

**APPENDIX A – OPPORTUNITIES AND CONSTRAINTS
ANALYSIS**

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APPENDIX A – OPPORTUNITIES AND CONSTRAINTS ANALYSIS

A.1 INTRODUCTION

A comprehensive regional screening process was employed to identify feasible alternative routes for the SunZia Southwest Transmission Project (Project). A study area was defined initially in May 2009 to include an area within which potential routes for the proposed Project could be located between the termination points in New Mexico and Arizona. The study area was expanded to its current boundaries in April 2010, and additional alternatives were considered and eliminated based on comments received from agencies and the public during the scoping process.

To identify potential locations for transmission line corridors and substation sites, levels of sensitivity were assigned to resources within the study area. Sensitivity levels established the basis for the identification of opportunities and constraints, for placement of the proposed Project transmission facilities. The opportunities and constraints were mapped, and individual subroutes were evaluated based on resource sensitivity and feasibility. This analysis was used to refine alternatives, eliminating some segments (or links) from further evaluation and carrying forward others for consideration in this environmental impact statement (EIS), as described in Sections 2.2 and 2.3.

The following describes constraints identified for land use, visual, cultural, and biological resources during this phase of the study. Engineering considerations included in the alternatives screening also are discussed, followed by a summary of siting opportunities identified in the study area. Opportunities and constraints by resource are displayed on the maps included at the end of this appendix. These maps were initially developed during the alternatives screening analysis and refined based on comments received during the scoping process. The opportunities and constraints analysis and alternatives screening process required a comprehensive evaluation of all preliminary alternative route segments, to determine which links would be carried forward and which would be recommended for elimination. This alternatives screening process, by subroute, is documented in Tables A-6 and A-7, which follow the maps.

In some instances, route group names or numbers have been changed and do not correspond to the route group or link numbers evaluated in this EIS. Note that these maps represent the collection and analysis of data at a regional scale. Comprehensive and current data were subsequently collected and refined in the corridor identification process. Resource studies, including the environmental impact analysis in this EIS, are based on more current and detailed data.

A.2 STUDY AREA DEFINITION

The study area was defined to include an area within which potential routes for the proposed 500 kV transmission lines could be located between the termination points in Lincoln County, New Mexico (proposed SunZia East Substation) and Pinal County, Arizona (planned Pinal Central Substation). Construction and operation of the proposed SunZia 500 kV transmission lines along one or more of these routes would therefore respond to the purpose and need, as well as the Project objectives; i.e., to promote interconnections of existing and planned transmission and generation facilities in New Mexico and Arizona.

Using readily available data, such as maps, terrain information, and information regarding existing linear facilities, a general study area boundary and potential alternative routes within the study area were identified. Major physiographic features, jurisdictional boundaries, specially designated areas, and existing utility corridors representing the limits of study were then used to define the study area boundary. Generalized corridors within the study area were identified using similar rationale.

The study area encompasses 10 counties in New Mexico and 5 counties in Arizona. The eastern terminus of the study area is located in Lincoln County, New Mexico, south of the town of Corona; it was selected because of its strategic location to potential sources of renewable energy. The western terminus of the study area is located in Pinal County, near Eloy, Arizona; it was selected because it can provide direct access to the high-voltage electrical infrastructure in the region.

In order to identify potential locations for transmission line corridors and substation siting areas, inventoried and mapped data were used to determine environmental, engineering, and agency/public constraints and opportunities within the study area. The approach used to identify these opportunities and constraints and the results from this analysis are described below.

A.3 EVALUATION OF OPPORTUNITIES AND CONSTRAINTS

The identification of opportunities and constraints was based on a sensitivity analysis. As used here, sensitivity is defined as a measure of the probable adverse response of each resource to direct and indirect impacts associated with the construction, operation, maintenance, and abandonment of the transmission lines, substations, and other Project facilities.

A.3.1 Siting Opportunities

Opportunities for new transmission lines and substation sites generally included locations consisting of, or in proximity to, existing or planned linear facilities, previously disturbed corridors, or corridors designated for future use as utility corridors or in conjunction with industrial use(s). Typically, these opportunities include existing transmission lines, major transportation corridors (interstate and state highways), pipeline corridors, railroads, and canals. These corridors provide potential access for construction and maintenance of transmission lines and substations. Existing linear corridors generally minimize ground disturbance, as well as biological, cultural, soil erosion, land use, and visual resources impacts. Linear features with high opportunity levels include:

- Transmission lines (230 kV or greater) Federally designated overhead transmission line corridors
- Department of Energy (DOE) West-wide Energy Corridors (Energy Policy Act of 2005 [EPAct] Section 368).

Linear features with moderate opportunity levels include:

- Transmission lines (less than 230 kV)
- Natural gas/petroleum pipelines (6-inch diameter or greater) Railroads – *Moderate*
- Interstates, U.S. highways, state highways, and other *primary* roads

A.3.2 Siting Constraints and Environmental Sensitivity

Criteria used in making the determination of environmental sensitivity include consideration for the following:

Protective Status – a measure of the formal concern expressed for a resource either through legal protection or by assignment of special status species.

Resource Value – a measure of rarity, high intrinsic worth, singularity, or diversity of a resource within an area.

Present and Future Use – a measure of the level of conflict based on land management policies and/or use that also may include issues of specific concern to the agencies and public.

With consideration of the above criteria, the environmental data gathered during the regional inventory was evaluated and given a relative sensitivity level. Four sensitivity levels, as described below, were used to define constraints within the study area based on protective status, resource value, and present and future use.

Exclusionary/Maximum Constraint Areas – Areas where legal status (i.e., wilderness areas or jurisdictional policy [e.g., active airports]) would prohibit, or most likely prohibit, the location of transmission or substation facilities. Locations of very high sensitivity are considered to be very high (or maximum) constraint and undesirable for location of transmission lines and substations.

High Sensitivity/Constraint Areas – Areas determined to be less suitable because of unique, highly valued, complex, historic, or protected resources and significant potential conflict with use, or areas posing substantial hazards to construction and operation of the transmission line and substations. Locations of high sensitivity (i.e., urban areas) are considered to be high constraint or least desirable for location of transmission lines and substations.

Moderate Sensitivity – Areas of potential environmental effects due to impacts to important or valued resources, resources assigned special status, or some conflict with use. Locations of moderate sensitivity are considered to be moderate constraint areas and less desirable for siting the transmission lines and substations.

Low Sensitivity Areas – Areas where resource conflicts identified through the feasibility study process are minimal. These areas of low sensitivity are considered to be of minimal constraint, or high opportunity, for locating the transmission lines and substations, particularly in association with existing transmission line corridors.

Levels of sensitivity were assigned based on different resource features and the above definitions. Table A-1 and the tables included in Appendix A provided guidelines for regional data classification.

Once classifications were assigned, GIS (Geographic Information System) was used to map sensitivity and constraint levels for each of the environmental resources inventoried within the study area. GIS was also used to create a composite constraints map for the study area, which served to identify potential overall levels of environmental constraint for the location of Project facilities.

Table A-1. Environmental Sensitivity Summary

Data Layers	Sensitivity Level
Land Use	
Airports and Heliports (municipal and private runways less than 5,000 feet)	Exclusion
Federal Wilderness Areas	Exclusion
National Monuments	Exclusion
BLM Exclusion Area	Exclusion
Federal Wilderness Study Areas	Exclusion
BLM Areas of Critical Environmental Concern	High
National or State Wildlife Refuges	High
National Conservation Areas	High
BLM Avoidance Area	High
State Parks	High
Urban Areas (incorporated and unincorporated cities and towns)	Moderate
BLM Pending Solar Right-of-Way	Moderate
BLM Pending Wind Right-of-Way	Moderate
Research Natural Area	Moderate
Special Management Area	Moderate
Special Management Area (proposed)	Moderate
Vacant/Undeveloped	Low
Visual and Recreation	
BLM Visual Resource Management Objectives Class I	Exclusion
BLM Visual Resource Management Objectives Class II	High
Scenic Trails	High
Scenic Roads or Byways	High
Concern Level Roads I	High
BLM Visual Resource Management Objectives Class III	Moderate
U.S. Forest Service Visual Quality Objective Partial Retention	Moderate
Special Recreation Management Area	Moderate
Rest Area	Moderate
Concern Level Roads II	Moderate
BLM Visual Resource Management Objectives Class IV	Low
U.S. Forest Service Visual Quality Objective Modification	Low
U.S. Forest Service Visual Quality Objective Maximum Modification	Low
Cultural Resources	
State Monument	High
National Register Districts	High
Historic Trails	High
Cultural Resource Area	Moderate
Biological Resources	
Designated Threatened and Endangered Species Critical Habitat	High
Wetlands	High
Desert Tortoise Habitat	
Category I	High
Category II	Moderate
Category III	Low
Sensitive Species	Moderate to High
General Native Vegetation	
Arizona Upland Sonoran Desertscrub	Moderate
Coniferous and Mixed Woodland	Moderate
Desert Grassland (Ecotone)	Moderate
Great Basin Conifer Woodland	Moderate
Juniper Savanna (Ecotone)	Moderate
Madrean Evergreen Woodland	Moderate
Montane Coniferous Forest	Moderate

Table A-1. Environmental Sensitivity Summary

Data Layers	Sensitivity Level
Petran Montane Conifer Forest	Moderate
Petran Subalpine Conifer Forest	Moderate
Plains and Great Basin Grassland	Moderate
Plains-Mesa Grassland	Moderate
Semidesert Grassland	Moderate
Subalpine Coniferous Forest	Moderate
Chihuahuan Desertscrub	Low
Closed Basin Scrub	Low
Interior Chaparral	Low
Lava Beds	Low
Lower Colorado River Sonoran Desertscrub	Low
Montane Scrub	Low
Plains-Mesa Sand Scrub	Low
Urban, Farmland, or Open Water	Low

A.3.3 Identification of Alternative Routes and Substation Siting Areas

Once inventory data were compiled and the constraints and opportunities were clearly defined, the data were used to identify those options that exhibited higher levels of opportunity combined with lower levels of constraint. Additionally, a review of aerial imagery was combined with selective field reviews to make geographic adjustments to the routes within the general study corridors, based on the environmental and engineering constraints and opportunities. The result of this process was a set of refined alternative routes that were presented for review during the scoping process.

As a part of the evaluation process, potential alternative transmission corridors and substation sites were then grouped into smaller geographic areas to allow for localized comparisons among substation siting areas within the Project study area. The initial three areas were as follows:

- SunZia East Substation (near Corona, New Mexico) to Midpoint Substation (Deming, New Mexico)
- Midpoint Substation (Deming, New Mexico) to Willow Substation (near Willcox, Arizona)
- Willow Substation (near Willcox, Arizona) to Pinal Central Substation

Alternatives within each of these routing areas were evaluated based on their ability to meet the Project objectives, and considered both environmental and engineering factors. Environmental evaluation included the review of opportunities and constraints (sensitivities); engineering evaluation included the consideration of engineering/construction constraints and reliability factors that were used to determine levels of potential risk. The characterizations of alternative routes can vary on a case-by-case basis, depending on specific and local conditions, as well as the potential to mitigate environmental and engineering concerns.

Through the scoping process, routes were further refined, deleted, and added based on the public’s comments and ongoing resource evaluations. A full discussion of the scoping process can be found in the *SunZia Southwest Transmission Project Scoping Report – April 2010, Volumes I, II, and III*. A summary of how the scoping process affected routing options is provided below.

A.4 RESOURCE SENSITIVITY AND CONSTRAINTS ANALYSIS

A.4.1 Land Use

Within the Project study area several land uses were determined to be exclusionary. These areas would not be compatible with a transmission project, and were excluded from alternative development options. Land uses determined to have a high sensitivity would most likely not be compatible with a transmission project. These areas were not excluded from the alternatives analysis, but would be avoided by most potential routes. Land uses determined to have a moderate to low sensitivity would most likely be compatible with a transmission project and were considered to be the most suitable for Project alternatives. Land uses and associated sensitivity levels are listed in Table A-2.

Table A-2. Land Use: Sensitive Areas	
Area or Resource	Project Location*
Exclusion Area	
<p>Airports and Heliports (municipal and private runways less than 5,000 feet) – FAA safety dictates these are not approved areas for transmission projects.</p>	<ul style="list-style-type: none"> • Holloman Air Force Base – 10 miles west of Alamogordo, NM • Alamogordo White Sands Regional Airport – 4 miles southwest of Alamogordo, NM • Truth or Consequences Municipal Airport – 6 miles north of Truth or Consequences, NM, along US Highway 85 • Las Cruces International Airport – 8 miles west of Las Cruces, NM • Carrizozo Municipal Airport – 1 mile northwest of Carrizozo, NM • Lincoln Station Airport (El Paso Natural Gas) – 9 miles south of Corona, NM • Deming Municipal Airport – 2 miles east of Deming, NM • Lordsburg Municipal Airport – .5 mile southeast of Lordsburg, NM • Socorro Municipal Airport – 3 miles south of Socorro, NM • Alexander Municipal Airport – 3 miles west of Belen, NM • Stallion Army Airfield – 18 miles southeast of Socorro, NM • Safford Regional Airport – 4 miles northeast of Safford, AZ • Cochise County Airport – 3 miles west of Willcox, AZ • Benson Municipal Airport – 3 miles northwest of Benson, AZ • Benson Airport (private) – 2 miles east of Benson, AZ • Ryan Field Airport – 10 miles southwest of Tucson, AZ • Marana Regional Airport (Avra Valley) – 15 miles northwest of Tucson, AZ • Coolidge Municipal Airport – 5 miles southeast of Coolidge, AZ • Davis Monthan Air Force Base – located 2 miles southeast of Tucson, AZ • Tucson International Airport – 6 miles south of Tucson, AZ • San Manuel Airport – 3 miles north of San Manuel, AZ • Marana Airport/Pinal Airpark – 20 miles southeast of Eloy, AZ, along I-10 • Eloy Municipal Airport – 4 miles northwest of Eloy, AZ • Silverbell Heliport (Western Army National Guard Aviation Training Site) – 20 miles southeast of Eloy, AZ along I-10 • Picacho Auxiliary Army Airfield #1 (National Guard Aviation Training Site) – approximately 8 miles southeast of Eloy, AZ

Table A-2. Land Use: Sensitive Areas

Area or Resource	Project Location*
<p>Wilderness Areas are federal lands set aside by an act of Congress. Human activities in wilderness areas are restricted to scientific study and nonmechanized recreation; horses are permitted, but motorized vehicles and equipment are not.</p>	<ul style="list-style-type: none"> • Galiuro Wilderness – 20 miles east of San Manuel, AZ • Peloncillo Mountains Wilderness Area – 7 miles northeast of San Simon, AZ • Saguaro Wilderness Area West – 14 miles northwest of Tucson, AZ, within Saguaro National Park • Rincon Mountain Wilderness Area – 20 miles east of Tucson, AZ • Redfield Canyon Wilderness Area – 32 miles north of Benson, AZ • Pusch Ridge Wilderness Area – 10 miles north of Tucson, AZ • Saguaro Wilderness Area East – 10 miles east of Tucson, AZ, within the Saguaro National Park • Indian Well Wilderness – 4 miles south of San Antonio, NM, along US Highway 85 • White Mountains Wilderness – 6 miles southeast of Carrizozo, NM
<p>National Monuments are places of historic, scenic, or scientific interest set aside for preservation usually by presidential proclamation.</p>	<ul style="list-style-type: none"> • White Sands National Monument – 30 miles northeast of Las Cruces, NM • Salinas Pueblo Mission National Monument (Abo, Quarai, and the Gran Quivira unit of Salinas Pueblo Missions National Monument) – all three ruins are located within a 25-mile radius of Mountainair, NM • Ironwood Forest National Monument – 20 miles west of Marana, AZ
<p>BLM Right-of-Way Exclusion Areas are not available for land use authorizations.</p>	<ul style="list-style-type: none"> • Several areas around the portion of Coronado National Forest east of San Manuel and an area near the New Mexico border north of San Simon, AZ • Main concentration of exclusion areas is around I-25, between El Paso and Socorro, NM • Few areas west and southwest of Lordsburg, NM • Two exclusion areas in the narrow part of the study area east of Deming, NM • Couple of areas west of Carrizozo, NM • Few areas south of Alamogordo, NM, along US Route 54
<p>Highly Sensitive Areas</p>	
<p>Wilderness Study Areas contain undeveloped federal land retaining its primeval character and influence, without permanent improvements or human habitation, and managed to preserve natural conditions.</p>	<ul style="list-style-type: none"> • Sierra de las Uvas – northeast of Deming, NM • Robledo Mountains – northwest of Las Cruces, NM • Aden Lava Flow – southwest of Las Cruces, NM • Organ Needles, Organ Mountains, and Pena Blanca – west of Las Cruces, NM • Devils Backbone, Antelope, Jornada del Muerto – south and southwest of San Antonio, NM • Sierra de las Canas – southeast of Socorro, NM • Aden Lava Flow – northwest of El Paso, NM • Florida Mountains – southeast of Deming, NM • West Portillo Mountains – southwest of Las Cruces, NM • Peloncillo Mountains – west of Lordsburg, NM • Presilla Mountains – east of Socorro, NM • Sierra Ladrones Mountains – southwest of Belen, NM • Veranito – north of Socorro, NM • Stallion – east of Socorro, NM

Table A-2. Land Use: Sensitive Areas

Area or Resource	Project Location*
<p>BLM Areas of Critical Environmental Concern are special designations that highlight areas where special management attention is needed to protect and prevent irreparable damage to important historical, cultural, or scenic values; fish and wildlife resources; or other natural systems. The BLM designates these areas and establishes special management measures for them through land use planning.</p>	<ul style="list-style-type: none"> • Roswell Cave Complex – 6 miles west of Carrizozo, NM • Three Rivers Petroglyph – 21 miles south of Carrizozo, NM • Sacramento Escarpment – 2 miles south of Alamogordo, NM • Organ/Franklin Mountains – 6 miles east of Las Cruces, NM • Los Tules – 5 miles south of Las Cruces, NM • San Diego Mountains and Rincon – 2 miles east of Hatch, NM • Robledo Mountains and Paleozoic Trackways – 10 miles northwest of Las Cruces, NM • Aden Lava Flow – 21 miles southwest of Las Cruces, NM • Doña Ana Mountains – 12 miles north of Las Cruces, NM • Uvas Valley – 17 miles west of Hatch, NM • Ladron Mountain/Devil’s Backbone Complex – 17 miles west of San Antonio, NM • San Pedro – 5 miles east of San Antonio, NM • Arroyo Tinajas – 5 miles east of Socorro, NM • Northern Peloncillo Mountains – 10 miles northeast of San Simon, AZ • Bear Springs Badlands – 12 miles west of Thatcher, AZ • Swamp Springs/Hot Springs – 2 miles south of the Galiuro Wilderness, AZ • 111 Ranch RNA – 25 miles north of Bowie, AZ • Table Mountain – 16 miles northeast of San Manuel, AZ • Wilcox Playa National Natural Landmark – 4 miles south of Willcox, AZ • Waterman Mountains – 18 miles southwest of Marana, AZ • Desert Grasslands RNA, Sombrero Butte – 11 miles northeast of San Manuel, AZ
<p>National or State Wildlife Refuge is a network of lands and waters managed to protect wildlife and wildlife habitat.</p>	<ul style="list-style-type: none"> • Bosque del Apache National Wildlife Refuge – 10 miles south of Socorro, NM • Sevilleta National Wildlife Refuge – 20 miles north of Socorro, NM • San Andres National Wildlife Refuge – 30 miles northeast of Las Cruces, NM
<p>National Conservation Areas are managed by the BLM under the National Landscape Conservation System. Restrictions vary between conservation areas, but generally the areas are not leased or sold under mining laws and motorized vehicle use is restricted.</p>	<ul style="list-style-type: none"> • Las Cienegas National Conservation Area – 38 miles southeast of Tucson, AZ • Gila Box Riparian National Conservation Area – 20 miles northeast of Safford, AZ
<p>BLM Right-of-Way Avoidance Areas are only available for land use authorizations if there are no other reasonable alternatives for the authorization.</p>	<ul style="list-style-type: none"> • Large concentration of avoidance areas occur around I-25, between Las Cruces and Socorro, NM • A couple of areas northwest of Carrizozo, NM • An area south of Alamogordo, NM • An area southwest of Las Cruces, NM • Areas northeast and southeast of Deming, NM • Few areas scattered between Lordsburg, NM and Deming, NM • Areas west, southwest, and south of Lordsburg, NM • Area east of Duncan, AZ • Area north of Bowie, AZ • Area west of Thatcher, AZ • Area southeast and an area northeast of San Manuel, AZ

Table A-2. Land Use: Sensitive Areas

Area or Resource	Project Location*
<p>State Parks are recreational areas managed by the state that typically include hiking, camping, picnic areas, and playgrounds.</p>	<ul style="list-style-type: none"> • Valley of Fires State Park – northwest of Carrizozo, NM • Rock Hound State Park – southeast of Deming, NM • Elephant Butte Lake State Park – just north of Truth or Consequences, NM • Caballo Lake State Park – just south of Truth or Consequences, NM • Percha Dam State Park – south of the Caballo Lake State Park, NM • Oliver Lee State Park – south of Alamogordo, NM • Leasburg Dam State Park – north of Las Cruces, NM • Mesilla Valley Bosque State Park – south of Las Cruces, NM • Franklin Mountains State Park – southeast of Las Cruces, NM • Roper Lake State Park – south of Safford, AZ • Oracle State Park – east of Oracle, AZ • Catalina State Park – north of Tucson, AZ • Picacho Peak State Park – southeast of Eloy, AZ
Moderate to Low Sensitivity Areas	
<p>Urban Areas are incorporated and unincorporated cities and towns.</p>	<ul style="list-style-type: none"> • Located at various points in or near the study area • New Mexico: Carrizozo, Alamogordo, Las Cruces, Socorro, Luis Lopez, San Antonio, Truth or Consequences, Arrey, Derry, Hatch, Deming, Anthony, Belen, Chaparral, Elephant Butte, Corona, Bingham, and Lordsburg • Arizona: Duncan, Willcox, Safford, Thatcher, San Manuel, Oracle, Coolidge, Eloy, San Simeon, Bowie, Benson, Tucson, and Marana
<p>BLM Pending Solar Right-of-Way is an area in which a solar power facility may be developed in the near future.</p>	<ul style="list-style-type: none"> • Northeast of Lordsburg, NM
<p>BLM Pending Wind Right-of-Way is an area in which a wind generation facility may be developed in the future.</p>	<ul style="list-style-type: none"> • Area northwest of Lordsburg, NM • Area east of Deming, NM • Area northwest of Las Cruces, NM
<p>Research Natural Areas are part of a nationwide network of ecological areas set aside for both research and education. The USFS establishes these areas containing pristine areas that typify certain types of important forest, shrubland, grassland, aquatic, geological, alpine, or similar environments that have unique characteristics of scientific interest.</p>	<ul style="list-style-type: none"> • Lordsburg Playa RNA – west of Lordsburg, NM • Aden Lava Flow RNA – southwest of Las Cruces, NM
<p>Special Management Areas contain valued plant or animal species, habitats, geological features, or scenic views. They are managed by the USFS. Other uses are permitted within an SMA if they are compatible with its designation.</p>	<ul style="list-style-type: none"> • Picacho Mountain SMA – east of Eloy, AZ • Fort Craig SMA – southwest of San Antonio, NM • Soaptree SMA – southeast of San Antonio, NM • Stallion SMA – east of Socorro, NM
<p>Special Management Areas (Proposed) have been proposed for SMA status but have not gone through the final approval yet.</p>	<ul style="list-style-type: none"> • West of Elephant Butte Reservoir, NM • 10 miles northwest of Las Cruces, NM • 20 miles southwest of Las Cruces, NM • 4 miles east of Las Cruces, NM • 20 miles south of Alamogordo, NM • 23 miles south of Carrizozo, NM • 25 miles west of Hatch, NM
<p>Vacant/Undeveloped – Jurisdictionally undefined areas or lands with lack of development.</p>	<ul style="list-style-type: none"> • Areas occur throughout the study area
<p>* All Project location mileage provided is approximate.</p> <p>FAA – Federal Aviation Administration USFS – U.S. Forest Service BLM – Bureau of Land Management SMA – Special Management Area RNA – Research Natural Area</p>	

A.4.2 Visual and Recreation Resources

In order to meet its responsibility to maintain the scenic values of the public lands, the Bureau of Land Management (BLM) has developed a visual resource management (VRM) system that addresses the following:

- Different levels of scenic values that require different levels of management. For example, management of an area with high scenic value might be focused on preserving the existing character of the landscape, while management of an area with little scenic value might allow for major modifications to the landscape. Determining how an area should be managed first requires an assessment of the area's scenic values.
- Assessment of scenic values and determination of visual impacts. This can be a subjective process. Objectivity and consistency can be greatly increased by using the basic design elements of form, line, color, and texture—which have often been used to describe and evaluate landscapes—to also describe proposed projects. Projects that repeat these design elements are usually in harmony with their surroundings; those that do not create contrast. By adjusting project designs so the elements are repeated, visual impacts can be minimized.

The BLM VRM system provides a way to identify and evaluate scenic values to determine the appropriate levels of management. It also provides a way to analyze potential visual impacts and apply visual design techniques to ensure that surface-disturbing activities are in harmony with their surroundings.

The BLM VRM system consists of two stages: (1) Inventory (Visual Resource Inventory) and (2) Analysis (Visual Resource Contrast Rating). For this siting study, existing data sources were reviewed to assess a basic level of sensitivity for the Project study area. A rating was assigned to the landscape or resources, then the ratings were used to define a basic level of sensitivity to the Project study area, including:

- Class I Objective: To preserve the existing character of the landscape. The level of change to the characteristic landscape should be very low and must not attract attention.
- Class II Objective: To retain the existing character of the landscape. The level of change to the characteristic landscape should be low.
- Class III Objective: To partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate.
- Class IV Objective: To provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high.

Managing recreation in a multiple-use setting requires that the BLM meet visitor demands for adventure, renewal, and wide-open spaces, while maintaining conditions that conserve the land and create sustainable recreational benefits for visitors and communities alike. In serving visitors, the BLM also has an opportunity to increase public understanding of the concept of multiple use and the unique role of the public lands in the history and cultural life of the United States. Certain recreational uses have higher sensitivity designations due to their unique attributes. Basic recreation functions also were identified and mapped based on their sensitivity rating (Table A-3).

Table A-3. Visual and Recreation Resources: Sensitive Areas

Designations	Project Location
Exclusion Areas	
BLM VRM Objectives Class I	<ul style="list-style-type: none"> • Area east of Socorro, NM • Area north of Elephant Butte Reservoir, NM • Area south of Alamogordo, NM • One area north and one east of Las Cruces, NM • Area northeast of San Simon, AZ • Area northwest of Willcox, AZ
USFS VQO Preservation	<ul style="list-style-type: none"> • Lincoln National Forest – small portion southeast of Carrizozo, NM
Highly Sensitive Areas	
BLM VRM Class II	<ul style="list-style-type: none"> • Area east of San Antonio, NM • Area west of San Antonio, NM, adjacent to the southern border of Cibola National Forest • Few areas scattered along I-25, between Truth or Consequences and San Antonio, NM • High concentration of areas occur around I-25 and the railroad extending from Las Cruces to Truth or Consequences, NM • Areas east of Las Cruces, NM • One area each south, northeast, and north of Alamogordo, NM • Area northwest of Carrizozo, NM • Scattered areas along the railroad between Hatch and Deming, NM • Area southeast of Deming, NM • One area north and one area south of I-10, halfway between Deming and Lordsburg, NM • Areas south, southwest, and west of Lordsburg, NM • Area east of Duncan, AZ • Area southeast and area west of Safford, AZ • Area northwest of Willcox, AZ
Scenic Trails	<ul style="list-style-type: none"> • Trail extending northeast and southeast from Lordsburg, NM • Trail cutting the study area north-south between Oracle and San Manuel, AZ
Scenic Roads or Byways	<ul style="list-style-type: none"> • Road paralleling I-25 from north to south of the study area • Segment going north-south east of Socorro, NM • Segment going east-west from Elephant Butte, NM • Segment going east-west from I-25 south of Truth or Consequences, NM • Segment in White Sands National Monument, southwest of Alamogordo, NM • Two segments going east-west from Highway 191 south of Safford, AZ • Highway 79 within the study area
Concern Level Roads I	<ul style="list-style-type: none"> • South and southeast of Oracle, AZ • East of San Manuel, AZ • Southwest of Safford, AZ
USFS VQO Retention	<ul style="list-style-type: none"> • Lincoln National Forest – small areas within the study area located outside of Alamogordo, NM
Moderate Sensitivity Areas	
BLM VRM Class III	<ul style="list-style-type: none"> • Area east of Socorro extending out to Carrizozo, NM • Area south and multiple areas west of San Antonio, NM • Areas around I-25 extending from El Paso to Elephant Butte Reservoir, NM • Concentration of areas north, northeast, and southwest of Deming, NM • Areas along I-10 between Deming, NM, and Bowie, AZ • Areas north of Lordsburg, NM • Areas north, east, and south of Safford, AZ • Area 20 miles southeast of San Manuel, AZ • Areas east, north, and west of San Manuel, AZ • Areas north of Marana, AZ, around highway 79 • Area in Picacho Mountains, AZ • Area east of intersection of Highway 287 and Highway 87 • Area south of Coolidge, AZ

Table A-3. Visual and Recreation Resources: Sensitive Areas

Designations	Project Location
USFS VQO Partial Retention	<ul style="list-style-type: none"> • Cibola National Forest – Majority of the forest in the study area southwest of Socorro, NM • Cibola National Forest – part of the forest in the study area northwest of Elephant Butte Lake, NM • Cibola National Forest – small portion of the forest within the study area southwest of Corona, NM • Lincoln National Forest – portion of the forest within the study area northeast of Carrizozo, NM • Lincoln National Forest – portion of the forest within the study area northeast of Carrizozo, NM • Lincoln National Forest – few small areas along the study area boundary, west of Alamogordo, NM
Special Recreation Management Area	<ul style="list-style-type: none"> • Southwest of Socorro, NM • Northeast of San Antonio, NM • Northwest of Carrizozo, NM • West of Carrizozo, NM • North of Las Cruces, NM • East of Las Cruces, NM, extending south along I-10
Rest Area	<ul style="list-style-type: none"> • One on I-25 south of San Antonio, NM • One on I-25 north of Las Cruces, NM • One on I-25 south of Las Cruces, NM • One on I-25 west of Las Cruces, NM • Two on I-10 west of Deming, NM, near the borders of Luna and Grant counties, NM • One on I-10, in Lordsburg, NM • One on I-10, west of San Simon, AZ • One on Highway 70, in Duncan, AZ • One on Highway 70, between Thatcher and Safford, AZ • One on I-10, north of Marana, AZ
Concern Level Roads II	<ul style="list-style-type: none"> • Southeast of Oracle, AZ • East of San Manuel, AZ • Southwest and south of Safford, AZ
Low Sensitivity Areas	
BLM VRM Class IV	<ul style="list-style-type: none"> • Areas on both sides of I-25 between Hatch and Socorro, NM • Areas east of San Antonio, NM • Areas southwest, west, northwest, north, and northeast of Alamogordo, NM • Areas northeast of Hatch, NM • Areas southeast, northeast, and northwest of Las Cruces, NM • Areas southwest of Hatch, NM • An area northeast of Deming, NM • Few areas north of I-10, between Deming and Lordsburg, NM • Areas south of Lordsburg, NM • Area north of I-10, extending from Lordsburg, NM to Safford, AZ • Few areas south of I-10, between Lordsburg, NM and Willcox, AZ • Area northwest of Willcox, AZ • Areas east and northeast of Mammoth, AZ
USFS VQO Modification	<ul style="list-style-type: none"> • Cibola National Forest – sparse areas within the study area, southwest of Socorro, NM • Cibola National Forest – few areas northwest of Elephant Butte, NM • Cibola National Forest – portion of the forest within the study area west of Corona, NM • Lincoln National Forest – areas within the study area northeast of Carrizozo, NM
USFS VQO Maximum Modification	<ul style="list-style-type: none"> • Cibola National Forest – few areas within the study area northwest of Elephant Butte, NM • Cibola National Forest – areas within the study area southwest of Corona, NM; one along the eastern boundary of the forest, one along the western boundary of the forest • Lincoln National Forest – areas within the study area northeast of Carrizozo, NM
BLM – Bureau of Land Management VQO – visual quality objective	VRM – visual resource management USFS – U.S. Forest Service

A.4.3 Cultural Resources

A cultural resource is anything resulting from human activities. These resources include objects, districts, landscapes, sacred sites, and traditional cultural properties. Cultural resources give us information about historic and prehistoric human cultures—their geographic distribution and time range, where the people came from, what happened to them, and what they made and did. This information is important because our present attitudes, values, ideas, and material culture have been largely shaped by our past.

Cultural resources are generally divided into three categories. These are prehistoric resources, historic resources, and traditional cultural properties. Because of their importance to the community, sensitivity ratings have been designated by the appropriate agency and identified for this study. Table A-4 lists those cultural resources that were identified as highly sensitive.

Table A-4. Cultural Resources: Highly Sensitive Areas	
Area or Resource	Project Location
State Monuments are resources designated for importance to the understanding of New Mexico’s history	<ul style="list-style-type: none"> • Fort Selden State Monument, NM – 14 miles northeast of Las Cruces, along I-25 • Tom Mix Monument, AZ – on Highway 79, northeast of Eloy
National Monuments are resources designated for importance to the Nation’s history	<ul style="list-style-type: none"> • Gran Quivira unit of Salinas Pueblo Missions National Monument- Mountainair, New Mexico
National Register Properties , such as buildings, structures, or objects, are listed on the National Register of Historic Places	<ul style="list-style-type: none"> • Socorro County, NM: Adobe Post Office, Carthage Post Office, Claunch Post Office, Craig, Elmendorf Post Office, Estey City, F Thurman Ranch, Fort Craig, Fort Craig Post Office, Paraje Post Office, San Antonio Post Office, San Marcial Post Office, Sanchez Well, Tajo, Tokay Post Office • Lincoln County, NM: Ancho Post Office, Jicarilla Post Office, Manchester, Manchester Post Office, Mayes Ranch, Oscura Post Office, Reventon Post Office, White Oaks Post Office • Sierra County, NM: Aleman Post Office, Cains Ranch, Cutter Post Office, Elephant Butte Post Office, Engle Post Office, Esque Spring, Floyd Crockett Ranch, Fort McRae, Gililand South Ranch, Hackberry Spring, Las Palomas Post Office, New Well, Potter Ranch Headquarters, Truth or Consequences Post Office, Woolf Ranch Headquarters • Otero County, NM: Black Lake Ranch, Chosa Ranch, Lomitas Ranch, Monista, Newman Post Office, Pelman Ranch, Salinas Post Office, Three Rivers Post Office, Valmont Post Office, Wilde Well • Doña Ana County, NM: Aden Post Office, Bairds Ranch, Beasley Homestead, Berino Post Office, Bosque School, Boyer Ranch, Brazito School, Detroit, Detroit Post Office, Doña Ana County Courthouse, Douglas School, Fillmore, Fort Selden, Fort Selden Post Office, Hill Post Office, La Mesa Post Office, Liberty School, Modoc, Modoc Post Office, Mossman Ranch, North Lucero Ranch, Norwood Ranch, Old Bennett Tank, Organ Post Office, Phillips Chapel CME Church, Rincon Post Office, Rodey Post Office, South Lucero Ranch, University Park Post Office, Vado Post Office, Van Pattens, Woods Ranch • Luna County, NM: Akela Post Office, Cambray Post Office, Camp Cody, Carne Post Office, Christian Science Church, Deming Hospital, East Side Public School, Florida Post Office, Gage Post Office, Holy Cross Sanatorium, Myndus Post Office • Grant County, NM: Separ Post Office, Ruia Post Office • Hidalgo County, NM: Leitendorf, Valedon Post Office, Steins Post Office • Cochise County, AZ: Bowie Junction • Graham County, AZ: Crook National Forest, Eureka Springs, Fort Grant, Frye, Gillespie, Old Gibson Sawmill, Pueblo Viejo
National Historic Trails are designated to identify and protect historic routes, historic remnants, and artifacts for public use and enjoyment	<ul style="list-style-type: none"> • Juan Bautista de Anza National Historic Trail – crosses the study area from north to south around Eloy, AZ • EL Camino Real – the trail crossed the study area from north to south starting at Socorro, NM, going to El Paso, NM

Table A-4. Cultural Resources: Highly Sensitive Areas

Area or Resource	Project Location
<p>Historic Trails and Travel Routes tell stories of an expanding nation and the challenges and hardships faced by people, both immigrant and native, who struggled to adapt themselves to the land and to each other</p>	<ul style="list-style-type: none"> • Gila Trail Route – the route goes through the study area starting west of Coolidge, AZ, south to Eloy, AZ, and then southeast to Marana, AZ. The route appears back in the study area for a short distance around Willcox, AZ; it reappears at San Simon, AZ and continues east to Las Cruces, NM • Mormon Battalion Crook Trail Route – the route goes through the study area starting west of Coolidge, AZ and south to Eloy, AZ; it continues southeast to Marana, AZ • Southern Pacific Mail and Stage Line – the trail starts 8 miles southeast of Coolidge, AZ and goes south 5 miles east of Eloy, AZ • Janos Copper Road Route – the route crosses the study area from north to south, 23 miles west of Deming, NM • Zuniga Route – portion of the route appears near Safford and Thatcher, AZ; another portion of the route crossed the study area from north to south starting around Florence, AZ and going to Marana, AZ • Butterfield Trail – the route goes through the study area starting west of Coolidge, AZ, south to Eloy, AZ, and then southeast to Marana, AZ; it reappears at San Simon, AZ, and continues east to Las Cruces, NM
<p>National Register Districts and Sites are a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development</p>	<ul style="list-style-type: none"> • Teypama Piro Site – south of Socorro, NM • Mockingbird Gap Archaeological Site – east of San Antonio, NM • Trinity Site – west of Carrizozo, NM • Fort Craig and San Felipe Pueblo Ruins – at the northern tip of Elephant Butte Reservoir, NM • Sandal Cave – North of Elephant Butte, NM and west of I-25 • Fort McRae – Elephant Butte, NM • Carrie Tingley Hospital Historic District, Hot Springs Bathhouse – Truth or Consequences, NM • Summerford Mountain Archaeological District – north of Las Cruces, NM • Fort Selden – northwest of Las Cruces, NM • Mesilla Plaza, Barela-Reynolds House, Alameda-Depot Historic District, Mesilla Historic District, Mesquite Street Original Townsite Historic District – Las Cruces, NM • Marijilda Canyon Prehistoric Archaeological District – south of Safford, AZ • Fort Grant – southwest of Safford, AZ • Oak Draw Archaeological District – north of Willow, AZ • Sierra Bonita Ranch – northwest of Willcox, AZ • Railroad Avenue Historic District – Willcox, AZ • Camp Grant Massacre Site – north of San Manuel, AZ • Kannally Ranch, Rancho Linda Vista Historic District – Oracle, AZ • McClellan Wash Archaeological District – east of Eloy, AZ • Verdugo Homestead Historic District – north of Eloy, AZ • Los Robles Archaeological District – southeast of Eloy, AZ

A.4.4 Biological Resources

Levels of very high, high, moderate, and low sensitivity were assigned to inventoried elements for this study, including the locations of known protected species and key habitat (Table A-5). Resources with a very high rating are those that have federal legislative protection and/or are rare or provide habitat for rare species. A high sensitivity level means that a resource is afforded legislative protection at a state or local level, or it has a special designation on government lands. Resources with moderate sensitivity ratings are not considered rare, but they are limited in extent, may be unique in structure, or are considered in agency planning documents. All other biological resources with no heightened sensitivity received a low sensitivity rating.

Table A-5. Biological Resources: Sensitive Areas	
Area or Resource	Project Location
Designated Threatened and Endangered Species Critical Habitat	
<i>Highly Sensitive</i>	
Wetlands	<ul style="list-style-type: none"> • Bingham Cienega in Pima County, AZ • Santa Cruz River near Tucson, AZ • Cienega Creek near Tucson, AZ • Near the City of Alamogordo and Holloman Air Force Base, NM • Rio Grande and associated tributaries in NM • San Pedro River in NM
Chiricahua Leopard Frog	<ul style="list-style-type: none"> • East of the San Pedro River, south of the Galiuro Wilderness
Gila Chub	<ul style="list-style-type: none"> • East of the San Pedro River, south of the Galiuro Wilderness
Rio Grande Silvery Minnow	<ul style="list-style-type: none"> • Along the Rio Grande, north of Elephant Butte Reservoir to Socorro, NM
Southwestern Willow Flycatcher	<ul style="list-style-type: none"> • Along the extent of the San Pedro River in AZ • Along the Gila River near Safford and Duncan, AZ • Along the Rio Grande north of Elephant Butte Reservoir to Socorro, NM
Desert Tortoise Habitat	<ul style="list-style-type: none"> • The Desert Tortoise is found in the study area in western AZ, ranging in elevation from sea level to approximately 5,200 feet. The Desert Tortoise has three geographically separated populations, two of which occur in the United States. The Mojave Desert Tortoise inhabits the area north and west of the Colorado River and is listed as threatened under the Endangered Species Act. The Sonoran population is found south and east of the Colorado River, in the central and western parts of AZ and Sonora, Mexico.
Category I Maintain stable, viable populations and protect existing tortoise habitat values; increase populations	<ul style="list-style-type: none"> • East of Eloy, AZ
<i>Low to Moderate Sensitivity</i>	
Desert Tortoise Habitat Category II – <i>Moderate</i> Maintain stable, viable populations and halt further declines in tortoise values	<ul style="list-style-type: none"> • East of Eloy, AZ – east and northeast of Oracle, AZ; south of the Galiuro Wilderness
Desert Tortoise Habitat Category III – <i>Low</i> Limit tortoise habitat and population declines to the extent possible by mitigating impacts	<ul style="list-style-type: none"> • Throughout a large portion of the AZ portion of the study area from the Winchester Substation to the Saguaro Power Plant, and north to the northern study boundary
Sensitive Species	
<i>Moderate to High Sensitivity</i>	
Cactus Ferruginous Pygmy-owl	<ul style="list-style-type: none"> • North of Saguaro Power Plant and south of Highway 79; north of Oracle, northeast of the Winchester Substation, in AZ
Black-bellied Whistling Duck	<ul style="list-style-type: none"> • 94 miles northeast of San Manuel near the San Pedro River, AZ
Common Black Hawk	<ul style="list-style-type: none"> • East of the San Pedro River and south of the Galiuro Wilderness; along the San Pedro River 15 miles northeast of Oracle, AZ
Reticulate Gila Monster	<ul style="list-style-type: none"> • Below 4,500 feet elevation in most of the AZ portion of the study area
Mississippi Kite	<ul style="list-style-type: none"> • 5 miles east of San Manuel; along the San Pedro River 15 miles northeast of Oracle, AZ

Table A-5. Biological Resources: Sensitive Areas

Area or Resource	Project Location
Arizona Night Lizard	• 17 miles north of San Manuel, AZ
Western Yellow Billed Cuckoo	• Along the San Pedro River
Northern Gray Hawk	• Southeast of San Manuel along the San Pedro River and south of the Galiuro Wilderness
<i>Machaeranthera bigelovii</i> var. <i>bigelovii</i>	• Southeast of San Manuel along the San Pedro River
Longfin Dace	• Southeast of San Manuel along the San Pedro River and south of the Galiuro Wilderness
Lowland Leopard Frog	• Southeast of San Manuel along the San Pedro River and south of the Galiuro Wilderness
Tropical Kingbird	• Southeast of San Manuel along the San Pedro River
Zone-tailed Hawk	• Southeast of San Manuel along the San Pedro River
Aravaipa Sage	• East of the San Pedro River and south of the Galiuro Wilderness
American Peregrine Falcon	• East of the San Pedro River and south of the Galiuro Wilderness
Northern Beardless-tyrannulet	• East of the San Pedro River and south of the Galiuro Wilderness
Mexican Long-tongued Bat	• East of the San Pedro River and south of the Galiuro Wilderness
Lesser Long-nosed Bat	• East of the San Pedro River and south of the Galiuro Wilderness
Western Yellow Bat	• East of the San Pedro River and south of the Galiuro Wilderness
Small Ballmoss	• East of the San Pedro River and south of the Galiuro Wilderness
Catalina Mountain Sage	• East of the San Pedro River and south of the Galiuro Wilderness
Speckled Dace	• East of the San Pedro River and south of the Galiuro Wilderness
Desert Sucker	• East of the San Pedro River and south of the Galiuro Wilderness
Sonoran Sucker	• East of the San Pedro River and south of the Galiuro Wilderness
Mexican Spotted Owl	• East of the San Pedro River and south of the Galiuro Wilderness
Rufous-winged Sparrow	• East of the San Pedro River and south of the Galiuro Wilderness
Giant Spotted Whiptail	• East of the San Pedro River and south of the Galiuro Wilderness
Arizona Necklace	• East of Thatcher, AZ
Sandhill Crane	• Near Thatcher and Safford, AZ
Arizona Viceroy	• Near Thatcher and Safford, AZ
Roundtail Horned Lizard	• Near Thatcher and Safford, AZ
Superb Beard Tongue	• East of Safford and west of Duncan, AZ
Western Green Toad	• East of Safford and west of Duncan, AZ
Swainson's Hawk	• East of Safford and west of Duncan, AZ
Mexican Hognose Snake	• Around San Simon, AZ
San Carlos Wild Buckwheat	• 5 miles east of San Manuel; along the San Pedro River 15 miles northeast of Oracle, AZ
General Native Vegetation	
<i>Highly Sensitive</i>	
Sand Dunes	• 15 miles west of Alamogordo, NM
<i>Moderate Sensitivity</i>	
AZ Upland Sonoran Desertscrub	• Extending from southern boundary to the northern boundary of the study area east of Picacho Peak State Park
Coniferous and Mixed Woodland	<ul style="list-style-type: none"> • 8 miles southwest of Corona, NM • 10 miles southwest of Socorro, NM • 14 miles northwest of Carrizozo, NM • At the study area boundary northeast and southeast of Carrizozo, NM • 37 miles southwest of Carrizozo, NM • 20 miles northwest of Elephant Butte, NM • 15 miles northeast of Elephant Butte, NM • 15 miles southeast of Elephant Butte, NM • 27 miles east of Elephant Butte, NM • 10 miles east of Las Cruces, NM • 10 miles southwest of Duncan, AZ • Loop-shaped area 15 miles southwest of Safford, AZ • Stretching along Coronado National Forest, northwest of Willcox, AZ • East and southeast of Oracle, AZ

Table A-5. Biological Resources: Sensitive Areas

Area or Resource	Project Location
Desert Grassland (Ecotone)	<ul style="list-style-type: none"> • Throughout the study area, extending from Lordsburg, NM, east to Las Cruces, NM and north to around Hatch, NM • East side of I-25 from Las Cruces, NM, north to Elephant Butte reservoir, NM • Along the study area boundary from southern crossing of I-10 in NM to 15 miles south of Carrizozo, NM • Around the base of the mountain range stretching from Las Cruces, NM, north to 30 miles southwest of Carrizozo, NM • East and southwest of Socorro, NM
Great Basin Conifer Woodland	<ul style="list-style-type: none"> • On the study area border, 15 miles northeast of San Manuel, NM
Juniper Savanna (Ecotone)	<ul style="list-style-type: none"> • Extending north from Highway 380 in NM to the study area boundary • Extending south from Highway 380 in NM south for 10 miles • Around Highway 54 in NM, extending from the study area boundary southeast of the highway to the study area boundary northwest of the highway • At the northeastern tip of the study area boundary
Montane Coniferous Forest	<ul style="list-style-type: none"> • 13 miles southwest of Socorro, NM • 13 miles southwest of Socorro, NM • 22 miles and 14 miles northeast of Carrizozo, NM • 12 miles east of Las Cruces, NM • 40 miles east of Elephant Butte, NM
Petran Montane Conifer Forest	<ul style="list-style-type: none"> • High elevation areas in Coronado National Forest southwest of Safford, AZ • High elevation areas in Coronado Nation Forest east of San Manuel, AZ
Petran Subalpine Conifer Forest	<ul style="list-style-type: none"> • High elevation area in Coronado National Forest southwest of Safford, AZ
Plains and Great Basin Grassland	<ul style="list-style-type: none"> • 23 miles northwest of Willcox, AZ
Plains-Mesa Grassland	<ul style="list-style-type: none"> • Area around Carrizozo, NM stretching north to the study area boundary • Area stretching from Corona, NM south along the Highway 54 and southeast to the study area boundary
Semidesert Grassland	<ul style="list-style-type: none"> • 8 miles south of Carrizozo, NM • 15 miles west of Carrizozo, NM • 37 miles northwest of Carrizozo, NM • 9 miles and 19 miles southwest of Socorro, NM • Small area 19 miles north of Alamogordo, NM • 10 miles northeast of Las Cruces, NM • 12 miles east of Las Cruces, NM • 13 miles northeast of Lordsburg, NM • South, southwest, west, and northwest of Duncan, AZ • Northeast of Safford, AZ • Area stretching from 10 miles south of Safford, AZ, south to the study area boundary, around Highway 191 • Areas surrounding Coronado National Forest east of San Manuel, AZ and west of Highway 191 • South, southwest, west, and northwest of San Manuel, AZ • Small area east of Eloy, AZ
Subalpine Coniferous Forest	<ul style="list-style-type: none"> • At the study area boundary southwest of Socorro, NM
Chihuahuan Desertscrub	<ul style="list-style-type: none"> • Area around I-25 from Las Cruces, NM north to Socorro, NM • Scattered areas of lower elevation between Elephant Butte, NM on the west, Holloman Air Force Base, NM on the east, El Paso, NM on the south, and Bingham, NM on the north • At the study area boundary northeast of El Paso, NM • Southeast of Deming, NM • 22 miles southwest of Deming, NM • Around Lordsburg, NM • Areas stretching from southern study area boundary to the northern study area boundary, between Lordsburg, NM and Bowie, AZ • At the study area boundary around Winchester Substation site

Table A-5. Biological Resources: Sensitive Areas

Area or Resource	Project Location
<i>Low Sensitivity</i>	
Closed Basin Scrub	<ul style="list-style-type: none"> • Two area northeast of Elephant Butte, NM • Area stretching from Carrizozo, NM south to 18 miles northeast of Las Cruces, NM • North of Las Cruces, NM • 15 miles east of Deming, NM • Around Lordsburg, NM
Interior Chaparral	<ul style="list-style-type: none"> • 28 miles west of Safford, AZ • 15 miles northeast and east of San Manuel, AZ • 4 miles south of Oracle, AZ • 15 miles northeast of Oracle, AZ
Lava Beds	<ul style="list-style-type: none"> • 25 miles northeast of Elephant Butte, NM • 6 miles east of Carrizozo, NM, stretching northeast and southwest
Lower Colorado River Sonoran Desertscrub	<ul style="list-style-type: none"> • Western part of the study area, stretching east to Marana, AZ
Plains-Mesa Sand Scrub	<ul style="list-style-type: none"> • Area between San Antonio, NM and Bingham, NM, stretching from the northern study boundary south to the Elephant Butte Reservoir, NM • Area east of Elephant Butte, NM stretching south to 15 miles north of Las Cruces, NM • 15 miles southwest of Alamogordo, NM • 38 miles southeast of Las Cruces, NM • 21 miles east of Deming, NM
Urban, Farmland, or Open Water	<ul style="list-style-type: none"> • Area from Socorro, NM south to 8 miles past San Antonio, NM • Areas along the Elephant Butte Reservoir, NM • Area 15 miles north of Alamogordo, NM • Area along I-10 between Las Cruces, NM and El Paso, NM • 35 miles northwest of Las Cruces, NM • Deming, NM area • 10 miles southeast of Lordsburg, NM • Southeast of Duncan, AZ

A.4.5 Engineering Considerations and Constraints

Engineering considerations also were included in the alternatives screening and opportunities and constraints analysis. Factors that were considered as engineering constraints and opportunities are briefly discussed below.

- System Planning – location of current and anticipated load centers, system reliability, and interconnections
- Engineering/Design Consideration – corridor width requirements, terrain, access, constructability, and flexibility to accommodate both alternating and direct current (AC/DC) configurations
- Permit Requirements – federal, state, municipal, and private land requirements
- Land Acquisition – jurisdictional ownership, existing/planned land use, zoning, desire to locate on private land, ability to purchase land, entitlements, potential land deals, etc.
- Agency/Public Considerations – potential avoidance of sensitive areas, including consideration for agencies, municipalities, stakeholders, the public, and others
- Costs – property acquisition, site development, materials and construction, potential offsite transmission, mitigation, and other costs

These considerations were evaluated in combination with environmental factors to determine the routes that would meet the purpose and need and present the fewest constraints.

A.5 SITING OPPORTUNITIES

In addition to the identification of resource constraints, areas of opportunity also were identified within the study area. For the purposes of the siting study, opportunities for new transmission lines and substation sites generally included locations consisting of, or in proximity to, existing or planned linear facilities, previously disturbed corridors, or corridors designated for future use as utility corridors or in conjunction with industrial use(s). Typically, these opportunities included existing transmission lines, major transportation corridors (interstate and state highways), pipeline corridors, railroads, and canals. These corridors provide potential access for construction and maintenance of transmission lines and substations. Existing linear corridors generally minimize ground disturbance, as well as biological, cultural, soil erosion, land use, and visual resource impacts.

Other siting opportunities include areas with low sensitivity, identified previously in Section A.4.

Three levels of opportunity, shown in Table A-6, were developed to characterize levels of opportunity for the transmission lines and substations.

Table A-6. Opportunity Level Summary	
Linear Features	Project Study Area Location
High Opportunity	
Transmission Lines (230 kV or greater)	<ul style="list-style-type: none"> • 230 kV lines heading east and northwest out of Tortolita Substation, northwest of Marana, AZ • 500 kV line heading northeast, then north out of Tortolita Substation, northwest of Marana, AZ • 345 kV line heading from Winchester Substation, west of Willcox, northeast to the proposed Willow Substation, then northeast toward Duncan, AZ • 230 kV line cuts through the study area north-south from east of Safford, AZ to east of Willcox, AZ • 345 kV line heads southeast from Duncan, AZ, then turns east just north of Lordsburg, AZ, continues east through Deming, AZ to the I-10, north of El Paso, NM • 345 kV line splits from the above 345 kV line around Deming, NM, and heads north along the study area boundary; turns west around Elephant Butte, NM • 345 kV line heading from El Paso, NM, north along Highway 54 and turning east 22 miles south of Alamogordo, NM • 345 kV line heading north from El Paso, NM east of I-25 to Socorro, NM
Federally Designated Overhead Transmission Line Corridors	<ul style="list-style-type: none"> • Fort Bliss McGregor Range BLM Designated Utility Corridor (1 mile wide) – along Highway 54 from El Paso, NM to 12 miles south of Alamogordo, NM • BLM Designated Utility Corridor (0.5 mile wide) – located in Anthony Gap, NM; generally parallels existing utilities
DOE West-wide Energy Corridors (EPACT Section 368)	<ul style="list-style-type: none"> • Segments of the corridor are located on BLM lands generally following major pipelines and I-10 and I-25 corridors

Table A-6. Opportunity Level Summary

Linear Features	Project Study Area Location
Moderate Opportunity	
Transmission Lines (less than 230 kV)	<ul style="list-style-type: none"> • 115 kV line going north-south through Eloy, AZ • 115 kV line heading east 3 miles south of proposed Pinal Central Substation and continuing southeast to Tortolita Substation • 115 kV lines head west of Tortolita Substation • Two 115 kV lines heading east from Tortolita Substation to Oracle, AZ and San Manuel, AZ • 115 kV line paralleling Highway 79 through the study area • 115 kV line along San Pedro River • 115 kV lines going northeast, southeast, and southwest out of Hidalgo Substation, northeast of Lordsburg, NM • 115 kV line going northwest and southwest out of Luna Substation in Deming, NM • 115 kV line going northeast out of Luna Substation in Deming, NM to Elephant Butte Reservoir, NM • 115 kV line going east out of Luna Substation in Deming, NM to Las Cruces, NM • 115 kV lines going southeast along the I-10 from Las Cruces, NM • 115 kV lines going northeast from El Paso, NM and Las Cruces, NM, along highways 70 and 74 toward Alamogordo, NM • 115 kV lines going northwest out of Las Cruces, NM toward Elephant Butte, NM, and then continuing north along the I-25
Natural Gas/Petroleum Pipelines (6-inch diameter or greater)	<ul style="list-style-type: none"> • Networks of pipelines occur between San Manuel, AZ and the eastern boundary of the study area • Paralleling the I-10 from San Manuel, AZ to Bowie, AZ • Paralleling Highway 191 and Highway 70 within the study area • Network of pipelines between Lordsburg, NM and Deming, NM • Pipelines going southeast from Deming, NM to El Paso, NM • Line going north from El Paso, NM to Socorro, NM
Railroads	<ul style="list-style-type: none"> • Railroad paralleling I-10 throughout the study area • Railroad going north from El Paso, NM to Socorro, NM
Interstates, US Highways, State Highways, Other Primary Roads	<ul style="list-style-type: none"> • Two interstates go through the study area: I-10 west-east, and I-25 north-south in NM • US Highway 79 goes southeast from Florence, AZ to Tucson, AZ • US Highway 77 cuts north-south west of San Manuel, AZ • US Highway 191 goes from Safford, AZ to Bowie, AZ • US Highway 70 goes from Safford, AZ east and southeast to Lordsburg, AZ • US Highway 180 cuts through the study area north-south at Deming, NM • US Highway 70 goes from Las Cruces, NM east to Alamogordo, NM • US Highway 75 goes northeast from El Paso, NM to Alamogordo, NM, then north to Corona, NM • US Highway 380 goes west-east from San Antonio, NM to Carrizozo, NM
BLM – Bureau of Land Management DOE – Department of Energy kV – kilovolt	

A.6 SUBROUTE ANALYSIS

Following the identification of resource constraints and siting opportunities in the study area, individual subroutes were evaluated to determine both individual resource and overall (composite) sensitivities along the route. This analysis is documented for the New Mexico and Arizona subroutes in Table A-7 and Table A-8.

Following the analysis of the sensitivities for each resource, the subroutes were analyzed in detail to identify alternative link segments that could be eliminated, modified, or carried forward for further consideration. This process is described in Chapter 2 of the EIS. In most instances, the alternative segments that were eliminated would have a higher level of constraint, and would be substantially similar in function and purpose to other alternatives carried forward for detailed analysis. The descriptions of constraining factors attributed to the links eliminated are provided in Table A-9.

Table A-7. Resource Sensitivity – New Mexico

Number	Links Included	Total Miles	Existing Parallel Utilities	Biology				Cultural			Land Use					Visual Recreation					Land Ownership						
				Low	Moderate	High	Exclusion	Low	Moderate	High	Low	Moderate	High	Exclusion	1/2-Mi. Wide BLM Utility Corridor	Low	Moderate	High	1/2-Mi. Wide BLM Utility Corridor	No VRM Data	BLM	U.S. Dept. of Defense	U.S. Forest Service	U.S. Fish & Wildlife	State	Private/Other	BLM - DOD Withdrawal
Group 1 – Subroute SunZia East Substation to West of San Antonio																											
1A	A10, E10, E20, E70, E210, E209, E211	122.2	PL – 18.9 mi. 115 kV – 12.8 mi. 345 kV – 21 mi.	26.7	79.8	5.4	10.4	120.9		1.3	85.7		19.8	16.7		98.1	0.9	23.2			17.1		6.8	10.4	18.0	69.9	
				22%	65%	4%	9%	99%	0%	1%	70%	0%	16%	14%		80%	1%	19%			14%	0%	6%	9%	15%	57%	0%
1B	A10, A20, E80a, E80b, E101, E110, E210, E209, E211	108.7	PL – 6.7 mi. 345 kV – 21 mi.	5.4	97.2	6.1		107.0		1.7	71.9	0.4	29.6	6.8		89.6	5.9	13.3			31.4				40.0	37.4	
				5%	89%	6%	0%	98%	0%	2%	66%	0%	27%	6%		82%	5%	12%			29%	0%	0%	0%	37%	34%	0%
1C	A10, A20, E80a, E80b, E101, E130, E150, E70, E180, E200, E211	98.9	PL – 6.7 mi. 345 kV-14.1 mi.	11.0	87.4	0.5		97.8		1.1	67.6	0.3	31.0			79.2	8.4	11.3			31.4				29.4	38.1	
				11%	88%	1%	0%	99%	0%	1%	68%	0%	31%	0%		80%	9%	11%			32%	0%	0%	0%	30%	38%	0%
1D	A10, A20, E80a, E80b, E101, E130, E140, A141, A140, A143, A160	99.8	PL – 32.7 mi.	25.5	73.1	1.2		93.6		6.2	73.4	1.1	25.3			74.3	8.0	17.5			35.3				28.5	36.0	
				26%	73%	1%	0%	94%	0%	6%	74%	1%	25%	0%		74%	8%	18%			35%	0%	0%	0%	29%	36%	0%
1E	A10, A20, E80a, E80b, E90, A90, A111, A112, A140, A143, A160	103.2	PL – 6.7 mi.	44.9	57.2	1.1		102.2		1.0	91.1	1.1	11.0			81.0	14.0	8.2			41.6				27.7	33.9	
				44%	55%	1%	0%	99%	0%	1%	88%	1%	11%	0%		78%	14%	8%			40%	0%	0%	0%	27%	33%	0%
1F	A10, A20, A30, A50, A60, A90, A111, A112, A140, A143, A160	90.7	PL – 4 mi.	38.7	50.9	1.1		89.7		1.0	78.6	1.1	11.0			67.1	14.7	8.9			47.5				14.9	28.3	
				43%	56%	1%	0%	99%	0%	1%	87%	1%	12%	0%		74%	16%	10%			52%	0%	0%	0%	16%	31%	0%
1G	A10, A20, A30, A50, A70, A80, A111, A112, A140, A143, A160	88.3	PL – 4 mi.	36.0	51.2	1.1		85.3	2.0	1.0	73.2	1.1	14.0			60.7	18.8	8.9			45.8				13.4	29.1	
				41%	58%	1%	0%	97%	2%	1%	83%	1%	16%	0%		69%	21%	10%			52%	0%	0%	0%	15%	33%	0%
1H	A10, A20, A30, A40, A41, A80, A111, A112, A140, A143, A160	87.6	PL – 4 mi.	36.1	50.3	1.1		84.5	2.0	1.0	72.5	1.1	14.0			55.0	22.6	9.9			48.5				14.5	24.5	
				41%	57%	1%	0%	97%	2%	1%	83%	1%	16%	0%		63%	26%	11%			55%	0%	0%	0%	17%	28%	0%
Group 2 – Subroute SunZia East Substation to Stallion AFB																											
2A	A10, A20, E80a, E80b, E90, A90	80.6	PL – 6.9 mi.	26.2	54.4			80.6			80.5	0.1				68.3	11.6	0.7			23.7				26.7	30.2	
				32%	68%	0%		100%	0%	0%	100%	0%	0%		85%	14%	1%			29%	0%	0%	0%	33%	38%	0%	
2B	A10, A20, A30, A50, A60, A90	68.1	PL – 4.0 mi.	20.0	48.2			68.1			68.1	0.0				54.4	12.4	1.3			29.6				13.9	24.6	
				29%	71%	0%		100%	0%	0%	100%	0%	0%		80%	18%	2%			43%	0%	0%	0%	20%	36%	0%	
2C	A10, A20, A30, A50, A70, A80	65.7	PL – 4.0 mi.	17.2	48.5			63.7	2.0		62.7		3.0			48.0	16.4	1.3			27.9				12.3	25.4	
				26%	74%	0%		97%	3%	0%	95%	0%	5%		73%	25%	2%			43%	0%	0%	0%	19%	39%	0%	
2D	A10, A20, A30, A40, A41, A80	65.0	PL – 4.0 mi.	17.4	47.6			63.0	2.0		61.9		3.0			42.3	20.3	2.4			30.6				13.5	20.8	
				27%	73%	0%		97%	3%	0%	95%	0%	5%		65%	31%	4%			47%	0%	0%	0%	21%	32%	0%	

Table A-7. Resource Sensitivity – New Mexico

Number	Links Included	Total Miles	Existing Parallel Utilities	Biology				Cultural			Land Use					Visual Recreation					Land Ownership						
				Low	Moderate	High	Exclusion	Low	Moderate	High	Low	Moderate	High	Exclusion	1/2-Mi. Wide BLM Utility Corridor	Low	Moderate	High	1/2-Mi. Wide BLM Utility Corridor	No VRM Data	BLM	U.S. Dept. of Defense	U.S. Forest Service	U.S. Fish & Wildlife	State	Private/Other	BLM - DOD Withdrawal
Group 3 – Subroute West of San Antonio to Midpoint Substation																											
3A	A161, A270, A330a, A330b, A400, A440, A520	119.9	345 kV – 62.4 mi. 345/115 kV – 12.2 mi.	82.6	37.2			118.1		1.8	116.6	0.0	3.3			51.3	7.1	22.0		39.5	67.3				18.5	34.1	
				69%	31%	0%		99%	0%	1%	97%	0%	3%	0%		43%	6%	18%		33%	56%	0%	0%	0%	15%	28%	0%
3B	A161, A260, A330a, A330b, A400, A440, A520	123.7	115 kV – 19.7 mi. 345 kV – 62.4 mi. 345/115 kV – 12.2 mi.	86.5	37.2			122.0		1.8	112.3	9.6	1.9			55.4	7.1	19.5		41.8	68.2				19.9	35.7	
				70%	30%	0%		99%	0%	1%	91%	8%	2%	0%		45%	6%	16%		34%	55%	0%	0%	0%	16%	29%	0%
Group 4 – Subroute Stallion AFB to Midpoint Substation																											
4A	A102, A103, A181, A311, A250, A256, A285, A261, A284, A340, A350, A352, A353, A360, A400, A440, A520	157.6	345 kV – 52.3 mi. 345/115 kV/ Hwy 26 – 12.5 mi.	102.1	55.5			150.3		7.3	145.5	1.9	10.2			67.2	20.4	8.6		61.4	84.6	8.2			14.8	50.0	
				65%	35%	0%		95%	0%	5%	92%	1%	6%	0%		43%	13%	5%		39%	54%	5%	0%	0%	9%	32%	
4B	A102, A103, A181, A311, A250, A256, A285, A261, A284, A340, A350, A352, A370, A390, A420, A440, A520	153.6	345 kV – 38.0 mi. 115 kV -24.0 mi. 345/115 kV/ Hwy 26 – 12.5 mi.	99.3	54.4			146.3		7.3	139.5	2.3	11.9			71.4	21.4	8.1		52.8	79.3	8.2			13.2	53.1	
				65%	35%	0%		95%	0%	5%	91%	2%	8%	0%		46%	14%	5%		34%	52%	5%	0%	0%	9%	35%	
4C	A102, A103, A181, A311, A250, A256, A285, A261, A284, A340, A350, A352, A370, A380, A430, A480, A510	168.3	345 kV – 38.0 mi. 115 kV – 23.5 mi. 345 kV(2) – 1.8 mi.	111.5	56.7			161.1		7.1	154.3	5.7	8.3			92.0	16.1	5.2		55.0	77.6	8.2			18.2	64.4	
				66%	34%	0%		96%	0%	4%	92%	3%	5%	0%		55%	10%	3%		33%	46%	5%	0%	0%	11%	38%	
4D	A102, A103, A181, A311, A250, A255, A301a, A301b, A340, A350, A352, A353, A360, A400, A440, A520	154.4	345 kV – 18.1 mi. 345/115 kV/ Hwy 26 – 12.5 mi.	102.9	51.5			151.6		2.8	143.2	1.0	10.2			55.0	20.4	8.6		70.4	93.6	8.2			14.9	37.7	
				67%	33%	0%		98%	0%	2%	93%	1%	7%	0%		36%	13%	6%		46%	61%	5%	0%	0%	10%	24%	
4E	A102, A103, A181, A311, A250, A255, A301a, A301b, A340, A350, A352, A370, A390, A420, A440, A520	150.4	115 kV – 24.0 mi. 345/115 kV/ Hwy 26 – 12.5 mi.	100.0	50.4			147.6		2.8	137.1	1.5	11.9			59.1	21.4	8.1		61.8	88.3	8.2			13.3	40.7	
				67%	33%	0%		98%	0%	2%	91%	1%	8%	0%		39%	14%	5%		41%	59%	5%	0%	0%	9%	27%	

Table A-7. Resource Sensitivity – New Mexico

Number	Links Included	Total Miles	Existing Parallel Utilities	Biology				Cultural			Land Use					Visual Recreation					Land Ownership							
				Low	Moderate	High	Exclusion	Low	Moderate	High	Low	Moderate	High	Exclusion	1/2-Mi. Wide BLM Utility Corridor	Low	Moderate	High	1/2-Mi. Wide BLM Utility Corridor	No VRM Data	BLM	U.S. Dept. of Defense	U.S. Forest Service	U.S. Fish & Wildlife	State	Private/Other	BLM - DOD Withdrawal	
4F	A102, A103, A181, A311, A250, A255, A301a, A301b, A340, A350, A352, A370, A380, A430, A480, A510	165.0	115 kV – 23.5 mi. 345 kV(2) – 1.8 mi.	112.3	52.7			162.4		2.6	151.9	4.8	8.3			79.8	16.1	5.2		64.0	86.6	8.2			18.3	52.0		
				68%	32%	0%		98%	0%	2%	92%	3%	5%	0%		48%	10%	3%		39%	52%	5%	0%	0%	11%	32%		
4G	A102, A103, A181, A300, A313, A301a, A301b, A340, A350, A352, A370, A390, A420, A440, A520	145.9	115 kV – 24.0 mi. 345/115 kV/ Hwy 26 – 12.5 mi.	94.4	51.6			143.1		2.8	117.3	1.5	26.2	1.0		62.7	13.0	11.0		59.2	79.1	22.2			18.7	25.9		
				65%	35%	0%		98%	0%	2%	80%	1%	18%	1%		43%	9%	8%		41%	54%	15%	0%	0%	13%	18%		
Group 5 – Subroute West of Las Cruces (Rio Grande) to Midpoint Substation																												
5A	D720, D730, A470, A500, A510	54.8	PL/345 kV - 20.7 mi. PL-26.8 mi.	21.3	33.6			54.8			51.4	3.1	0.3			40.2	2.4	12.1			24.7				14.5	15.7		
				39%	61%	0%		100%	0%	0%	94%	6%	1%	0%		73%	4%	22%			45%	0%	0%	0%	26%	29%		
5B	D720, D730, A460, A450, A480, A510	55.7	PL/345 kV - 20.7 mi. PL-10.2 mi. 115 kV-14.4 mi. 345 kV-1.9 mi.	14.1	41.6			55.2		0.5	55.7					50.0	2.8	2.9			24.2				13.9	17.7		
				25%	75%	0%		99%	0%	1%	100%	0%	0%	0%		90%	5%	5%			43%	0%	0%	0%	25%	32%		
5C	D7230, D740, D450, A480, A510	54.4	PL/345 kV-31.3 mi. 115kv-14.4 mi. 345 kV-1.9 mi.	11.1	43.4			52.9		1.5	54.4					48.3	2.8	3.3			24.1				10.8	19.5		
				20%	80%	0%		97%	0%	3%	100%	0%	0%	0%		89%	5%	6%			44%	0%	0%	0%	20%	36%		
Group 6 – Subroute Chaparral, NM to West of Las Cruces (Rio Grande)																												
A	D340, D380, D410, D470, D511, D512, D513, D515	34.0	345-115 kV-0.4 mi. 345 kV(2)-3.2 mi. 345 kV-2.7 mi.	18.4	15.3	0.4	30.6		3.5	12.9	13.4	5.6	2.1		21.7	2.7	9.7				7.7	5.2			10.4	10.7		
				54%	45%	1%	90%	0%	10%	38%	39%	16%	6%	0%	64%	8%	28%	0%	0%	0%	23%	15%	0%	0%	31%	31%		
6B	D340, D360, D371, D400, D450, D470, D511, D512, D513, D515	37.9	345-115 kV-3.6 mi. 345 kV(2)-7.8 mi. 345 kV-2.7 mi.	21.3	15.4	1.3	34.5		3.5	18.1	12.5	5.2	2.1		21.7	2.7	11.5			2.0	20.3	5.2			3.4	9.0		
				56%	40%	3%	91%	0%	9%	48%	33%	14%	6%	0%	57%	7%	30%	0%	0%	5%	54%	14%	0%	0%	9%	24%		
6C	D340, D350, D371, D400, D440, D460, D500, D511, D512, D513, D515	39.9	345-115 kV-3.6 mi. PL/115 kV-3.2 mi. 115 kV-5.3 mi. 345 kV-0.5 mi.	24.2	15.4	0.3	30.8		9.1	17.2	12.5	0.7	4.3	5.1	15.2	6.0	11.5			5.1	2.0	26.3	0.7			3.4	9.4	
				61%	39%	1%	77%	0%	23%	43%	31%	2%	11%	13%	38%	15%	29%	0%	13%	5%	66%	2%	0%	0%	9%	24%		
6D	D340, D360, D371, D400, D440, D460, D480, D481, D512, D513, D515	39.0	345-115 kV-3.6 mi. PL/115 kV-2.4 mi. PL-2.3 mi. Interstate 10-6.1 mi.	23.4	15.4	0.3	34.5		4.5	20.7	12.8	0.7	0.0	4.8	14.3	0.9	17.0			4.8	2.0	22.6	0.7			3.4	12.3	
				60%	39%	1%	88%	0%	12%	53%	33%	2%	0%	12%	37%	2%	44%	0%	12%	5%	58%	2%	0%	0%	9%	32%		
6E	D340, D360, D371, D400, D440, D460, D480, D700	35.9	345-115 kV-3.6 mi. PL/115 kV-2.4 mi. PL-12.4 mi. Interstate 10-1.8 mi.	19.6	16.1	0.3	31.3		4.7	17.9	12.5	0.7		4.8	13.2		15.9			4.8	2.0	20.8	0.7			5.3	9.2	
				54%	45%	1%	87%	0%	13%	50%	35%	2%	0%	13%	37%	0%	44%	0%	13%	6%	58%	2%	0%	0%	15%	26%		

Table A-7. Resource Sensitivity – New Mexico

Number	Links Included	Total Miles	Existing Parallel Utilities	Biology				Cultural			Land Use					Visual Recreation					Land Ownership								
				Low	Moderate	High	Exclusion	Low	Moderate	High	Low	Moderate	High	Exclusion	1/2-Mi. Wide BLM Utility Corridor	Low	Moderate	High	1/2-Mi. Wide BLM Utility Corridor	No VRM Data	BLM	U.S. Dept. of Defense	U.S. Forest Service	U.S. Fish & Wildlife	State	Private/Other	BLM - DOD Withdrawal		
Group 7 – Subroute North of Tularosa, NM to Chaparral, NM																													
7A	D903, D150, D200, D220, D250, D270, D272, D291, D320	65.8	115 kV(2)-17.3 mi. 345/115 kV-16.5 mi. 345/115 kV/Hwy 54/RR-14.8mi	34.6	31.2			65.8			29.4	0.7	35.7					44.5		2.1		19.2	19.4	35.7			3.5	7.3	
				53%	47%	0%		100%	0%	0%	45%	1%	54%	0%				68%	0%	3%		29%	29%	54%	0%	0%	5%	11%	0%
7B	D903, D150, D200, D220, D260a, D260b, D290, D310, D330	68.7	Hwy 54/RR-31.5 mi. RR-11.8 mi.	40.3	28.4			68.7			24.2	0.0	44.5					50.7		2.9		15.0	15.2	3.3			1.9	7.3	41.1
				59%	41%	0%		100%	0%	0%	35%	0%	65%	0%				74%	0%	4%		22%	22%	5%	0%	0%	3%	11%	60%
Group 8 – Subroute West of San Antonio to Midpoint Substation																													
8A	A10, A20, A30, A40, A800a, A800b, D841, D900, D860, D902	103.3	PL-4.0 mi. Hwy 54/RR-3.1 mi. Hwy 54/RR-3.1 mi.	27.8	75.5			101.7		1.5	103.3							60.0	13.8	5.1		24.4	49.2				19.4	34.7	
				27%	73%	0%		99%	0%	1%	100%	0%	0%	0%				58%	13%	5%		24%	48%	0%	0%	0%	19%	34%	
8B	A10, A20, A30, A40, A800a, A800b, D840, D833, D104a, D104b	106.7	PL-4.0 mi. RR-7.1 mi. 115 kV-1.4 mi.	17.0	89.8			106.7			105.8			1.0				46.3	13.8	12.5		34.2	63.4				13.0	30.4	
				16%	84%	0%		100%	0%	0%	99%	0%	0%	1%				43%	13%	12%		32%	59%	0%	0%	0%	12%	28%	
8C	D10a, D10b, D62, D70, D90, D101, D830, D850, D900, D860, D902	96.5	RR-14.1 mi. Hwy54-5.7 mi.	17.2	76.7	2.6		94.4		2.1	96.3	0.2						71.9		8.8		15.8	16.1				25.8	54.6	
				18%	79%	3%		98%	0%	2%	100%	0%	0%	0%				75%	0%	9%		16%	17%	0%	0%	0%	27%	57%	
8D	D10a, D10b, D62, D70, D90, D101, D831, D832, D104a, D104b	98.0	PL-4.0 mi. RR-7.1 mi. 115 kV-1.4 mi. RR/Hwy54-2.0 mi.	4.6	90.8	2.6		97.0		1.0	96.9	0.2						55.0		16.1		27.0	31.7				16.3	49.9	
				5%	93%	3%		99%	0%	1%	99%	0%	0%	0%				56%	0%	16%		28%	32%	0%	0%	0%	17%	51%	

Table A-8. Resource Sensitivity – Arizona

Links Included	Total Miles	Existing Parallel Utilities	Biology			Cultural			Land Use				Visual Recreation				Land Ownership									
			Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	Exclusion	Low	Moderate	High	No VRM Data	BLM	BOR	AZ Game and Fish	U.S. Dept. of Defense	U.S. Forest Service	U.S. Fish & Wildlife	State	Private Other	Tribal Lands	BLM – DOD Withdrawal
Safford Route																										
B30, B90, B120, B160, B170, C10, C170, C172, C570, C592, C620, C760, C780, C830, C840, C850, C880	260.7	345 kV/PL – 27.0 mi. 345 kV – 14.8 mi.	43.5	216.2	0.9	253.4		7.3	250.8	6.0	3.8		218.1	24.3	18.3		70.7	0.4					162.3	27.3		
		345 kV (2) – 1.6 mi. 230 kV/PL/ Hwy 191 – 10.3 mi. PL/Hwy 191 – 15.5 mi.	16.7%	82.9%	0.4%	97.2%		2.8%	96.2%	2.3%	1.5%		83.7%	9.3%	7.0%		27.4%	0.2%					61.1%	10.7%		
Sulphur Springs																										
B30, B90, B120, B160, B170, C70, C90, C130, C170, C172, C570, C592, C620, C760, C780, C830, C840, C850, C880	260.2	345 kV/PL – 27.0 mi. 345 kV – 14.8 mi.	46.4	212.9	0.9	253.0		7.3	250.3	6.1	3.8		225.2	18.3	16.7		64.6	0.4					167.7	27.5		
		345 kV (2) – 1.6 mi. PL – 6.0 mi.	17.8%	81.8%	0.4%	97.2%		2.8%	96.2%	2.3%	1.5%		86.6%	7.0%	6.4%		25.1%	0.2%					63.3%	10.8%		
Winchester																										
C70, C110, C210, C260, C261, F40, F51, F60	73.6	345 kV (2) – 70.5 mi.	8.7	48.4	16.5	65.5		8.1	63.1	6.8	3.7		50.7		22.9								57.0	16.6		
		345 kV (2)/PL – 2.7 mi.	11.8%	65.8%	22.4%	89.0%		10.9%	85.8%	9.2%	5.0%		68.8%		31.2%								77.4%	22.6%		
Railroad																										
F10, F20, F51, F60	86.9	345 kV (2)/PL – 4.8 mi. I-10 – 9.3 mi. RR – 7.1 mi. RR/PL – 8.0 mi. RR/PL/230 kV – 2.0 mi.	9.4	59.6	17.9	66.4		20.4	73.5	7.1	4.8	1.5	58.0		28.9		2.7		1.1		0.3		52.0	30.8		
		RR/230 kV – 3.3 mi. PL/I-10/115 kV – 2.2 230/115 kV/PL – 4.7 230/115 kV – 6.8 230 kV/PL – 18.1 230 kV – 20.3	10.8%	68.5%	20.6%	76.5%		23.5%	84.5%	8.2%	5.5%	1.7%	66.7%		33.2%		3.1%		1.3%		0.3%		59.8%	35.4%		
Interstate 10																										
F10, F31, F60	87.7	PL/I-10 – 12.7 mi. I-10 – 18.1 mi. PL/I-10/ 115 kV – 2.2 mi.	9.4	59.2	19.0	77.0		10.6	68.0	12.1	5.9	0.8	58.9		28.7		2.7		1.1		0.3		49.7	33.9		
		230/115 kV/PL – 4.7 mi. 230/115 kV – 6.8 mi. 230 kV/PL – 18.1 mi. 230 kV – 20.3 mi.	10.8%	67.5%	21.7%	87.8%		12.1%	77.5%	13.8%	6.7%	0.9%	67.2%		32.8%		3.1%		1.3%		0.3%		56.7%	38.7%		
Tucson East																										
F81, F510, F540	54.5	138 kV – 22.1 mi. 138/115 kV – 1.0 mi. 115 kV – 1.0 mi.	3.5	24.1	26.9	38.8	0.3	15.5	13.2	22.0	18.7	0.6	18.1	0.0	36.3		0.1	0.6					21.9	32.0		
		138/161 kV – 10.0 mi. 138/161 kV/P – 4.3 mi.	6.4%	44.3%	49.3%	71.1%	0.5%	28.4%	24.2%	40.3%	34.4%	1.1%	33.3%	0.1%	66.7%		0.2%	1.1%					40.2%	58.7%		
Tucson Central																										
F82, F80, F111, F112, F510, F540	53.8	I-10/345/138 kV/ PL – 5.3 mi. 138 kV – 12.2 mi.	3.5	29.8	20.5	34.0		19.8	18.1	20.1	14.1	1.5	19.9	0.0	33.9		0.1	0.6					24.8	28.4		
		I-10 – 7.8 138 kV/I-10 – 3.7 mi. 138/115 kV – 7.4 mi. 138/161 kV – 10.0 mi.	6.5%	55.4%	38.2%	63.2%		36.8%	33.7%	37.4%	26.3%	2.7%	37.0%	0.1%	62.9%		0.2%	1.1%					46.1%	52.8%		

Table A-8. Resource Sensitivity – Arizona

Links Included	Total Miles	Existing Parallel Utilities	Biology			Cultural			Land Use				Visual Recreation				Land Ownership										
			Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	Exclusion	Low	Moderate	High	No VRM Data	BLM	BOR	AZ Game and Fish	U.S. Dept. of Defense	U.S. Forest Service	U.S. Fish & Wildlife	State	Private Other	Tribal Lands	BLM – DOD Withdrawal	
		138/161 kV/PL – 4.3 mi.																									
Tucson Meader																											
F82, F80, M1, F112, F510, F540	56.6	I-10/345/138 kV/ PL – 5.3 mi. 138 kV – 12.2 mi. 161 kV – 8.0 mi. 115 kV – 3.3 mi. 138/115 kV – 7.4 mi. 138/161 kV – 10.0 mi. 138/161 kV/PL – 4.3 mi.	3.5	28.3	24.8	32.3		24.3	21.5	17.5	17.0	0.6	25.5	0.0	31.1		0.1	0.6					23.7	29.4	2.9		
			6.2%	50.0%	43.8%	57.1%		42.9%	38.0%	30.9%	30.1%	1.0%	45.0%	0.1%	54.9%		0.2%	1.1%					41.9%	51.9%	5.1%		
Tucson West																											
F82, F121, F540	86.5	345 kV – 8.3 mi. 345/138 kV – 5.6 mi. 345/115 kV – 9.2 mi. CAP/138 – 4.7 mi. 138/161 kV – 10.0 mi. 138/161 kV/PL – 4.3 mi.	6.1	19.1	61.3	81.1		5.5	58.3	20.7	6.4	1.0	47.3	1.2	38.0		1.2	3.5					47.5	32.4	2.1		
			7.1%	22.1%	70.9%	93.7%		6.3%	67.4%	24.0%	7.5%	1.2%	54.7%	1.3%	44.0%		1.4%	4.0%					54.9%	37.5%	2.4%		
San Pedro North																											
500, 570	11.3			11.3									11.3										11.3				
				100.0%										100.0%										100.0%			
510, 520, 540, 570	12.7			12.7									10.9	1.7			1.7						11.0				
				100.0%									85.8%	13.4%			15.0%						97.3%				
510, 520, 530	12.0	115 kV – 7.9 mi.		11.9	0.0								12.0		2.5	2.5		1.7					5.6	4.6			
				99.2%	0.4%								100.0%		58.3%	20.8%	20.8%		14.2%					46.7%	38.3%		
San Pedro Middle																											
470, 510, 660	33.4			0.5	32.9	33.4							32.6	0.8									26.3	5.1			
				1.5%	98.5%	100.0%								97.6%	2.4%									78.7%	15.3%		
400, 430, 460, 660	32.0	115 kV – 18.6 mi.	0.2	24.0	7.8	32.0							31.2	0.8									23.8	4.1			
			0.6%	75.0%	24.4%	100.0%								97.5%	2.5%									74.4%	12.8%		
400, 420, 443, 450	28.8	PL – 24.0 mi.	0.2	18.0	10.7	28.4		0.4	24.5	4.3				28.8									25.8	3.0			
			0.7%	62.5%	37.2%	98.6%				1.4%	85.1%	14.9%			100.0%									89.6%	10.4%		
Muleshoe																											
301, 331	6.2		1.2	4.9	0.1	6.1		0.1	6.1				6.1		0.1								6.1%				
			19.4%	79.0%	1.6%	98.4%				1.6%	98.4%				98.4%		1.6%							98.4%			
271, 311, 310, 331	6.7		1.7	4.9	0.1	6.6		0.1	6.6				6.6		0.1								6.6				
			25.4%	73.1%	1.5%	98.5%				1.5%	98.5%				98.5%		1.5%							98.5%			
271,266,275,281,311, 331	7.6		2.8	4.7	0.1	7.5		0.1	7.5				7.5		0.1								7.5				
			36.8%	61.8%	1.3%	98.7%				1.3%	98.7%				98.7%		1.3%							98.7%			
271, 266, 275, 321	7.4		4.4	2.9	0.1	7.3		0.1	7.3				7.3		0.1								7.3				
			59.5%	39.2%	1.4%	98.6%				1.4%	98.6%				98.6%		1.4%							98.6%			
San Pedro South																											
270, 271, 266, 276	20.3		5.1	14.6	0.6	20.3							19.8	0.6									17.3	3.0			
			25.1%	71.9%	3.0%	100.0%								97.5%	3.0%									85.2%	14.8%		
260, 273, 276	26.0	345 kV – 10.4 mi. 115 kV – 7.1 mi.	11.1	14.3	0.6	26.0							25.4	0.6									25.7	0.2			
			42.7%	55.0%	2.3%	100.0%								97.7%	2.3%									98.8%	0.8%		
260, 261, 201	28.8	345 kV – 16.5 mi.	7.6	21.3		28.8							28.6	0.2									28.8				
			26.4%	74.0%		100.0%								99.3%	0.7%									100.0%			

Table A-8. Resource Sensitivity – Arizona

Links Included	Total Miles	Existing Parallel Utilities	Biology			Cultural			Land Use				Visual Recreation				Land Ownership									
			Low	Moderate	High	Low	Moderate	High	Low	Moderate	High	Exclusion	Low	Moderate	High	No VRM Data	BLM	BOR	AZ Game and Fish	U.S. Dept. of Defense	U.S. Forest Service	U.S. Fish & Wildlife	State	Private Other	Tribal Lands	BLM – DOD Withdrawal
7A																										
D903, D150, D200, D220, D250, D270, D272, D291, D320	65.8	115 kV(2) – 17.3 mi. 345/115 kV – 16.5 mi. 345/115 kV/Hwy 54/RR – 14.8 mi.	34.6	31.2		65.8			29.4	0.7	35.7		44.5		2.1	19.2	19.4			35.7			3.5	7.3		
			53%	47%	0%	100%	0%	0%	45%	1%	54%	0%	68%	0%	3%	29%	29%			54%	0%	0%	5%	11%		0%
7B																										
D903, D150, D200, D220, D260a, D260b, D290, D310, D330	68.7	Hwy 54/RR – 31.5 mi. RR – 11.8 mi.	40.3	28.4		68.7			24.2	0.0	44.5		50.7		2.9	15.0	15.2			3.3			1.9	7.3		41.1
			59%	41%	0%	100%	0%	0%	35%	0%	65%	0%	74%	0%	4%	22%	22%			5%	0%	0%	3%	11%		60%
8A																										
A10, A20, A30, A40, A800a, A800b, D841, D900, D860, D902	103.3	PL – 4.0 mi. Hwy 54/RR – 3.1 mi. Hwy 54/RR – 3.1 mi.	27.8	75.5		101.7		1.5	103.3				60.0	13.8	5.1	24.4	49.2						19.4	34.7		
			27%	73%	0%	99%	0%	1%	100%	0%	0%	0%	58%	13%	5%	24%	48%			0%	0%	0%	19%	34%		
8B																										
A10, A20, A30, A40, A800a, A800b, D840, D833, D104a, D104b	106.7	PL – 4.0 mi. RR – 7.1 mi. 115 kV – 1.4 mi.	17.0	89.8		106.7			105.8			1.0	46.3	13.8	12.5	34.2	63.4						13.0	30.4		
			16%	84%	0%	100%	0%	0%	99%	0%	0%	1%	43%	13%	12%	32%	59%			0%	0%	0%	12%	28%		
8C																										
D10a, D10b, D62, D70, D90, D101, D830, D850, D900, D860, D902	96.5	RR – 14.1 mi. Hwy 54 – 5.7 mi.	17.2	76.7	2.6	94.4		2.1	96.3	0.2			71.9		8.8	15.8	16.1						25.8	54.6		
			18%	79%	3%	98%	0%	2%	100%	0%	0%	0%	75%	0%	9%	16%	17%			0%	0%	0%	27%	57%		
8D																										
D10a, D10b, D62, D70, D90, D101, D831, D832, D104a, D104b	98.0	PL – 4.0 mi. RR – 7.1 mi. 115 kV – 1.4 mi. RR/Hwy54 – 2.0 mi.	4.6	90.8	2.6	97.0		1.0	96.9	0.2			55.0		16.1	27.0	31.7						16.3	49.9		
			5%	93%	3%	99%	0%	1%	99%	0%	0%	0%	56%	0%	16%	28%	32%			0%	0%	0%	17%	51%		

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Table A-9. Alternatives Considered but Eliminated

Routes/Subroutes in Common	Link(s)	General Location	Constraint Factors
WSMR Route 1	A10, E10, E30, E50, E60, E70 Local alternative: Link E40	Starting at the SunZia East substation, this route progresses north and west through the Cibola National Forest, north of the Gran Quivira unit of Salinas Pueblo Missions National Monument and parallels an existing pipeline and transmission line until it reaches the town of Belen. After crossing Interstate 25, the route parallels the west side of interstate 25 and follows an existing 345kV transmission line through the Sevilleta NWR until it intersects Link E110, E120.	This route was eliminated because it would require a plan amendment to the Cibola National Forest Land and Resource Management Plan. This route was also crosses the Sevilleta NWR and would not be feasible due to the land grant deed restriction in place for the Sevilleta NWR.
WSMR Route 1A	A10, E10, E20, E70	Starting at the SunZia East substation, this route progresses north and west through the Cibola National Forest, north of the Gran Quivira unit of Salinas Pueblo Missions National Monument and parallels an existing pipeline until it turns west and parallels US 60 until it intersects Link E60, E70 and turns south paralleling an existing 345kV transmission line through the Sevilleta NWR until it intersects Link E110, E120.	This route was eliminated because it would require a plan amendment to the Cibola National Forest Land and Resource Management Plan. This route was also crosses the Sevilleta NWR and would not be feasible due to the land grant deed restriction in place for the Sevilleta NWR.
WSMR Route 2	A10, A20, E80, E82, E83, E100, E110, E120	Starting at the SunZia East substation, this route follows an existing pipeline to the north and west and stays south of the Gran Quivira unit of Salinas Pueblo Missions National Monument before turning west and progressing towards the southern end of the Sevilleta NWR. The route stays south of the southern boundary of the Sevilleta NWR and crosses Interstate 25 before continuing along the southern border of the western portion of the Sevilleta NWR and turning south.	Portions of the eastern section of the route remain. However, the western section cross some BLM R.O.W. Avoidance areas and adjustments were made to provide a route with fewer land use and visual impacts to the area around the Sevilleta NWR.
WSMR Route 4	A180, A183, A312	These links are located near the northwest corner of WSMR. The links are located in a northerly/southerly direction along the border of the WSMR near the Antelope and Jornada del Muerto WSAs.	These links were eliminated due to their proximity to the Antelope and Jornada del Muerto WSAs and because of potential interference with military testing in this area on the WSMR.
	E92	This link was an alternative to Link E91 and is west of a county road that runs generally north and south through the Northern Call-Up Area.	This link was eliminated due to conflicts with nearby residences. An alternative link was located approximately 2 miles to the east to reduce the visual impacts from these residences.
	E140	Link E140 generally parallels the east side of the Rio Grande from north of Socorro near the Sevilleta NWR south to near the town of San Antonio.	This link was eliminated because it would potentially impact cultural resources along the Camino Real Trail corridor.
	No Link Number	A link between A162 and A163 crossed the Willow Spring Ranch Subdivision.	This link diagonally crosses the subdivision was eliminated because Link A162 parallels an existing 345kV line.
Subroutes 1C1, 1C2, 1C3	A10, A30, A40, A41, A80, A102, A103, A181, A250, A255, A256, A261, A284, A300, A301a, A301b, A313, A340, A351, A352, A353, A360, A370, A420, A480, A510	Starting at the SunZia East substation, these routes proceed south and west, north of WSMR. The routes turn south near the northwest corner of WSMR and proceeds south along the western border of WSMR. Subroute 1C1 continues to the south and west until it intersects an existing 345kV transmission line and turns back to the south and east parallels this line until a point approximately 3 miles north of the Sierra and Dona Ana County line. From there, the route turns east and proceeds to the towns of Arrey and Derry, crosses the Rio Grande, and connects to the intersection of links A330b and A400. Subroute 1C2 is similar to 1C1 but instead of continuing to the existing 345kV transmission line, it turns to the southeast and parallels the eastern border of the Armendaris Ranch (Link A255). From the southern end of the Armendaris Ranch (links A255, A301a) the subroute continues south along the western border of WSMR and then turns to the south and west and connects with subroute 1C1. Subroute 1C3 is similar to 1C1 and 1C2; however, it proceeds along the western border of WSMR from the northwest corner of WSMR (Link A103) until it connects with subroute 1C2 at the southern edge of the Armendaris Ranch (Link A301a).	These routes were eliminated after review by WSMR and they proposed routes further north that would have less impacts to military operations through the Northern Call-Up Area.
Subroutes 2A	D10a, D10b, D50, D61, D62, D70, D71, D90, D101, D104a, D104b, D150, D160, D180, D190, D200, D220, D260a, D260b, D280, D290, D310, D330, D340, D350, D360, D371, D400, D420, D430, D440, D460, D480, D512, D515, D700, D720, D730, D740, D830, D831, D832, D833, D903, A450, A460, A470, A480, A510, A520	Starting at the SunZia East substation, this route proceeds to the south paralleling the eastern side of US 54 near the El Paso and Northeastern railroad until it nears the town of Carrizozo. Local alternatives lie around a major subdivision under construction, and then crosses US 380 before turning to the west and proceeding back towards US 54. The route then turns south and continues to parallel US 54 until it nears the town of Tularosa where it skirts the base of the mountain range east of the town and continues south. The route then crosses US 54 south of Tularosa and proceeds south between the town of Alamogordo and Holloman AFB. Once south of Alamogordo, the route crosses back to the east side of US 54 and continues south along the east side of the BNSF railroad through Fort Bliss McGregor Range and turning west south of the Dona Ana Range near the town of Chaparral. The route then turns to the north and west and proceeds along an existing pipeline though the towns of Anthony, Berino, Vado, and Mesquite as it continues towards the city of Deming. Approximately nine miles east of Deming, the route turns north and crosses I-10 before turning north and west and terminating at the proposed Midpoint Substation.	These routes were eliminated after review by WSMR and Fort Bliss because they crossed BLM land that has been withdrawn for military use and would create immitigable impacts to the current mission of Fort Bliss.
Subroutes 2B	A10, A30, A40, A450, A460, A470, A480, A510, A520, D150, D200, D220, D220a, D250, D270, D272, D280, D320, D340, D380, D390, D400, D420, D430, D440, D460, D480, D481, D512, D515, D700, D720, D730, D740, D800a, D800b, D830, D833, D840, D841, D850, D900, D902, D903	Starting at the SunZia East substation, this route proceeds south and west before turning south along the extended eastern boundary of WSMR. The route proceeds along the eastern border of WSMR until it nears Holloman AFB and proceeds south around the eastern side of the base, before continuing south along the eastern border of WSMR. After passing through the Doña Ana Range, the subroute turns west and continues along the southern border of the Doña Ana Range north of the town of Chaparral until it meets and parallels an existing utility corridor and turns northwest along an existing pipeline though the towns of Anthony, Berino, Vado, and Mesquite as it continues towards the city of Deming. Approximately nine miles east of Deming, the route turns north and crosses I-10 before turning north and west and terminating at the proposed Midpoint Substation.	These routes were eliminated after review by WSMR and Fort Bliss because they crossed BLM land that has been withdrawn for military use and would create immitigable impacts to the current mission of Fort Bliss.
	A320	This link starts north of Truth or Consequences and follows an existing 115 kV transmission line southeast towards Las Cruces.	This link was eliminated because it would result in two additional Rio Grande River crossings, and would require special tower design at the Elephant Butte Dam.
Subroute 3A	B120	This link is located between the Hidalgo and Midpoint substations.	While this link maximizes the amount of BLM crossed between the Midpoint and Lordsburg substations, it crosses through two avoidance areas. The link was split, and a portion was relocated to avoid as many of the avoidance areas as possible.

Table A-9. Alternatives Considered but Eliminated

Routes/Subroutes in Common	Link(s)	General Location	Constraint Factors
	B200	This link follows an existing 345 kV transmission line heading northwest from Lordsburg and then turns west near Duncan before paralleling an existing 345 kV transmission line southwest to the planned Willow 500 kV substation.	This link was eliminated because it would add 14 miles, longer than Subroute 3A or 3B, which would be substantially similar.
	No Link Number	This link lies between the planned Willow 500 kV substation and the Arizona/New Mexico border.	This link was moved north approximately 2-1/2 miles to maximize the use of public land. This link became Link B160b.
Subroute 3B	A490, B60, D100	These links connect Subroute 3B to the proposed Midpoint Substation. They are located through the city of Deming.	These links were eliminated due to a number of residential crossings through the city of Deming.
	B210	This link was identified because it would parallel the permitted Bowie 345 kV Transmission Line.	The link was eliminated to avoid crossing agricultural lands. Link B170 would be more direct.
Subroute 4A	No Link Number	This link is located between Mount Graham and Safford.	This link was eliminated because of visual impacts to nearby residences. It was later relocated closer to the Coronado National Forest Boundary.
	C490, C560, C580, C591, C600, C610, C630, C750	These links cross the San Pedro River furthest north and continue west into the permitted Pinal Central 500 kV substation.	These routes were eliminated because of land use conflicts along the San Pedro River near the town of Mammoth.
Subroute 4B	C150	This link is near the Fort Grant State prison and the town of Bonita.	This link was eliminated due to conflicts with residential and agricultural properties.
Subroute 4C1	C250	This route would parallel an existing pipeline through the Muleshoe Ranch CMA connecting the portion of the subroute that is east of the San Pedro River with the portion of the subroute approximately 15 miles west of Willcox.	
	C290, C300, C310, C320, C330, C340, C350, C360, C370, C380, C390, C400	These links are located east of the San Pedro River and between the Muleshoe Ranch CMA and the existing 345 kV transmission line near the Winchester Substation.	These links were eliminated because shorter, more direct alternatives were identified.
	C410, C420, C430, C440, C460, C520, C530, C540	These links are located along the east side of the San Pedro River.	Link C460 passes through the town of San Manuel. There are other subroutes with less land use impacts, therefore these links were eliminated.
	C480	This link connects subroutes 4A and 4B to 4C1 northeast of San Manuel.	This link was eliminated because it crosses residential development and privately owned land northeast of San Manuel. There are other links with no residential impacts located on Public lands.
Subroute 4C2	C700, C710, C720	These links made up a crossover group of links between subroutes 4C1 and 4C2 near the planned Willow Springs subdivision, north of Oracle.	These links were eliminated with the northernmost routes that cross the San Pedro River were eliminated.
Subroute 4C3	F10, F20, F30	These links follow the I-10 corridor from north of Willcox, east of the Willcox Playa, through Benson and end near the community of Vail. Link F20 follows the Union Pacific railroad corridor between Benson and Vail.	These links were eliminated because the portion of the route in this area that followed the existing 345 kV transmission line was shorter and had less land use impacts.
	F42, F70	These links are located north of I-10 between Vail and Speedway Boulevard and is referred to as the I-10 route and Railroad Route in Chapter 2.	These links were eliminated because of conflicts with historic districts through downtown Tucson and would result in the displacement of approximately 415 residences, 50 commercial buildings, 2 schools and 130 industrial structures.
	F43	This link follows the Pantano Wash and Rillito River through the city of Tucson.	The eastern portion of this link crosses residential and commercial property. It was eliminated because Link F81a is located on State land and doesn't have these land use impacts.
	F50, F110, F270, F290, F360, F370, F380, F400, F550, F390	These links were known as the "Tucson West" subroute. They start near Vail road and I-10 and proceed south and west through the communities of Corona De Tucson, Sahuarita and Green Valley before turning north and proceeding around the west side of the San Xavier Indian Reservation and north across the Tohono O'odham Indian Reservation at the "Garcia Strip" before continuing north through Avra Valley and crossing I-10 near the Tortolita Substation.	This route was eliminated when the Tohono O'odham Indian Nation passed a resolution opposing for a transmission line crossing tribal land.
	F120, F130, F140, F150, F160, F170, F180, F190, F200, F220, F230, F240, F250, F260, F280	These links are located south of I-10 and are alternative links for the "Tucson West" route between Green Valley and I-10.	These links were eliminated when the Tucson West were eliminated.
	F100, F103, F104, F330, F340, F331 F350, F351	These links connect the I-10 near downtown Tucson with the Tucson West Route. These links are near the Tucson Mountain Park, Tucson Mitigation Corridor and the Tohono O'odham Indian Nation's Garcia Strip.	These links were eliminated when the Tohono O'odham Indian Nation passed a resolution opposing for a transmission line crossing tribal land. The AGFD, Pima County and the BOR manage the Tucson Mitigation Corridor and will not allow a transmission line across the TMC.
	F410, F420, F430, F431, F432, F440, F450, F461, F470, F480	These links are located west and north of the Saguaro National Park.	These links are a continuation of the links through the TMC. These links were eliminated after the Tohono O'odham Indian nation passed a resolution opposing for a transmission line crossing tribal land.

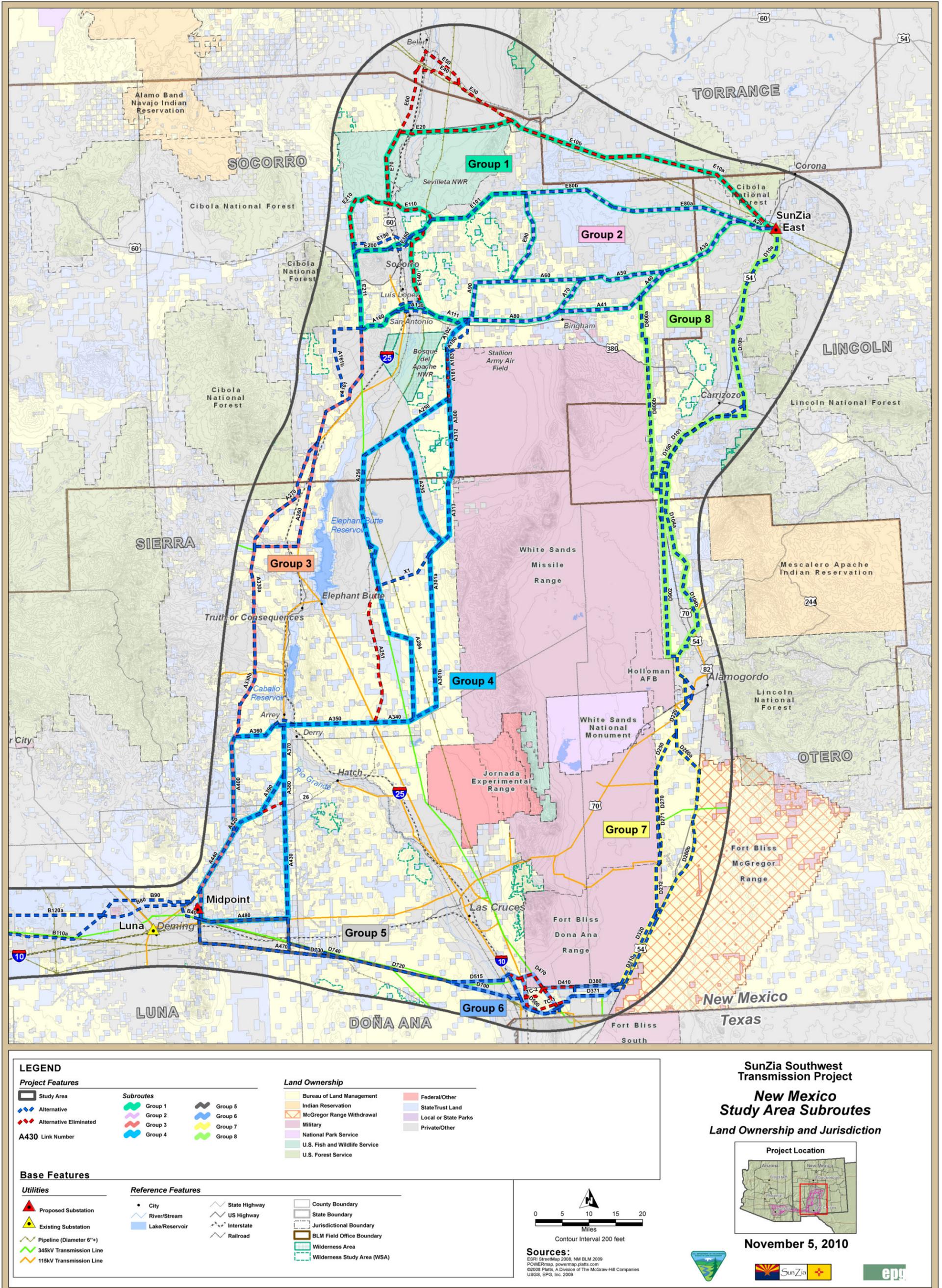
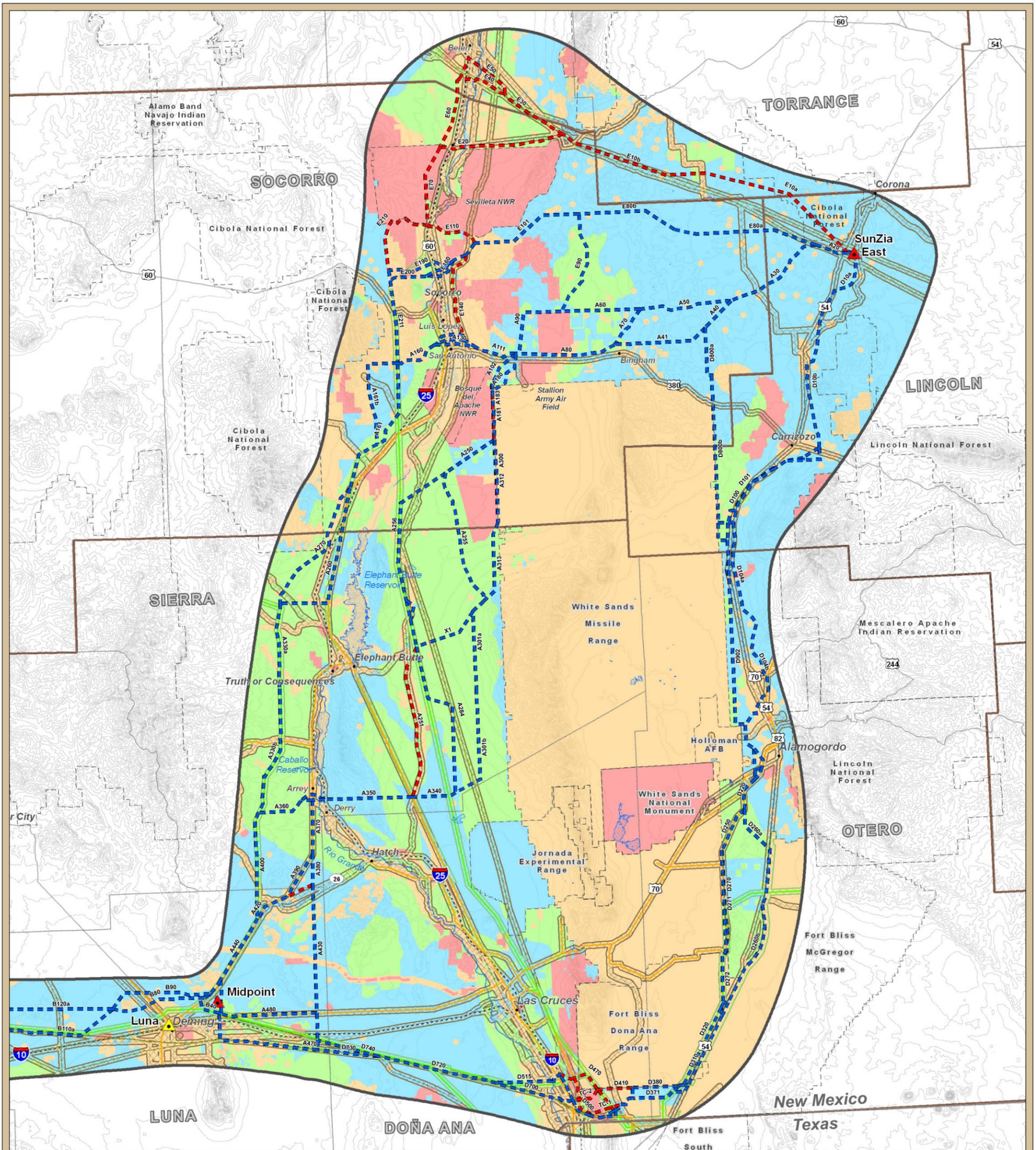


Figure A-1. NM: Land Ownership and Jurisdiction



SunZia Southwest Transmission Project

Composite Constraints and Opportunities

LEGEND

Project Features	Constraints	Opportunities
<ul style="list-style-type: none"> Study Area Alternative Alternative Eliminated A430 Link Number 	<ul style="list-style-type: none"> Exclusion High Moderate Low 	<ul style="list-style-type: none"> High Moderate

Base Features	Reference Features	
<ul style="list-style-type: none"> Proposed Substation Existing Substation Pipeline (Diameter 6"+) 345kV Transmission Line 115kV Transmission Line 	<ul style="list-style-type: none"> City River/Stream Lake/Reservoir State Highway US Highway Interstate Railroad 	<ul style="list-style-type: none"> County Boundary State Boundary Jurisdictional Boundary

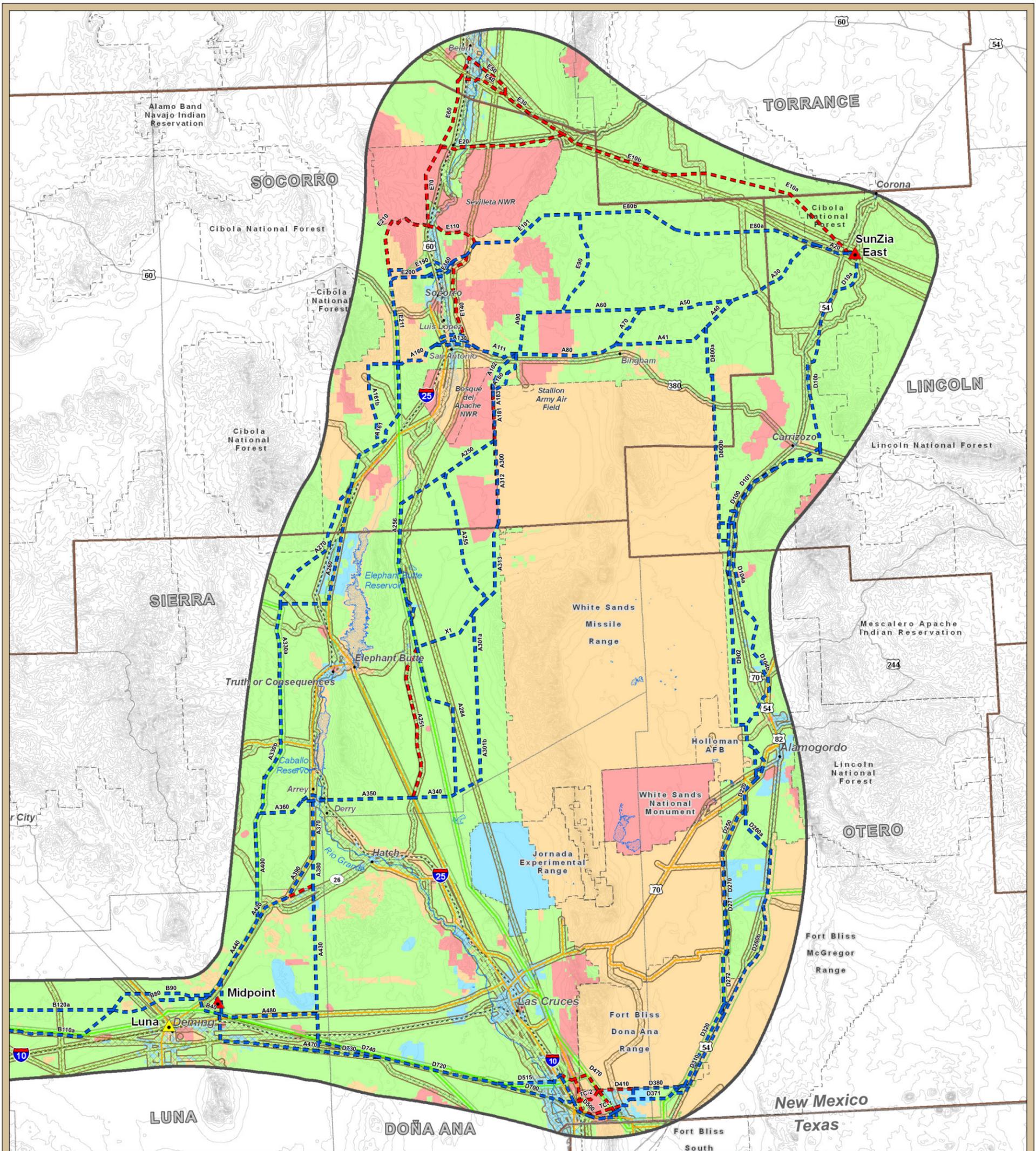
Sources:

Bureau of Transportation Statistics 2008, ESRI StreetMap 2008, National Scenic Byways Program 2008, NM BLM 2009, Mimbres RMP 1999, Socorro RMP 2010, NM Energy, Minerals and Natural Resources Department 2009, POWERmap, powermap.platts.com, ©2008 Platts, A Division of The McGraw-Hill Companies, USGS, EPO, Inc. 2010

November 9, 2010

Contour Interval 200 feet

Figure A-2. NM: Composite Opportunities and Constraints



SunZia Southwest Transmission Project

Land Use Opportunities and Constraints

LEGEND

Project Features	Constraints	Opportunities
<ul style="list-style-type: none"> Study Area Alternative Alternative Eliminated A430 Link Number 	<ul style="list-style-type: none"> Exclusion High Moderate Low 	<ul style="list-style-type: none"> High Moderate
Base Features	Reference Features	
<ul style="list-style-type: none"> Proposed Substation Existing Substation Pipeline (Diameter 6"+) 345kV Transmission Line 115kV Transmission Line 	<ul style="list-style-type: none"> City River/Stream Lake/Reservoir State Highway US Highway Interstate Railroad 	<ul style="list-style-type: none"> County Boundary State Boundary Jurisdictional Boundary

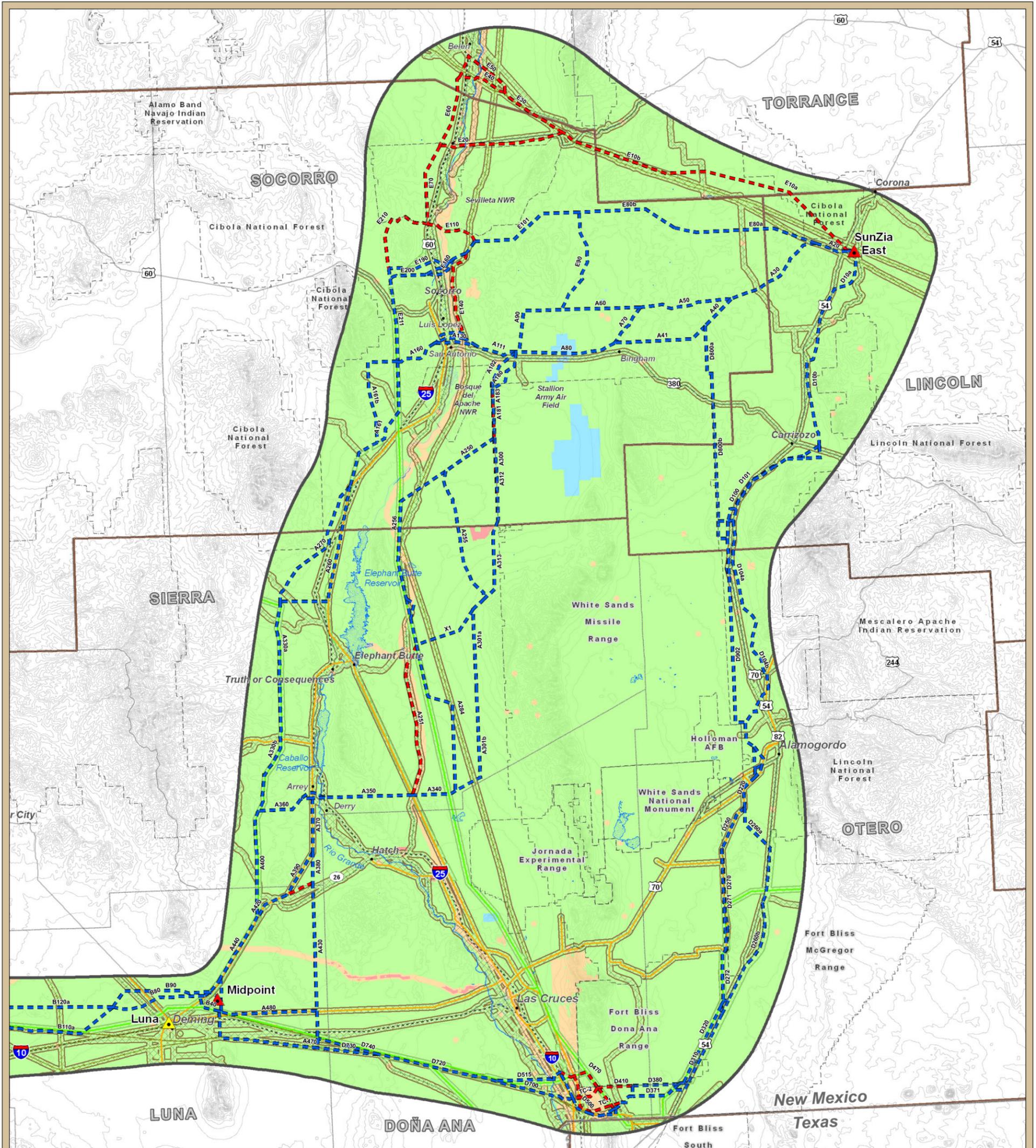
Sources:

Bureau of Transportation Statistics 2008, ESRI StreetMap 2008, National Scenic Byways Program 2008, NM BLM 2009, Mimbres RMP 1999, Socorro RMP 2010, NM Energy, Minerals and Natural Resources Department 2009, POWERmap, powermap.platts.com, ©2008 Platts, A Division of The McGraw-Hill Companies, USGS, EPO, Inc. 2010

November 9, 2010

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Figure A-3. NM: Land Use Opportunities and Constraints



SunZia Southwest Transmission Project

Cultural Opportunities and Constraints

Project Location

LEGEND

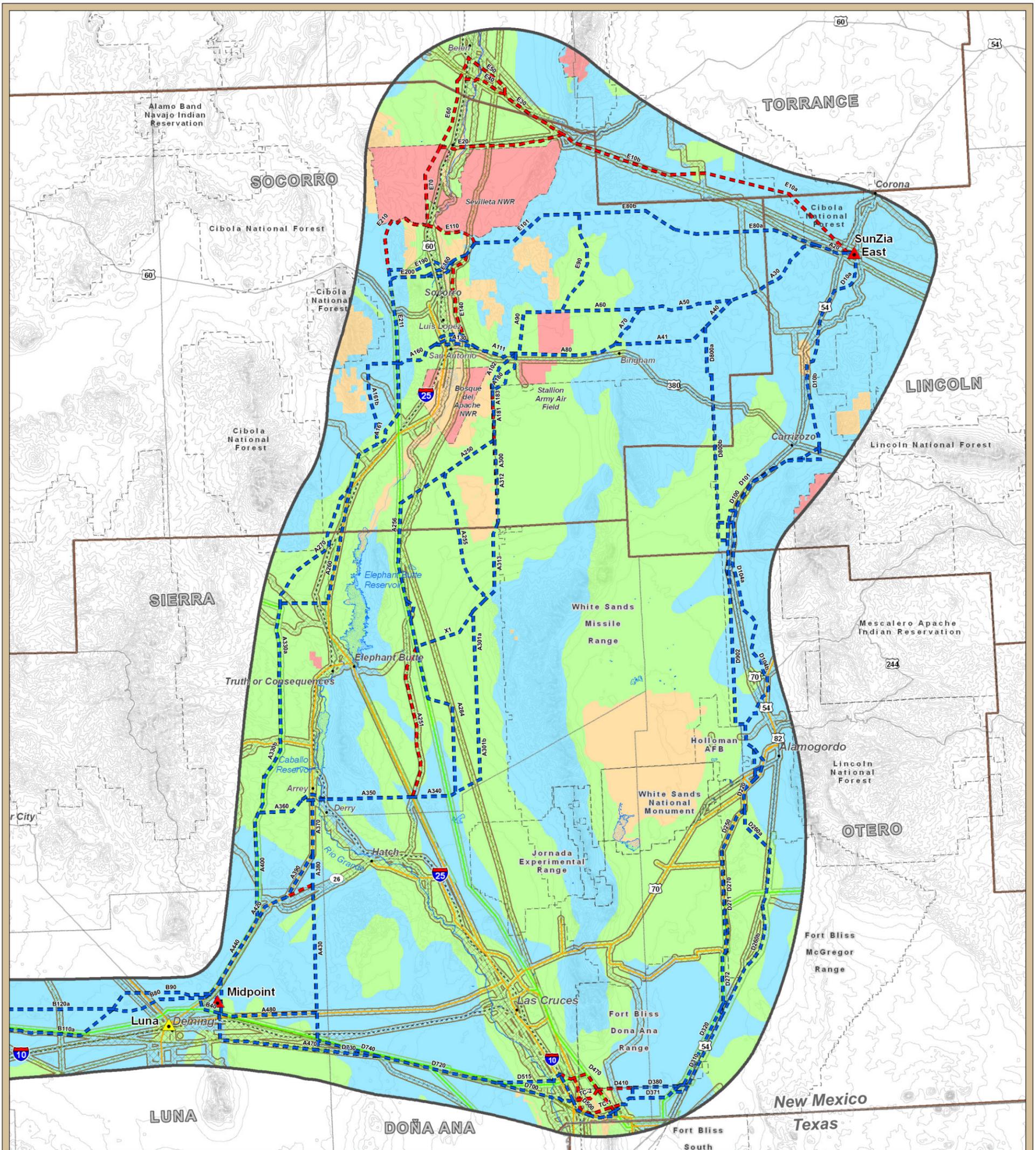
Project Features	Constraints	Opportunities
<ul style="list-style-type: none"> Study Area Alternative Alternative Eliminated A430 Link Number 	<ul style="list-style-type: none"> Exclusion High Moderate Low 	<ul style="list-style-type: none"> High Moderate
Base Features	Reference Features	
<ul style="list-style-type: none"> Proposed Substation Existing Substation Pipeline (Diameter 6"+) 345kV Transmission Line 115kV Transmission Line 	<ul style="list-style-type: none"> City River/Stream Lake/Reservoir State Highway US Highway Interstate Railroad 	<ul style="list-style-type: none"> County Boundary State Boundary Jurisdictional Boundary

Sources:

Bureau of Transportation Statistics 2008, ESRI StreetMap 2008
 National Scenic Byways Program 2008,
 NM BLM 2009, Mimbres RMP 1999, Socorro RMP 2010,
 NM Energy, Minerals and Natural Resources Department 2009
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0 8 16 24 32
 Miles
November 9, 2010
 Contour Interval 200 feet

Figure A-5. NM: Cultural Resource Opportunities and Constraints



SunZia Southwest Transmission Project

Biology Opportunities and Constraints

Project Location

LEGEND

Project Features	Constraints	Opportunities
<ul style="list-style-type: none"> Study Area Alternative Alternative Eliminated A430 Link Number 	<ul style="list-style-type: none"> Exclusion High Moderate Low 	<ul style="list-style-type: none"> High Moderate

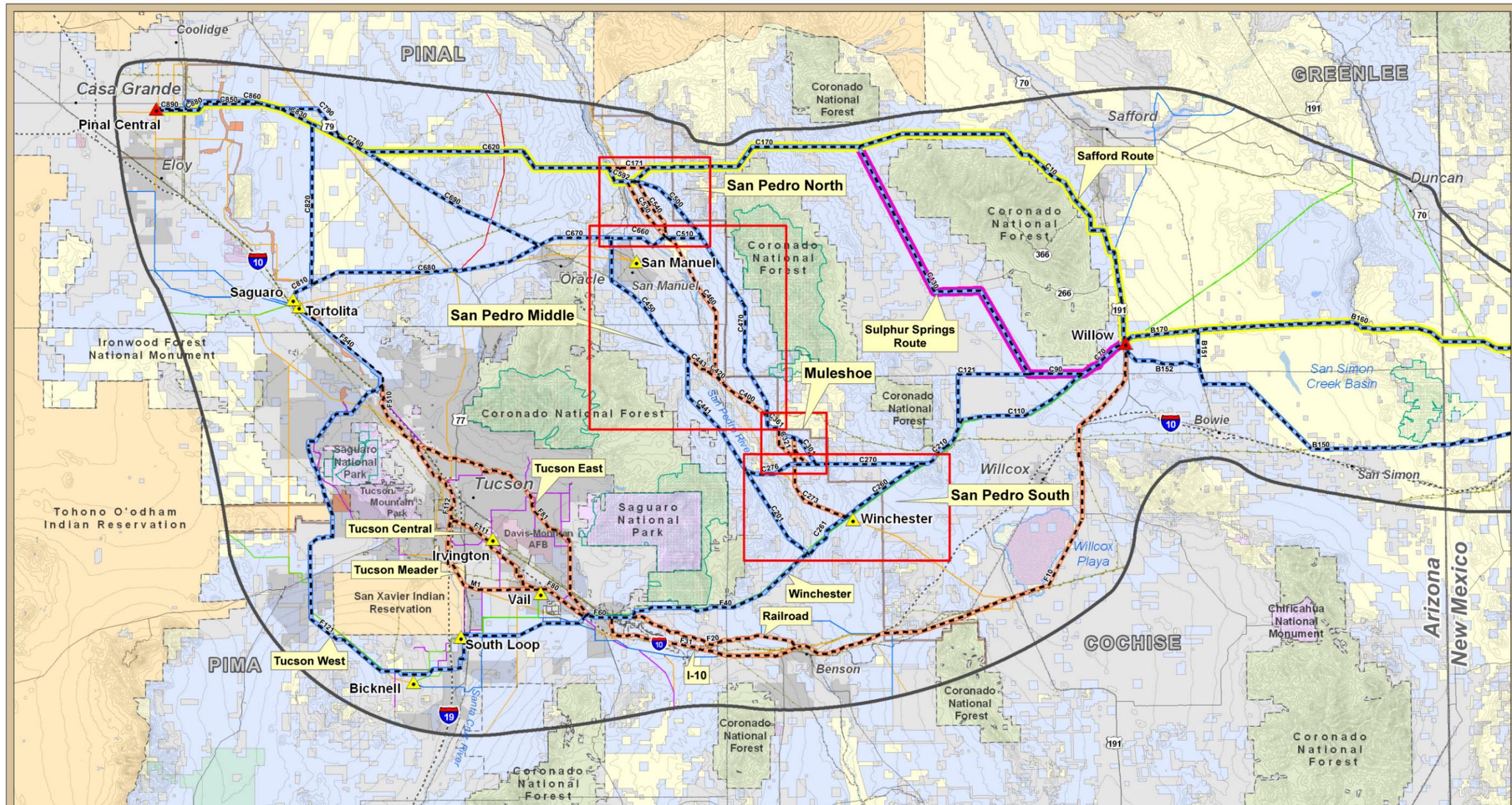
Base Features	Reference Features	
<ul style="list-style-type: none"> ▲ Proposed Substation ▲ Existing Substation Pipeline (Diameter 6"+) 345kV Transmission Line 115kV Transmission Line 	<ul style="list-style-type: none"> ● City ~ River/Stream Lake/Reservoir State Highway US Highway Interstate Railroad 	<ul style="list-style-type: none"> County Boundary State Boundary Jurisdictional Boundary

Sources:

Bureau of Transportation Statistics 2008, ESRI StreetMap 2008
 National Scenic Byways Program 2008,
 NM BLM 2009, Mimbres RMP 1999, Socorro RMP 2010,
 NM Energy, Minerals and Natural Resources Department 2009
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0 8 16 24 32
 Miles
November 9, 2010
 Contour Interval 200 feet

Figure A-6. NM: Biological Opportunities and Constraints



SunZia Southwest Transmission Project

Alternative Routes for Consideration Land Ownership

Project Location

LEGEND

Project Features		Land Ownership	
Alternatives Subject to Further Study	Bureau of Land Management	U.S. Bureau of Reclamation	Federal/Other
Alternatives Recommended for Elimination	U.S. Department of Defense	Indian Reservation	State Trust Land
Safford Route	National Park Service	U.S. Forest Service	Local or State Parks
Sulphur Springs Route	U.S. Fish and Wildlife Service	Private/Other	
Study Area			

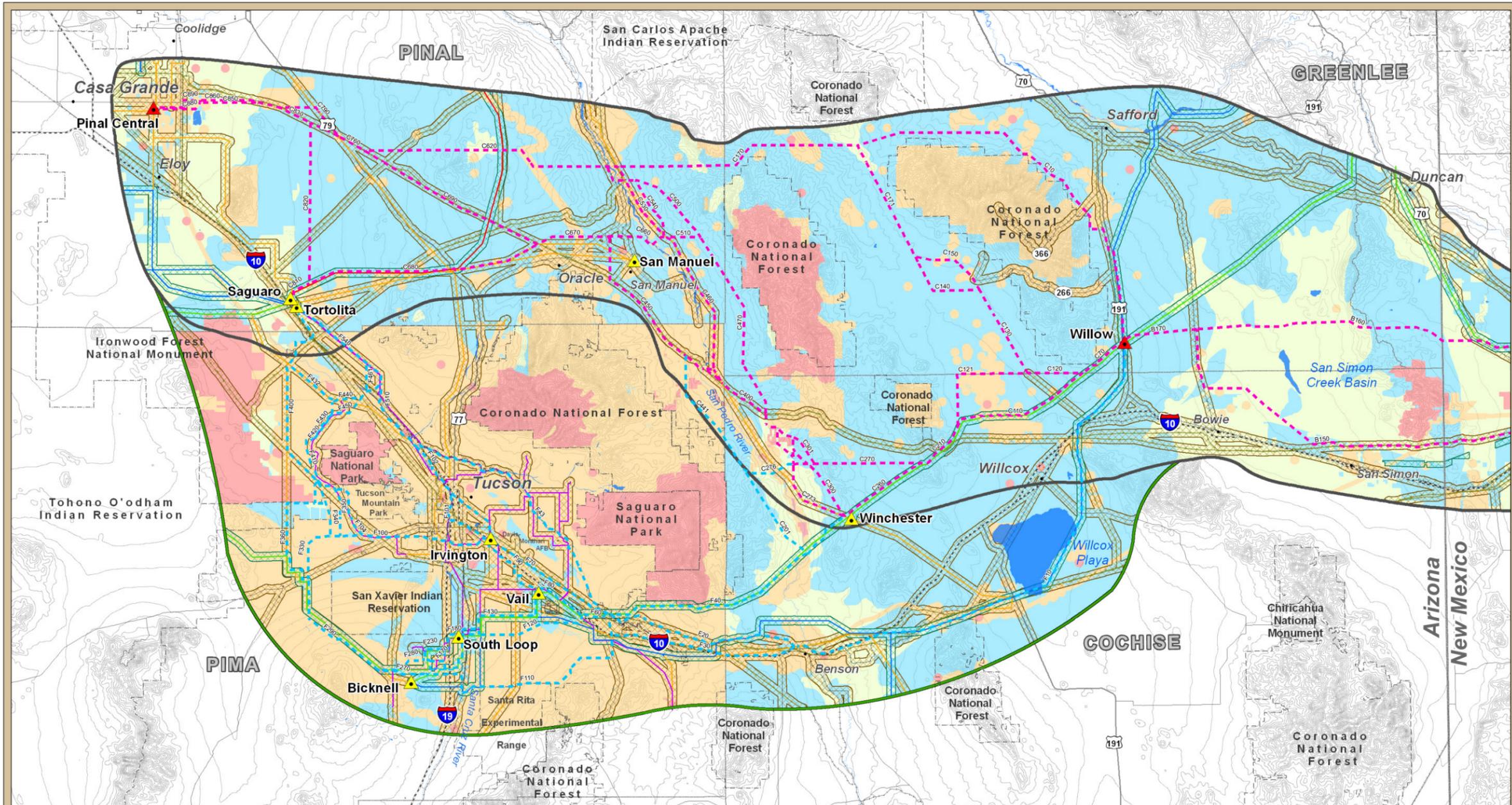
Base Features		Reference Features	
Proposed Substation	500kV Transmission Line	City	State Highway
Existing Substation	345kV Transmission Line	River/Stream	U.S. Highway
Pipeline (Diameter 6"*)	230kV Transmission Line	Lake/Reservoir	Interstate
	138kV/161kV Transmission Line	Urban Area	Railroad
	115kV Transmission Line	County Boundary	State Boundary
		Jurisdictional Boundary	Wilderness Area
		Wilderness Study Area (WSA)	BLM Field Office Boundary

Sources:

AZ BLM 2009
 AZ State Land Department and ALRIS 2008
 ESRI StreetMap 2008, Mimbres RMP 1999
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Contour Interval 200 feet
 August 3, 2010

Figure A-7. AZ: Land Ownership and Jurisdiction



SunZia Southwest Transmission Project

Composite Opportunities and Constraints

LEGEND

Opportunity Areas	Constraint Areas
Opportunity Level	Constraint Level
High (Blue hatched)	Exclusion (Red)
Moderate (Orange hatched)	High (Orange)
	Moderate (Light Blue)
	Low (Light Green)

Base Features	Utilities	Reference Features
<ul style="list-style-type: none"> Proposed and Alternative Routes Alternative Routes Subject to Feasibility Study Study Area - October 2009 Study Area - April 2010 	<ul style="list-style-type: none"> Proposed Substation Existing Substation Pipeline (Diameter 6"+) 500kV Transmission Line 345kV Transmission Line 230kV Transmission Line 138kV/161kV Transmission Line 115kV Transmission Line 	<ul style="list-style-type: none"> City River/Stream Lake/Reservoir Urban Area State Highway U.S. Highway Interstate Railroad County Boundary State Boundary Jurisdictional Boundary

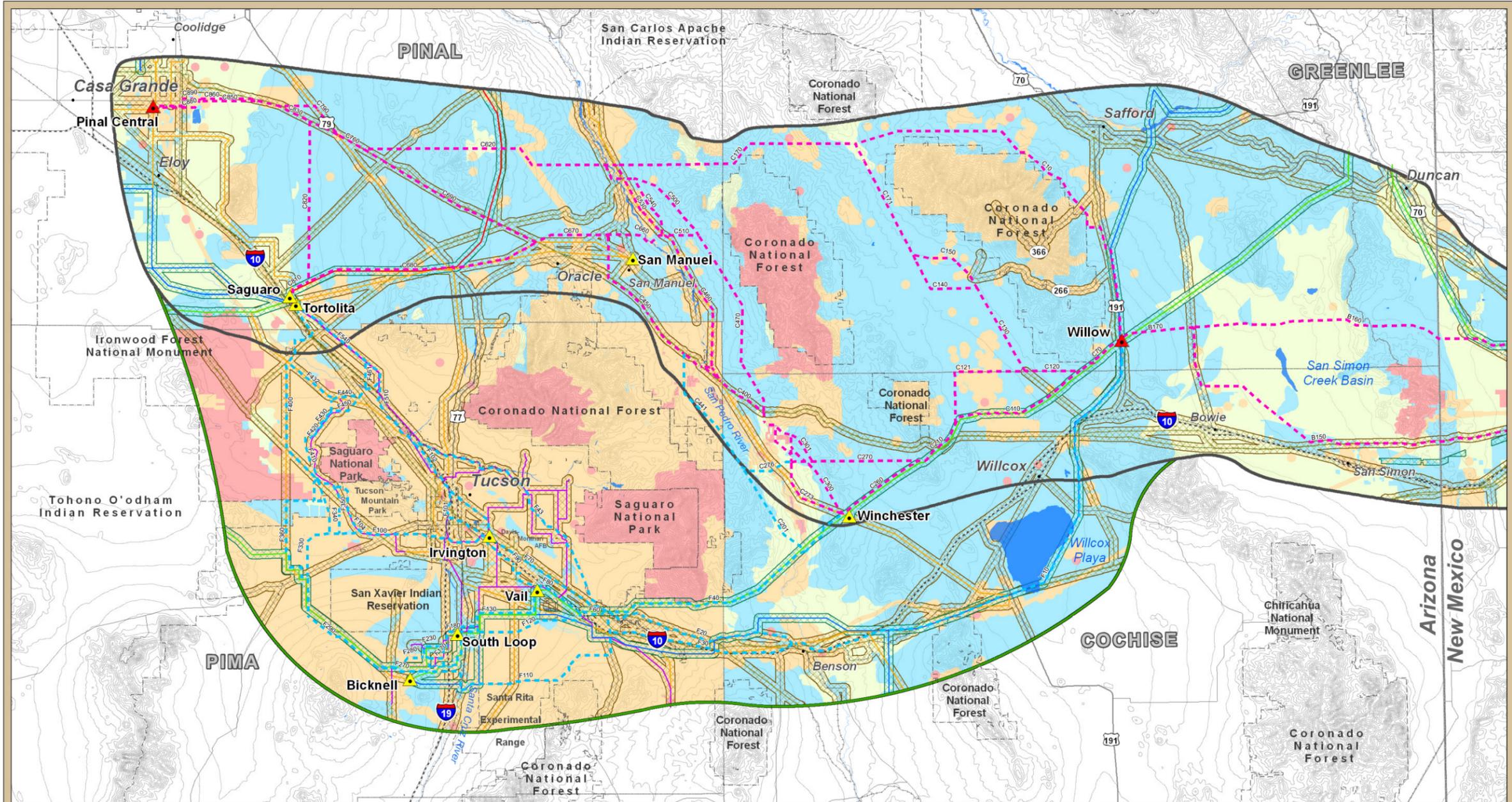
Sources:

AZ BLM 2009
 AZ State Land Department and ALRIS 2008
 ESRI StreetMap 2008, Mimbres RMP 1999
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Contour Interval 200 feet

April 28, 2010

Figure A-8. AZ: Composite Opportunities and Constraints



SunZia Southwest Transmission Project

Composite Opportunities and Constraints

LEGEND

Opportunity Areas	Constraint Areas
Opportunity Level	Constraint Level
High (Blue hatched)	Exclusion (Red)
Moderate (Yellow hatched)	High (Orange)
	Moderate (Light Blue)
	Low (Light Green)

Base Features	Utilities	Reference Features
<ul style="list-style-type: none"> Proposed and Alternative Routes Alternative Routes Subject to Feasibility Study Study Area - October 2009 Study Area - April 2010 	<ul style="list-style-type: none"> Proposed Substation Existing Substation Pipeline (Diameter 6"+) 500kV Transmission Line 345kV Transmission Line 230kV Transmission Line 138kV/161kV Transmission Line 115kV Transmission Line 	<ul style="list-style-type: none"> City River/Stream Lake/Reservoir Urban Area State Highway U.S. Highway Interstate Railroad County Boundary State Boundary Jurisdictional Boundary

Sources:

AZ BLM 2009
 AZ State Land Department and ALRIS 2008
 ESRI StreetMap 2008, Mimbres RMP 1999
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Contour Interval 200 feet

April 28, 2010

Figure A-9. AZ: Land Use Opportunities and Constraints

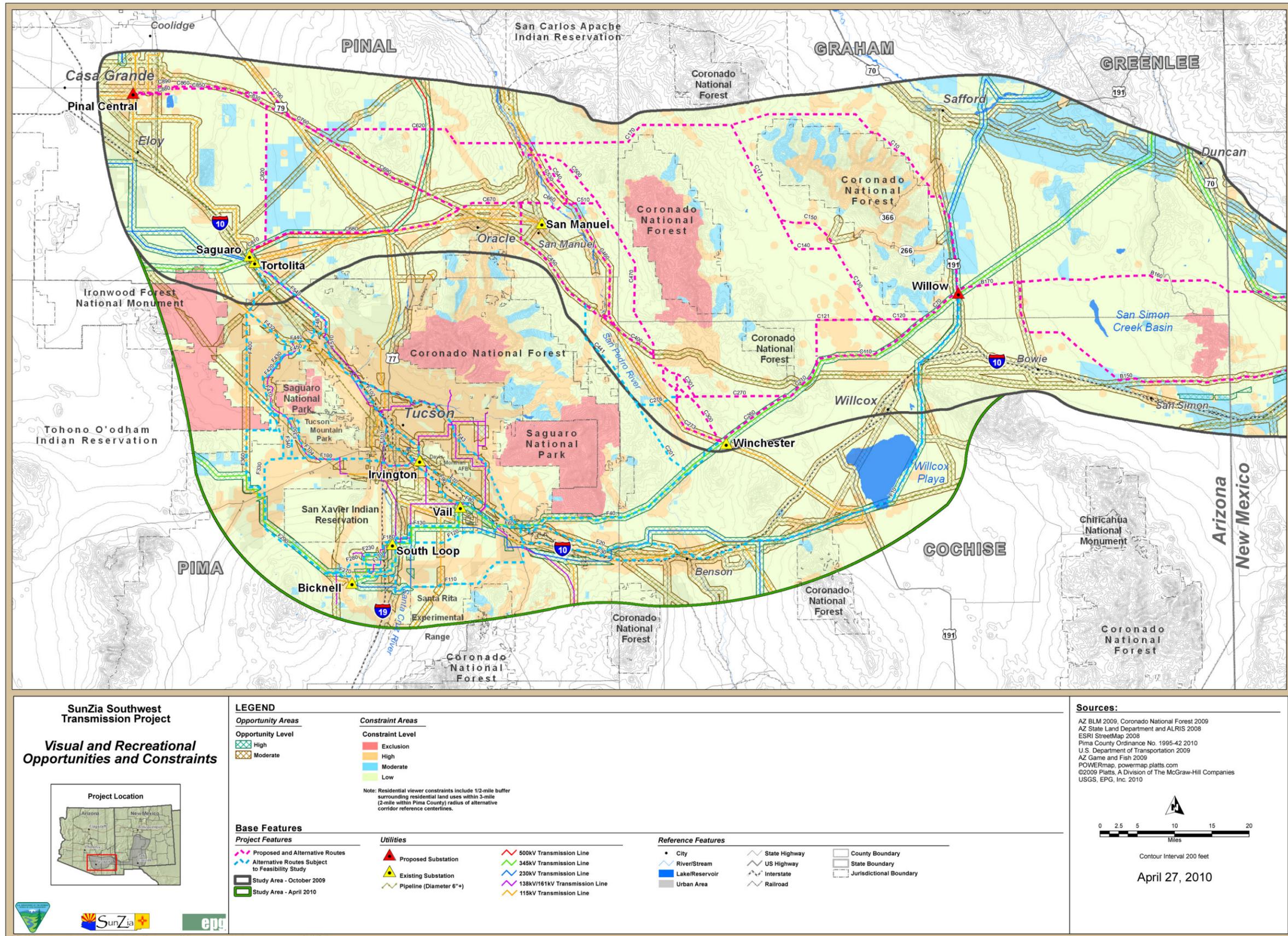


Figure A-10. AZ: Visual and Recreation Opportunities and Constraints

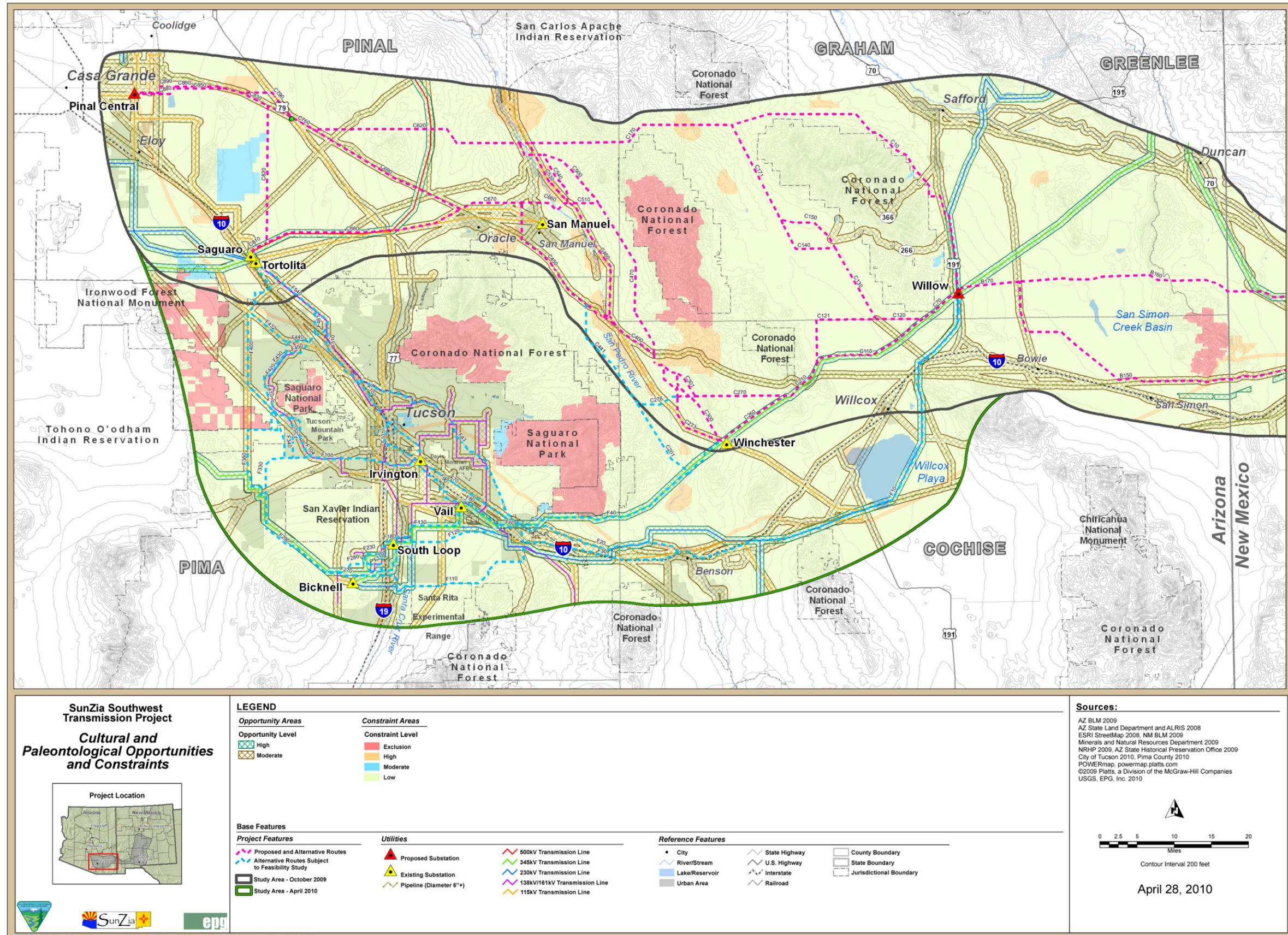


Figure A-11. AZ: Cultural Resource Opportunities and Constraints

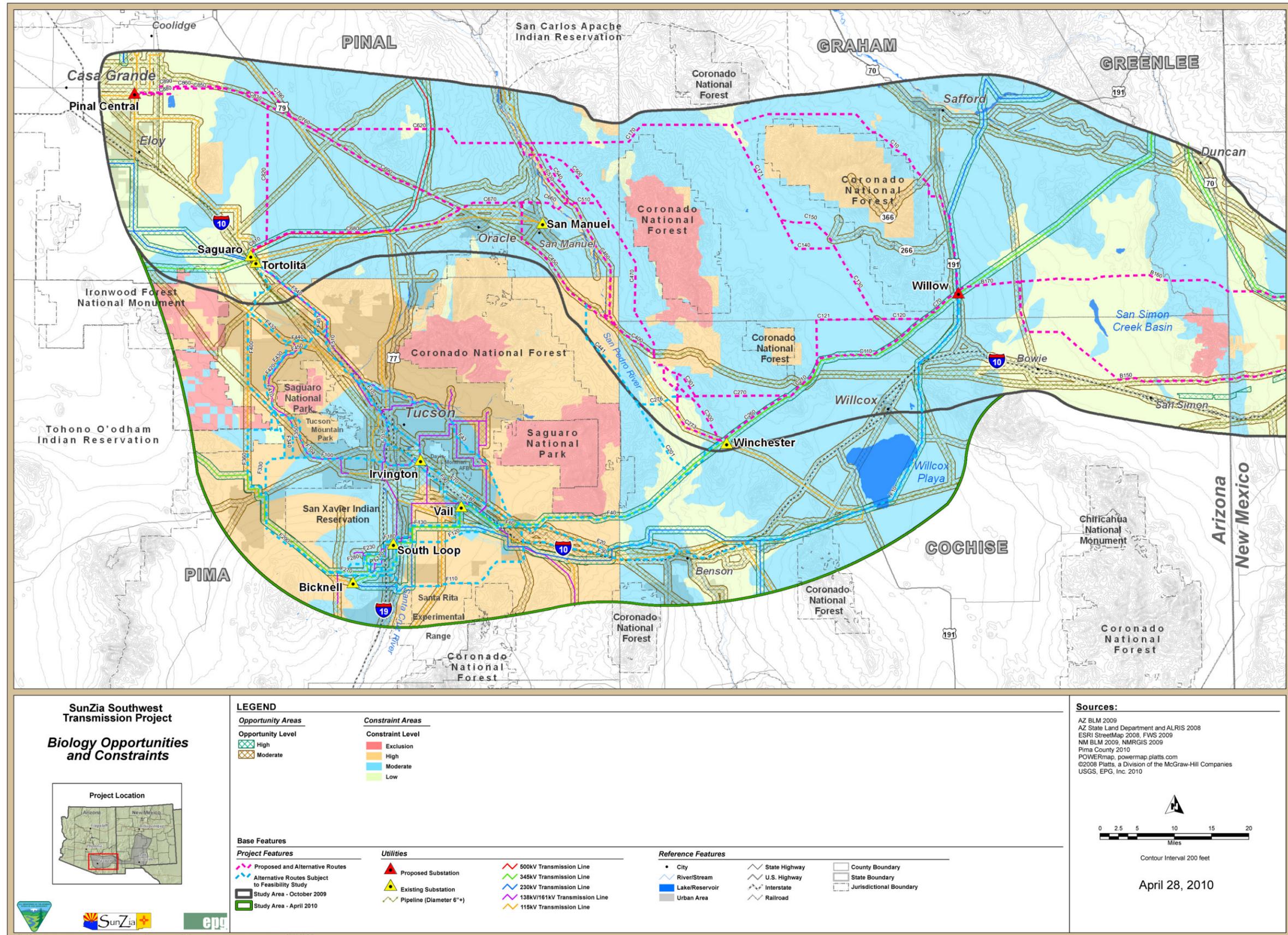


Figure A-12. AZ: Biological Opportunities and Constraints