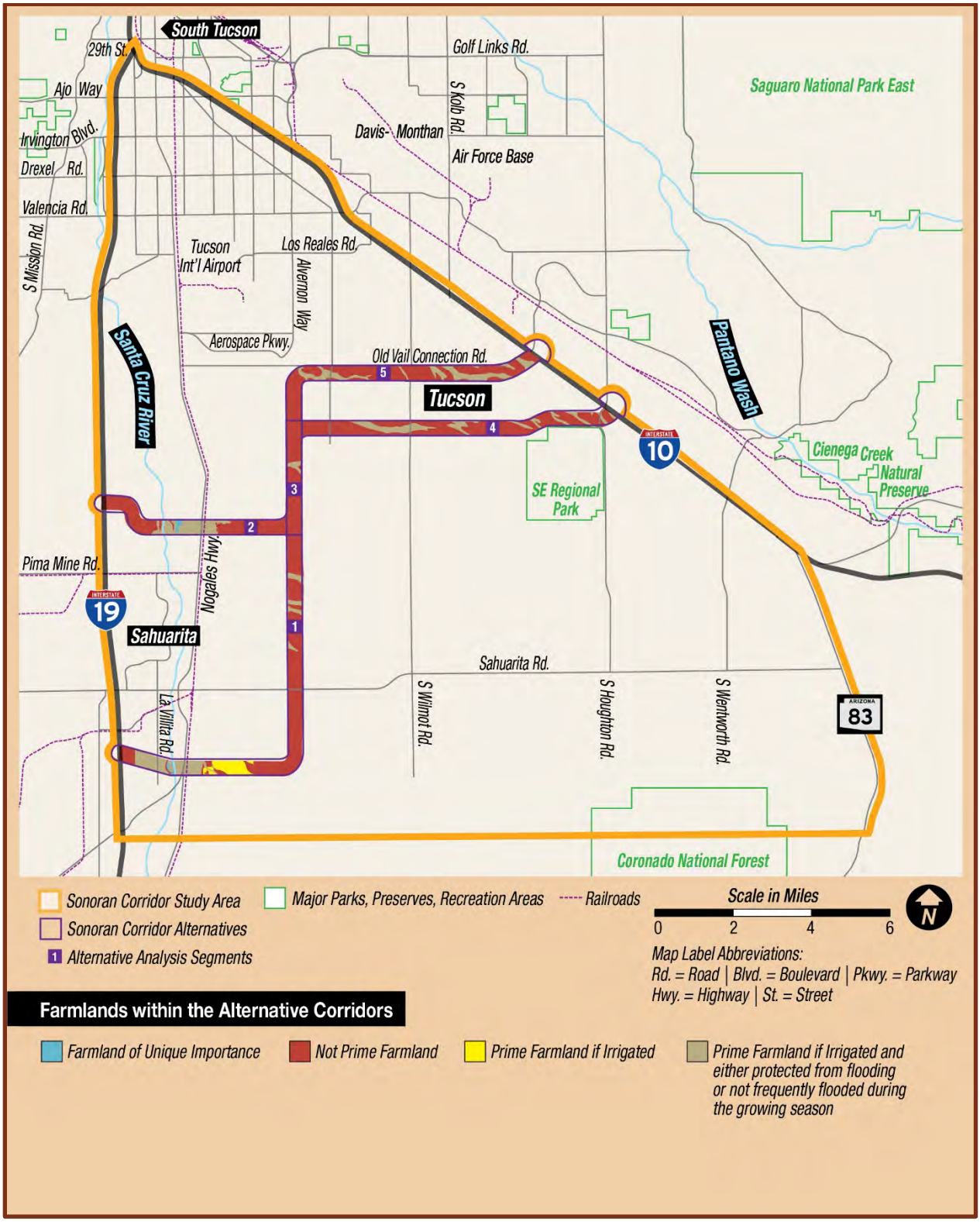
The low areas within the study area associated with the Santa Cruz River encompass numerous loamy soil types that are frequently rated as Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season, Prime farmland if irrigated, or Farmland of unique importance. The majority of these soils are not currently under cultivation. Segment 1 crosses prime and unique farmlands that are currently occupied by groves associated with Green Valley Pecan Company, which according to the Pecan Growers Association of Arizona, is the largest pecan farm on Earth.[8]

Segment 2 also crosses the Santa Cruz River and traverses areas of soils rated as Prime farmland and Unique farmland. Currently, none of the land in Segment 2 is under cultivation. The Civano Growers Wholesale Plant Nursery is immediately outside of Segment 2, but it is anticipated to be avoided. A portion of Segment 2 has been impacted by sand and gravel mining and is unlikely to retain its Prime or Unique farmland ratings originally identified in NRCS soil surveys.

The remaining corridor segments, 3 through 5, encompass no farmland under cultivation but do contain pockets of soils that are rated as Prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season. There is also livestock grazing occurring on unimproved land in the study area, including areas coinciding with the corridor alternatives. Although rangeland can be designated as Prime farmland or Unique farmland, there is no apparent rating in the areas being used for livestock grazing and, based on observable vegetation types and cover, the forage is not of exceptional quality.

[8] https://agriculture.az.gov/sites/default/files/AZDA_GuideToAZAg-R5.pdf

Figure 3-33. Prime and Unique Farmland in the Corridor Alternatives



3.12.5 Environmental Consequences

3.12.5.1 Corridor Alternative 1

Implementing a transportation project in Corridor Alternative 1 would have physical impacts to the terrain adjacent to the Santa Cruz River and other portions of the natural drainage system where they would be spanned. These crossings would typically include the construction of earthen approaches to bridge abutments as well as changes to the natural terrain profiles at the approach to culverts. In addition to the geophysical obstacles, the active UPRR Nogales Branch would be crossed. This would require spanning the railroad or possibly constructing an underpass. Either option for the railroad crossing would involve earthwork in the form of building up the approaches or excavating for an underpass.

Although the remainder of the terrain in Segments 3 and 5 is relatively flat, contemporary standards for highway design would require road grades with gentle vertical curves that would potentially increase the quantities of earthwork (cutting and filling). The earthwork balance (the ratio of additional earth needed to construct the highway versus the excess earth to be removed) has not been quantified for this alternative. However, due to the relative uniformity of the terrain, implementation of this corridor alternative is not expected to be drastically biased toward either greater cutting or greater filling.

The Santa Rita fault zone partially occupies some of the study area but is outside Corridor Alternative 1. Because the faults are mapped outside this corridor alternative, it is unlikely that construction related to implementation of this alternative would precipitate or worsen the possibility of a fault rupture. The faults would not present a direct threat to future facilities developed under this alternative, but a potential earthquake in close proximity to a future highway has the potential to damage the facility by compromising bridges and heaving or cracking the road surface.

The soils in the study area are generally sandy loams not associated with shrinking and swelling that could potentially impact Corridor Alternative 1 should it be implemented. The soils, in most cases, are also well drained, lessening the likelihood of water being retained or flooding during storms.

Corridor Alternative 1 would not impact any farmland that is currently cultivated but could involve impacts if farmland within the corridor alternative is cultivated in the future.

3.12.5.2 Corridor Alternative 7

Corridor Alternative 7 would have physical impacts to the landscape similar to Corridor Alternative 1, including spanning the Santa Cruz River and other portions of the natural drainage system, as described above. This corridor alternative would also cross the UPRR and require earthwork and corresponding changes to the physical landscape to either span or tunnel under the railroad. Similar to Corridor Alternative 1, the earthwork balance is not expected to favor either greater amounts of borrow or fill.

The Santa Rita fault zone is located outside of Corridor Alternative 7. As with the other corridor alternatives, the faults would not present a direct threat, but an earthquake in close proximity has the potential to damage a future highway.

The geotechnical properties of the soils in the study area do not appreciably differ between the corridor alternatives and, as previously stated, are not expected to pose challenges for the construction of this or any other corridor alternative.

Segment 1, which constitutes part of Corridor Alternative 7, contains farmland that is currently under cultivation, crossing the Green Valley Pecan Company grove for nearly 1 mile. Potential impacts to the Green Valley Pecan Company and any other cultivated land within Corridor Alternative 7 that may exist in the future would be quantified and evaluated during Tier 2 analysis.

3.12.5.3 Corridor Alternative 8A

Corridor Alternative 8A would have similar physical impacts to the landscape as Corridor Alternatives 1 and 7 that would include spanning the Santa Cruz River and other portions of the natural drainage system as described above. This alternative would also cross the UPRR and require earthwork and corresponding changes to the physical landscape to either span or tunnel under.

The Santa Rita fault zone is located outside of Corridor Alternative 8A. As with the other corridor alternatives, these faults would not present a direct threat, but an earthquake in close proximity has the potential to damage a future highway.

The soils in the study area do not appreciably differ between the corridor alternatives and, as previously stated, are not expected to pose challenges for the construction of this or any other corridor alternative.

With regard to farmland, implementation of Corridor Alternative 8A would pose identical potential impacts to Segment 1 as described above Corridor Alternative 7.

3.12.5.4 No-Build Alternative

Allowing the transportation network to develop as a grid of arterial streets without a Sonoran Corridor freeway would result in similar impacts to the implementation of any one of the corridor alternatives. In the No-Build Alternative, the arterial road network would likely be built to accommodate higher capacity to meet future transportation needs. The wider roads would present potentially as great or greater physical impacts to the landscape and drainage systems in the study area. The location and number of crossings of the Santa Cruz River and UPRR could potentially increase under this scenario and present greater physical impacts. It is also possible that an expanded-capacity arterial road network could increase the amount of farmland converted to transportation uses when compared to implementing one of the corridor alternatives. No greater potential impact is anticipated with the No-Build Alternative when compared to the corridor alternatives with regard to geologic hazards, including soils or earthquakes.

3.12.6 Available Mitigation Measures

To address the geophysical impacts to the landscape that would potentially result from the implementation of a corridor alternative, the highway and its associated features would be constructed to the contemporary standards outlined by AASHTO, FHWA, and ADOT. Context Sensitive Solutions and Design[9] can be employed at the project-level development phase to narrow the project's footprint significantly from the 2,000-foot-wide corridor alternatives, and reduce the amount of earthwork, excavation, and changes to topography to accommodate a Sonoran Corridor. A combination of techniques, such as steepening built slopes to the maximum, blending built features into the surrounding natural terrain, and choosing to preserve more natural features by bridging them, are all possible ways to reduce impacts.

To manage the risk to the structural integrity of a corridor alternative to protect public safety, the project-level design would incorporate the ADOT design standards for seismic resistance. Geotechnical investigations would also be conducted to verify the suitability of underlying soils to ensure the risks are acceptable, such as low probability of soil liquefaction or other soil hazards. Should these risks be identified, the appropriate engineered countermeasures would be incorporated into project-level design.

Potential effects on Prime farmlands and Unique farmlands would be quantified during the Tier 2 NEPA study and documented using Form AD-1006 in compliance with the FPPA. As with all acquisition of private holdings for the implementation of a corridor alternative, adherence to the URA would be a project requirement.

3.12.7 Conclusion

Other than the Santa Cruz River, few prominent geophysical features would be impacted by constructing a freeway within any of the corridor alternatives. The probability of encountering seismic hazards, soil hazards, or other underlying geologic features that would be directly impacted by any of the corridor alternatives or that would potentially impact a freeway facility should one be constructed, is also low. By overall percentage of all land use categories, only a small amount of farmland currently under cultivation would be impacted by either Alternatives 7 or 8A. However, this farmland is important not only for its designation as both Prime and Unique, but also because from a global standpoint, it is significant to the production of pecans. When project-level development occurs, strategies to reduce impacts to the pecan grove would be employed to mitigate farmland, community, and economic impacts. Tier 2 studies would also include coordination to determine if the local jurisdictions affected include farmland or agricultural land protection or preservation goals and policies in their respective general or future land use plans.

[9] https://www.fhwa.dot.gov/planning/css/

3.13 Biological Resources

Biological resources include general wildlife, plants, and other organisms as well as species receiving special protection by a federal, Tribal, state, or local governmental agency/organization. Biological resources addressed in this section were identified through coordination with agencies such as the AGFD and USFWS, as well as GIS data analysis and literature review. This section provides an overview of biological resources in the study area, identifies the potential environmental consequences of implementing the No-Build and Corridor Alternatives, and describes available mitigation measures to avoid or minimize those consequences.

3.13.1 Vegetation and Wildlife

This section is devoted to general vegetation and wildlife in the study area.

3.13.1.1 Regulatory Framework

The State of Arizona has primary jurisdiction over wildlife on its non-tribal lands, except where preempted by federal laws such as the Endangered Species Act (ESA). The AGFD is the primary state agency charged with managing Arizona's wildlife. Protected species or "special status" species receive special protection by a federal, Tribal, state, or local governmental agency for various reasons, such as rarity, declining habitat or population numbers, known threats, or cultural significance. Regulatory compliance requirements for protected species vary based on the agency with regulatory oversight and are often tied to land ownership, jurisdiction, or management status. For example, BLM Special Status Species Policy, described in Section 3.13.3.1, Regulatory Framework, is only applicable on BLM-managed lands. The following is an overview of the key laws, regulations, and policies applicable to general vegetation and wildlife in the study area.

Table 3-37. Applicable General Vegetation and Wildlife Regulations

REGULATION	DESCRIPTION
Federal	
Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. 703-712, as amended)	This law protects migratory birds and their parts (including eggs, nests, and feathers) from "take" and commerce.
Executive Order13186 Responsibilities of Federal Agencies to Protect Migratory Birds	This EO directs federal agencies to develop and implement a memorandum of understanding with USFWS and other federal agencies to promote conservation of migratory bird populations for actions likely to have a measurable negative effect on such populations.
Federal Noxious Weed Act (7 U.S.C. 2801 et. seq.)	This law establishes a federal program to control the spread of "undesirable plants," meaning plant species that are classified as undesirable, noxious, harmful, exotic, injurious, or poisonous, pursuant to state or federal law.
Fish and Wildlife Coordination Act (16 U.S.C 661 et. seq.).	This law requires coordination with USFWS and state fish and wildlife agencies for the purpose of protecting fish and wildlife when federal actions result in modification of a natural stream or body of water.

Table 3-37. Applicable General Vegetation and Wildlife Regulations (continued)

REGULATION	DESCRIPTION
Tribal	
Tohono O'odham Nation San Xavier District	The TON does not have laws or regulations designating special status species or protecting specific biological resources; however, the TON was contacted to determine any biological concerns for Corridor Alternative 1 located on the SXD; a response has yet to be received at time of printing.
State of Arizona	
Arizona Native Plant Law (Arizona Revised Statute 3-903 through 3-905)	This law protects various native plant species that are wild growing (i.e., not planted for landscaping or other purposes) and is administered by the Arizona Department of Agriculture.
Arizona Noxious Weed Provisions (Arizona Revised Statute § 3-201 et seq.)	These provisions authorize the Arizona Department of Agriculture to control, eradicate, or suppress invasive/noxious plant species and prevent their introduction into Arizona. The list of regulated, restricted, and prohibited plant species is established in Arizona Administrative Code R3-4-244 and 4-245.
Arizona EO 91-6, Protection of Riparian Areas (State of Arizona Governor EO 91-6)	This order encourages the development of practices that would maintain existing riparian areas and enhance and restore degraded riparian areas, and requires state agencies to rigorously enforce their existing authorities to ensure riparian protection, maintenance, and restoration.
Title 17 of the Arizona Revised Statutes, Game and Fish	Title 17 places the responsibility for management of Arizona's wildlife resources with the Arizona Game and Fish Commission and AGFD: • *Arizona Revised Statute 17-102* establishes that most wildlife in Arizona is the property of the state. • *Arizona Revised Statute 17-231* establishes that through the Commission, the AGFD may develop policies and programs for the management, preservation, and harvest of wildlife; establish hunting, trapping, and fishing rules and prescribe the manner and methods which may be used in taking wildlife; enforce laws for the protection of wildlife; and develop and distribute information about wildlife and activities of the AGFD. • *Arizona Revised Statute 17-301 et seq*. provides detailed rules for licenses and permits, taking and handling of wildlife, possession of live wildlife, heritage grants, and wildlife areas, among others.
Pima County	
Pima County Native Plant Ordinance (Pima County Zoning Code 18.72)	This ordinance promotes the preservation of native plants by adopting comprehensive requirements for preservation in place, transplanting on site, and mitigation. The *Pima County Development Services Planning Division Native Plant Preservation Manual* establishes standards and procedures for implementing the native plant ordinance requirements.

3.13.1.2 Methodology

Vegetation and wildlife are described at a landscape level (i.e., large scale) within the study area. Available literature, GIS-based data, and online resources related to vegetation and wildlife were reviewed to identify general vegetation and wildlife within the study area and corridor alternatives. The GIS-based data includes the digital representation of Brown and Lowe's "Biotic Communities of the Southwest" and the USGS 2016 LANDFIRE Land and Vegetation Cover dataset that provides information on existing land cover and vegetation types. Using GIS software, the corridor alternatives were visually overlaid onto these datasets to identify which biotic communities, vegetation types, and natural areas versus developed areas for human use are present within each corridor alternative. Online resources that were reviewed within this section include Audubon Society digital maps to identify the presence of Important Bird Areas within the study area. In addition, to evaluate potential impacts to Species of Economic and Recreational Importance, a digital map of Arizona's Most-Valued Hunting and Fishing Locations created by AGFD and the Theodore Roosevelt Conservation Partnership was reviewed to identify important hunting or fishing areas within each corridor alternative.

The analysis considers impacts on general wildlife, wildlife habitat, and vegetation types, including biotic communities, riparian habitat, Important Bird Areas, migratory birds, invasive species, and Species of Economic and Recreational Importance.

3.13.1.3 Affected Environment

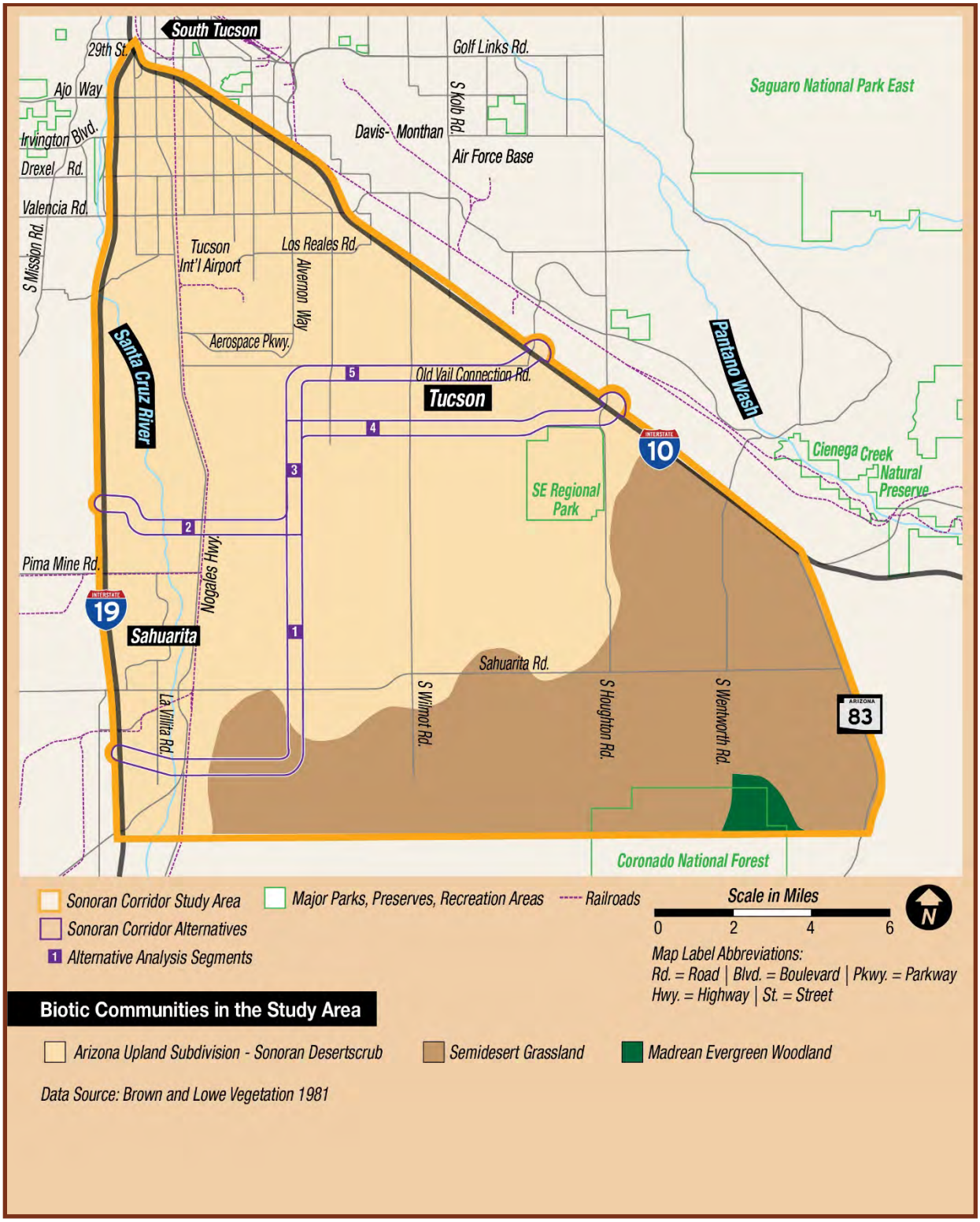
Biotic Communities

A biotic community is a distinct assemblage of plants, animals, and other organisms present over a geographical area as a result of the topography, geology, soils, climate, and other environmental conditions specific to that area. Two major biotic communities are present in the study area and the corridor alternatives also cross several smaller-scale assemblages within those communities that provide important habitat for wildlife. Table 3-38 provides the acreage of each biotic community within the corridor alternatives. Figure 3-34 shows the biotic communities present in the study area. A description of the biotic communities within the corridor alternatives is provided below.

Table 3-38. Biotic Community Acreage

BIOTIC COMMUNITY	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
Arizona Upland Desertscrub	3,845.0	4,452.6	4,583.5
Semidesert Grassland	0.0	702.2	702.2
Total	3,845.0	5,154.8	5,285.7

Figure 3-34. Biotic Communities



Sonoran Desertscrub, Arizona Upland Subdivision—The Sonoran Desert covers much of Southwestern Arizona and portions of Southeastern California and Northwestern Mexico. Desertscrub is a general term used to describe vegetation in drier climates that is dominated by a sparse ground cover of low-lying, drought-tolerant shrubs. There are two subdivisions of Sonoran Desertscrub present in Arizona, the Lower Colorado River Valley and Arizona Upland subdivisions (Turner and Brown 1994). Only the Arizona Upland subdivision is present in the study area.

A major difference between the two subdivisions is the setting of the iconic saguaro cactus (*Carnegiea gigantea*) and the three major trees found in the Sonoran Desert—paloverde (*Parkinsonia* spp.), ironwood (*Olneya tesota*), and mesquite (*Prosopis* spp.). The Lower Colorado River Valley subdivision occurs at lower elevations below approximately 980 feet above sea level and is thus drier, which generally limits growth of saguaros and desert trees to areas adjacent to washes, with the areas in between often dominated by sparse creosote bush (*Larrea tridenta*). The Arizona Upland subdivision occurs at the Sonoran Desert's upper elevations from about 980 to 3,500 feet on low mountains, hills, and bajadas. These higher elevation areas receive more precipitation, allowing saguaros and trees to also establish in the upland areas between drainages, and for greater vegetation density and species diversity in general. In addition to the saguaro cactus and the three major desert trees described above, other common plant species of the Arizona Upland subdivision include shrubs such as creosote bush, bursage (*Ambrosia* spp.), brittle bush (*Encelia farinosa*), and wolfberry (*Lycium* spp.); and several varieties of cacti, including barrel cactus (*Ferocactus* spp.), cholla (*Cylindropuntia* spp.), and hedgehog cactus (*Echinocereus* spp.), in addition to smaller pincushion cacti (*Mammillaria* and *Escobaria* spp.).

Common general wildlife species occurring in the Arizona Upland subdivision that occur in the study area include lizards such as ornate tree lizards (*Urosaurus ornatus*) and spiny lizards (*Sceloporus* spp.); snakes such as the gophersnake (*Pituophis catenifer*) and Western diamondback rattlesnake (*Crotalus atrox*); mammals such as white-throated woodrats (*Neotoma albigula*) and coyotes (*Canis latrans*); and birds such as Gambel's quail (*Callipepla gambelii*) and Gila woodpeckers (*Melanerpes uropygialis*) (Turner and Brown 1994). Although little water is present, desert-adapted amphibians also make their homes in this subdivision. Spadefoot toads (*Scaphiopus* spp.) and the Sonoran Desert toad (*Bufo alvarius*)—formerly known as the Colorado River toad—stay buried beneath the ground surface for much of the year until the monsoon rains, when they emerge to breed in the pools of water left behind.

Semidesert Grassland—The study area is located in an area that transitions between the Sonoran Desert and the grasslands, oak woodlands, and pine forests of southeastern Arizona mountain ranges. Semidesert Grasslands typically occur at elevations between 3,600 and 5,600 feet between the Sonoran Desert or Chihuahuan Desert and upper elevation communities, such as Interior Chaparral and Madrean Evergreen Woodland (Brown 1994). This community receives more precipitation and is generally colder than Sonoran Desertscrub and is characterized by a ground cover of short grasses interspersed with a variety of low-growing shrubs, trees, succulents, and cacti. Common plant species include grasses such as gramas (*Bouteloua spp.*) and tobosa grass (*Hilaria mutica*); shrubs such as broom snakeweed (*Gutierrezia sarothrae*) and wait-a-minute bush (*Mimosa biuncifera*); various low-growing varieties of mesquite and some oak (*Quercus* spp.); cacti such as cholla and prickly pear (*Opuntia* spp.); and several varieties of succulents, including sotol (*Dasyilirion wheeleri*), agave (*Agave* spp.), and yucca (*Yucca* spp).

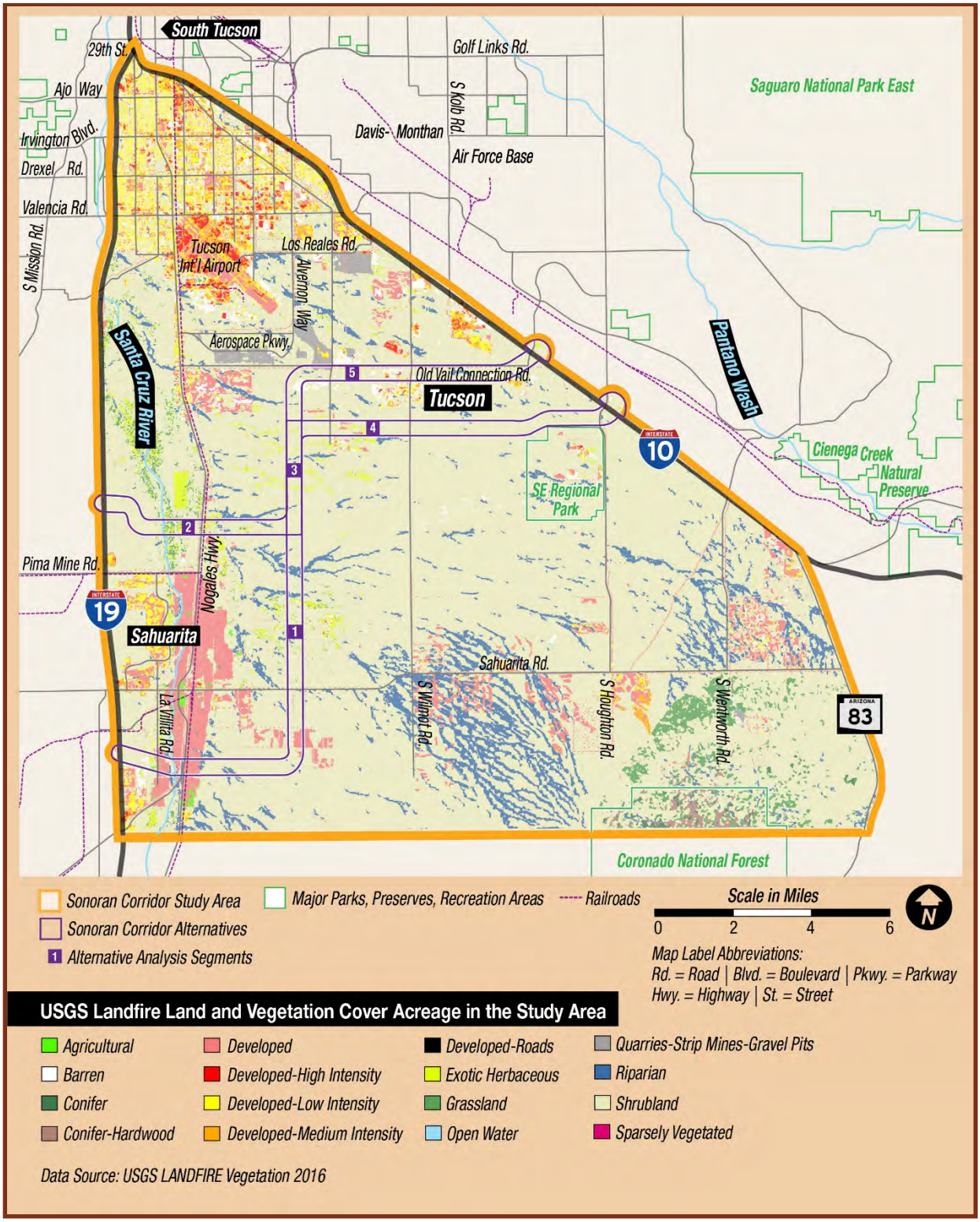
Common general wildlife species occurring in Semidesert grasslands are similar to those of the Arizona Upland subdivision of Sonoran Desertscrub, but due to increased elevation and temperatures that are colder on average, species such as scaled quail (*Callipepla squamata*) and white-tailed deer (*Odocoileus virgininus*) begin to occur or become more common, and some species such as the Sonoran desert tortoise (SDT) (*Gopherus morafkai*) become less common or altogether absent.

Although the study area is relatively undeveloped, substantial development occurs in the northern portion near Tucson, in the southwestern portion near Sahuarita, and along the I-10 and I-19 corridors, with scattered development elsewhere. Developed areas have been converted to human use and often lack native vegetation, which generally reduces habitat value for native wildlife and decreases species diversity, though some areas converted to human use, such as agricultural fields, can provide important habitat for some species. US Geological Survey 2016 LANDFIRE Land and Vegetation Cover Acreage data was used to identify areas of the corridor alternatives that remain natural versus areas that have been developed for human use, as well as identify general vegetation types present. Figure 3-35 shows the land cover and vegetation types present in the study area and Table 3-39 provides the acreage of each land cover and general vegetation type present within the corridor alternatives. Land cover types that indicate natural undeveloped areas include the exotic herbaceous, grassland, open water, riparian, and shrubland types.

Table 3-39. USGS LANDFIRE Land and Vegetation Cover Acreage

LAND COVER TYPE	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
Agricultural	0.0	2.5	2.5
Barren	142.6	153.1	35.1
Developed	63.9	317.5	320.7
Developed, High Intensity	2.4	2.4	0.0
Developed, Low Intensity	12.0	15.4	8.9
Developed, Medium Intensity	5.0	5.0	0.0
Developed, Roads	100.0	143.8	105.2
Exotic Herbaceous	150.4	120.8	128.5
Grassland	56.5	15.8	15.3
Open Water	2.4	2.4	0.0
Quarries, Strip Mines, Gravel Pits	71.4	71.4	0.0
Riparian	166.8	217.6	201.0
Shrubland	3,080.6	4,087.1	4,468.5
Total	3,854.0	5,154.8	5,285.7

Figure 3-35. USGS LANDFIRE Land and Vegetation Cover



Riparian Habitat

There are no perennial streams or intermittent streams in the study area; however, numerous ephemeral drainages are present. Drainage in the study area is generally from east to west and northwest toward the Santa Cruz River, which is ephemeral in the study area. Further south, the Santa Cruz River in some reaches supports surface water and high-value broadleaf riparian habitat dominated by cottonwood (*Populus* spp.) and willow (*Salix* spp.). While this habitat type is not present in the study area, many of the ephemeral washes in the study area and areas near water sources, such as livestock ponds, support xeroriparian or "dry riparian" habitat, which generally consists of the same plant species found in upland areas but at much greater densities due to increased availability of surface and subsurface water. When these areas are dominated by mesquite trees and are large enough to form a closed canopy they are often referred to as mesquite "bosques," which is a Spanish word for forest or woodland. Xeroriparian communities can attract species such as birds like Bell's vireos and Lucy's warblers, not typically found in the surrounding more sparsely vegetated areas. These areas also provide important sources of food and cover for wildlife and can also act as travel corridors, as discussed in more depth in Section 3.13.4, Wildlife Connectivity.

The "Riparian" vegetation type shown on Figure 3-35 and in Table 3-39 represents xeroriparian corridors along the ephemeral drainages and near livestock ponds in the study area. Some of these areas could be considered mesquite bosques, particularly along the washes in the western portion of the study area near their confluence with the Santa Cruz River. The "Open Water" land cover type shown in Figure 3-35 primarily represents livestock ponds and excavations associated with development, such as sand and gravel mining operations that have filled with ground water.

Important Bird Areas

The Arizona Important Bird Area Program is part of an international program with the purpose of identifying a network of sites that maintain the long-term viability of wild bird populations. There are no Arizona Important Bird Area Program sites currently located within the study area.

Migratory Birds

Most bird species in the study area are native to the US and are migratory and therefore protected under the MBTA. Non-native species introduced to the US, such as house sparrows, European starlings, and non-native pigeons, are not protected. Many migratory bird species present in the study area also nest in the study area during the breeding season for each species. The breeding season for most birds in southern Arizona is between March 1 and August 30. Nesting likely occurs in the undeveloped portions of the study area as well the agricultural fields and more developed areas on the ground, in trees and other vegetation, and on human-made structures.

Invasive Species

Invasive species are species that are not native to an ecosystem and cause harm primarily through displacing native species, which can also have substantial economic impacts. These species are typically spread by human activity and often grow and reproduce quickly, which helps them spread rapidly. One of the more prolific and problematic invasive plant species known to occur in Pima County is Buffelgrass (*Pennisetum ciliare*), which grows densely and can crowd out native grasses, shrubs, and cacti of similar size. It primarily colonizes disturbed areas, such as roadsides and cleared areas, and can spread rapidly

along roadways. Buffelgrass is known to occur in the study area along I-10, I-19, and along several roadways in between. The "Exotic Herbaceous" vegetation type shown on Figure 3-35 and in Table 3-39, likely represents invasive plant species present in the study area; buffelgrass is likely a component of that vegetation type.

Species of Economic and Recreational Importance

Some of the more common species associated with the biotic communities within the study area also are AGFD Species of Economic and Recreational Importance (SERI) in the state. The Arizona State Wildlife Action Plan—2012–2022 (AGFD, 2012a) describes five factors that are important in modeling areas for conservation potential. One of the factors is the economic importance of the landscape, which is represented by SERI. This category represents the economic and recreational importance of 13 of Arizona's huntable species. The distribution of these species influences important aspects of wildlife-related recreation and the distribution of consumer spending across the state. Together, the economic and recreational importance of game species to hunters, the community, and AGFD provide a realistic view of the importance of game habitat for conservation. The Arizona State Wildlife Action Plan provides a description of the model and its various elements (AGFD, 2012a). AGFD and the Theodore Roosevelt Conservation Partnership conducted a survey of randomly selected Arizona hunters/anglers asking them to identify the areas of Arizona they most value for hunting and fishing. A map depicting the results of the survey (AGFD, 2016a) suggests that a moderate to low number of participants found portions of the study area to be of value to them for mule deer (*Odocoileus hemionus*), javelina (*Pecari tajacu*), quail species (*Callipepla* spp.), and dove species (*Zenaida* spp.).

3.13.1.4 Environmental Consequences

This section includes an analysis and comparison of the impacts due to the corridor alternatives and the No-Build Alternative. Overall, the corridor alternatives would result in a loss of general vegetation and wildlife.

Corridor Alternative 1

Biotic Communities

Corridor Alternative 1 is entirely comprised of Arizona Upland Desertscrub at 3,845.0 acres. This corridor alternative has less acreage than Corridor Alternatives 7 and 8A, and Semidesert Grassland biotic community is not present. The alignment of the highway within this corridor alternative has not been determined, but construction of a new highway would result in the removal of vegetation typical of the Arizona Upland Desertscrub biotic community, which would likely include plants protected by the Arizona Native Plant Law.

Riparian Habitat

Approximately 166.8 acres of riparian habitat is present in Corridor Alternative 1. Similar to biotic communities, this amount is the least amount of habitat in comparison to Corridor Alternatives 7 and 8A. As discussed above, the riparian habitat present within the study area is xeroriparian vegetation likely comprised primarily of mesquite (*Prosopis* spp.) trees. The alignment of the new highway within this corridor alternative has not been determined, but it is likely some xeroriparian habitat would be removed with the construction of a new highway.

Migratory Birds

The majority of birds within the study area are likely migratory and vary between ground dwelling (e.g., western burrowing owl [*Athene cunicularia hypugaea*]) and tree dwelling, and nest in a variety of habitats including agricultural fields and developed areas with natural ground surface. Due to the vast spectrum of habitat requirements for migratory birds protected by the MBTA, the construction of a new highway within this corridor would likely impact migratory birds. Mitigation would be required prior to and throughout the construction of a new highway in order to avoid impacts to nesting migratory birds.

Invasive Species

Approximately 150.4 acres of exotic herbaceous habitat is present within Corridor Alternative 1. The majority of this habitat is in association with ground disturbance generated from mining activities and solar panel facilities located outside Corridor Alternative 1 and off-road vehicle use within the corridor. This acreage is the largest amount of invasive species among the corridor alternatives. ADOT tracks the location of invasive species within state highway system ROW and attempts to eradicate and control the spread of invasive species. Measures would be implemented to prevent the introduction and control the spread of noxious and invasive species within all corridor alternatives.

Species of Economic and Recreational Importance

The construction of a new highway within Corridor Alternative 1 would likely not have a significant impact on SERI species since only a moderate to low number of hunters select areas within the study area as high value habitat. In addition, the construction of a new highway within Corridor Alternative 1 may provide new access to public lands in vicinity of the corridor alternative for hunters and anglers to utilize.

Corridor Alternative 7

Biotic Communities

Corridor Alternative 7 is comprised of 4,452.9 acres of Arizona Upland Desertscrub and 702.2 acres of Semidesert Grassland. The alignment of the highway within this corridor has not been determined, but a new highway would result in the removal of vegetation typical of these biotic communities, which would likely include plants protected by the Arizona Native Plant Law.

Riparian Habitat

Approximately 217.6 acres of riparian habitat is present in Corridor Alternative 7. Similar to Corridor Alternative 1, the alignment of the new highway within this corridor alternative has not been determined, but it is likely some xeroriparian habitat would be removed with the construction of a new highway.

Migratory Birds

The same potential impacts and mitigation measures mentioned in Corridor Alternative 1 would apply to all corridor alternatives.

Invasive Species

Approximately 120.8 acres of exotic herbaceous habitat is present within Corridor Alternative 7. This is the least amount of acreage within the corridor alternatives. As mentioned in Corridor Alternative 1, measures would be implemented to prevent the introduction of, as well as control the spread of, noxious and invasive species within all corridor alternatives.

Species of Economic and Recreational Importance

As discussed in Corridor Alternative 1, the habitat within the study area is of value to a moderate to low number of hunters. Therefore, the construction of a new highway would likely not have a significant impact on SERI species. In addition, the construction of a new highway within Corridor Alternative 7 may provide new access to public lands in vicinity of the corridor alternative for hunters and anglers to utilize.

Corridor Alternative 8A

Biotic Communities

Corridor Alternative 8A is comprised of the most amount of habitat, with 4,586.3 acres of Arizona Upland Desertscrub and 702.2 acres of Semidesert Grassland. The alignment of the highway within this corridor alternative has not been determined, but construction of a new highway would result in removal of vegetation typical of these biotic communities, which would likely include plants protected by the Arizona Native Plant Law.

Riparian Habitat

Approximately 201.0 acres of riparian habitat is present in Corridor Alternative 8A. Similar to the previous corridor alternatives, the alignment of the new highway within this corridor alternative has not been determined, but it is likely some xeroriparian habitat would be removed with the construction of a new highway.

Migratory Birds

The same potential impacts and mitigation measures mentioned in Corridor Alternative 1 would apply to all corridor alternatives.

Invasive Species

Approximately 128.5 acres of exotic herbaceous habitat is present within Corridor Alternative 8A. As mentioned in Corridor Alternative 1 and Corridor Alternative 7, measures would be implemented to prevent the introduction of, as well as control the spread of, noxious and invasive species within all corridor alternatives.

Species of Economic and Recreational Importance

As discussed in Corridor Alternative 1, the habitat within the study area is of value to a moderate to low number of hunters. Therefore, the construction of a new highway would likely not have a significant impact on SERI species. In addition, the construction of a new highway within Corridor Alternative 8A may provide new access to public lands in vicinity of the corridor alternative for hunters and anglers to utilize.

No-Build Alternative

Under the No-Build Alternative, a future freeway within the study area would not be constructed. Vehicular travel through the study area could continue according to existing patterns along the existing transportation network. The No-Build Alternative would include the programmed improvements to the regional transportation system that are in PAG's federally approved Metropolitan TIP. These improvement projects may have localized implications as described below.

Biotic Communities

The overall impact to biotic communities would be negligible due to future projects occurring on or along existing facilities.

Riparian Habitat

The overall impact to riparian habitat would be negligible due to future projects occurring on or along existing facilities.

Migratory Birds

Future projects on I-19 and I-10 may have localized implications that require mitigation in order to avoid nesting birds protected by the MBTA.

Invasive Species

As mentioned above, ADOT currently tracks and treats invasive plant species along existing facilities. Future projects along existing facilities would likely require measures to prevent the introduction or spread of noxious and invasive plant species.

Species of Economic and Recreational Importance

The overall impact to SERI species would be negligible due to future projects occurring on or along existing facilities.

3.13.1.5 Available Mitigation Measures

This Tier 1 analysis provides an overview of potential impacts from a new transportation facility within the corridor alternatives. Specific alignments, design characteristics, and construction methods have yet to be determined. Therefore, specific methods to avoid, minimize, or mitigate project-related impacts cannot be developed at this stage of study. However, general mitigation strategies that would be further refined during the Tier 2 process are outlined below:

- ADOT would evaluate the preferred alignment during the Tier 2 process to determine general vegetation and wildlife habitat and species-specific survey needs during the Tier 2 process, as well as develop design and construction-specific mitigation measures for species such as general migratory birds, burrowing owls, bats, and protected native plants.
- ADOT would coordinate with the Arizona Game and Fish Department during the Tier 2 process regarding the potential for incorporating roosting sites for bats into the design of any new bridges, drainage design that minimizes impact to wash channel geometry to avoid altering hydrologic function, and working with local native plant groups for native plant salvage and potential seed collection prior to vegetation removal.
- ADOT will participate, support, and commit to long-term invasive species management efforts in the Sonoran Corridor. To effectively combat noxious and invasive weeds, a coordinated effort across federal, state, Tribal, and local levels is required.
- To avoid the introduction of noxious and invasive species seeds, and to avoid noxious and invasive species seeds from entering/leaving the sites, all construction equipment must be washed and free of all attached plant/vegetation and soil/mud debris prior to entering/leaving the construction sites.

- All disturbed soils that are not paved and that will not be landscaped or otherwise permanently stabilized by construction will be seeded using species native to the project vicinity.
- Protected native plants will be impacted by the Sonoran Corridor; therefore, it will be determined if AZDA notification is needed for compensation purposes. If notification is needed, ADOT will send the notification prior to the start of construction.

3.13.1.6 Conclusion

Biotic Communities

Corridor Alternative 1 is the smallest corridor alternative and contains only one biotic community. The alignment of the proposed new highway has not been determined, but the selection of Corridor Alternative 1 in comparison to Corridor Alternatives 7 and 8A would likely have the smallest impact to biotic communities.

Riparian Habitat

Corridor Alternative 7 contains the largest amount of riparian habitat at 217.6 acres. Corridor Alternative 1 contains the least amount at 166.8 acres, but this may be due to the fact that Corridor Alternative 1 has the smallest footprint. Regardless of the corridor selection, riparian habitat would likely be removed by the construction of a new highway. As discussed above, riparian habitat within the study area is likely xeroriparian vegetation along ephemeral drainages.

Migratory Birds

Habitat requirements for migratory birds protected by the MBTA are vast and wide ranging. Thus, it is reasonably certain that birds protected by the MBTA are present throughout all three corridor alternatives. Mitigation would be required in order to avoid impacts to nesting migratory birds.

Invasive Species

The largest amount of exotic herbaceous habitat is present within Corridor Alternative 1 at 150.4 acres with the least amount habitat at 120.8 acres within Corridor Alternative 7. ADOT continually monitors existing facilities for invasive species; thus, measures would be required in order to prevent the introduction or spread of invasive species within the study area.

Species of Economic and Recreational Importance

The study area is of value to a moderate to low number of hunters. Thus, the construction of a new highway in the study area is unlikely to have significant impacts to SERI species, regardless of corridor alternative. Conversely, a new highway may provide improved access to public land for hunters and anglers.

3.13.2 Threatened and Endangered Species

This section is devoted to Threatened and Endangered (T&E) species and as they pertain to the ESA.

3.13.2.1 Regulatory Framework

Table 3-40. Applicable Threatened and Endangered Species Regulations

REGULATION	DESCRIPTION
ESA of 1973 (16 U.S.C. 1531 et. seq., P.L. 93-205)	This law provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found. It generally prohibits take of threatened and endangered species except under certain circumstances and under special permits and establishes procedures required for federal agencies to consult with the USFWS regarding actions that may affect ESA-protected species and critical habitat.

The purpose of the ESA is to protect and recover T&E species and the ecosystems upon which they depend. The law also prohibits "take" of any ESA-listed species of fish or wildlife. Take is defined as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect or attempt to engage in any such conduct." Listed plant species are not protected from take, although it is illegal to collect or maliciously harm them on federal land (USFWS 2013).

Section 7 of the ESA requires federal agencies to consult with the USFWS to ensure they are not undertaking, funding, permitting, or authorizing actions that are likely to jeopardize the continued existence of T&E species or destroy or adversely modify critical habitat. Depending on the level of potential effects to listed species for a given action, the result of the Section 7 process may include a permit for the incidental take of listed species. Incidental take results from, but is not the purpose of, carrying out an otherwise lawful activity (USFWS 2013).

Private citizens, corporations, counties, municipalities, and other non-federal entities may obtain an incidental take permit for certain activities through the ESA Section 10 process, provided they have developed an approved habitat conservation plan (HCP). HCPs include an assessment of the likely impacts to T&E species from the proposed action(s), measures that will be taken to avoid, minimize, and mitigate the impacts, and identifies the funding to implement those measures. HCPs may also benefit listed species through habitat management and economic development that considers species conservation needs (USFWS 2013).

The Tier 1 phase of the Sonoran Corridor study is a federal action, thus only the Section 7 process is currently applicable. However, if in the future a local government partner such as Pima County or the City of Tucson decides to construct a transportation facility without a federal nexus, the Section 10 process would then be applicable. Below are two Section 10 HCPs relevant to that situation:

Pima County Multi-Species Conservation Plan

This plan was developed as part of Pima County's Sonoran Desert Conservation Plan to balance long-term conservation and protection of cultural and natural resources with economic development needs. The Multi-Species Conservation Plan (MSCP) is an HCP prepared as part of an application for an ESA Section 10 incidental take permit. The permit allows non-federal development projects to incidentally take ESA-protected species as long as the minimization and mitigation measures identified in the MSCP are implemented. The plan covers 44 species, including some that are currently not protected by the ESA but have the potential to be listed in the future (Pima County 2016). The Section 10 incidental take permit was issued to Pima County in July 2016. The plan covers County activities, including construction, repair, maintenance, and operation of County facilities and infrastructure, which includes roads.

City of Tucson Habitat Conservation Plan

Like the Pima County MSCP, the City of Tucson HCP is part of an ESA Section 10 incidental take permit application. However, the plan is currently in draft form and the Section 10 permit has not yet been issued. Through this HCP, the City of Tucson aims to promote conservation of natural resources while providing for future growth. The plan covers proposed development activities in three planning sub-areas, the Southlands, Avra Valley, and Santa Cruz River sub-areas. It includes two ESA-listed species and six species that are currently not listed (City of Tucson n.d.). A portion of the Sonoran Corridor Study Area occurs within the Southlands sub-area. The HCP would cover capital improvement projects implemented by the City, including road construction and improvement projects.

3.13.2.2 Methodology

To obtain a list of federally listed species and critical habitats within the study area, a USFWS Information for Planning and Consultation (IPaC) query was completed. Habitat requirements for each identified species were gathered from a variety sources, such as the USFWS Arizona Ecological Services Office online document library, AGFD Heritage Data Management System species abstracts, and other available literature. All species are briefly analyzed in Table 3-41 to determine their potential occurrence within the study area. Only one species identified by the IPaC query, Pima pineapple cactus (PPC), has a high potential for occurrence within the study area based on its known range and occurrences and habitat present in the study area. Three additional species not identified by the IPaC query are also included in Table 3-41, the jaguar, ocelot, and Sonoran desert tortoise (SDT). The jaguar and ocelot are federally listed and unlikely to occupy the study area permanently but may travel through it. The SDT is not federally listed but was formerly a candidate for listing and still receives protection through a Candidate Conservation Agreement (CCA) that includes ADOT as a signatory agency.

To determine the amount of potentially suitable habitat for PPC in each corridor alternative, the USGS 2016 LANDFIRE Land and Vegetation Cover data (Table 3-39) was queried for applicable PPC habitat types. GIS-based data was also used to determine the potential for jaguar and ocelot movement through the study area as well as the quality and quantity of SDT habitat within the corridor alternatives. Lastly, habitat conservation plans available online through the USFWS Environmental Conservation Online System (ECOS) were reviewed and applicable habitat conservation plans within the study area were included in the analysis for discussion.

The analysis in this section evaluates general potential effects to PPC, jaguar, ocelot, and SDT and their habitat. To assist in this analysis, applicable documents available from the USFWS (e.g., Recovery Plans, CCAs, Listing Documents) were reviewed.

3.13.2.3 Affected Environment

An IPaC query was completed for the study area, and T&E species or critical habitat protected by the federal ESA that were identified as potentially occurring within the corridor alternatives are included in Table 3-41. Three additional species not identified by the IPaC – the jaguar, ocelot, and SDT – are also included in Table 3-41 for reasons described above.

Table 3-41. ESA-Protected Species and Habitat

COMMON NAME	SCIENTIFIC NAME	STATUS[1]	HABITAT REQUIREMENTS	POTENTIAL TO OCCUR
Mammals				
Jaguar	*Panthera onca*	E, DCH	Based on limited records, Arizona jaguars appear to be associated with Madrean evergreen woodland and semidesert grassland biotic communities, usually in intermediately rugged to extremely rugged terrain with low human disturbance, within 6.2 miles of water. Elevation: all Arizona records are between 3,400 and 9,000 feet above mean sea level (amsl) (AGFD 2004; Culver 2016; USFWS 2018a, 2014a).	The study area is generally flat and lacking rugged terrain. Known recent occurrences within Arizona have been primarily in the Sky Islands of southern Arizona. However, jaguars historically occurred well north of the study area and the study area could be used as a movement corridor.
Ocelot	*Leopardus pardalis*	E	Little is known about ocelot habitat use in Arizona, though most occurrence records have been associated with desertscrub, dense thornscrub, and oak and pine-oak woodland. Elevation: below 4,000 feet amsl (AGFD 2010; USFWS 2012)	Desertsrub occurs within the study area and there are relatively recent occurrence records north and south of the study area, indicating the study area could be used as a movement corridor.

[1] Status: CCA = Candidate Conservation Agreement under the ESA; DCH = Critical Habitat is Designated under the ESA; E = Listed as Endangered under the ESA; PCH = Critical Habitat is Proposed under the ESA; T = Listed as Threatened under the ESA.

Table 3-41. ESA-Protected Species and Habitat (continued)

COMMON NAME	SCIENTIFIC NAME	STATUS[1]	HABITAT REQUIREMENTS	POTENTIAL TO OCCUR
Birds				
California least tern	*Sterna antillarum browni*	E	Nests in colonies on barren to sparsely vegetated areas including open sandy beaches, sandbars, gravel pits, or exposed flats along shorelines of inland rivers, lakes, reservoirs, and drainage systems (USFWS 2009).	A gravel pit is present within Corridor Alternative 1 and Corridor Alternative 7, but it is extremely unlikely for this species to be present within the study area. There are no sandy beaches, sandbars, and shorelines.
Yellow-billed cuckoo	*Coccyzus americanus*	T, PCH	Highly variable. Occurs in riparian woodlands, mesquite woodlands, or Madrean evergreen woodlands in perennial, intermittent, or ephemeral drainages, from dense contiguous patches of trees on wide floodplains to narrow stringers and small groves of scattered trees in more xero-riparian habitats. Canopy closure varies between and often within drainages. Elevation: sea level to 7,000 feet amsl (AGFD 2011; Halterman et al. 2015).	Ephemeral drainages are present throughout the study area, but overall the habitat is open and lacking contiguous patches, stringers, and small groves of dense trees.
Reptiles				
Northern Mexican gartersnake	*Thamnophis eques megalops*	T	Lotic and lentic habitats with edges of dense emergent vegetation, including cienegas, ponds, stock tanks, and lower gradient rivers and streams with pools, protected backwaters, braided side channels, and beaver ponds. Terrestrial habitats are used during gestation and periods of inactivity and can occur up to 1 mile from surface water. Adequate ground cover important; canopy cover less so. Elevation: 3,000—5,000 feet amsl, but up to 6,500 feet (range-wide up to 8,500 feet) (AGFD 2012b; Emmons and Nowak 2016; USFWS 2014b).	One pond is present within Corridor Alternative 1 and Corridor Alternative 7, but it is lacking natural elements, including dense emergent vegetation and adjacent terrestrial habitat.

[1] Status: CCA = Candidate Conservation Agreement under the ESA; DCH = Critical Habitat is Designated under the ESA; E = Listed as Endangered under the ESA; PCH = Critical Habitat is Proposed under the ESA; T = Listed as Threatened under the ESA.

Table 3-41. ESA-Protected Species and Habitat (continued)

COMMON NAME	SCIENTIFIC NAME	STATUS[1]	HABITAT REQUIREMENTS	POTENTIAL TO OCCUR
Sonoran Desert tortoise	*Gopherus morafkai*	CCA	Primarily rocky slopes and bajadas in Sonoran or Mohave desertscrub. However, individuals may also use inter-mountain valleys as part of their home ranges and for dispersal, as SDT or their sign have been found up to 1 mile from the nearest slope, indicating that they occur in lower densities in flatter areas away from slopes Elevation: 900—4,200 feet amsl (AGFD 2015; USFWS 2015b).	The study area is located within the current range of the SDT. Suitable habitat and known occurrences are present within the study area.
Sonoyta mud turtle	*Kinosternon sonoriense longifemorale*	E	Aquatic habitats with perennial or near perennial surface water, including streams and natural and human-made ponds. Adjacent terrestrial habitat that maintains soil moisture. Elevation: sea level to 6,700 feet (AGFD 2016b; USFWS 2017).	One pond is present within Corridor Alternative 1 and Corridor Alternative 7, but it is lacking natural elements to support the Sonoyta mud turtle, including adjacent terrestrial habitat.
Plants				
Pima pineapple cactus	*Coryphantha scheeri* var. *robustispina*	E	Ridges in semidesert grassland and alluvial fans in Sonoran Desertscrub. Occurs on alluvial hillsides in rocky, sandy soils. Habitat type is primarily desert grassland. Elevation: 2,300—5,000 feet amsl (AGFD 2001).	The study area is located within the current range of the PPC. Suitable habitat and known occurrences are present within the study area.

[1] Status: CCA = Candidate Conservation Agreement under the ESA; DCH = Critical Habitat is Designated under the ESA; E = Listed as Endangered under the ESA; PCH = Critical Habitat is Proposed under the ESA; T = Listed as Threatened under the ESA.

Pima Pineapple Cactus

The study area is located with the known current range of the PPC. PPCs are known to occur in the general area, and primarily grow in open areas within the Sonoran Desertscrub and Desert Grassland biotic communities but otherwise have fairly general habitat requirements and occur across multiple soil types. PPC may occur within all corridor alternatives in areas that are undisturbed and mostly open, including areas classified as Barren, Grassland, and Shrubland under the USGS LANDFIRE Land and Vegetation Cover data (Table 3-42). Corridor Alternative 8A potentially contains the greatest amount of PPC habitat at 4,518.9 acres and Corridor Alternative 1 potentially contains the least amount at 3,279.7 acres.

Table 3-42. Potentially Suitable Pima Pineapple Cactus Habitat Acreage

LAND COVER TYPE	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
Barren	142.6	153.1	35.1
Grassland	56.5	15.8	15.3
Shrubland	3,080.6	4,087.1	4,468.5
Total	3,279.7	4,255.9	4,518.9

It is likely that PPCs are present within all three corridor alternatives though surveys would be required to confirm their presence and determine the exact numbers. Although PPC density varies greatly across seemingly suitable habitat, the 2018 PPC Recovery Plan provides survey data for PPC in southern Arizona where 6,131 individual plants were located over 105,786 acres surveyed (USFWS, 2018b) for a rough density estimate of approximately 0.058 PPC per acre.

Jaguar and Ocelot

A habitat model for jaguar developed by the Wildlife Conservation Society for the USFWS and Jaguar Recovery Team predicts suitable habitat to the north and south of the study area but does not show suitable habitat within the study area (Stoner 2015). However, from 1996 through July 2017, five, possibly six, individual jaguars have been documented in southern Arizona and jaguars historically occurred well north of the study area (USFWS 2018a), thus the study area could be used as a movement corridor. Little is known about ocelot habitat use in Arizona and there is no ocelot habitat model currently available, though they appear to have a wider range of habitat use. Like the jaguar, suitable ocelot habitat and occurrence records occur north and south of the study area, thus the study area could be used by ocelots as a movement corridor. For both the jaguar and ocelot, all three corridor alternatives provide similar habitat in that regard.

Sonoran Desert Tortoise

The SDT was previously a candidate for listing under the federal ESA, but on October 6, 2015, USFWS determined that listing this species was not warranted at the time, due in part to the CCA (USFWS, 2015a) developed in cooperation with AGFD, USFWS, ADOT, and 13 other federal agencies. Although it currently does not receive protection under the federal ESA, the tortoise is included in this T&E Species analysis because it is known to occur within the study area, and ADOT is a signatory agency of the tortoise CCA.

Suitable SDT habitat may be present throughout the corridor alternatives, specifically along incised washes that provide sheltering habitat within shrubland or grassland land cover. A review of the SDT Potential Habitat spatial modeling created by BLM, USFWS, USGS, and AGFD (USFWS 2015c) revealed that patches of high- and low-value potential habitat for SDT may be present throughout each corridor alternative (Figure 3-36). The data represented in this spatial modeling is designed to provide a landscape-scale depiction of the relationship between several different spatial data layers that are relevant to SDT habitat. No attempt is made to define or describe actual, on-the-ground SDT habitat through this modeling. Therefore, the quality of the habitat within the corridor alternatives may be greater than or less than what is reported in the spatial modeling. However, based on the SDT potential habitat modeling, Corridor Alternative 1 contains the largest amount of potential SDT habitat, with 85.0 acres of high-value habitat and 16.7 acres of low-value habitat for a total of 101.7 acres (Table 3-43). Corridor Alternative 8A contains the least amount with 20.9 acres of high value habitat and 53.0 acres of low value habitat for a total of 73.9 acres. It should be noted that some of this acreage overlaps between corridor alternatives, e.g., Corridor Alternatives 7 and 8A include some of the same habitat areas because a portion of their alignment is identical. Further habitat evaluation conducted during the Tier 2 analysis would further identify suitable habitat present at a smaller scale.

Figure 3-36. Potentially Suitable Sonoran Desert Tortoise Habitat

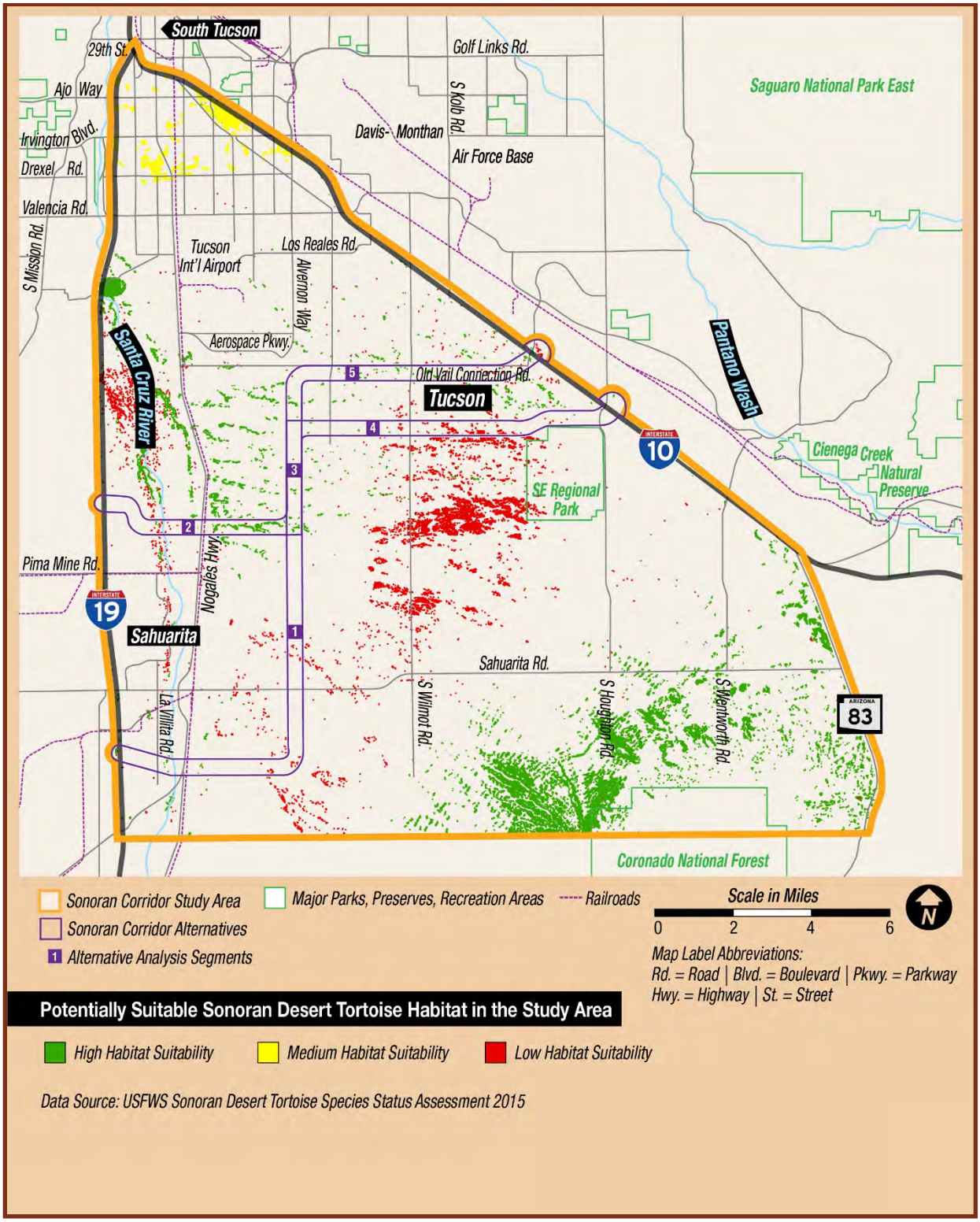


Table 3-43. Potentially Suitable Sonoran Desert Tortoise Habitat Acreage

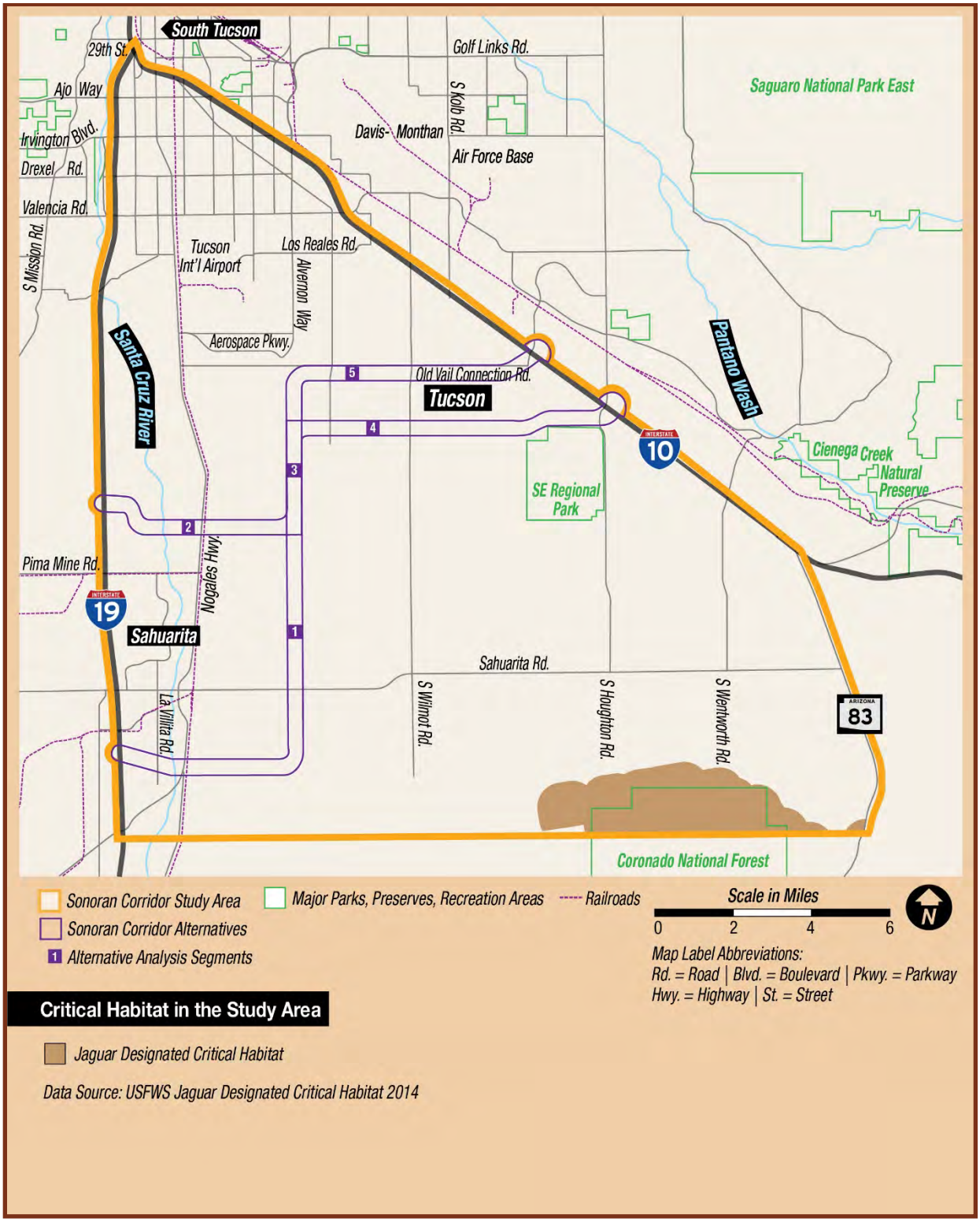
SDT POTENTIAL HABITAT VALUE	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
High	85.0	49.9	20.9
Low	16.7	24.7	53.0
Total	101.7	74.5	73.9

Source: Sonoran Desert Tortoise Potential Habitat Spatial Modeling. BLM, USFWS, USGS, AGFD.

Proposed or Designated Critical Habitat

No ESA proposed or designated critical habitat exist within the corridor alternatives. Designated critical habitat for jaguar is present within the study area at the base of the Santa Rita Mountains, approximately 6.3 miles east of Corridor Alternative 7 and Corridor Alternative 8A as the alignment heads north from the I-19 terminus (Figure 3-37).

Figure 3-37. Critical Habitat within the Study Area



3.13.2.4 Environmental Consequences

This section includes an analysis and comparison of the impacts due to the corridor alternatives and the No-Build Alternative. Overall, construction of a freeway within one of the corridor alternatives may affect T&E species. Such construction could result in the loss of some PPC suitable habitat, and any PPC located within the freeway footprint could likely be adversely affected. However, this would be determined during the Tier 2 analysis through the preparation of a Biological Assessment and ESA Section 7 consultation with USFWS.

All of the corridor alternatives would also result in habitat fragmentation and could potentially create a movement barrier for SDT, jaguar, and ocelot. All of the corridor alternatives would also result in the removal of some SDT habitat and potentially function as a barrier to SDT movement. Furthermore, SDT could be injured or killed if present during construction, as well as by wildlife-vehicle collisions during normal operation of a new transportation facility. A more detailed analysis to determine the nature and extent of potential impacts would be conducted during the Tier 2 analysis.

None of the corridor alternatives are located within the boundaries of proposed or designated critical habitat. Therefore, the construction of a new freeway within any of the corridor alternatives would have no effect to proposed or designated critical habitat.

Corridor Alternative 1

Approximately 3,279.7 acres of potentially suitable PPC habitat is present within Corridor Alternative 1 and PPC are present. During Tier 2 analysis, surveys would be conducted to verify suitable habitat and determine the number of PPC individuals that would be affected.

For jaguar, ocelot, and SDT, Table 2-3 indicates Corridor Alternative 1 is 16.06 miles long, and according to Table 3-38 its overall footprint is approximately 3,845.0 acres, making it the shortest corridor alternative with the smallest footprint. This alternative could also result in the least amount of overall habitat fragmentation south of the junction of I-10 and I-19 among the corridor alternatives. Corridor Alternative 1 also contains the largest amount of high-value potential habitat for SDT, with 85.0 acres.

Corridor Alternative 7

Approximately 4,255.9 acres of potentially suitable PPC habitat is present within Corridor Alternative 7, and PPC are present. During Tier 2 analysis, surveys would be conducted to verify suitable habitat and determine the number of PPC individuals that would be affected.

For jaguar, ocelot, and SDT, Table 2-3 indicates Corridor Alternative 7 is 20.47 miles long, and according to Table 3-38 its overall footprint is approximately 5,154.88 acres, placing its length and acreage between that of the other two corridor alternatives. However, this alternative could result in the most overall habitat fragmentation south of the junction of I-10 and I-19. The amount of potential SDT habitat in Corridor Alternative 7 is also between that of the other two alternatives.

Corridor Alternative 8A

Approximately 4,518.9 acres of potentially suitable PPC habitat is present within Corridor Alternative 8A, and PPC are present. During Tier 2 analysis, surveys would be conducted to verify suitable habitat and determine the number of PPC individuals that would be affected.

For jaguar, ocelot, and SDT, Table 2-3 indicates Corridor Alternative 8A is 21.04 miles long, and according to Table 3-38 its overall footprint is approximately 5,285.77 acres, making it the corridor alternative with the largest footprint. However, overall habitat fragmentation south of the junction of I-10 and I-19 for this alternative could be between the other two corridor alternatives. Corridor Alternative 8A also contains the least amount of SDT potential habitat at 73.9 acres.

No-Build Alternative

Under the No-Build Alternative, a future freeway within the study area would not be constructed. Vehicular travel through the study area could continue according to existing patterns along the existing transportation network. The No-Build Alternative would include the programmed improvements to the regional transportation system that are in PAG's federally approved Metropolitan TIPs. These improvement projects could have localized implications on PPC, jaguar, and ocelot that could require consultation with the USFWS per Section 7 of the ESA.

Because the SDT is not federally listed under the ESA, projects on existing facilities would not require consultation with USFWS. However, ADOT is a signatory agency on the SDT CCA, thus future projects on existing ADOT facilities would require adherence to the basic tortoise environmental commitments of the CCA. Overall, the effects of the No-Build Alternative would likely be more localized and discrete compared to the effect of constructing a future freeway within one of the corridor alternatives.

3.13.2.5 Available Mitigation Measures

This Tier 1 analysis provides an overview of potential impacts from a new transportation facility within the corridor alternatives. Specific alignments, design characteristics, and construction methods have yet to be determined. Therefore, specific methods to avoid, minimize, or mitigate project-related impacts cannot be developed at this stage of study. However, general mitigation strategies that would be further refined during the Tier 2 process are outlined below:

- Prior to the Tier 2 process, ADOT will update the IPaC query and conduct a thorough assessment of habitat for ESA-listed species and will avoid or minimize impacts to suitable habitat within the construction footprint.
- ADOT will conduct PPC surveys prior to the Tier 2 process to inform design, minimize the construction footprint through quality PPC habitat, and implement long-term control of noxious weeds.
- ADOT will minimize the construction footprint to the extent possible and improve drainage structures to facilitate jaguar and ocelot movement or construct wildlife crossings that jaguar and ocelots will use.
- During the Tier 2 process, ADOT will conduct consultation with USFWS where potential mitigation measures to avoid or minimize impacts to ESA-listed species will be further refined. if it is determined that unavoidable impacts to ESA-listed species or habitat are likely to occur, compensatory mitigation will be negotiated with USFWS during Section 7 consultation as necessary.
- ADOT will continue to honor its SDT CCA commitments to implementing the following conservation measures from the CCA (USFWS 2015a):
  - Maintain ADOT ROW to minimize invasive species and fire risks as funding allows.
  - Share maps of invasive species on ADOT ROW in SDT habitat with land managing agencies.

- Partner with state and federal agencies to address invasive species in and adjacent to ADOT ROW in SDT habitat.
- Promote awareness of the conservation status of SDT within ADOT (incorporate in trainings, post flyers in districts, ADOT blog post).
- Partner with AGFD and other partners to facilitate development of conservation approaches and research related to increasing road permeability for SDT.
- Conduct habitat suitability surveys and analyze potential impacts for projects with a scope of work that could impact SDT habitat.
- Coordinate and partner with State and Federal agencies and other interested parties to incorporate project design features where warranted to minimize SDT habitat fragmentation.
- Coordinate and partner with State and Federal agencies and other interested parties to incorporate project design features where warranted to minimize SDT vehicle strikes.
- Collect data on SDT sightings in ADOT ROW and provide to AGFD.
- Partner with AGFD to facilitate development of survey and handling procedures.
- Follow the most current protocol for relocating any SDT that may be impacted by an ADOT construction or maintenance project.
- Provide awareness training and/or information to ADOT and contractor personnel working on construction and maintenance projects in areas with suitable habitat.

3.13.2.6 Conclusion

Constructing a new highway within any of the corridor alternatives could likely require formal ESA Section 7 consultation with the USFWS for adverse effects related to PPC, and may warrant informal consultation for jaguar and ocelot. This is dependent upon determinations made as part of a Biological Assessment that would be completed during the Tier 2 analysis. All the corridor alternatives could also have some impact to SDT, the nature and extent of which would also be further evaluated during the Tier 2 analysis.

Corridor Alternative 1 contains the least amount of potentially suitable PPC habitat but the greatest amount of potential SDT habitat. Regarding jaguar and ocelot, Corridor Alternative 1 is the shortest corridor alternative with the smallest footprint that could also result in the least amount of overall habitat fragmentation south of the junction of I-10 and I-19.

Corridor Alternative 7 contains an amount of potentially suitable PPC habitat and potential SDT habitat that is between the other two corridor alternatives. For jaguar and ocelot, Corridor Alternative 7 could have an overall footprint impact that is between the other two corridor alternatives and could result in the most overall habitat fragmentation south of the junction of I-10 and I-19.

Corridor Alternative 8A contains the greatest amount of potentially suitable PPC habitat, but the least amount of potential SDT habitat. With respect to jaguar and ocelot, Corridor Alternative 8A has the largest overall footprint, but an amount of habitat fragmentation south of the junction of I-10 and I-19 that is between the other two alternatives.

As mentioned above, the corridor alternatives are not located within the boundaries of proposed or designated critical habitat. Therefore, the construction of a new transportation facility within any of the corridor alternatives would have no effect to proposed or designated critical habitat.

3.13.3 Arizona Species of Greatest Conservation Need

Special-status species are plant and animal species that receive designations by federal, state, or local government agency due to concerns about their rarity or sensitivity to stressors in the environment. Species with special status that are listed as threatened or endangered under the ESA are discussed in Section 3.13.2. Species of special concern designated by the State, BLM, Pima County, and City of Tucson will be discussed in detail in the following section.

3.13.3.1 Regulatory Framework

Table 3-44. Applicable Arizona Species of Greatest Conservation Need Regulations

REGULATION	DESCRIPTION
Federal	
Bureau of Land Management Special Status Species Policy	The Federal Land Policy Management Act of 1976 (43 U.S.C. 1701 et seq.) requires management of BLM-administered land for "multiple use." As part of this multiple use mandate, BLM Manual Section 6840 requires BLM to designate and conserve BLM sensitive species. BLM sensitive species include all ESA listed, proposed, or candidate species and delisted species for the 5 years following delisting, as well as additional species designated by BLM state directors that may require proactive management to avoid the need for protection under the ESA.
Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. 668-668d, 54 Stat. 250, as amended)	This law protects bald and golden eagles by prohibiting the take, possession, or commerce of eagles except under specific conditions.
State of Arizona	
Arizona Revised Statute 17 et seq.	This statute establishes that management of Arizona's wildlife resources is the responsibility of the Arizona Game and Fish Commission and AGFD, and that through the Commission, AGFD may develop policies and programs for the management, preservation, and harvest of wildlife. Based on the authorities granted by Title 17, AGFD has developed a proactive State Wildlife Action Plan to assess the health of wildlife and determine strategies for conservation of Arizona's numerous and diverse wildlife species and their associated habitats (AGFD, 2012a). A component of the State Wildlife Action Plan identifies Species of Greatest Conservation Need (SGCN) as well as SERI and the need for strategies to minimize and offset potential impacts to these species.

3.13.3.2 Methodology

Species of Greatest Conservation Need (SGCN) are described at a landscape level (i.e., large-scale) within the study area, as they include a wide variety of species that may occupy the overall landscape. GIS-based data and online resources from AGFD related to the distribution and ecology of SGCN were reviewed to identify applicable special-status species within the study area and corridor alternatives. GIS-based data include digital representations of species distributions provided by the AGFD Heritage Data Management System. The distributions were overlaid with corridor alternatives to identify SGCN that may be present within each

corridor alternative. Online resources provided by the AGFD Heritage Data Management System include species abstracts consisting of detailed descriptions of ecology and suitable habitat of applicable SGCN.

The analysis considers impacts on a wide-variety of plant and wildlife species that are considered SGCN. To evaluate potential impacts to SGCN, digital representations of Brown and Lowe's "Biotic Communities of the Southwest" and US Geological Survey "2016 LANDFIRE Land and Vegetation Cover" were reviewed in order to identify the likelihood of different SGCN occurring within each corridor alternative. Acreage calculations of habitat types (e.g., xeroriparian, agricultural, developed) present within the study area were used to estimate presence or abundance of different SGCN within a respective corridor alternative. Since SGCN include a wide variety of plants and wildlife that utilize different habitat types, each alternative may vary in its potential impact depending on the amount of each habitat type present.

3.13.3.3 Affected Environment

Arizona's online environmental review tool (AGFD 2020) is an internet-based interactive mapping and database application that provides information regarding the potential presence of special status species and special areas to aid in the environmental decision-making processes. The online environmental review tool is administered by the AGFD Heritage Data Management System and Project Evaluation Program. It provides a special status species list for Phase I Environmental Compliance and NEPA documents and provides information and guideline links for incorporating wildlife conservation into project planning. This website tool was accessed to determine special status species known to occur within 3 miles of the study area. Other special status species that have not received federal listing and are present in the vicinity of the study area include SGCN and BLM sensitive species (Section 3.13.3.1, Regulatory Framework). SGCN are wildlife species indicative of the overall health of a state's wildlife resources and some species may be rare or declining. BLM sensitive species are wildlife species that are known to occur on BLM-administered lands that are not federally protected under the ESA but warrant special attention and management to keep them from becoming listed in the future. A list of SGCN and BLM sensitive species was generated by the online environmental review tool for the study area (Table 3-45). SGCN species status ranks are based on the following criteria:

- Extirpated from Arizona
- Demographic status
- Federal or state status
- Concentration status
- Declining status
- Fragmentation status
- Disjunct status
- Distribution status

Table 3-45. Species of Greatest Conservation Need and BLM-sensitive Species

COMMON NAME	SCIENTIFIC NAME	STATUS
Amphibians		
Lowland Leopard Frog	*Lithobates yavapaiensis*	1A
Western Narrow-mouthed Toad	*Gastrophryne olivacea*	S
Birds		
Abert's Towhee	*Melozone aberti*	1B
American Bittern	*Botaurus lentiginosus*	1B
American Peregrine Falcon	*Falco peregrinus anatum*	1A
Arizona Bell's Vireo	*Vireo bellii arizonae*	1B
Bald Eagle	*Haliaeetus leucocephalus*	1A
Brewer's Sparrow	*Spizella breweri*	1C
Broad-billed Hummingbird	*Cynanthus latirostris*	1B
Brown-crested Flycatcher	*Myiarchus tyrannulus*	1C
Buff-collared Nightjar	*Antrostomus ridgwayi*	1B
Cactus Ferruginous Pygmy-owl	*Glaucidium brasilianum cactorum*	1B
Costa's Hummingbird	*Calypte costae*	1C
Desert Purple Martin	*Progne subis hesperia*	1B
Eastern Meadowlark	*Sturnella magna*	1C
Elf Owl	*Micrathene whitneyi*	1C
Ferruginous Hawk	*Buteo regalis*	1B
Gila Woodpecker	*Melanerpes uropygialis*	1B
Gilded Flicker	*Colaptes chrysoides*	1B
Golden Eagle	*Aquila chrysaetos*	1B
Gray Flycatcher	*Empidonax wrightii*	1C
LeConte's Thrasher	*Toxostoma lecontei*	1B
Lincoln's Sparrow	*Melospiza lincolnii*	1B
Lucy's Warbler	*Oreothlypis luciae*	1C
Marsh Wren	*Cistothorus palustris*	1C

SGCN Status: 1A = Tier of SGCN that the AGFD has entered into an agreement with, has legal or contractual obligation to, or warrants protection of a closed season; 1B = Tier of SGCN that are not Tier 1A species; 1C = Tier of SGCN for species with an unknown status; S = BLM sensitive

Table 3-45. Species of Greatest Conservation Need and BLM-sensitive Species (continued)

COMMON NAME	SCIENTIFIC NAME	STATUS
Pacific Wren	*Troglodytes pacificus*	1B
Red-naped Sapsucker	*Sphyrapicus nuchalis*	1C
Rufous-winged Sparrow	*Peucaea carpalis*	1B
Sage Thrasher	*Oreoscoptes montanus*	1C
Savannah Sparrow	*Passerculus sandwichensis*	1B
Sprague's Pipit	*Anthus spragueii*	1A
Swainson's Hawk	*Buteo swainsoni*	1C
Violet-crowned Hummingbird	*Amazilia violiceps*	1B
Western Burrowing Owl	*Athene cunicularia hypugaea*	1B/S
Wood Duck	*Aix sponsa*	1B
Yellow Warbler	*Setophaga petechia*	1B
Invertebrates		
Black Mountain Talussnail	*Sonorella papagorum*	1B
Mammals		
Antelope Jackrabbit	*Lepus alleni*	1B
Arizona Myotis	*Myotis occultus*	1B
Banner-tailed Kangaroo Rat	*Dipodomys spectabilis*	1B
Black-tailed Prairie Dog	*Cynomys ludovicianus*	1A
Brazilian Free-tailed Bat	*Tadarida brasiliensis*	1B
California Leaf-nosed Bat	*Macrotus californicus*	1B
Cave Myotis	*Myotis velifer*	1B/S
Cockrum's Desert Shrew	*Notiosorex cockrumi*	1B
Greater Western Bonneted Bat	*Eumops perotis californicus*	1B
Harris' Antelope Squirrel	*Ammospermophilus harrisii*	1B
Jaguar	*Panthera onca*	1A
Kit Fox	*Vulpes macrotis*	1B
Lesser Long-nosed Bat	*Leptonycteris yerbabuenae*	1A
Ocelot	*Leopardus pardalis*	1A

SGCN Status: 1A = Tier of SGCN that the AGFD has entered into an agreement with, has legal or contractual obligation to, or warrants protection of a closed season; 1B = Tier of SGCN that are not Tier 1A species; 1C = Tier of SGCN for species with an unknown status; S = BLM sensitive

Table 3-45. Species of Greatest Conservation Need and BLM-sensitive Species (continued)

COMMON NAME	SCIENTIFIC NAME	STATUS
Pale Townsend's Big-eared Bat	*Corynorhinus townsendii pallescens*	1B
Pocketed Free-tailed Bat	*Nyctinomops femorosaccus*	1B
Southern Pocket Gopher	*Thomomys umbrinus intermedius*	1B
Spotted Bat	*Euderma maculatum*	1B
Western Red Bat	*Lasiurus blossevillii*	1B
Western Yellow Bat	*Lasiurus xanthinus*	1B
Yuma Myotis	*Myotis yumanensis*	1B
Reptiles		
Desert Mud Turtle	*Kinosternon sonoriense*	1B
Giant Spotted Whiptail	*Aspidoscelis stictogramma*	1B
Gila Monster	*Heloderma suspectum*	1A
Hooded Nightsnake	*Hypsiglena sp. Nov.*	1B
Ornate Box Turtle	*Terrapene ornata*	1A
Red-backed Whiptail	*Aspidoscelis xanthonota*	1B
Regal Horned Lizard	*Phrynosoma solare*	1B
Saddled Leaf-nosed Snake	*Phyllorhynchus browni*	1B
Sonoran Coralsnake	*Micruroides euryxanthus*	1B
Sonoran Desert Toad	*Incilius alvarius*	1B
Sonoran Desert Tortoise	*Gopherus morafkai*	1A/S
Sonoran Whipsnake	*Coluber bilineatus*	1B
Tiger Rattlesnake	*Crotalus tigris*	1B
Variable Sandsnake	*Chilomeniscus stramineus*	1B
Plants		
Tumamoc Globeberry	*Tumamoca macdougalii*	S

SGCN Status: 1A = Tier of SGCN that the AGFD has entered into an agreement with, has legal or contractual obligation to, or warrants protection of a closed season; 1B = Tier of SGCN that are not Tier 1A species; 1C = Tier of SGCN for species with an unknown status; S = BLM sensitive

If a species status is ranked as "1," it was determined to be vulnerable under one or more of the vulnerability criteria listed above and was included in the list of SGCN. Species listed as 1A received a score of "1" for vulnerability and matched at least one of the following:

- Federally listed as endangered or threatened under the ESA
- Listed as a candidate species under ESA
- Covered under a signed conservation agreement or a signed conservation agreement with assurances
- Recently removed from the ESA and requires post-delisting monitoring
- Closed season species as identified in Arizona Game and Fish Commission Order 40, 41, 42, or 43

Species listed as 1B received a score of "1" for vulnerability, but do not match any of the above criteria for 1A species. Species listed as 1C received a score of "0" for vulnerability, meaning the species status is unknown and vulnerability could not be assessed. These species with unknown status represent priority research and information needs. Lastly, species listed as "S" are BLM sensitive species.

Amphibians

The lowland leopard frog and western narrow-mouthed toad are the only special status amphibians that have been documented in the vicinity of the study area. The lowland leopard frog is an aquatic frog species that inhabits aquatic systems from desert grasslands to pinyon-juniper woodlands. Suitable habitat consists of rivers, permanent streams, permanent pools in intermittent streams, and cienegas, as well as man-made systems such as cattle tanks, canals, and irrigation sloughs (AGFD, 2006). No perennial streams or intermittent streams are present in the study area. The western narrow-mouthed toad inhabits mesquite semi-desert grassland to oak woodlands and occurs in the proximity of streams, springs, and rain pools (AGFD, 2019). The species is more terrestrial than leopard frogs and may occur within the study area during the summer rainy season when rain pools are present.

Birds

Numerous special status bird species have been documented in the vicinity of the study area. The breeding season for most bird species in southern Arizona is between March 1 and August 30. The wide variety of special status bird species listed exhibit various nesting habits and are likely to nest throughout the study area. Xeroriparian zones along ephemeral washes where a diverse and dense concentration of vegetation is present may provide a greater abundance of nesting potential than other habitat types. Additionally, nesting may occur in agricultural fields and in more developed areas on the ground, in trees and other vegetation, and on human-made structures.

Bald and golden eagles were not identified by the AGFD online environmental tool as documented within 3 miles of the study area but were predicted to potentially occur in the study area based on range models. The diet of bald eagles in Arizona consists primarily of fish and thus they are typically found in areas near open water such as lakes and larger rivers, both during the breeding season and during winter (AGFD, 2011a). Golden eagles are more habitat generalists but are usually found in open country, especially in hilly or mountainous regions, often nesting on rock ledges, cliffs, or in large trees (AGFD, 2002). There is no suitable nesting habitat for bald eagles in the study area and golden eagle nesting in

the study area is unlikely. However, the study area may provide temporary habitat for dispersing young and wintering bald eagles, as well as general foraging habitat for golden eagles.

Invertebrates

The Black Mountain talussnail is the only special status invertebrate listed that has been documented in the vicinity of the study area. The species is a native mollusk that is generally found in crevices deep within slopes covered with slides of black basalt. However, the species is only known from one site at Black Mountain near SXD, and is located on TON lands (AGFD, 2004a).

Mammals

A wide variety of special status mammals are known to occur in the vicinity of the study area. Most mammals listed are bat species that may occupy crevices in rocky outcrops and man-made structures (such as bridges and eaves of buildings) within the study area. Other mammals listed, such as the antelope jackrabbit, southern pocket gopher, kit fox, and Harris's antelope squirrel, are burrowing animals and may occur more abundantly throughout undeveloped and agricultural portions of the study area. The jaguar is listed as a SGCN; however, potential effects to the jaguar have already been discussed as a part of this document (Section 3.13.2, Threatened and Endangered Species). Ocelots are occasionally documented in southern Arizona. This small wild cat is very secretive and generally inhabits areas of dense vegetation for cover. Although unlikely, the ocelot does have potential to occur in the more densely vegetated portions of the study area where it may be using the area as a travel path.

Reptiles

Several special status reptile species are known to occur in the vicinity of the study area. These reptiles can be found primarily throughout undeveloped portions of the study area. Within undeveloped areas, xeroriparian zones provide more diverse habitat and foraging opportunities for a greater abundance of reptile species. The SDT is listed as a SGCN and a BLM sensitive species. However, potential effects to the SDT have already been addressed in this document (Section 3.13.2, Threatened and Endangered Species).

Plants

The Tumamoc globeberry is a BLM sensitive plant species known to occur in the vicinity of the study area. The plant grows in sandy soils of valley bottoms to rocky soils of upper bajada slopes. It thrives in xeric situations in the shade of a variety of nurse plants along gullies and sandy washes of hills and valleys in Sonoran Desertscrub (AGFD, 2004c). The plant is widespread in Pima County and may occur within the study area.

3.13.3.4 Environmental Consequences

This section includes an analysis and comparison of the impacts due to the corridor alternatives and the No-Build Alternative. Overall, the corridor alternatives would result in a loss of SGCN and BLM-sensitive species.

Corridor Alternative 1

Amphibians

Due to the absence of perennial and intermittent water sources, the lowland leopard frog is not anticipated to occur within Corridor Alternative 1 and does not have potential to be affected if construction of a new highway occurs within this corridor alternative. Suitable habitat for the western narrow-mouthed toad may occur within Corridor Alternative 1; therefore, the toad species has potential to be affected if construction of a new highway occurs within this corridor alternative.

Birds

Take of bald or golden eagles is not anticipated for this corridor alternative due to lack of suitable nesting habitat. However, xeroriparian habitat provides richer nesting opportunities for other bird species, including special status species such as the yellow warbler, Lucy's warbler, brown-crested flycatcher, and Arizona Bell's vireo. Therefore, these habitat types may contain higher concentrations of nesting birds than the surrounding upland habitat. Corridor Alternative 1 contains 166.8 acres of xeroriparian habitat, which is less acreage than either Corridor Alternative 7 or Corridor Alternative 8A (Table 3-39). The alignment of the proposed highway within Corridor Alternative 1 has not been determined, but construction of a new highway within this corridor alternative would likely affect some nesting special status bird species. Mitigation would be required prior to and throughout the construction of a new highway in order to avoid effects to nesting special status bird species.

Invertebrates

No known populations of the Black Mountain talussnail are present within the study area. Therefore, construction of a new highway within Corridor Alternative 1 would not have potential to affect the Black Mountain talussnail.

Mammals

Terrestrial mammals receiving special status may be common throughout undeveloped and agricultural portions of Corridor Alternative 1. However, bat species may more readily occupy developed portions of the corridor alternative where existing built structures, such as bridges, culverts, and buildings, provide adequate roosting habitat. Corridor Alternative 1 contains approximately 63.9 acres of developed land that may provide bat roosting habitat. Undeveloped land including shrublands, grasslands, riparian zones, and barren land make up most of the land in Corridor Alternative 1 (Table 3-39). Due to the wide variety of habitat special status mammal species may use, the construction of a new highway within this corridor alternative could likely affect some SGCN mammals.

Reptiles

Special status reptile species are likely to occur within Corridor Alternative 1. The majority of land within all corridor alternatives is undeveloped and provides suitable habitat for many reptile species. Therefore, construction of a new highway within this corridor alternative could have the potential to affect special status reptile species.

Plants

The Tumamoc globeberry occupies xeric habitats within Sonoran Desertscrub and has potential to occur within Corridor Alternative 1. The Arizona Upland Division of Sonoran Desertscrub makes up the vast majority of habitats within this corridor alternative. Therefore, construction of a new highway within this corridor alternative has potential to affect the Tumamoc globeberry.

Corridor Alternative 7

Amphibians

The same potential impacts to the western narrow-mouthed toad mentioned in Corridor Alternative 1 would apply to all corridor alternatives.

Birds

Take of bald or golden eagles is not anticipated for this corridor due to lack of suitable nesting habitat. However, Corridor Alternative 7 contains the most xeroriparian habitat for other nesting bird species in comparison to the other two corridor alternatives. However, the same potential impacts and mitigations to nesting special status bird species mentioned in Corridor Alternative 1 would apply to all corridor alternatives.

Invertebrates

No known populations of the Black Mountain talussnail are present within the study area. Therefore, construction of a new highway within Corridor Alternative 7 would not have potential to affect the Black Mountain talussnail.

Mammals

The same potential impacts to terrestrial mammal species mentioned in Corridor Alternative 1 would apply to all corridor alternatives. However, Corridor Alternative 7 contains the most amount of developed land in comparison to the other two corridor alternatives. Therefore, Corridor Alternative 7 has more potential to affect bat species than the other corridor alternatives.

Reptiles

As discussed in Corridor Alternative 1, the majority of land within all the corridor alternatives is undeveloped. Therefore, the same potential impacts to the special status reptile species mentioned in Corridor Alternative 1 would apply to all corridor alternatives.

Plants

Potential suitable habitat for the Tumamoc globeberry is present throughout the study area. Therefore, the same potential impacts to the Tumamoc globeberry mentioned in Corridor Alternative 1 would apply to all corridor alternatives.

Corridor Alternative 8A

Amphibians

The same potential impacts to the western narrow-mouthed toad mentioned in Corridor Alternative 1 would apply to all corridor alternatives.

Birds

The same potential impacts and mitigations to nesting special status bird species mentioned in Corridor Alternative 1 would apply to all corridor alternatives.

Invertebrates

No known populations of the Black Mountain talussnail are present within the study area. Therefore, construction of a new highway within Corridor Alternative 8A would not have potential to affect the Black Mountain talussnail.

Mammals

The same potential impacts to terrestrial mammal species mentioned in Corridor Alternative 1 would apply to all corridor alternatives. However, Corridor Alternative 8A does not contain any developed land. Therefore, Corridor Alternative 8A has the least potential to affect bat species compared to the other corridor alternatives.

Reptiles

Due to the presence of vast amounts of undeveloped land in all three corridor alternatives, the same potential impacts to the special status reptile species mentioned in Corridor Alternative 1 would apply to all other corridor alternatives.

Plants

Potential suitable habitat for the Tumamoc globeberry is present throughout the study area. Therefore, the same potential impacts to the Tumamoc globeberry mentioned in Corridor Alternative 1 would apply to all corridor alternatives.

No-Build Alternative

As mentioned previously, affects for the No-Build Alternative were analyzed using the programmed improvements to the regional transportation system that are in PAG's federally approved Metropolitan TIPs.

Amphibians

The overall impact to special status amphibians would be negligible due to future projects occurring on or along existing facilities.

Birds

Future projects on I-19 and I-10 may have localized implications that require mitigation in order to avoid nesting birds protected by the MBTA, which includes SGCN and BLM-sensitive bird species.

Invertebrates

The overall impact to special status invertebrates would be negligible due to future projects occurring on or along existing facilities.

Mammals

The overall impact to special status mammal species would be negligible due to future projects occurring on or along existing facilities.

Reptiles

The overall impact to special status reptile species would be negligible due to future projects occurring on or along existing facilities.

Plants

The overall impact to special status reptile species would be negligible due to future projects occurring on or along existing facilities.

3.13.3.5 Available Mitigation Measures

This Tier 1 analysis provides an overview of potential impacts from a new transportation facility within the corridor alternatives. Specific alignments, design characteristics, and construction methods have yet to be determined. Therefore, specific methods to avoid, minimize, or mitigate project-related impacts cannot be developed at this stage of study. However, general mitigation strategies that would be further refined during the Tier 2 process are outlined below.

- Minimize loss of natural habitats.
- Provide construction workers with environmental awareness training, including measures to be taken to minimize impacts to the natural environment.
- Where options are available, align the corridor to maximize the use of disturbed lands and minimize habitat fragmentation.
- Minimize construction impacts by limiting the disturbance zone as much as possible; use previously disturbed areas for staging and equipment storage.
- Flag or fence sensitive habitats to preclude construction impacts from occurring within the area.
- Transplant displaced vegetation to adjacent lands, when feasible.
- Replace lost habitat.

3.13.3.6 Conclusion

Alignment of a proposed highway within the proposed corridor alternatives has not been determined. Evaluations of potential affects to species present within these corridor alternatives is based on the hypothetical construction of a new highway within these corridors.

Amphibians

Due to the presence of potentially suitable habitat throughout the study area, all three corridor alternatives would potentially affect the western narrow-mouthed toad. None of the corridor alternatives would affect the lowland leopard frog, as perennial water sources are not present within the study area.

Birds

None of the corridor alternatives are anticipated to result in take of bald or golden eagles. The habitat and nesting requirements for other special status bird species listed in Table 3-41 vary widely. Thus, it is likely that these other nesting birds listed as SGCN or BLM-sensitive species would be present throughout all the corridor alternatives. Mitigation would be required in order to avoid effects to these special status bird species.

Invertebrates

None of the corridor alternatives would have an effect on the Black Mountain talussnail. Currently, the mollusk species is not known to occur within the study area.

Mammals

All the corridor alternatives would affect special status mammal species. However, Corridor Alternative 7 could have a greater impact on bat species due to the increased amount of developed land present. Developed land has more potential to provide roosting opportunities for bats, due to the presence of buildings, bridges, and culverts where bats tend to roost.

Reptiles

All the corridor alternatives include large tracts of undeveloped lands in desertscrub and grassland habitats. Many of the reptile species listed as SGCN and BLM sensitive occur throughout the habitats present within the alternatives and can be expected to be affected by the construction of a new highway.

Plants

All the corridor alternatives would have an effect on the Tumamoc globeberry. Potential suitable habitat exists in all corridor alternatives due to the Sonoran Desertscrub biotic community making up most of the habitat within the study area.

3.13.4 Wildlife Connectivity

Movement is a critical component to the survival of wildlife. The ability to move across the landscape and seek food, shelter, or mates is essential to species persistence. Furthermore, a species' dispersal, migration, and recolonization in response to changing environmental factors is paramount to maintaining biodiversity. Habitat fragmentation and loss are among the leading threats to biodiversity. Conserving networks of large wildland blocks connected by corridors allows natural ecological and evolutionary processes (i.e., gene flow, pollination, dispersal, energy flow, nutrient cycling, inter-specific competition, and mutualism) to operate over large spatial and temporal scales. Maintaining these networks of wildlife habitat can also allow ecosystems to recover from natural and human-caused environmental disturbances and changes.

3.13.4.1 Regulatory Framework

As discussed in the above sections, Arizona Revised Statute Title 17 establishes that maintenance, management, and preservation of Arizona's wildlife resources is the responsibility of the Arizona Game and Fish Commission and AGFD. Based on the authorities granted by Title 17, AGFD funded the Arizona Wildlife Linkages Workgroup (AWLWG), which is a collaborative effort between AGFD, ADOT, FHWA, USFWS, BLM, and other federal and state agencies, academic institutions, and conservation organizations. AWLWG published the Arizona Wildlife Linkages Assessment in 2006, which identified potential wildlife linkage zones between large blocks of wildlife habitat throughout Arizona (AWLWG, 2006). These potential linkage zones represent areas that may be integrated into regional planning frameworks to address habitat fragmentation and maintain connectivity among habitat blocks used by wildlife. Later that same year, AGFD and Northern Arizona University formed the Arizona Missing Linkages project to develop detailed linkage designs for 16 priority areas highlighted in the Arizona Wildlife Linkages Assessment and published reports for those designs in 2007 and 2008. In 2011, the Regional Transportation Authority of Pima County began holding workshops to further refine potential linkage areas across Pima County, which led to the development of the 2012 Pima County Wildlife Connectivity Assessment (AGFD, 2012c).

3.13.4.2 Methodology

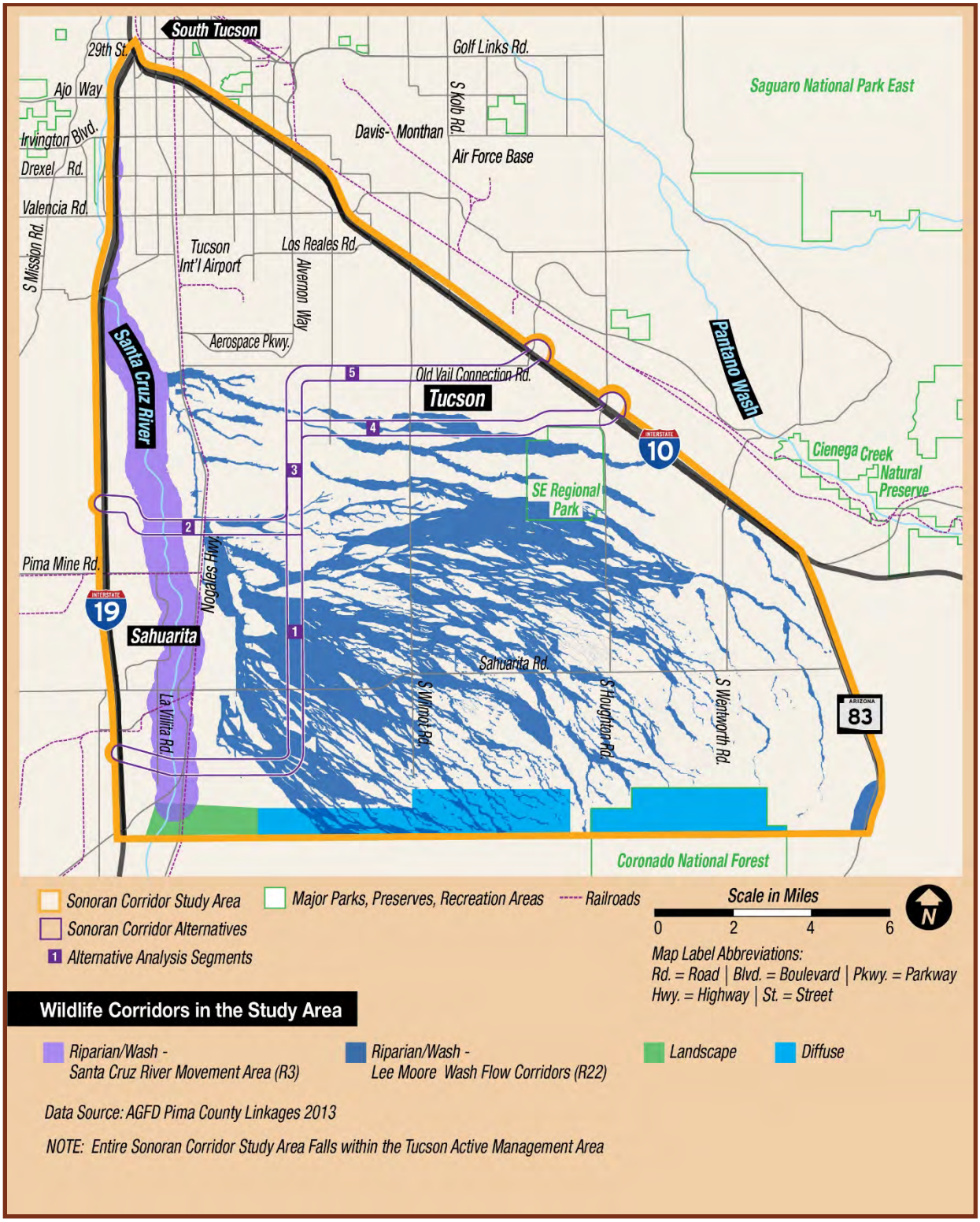
The Arizona Wildlife Linkages Assessment, Arizona Missing Linkages reports, and Pima County Wildlife Connectivity Assessment were reviewed for established wildlife movement corridors within the study area. GIS data resulting from those reports was then used to quantitatively analyze potential impacts to wildlife connectivity within the corridor alternatives.

3.13.4.3 Affected Environment

The 2006 Arizona Wildlife Linkages Working Group Assessment identified 152 potential habitat linkage zones in Arizona (AWLWG, 2006). Corridor Alternative 8A intersects Potential Linkage Zone #92: San Xavier to Sierrita—Santa Rita, which provides connection between the SXD and Santa Rita Mountains to the south of the study area. The nearest detailed linkage design established by the Arizona Missing Linkages project is the Santa Rita-Tumacacori Linkage Design (Beier et al., 2006) to the south of the study area. This detailed linkage design includes the Santa Cruz River from south of Corridor Alternative 8A and further to the south.

The Pima County Wildlife Connectivity Assessment (AGFD, 2012c) further refined the statewide linkages by recognizing diffuse movement areas for wildlife in addition to landscape-level movement between habitat blocks and riparian corridor movement areas. The only designated movement areas intersecting the corridor alternatives are classified as riparian movement areas that provide travel corridors to other movement areas in the region (Figure 3-38). Riparian and xeroriparian washes lined with dense vegetation are often used as corridors for wildlife movement, providing both cover and forage along travel corridors to other movement areas.

Figure 3-38. Wildlife Movement Corridors



Movement area R3 is located along the Santa Cruz River, providing connectivity between habitat blocks to the north and south of the study area. Segments 1 and 2 both cross movement area R3. Wildlife identified as using this movement area include bats, migratory and riparian birds, bobcat (*Lynx rufus*), mountain lion (*Puma concolor*), raccoon (*Procyon lotor*), and deer (*Odocoileus* spp.). The R22 Lee Moore Wash Flow Corridors movement area incorporates the xeroriparian washes that are tributaries to the Santa Cruz River throughout the corridor alternatives. This movement area aids in east-west wildlife movement and connects a habitat block in the Santa Rita Mountains to the south of the study area to the Santa Cruz River corridor. No species were identified as specifically utilizing the R22 movement area. Current threats and potential barriers to wildlife movements through the R3 and R22 riparian movement areas include agriculture, exotic species, low- and high-density residential development, energy development, powerlines, and paved roads. Refer to Table 3-46 for the total and percentage of movement areas present by corridor alternative.

Table 3-46. Movement Areas by Corridor Alternative

MOVEMENT AREA	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
Santa Cruz River (R3)	249 acres	266 acres	266 acres
Lee Moore Wash Flow Corridors (R22)	254 acres	1,150 acres	1,702 acres
Total Movement Area acreage	504 acres	1,423 acres	1,976 acres
Percentage of Movement Area in the Corridor Alternative[1]	21%	59%	82%

[1] Percentage of movement area is calculated using the sum of both the R3 and R22 movement areas.

Overall, the corridor alternatives are isolated in a habitat block between I-10 and I-19 and bounded to the north by the City of Tucson. Based on wildlife movement data collected by AGFD, which considered parameters such as traffic volume, footprint, truck use, and speed limit, the existing I-10 and I-19 freeways represent near-total barriers to wildlife (AGFD, 2018). ROW fencing, traffic volume, noise, human presence, and the speed of traffic all contribute to highways being effective barriers. Species that typically move across the landscape using natural corridors, such as washes, may be hesitant to cross a highway due to the sparse vegetative cover. Conversely, for species that are likely to cross open spaces, highways present threats to species by increasing the potential for vehicle-wildlife collisions. Therefore, wildlife movement through the study area has several existing barriers that reduce the area's value for large-scale wildlife movement. However, potential for north-south movement does occur along the Santa Cruz River, as I-19 and other roadways across the river in the study area are bridged crossings that may facilitate use of the riverbed as a movement corridor. There are no current efforts underway to retrofit I-19 or I-10 in the study area to better facilitate wildlife movement, although linkages have been identified in these areas and ADOT would consider including retrofits with future projects as appropriate.

3.13.4.4 Environmental Consequences

This section analyzes and compares the effects to wildlife connectivity from the future construction of a highway as well as the No-Build Alternative. This Tier 1 analysis provides a general overview, as no project-specific details regarding roadway alignment within the study corridors or design and siting of

potential crossing structures are available currently. Further coordination with AGFD and studies during the Tier 2 NEPA process would aid project-specific analysis and decision making. This Tier 1 analysis considers potential temporary effects to wildlife connectivity from construction of a highway, and the long-term effects on the landscape from the physical presence of a highway.

Construction of a highway within any of the corridor alternatives would further fragment the habitat within the study area by introducing a new linear infrastructure facility where one does not currently exist. Although the study area is effectively isolated and of low quality for large-scale wildlife movement, it is nonetheless a large area of relatively intact and undeveloped habitat that would become fragmented. On a small scale, local wildlife that currently inhabits the study area may utilize the movement areas identified in the Pima County Assessment for the essential movement of day-to-day survival, such as seeking food, shelter, or mates. This local wildlife would experience increased isolation due to the barrier effects of a new highway, such as traffic, fencing, noise, human presence, and sparse vegetative cover. In addition, habitat degradation from construction of a new highway would be anticipated due to increased disturbances, such as noise and light pollution, and the spread of invasive species, all of which extend beyond the roadway itself and contribute to wildlife isolation. Therefore, loss of native vegetation and wildlife habitat, increased habitat fragmentation, and restricted wildlife movement across the landscape can be anticipated from the construction of a future highway, regardless of the corridor alternative in which it is located.

Corridor Alternative 1

Based on Table 2-3, Corridor Alternative 1 is 16.06 miles long, and Table 3-38 indicates that its overall footprint is approximately 3,845.0 acres, making it the shortest corridor alternative with the smallest footprint. A new freeway within this alternative would also result in the least amount of overall habitat fragmentation south of the junction of I-10 and I-19 among the corridor alternatives. Corridor Alternative 1 also contains the least movement area of all the corridor alternatives, at 504.0 acres and 21 percent. Therefore, Corridor Alternative 1 could have the least effect to wildlife connectivity among the corridor alternatives.

Corridor Alternative 7

Based on Table 2-3, Corridor Alternative 7 is 20.47 miles long, and Table 3-38 indicates that its overall footprint is approximately 5,154.88 acres, placing this alternative between the other two in terms of footprint size. However, this alternative could result in the most overall habitat fragmentation south of the junction of I-10 and I-19. Corridor Alternative 7 contains more movement area than Corridor Alternative 1, but less than Corridor Alternative 8A.

Corridor Alternative 8A

Based on Table 2-3 Corridor Alternative 8A is 21.04 miles long, and Table 3-38 indicates that its overall footprint is approximately 5,285.77 acres, making it the corridor alternative with the largest footprint. Overall habitat fragmentation south of the junction of I-10 and I-19 for this alternative could be between the other two; however, Corridor Alternative 8A impacts the most movement area of at 1,976 acres and 82 percent. Therefore, Corridor Alternative 8A would likely have the most detrimental effect on wildlife movement through the study area.

No-Build Alternative

Under the No-Build Alternative, a future freeway within the study corridors would not be constructed and there would be no project-related effects to wildlife corridors or habitat connectivity. However, without a comprehensive high-level strategy involving landowners, future developers, and mechanisms to preserve wildlife corridors, the study area will eventually be developed with no consideration for the protection and preservation of wildlife corridors.

3.13.4.5 Available Mitigation Measures

This Tier 1 analysis provides an overview of potential impacts from a new transportation facility within the corridor alternatives. Specific alignments, design characteristics, and construction methods have yet to be determined. Therefore, specific methods to avoid, minimize, or mitigate project-related impacts cannot be developed at this stage of study. However, general mitigation strategies that will be further refined during the Tier 2 process are outlined below.

- ADOT would coordinate with AGFD, BLM, Pima County, and other stakeholders to determine wildlife connectivity data needs and study design at that time. ADOT would then fund and facilitate implementation of identified studies during the Tier 2 phase if warranted. ADOT and the stakeholders would identify the crossing structures, design features, and supporting mitigation or conservation necessary to facilitate movement of wildlife through the roadway barrier.
- Prior to Tier 2 analyses, ADOT would evaluate the Pima County Wildlife Connectivity Assessment report to identify and minimize impacts to wildlife movement areas.
- Structures designed to enhance wildlife connectivity, such as wildlife underpasses and fencing to funnel wildlife to these structures, would be evaluated by ADOT in association with AGFD and designed and constructed taking species-specific needs into consideration. This may involve design improvements to drainage structures to facilitate movement and/or design of separate dedicated wildlife crossing structures.

3.13.4.6 Conclusion

In general, the affected environment, environmental consequences, and available mitigation measures are similar for all corridor alternatives. While Corridor Alternative 7 and Corridor Alternative 8A both cross more riparian movement area, roadway alignment within these corridors and wildlife crossing structures could be incorporated during Tier 2 analysis that could substantially reduce a future highway's effect on wildlife connectivity.

Potential wildlife connectivity impacts resulting from construction of a future highway within one of the corridor alternatives could be mitigated by incorporating a comprehensive network of crossing structures, such as underpasses, culverts, funnel fencing, and other elements designed to promote safe migration of wildlife through the study area. Detailed analysis in the Tier 2 NEPA document would require site-specific data on biological resources potentially affected by the project; wildlife movement studies/surveys; technical studies, including field surveys and research programs that inform project design and location of project facilities; and further research on the effects of interrupting or enhancing specific wildlife movement corridors within the study area. Continued coordination with AGFD and with land and resource management agencies during Tier 2, along with studies on wildlife movement in the region, would aid in the design and siting of crossing structures to best accommodate wildlife movement across a future highway corridor and reduce habitat fragmentation and loss.

3.14 Water Resources

This section identifies drainage and floodplain issues to be considered when evaluating impacts resulting from corridor and No-Build alternatives. Included in this analysis are applicable drainage patterns, such as surface water, groundwater, and floodplains. Surface water includes water present above the soil surface such as rivers, streams, lakes, pools, and stormwater runoff. Groundwater is water that flows below the soil surface that can be collected by underground wells or other facilities constructed for collecting water or for monitoring.

3.14.1 Waters of the US

The definition of Waters of the US (Waters) has been in the process of revision in recent years. The current definition of Waters includes several natural water body types such as rivers, lakes, streams, wetlands and other water features that are subject to U.S. Army Corps of Engineers (Corps) (33 CFR 328.3) and EPA (40 CFR 120.2) jurisdiction.

3.14.1.1 Regulatory Framework

The Clean Water Act (33 U.S.C. 1251) of 1972 (as amended) (CWA) is the primary federal statute governing discharge of pollutants into jurisdictional Waters. The principal goal of the CWA is to establish water quality standards to restore and maintain the chemical, physical, and biological integrity of the nation's Waters by preventing point (concentrated output) and nonpoint (widely scattered output) pollution sources.

Section 404 of the CWA regulates the discharge of earthen fill, concrete, and other construction materials into Waters, and authorizes the Corps to issue permits regulating the discharge of dredge or fill material into Waters. The geographic limits of Waters are defined through a preliminary or approved jurisdictional determination (JD) accepted by Corps. A preliminary JD is non-binding and advisory in nature, but presumes all the waters under consideration are jurisdictional. An approved JD is a final legal determination that there are, or that there are not, wetlands or streams under federal jurisdiction (See, 33 U.S.C. 331.2).

Specifically for Arizona, the most common types of Section 404 permits for transportation projects are (1) Regional General Permit (RGP) 96, which authorizes up to 1.0 acre of permanent impact to each Waters and 0.025 acre of permanent or temporary impact to special aquatic areas on non-tribal lands, (2) Nationwide Permit 14 (Linear Transportation Projects), which authorizes projects with less than 0.5 acre of permanent loss of Waters with no impacts on special aquatic areas such as wetlands, and (3) individual permits, which are required for projects that do not meet the requirements of a Nationwide Permit or Regional General Permit. For regulatory and permitting purposes, the corridor alternatives in this Draft Tier 1 EIS are located in the Corps' Los Angeles District.

EPA's 404(b)1 guidelines allow the discharge of dredged or fill material into Waters to be permitted only if there is no practicable alternative that would have less adverse effects. An alternative is practicable if it is available and capable of being implemented after considering cost, existing technology, and logistics, in light of overall project purposes (40 C.F.R. § 230). Per the 404(b)(1) guidelines, the Corps is obligated to select and permit the "least environmentally damaging, practicable alternative" (LEDPA) (33 U.S.C 1344). Issuance of a Section 404 permit by the Corps follows a sequential process that encourages

first the avoidance of impacts to Waters, followed by minimization of impacts, and then finally, mitigation to minimize or offset the impacts of unavoidable impacts to jurisdictional waters with no net loss of the functions and values of the water resource.

Section 408 of the Rivers and Harbors Act of 1899, as amended and codified at 33 U.S.C. (408) provides that Corps may grant permission for another party to alter a Corps-administered Civil Works project upon a determination that the alteration proposed will not be injurious to the public interest and will not impair the usefulness of the Civil Works project. Portions of the Santa Cruz river have been channelized and any proposed construction activity over or in the Santa Cruz would be subject to Corps review to determine if a Section 408 permit is required. Section 408 permit requirements of a future highway would be determined at the Tier 2 phase.

This Draft Tier 1 EIS analyzes corridor alternatives for the potential future construction of a highway alignment. It is important in a Tier 1 study that the selection of the Preferred Alternative does not eliminate the potential LEDPA. Therefore, provisions set forth in Section 404(b)(1) of the CWA were considered when evaluating the corridor alternatives that would involve discharge of dredged or fill material to Waters. At the Tier 2 phase, if an individual permit is determined to be necessary, the Corps requires that the Preferred Alternative be the LEDPA. Thus, future Tier 2 studies would provide the quantitative analysis necessary to make final LEDPA determinations.

To administer the Section 404 permit program, EPA and the Corps define wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (EPA, 40 CFR 239.2, and Corps, 33 CFR §328.3). Regulatory framework pertaining to wetlands also comes from EO 11990 which states "Each agency shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities." FHWA's regulations on the evaluation and mitigation of adverse impacts to wetlands are found in 23 CFR 777, *Mitigation of Impacts to Wetlands and Natural Habitat*. In addition to being Waters, jurisdictional wetlands in Arizona are also regulated as special aquatic sites per 40 CFR 230.41. This designation affects the Section 404 permitting program by implementing impact thresholds for this resource that are more stringent than Waters not designated as special aquatic sites.

3.14.1.2 Methodology

The geographical limits of Waters are defined through a preliminary or approved JD that is accepted by the Corps. A JD determines the limits of the ordinary high-water mark (OHWM) of a watercourse, and a wetland delineation determines the limits of soils, hydrology, and vegetation indicative of wetland conditions. A preliminary JD assumes all watercourses exhibiting characteristics of an OHWM and wetlands with hydric soils, hydrophytic vegetation, and wetland hydrology within a given area, or if it has the soils, hydrology, and vegetation indicative of wetland conditions, are subject to Corps jurisdiction. A JD for the Sonoran Corridor would be completed in conjunction with the Tier 2 NEPA documents. For the purposes of this Draft Tier 1 EIS, potential Waters were researched and identified by desktop review of GIS data.

Surface water bodies (e.g., streams, rivers, lakes, and ponds) that have potential to be Waters were identified by reviewing the US Geological Survey (USGS) National Hydrography Dataset, USGS 7.5-minute topographic quadrangles, and Environmental Systems Research Institute (ESRI) World Imagery. All flowlines from the USGS National Hydrography Dataset that were displayed within the corridor alternatives were verified against ESRI World Imagery to determine if potential OHWM characteristics could be observed. Features that exhibit potential OHWM characteristics are considered "potential Waters" for analysis purposes of this Draft Tier 1 EIS.

To identify potential wetlands within the corridor alternatives, the USFWS National Wetland Inventory (NWI) database was reviewed in GIS (USFWS, 2019). The NWI maps are based on a classification system known as the Cowardian system, which classifies the types of ecosystems related to water resources (Cowardian, 1979). It should be noted that NWI data is mapped in GIS by USFWS to provide biologists and others with information on the distribution and type of wetlands to aid in conservation efforts. Although NWI data can be used as an aid in identifying the location of potential jurisdictional wetlands, wetlands designated by NWI are not required to have the same three characteristics (i.e., dominance or prevalence of hydrophytic vegetation, hydric soils, and persistent wetland hydrology) that are required in a formal wetland delineation by the Corps (Corps, 1987). As discussed above, such formal delineations are beyond the scope of this Tier 1 analysis but would be included in the Tier 2 phase. Therefore, analysis of wetlands in this Draft Tier 1 EIS considers only those resources identified in the NWI dataset as "potential wetlands." Outside of any agricultural ponds or artificial water sources, the potential for jurisdictional wetlands to exist within any of the corridor alternatives is very low. The NWI dataset is not tailored to wetland areas in the arid southwest (including Arizona), and often maps dense stands of mesquite and other vegetation as a wetland although they do not exhibit the three characteristics required to be considered jurisdictional. While there may be small ponding areas along the floodplain of some of these ephemeral washes, most features within the corridor alternatives are not saturated for an adequate duration to support hydrophytic vegetation and the development of hydric soils. Most of the NWI-mapped potential wetlands in the study area are not likely to qualify as jurisdictional wetlands.

Each 2,000 foot-wide corridor alternative was overlaid on the GIS data to quantify the resource and to identify its location within each corridor segment. The potential impacts were then qualitatively assessed by investigating each resource for potential avoidance by the construction of a future highway within the corridor. Key factors that were assessed in this impact analysis include:

- Quantitative assessment of potential Waters and Wetlands that are mapped in GIS within each corridor alternative.
- Qualitative assessment of the configuration of potential Waters and Wetlands within each corridor alternative, to identify the potential to avoid Waters by shifting a future highway alignment within the corridor alternative.

After conducting the quantitative and qualitative assessments outlined above, the level of impact for each corridor alternative on Waters was ranked as low, moderate, or high in comparison to each other and the No-Build Alternative. Construction impacts associated with a new highway would likely require authorization under a Section 404 individual permit if jurisdictional wetlands are impacted. Of the potential wetlands within the study corridors, freshwater ponds are most likely to have the characteristics of jurisdictional wetlands. In addition to typically requiring authorization under an

individual permit, jurisdictional wetlands are commonly mitigated at a higher ratio (i.e., up to 3:1) than non-wetland Waters (i.e. other Waters). Thus, higher consideration was given to freshwater ponds in Section 3.14.1.4, Environmental Consequences.

3.14.1.3 Affected Environment

The following sections summarize the Waters in the corridor alternatives.

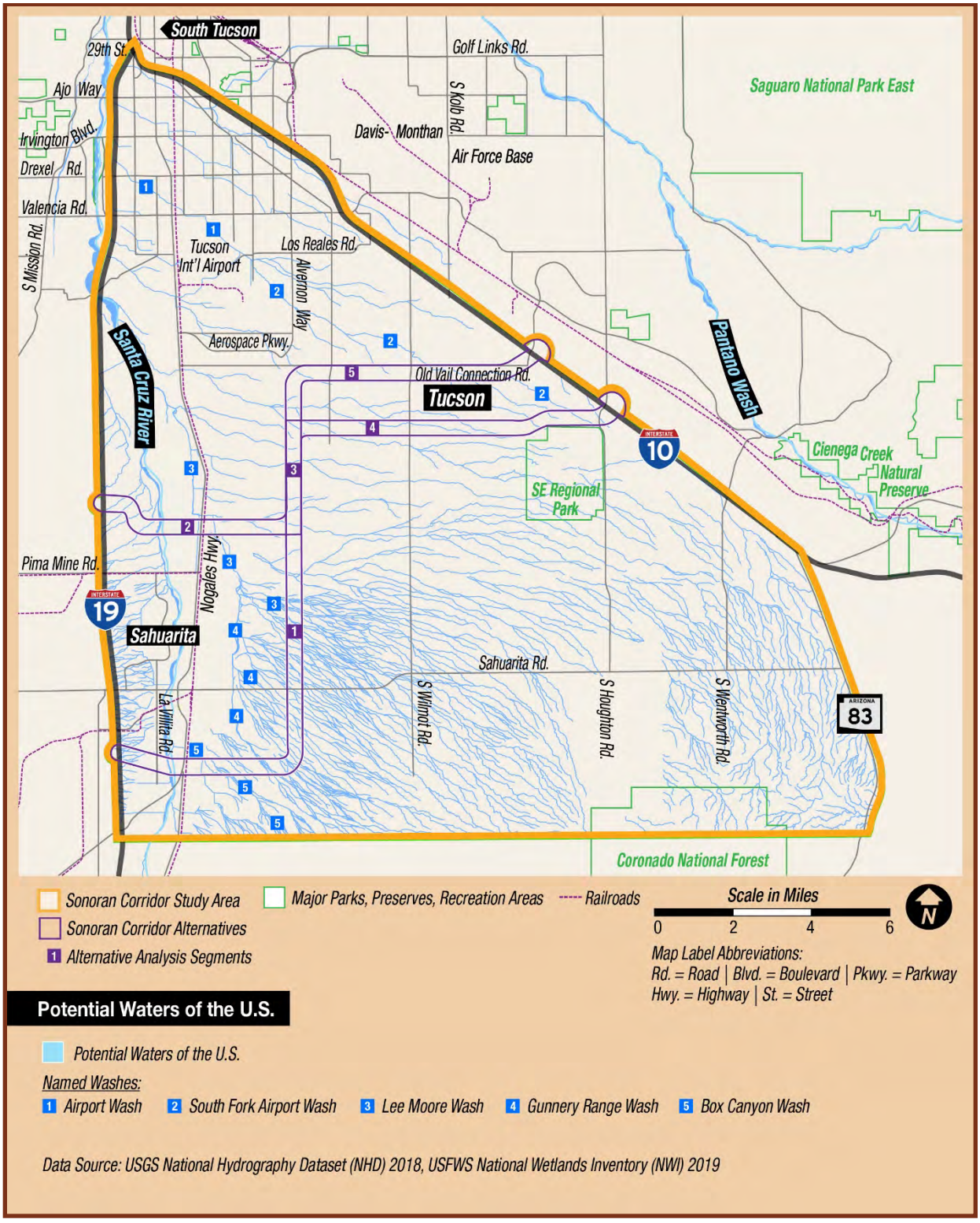
Potential Waters of the US

The corridor alternatives are part of the Basin and Range physiographic region, which is characterized by ephemeral desert washes that carry runoff creating intricate, braided drainage systems across valleys between elevated landforms such as mountains or buttes. Runoff within the study area results predominantly from rainfall during occasional winter storms and summer thunderstorms, and annual precipitation is about 15 inches per year (ADEQ, 2016). The corridor alternatives are located within the Santa Cruz watershed, and watercourses generally flow to the Santa Cruz River.

The Santa Cruz River is the primary watercourse in the study area and flows south to north across Segment 1 and Segment 2 of the corridor alternatives. Within the study area, the Santa Cruz River is incised from the surrounding uplands, varies from 50-feet to 400-feet wide, has a natural-bottom comprised of sand, gravel and cobble and banks vegetated with xeric-riparian species. Ground water pumping has eliminated the natural perennial flow regime from most reaches of the Santa Cruz River, except where treated wastewater effluent discharges from Nogales and Tucson. No effluent discharges are located within or near the study area, and all reaches of the Santa Cruz River within the corridor alternatives are ephemeral and flow only during and immediately following a storm event. Two reaches of the Santa Cruz River, identified as Reach A and Reach B, have been determined by the Corps and designated by the EPA as Traditional Navigable Waters (Corps, 2008a and USEPA 2008). Neither reach is located within the study area, though Reach B, located from the Roger Road wastewater treatment plant downstream to the Pima/Pinal County line, is downstream of the study area (Corps, 2008a). Therefore, it is reasonable to expect that the Santa Cruz and its direct tributaries are jurisdictional waters.

Major washes in the study area that are direct tributaries to the Santa Cruz River include Box Canyon Wash, Lee Moore Wash, Gunnery Range Wash, and South Fork Airport Wash. These ephemeral washes can generally be characterized as being natural drainages with single and braided channels, sand and gravel substrate bottoms and xeric-riparian vegetation lining the banks. Aside from direct tributaries to the Santa Cruz River, surface waters (i.e., streams, rivers, lakes, and ponds) designated on USGS maps are also likely to be determined jurisdictional unless non-jurisdictional conditions can be documented. There are 131 unnamed ephemeral washes within the study area that are denoted as streams on the USGS 7.5-minute topographic quadrangles, and thus are considered potential Waters for this Tier 1 analysis (Figure 3-39). Ephemeral washes perform both hydrologic and biogeochemical functions that directly affect the integrity and functional condition of higher-order waters downstream. These washes provide hydrologic connectivity within the watershed, facilitating the movement of water, sediment, nutrients, wildlife, and plant propagules, and are responsible for a large portion of basin ground-water recharge in arid and semi-arid regions. These ephemeral systems contribute to the Biogeochemical functions of these ephemeral systems include storing, cycling, transforming, and transporting elements and compounds within their watershed. Ephemeral washes also provide habitat for breeding, shelter, foraging and movement of wildlife (Levick, L et. al. 2008).

Figure 3-39. Potential Waters of the US



A review of aerial imagery indicates other unidentified ephemeral washes and watercourses within the corridor alternatives. As discussed above, the jurisdictional status of water resources would be determined in the JD process during Tier 2 analyses. Table 3-47 shows the total potential Waters present by corridor segment.

Table 3-47. Potential Waters of the US by Corridor Segment

POTENTIAL WATERS	CORRIDOR SEGMENT 1	CORRIDOR SEGMENT 2	CORRIDOR SEGMENT 3	CORRIDOR SEGMENT 4	CORRIDOR SEGMENT 5
Number of Ephemeral Washes	93	13	8	8	12
Length of Ephemeral Washes (feet)	172,273	32,646	13,245	35,052	26,294
Percentage of Ephemeral Washes[1]	62%	12%	5%	13%	9%

[1] Percentage of ephemeral drainages is calculated using the length of ephemeral washes.

When runoff is present, ephemeral washes predominantly flow southeast to northwest across the study area, although a few washes located west of the Santa Cruz River flow southwest to northeast across Corridor Segments 1 and 2. In Corridor Segments 2, 4, and 5, a few washes flow east to west for an extended distance, 1 to 3 miles within the corridors, running parallel to the corridor alternatives rather than crossing them perpendicularly.

Agricultural irrigation canals are present within Segment 1 of the corridor alternatives. The Corps does not typically have jurisdiction over irrigation canals unless the canal serves as a connector for a Water of the US, e.g., when water conveyed by the canal comes from and returns to Waters. Jurisdictional determination of these features would occur during JD efforts in the Tier 2 analysis.

Wetlands

Wetland classifications found within the corridor alternatives are limited to freshwater ponds (i.e., PUBF, PUSAh, and PUSJh) and riverine (i.e., R4SBA, R4SBAx, R4SBC, R4SBJ, and R5UBH) with the majority being classified as intermittent riverine systems that are seasonally flooded (i.e., R4SBC) (Figure 3-40). Table 3-48 shows the wetland classification definitions with the corridor alternatives. No areas of freshwater emergent, forested, or shrub wetlands were mapped in the study corridors. As previously discussed, NWI-mapped potential wetlands in the corridor alternatives are not likely to qualify as jurisdictional wetlands and can mostly be characterized as the various channels of the ephemeral washes in the study area; ponding areas in or adjacent to the ephemeral washes; and retention basins, stock tanks, or other water storage or management areas for agricultural, industrial, and residential purposes. Two freshwater ponds in Corridor Segment 5 are associated with sewage disposal/treatment at the Arizona State Prison Complex Tucson and would not be considered jurisdictional wetlands. Thus, these two ponds were removed from further consideration in this Tier 1 analysis.

Figure 3-40. Potential Wetlands

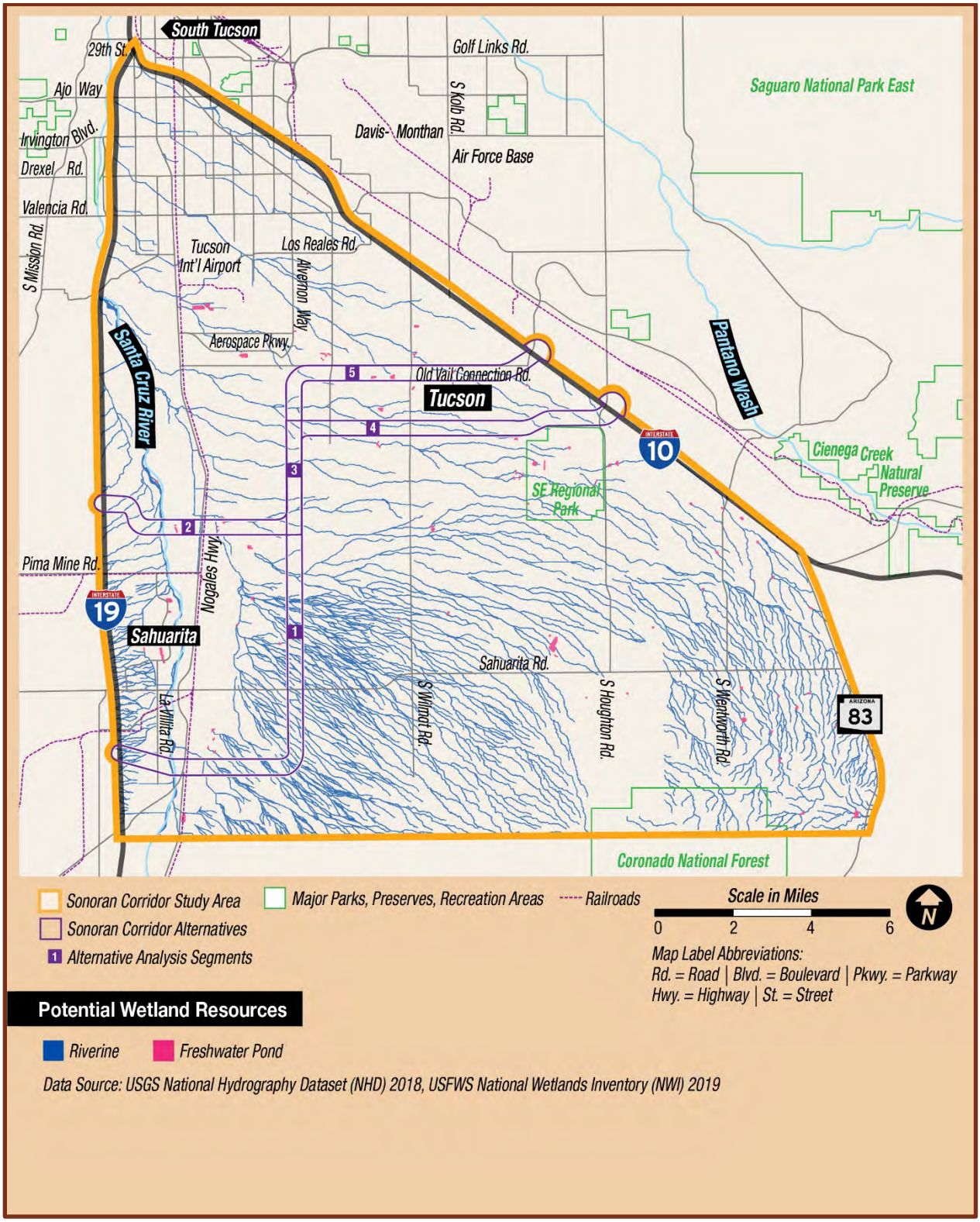


Table 3-48. Potential Waters of the US Classified as Wetlands by Corridor Segment

WETLAND CLASSIFICATION		DEFINITION
Freshwater Ponds	PUBF	Semi-permanently flooded palustrine system with unconsolidated bottom that has more than 25% cover of particles smaller than stones (less than 6-7 cm), and a vegetative cover less than 30%. Surface water persists throughout the growing season in most years. When surface water is absent, the water table is usually at or very near the land surface.
	PUSAh	Temporarily flooded palustrine system with unconsolidated substrates of less than 75% cover of stones, boulders or bedrock and a vegetative cover less than 30%. Surface water is present for brief periods (from a few days to a few weeks) during the growing season, but the water table usually lies well below the ground surface for most of the season. Pond has been created or modified by a man-made barrier or dam that obstructs the inflow or outflow of water.
	PUSJh 33	Intermittently flooded palustrine system with unconsolidated substrates of less than 75% cover of stones, boulders or bedrock and a vegetative cover less than 30%. Surface water is present for variable periods without detectable seasonal periodicity. Weeks, months, or even years may intervene between periods of inundation. Pond has been created or modified by a man-made barrier or dam that obstructs the inflow or outflow of water.
Riverine	R4SBA	Temporarily flooded riverine system. Surface water is present for brief periods (from a few days to a few weeks) during the growing season, but the water table usually lies well below the ground surface for most of the season.
	R4SBAx	Temporarily flooded riverine system with channels that were excavated by humans. Surface water is present for brief periods (from a few days to a few weeks) during the growing season, but the water table usually lies well below the ground surface for most of the season.
	R4SBC	Seasonally flooded riverine system. Surface water is present for extended periods especially early in the growing season, but is absent by the end of the growing season in most years. The water table after flooding is variable, extending from saturated to the surface to a water table well below the ground surface.
	R4SBJ	Intermittently flooded riverine system. Surface water is present for variable periods without detectable seasonal periodicity. Weeks, months, or even years may intervene between periods of inundation.
	R5UBH	Riverine system with unknown flow regime and an unconsolidated bottom with more than 25% cover of particles smaller than stones (less than 6-7 cm), and a vegetative cover less than 30%.

Although jurisdiction wetlands are not anticipated within the corridor alternatives, for the comparison purposes in this Tier 1 analysis Table 3-49 shows a summary of the potential wetlands present by corridor segment. Corridor Segment 1 has the highest acreage of potential wetlands, with 83.02 acres, and Corridor Segment 3 has the lowest acreage, with 5.97 acres of potential wetlands. While all potential wetlands in Corridor Segments 1 and 3 are riverine, Corridor Segment 5 has the highest acreage of freshwater potential wetlands, with 9.22 acres.

Table 3-49. Potential Waters of the US Classified as Wetlands by Corridor Segment

WATERS OF THE US	CORRIDOR SEGMENT 1	CORRIDOR SEGMENT 2	CORRIDOR SEGMENT 3	CORRIDOR SEGMENT 4	CORRIDOR SEGMENT 5
Number of Riverine Wetlands	5	12	9	9	10
Riverine Wetland (acres)	83.02	19.53	5.97	15.81	11.72
Number of Freshwater Pond Wetlands	0	5	0	0	3
Freshwater Pond Wetlands (acres)	0	6.67	0	0	9.22
Total Potential Wetlands (acres)	83.02	26.20	5.97	15.81	20.94
Percentage of Potential Wetlands[1]	55%	17%	4%	10%	14%

[1] Percentage of potential wetlands is calculated using the total acreage of potential wetlands.

3.14.1.4 Environmental Consequences

This section describes the impacts to Waters which include potentially jurisdictional ephemeral washes and potential wetlands that were considered within the corridor alternatives. Table 3-50 shows a summary of the potential Waters present by corridor alternative that will be discussed in the following section.

Table 3-50. Potential Waters of the US by Corridor Alternative

POTENTIAL WATERS OF THE US	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
Number of Ephemeral Washes	33	113	109
Length of Ephemeral Washes (feet)	72,185	211,811	220,569
Percentage of Ephemeral Washes[1]	26%	76%	79%
Number of Riverine Wetlands	31	24	23
Riverine Wetland (acres)	37.22	100.71	104.80
Number of Freshwater Pond Wetlands	8	3	0
Freshwater Pond Wetlands (acres)	15.90	9.22	0.00
Total Wetlands (acres)	53.11	109.93	104.80
Percentage of Wetlands[2]	35%	72%	69%

[1] Percentage of ephemeral drainages is calculated using the length of ephemeral washes.
[2] Percentage of potential wetlands is calculated using the total acreage of potential wetlands.

Corridor Alternative 1

Complete avoidance of Waters is not feasible if a roadway were constructed within Corridor Alternative 1, but the effects would vary based on the alignment of a future highway within the corridor. Ephemeral drainages that flow perpendicular to the corridor would be impacted less by construction of a highway than washes that flow parallel to the corridor. Waters that flow perpendicular would be affected only by the length of a culvert required to allow flows to pass beneath the roadway plus any erosion or scour control constructed within the OHWM. Impacts could be minimized further by using a

bridge to entirely span Waters. Longer reaches of Waters that parallel the corridor could be affected by cuts, fills, or diversion structures, or may be relocated or truncated to accommodate construction of a highway.

Corridor Segments 2 and 5 both have parallel ephemeral washes that flow for over 1 mile within the corridor. Despite this, Corridor Alternative 1 has both the fewest ephemeral washes and lowest percentage of potential Waters among all corridor alternatives. Corridor Alternative 1 also has the lowest percentage of total potential wetlands, but this corridor alternative contains all of the freshwater pond wetlands located within the corridor alternatives. Thus, the number of individual freshwater ponds and total acreage of potential wetlands that are freshwater ponds are the highest in Corridor Alternative 1. As discussed above, freshwater ponds have the most potential to possess the characteristics of a jurisdictional wetland, and thus are more likely to require a Section 404 Individual Permit and heightened mitigation.

Due to the narrow width of parallel washes within this 2,000-foot-wide corridor alternative, a future highway could be aligned to minimize impacts. Complete avoidance of ephemeral drainage is not feasible, because all watercourses identified in this analysis span the corridor alternative. Conversely, the freshwater ponds within Corridor Alternative 1 are small and could be avoided entirely or partially, depending on the future highway alignment within the corridor alternative. Thus, avoidance of jurisdictional ephemeral washes by Corridor Alternative 1 is not feasible but a future highway alignment in Corridor Alternative 1 is anticipated to completely avoid potential wetlands.

Corridor Alternative 1 crosses allotted lands of the SXD. ADOT and FHWA have been in ongoing and frequent contact with SXD, TON, the Allottee Association, and the affected allottees who own property in the proposed Corridor Alternative 1. Information collected from affected allottees to date suggests a lack of critical support for Alternative 1. Although Corridor Alternative 1 is anticipated have the least impact to Waters within the Study area among the corridor alternatives, it would not likely satisfy practicability considerations that are associated with Section 404(b)(1) of the CWA as the LEDPA at a Tier 1 level due to the corridor's path through allotted lands of the SXD and the inability to condemn the land for future Tier 2 projects without allottee approval.

Corridor Alternative 7

Similar to Corridor Alternative 1, effects to Waters are unavoidable if a highway were constructed within Corridor Alternative 7, but the effects would vary based on the alignment of a future highway within the corridor alternative. Corridor Alternative 7 has the fewest number of ephemeral washes that parallel the corridor. Conversely, this corridor alternative contains the most ephemeral washes of all the corridor alternatives and the majority of these drainages flow perpendicular to the corridor. Ephemeral washes that flow perpendicular to a roadway are impacted less by it than washes that flow parallel to it. Waters that flow perpendicular would be affected only by the length of a culvert required to allow flows to pass beneath a future highway plus any erosion or scour control constructed within the OHWM. Impacts could be minimized further by using a bridge to entirely span Waters, but given the small size and close proximity of ephemeral washes in this corridor alternative, this would likely not be a feasible design option.

The highest percentage (i.e., approximately 72 percent) of the potential wetlands among the three Corridor Alternatives is located in Corridor Alternative 7. Riverine wetlands comprise most of these

potential wetlands and are less likely to possess the characteristics of jurisdictional wetlands that require higher mitigation ratios. Three freshwater ponds totaling 9.22 acres of potential wetland are located within Segment 5 of this corridor alternative. Similar to Corridor Alternative 1, all freshwater ponds within Corridor Alternative 7 are small and could easily be avoided entirely or partially, depending on the future highway alignment within the corridor. Thus, avoidance of jurisdictional ephemeral washes by a future freeway in Corridor Alternative 7 is not feasible but a future highway alignment in Corridor Alternative 7 is anticipated to completely avoid potential wetlands.

At the moment, there is nothing that would preclude future Tier 2 alignments located within Corridor Alternative 7 from satisfying all conditions that are associated with Section 404(b)(1) of the CWA in regard to determining a LEDPA. Corridor Alternative 7 contains the most ephemeral washes of all the corridor alternatives, but a future highway alignment within this corridor would result in the fewest impacts on Waters due to majority of these drainages flowing perpendicular to the corridor, allowing for more direct crossings. Future Tier 2 studies would provide a quantitative analysis of impacts to Waters. Should an individual permit be required, the LEDPA, after considering cost, existing technology, and logistics, in light of overall project purposes, would be identified within the selected corridor during the Tier 2 study.

Corridor Alternative 8A

As with all other corridor alternatives, effects to Waters could not be avoided if a highway were constructed within Corridor Alternative 8A, but the effects would vary based on its alignment within the corridor. Corridor Alternative 8A does not contain the most ephemeral washes of the corridor alternatives, but it has the highest acreage and percentage of ephemeral washes because several of these washes parallel Segment 4 of this corridor alternative. Complete avoidance of the ephemeral washes through strategic alignment of a future highway is not feasible because the washes span the entire corridor alternative, though impacts to potential Waters could be significantly reduced within Corridor Alternative 8A.

Potential wetlands found in Corridor Alternative 8A are limited to riverine wetlands. No freshwater ponds are located within this corridor alternative; thus, Corridor Alternative 8A would have the least potential for containing a jurisdictional wetland in a Tier 2 analysis. Because wetlands are not likely present within this corridor alternative, Corridor Alternative 8A has the least potential to impact wetlands. Although wetland impacts are not likely with a future highway alignment in Corridor Alternative 8A, avoidance of jurisdictional ephemeral washes is not feasible and Corridor Alterative 8A is likely to have the highest acreage of impacts to potential Waters.

Similar to Corridor Alternative 7, at this time there is nothing that would preclude future Tier 2 specific alignments located within Corridor Alternative 8A from satisfying all conditions that are associated with Section 404(b)(1) of the CWA in regard to determining a LEDPA. However, unlike Corridor Alternative 7, Corridor Alternative 8A has several parallel drainages that prevent direct (i.e., perpendicular) crossings, or crossings that span the drainage and avoid impacts to Waters altogether. Thus, a future highway alignment within Corridor Alternative 8A is likely to have more impacts to Waters than Corridor Alternative 7. Future Tier 2 studies would provide a quantitative analysis of impacts to Waters. Should an individual permit be required, the LEDPA, after considering cost, existing technology, and logistics, in light of overall project purposes, would be identified within the selected corridor during the Tier 2 study.

No-Build Alternative

Under the No-Build Alternative, no future freeway within the corridor alternatives would be constructed. Vehicular travel through the study area could continue according to existing patterns along the existing transportation network. The No-Build Alternative would include the programmed improvements to the regional transportation system that are in PAG's federally approved Metropolitan TIPs. These individual improvement projects could have localized impacts on Waters, such as placement of fill, that would require authorization under Section 404 of the CWA. Overall, the No-Build Alternative would impact Waters as a result of separate and distinct improvement projects, but they would likely be more localized and discrete compared to the more comprehensive, wide-ranging impact of constructing a future highway within one of the corridor alternatives.

3.14.1.5 Available Mitigation Measures

Future impacts to jurisdictional Waters due to construction of a highway within one of the corridor alternatives would be authorized under one of the CWA Section 404 permits identified in Table 3-52. Under the Section 404 permitting process, design and construction of a new transportation facility under any of the corridor alternatives would require avoidance, minimization, and then mitigation for unavoidable impacts. Waters would be delineated in conjunction with Tier 2 NEPA documentation. Avoidance could be accomplished by designing and constructing a future highway alignment within the 2,000 foot-wide corridor alternative away from Waters to the extent possible. Minimization of impacts could also be achieved by shifting the construction footprint of a future highway alignment. For example, if a jurisdictional watercourse is particularly wide on one side of the 2,000foot-wide corridor, the roadway could be shifted to a narrower reach within the corridor. However, alignment shifts are dependent on many factors, including design standards and impacts to other environmental resources. Structural design and construction techniques which minimize impacts to Waters would also be considered and implemented as necessary during Tier 2 analysis.

Where avoidance or minimization of impacts to Waters is not feasible, mitigation strategies could be implemented. These could potentially include in-lieu fees and on-site or off-site permittee-responsible mitigation, such as vegetation or habitat restoration. Coordination with the Corps and appropriate state resource agencies to develop mitigation strategies would also take place during the Tier 2 NEPA process, after unavoidable impacts have been identified. Mitigation for unavoidable impacts to Waters would be addressed in detail in the Tier 2 NEPA document.

3.14.1.6 Conclusion

In conjunction with the Tier 2 NEPA documentation, a JD would be conducted to determine water resources that are recommended as Waters and are subject to Section 404 permitting. In addition, a detailed impact analysis and quantification of permanent impacts to delineated Waters would occur during the Tier 2 analysis when the design of a future highway alignment within the corridor alternatives is being developed. None of the corridor alternatives provide the opportunity for complete avoidance of jurisdictional Waters because they all cross the Santa Cruz River and ephemeral washes. According to Section 404(b)(1), when avoidance of Waters is not practicable, impacts would be minimized, and unavoidable impacts mitigated. During Tier 2, coordination would take place with the Corps to determine Section 404 permitting and mitigation requirements. The general and special conditions of the future

Section 404 Permit would minimize impacts on Waters to the extent practicable. Any mitigation measures included by the Corps in the permit verification letter(s) would need to be included in Tier 2 NEPA environmental and construction documents. Table 3-51 shows the various Section 404 permitting scenarios that could be encountered during Tier 2. These scenarios assume the highest level of notification; thus, thresholds for both the RGP and NWP assume a pre-construction notification would be prepared. The last 3 columns identify conditions of each of the permit criteria listed in the first column, that construction of a highway project must meet to be authorized under a given permit.

Table 3-51. Tier 2 Section 404 Permitting Scenarios

PERMIT CRITERIA	RGP 96 WITH A PRE-CONSTRUCTION NOTIFICATION	NWP 14 WITH A PRE-CONSTRUCTION NOTIFICATION	INDIVIDUAL PERMIT
Acreage of Impacts to Waters of the US (determined on a per crossing basis)	Impacts <1 acre	Impacts <0.50 acre	No impact threshold
Land Ownership	ADOT ROW/Easement through non-Tribal lands	Any land ownership	Any land ownership
Biological Resources	Allows adverse impacts to biological resources with complete Section 7 consultation unless it jeopardizes the continued existence of a threatened or endangered species	Allows adverse impacts to biological resources with complete Section 7 consultation unless it jeopardizes the continued existence of a threatened or endangered species	Allows adverse impacts to biological resources with complete Section 7 consultation unless it jeopardizes the continued existence of a threatened or endangered species
Cultural Resources	May affect cultural resources with sufficient Section 106 consultation	May affect cultural resources with sufficient Section 106 consultation	May affect cultural resources with sufficient Section 106 consultation
Special Aquatic Sites	Impacts <0.025 acre	No impacts to special aquatic sites	May impact special aquatic sites
General/Regional Conditions	Complies with all general, special, and regional conditions	Complies with all general and regional conditions	Must comply with all conditions of an Individual Permit
Additional Section 404 Permitting Requirement(s)	Would require a separate permit for impacts from geotechnical investigations or utilities.	Would require a separate permit for impacts from geotechnical investigations or utilities.	Could cover all impacts from all construction activities.

3.14.2 Water Quality

This section assesses the potential effects of sediment erosion and chemical pollution from the future construction and operation of a highway and from the No-Build Alternative on surface water resources (e.g. streams, lakes, ponds, wetlands) as well as ground water.

3.14.2.1 Regulatory Framework

The CWA (33 U.S.C. 1251) is the primary federal statute regulating the discharge of sediment erosion and chemical pollution to surface water resources (e.g., streams, lakes, ponds, wetlands) as well as ground water. As discussed in Section 3.14.1.1, the principal goal of the CWA is to establish water quality standards to restore and maintain the chemical, physical, and biological integrity of the nation's jurisdictional waters by preventing the discharge of pollutants into Waters. Pollution sources that are regulated under the CWA include both point (concentrated output) and non-point (widely scattered output) sources. While effects to Waters are addressed in Section 3.14.1, Waters of the US, CWA compliance is discussed here for its applicability to water quality. Section 404 of the CWA regulates the discharge of earthen fill, concrete, and other construction materials into Waters and authorizes the Corps to issue permits regulating such discharges. Section 401 of the CWA requires any applicant requesting a federal permit or license for activities that may result in discharge into Waters to first obtain a Section 401 certification from the state in which the discharge originates. The Section 401 certification verifies that the prospective permits comply with the state's applicable effluent limitations and water quality standards. Federal permits or licenses are not issued until the Section 401 certification is obtained. In Arizona, Section 401 water quality certification is administered by ADEQ if the permitted activity is located on non-Tribal lands. For permitted activities located on Tribal land, the Section 401 water quality certification is obtained from either EPA or the respective Tribe. If a project meets the terms and conditions of a Nationwide Permit and the criteria for conditional Section 401 certification, notification to ADEQ or EPA is not required. However, if a project does not meet the criteria for conditional certification, such as projects occurring within 0.25 mile of unique or impaired waters, an individual Section 401 certification application is required.

Section 402 of the CWA forms the National Pollutant Discharge Elimination System (NPDES), which regulates point-source pollutant discharges, including stormwater, into Waters. Discharges under NPDES must conform to a permit that stipulates discharge limits, monitoring and reporting requirements, and outlines special conditions to reduce impacts to water quality from the project's specific discharging pollutants (33 U.S.C. 1342). Section 402(p) requires the implementation of controls for certain stormwater discharges. Permit types under this regulation were implemented in two phases depending on the size and type of operator. Phase I regulation (64 FR 68722) requires stormwater discharges from large construction sites (i.e., greater than 5 acres), certain industrial activities, and medium and large Municipal Separate Stormwater Sewer Systems (MS4) (i.e., serving a population of 100,000 or more) to obtain NPDES permit coverage and implement a stormwater management program. Phase II regulation (64 FR 68722) requires small MS4s (i.e., those serving a population less than 100,000) and construction sites that disturb 1 to 5 acres to obtain a permit for stormwater discharges. Construction activities are covered under a construction general permit, which is issued every 5 years and requires the preparation of a Stormwater Pollution Prevention Plan (SWPPP) and implementation of erosion control best management practices for construction activities exceeding 1 acre of ground disturbance.

In 2002, ADEQ was delegated the authority from EPA to administer the NPDES program at the state level, resulting in the Arizona Pollutant Discharge Elimination System (AZPDES). For point-source pollutant discharges on Tribal land or other federal land, a permit must be obtained through the NPDES program administered by EPA Region 9. As with the NPDES program, AZPDES permits are

tailored to the projects' discharging pollutants. The first construction general permit was issued by ADEQ in 2003; ADEQ requires operators that serve populations greater than 100,000 to obtain Phase I MS4 Permits and develop individual programs for stormwater management (ADEQ, 2013). Within the study area, corridor operators holding Phase I MS4 permits include ADOT, Pima County, and City of Tucson. ADOT's Stormwater Management Plan identifies the program and procedures implemented by ADOT to minimize, to the extent practicable, the release of pollutants to and the discharge of pollutants from the ADOT MS4 (ADOT, 2017). Pima County developed a Stormwater Management Program that describes the control measures Pima County uses to protect surface water quality (Pima County, 2015), and the City of Tucson passed Stormwater Management Ordinance Number 10209 in 2005 (City of Tucson, 2005).

Unique and Impaired Waters

The Arizona List of Unique Waters [Arizona Administrative Code R18-11-112(E)] and the Arizona 2006/2008 Section 303(d) and 2016 lists of Impaired and Not Attaining Waters were reviewed to determine whether any unique or impaired waters are present. There are no unique waters, EPA Section 303(d) non-attaining impaired waters, or EPA Section 303(d) impaired waters occur in or within 1 mile of the study area. Therefore, impacts to these resources were not evaluated as part of this Draft Tier 1 EIS.

Groundwater Resources

The Safe Water Drinking Act of 1974 (42 U.S.C. 300 et seq.) protects drinking water supplies in areas where there are few or no alternatives to groundwater resources and where, if contamination occurred, using an alternative source would be extremely expensive (USEPA, 2017). Under Section 1424(e) of the Safe Water Drinking Act, EPA is authorized to review proposed projects within a sole source aquifer (SSA) that are federally funded. An SSA is defined by EPA as an aquifer that supplies at least 50 percent of the drinking water for its service area where there are no reasonably available alternative drinking water sources should the aquifer become contaminated (USEPA, 2019). In Arizona, EPA developed a MOU with FHWA and ADOT to establish review responsibilities under the SSA program, and to list categories of projects which should or should not be referred to EPA for review. As previously mentioned, because ADOT has assumed FHWA's NEPA responsibilities under both a 326 MOU and 327 MOU, ADOT is solely liable and responsible for Tier 2 coordination with EPA that is associated with the SSA program.

The SSA program only provides limited federal protection of ground water resources which serve as drinking water supplies. It is not a comprehensive ground water protection program. Protection of ground water resources can best be achieved through an integrated and coordinated combination of federal, state, and local efforts. In Arizona, ADEQ has a responsibility to maintain Arizona's primary enforcement authority of the Safe Drinking Water Act (ARS § 49-353(A)(2)(a)). Rules pertaining to Arizona's drinking water and the aquifer water quality standards adopted by ADEQ are located in Title 18, Chapter 4, of the Arizona Administrative Code (AAC) (18 AAC 4). ADEQ has delegated the Pima County Department of Environmental Quality the oversight of inspections, engineering plan reviews, and compliance and enforcement activities for all public water systems in Pima County. A public water system is defined as a water system that serves 15 or more connections, or 25 or more people, for more than 60 days a year (Pima County, 2019).

Arizona's Groundwater Management Code of 1980 recognized the continued depletion of finite groundwater supplies as a threat to prosperity and quality of life. To manage this finite resource, the Groundwater Code established the Arizona Department of Water Resources (ADWR) to administer the Code's three levels of water management (ADWR, 2019):

- The lowest level of management includes general provisions that apply statewide.
- The next level of management applies to Irrigation Non-Expansion Areas.
- The highest level of management, with the most extensive provisions, is applied to AMAs where groundwater overdraft is most severe. A total of five AMAs (i.e., Cities of Phoenix, Tucson, and Prescott, and Pinal and Santa Cruz Counties) have been created.

The Arizona Legislature established the Underground Water Storage and Recover Program in 1986 to allow persons to store surplus supplies of water underground and recover it at a later time. The recharge program was further defined by the *Underground Water Storage, Savings, and Replenishment Act* that was enacted by the Legislature in 1994. Together, the Underground Water Storage and Recover Program and the *Underground Water Storage, Savings, and Replenishment Act* define Arizona's recharge program (ARS 45-801 et seq.; AAC R12-12-151). ADWR administers the recharge program and its associated permits.

The *Fish and Wildlife Coordination Act* requires federal agencies to consult with USFWS before undertaking or approving water projects that would control or modify surface water (16 U.S.C. 662).

3.14.2.2 Methodology

To assess the effects from a future highway alignment on water quality, each 2,000-foot-wide corridor alternative was overlaid on GIS data to identify and locate the resources present in each corridor. GIS data reviewed for this assessment were obtained from:

- ADEQ to determine the presence of impaired waters and waters not attaining Arizona's water quality standards.
- ADWR for data on registered wells.
- EPA and ADWR for data on SSAs and AMAs.
- USFWS NWI reviewed to identify wetland resources, as explained in Section 3.14.1.2.
- US Geological Survey National Hydrography Dataset for data on watershed boundaries. Also reviewed for surface waters, as explained in Section 3.14.1.2.

Potential environmental consequences to water quality from construction of a highway is primarily the same across all corridor alternatives due to the presence of the same resources in all study corridors. Environmental consequences vary with surface waters and wetlands, but effects to water quality in these resources is thoroughly discussed in Section 3.14.1.4. Construction of a new highway within the corridor alternatives would increase the amount of impervious surface (i.e., pavement), which influences stormwater runoff flow and volume. Increased impervious surface increases the potential for flooding because natural, pervious surface is no longer exposed for stormwater absorption. However, the amount of ground surface to be converted to impervious would be a very small fraction of the exposed, pervious surface in the surrounding

area. Additionally, potential flooding would be mitigated through drainage design. Compliance with CWA Section 401 Water Quality Certification and Section 402 NPDES or AZPDES permit requirements would be necessary. As previously discussed, permit requirements would be considered during Tier 2 evaluations.

All corridor alternatives are located in the Upper Santa Cruz and Avra Basin SSA, and wells provide a more direct pathway for runoff to infiltrate groundwater. The number of wells within a corridor alternative correlates to the potential for groundwater contamination and the types of mitigation measures that may be required. More wells within a corridor alternative also increases their potential to come into conflict with a future highway alignment and the likelihood of well relocations. For each corridor alternative the number of registered wells was determined through GIS analysis.

3.14.2.3 Affected Environment

The corridor alternatives are located in the Upper Santa Cruz watershed (8-digit Hydrologic Unit Code 15050301). As discussed in detail in Section 3.13.4.3, surface waters (i.e., streams, rivers, lakes, and ponds) throughout the corridor alternatives are ephemeral and are primarily washes that convey stormwater runoff to the Santa Cruz River. The Santa Cruz River is the largest watercourse in the study area, and it crosses all corridor alternatives flowing south to north. Ephemeral washes predominantly flow southeast to northwest or east to west across the study corridors. Though a few washes located west of the Santa Cruz River flow southwest to northeast, there are no lakes within the study corridors, and ponds are limited to water catchments (e.g., retention basins, stock tanks, or other water storage or management areas for agricultural, industrial, and residential purposes) that are typically located adjacent to an ephemeral wash.

Two drainage reaches within the study area (i.e., Julian Wash and the Santa Cruz River south of Pima Mine Road) have designated uses typical of medium- to large-sized ephemeral drainages, though neither drainage reach was assessed in the 2016 Water Quality in Arizona 305(b) Assessment Report. Julian Wash is located north of the corridor alternatives and is designated for aquatic and wildlife (ephemeral), and partial body contact uses. The same uses, along with agricultural livestock watering, were designated for the Santa Cruz River south of Pima Mine Road, which is crossed by Segment 1 of Corridor Alternatives 7 and 8A.

Groundwater is underground water in fractures and pores spaces between soil, sand, and rock, and is a significant source of water throughout Arizona, comprising approximately 43 percent of the total supply. It can originate from precipitation that infiltrates through soil and moves slowly through geologic formations of soil, sand, and rocks called aquifers. In the regions surrounding the study corridors, groundwater is a major source of potable and irrigation water. All study corridors are within the Upper Santa Cruz and Avra Basin SSA designated area, which covers approximately 4,591 square miles in southern Arizona (USEPA, 2008). Similarly, all corridor alternatives are located in the Tucson AMA which covers approximate 3,869 square miles and extends from the border with Mexico to approximately 40 miles north of Tucson (ADWR, 2010). The management goal for the Tucson AMA is to establish a safe yield condition by 2025 so that no more groundwater is being withdrawn than is being annually replaced. No other SSAs or AMAs are located within the study area.

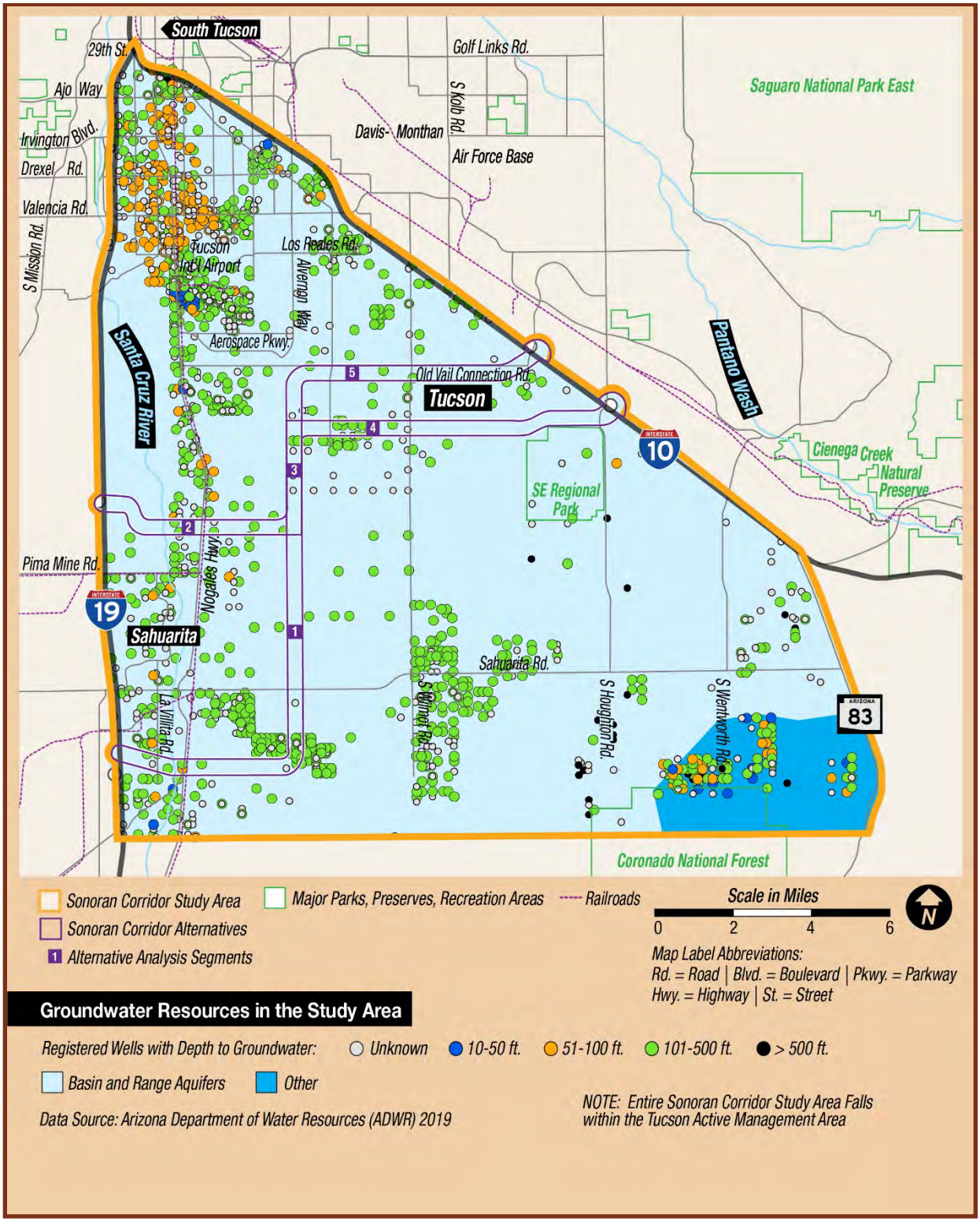
Tucson's Colorado River water allocation is managed by the Clearwater Renewable Resource Facility, which consists of the Clearwell Reservoir and two major aquifer storage and recovery projects: the Central Avra Valley Storage and Recovery Project (CAVSARP) and the Southern Avra Valley Storage and Recovery Project (SAVSARP) (City of Tucson, 2013). Colorado River water delivered to Tucson via the Central Arizona Project canal sinks into the ground and recharges the aquifer in Avra Valley at CAVSARP and SAVSARP. Water is eventually pumped from the CAVSARP and SAVSARP to the surface and held in the Clearwell Reservoir before being delivered to Tucson Water customers (City of Tucson, 2019). Through the recharge and recovery process at the CAVSARP and SAVSARP, Colorado River water mixes with native groundwater to produce a blended water supply to Tucson Water customers (City of Tucson, 2013).

There are 58 groundwater wells within the corridor alternatives which show groundwater levels ranging from about 79 feet to 355 feet below ground surface (Figure 3-41). Groundwater depth can affect transportation construction, especially in the case of shallow groundwater. However, groundwater throughout the corridor alternatives is relatively deep (> 79 feet), which has a less tangible effect on design and construction. Wells are owned by private, municipal, utility, and corporate entities and are used for irrigation, livestock watering, private and public water supplies, groundwater monitoring, and geotechnical information. A total of 28 wells are located within Corridor Segment 1, which is almost 3 times the number of wells in any other segment. Thus, corridor alternatives that include Corridor Segment 1 (i.e., Corridor Alternative 7 and Corridor Alternative 8A) had the highest number of wells each falling within their boundaries. Table 3-52 shows the total and percentage of wells present by corridor alternative and a summary of groundwater depth by alternative. Wells are often considered a threat to groundwater quality as they provide a more direct pathway for runoff to infiltrate groundwater. All wells affected by construction of a future highway would be properly abandoned in accordance with ADWR standards prior to construction activities; therefore, there would be no potential for discharges to the sole source aquifer with any of the corridor alternatives.

Table 3-52. Wells and Groundwater Depth by Corridor Alternative

OTHER WATERS	CORRIDOR ALTERNATIVE 1	CORRIDOR ALTERNATIVE 7	CORRIDOR ALTERNATIVE 8A
Number of Wells	22	41	43
Percentage of Wells	38%	71%	74%
Groundwater Depth Range (feet)	80-355	79-355	79-280
Average Groundwater Depth (feet)	197	216	200

Figure 3-41. Groundwater Resources



3.14.2.4 Environmental Consequences

This section describes water quality-related impacts to both surface water and groundwater resources. Water quality-related impacts to surface water may include increases in sediment loading into receiving watercourses, release of pollutants generated by traffic, and erosion of unprotected banks. Construction of a future highway in any of the corridor alternatives would require authorization under a CWA Section 404 permit, and Section 401 water quality certification. Additionally, construction activities would exceed 1 acre of ground disturbance, thus requiring the preparation and implementation of a SWPPP as well as implementation of erosion control best management practices for the protection of Waters. After construction is complete, a future highway would be part of ADOTs municipal separate storm sewer system (MS4) and would be managed in accordance with ADOTs Stormwater Management Plan (SWMP) for compliance with their AZPDES MS4 Permit. A future highway in any of the corridor alternatives would require the implementation of control measures to protect water quality from pollutant loading in discharges associated with highway runoff.

Water quality-related impacts to groundwater are most often affected by wells. As discussed above, all wells affected by construction of a future highway would be properly abandoned in accordance with ADWR standards prior to construction activities and there would be no potential for discharges to an SSA with any of the corridor alternatives. Another groundwater concern is depth to groundwater which can affect the design and construction of a future highway. Shallow groundwater can affect the geotechnical design of foundations and roadway subgrade and require dewatering during construction, but deeper groundwater has a less tangible effect on design and construction. Average depth to groundwater in all the corridor alternatives is greater than 100 feet. Therefore, shallow groundwater is not anticipated to cause design or construction challenges to a future highway in any of the corridor alternatives and impacts to groundwater resources are not anticipated with any of the corridor alternatives.

Corridor Alternative 1

Corridor Alternative 1 differs from the other corridor alternatives in that the western portion of this alternative crosses allotted lands of the TON SXD. Therefore, Section 401 water quality certification for construction of future highway within this corridor would be issued from EPA for those portions of the project located on TON lands and from ADEQ for all other portions of the project. Similarly, the project would require coverage under both NPDES and AZPDES. Corridor Alternative 1 is also the shortest corridor. Therefore, the construction footprint would be the smallest with this alternative and a future highway would result in the creation of less impervious surface area compared to the other corridor alternatives. Both a smaller construction footprint and less impervious surface area reduces the potential sediment and pollutant loading of stormwater runoff.

Corridor Alternative 7

Water resources that affect water quality are relatively the same in Corridor Alternative 7 and Corridor Alternative 8A. This alternative will require Section 401 water quality certification from ADEQ and would require coverage under AZPDES. Corridor Alternative 7 is longer than Corridor Alternative 1 and the construction of a future highway would thus result in a larger construction footprint and conversion of more surface area to impervious. Preparation and implementation of a SWPPP, implementation of erosion control best management practices, and compliance with the conditions of the Section 401 water quality certification would all be required to protect water quality during construction, and after construction is completed, control measures would be employed to ensure that stormwater discharges

conform to the requirements of ADOTs SWPPP. However, due to the larger area impacted by construction of a future highway in this corridor, Corridor Alternative 7 has higher potential sediment and pollutant loading of stormwater runoff than Corridor Alternative 1.

Corridor Alternative 8A

Water resources that affect water quality in Corridor Alternative 8A are almost exactly the same as Corridor Alternative 7. Corridor Alternative 8A is slightly larger than Corridor Alternative 7. Therefore, a future highway alignment within this corridor would have the largest footprint and have the highest potential sediment and pollutant loading of stormwater runoff.

No-Build Alternative

Under the No-Build Alternative, a future highway within the corridor alternatives would not be constructed and no project-related effects on water quality would occur. Vehicular travel through the study area could continue according to existing patterns along the existing transportation network. The No-Build Alternative would include the programmed improvements to the regional transportation system that are in PAG's federally approved Metropolitan TIPs. These individual improvement projects would require a Section 404 permit and Section 401 water quality certification if they result in discharge of dredge or fill material into Waters. Coverage under NPDES and/or AZPDES would also be necessary if the ground disturbance associated with the project exceeds 1 acre. Construction activities associated with individual improvement projects would not influence sediment and pollutant loading of stormwater runoff or potential contaminants to groundwater.

3.14.2.5 Available Mitigation Measures

Stormwater discharges associated with future construction of a highway within one of the corridor alternatives would require coverage under an AZPDES and if applicable, NPDES construction general permit. Specific mitigation measures would be determined during Tier 2 analysis when a highway alignment has been developed. However, mitigations and standard specifications that can be anticipated include the following:

- Obtain CWA Section 402 permit authorization through the AZPDES and/or NPDES Construction General Permit, as necessary.
- Obtain CWA Section 401 water quality certification by ADEQ and/or EPA, as necessary.
- In compliance with the Construction General Permit, develop a Stormwater Pollution Prevention Plan that includes the most current best management practices for erosion and sediment control.
- Incorporate design for Low Impact Development/Green Infrastructure and Post Construction Water Quality Control Measures, in compliance with ADOT's MS4 permit and Sustainability programs.

3.14.2.6 Conclusion

In general, the affected environment, environmental consequences, and available mitigation measures for water quality-related impacts to both surface water and ground water resources are similar for all corridor alternatives. While the limits of Corridor Alternative 7 and Corridor Alternative 8A both encompass more surface area and have a higher potential for sediment and pollutant loading of stormwater runoff, impacts to water quality from construction of a highway within any of the corridor alternatives would be mitigated through compliance with CWA regulations (i.e. Section 404, 401 and 402).

All corridor alternatives are within the Upper Santa Cruz and Avra Basin SSA designated area. As previously mentioned, ADOT has assumed FHWA's NEPA responsibilities under both a 326 MOU and 327 MOU. ADOT is solely liable and responsible for coordinating any project review associated with the SSA program with the EPA during Tier 2.

3.14.3 Flood Hazard Evaluation and Floodplain Mitigation

This section assesses the potential effects on regulated and non-regulated floodplains from the construction and operation of a highway within a corridor alternative as well as from the No-Build Alternative.

3.14.3.1 Regulatory Framework

The National Flood Insurance Program was created in part to set national standards for regulating new development in floodplains. The national program of floodplain mapping is administered by the Federal Emergency Management Administration (FEMA) to identify areas to guide local policy, such as zoning and building codes, to local jurisdictions and developers and establish eligibility for property owners to receive coverage under the National Flood Insurance Program. Local policies that apply to the study area include those of the Pima County Flood Control District that apply to unincorporated county areas, and Tucson's Planning and Development Services, which regulates development for locations within the City of Tucson's corporate limits.

FEMA issues flood zone maps on a countywide level. Among other provisions, the National Flood Insurance Program regulations state that construction is located within a regulatory floodway, as delineated on the Flood Insurance Rate Map, must not increase base flood elevation levels (44 CFR 59-65).

Floodplain Management for transportation projects is regulated by USDOT Order 5650.2 "Floodplain Management and Protection." The purpose of USDOT Order 5650.2 is to ensure that proper consideration is given to the avoidance and mitigation of adverse floodplain impacts by USDOT actions, planning programs, and budget requests (U.S. Department of Transportation, 1979).

EO 11988—Floodplain Management, requires federal agencies "to avoid, to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative" (42 FR 26951). This EO establishes an eight-step process that agencies should carry out as part of the decision-making process on projects that could impact floodplains.

EO 13690—This executive order amended EO 11988 to improve the Nation's resilience to current and future flood risk and established the Federal Flood Risk Management Standard (80 FR 6425). EO 13690 guides agencies to use a higher flood elevation and expanded flood hazard area than the base flood to ensure that future changes are adequately accounted for in agency decisions.

According to Pima County, the Flood Control District "strives to use forward-looking floodplain management planning practices to minimize the risk of flood and erosion damage for all county residents, property, and infrastructure. These efforts include identifying high flood risk areas, preserving natural watercourses, constructing flood control facilities, establishing locally appropriate development standards, distributing public information, providing early warning, and responding to flood emergencies." Although the County is primarily concerned with ensuring new residential and commercial developments are limited to locations outside of flood hazards, they maintain an interest in the compatibility of new transportation facilities with their goals to minimize floods risks.

County Flood Control Districts require a Floodplain Use Permit for a project within a jurisdictional floodplain. Approval of a Floodplain Use Permit typically requires development of a hydraulic computer model to demonstrate that facility components will not result in increased potential for flooding or erosion. This level of detail is not available at this stage of the planning process and would be addressed, as appropriate, during Tier 2 studies.

The City of Tucson has goals similar to the County that are enumerated in their municipal code (Chapter 26, Section 26-1.4):

(a) Restrict or prohibit uses which are dangerous to health, safety, and property due to water or erosion hazards, or which result in damaging increases in erosion, flood heights or velocities;
(b) Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;
(c) Control the alteration of natural floodplains, stream channels, and natural protective barriers, which help accommodate or channel floodwaters;
(d) Control filling, grading, dredging, and other development which may increase flood damage; and
(e) Prevent or regulate the construction of flood barriers which will unnaturally divert floodwaters, or which may increase flood hazards in other areas.

3.14.3.2 Methodology

The most widespread determination of flood hazards within the study area is the *Flood Insurance Study, Pima County AZ and Incorporated Areas* (2012). This county wide mapping of flood hazards was done in conjunction with the production of official FEMA Flood Insurance Rate Maps that became effective in 2011.

The *Upper Santa Cruz RiskMAP (Risk Mapping, Assessment, and Planning) Study* (2018) was conducted to provide greater detail of flood hazards not reflected in the 2011 Flood Insurance Rate Maps. These details included modeling flood risks that are statistically less frequent than the 100-year flood events. Detailed GIS and elevation data were generated to better help developers make informed decisions regarding flood hazards.

The *Airport Wash (South) Basin Management Study* (2014) similarly provides detailed flood modeling in the vicinity to the south of TUS. This effort made engineering recommendations to address previously known flooding areas and included a framework for identifying problem areas and accommodating planned and future development corridors. Earlier studies near the airport include the *Concept Design*

Report for Franco Wash Tributary Project (1997) that proposed the realignment of Bradley Wash directly into Franco Wash.

The *San Xavier Flood Hazard Study* (2014) established 100- and 500-year risks for the Santa Cruz River within and adjacent to the SXD. This study also examined risks related to erosion of the river channel and floodplain. Both scour (vertical downcutting) and lateral migration predictions were made for the river channel.

The *Hydrologic and Hydraulic Analysis for the Southeast Regional Park* (2012) was conducted for the areas in and surrounding the Pima County Fairgrounds and associated development. This study provides a base condition model for all future developments to aid in the planning and design process.

In the Sahuarita area, the *Supplementary Drainage Analysis in Support of the Tentative Block Plat for Rancho Sahuarita* (1998) was conducted to determine drainage requirements for this housing development. These requirements were based on 1997 versions of the Flood Insurance Rate Maps and made recommendations to pipe concentrated flows directly to the Santa Cruz River following the land use improvements.

The *Lee Moore Wash Basin Management Study* (2009) was initiated to identify flood hazards of a 213-square-mile area draining northwest from the Santa Rita Mountains to the Santa Cruz River. This study covers nearly the entire Sonoran Corridor study area south of TUS and east of Sahuarita. The flood-control related improvements recommended by this study have been adopted into an implementation plan which continues to be updated to address flooding "problem areas." These improvements have been conceptually designed and the opportunities and constraints identified to the local agencies and stakeholders represented within the study area.

3.14.3.3 Affected Environment

Floodplains designated by FEMA within the study area are associated with the Santa Cruz River. The Santa Cruz River and its major tributaries are also mapped as floodways (FEMA, 2015). The Pima County Regional Flood Control District completed several drainage studies within the study area. The Lee Moore Wash West Floodplain Mapping Project completed in 2019 is a revision to an earlier 2009 Lee Moore Wash Basin Management Study which identified flooding concerns. This most recent study shows that within the study area a majority of the braided washes experience flooding during the 100-year event and will be used to evaluate potential floodplain impacts in areas not currently mapped by FEMA. (See Figure 3-42.)

Figure 3-42. Mapped Floodplains and Lee Moore Wash Basin

3.14.3.4 Environmental Consequences

Corridor Alternative 1

Along the portion of Segment 2 between I-19 and the eastern boundary of the SXD, Corridor Alternative 1 crosses the Santa Cruz River floodplain in an area where detailed studies have not been conducted. East of the SXD boundary, Corridor Alternative 1 crosses portions of the Santa Cruz River that have been mapped as 100-year floodplains on FEMA Flood Insurance Rate Maps as well as those associated with the tributaries Lee Moore Wash, Pretty Ranch Wash, and Fagan Wash. The north-south oriented Segment 3 and the east-west Segment 5 connecting with I-10 do not cross any 100-year floodplains mapped on Flood Insurance Rate Maps. However, as identified in the above-listed studies, numerous flood risks less probable than the 100-year event have been identified that would be affected by this corridor alternative.

Corridor Alternative 1 would potentially impact floodplains associated with the Santa Cruz River and several tributaries. There is also potential for this corridor alternative to impact flood-prone areas that experience less frequent flooding, such as locations within 500-year floodplains, which are widespread throughout the study area and would be affected by all alternatives. Additionally, the portion of Corridor Alternative 1 located on TON land has not been subjected to a study of flood hazards, and potential impacts remain unknown for that area.

Corridor Alternative 1 has the least mapped FEMA-designated 100-year floodplain acreage within the Analysis Area (146.24 acres) and the least area identified as floodplains in the 2019 Lee Moore Study (247.47 acres). Floodplains could be affected by an increase in impervious surface, constriction or blockage of surface water flow, and the placement of fill or structures within a floodplain. Placement of fill within a floodplain could increase base flood elevation and exacerbate flooding upstream.

Corridor Alternatives 7 and 8A

Corridor Alternatives 7 and 8A have the same amount of FEMA-designated 100-year floodplain acreage within the Analysis Area (241.29 acres). Corridor Alternative 7 intersects 1,140.62 acres of floodplains identified in the Lee Moore Study while Corridor Alternative 8A intersects 1,691.80 acres. Like impacts discussed above, floodplains could be affected by an increase in impervious surface, constriction or blockage of surface water flow, and the placement of fill or structures within a floodplain.

No-Build Alternative

Allowing the transportation network to develop as a grid of arterial streets without a highway would result in similar impacts to the implementation of any one of the corridor alternatives. In a No-Build scenario, the arterial road network would likely develop as planned to support the anticipated land development and associated transportation demands. Without a highway facility, the arterial streets would likely still require the same number of crossings of the 100-year floodplain associated with the Santa Cruz River and its tributaries, as well as crossings of the diffuse and widespread 500-year hazards. Without a highway, the demands on the arterial network would be greater and facilities would likely be wider to accommodate more traffic capacity compared to a system that includes a highway. Thus, the magnitude of impacts to flood-hazard-prone areas would likely be similar when compared to the implementation of any of the corridor alternatives.

3.14.3.5 Available Mitigation Measures

Bridging the Santa Cruz River and its associated floodplain and floodway would be the most effective means of minimizing the impacts to flood hazards and ensuring the elevation of flood waters does not impact the adjacent lands. The bridge and roadway approaches would be designed in accordance with ADOT's standard specifications to ensure hydraulic flows are maintained and prevent the worsening of flood hazards. Should the No-Build Alternative be adopted, the requirements for future arterial crossings of the Santa Cruz River would be similar and local flood-control authorities' design standards would apply.

In addition to meeting the state or local bridge design standards for the Santa Cruz River crossing, coordination with local floodplain authorities would be necessary to demonstrate compliance with local design requirements for areas outside the 100-year hazard area. In many cases, local processes are prescribed in planning documents to address flood hazards by ensuring culverts are properly sized and, if flows are concentrated, the necessary modifications to the natural drainage system are employed to address potential flooding.

In some locations, especially should an alternative be implemented that involves lands on the SXD, detailed flood studies may be required. It may also be necessary to prepare a letter of map revision in the event that the implementation of an alternative modifies the topography of a mapped floodplain, to certify the changes.

3.14.3.6 Conclusion

The corridor alternatives under consideration all have the potential to impact the floodplain and floodway associated with the Santa Cruz River as well as the widespread 500-year flood hazards throughout the study area. These potential impacts are expected to be reduced or eliminated through adherence to state and local design requirements and preservation and construction of floodwater conveyances that protect both new transportation facilities and adjacent lands from flooding.

3.15 Visual and Aesthetic Scenic Resources

This section provides an overview of the regulatory framework, methodology, affected environment, environmental consequences, and available mitigation measures that could be used to mitigate effects on identified visual and aesthetic scenic resources (VASR) within and adjacent to the corridor alternatives.

3.15.1 Regulatory Framework

This section is being prepared in accordance with Section 101 (b) and 102 of NEPA and Section 14 (n)(12) of FR Vol. 64, No. 101, May 26, 1999, Notice 28545, all pertaining to visual resources.

3.15.2 Methodology

The visual resource analysis of the corridor alternatives was conducted as a broad, general review using available mapping and aerial imagery in combination with online resources such as Google Earth's aerial and street view imagery. The visual resource analysis considers impacts on existing VASRs identified within the corridor alternative areas.

3.15.3 Affected Environment

The visual environment of the study area is dominated by undeveloped fairly flat natural Upper Sonoran Desert landscape which is crossed by I-19, Nogales Highway, and the UPRR. There are also up to five named washes and a river which bisect the corridor alternatives. In addition, existing agricultural uses are either adjacent to or within portions of the corridor alternatives. Other existing visual elements include existing sparsely developed rural/residential housing; industrial uses such as a sand and gravel extraction and the ASARCO mining operation; a federal and state penitentiary; Pima County Southeast Regional Park; and numerous overhead utility transmission lines, poles, and towers crossing or running parallel to the corridor alternatives. Distant background views of several landforms that include Black Mountain, the Rincon Mountains, the Santa Catalina Mountains, the Sierrita Mountains, and the Tucson Mountains dominate the area. (See Figure 3-43.)

The existing VASRs identified within or adjacent to the corridor alternatives fall into two primary categories: park and recreation areas, and natural and scenic landscapes. Other VASR categories include landmarks and historic districts and sites, which do not occur within the corridor alternatives.

The existing desert landscape within the corridor alternatives is densely vegetated yet at higher elevations provides expansive view opportunities of the Santa Cruz River Valley. The exception to this occurs in locations crossing drainage washes where existing vegetation includes dense growth of desert trees that limit immediate foreground views.

Particularly notable among the existing agricultural uses within the corridor alternatives are the pecan groves between I-19 and the Santa Cruz river.

Figure 3-43. Visual and Aesthetic Scenic Resources in and around the Study Area

The study area contains one park and recreation area VASR where the corridor alternative crosses the Juan de Batista de Anza National Historic Trail. In addition, views of certain elements of the existing landscape may be considered sacred to followers of traditional Tribal practices.

3.15.4 Environmental Consequences

This section generally describes the potential alteration of views to and from the identified VASRs and discusses the short- and long-term effects on the VASRs. It also discusses whether a future highway project within any of the corridor alternatives has the potential to degrade the existing VASRs through the introduction of new visual elements.

3.15.4.1 Corridor Alternative 1

Within Corridor Alternative 1, potential view alterations to the Juan Bautista de Anza National Historic Trail would most likely be minimal because of the small scale of the existing trail within the overall context of the surrounding landscape. Potential view alterations from the Juan Bautista de Anza National Historic Trail could affect the trail user's experience by interrupting views with the addition of new TIs, signal poles and lights, roadway high mast area lights, and vehicular traffic, as well as potentially more limited views of the Santa Catalina, Rincon, and Santa Rita mountains in background views to the east and southeast.

Short-term effects for views both to and from the Juan Bautista de Anza National Historic Trail from implementing Corridor Alternative 1 could potentially include the introduction of visual elements related to construction activities, including large construction vehicles, signing, barriers, work area lighting, stockpiling of materials, and equipment storage. Long-term effects to and from the trail could potentially include views of a new TI, overhead bridge crossing, embankments, roadway improvements, noise walls, high mast roadway area lighting, traffic poles and signals, and headlight glare from vehicles.

Potential view alterations to VASRs includes the expansive views of the Santa Cruz River Valley, Sonoran Desert landscape, and surrounding Santa Rita, Rincon, Santa Catalina, Sierrita, and Black mountains. Reduction or obliteration of views in the foreground to middle ground range from within the corridor alternative could occur. Background views both during the day and at night have the potential to be altered through the introduction of new visual elements into the landscape.

Potential view alterations from higher elevations in the surrounding Santa Cruz River Valley and surrounding mountain ranges include the possible introduction of new visual elements that could visually fragment and reduce the sense of scale of the long views across the valley.

Like other VASRs described previously, short-term effects could potentially include views of construction activities, while long-term effects could potentially include visual elements such as above-grade roadway, roadway lighting and poles, traffic signal lights and poles, increased vehicular traffic, and headlight glare at night.

During meetings with the TON and with owners of allotted lands on the SXD, concerns about permanent visual changes in the landscape were raised. Concerns were also raised about views to landforms considered sacred, such as the Santa Rita Mountains.

3.15.4.2 Corridor Alternative 7

Corridor Alternative 7 has the same potential to affect VASRs as Corridor Alternative 1.

3.15.4.3 Corridor Alternative 8A

Corridor Alternative 8A has the same potential to affect VASRs as Corridor Alternatives 1 and 7.

3.15.4.4 No-Build Alternative

Under the No-Build Alternative, a future planned highway within the study corridors would not be constructed, resulting in no effects on existing VASRs. Other planned land-use changes and local transportation projects, however, still have the potential to impact VASRs within the corridor alternatives.

3.15.5 Available Mitigation Measures

Mitigations for visual impacts should be politically and financially feasible to the community, and be possible, practicable, and context-sensitive. Mitigations should not cause additional negative impacts. Several mitigation measures could potentially be utilized to minimize adverse effects on the existing visual environment as a result of added visual elements within the corridor alternatives. These include:

- Using vegetation to restore or enhance landscapes affected by ground-disturbing activities. The design approach for this mitigation measure would vary based on the context for the use of this method from a natural to a formalized landscape. Salvage of existing desert vegetation for use in vegetative mitigation should be emphasized.
- Conserving and salvaging existing vegetation whenever possible at the fringes of future development to aid in visual screening.
- Developing aesthetic treatments for any new structures such as bridges, walls, and utility infrastructure so that improvements blend in with the surrounding environment. Aesthetic treatments could range from paint color finishes to material selections or graphic visual elements.
- Establishing or using existing standards for improvements such as light poles, guard railing, communications poles, etc., that use muted colors and non-glare surfaces that would allow the features to blend with the surrounding landscape in areas with existing VASRs.
- Using lighting that is compatible with dark sky ordinance requirements.
- Using landform grading when applicable to aid in minimizing or screening undesirable views of development within the corridor. Landform grading that results in a more natural-looking appearance is preferred whenever possible.

3.15.6 Conclusion

In a future Tier 2 environmental document, considerations and alignment alternative selection would entail the need to conduct a more detailed investigation of potential effects on identified VASRs resulting from the introduction of new visual elements. As a result, and with public input, specific recommendations could be made for locations and types of mitigation measures to be used for offsetting these effects. Further analysis would also be required in Tier 2 to determine any visual impacts.

3.16 Utilities and Railroads

3.16.1 Existing Conditions

Various utilities are located within the Sonoran Corridor Study Area (See Figure 3-44). The following inventory lists the utility type, owner and description of major facilities in the Study Area. Smaller local utilities that could cross the path of the corridor alternatives have not been investigated and are not discussed in this Tier 1 EIS.

3.16.1.1 Electric Power

- Tucson Electric Power (TEP) is building a new 138-kilovolt (kV) substation, transmission lines and a switchyard near Swan Road and Old Vail Connection Road
- Tohono O'odham Utility Authority has electric lines within the Study Area and on the San Xavier District
- TEP is planning to locate a 100-megawatt (MW) solar array and accompanying 30 MW energy storage system at the Wilmot Energy Center (WEC)
- Western Area Power Administration's (WAPA) Apache-Tucson 115kV transmission line runs through the study area from southeast to northwest, generally paralleling I-10
- ASARCO/TEP Avalon Solar Project – 35 MW Solar Generating Station

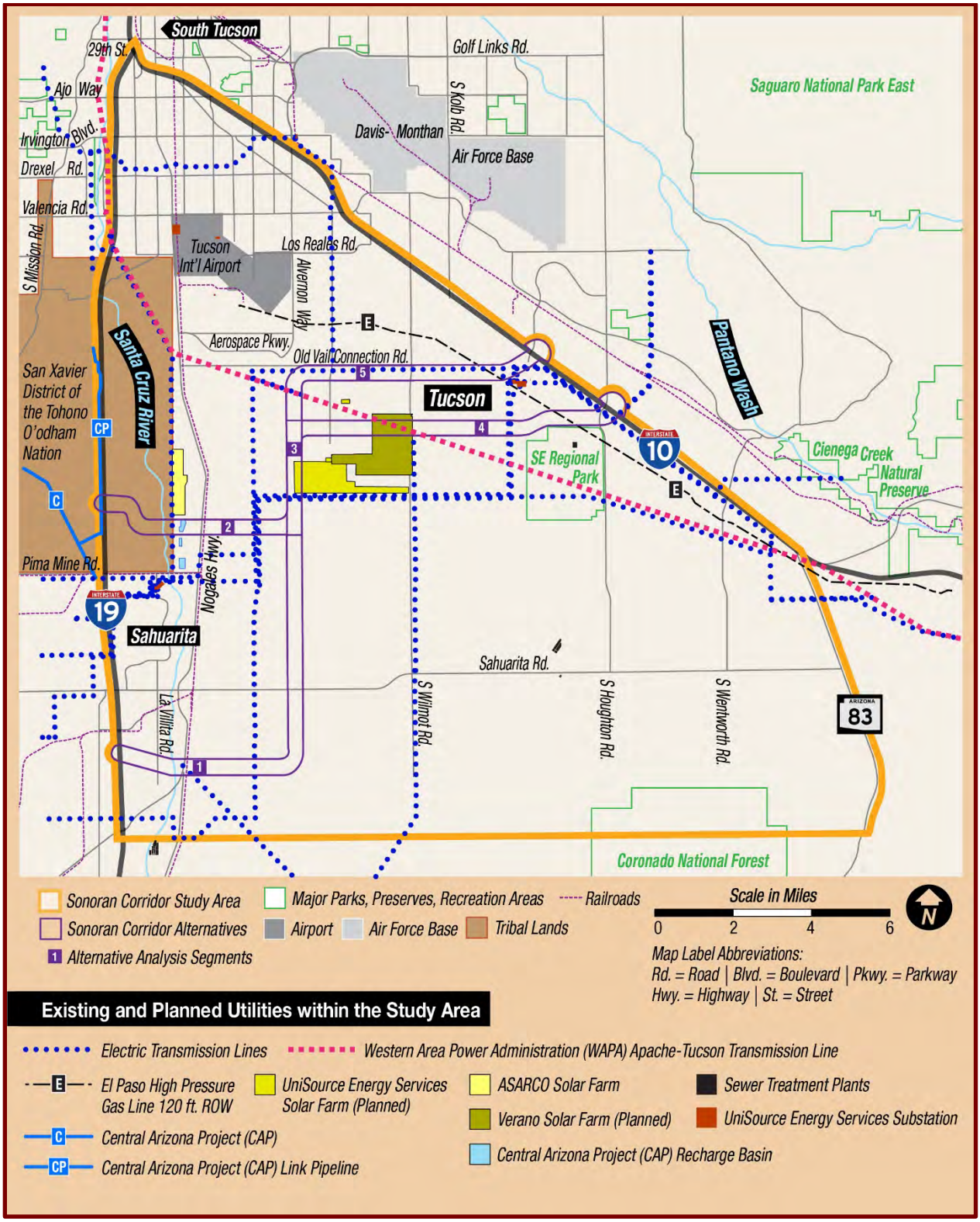
3.16.1.2 Gas

- EPNG High Pressure gas pipeline runs within a 120-foot Right-of-Way parallel to and just south of I-10

3.16.1.3 Irrigation and Well Facilities

- Bureau of Reclamation (BOR) – Central Arizona Project (CAP) Link pipeline adjacent to I-19; Water delivery and distribution system and irrigation system with associated flood protection features for the SXD provided under the Southern Arizona Water Rights Settlement Act (SAWRSA) of 1982, as amended and restated in Public Law 108-451, the Arizona Water Settlement Act (AWSA) of 2004. There are also several wells located on the SXD within the Study Area that could be impacted by the project depending on the alternative selected. Future BOR projects associated with the SAWRSA and AWSA would need to be considered in Tier 2 if the Selected Alternative is Alternative 1.
- Central Arizona Water Conservation District - recharge basins between I-19 and Nogales Highway
- City of Tucson – recharge basins between I-19 and Nogales Highway
- Private Irrigation - Wells and irrigation infrastructure (see Section 3.14.2)

Figure 3-44. Existing and Planned Utilities within the Study Area



3.16.1.4 Railroads

- Union Pacific Railroad (UPRR) – Nogales Branch, parallel to Nogales Highway
- Mission Mine rail line (ASARCO) – Runs parallel to Pima Mine Road and connects to the UPRR Nogales Branch

In addition to the utilities listed above, significant solar power investment has been and is being made within the study area by TEP, ASARCO, and others.

3.16.2 Environmental Consequences

3.16.2.1 Corridor Alternatives

In an effort to avoid major utilities to the extent possible, existing facilities were taken into consideration during the Sonoran Corridor Study's alternatives development and screening phases. However, constructing a freeway between I-19 and I-10 at any location, including within the three corridor alternatives, would have an effect on some major utilities. Many facilities (e.g., solar farms) can be avoided in the design phase. This section outlines the identified crossings of the Sonoran Corridor alternatives with existing major utility corridors; however, specifics on the potential impact at the Tier 1 EIS level are not available.

Corridor Alternative 1

A new freeway within Corridor Alternative 1 would need to cross the WAPA 115 kV overhead line, as well as other electrical transmission lines. It would also need to cross the BOR CAP Link pipeline and possibly cross over or near a CAP recharge basin, in addition to crossing the UPRR Nogales Branch. Near its interchange with I-10 it would cross over the EPNG high pressure pipeline.

Corridor Alternative 7

As with Corridor Alternative 1, a new freeway within Corridor Alternative 7 would need to cross several electrical transmission lines, including the WAPA 115 kV overhead line, the UPRR Nogales Branch, and the El Paso Natural Gas pipeline. The crossing of the electric lines and railroad under Corridor Alternative 7 would be in different locations from where Corridor Alternative 1 crosses those utilities.

Corridor Alternative 8A

Utility impacts for Corridor Alternative 8A would be the same as those for Corridor Alternative 7, but would cross some of the electrical transmission lines and the EPNG pipeline in different locations.

At the Tier 2 stage, other potentially affected utilities would be addressed upon development of preliminary design plans to identify specific impacts and mitigations.

3.16.2.2 No-Build Alternative

The No-Build Alternative would not affect existing utilities or the UPRR because no Sonoran Corridor highway would be built.

3.16.2.3 Mitigation

During more detailed analysis in a Tier 2 study, potential utility conflicts would be identified and resolved as part of the mitigation plan for the project. Where avoidance of utilities is not possible or feasible during design, utility work related to the project would need to be closely coordinated with the utility owners.

ADOT would coordinate with the appropriate agencies, utilities, private companies and UPRR during Tier 2 analyses regarding specific impacts, adjustments, and any potential disruption to utility functions. The ADOT Utility and Railroad Engineering Section would further investigate utility involvement to coordinate any need for relocation and the accommodation of utilities with the proposed construction.

Should a utility relocation be required, ADOT would coordinate with utility owners to determine the need for new right-of-way, as required.

During construction, utility work related to the freeway would continue to be closely coordinated with utility owners as well as customers, particularly if outages are required.

3.16.2.4 Conclusion

None of the potential utility-related issues are anticipated to present a fatal flaw to the viability of the utilities or have a major impact on the selection of a preferred alternative. The primary impacts of constructing a freeway within one of the corridor alternatives would be the requirement to pass beneath electric power transmission lines and over water infrastructure utilities, as well as to cross the UPRR. Potential impacts to power line pole locations would have to be identified and resolved, and the need to negotiate crossing of the BOR CAP Link pipeline (for Corridor Alternative 1) and the UPRR for all three corridor alternatives would need to be determined at the Tier 2 stage during preliminary design of the project.

3.17 Energy

This section discusses the energy that would be used in the region for the No-Build Alternative and corridor alternatives. Primary energy use is assumed to be from fossil fuel consumption (gasoline and diesel fuel) by vehicles traveling in and near the study area. Other energy use would be associated with construction, maintenance, and development activities. Fuel would be consumed during the planned construction of new arterial streets and freeways identified in the RMAP, which constitutes the No-Build network. Also, fuel would be consumed during construction of commercial developments, industrial buildings, and homes throughout the study area and surrounding region.

3.17.1 Regulatory Context

Regulations for implementing the procedural provisions of NEPA require that the energy requirements and conservation potential of various alternatives and mitigation measures be evaluated as part of the environmental consequences of the proposed action (40 CFR § 1502.16[e]).

3.17.2 Methodology

Operational energy use was calculated using VMT and VHT projections, which were developed using travel demand modeling to forecast 2045 conditions. This included developing a base highway network for use by the PAG transportation model, along with population and employment projections from PAG. Local government stakeholders (i.e., City of Tucson, Town of Sahuarita, Pima County, and the SXD) also provided input from their transportation networks and long-range transportation plans.

3.17.3 Affected Environment

The average fuel economy of the nation's vehicles, measured in miles per gallon (mpg), has consistently improved over the past 40 years. This trend is expected to continue during the next 25 years. However, the improved fuel economy is not likely to be dramatic. Barring a technological breakthrough in the design of engines providing power to the vehicles of 2045, such as a significant shift to electric or fuel cell vehicles that use less energy, a substantial change in fuel economy is difficult to predict, and therefore not assumed in this analysis. The average fuel economy of a passenger car operated in the United States in 1990 was 20.2 mpg and, 20 years later in 2010, it was 23.5 mpg. In 2018 it was estimated at 25.1 mpg (EPA, 2018).

Automobiles are most efficient when operating at steady speeds between 35 and 45 mph with no stops. Fuel consumption increases by approximately 17 percent as speeds increase from 55 to 70 mph (Oak Ridge National Laboratory, 2012).

Total fuel consumption in the United States has consistently risen from year to year. From 2010 to 2015, motor vehicle fuel consumption increased from 170 to 173 billion gallons per year in the United States, and the state of Arizona consumed 3.4 billion gallons per year, or 2 percent of the 2010 total (USDOT Bureau of Transportation Statistics 2013). Increased congestion on freeways and arterial streets has become a major contributor to increased fuel consumption. The 2019 Annual Urban Mobility Report (Texas A&M Transportation Institute, 2019) reported that vehicles in the Tucson urban area consumed

approximately 14 million gallons of excess fuel and lost over 32 million hours in delay in 2017 because of congestion.

3.17.4 Environmental Consequences

Construction activities for any of the corridor alternatives would have comparable fuel commitments. Construction energy use is, however, not addressed in further detail because the total fuel needed for construction of the corridor alternatives is assumed to be essentially the same as the total fuel needed for construction of other road projects under the No-Build Alternative. Operational energy use for the corridor alternatives was calculated by dividing the yearly VMT projections for each alternative (and for the No-Build Alternative, as a point of comparison) by the fuel economy of the vehicle fleet.

3.17.4.1 Corridor Alternatives

Operational energy use was considered for the study area and was evaluated for the corridor alternatives (see Chapter 2, Alternatives). Table 3-53 shows that for all three corridor alternatives, operational energy use for the corridor alternatives is slightly greater than the No-Build Alternative (less than 1 percent).

Table 3-53. Daily Fuel Consumption, 2045

TRAVEL AND ENERGY USE	2045 NO-BUILD	ATERNATIVE 1	ALTERNATIVE 7	ALTERNATIVE 8A
Daily VMT	10,624,000	10,705,000	10,684,000	10,677,000
Daily VHT	276,435	274,528	274,231	274,000
Average Speed (mph)	38.43	38.99	38.96	38.97
Operational Energy Use (million gallons/year)	423,267	426,494	425,657	425,378

[a] Vehicle-miles traveled (VMT) was estimated by the PAG travel demand model. VHT = Vehicle-hours traveled
[b] Gallons per year data were determined by dividing the VMT by the national fuel economy factor for all motor vehicles of 25.1 miles/gallon in 2018.

3.17.4.2 No-Build Alternative

While the No-Build Alternative would not need fuel for construction, other road projects and improvements would need to be developed in the study area to accommodate the region's growth. The No-Build Alternative would not entail energy consumption associated with use of the proposed corridor because it would not be built.

3.17.5 Potential Avoidance, Minimization, and Mitigation Strategies

No mitigation is proposed for energy use associated with the corridor alternatives.

3.17.6 Subsequent Tier 2 Analysis

If a corridor alternative is selected, the energy use of individual projects would be examined as necessary during the Tier 2 studies.

3.17.7 Conclusion

There is little to differentiate the alternatives relative to energy usage. The No-Build Alternative uses less overall energy but moves fewer trips over the course of the day. All three corridor alternatives effectively function the same with respect to energy usage.

3.18 Construction Impacts

Development of a new Sonoran Corridor would cause temporary construction-related impacts on a number of resources evaluated in this Draft Tier 1 EIS, should a corridor alternative be identified as the Selected Alternative and proceed to the Tier 2.

3.18.1 Methodology

Construction impacts are impacts associated with the construction process and can be either temporary or permanent. Permanent impacts are reviewed in the individual resource sections of this chapter. This section will discuss the temporary construction impacts expected for all corridor alternatives and potential mitigation measures. The No-Build Alternative would not lead to construction activities and therefore will not be discussed.

Those resource areas for which no construction-related impacts are anticipated are not included in the following discussion. Moreover, for some resource areas, such as cultural resources and acquisitions and displacements, impacts are expected to be permanent. Because the alternatives discussed in this Draft Tier 1 EIS are relatively wide corridors, potential construction impacts are described in a general way.

3.18.2 Environmental Consequences

Short-term impacts associated with construction would affect the resource areas identified in Table 3-54. If a corridor alternative is chosen and is advanced to Tier 2, design would be further refined and detailed construction activities, traffic control, and public involvement plans would be prepared to avoid and minimize adverse effects to the extent practicable and to inform the public of ongoing activities. Specific temporary construction-phase impacts and mitigation measures would be further refined during any future Tier 2 study.

Table 3-54. Short-term Construction Impacts

RESOURCE	POTENTIAL CONSTRUCTION IMPACTS	POTENTIAL MITIGATION STRATEGIES
Socioeconomic Conditions	Detours, lane closures, and the movement of construction-related vehicles would temporarily affect access to residential areas and businesses. Construction-related activities have the potential to affect access to community facilities and services and the delivery of emergency services. Construction of a new Sonoran Corridor would generate employment opportunities throughout the construction period.	ADOT's traffic control management procedures would be implemented to avoid, minimize, or mitigate potentially adverse construction-related access impacts on affected neighborhoods, businesses, and community facilities and services. Construction action and traffic control plans would identify temporary transportation impacts and the locations of potential temporary detours. The plans would help ensure that local access to homes and businesses, and access for emergency services providers, is maintained. Plans would specify time frames for temporary detours and identify the process for notifying affected parties of the construction period and changes in access.
Environmental Justice/ Title VI	Construction-related impacts could disproportionately affect minority and low-income populations in the study area. These construction-related impacts include adverse effects on social conditions, parkland and recreational facilities, traffic and transportation, air quality, noise, visual resources, and utility service. These construction-related impacts would be short-term and temporary because they would occur during construction or until ground-disturbing activities are completed.	Mitigation measures presented in this table would address construction-related impacts for both minority and low-income populations and the general population. During Tier 2, avoidance of impacts to protected populations would be further evaluated.
Biological Resources	Temporary construction impacts would occur during and for a period after construction because of reduced habitat quantity and quality in disturbed areas. During construction, artificial lighting and noise, and dust in the air generated by equipment and human activity, could temporarily displace birds from foraging, resting, and nesting habitat. Disturbance-related displacement from favored breeding habitats could result in birds competing with other birds for suitable replacement habitats. This could result in nesting in less-favored areas where nests may be damaged or accessed more easily by predators, which could limit survival of offspring or adults.	Once construction activities are complete, disturbed native desertscrub habitats adjacent to the new roadway embankment would be addressed according to a revegetation plan. Measures to avoid, minimize, and mitigate impacts on protected species, comply with state and federal regulations, and reduce habitat fragmentation, wildlife displacement, impediments to movements, collisions, and spread of invasive species would be developed for a preferred alternative during the Tier 2 study

Table 3-54. Short-term Construction Impacts (continued)

RESOURCE	POTENTIAL CONSTRUCTION IMPACTS	POTENTIAL MITIGATION STRATEGIES
Hydrology, Floodplains, and Water Resources	Construction activities such as clearing, grading, trenching, and excavating would disturb soils and sediment. If not managed properly, disturbed soils and sediment could be washed into nearby water bodies during storms, thereby reducing water quality.	Measures to avoid, minimize, or mitigate impacts on hydrology, floodplains, and other water resources would be implemented to address temporary construction impacts. Ground-disturbing activities exceeding 1 acre would require an AZPDES permit from the Arizona Department of Environmental Quality, or a NPDES permit from EPA on Tribal lands. The permit must be consistent with discharge limitations and water quality standards established for the receiving water. Construction-related activities regulated under the AZPDES/NPDES permit are required to have a Stormwater Pollution Prevention Plan, which would be prepared by the contractor. Implementing best management practices would reduce water quality impacts on the receiving waters of the Santa Cruz River and its tributaries. Both construction and operational impacts may be mitigated by using best management practices.
Air Quality	Air quality impacts associated with construction would be limited to short-term increased fugitive dust and mobile source emissions. Fugitive dust would be generated by haul trucks, concrete trucks, delivery trucks, and other earthmoving vehicles. Increased dust levels would be attributable primarily to particulate matter resuspended by vehicle movement over paved and unpaved roads and other surfaces, dirt tracked onto paved surfaces from unpaved areas at access points, and material blown from uncovered haul trucks. Most fugitive dust is made up of relatively large particles (that is, greater than 100 microns in diameter) that are responsible for the reduced visibility often associated with this type of construction. Given their relatively large size, these particles tend to settle within 20 to 30 feet of their source.	To reduce the amount of construction dust generated, particulate control measures related to construction activities would be followed. Measures to avoid, minimize, or mitigate adverse effects would be implemented in accordance with the most recent version of ADOT's *Standard Specifications for Road and Bridge Construction* (ADOT, 2008). The measures would address three phases of construction: site preparation, construction, and post-construction.

Table 3-54. Short-term Construction Impacts (continued)

RESOURCE	POTENTIAL CONSTRUCTION IMPACTS	POTENTIAL MITIGATION STRATEGIES
Noise	Constructing roads causes a substantial amount of temporary noise. Noise during construction could be a nuisance to nearby residents and businesses. Construction would generate similar types of noise that would occur sporadically in different locations throughout the construction period. Typical noise levels from construction *equipment* range from 69 to 106 dBA at 50 feet from the source; however, most typical construction *activities* fall within the 75 to 85 dBA range at 50 feet.	ADOT will consider the effects of noise from project construction activities and will determine any additional measures that are needed in the plans or specifications to minimize or eliminate adverse impacts from construction noise. Stationary equipment would be located as far from sensitive receptors as possible. Construction alerts would be distributed to inform the public of ongoing construction activities near noise-sensitive locations. Alerts will be provided in alternate language formats and distribution methods based on a Limited English Proficiency Four Factor Analysis and in accordance with ADOT's Public Involvement Plan.
Utilities	Construction may temporarily disrupt the delivery of utility services to customers near the new Sonoran Corridor. Potential permanent impacts, such as required utility relocations resulting from conflicts with the new Sonoran Corridor, may also result and would be evaluated during the Tier 2 study once a preferred alternative is selected and the specific conflicts are identified.	Disruptions to utility services would be restricted to be short-term and localized. Advanced planning would take place during the design phase so that utility interruptions would not occur or would be minimized. ADOT and its contractors would coordinate with utility service providers during the design phase and throughout construction to identify potential problems or conflicts and to provide opportunities for their resolution before construction begins. Utility interruptions would be scheduled, and affected parties would be notified in advance. Emergency response procedures would be outlined by ADOT in consultation with utility providers to ensure quick and effective repair of any inadvertent or accidental disruptions in service.
Visual Resources	Temporary visual impacts would result from construction activities, such as temporary vegetation removal, disturbed soil, construction equipment, and construction equipment operation. Such impacts would occur where the proposed freeway is adjacent to existing homes and where TIs would be built. These temporary disruptions and activities would be typical of any major highway project and are not considered adverse impacts. Further evaluation of visual impacts would be conducted during the Tier 2 study.	No mitigation would be needed for temporary construction impacts on visual resources.

3.18.3 Conclusion

If a corridor alternative were selected, short-term construction impacts on most of the resource categories discussed in this section would be similar regardless of the corridor alternative chosen. Such temporary construction impacts would be typical of a major highway project, and mitigation measures would be implemented to minimize such impacts.

3.19 Unavoidable Adverse Impacts

Irreversible or irretrievable commitments involve the use, consumption, or destruction of a specific resource (e.g., energy and natural resources such as water, minerals, or timber) that cannot be replaced or restored within a reasonable timeframe. These resources would be used in the project implementation and would never return. Resources of greatest concern are those that are considered scarce or rare and those resources where the effects cannot be minimized or mitigated.

3.19.1 Methodology

The resources of particular concern were those that could result in an irretrievable use, such as consumption of a resource or use of new land area committed to future transportation uses.

3.19.2 Potential Impacted Resources

Natural Resources

Resources such as land, threatened and endangered species and their associated habitat, biological resources, water resources, and agricultural lands may experience irreversible and irretrievable effects. Given the level of analysis within this Draft Tier 1 EIS, specific effects and the attributes that would make the resources scarce or unique have not been determined. In general, the effects would be a result of the conversion from undeveloped land to developed land.

Cultural Resources

Impacts to these resources would be an irretrievable commitment. Archaeological sites located within the actual construction footprint would require documentation through data recovery. Archaeological artifacts could be preserved through curation, but the historic integrity of the site would be lost. Impacts to historic sites outside of the construction area would be primarily contextual. Construction on a new alignment could potentially impact traditional cultural properties.

Energy

Energy resources such as oil and gas are not considered rare, but once used, these materials are not renewable. During construction, consumption of oil and gas would be increased for the construction time period. Advances in technology may contribute to a reduction in the consumption and usage of oil and gas in the long term.

Construction Materials

These materials could include Portland cement concrete (concrete), asphalt concrete (asphalt), rock base course, and steel. Water would be consumed for mixing concrete, washing equipment, and dust control. The use of these materials would be largely irretrievable; however, these resources are generally not in short supply.

3.19.2.1 Summary

Corridor Alternative 1 would require the least amount of undeveloped land and construction materials due to its shorter length. This alternative has the most information about cultural resources existing within the corridor, and most known sites can be avoided.

Corridor Alternatives 7 and 8A would have a moderate need for resources. They would require larger amounts of undeveloped land and construction materials compared to Corridor Alternative 1.

The No-Build Alternative would not result in a new commitment of resources by the Sonoran Corridor so the existing conditions and baseline trends would continue. Conversion of land uses and construction of local roads consistent with area plans under the No-Build Alternative would result in the commitment of irreversible and irretrievable resources.

3.19.3 Potential Mitigation Strategies

Specific mitigation strategies would be identified as part of the Tier 2 analysis. Implementation of best management practices and mitigation measures, as described in the various resource sections, would minimize resource impacts.

3.19.4 Future Tier 2 Analysis

Potential effects and mitigations for the identified resources would be further evaluated as part of a future Tier 2 analysis. Those efforts would be used to refine the irreversible and irretrievable commitments of resources including the quantification of potential effects for each resource.

3.19.5 Conclusion

Each of the corridor alternatives as well as the No-Build Alternative would result in the commitment of irreversible and irretrievable resources. Mitigation strategies and project effects would be further evaluated in the Tier 2 analysis.

3.20 Indirect and Cumulative Effects

This section identifies and assesses the potential indirect and cumulative effects that implementation of one of the corridor alternatives would have on the surrounding human, built, and natural environments.

3.20.1 Regulatory Context

CEQ states that indirect effects "*are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems"* (40 CFR 1508.8[b]). Secondary impacts or indirect effects are commonly categorized as effects that would not occur "but for" the implementation of a project. Indirect impacts are perhaps less obvious than those identified as direct impacts. They are more difficult to quantify, additive in nature, or long-term in occurrence and effect. This section identifies the likely, foreseeable secondary impacts or indirect effects that would result from construction of the Sonoran Corridor.

The CEQ states that cumulative effects result from the *"incremental impact of an action when added to other past, present, and reasonably foreseeable future actions regardless of which agency (federal or non-federal) or person undertakes such actions. Cumulative effects can result from individually minor, but collectively significant actions taking place over a period of time"* (40 CFR 1508.7). An action cannot contribute to the cumulative effects on a resource if it will not have either a direct or indirect effect on that resource. The CEQ recommends that cumulative impact analyses examine resources that could be impacted by the action(s) under investigation or that are known to be vulnerable. Additionally, spatial and geographic parameters must be established to evaluate effects that may occur in a different area and to capture effects from past or future actions.

FHWA has developed guidance on the analysis of indirect and cumulative effects which supplements the CEQ guidance. The Federal Highway Administration (FHWA) guidance, *Secondary and Cumulative Impact Assessment in the Highway Project Development Process*, (FHWA 1992) reiterates the CEQ's message of the importance of considering potential indirect and cumulative effects in decision making for transportation projects and provides direction on implementation of CEQ requirements. It emphasizes the importance of considering the functionality of the resources and trends in the condition of the resources that may be impacted.

3.20.2 Methodology

3.20.2.1 Indirect Effects

An important consideration for indirect effects is an estimate of the potential for development in the area of a proposed project within a reasonable period of time. This estimate should recognize the potential development both with and without the project. A typical indirect effect of a major transportation corridor is the conversion of residential land uses to more intensive land uses, particularly when the land is zoned and planned for those more intensive uses. In this case, the corridor alternatives have been placed to avoid residential communities as much as is possible. Therefore, the potential for indirect land use conversions of residential developments is expected to be minor.

However, some changes in other land use categories could occur that would move portions of the study area into higher economic uses. Those could produce indirect effects that would be addressed in a Tier 2 environmental analysis. This Tier 1 EIS assumes that the local municipalities and county comprehensive and general plans direct the type of development in the study area.

The assessment of indirect effects in this study broadly considered growth-inducing impacts that could result from a new Sonoran Corridor, including secondary development that could generate additional traffic, population and job growth, economic benefits, or other impacts related to a new transportation facility. The growth assessment qualitatively identified the areas that may experience indirect effects (areas of influence) by reviewing land use plans and analyzing the already planned development and potential areas of influence of the Sonoran Corridor. Resources that are present within the study area that may be indirectly affected by changes in land use and transportation patterns and accessibility, or related economic activity, were reviewed.

This discussion of indirect effects is qualitative and identifies the types of indirect effects that could occur for each alternative. Indirect effects may be positive or negative, and differ by resource as well as alternative, meaning an indirect effect may be positive for one resource and negative for another.

Area of Influence (AOI)

The determination of an AOI for the corridor alternatives considered the potential changes in travel patterns and demand that could result from the implementation of the Sonoran Corridor. This was accomplished through consideration of the following:

- *Travel Time Influences* - Faster travel times benefit freight carriers, for whom costs are sensitive to travel time, and faster routes may shift the movement of freight away from congested areas. Currently, I-19 and I-10 carry substantial amounts of international, national, and regional freight traffic. Trips that are destined for areas outside Arizona may seek a trip that avoids the urban area of Tucson if it offers a more direct, less congested route that could result in faster arrival times at the ultimate destination. Faster travel times also would benefit the traveling public through improved access to employment and economic centers, which in turn may affect land uses in terms of location and density. More convenient commute times to employment centers can promote residential development farther from those employment centers. In addition, better access to the transportation network may promote employment centers in new locations.
- *Influence of Access* - Improved access to a transportation facility can be a factor which influences type of growth or the rate of development of an area. Because the Sonoran Corridor is anticipated to be an access-controlled facility, improved access along its length would occur primarily at traffic interchanges. Interchange locations for the Sonoran Corridor are not specifically determined as part of the Tier 1 process, but would be developed as part of more detailed alignments in a project-level Tier 2 environmental review. Traffic interchanges would likely be developed at the intersection of the Sonoran Corridor and major arterial roads that are identified in the 2045 RMAP (see Figure 3-45, Figure 3-46, and Figure 3-47) and may include Nogales Highway, Sahuarita Road, Wilmot Road, and Houghton Road. Other interchanges may develop as specific roadways are built in association with development, such as access to planned industrial development near Alvernon Way south of TUS. Growth-inducing

Figure 3-45. Growth Areas and Corridor Alternative 1 Area of Influence

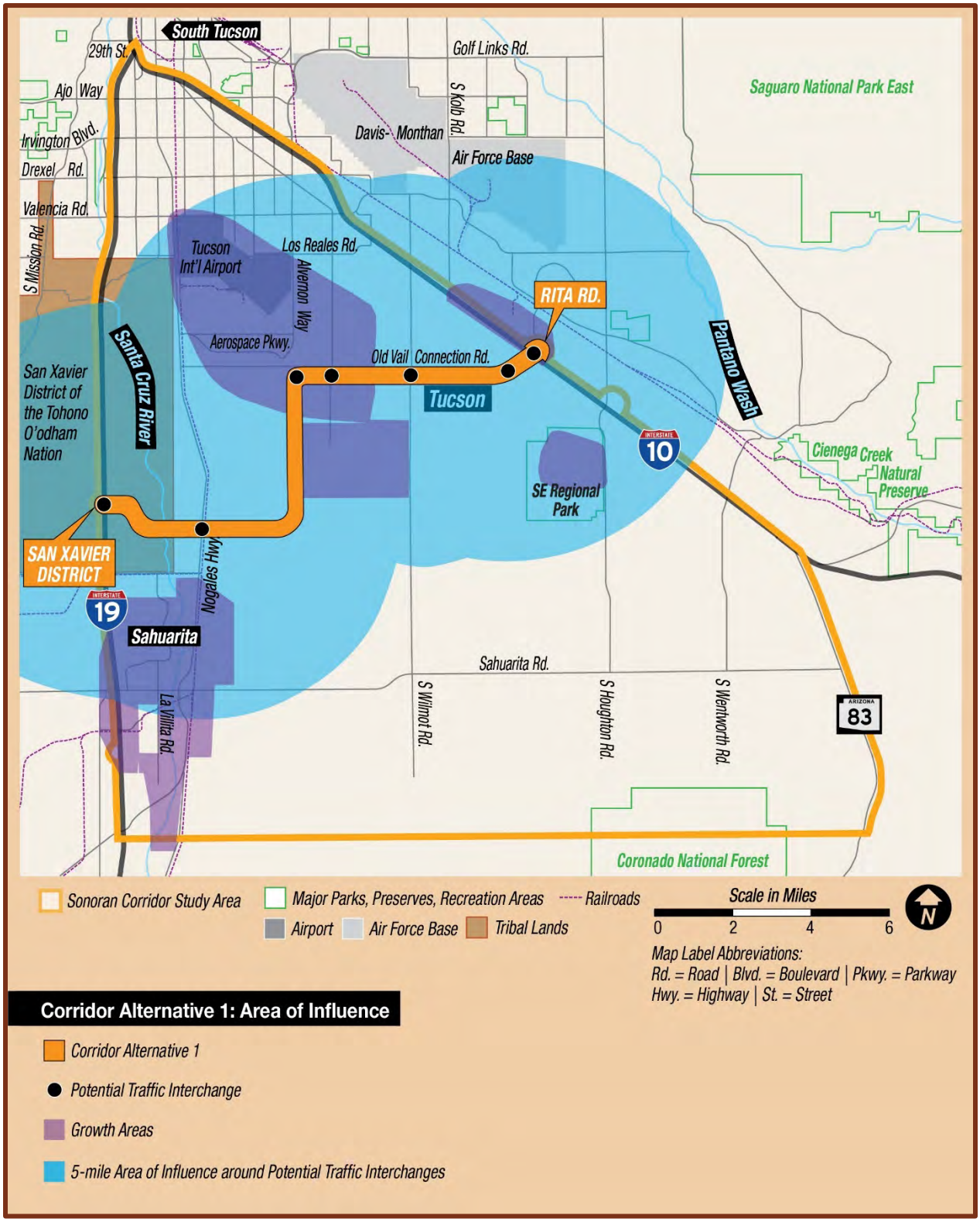


Figure 3-46. Growth Areas and Corridor Alternative 7 Area of Influence

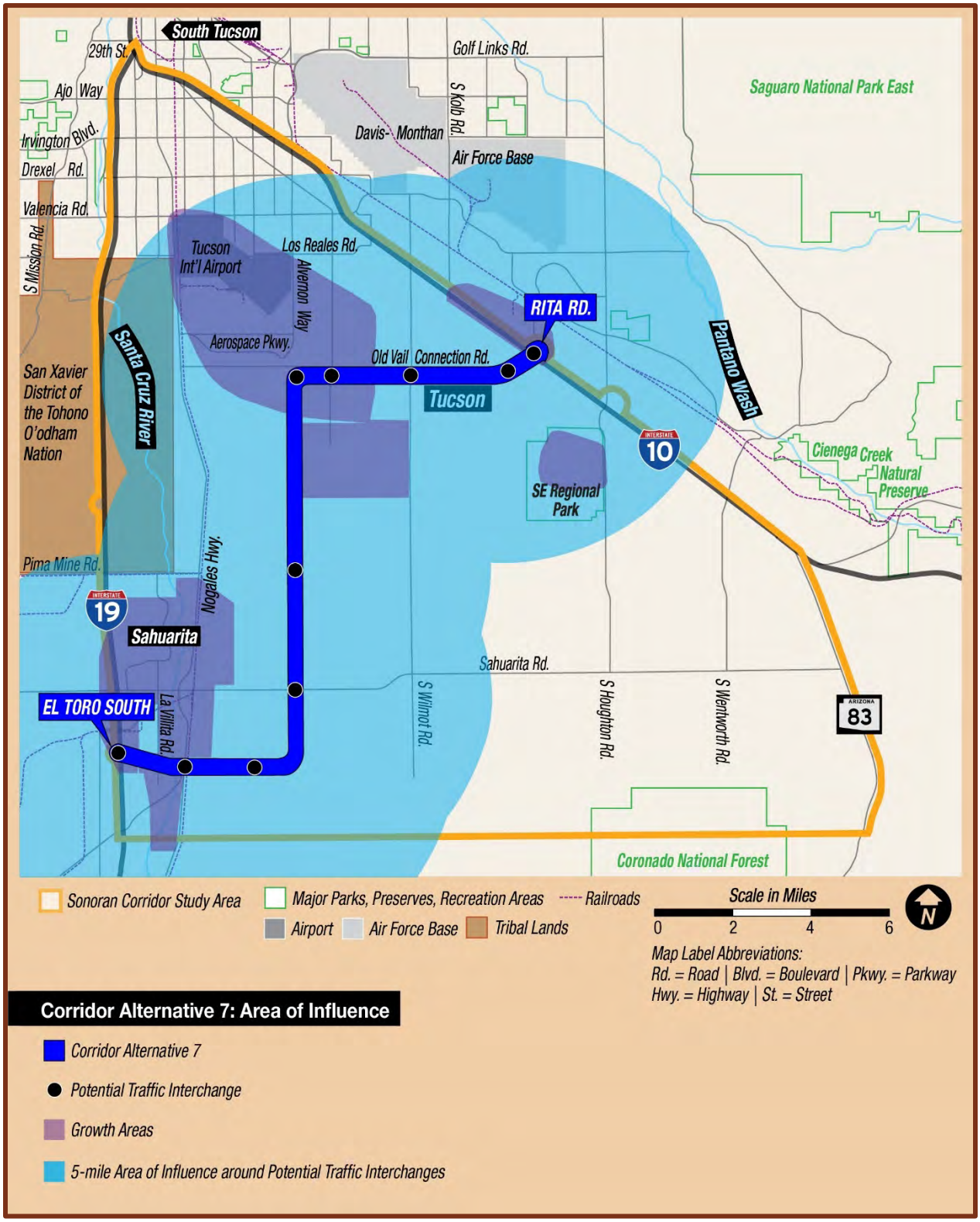
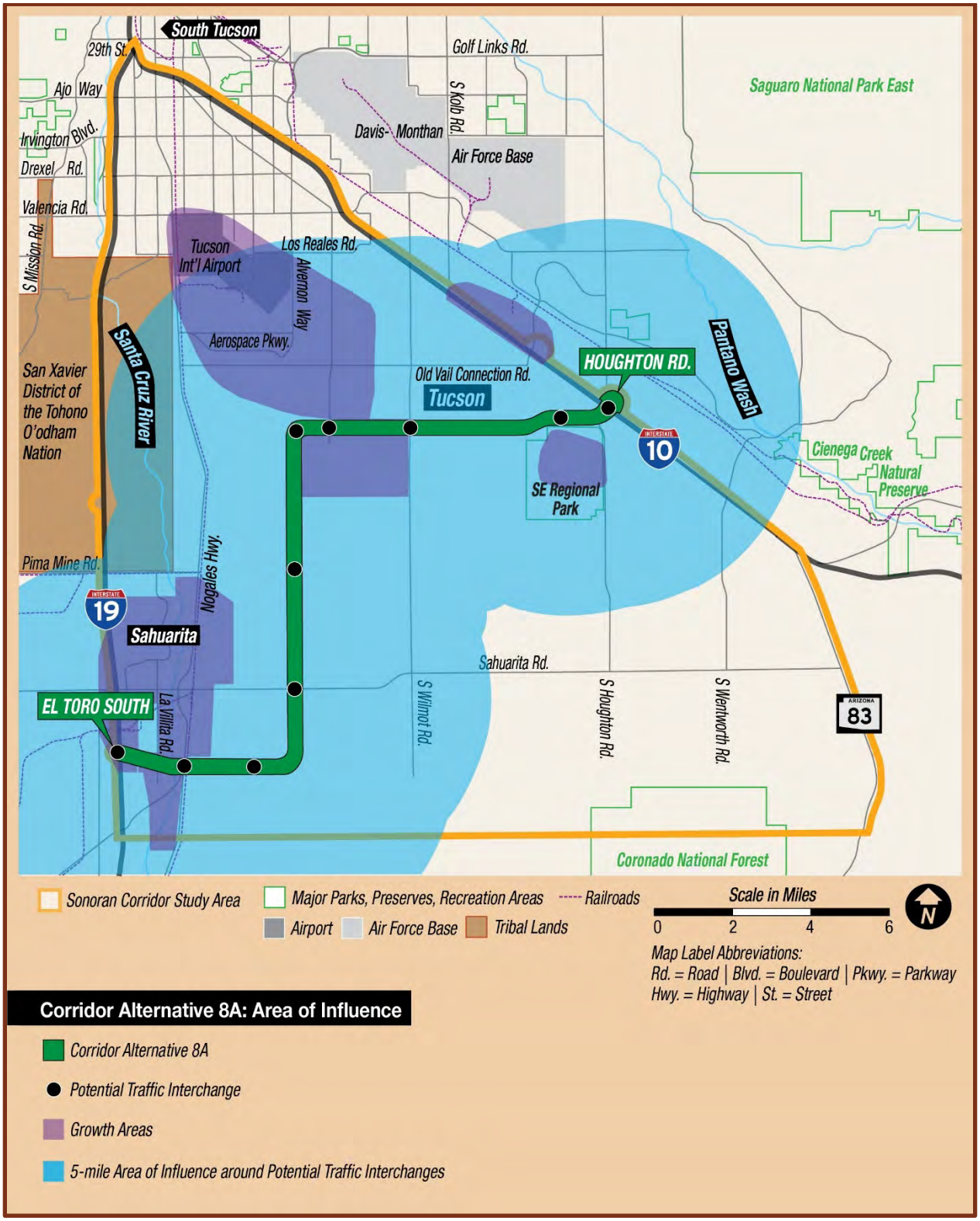


Figure 3-47. Growth Areas and Corridor Alternative 8A Area of Influence



effects of a Sonoran Corridor could be expected to extend 0.5 mile from an interchange location for commercial or industrial development, and up to 5 miles for residential development.

The travel forecasting completed as part of the Sonoran Corridor study includes interchange assumptions based on current regional transportation plan networks that would warrant connections to a new high-capacity transportation facility. Additional information about interchanges and transportation modeling can be found in Chapter 2, Alternatives Considered. In the future, additional or different interchange locations could be identified based on land use patterns, growth, and specific access needs.

- *Change in Growth Patterns* - Within the Study Area, 28,349 acres are identified as future growth areas. Improved access could induce growth. Developable areas within 5 miles of interchanges are assumed to have the potential for project-induced growth. The following are acreages of future growth areas within 5 miles of potential future TIs on the Sonoran Corridor Alternatives:
  - Corridor Alternative 1: 24,885 acres
  - Corridor Alternative 7: 28,209 acres
  - Corridor Alternative 8A: 26,747 acres

Cumulative Effects

Cumulative effects include the direct and indirect impacts of the project together with the impacts of all other anticipated past, present, and reasonably foreseeable future actions in the area, including those of others. This cumulative impacts assessment considered past, present, and reasonably foreseeable future transportation and non-transportation projects considered by FHWA, ADOT, PAG, Pima County, Tucson, Sahuarita, and other federal, state, and local agencies.

The timeframe established for the cumulative impact analysis extends between 1957 and 2045, to correspond with adopted demographic data utilized in the RMAP 2045. The completion of I-10 within the study area occurred in 1957 and serves as the temporal starting point for analyses as it captures the travel and development patterns associated with the construction of the Interstate System in the State of Arizona.

The geographic area evaluated for cumulative effects varies by resource and is as large as the area of direct and indirect effects. While growth-inducing impacts are anticipated to have a range of five miles from an interchange, effects on resources such as wildlife connectivity can extend farther. For this evaluation the study area was utilized as the geographic limit of cumulative effects analysis. Cumulative impacts of constructing a new Sonoran Corridor were qualitatively assessed by reviewing long-range transportation plans developed by PAG in the 2045 RMAP. In addition, through stakeholder outreach undertaken as part of this Draft Tier 1 EIS, ADOT met with the SXD of the TON and other federal, state, and local entities to identify recent development (past and present actions), and proposed and planned projects (foreseeable actions) within or near the study area.

The determination of cumulative effects requires outlining the cause-and-effect relationships between the multiple actions and the environmental resource of concern. A trend analysis method was used to analyze the environmental resources' current health by considering effects from past and present actions, and to determine the environmental resources' viability into the future after considering stressors from all foreseeable transportation and non-transportation actions.

3.20.3 Affected Environment: Previous Actions, Existing Conditions, and Reasonably Foreseeable Future Actions

This section describes conditions in the study area relevant to indirect effects and cumulative impacts, including land use, population and employment, and transportation facilities.

3.20.3.1 Previous Actions and Existing Conditions

A timeline of major events and projects within the study area is listed in Table 3-55 below:

Table 3-55. Previous Actions Affecting the Study Area

PREVIOUS ACTION	YEAR
Tucson becomes part of the US as a result of the Gadsden Purchase	1854
San Xavier Reservation established	1874
Sahuarita founded	1911
Tohono O'odham Reservation established	1917
Interstate 10 completed within the study area	1957-1960
Tucson International Airport opens	1963
Green Valley Pecan Company begins converting cotton fields to pecan groves	1965
Interstate 19 completed within the study area	1974
Desert Diamond Casino opens	2001
Solar field construction	2015

Land Use

As described in detail in Section 3.2, land uses within the study area are primarily categorized as agricultural, existing residential, or undeveloped, with pockets of industrial and commercial at the Rita Road TI. A cluster of resource extraction/mining activities exists along the Old Vail Connection Road ROW south of TUS. In Sahuarita, the existing uses are residential and agricultural. Most of the residential areas are low density and can be found in small clusters with varying numbers of residences. The clusters are located within Sahuarita and unincorporated Pima County; however, most of unincorporated Pima County within the study area is undeveloped land.

Population and Employment

Population within the study area, according to 2015 PAG estimates, is 7,187, with 1,022,079 being the estimated total for all of Pima County. TUS and surrounding areas and the UA Tech Park are two critical employment areas within the Tucson metropolitan area. Employment in the study area in 2015 was 15,232 with 635,000 jobs in the region. Detailed information on study area population and employment can be found in Section 1.5 and Section 3.3.

Transportation Facilities

The existing transportation network within the study area is limited. The I-19 and I-10 freeways create the western and northeastern boundaries of the roughly triangular study area, with SR 83 being the easternmost boundary. Existing north-south routes that traverse the study area are limited to Nogales Highway, Wilmot Road, Houghton Road, and Wentworth Road. Sahuarita Road is the only existing route south of TUS that traverses the study area east to west. The road network north of TUS is well developed in a traditional grid pattern.

3.20.3.2 Reasonably Foreseeable Future Actions

Planned and Programmed Transportation Projects

The Sonoran Corridor, as listed in the PAG 2045 RMAP between Pima Mine Road and Rita Road, includes a new 4-lane roadway connecting I-10 to I-19. The Sonoran Corridor has been identified by Congress in the most recent surface transportation bill as a High Priority Corridor of the National Highway System.

The major changes proposed and programmed in the region's transportation system are improvements to I-10 East between I-19 and Kolb Road, and I-19 between I-10 and San Xavier Road. One significant new roadway that is reflected in the plan is the link between Aerospace Parkway and I-10 along Old Vail Connection Road, which could be part of a future Sonoran Corridor. Other important improvements in the study area include widening of Wilmot Road, Houghton Road, and Sahuarita Road (Table 3-56). A few other existing roadways are planned for widening or extension to enhance the limited network that currently exists in the study area. Projects identified in the 2045 RMAP are depicted in Figure 2-8.

Table 3-56. Proposed and Funded Roadway Improvements within the Study Area

ROADWAY	LIMITS	PROJECT DESCRIPTION
I-10:I-19 to Kolb Road/State Route 210 extension to I-10	I-19 to Houghton	Widening of I-10 from I-19 to Kolb Rd, and the reconstruction of various TI's/Extension of SR 210 to connect with I-10
I-19	San Xavier Road to Ajo Way	Widening of I-19 from 4 to 6 lanes, including two TIs
Houghton Parkway	I-10 to Tanque Verde Road	Widen to 4- and 6-lane parkway, new bridges and greenway, bike lanes and sidewalks
Nogales Hwy	Old Vail Connection Road to Los Reales Rd	Widen to 6-lane roadway, sidewalks and bike lanes
Nogales Hwy	Calle Valle Verde to Sahuarita Road	Widen to 4-lane roadway, bike lanes
Old Vail Connection Road	Alvernon Way to Rita Road	Construct new 2-lane roadway
Pima Mine Road	I-19 to Nogales Hwy	Widen to 4-lane roadway, bike lanes
Rancho Sahuarita Blvd.	Sahuarita Road to El Toro Road	Construct 4-lane roadway, bike lanes, sidewalk and drainage
Sahuarita Road	Country Club Road to SR 83	Reconstruct 2-lane roadway with drainage, bike lanes
Sahuarita Road	La Cañada Drive to La Villita Road	Widen to 6-lane roadway

The 2045 RMAP's Reserve Project List includes projects identified as future transportation needs for which funding has not been identified over the RMAP's 30-year plan horizon. If priorities change and funding can be identified, a reserve project may be added to the plan through an appropriate amendment process (Table 3-57).

Table 3-57. Unfunded Future Projects in Study Area

ROADWAY	LIMITS	PROJECT DESCRIPTION
El Toro Road	La Villita Road to Wilmot Road	Construct 4-lane divided roadway, includes bridge over Santa Cruz River in Sahuarita
El Toro Road Regional Arterial	I-19 to Wilmot Road	6-lane Regional Arterial Upgrade of El Toro Road
Houghton Road	Tanque Verde Road to Catalina Hwy.	Widen to 3-lane roadway
Nogales Hwy.	Pima Mine Road to Old Vail Connection Road	Widen to 4-lane roadway
Nogales Hwy.	Sahuarita Road to Pima Mine Road	Widen to 4-lane divided roadway
Old Nogales Hwy. Corridor	Continental Road to Nogales Hwy.	Widen to 4-lane roadway, includes bridge over Santa Cruz River
Pima Mine Road Regional Arterial	Alvernon Way to I-10	Upgrade Pima Mine Road to a regional arterial
Sahuarita Road Regional Arterial	I-19 to SR 83	Upgrade Sahuarita Road to a regional arterial
I-10 East	Rita Road TI I-10 and Rita Road	Reconstruct Traffic Interchange
I-10 East	Kolb Road to Houghton Road	Widen to 8 lanes
I-19: Mainline Widening #1	Continental Road to El Toro Road	Widen to 6 lanes
I-19: Mainline Widening #2	El Toro Road to Valencia Road	Widen to 6 lanes
I-19	Pima Mine Road	Reconstruct Traffic Interchange
I-19	San Xavier Road	Reconstruct Traffic Interchange
I-19	Drexel Road	Reconstruct Traffic Interchange
I-19	El Toro Road	Reconstruct Traffic Interchange
I-11	Nogales to Las Vegas	New interstate highway

Source: PAG RMAP

Future Non-Transportation Projects

As described in detail in Section 3.2, future non-transportation projects that are anticipated to occur in the future are comprised of development in accordance with adopted plans. Table 3-58 summarizes the major non-transportation projects and plans that coincide with the study area.

Table 3-58. Future Non-Transportation Projects

PLAN/PROJECT	DESCRIPTION
Tucson Southlands	Long-range growth area with no currently specified plan
Verano Specific Plan	Planned Development Community with anticipated industrial and commercial uses and minor residential component
Southeast Conceptual Area Plan (SECAP)	Special Planning Area for future master planned development
Rita 244	The land near the existing Rita Road interchange at I-10 is comprised of a planned business park, industrial, and commercial development known as the Rita 244/Target Distribution Center development, and the UA Tech Park.
UA Tech Park	The UA Tech Park developed a land-use plan in 2013. The plan included increased development in the southern portion of the tech park, open space, and a large solar field in the northern half of the property (subsequently completed).
Tucson Airport Master Plan	TUS completed an airport master plan in 2014 and is currently in the process of updating that plan. Expansion of airport facilities and air traffic is anticipated, with associated vehicular traffic to and from these facilities.
San Xavier District Cooperative Farm Extension	BOR plans to construct an extension of the irrigation system for the San Xavier Cooperative Farm that will serve 1,094 acres of additional land proposed for agricultural use.
CAP Reliability Project	BOR plans a project to allow the SXD to satisfy their CAP water demands during regular annual maintenance outages of the CAP.
Pima County's Southeast Employment and Logistics Center	This plan includes a major employment hub planned around the existing Pima County Fairgrounds.

3.20.4 Environmental Consequences

The following sections discuss the potential indirect and cumulative effects of the corridor alternatives as well as the No-Build Alternative. All corridor alternatives have similar indirect and cumulative effects and are therefore not presented independently.

3.20.4.1 Corridor Alternatives

Indirect Effects

Any of the three Sonoran Corridor alternatives has the potential to result in an increase in the rate of growth of secondary development that could generate additional traffic, population and employment growth, economic benefits, or other impacts. This includes things such as changes in planned land uses or expansion of development footprints that could occur as a result of the Sonoran Corridor. For example, the Sonoran Corridor could potentially spur development on currently unplanned or minimally planned ASLD lands, which are typically sold at auction only when the economics of such a transaction are considered favorable. (ASLD Trust Land must be sold to the highest bidder for the benefit of funding public institutions.) This development potential would be subject to several requirements to satisfy treatment of water courses and biological resources in addition to managing land use and traffic impacts.

TIs along the future Sonoran Corridor would substantially improve access between the local communities and the larger region, which may accelerate or spur additional development at these locations. Residential communities near these TI locations would have better access to jobs, schools, shopping, and services, while commercial developments near the interchanges would have good access to suppliers and customers. These would be analyzed in a Tier 2 study once a specific alignment is known. The types of indirect environmental impacts that could potentially result from induced development or changes are described in Table 3-59.

Table 3-59. Potential Indirect Effects of the Sonoran Corridor

RESOURCE	POTENTIAL SECONDARY IMPACTS OF THE NO-BUILD ALTERNATIVE	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 1	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 7	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 8A
Traffic and transportation	Traffic modeling under the No Build Alternative indicates that local roadways as well as I-10 and I-19 would experience congestion in the design year 2045.	Increased traffic volumes may occur more quickly if secondary development were induced by the proposed action. This could affect development on the SXD in the western portion of the corridor. However, traffic congestion is improved in the design year 2045 compared to the No-Build Alternative. Given the forecasts, any potential intensification of land uses would be expected to have minor traffic effect.	Increased traffic volumes may occur more quickly if secondary development were induced by the proposed action. This would impact Sahuarita as well as the area between TUS and I-10. However, traffic congestion is improved in the design year 2045 compared to the No-Build Alternative. Given the forecasts, any potential intensification of land uses would be expected to have minor traffic effect.	Increased traffic volumes may occur more quickly if secondary development were induced by the proposed action. This would affect Sahuarita and the area near Houghton Road on I-10. However, traffic congestion is improved in the design year 2045 compared to the No-Build Alternative. Given the forecasts, any potential intensification of land uses would be expected to have minor traffic effect.

Table 3-59. Potential Indirect Effects of the Sonoran Corridor (continued)

RESOURCE	POTENTIAL SECONDARY IMPACTS OF THE NO-BUILD ALTERNATIVE	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 1	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 7	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 8A
Land use	Under the No-Build Alternative, land uses would continue along current trajectories, with continued growth and development along existing transportation corridors. The pace of development and subsequent change in land use patterns would be guided by market forces and availability of public services. No indirect effects to land use are anticipated.	The construction of a new transportation facility could affect the type or pace of land use changes in areas that are currently undeveloped. On the SXD, there are no defined plans for growth among the allottees. Corridor Alternative 1 could open the area to activity that would change the character of the segment within the SXD given the limited anticipated land use changes. The introduction of new access in the rest of the corridor could trigger or accelerate the development of land that would be better connected to employment and services; that serve long-distance travel; or promote development of new industrial, manufacturing, or other businesses that value close access to high-capacity transportation.	The introduction of new access could trigger or accelerate development on lands that would be better connected to employment and services; result in the development of commercial services that serve long-distance travel; or promote development of new industrial, manufacturing, or other businesses that value close access to high-capacity transportation. In general, increases in economic value associated with the corridor could potentially result in rezoning of land to permit more intensive uses in some locations such as Sahuarita, near the airport and near Rita Road along I-10. That could increase traffic volumes or expand the development footprint in the area, which could result in additional impacts. Based on forecasted travel, the effect would most likely be minor.	The introduction of new access could trigger or accelerate the development of land that would be better connected to employment and services; result in the development of commercial services that serve long-distance travel; or promote development of new industrial, manufacturing, or other businesses that value close access to high-capacity transportation. In general, increases in economic value associated with the corridor could potentially result in rezoning of land to permit more intensive uses in some locations such as Sahuarita, near the Pima County Fairgrounds, and along I-10. That could increase traffic volumes or expand the development footprint in the area, which could result in additional impacts, but based on forecasted travel, the effect would most likely be minor.

Table 3-59. Potential Indirect Effects of the Sonoran Corridor (continued)

RESOURCE	POTENTIAL SECONDARY IMPACTS OF THE NO-BUILD ALTERNATIVE	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 1	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 7	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 8A
Population and employment	Because transportation and land use plans have been designed to respond to population forecasts (as opposed to encouraging population growth where it might not otherwise occur), no secondary impacts have been identified.	Secondary development resulting from Corridor Alternative 1 may potentially change socioeconomic conditions in the SXD if the new facility encourages development opportunities not currently contemplated by allottees in the area. The rest of the corridor is more likely to develop non-residential uses related to the proximity of the proposed corridor.	Indirect effects of Corridor Alternative 7 related to higher or faster development in identified growth areas (e.g., Sahuarita and Tucson) would likely show a moderately higher increase in employment levels in Sahuarita, Tucson, and Pima County within the area of influence of the corridor interchanges.	Indirect effects of Corridor Alternative 8A related to higher or faster development in growth areas would likely show a moderately higher increase in population and employment levels in Sahuarita, Tucson, and Pima County within the area of influence of the corridor interchanges.
EJ and community facilities	Development of the areas has the potential to affect communities and EJ populations through changes in development patterns, traffic, or property values specific to their neighborhoods. In addition, environmental effects of secondary development have the potential to negatively impact these populations, e.g., through increased traffic and associated degradation of air quality. Benefits to these communities could also result through improved access to housing, employment, and educational opportunities.	Secondary development has the potential to affect communities and EJ populations through changes in development patterns, traffic, or property values specific to neighborhoods where they are located. In addition, environmental effects of secondary development have the potential to negatively impact these populations, e.g., through increased traffic and associated degradation of air quality. Benefits to these communities could also result through improved access to housing, employment, and educational opportunities.	Secondary development has the potential to affect communities and EJ populations through changes in development patterns, traffic, or property values specific to neighborhoods where they are located. In addition, environmental effects of secondary development have the potential to negatively impact these populations, e.g., through increased traffic and associated degradation of air quality. Benefits to these communities could also result through improved access to housing, employment, and educational opportunities.	Secondary development has the potential to affect communities and EJ populations through changes in development patterns, traffic, or property values specific to neighborhoods where they are located. In addition, environmental effects of secondary development have the potential to negatively impact these populations, e.g., through increased traffic and associated degradation of air quality. Benefits to these communities could also result through improved access to housing, employment, and educational opportunities.

Table 3-59. Potential Indirect Effects of the Sonoran Corridor (continued)

RESOURCE	POTENTIAL SECONDARY IMPACTS OF THE NO-BUILD ALTERNATIVE	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 1	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 7	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 8A
Hydrology, floodplains, and water resources	Development of the area has the potential to affect surface waters, aquifers, floodplains, and wetlands, and may introduce runoff, segmentation, and changes in hydrology.	Secondary development would likely increase the quantity of impervious surfaces within the watershed, which would increase surface flows entering waters. Resulting stream flow and velocity changes during storms may result in increased flooding and stream degradation. In addition, these changes may affect the quality and quantity of water available for recreation, habitat, drinking, or agricultural purposes.	Secondary development would likely increase the quantity of impervious surfaces within the watershed, which would increase surface flows entering waters. Resulting stream flow and velocity changes during storms may result in increased flooding and stream degradation, which could create potential challenges along major drainages complexes in particular (e.g., Lee Moore Wash) that primarily affects Alternatives 7 and 8A. In addition, these changes may affect the quality and quantity of water available for recreation, habitat, drinking, or agricultural purposes.	Secondary development would likely increase the quantity of impervious surfaces within the watershed, which would increase surface flows entering waters. Resulting stream flow and velocity changes during storms may result in increased flooding and stream degradation, which could create potential challenges along major drainages complexes in particular (e.g., Lee Moore Wash) that primarily affects Alternatives 7 and 8A. In addition, these changes may affect the quality and quantity of water available for recreation, habitat, drinking, or agricultural purposes.
Biological resources	Development of the area has the potential to affect vegetation and wildlife habitat, resources, and corridors. This development may cause or increase gradual changes in species composition, diversity, genetic makeup, and health because of impacts on habitat, habitat fragmentation, or genetic isolation. In addition, secondary development may introduce additional invasive species to the study area.	Indirect effects would be similar to the No-Build but may occur more rapidly. Changes resulting from the introduction of the corridor could potentially cause land uses in the area to intensify or expand into undeveloped lands such as the SXD. Indirect effects of each corridor alternative on biological resources are difficult to differentiate as habitat for some species is more prevalent within Corridor Alternative 1 (e.g., Sonoran desert tortoise) while other resources such as riparian habitat is more	Indirect effects would be similar to the No-Build but may occur more rapidly. Changes resulting from the introduction of the corridor could potentially cause land uses in the area to intensify or expand into undeveloped lands. Indirect effects of each alternative on biological resources are difficult to differentiate, but habitat for some resources such as riparian habitat is more prevalent within and adjacent to Corridor Alternatives 7 and 8A. The effects on the impacted biology would	Indirect effects would be similar to the No-Build but may occur more rapidly. Changes resulting from the introduction of the corridor could potentially cause land uses in the area to intensify or expand into undeveloped lands. Indirect effects of each alternative on biological resources are difficult to differentiate, habitat for some resources such as riparian habitat is more prevalent within and adjacent to Corridor Alternatives 7 and 8A. The effects on the impacted biology would

Table 3-59. Potential Indirect Effects of the Sonoran Corridor (continued)

RESOURCE	POTENTIAL SECONDARY IMPACTS OF THE NO-BUILD ALTERNATIVE	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 1	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 7	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 8A
		prevalent within and adjacent to Corridor Alternatives 7 and 8A. The effects on the impacted biology would need to be addressed as part of Tier 2 analyses.	need to be addressed as part of Tier 2 analyses.	need to be addressed as part of Tier 2 analyses.
Cultural resources	Development of the area may potentially affect historical or archaeological sites directly through impacts or degradation from creating access to areas where they exist.	Indirect effects would most likely be similar to the No-Build; however, they may occur sooner. While the corridor alternatives were developed to minimize impacts to resources, the introduction of the Sonoran Corridor could cause land uses in the area to change in a manner that impacts identified cultural resources. The effects on the impacted resources would be determined as part of the Section 106 consultation process during Tier 2 studies. Corridor Alternative 1 has the highest potential to impact cultural resources and it is anticipated that any cultural resources effects due to growth would also be highest under this corridor alternative.	Indirect effects would most likely be similar to the No-Build; however, they may occur sooner. While the corridor alternatives were developed to minimize impacts to resources, the introduction of the Sonoran Corridor could cause land uses in the area to change in a manner that impacts identified cultural resources. The effects on the impacted resources would be determined as part of the Section 106 consultation process during Tier 2 studies.	Indirect effects would most likely be similar to the No-Build; however, they may occur sooner. While the corridor alternatives were developed to minimize impacts to resources, the introduction of the Sonoran Corridor could cause land uses in the area to change in a manner that impacts identified cultural resources. The effects on the impacted resources would be determined as part of the Section 106 consultation process during Tier 2 studies.

Table 3-59. Potential Indirect Effects of the Sonoran Corridor (continued)

RESOURCE	POTENTIAL SECONDARY IMPACTS OF THE NO-BUILD ALTERNATIVE	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 1	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 7	POTENTIAL SECONDARY IMPACTS OF CORRIDOR ALTERNATIVE 8A
Farmland	Development of the area has the potential to affect active farmland (including prime and unique farmland), which may include the loss, impairment, and subdivision of agricultural parcels.	Indirect effects would be similar to the No-Build Alternative; however, may occur more rapidly. Some farmlands, though not directly affected, such as the San Xavier Cooperative Farm, could be impacted or influenced by corridor placement and construction. Those possibilities would be addressed in a Tier 2 analysis when more detailed alignment information becomes available.	Some farmlands, such as the pecan farms in Sahuarita, may be affected by access loss or changes due to corridor placement and construction. Those possibilities would be addressed in a Tier 2 analysis when more detailed alignment information becomes available.	Some farmlands, such as the pecan farms in Sahuarita, may be affected by access loss or changes due to corridor placement and construction. Those possibilities would be addressed in a Tier 2 analysis when more detailed alignment information becomes available.
Air quality/noise	Increased traffic from secondary development has the potential to increase localized noise levels and emissions of air pollutants such as CO and PM_{10}. It may also affect energy use and climate change.	Indirect effects would be the same as the No-Build; however, important changes could occur on the SXD with introduction of a roadway in an undeveloped area. In other sections, the indirect effects on air quality (from unplanned increases in traffic volumes) would be minor compared to the effect of the corridor.	Indirect effects would be the same as the No-Build; however, they may occur sooner. The indirect effects on air quality (from unplanned increases in traffic volumes) would be minor compared to the effect of the corridor.	Indirect effects would be the same as the No-Build; however, they may occur sooner. The indirect effects on air quality (from unplanned increases in traffic volumes) would be minor compared to the effect of the corridor.
Hazardous waste/materials	No potential indirect effects.	Secondary development has the potential to affect existing contaminated or hazardous material sites or result in the generation of hazardous waste or potential spills.	Secondary development has the potential to affect existing contaminated or hazardous material sites or result in the generation of hazardous waste or potential spills.	Secondary development has the potential to affect existing contaminated or hazardous material sites or result in the generation of hazardous waste or potential spills.

With the addition of a new transportation corridor, particularly in areas where a service TI is proposed, the improved access to and from these locations could support additional development. The corridor alternatives were located to avoid or minimize impacts on existing residents, businesses, community facilities, known cultural resources, and other natural and built environmental features.

Cumulative Impacts

Implementing a new Sonoran Corridor, combined with past, present, and foreseeable future actions, would increase the rate of conversion of undeveloped and agricultural land to a transportation use. This may affect natural resources (for example, direct impacts to plant and wildlife species, habitat fragmentation, and barriers to wildlife movement) and cultural resources (for example, historical and archaeological sites directly impacted by construction or damaged by opening areas for development). Table 3-60 summarizes the cumulative effects on various environmental resources within the area.

Table 3-60. Cumulative Effects Summary

RESOURCE AND CURRENT STATE	POTENTIAL CUMULATIVE EFFECTS OF THE NO-BUILD ALTERNATIVE	POTENTIAL CUMULATIVE EFFECTS OF THE CORRIDOR ALTERNATIVES
Cultural Resources – Within the Study Area, for areas where surveys have occurred, there has been little impact on historic properties. Development of lands in the past may have impacted unknown resources.	Development and implementation of the reasonably foreseeable actions will continue to affect cultural resources and would have potential incremental effects, such as increased noise, public access, or visual effects on archaeological sites. Future development would require the identification and treatment of these resources.	Effects same as No-Build; however, affects may occur more rapidly.
Section 4(f), 6(f), & Recreational Resources – Previous development has both reduced the amount of recreational open space in the study area, as well as created areas for recreation such as parks. Likewise, Section 4(f) resources have been both impacted and created by previous actions.	The trend in the Study Area is expected to be the same as development occurs, with some impacts such as historic properties being negatively impacted while others, such as parks, are being created. Decrease the potential land available for dispersed recreation uses. Increase the demand to provide parks, recreational facilities and open spaces in growing urban/suburban areas. Change the accessibility to recreational resources. While travel to some resources may be more difficult due to traffic congestion, new facilities may be closer and more accessible.	Cumulative effects same as the No-Build
Air Quality – Portions of the Study Area are within the Tucson Maintenance Area for CO. Due to the limited roadway network within the Study Area, contributions of emissions to regional air quality are minor. Within the region over the past 10 years, emission levels are decreasing.	Generate minor potential incremental effects due to the combined indirect effects and additional traffic volumes and congestion. Potential implementation of new air quality regulations, improving diesel and dust controls, reduced dependence on fossil fuels, and adoption of cleaner car engine technologies may offset these effects.	The corridor alternatives are not expected to generate potential incremental effects due to reduced congestion, the potential implementation of new air quality regulations, improving diesel and dust controls, reduced dependence on fossil fuels, and adoption of cleaner car engine technologies.

Table 3-60. Cumulative Effects Summary (continued)

RESOURCE AND CURRENT STATE	POTENTIAL CUMULATIVE EFFECTS OF THE NO-BUILD ALTERNATIVE	POTENTIAL CUMULATIVE EFFECTS OF THE CORRIDOR ALTERNATIVES
Noise and Vibration – Due to the sparse development in many portions of the study area, noise levels are generally low. Noise levels near the airport and railroad do have periods of high noise levels.	As lands are developed, the trend is for increased ambient noise levels. The reasonably foreseeable actions would contribute to potential incremental increases in noise levels in communities as population growth occurs.	Due to the increased anticipated speeds and associated traffic noise, the Corridor Alternatives would contribute to an overall increase in future noise conditions compared to the No-Build
Geology, Topography, Soils, and Prime and Unique Farmland – Within the region there is a trend of conversion of agricultural lands (including Prime and Unique Farmlands) to other land uses.	Increase incremental effects including the use of geologic resources and soils; loss of those resources through covering, and the potential loss of farmland	Cumulative effects same as the No-Build
Biological Resources – Habitat throughout the study area is relatively unfragmented by development and built features.	In the region, conversion of lands to developed uses and the construction of roads and other linear features have led to a trend of fragmenting blocks of habitat and created impediments to wildlife movement between them. The reasonably foreseeable actions would contribute to habitat loss, fragmentation, and isolation effects corridor-wide and be of greatest concern near threatened and endangered species habitats and along wildlife corridors as land is developed.	Cause localized, incremental effects in locations with planned corridor improvements and increased development.
Water Resources – Surface water within the Study Area has few restrictions and has not been altered through channelization or culverts.	As development occurs and reasonably foreseeable actions are implemented, there is a trend for surface waters to be diverted and channelized as well as a greater demand placed on groundwater resources.	Increase incremental effects to a greater extent than the No-Build Alternative.
Visual and Aesthetic Scenic Resources – There are many portions within the Study Area with undisturbed expansive views as well as interspersed suburban and industrial areas. Past actions within the Study Area have created a change in visual character from rural to suburban/urban.	The study area is expected to experience a transition in land use from low-density, open uses to residential, commercial, and light industrial uses. This would continue the trend of the perception of open spaces with distant mountain backdrops changing to one of expanding suburban and urban development.	Under the Corridor Alternatives, the proposed freeway would be a part of the change in visual character which would contribute to the effect occurring under the No-Build Alternative.

3.20.5 Summary

Although implementation of a new Sonoran Corridor, combined with past, present, and future foreseeable actions, may have a cumulative effect on environmental resources, the construction of a Sonoran Corridor would result in a more efficient and enhanced transportation system, which would lead to improved mobility and air quality through reduced congestion and vehicle emissions, and safety. In addition, a new Sonoran Corridor would provide a regional connector that would support projected travel demand. In particular, it would enhance traffic circulation and provide access to planned growth areas.

Under the No-Build Alternative, no new transportation facility would be constructed, and no new indirect or cumulative impacts are anticipated beyond those that could result from other projects. However, implementation of planned and programmed transportation projects would not adequately accommodate traffic generated by future land development and population and employment growth in the study area.

3.20.6 Mitigation Strategies

Mitigation strategies that were identified for technical resource areas to address direct impacts also would mitigate indirect and cumulative effects.

3.20.7 Conclusion/Future Tier 2 Analysis

Each of the corridor alternatives could result in secondary growth and development. The methodology to address indirect and cumulative effects would be revisited during future Tier 2 analysis to reflect a more detailed understanding of a proposed project once a specific roadway alignment is known. Once an engineered alignment is developed, Indirect and Cumulative effects would be redefined and evaluated in the Tier 2 analysis based on the detailed alignment. A typical analysis used at the project level to identify and assess cumulative effects would incorporate the following general concepts: identifying resources, identifying geographic boundaries, discussing current resource health and historic context, identifying reasonably foreseeable future actions, assessing effects, and reporting.

Coordination would occur with federal, state, regional, and local agencies to identify local projects for consideration as part of the indirect and cumulative analysis. Future Tier 2 environmental documentation would further refine the mitigation to minimize direct, indirect, and cumulative effects on resources.