APPENDIX I – ANALYSIS OF ACCESS CONDITIONS AND POTENTIAL GROUND DISTURBANCE

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SUNZIA SOUTHWEST TRANSMISSION PROJECT

ANALYSIS OF ACCESS CONDITIONS AND POTENTIAL GROUND DISTURBANCE

Prepared by
Environmental Planning Group, LLC

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1. INTRODUCTION

Access roads account for a substantial portion of the ground disturbance and potential resource impacts associated with the construction and maintenance of a transmission line project, and are therefore an important component in estimating the ground disturbance that could potentially result from the construction and operation of the SunZia Southwest Transmission Project (Project).

To estimate the potential ground disturbance related to the construction of new roads or improvements to existing roads, a GIS-based application was developed for the Project. The application, or model, predicts the amount of surface disturbance based on topographic features and existing road conditions. This application was used to identify and quantify predicted surface disturbances due to access for all alternatives analyzed in the environmental impact statement (EIS).

If the BLM issues a right-of-way grant, construction plans would be completed for the final transmission line route in conjunction with engineering, geotechnical investigations, and site-specific biological and cultural resource surveys. The Final Plan of Development would then be prepared based on construction plans, results of the detailed surveys, and mitigation plans. The final plans for construction and use of access roads would address best management practices, regulations and guidelines of land management agencies, and BLM guidelines such as those contained in the Gold Book.[1]

1.1 Typical Access Road Characteristics

Where new roads would be required to meet the access needs of the Project, it is anticipated that a single new road would be constructed to serve both of the proposed 500-kilovolt (kV) transmission lines (Figure I-1); however, in locations of steep or rugged terrain, two separate access roads may be required to accommodate construction of the two parallel transmission lines. The new roads may be built to provide either temporary or permanent access. Temporary roads serve the need for Project access during the construction phase, and are not anticipated to be necessary for maintenance, operation, or decommissioning purposes (e.g., access to temporary work areas, wire pulling and tensioning sites, concrete batch plants, etc.),. Upon completion of construction activities, temporary access roads would be reclaimed according to the procedures specified in the final Plan of Development (POD). Where new roads would be required for maintenance and operation purposes, or where landowners or land-management agencies may request, access roads would be constructed for permanent use.

A single “main” roadway would typically be used for construction access, and would likely be used as the permanent maintenance road. The main road is generally parallel to and within the right-of-way, although portions of the road may be located outside the right-of-way due to terrain conditions, to avoid environmentally sensitive features, or because there is an existing road located within a distance from the tower sites that provides a practical means of access. Spur roads between the main roadway and individual structure pads would be used to provide access for equipment and vehicles. All access roads (new, improved, or spur), temporary or permanent,

[1] United States Department of the Interior and United States Department of Agriculture. 2007. *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development.* (The Gold Book) BLM/WO/ST-06/021+3071/REV 07. Bureau of Land Management. Denver, Colorado.

would be constructed with a typical travel-surface width of 20 feet, with 2-foot berms and/or drainage ditches on either side of the travel surface, for a total roadway width of 24 feet. In steep terrain, total disturbance would likely exceed 24 feet, due to cut and fill conditions (Figure I-2). Helicopters may be used for construction (structure placement) in areas where there are environmental constraints, terrain restrictions, or where it is economically practical.

2. ACCESS APPLICATION METHODOLOGY

Access conditions vary across the Project study area. To estimate the potential ground disturbance that could result from the construction of access roads, a geographic information system (GIS) application was developed to classify different conditions that are found throughout the Project area, and to quantify the amount of ground disturbance likely to result from construction access for the Project.

Existing access conditions were used in conjunction with typical access road characteristics to estimate the potential ground disturbance along Project alternative centerlines. The model is based on the following two conditions:

(1) identification and assessment of existing road conditions within 700 feet of each Project alternative route centerline (of a typical 400-foot-wide right-of-way)

(2) measurement of slope (degree or percent of ground surface inclination), averaged for each 0.1 mile along each of the Project alternative route centerlines

2.1 Identification and Assessment of Access Conditions

The typical transmission line tower span would be 1,200 to 1,600 feet; based on the use of either a guyed-V structure or the self-supporting lattice (SSL) structure. (The spans for both AC and DC structures would be similar.) In order to limit the amount of new road construction for the Project, existing roads within 700 feet of Project alternative centerlines are proposed to be used for access to the Project right-of-way and Project facilities, where practicable. Where existing roads could be used for construction and operation purposes, only spur roads to Project or structure work areas may be needed. Beyond 700 feet from a Project alternative centerline, constructing a new road from structure-to-structure would typically result in less ground disturbance than building spur roads from existing roads to each Project or structure work area. The number of new spur roads would be held to a minimum, consistent with their intended use (e.g., structure construction or conductor stringing and tensioning). Some existing roads could require upgrading to meet BLM standards and Best Management Practices for road construction. All existing roads would be left in a condition equal to or better than their condition prior to construction, in accordance with BLM, state, and/or local road standards or private landowner agreements.

Transportation of materials and equipment from storage yards to areas where they would be needed along the transmission line right-of-way would require roads that could bear the weight and use of heavy construction vehicles. Existing paved and unpaved access roads were identified using high resolution aerial photography. Photogrammetry techniques were then used to assess the conditions of existing potential access roads (e.g., width and general conditions). The existing roads were digitized within 700 feet of the Project alternative centerlines using GIS. Access road conditions were categorized into three access levels, presented below.

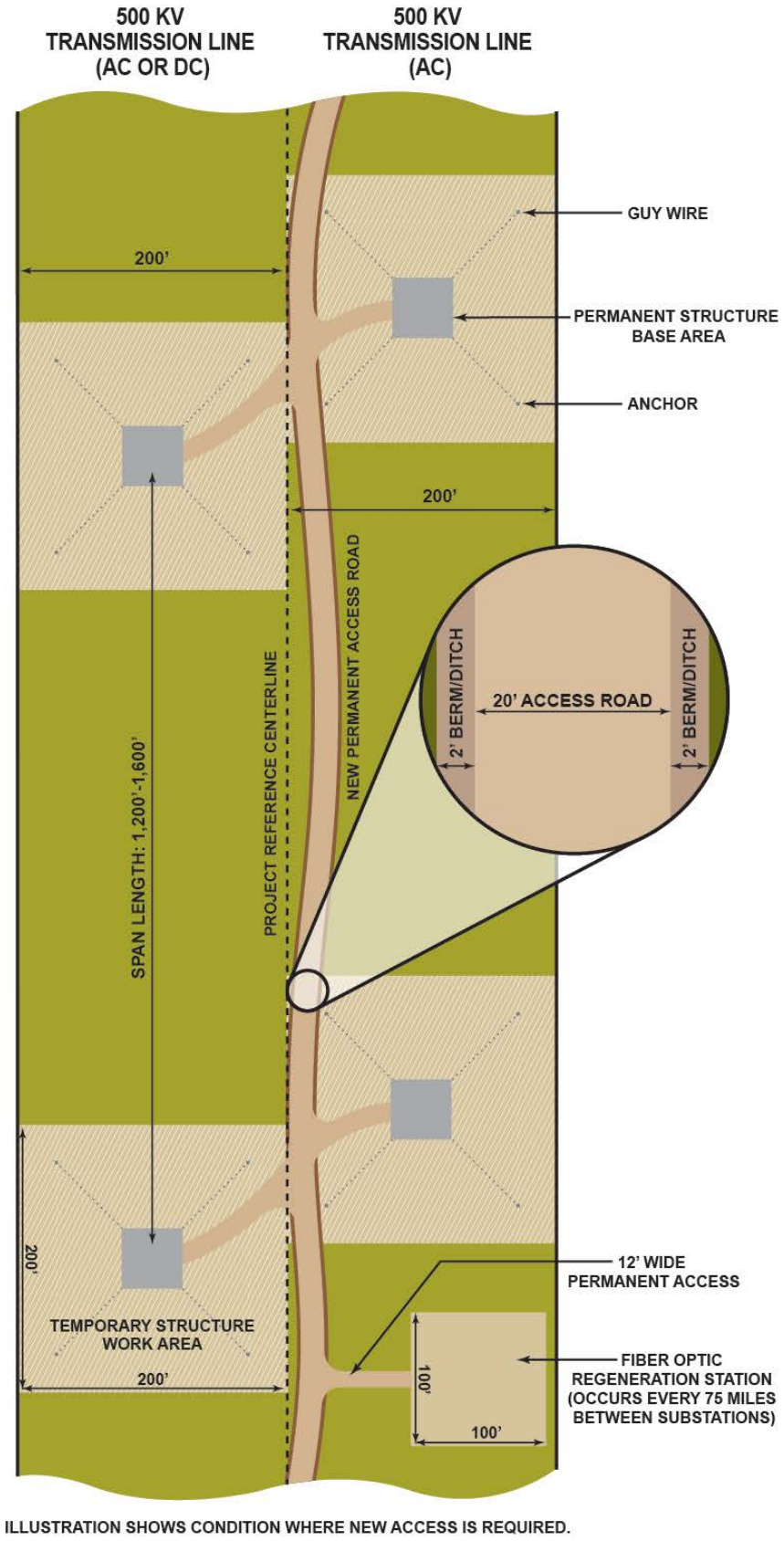


Figure I-1. Typical Right-of-Way Configuration

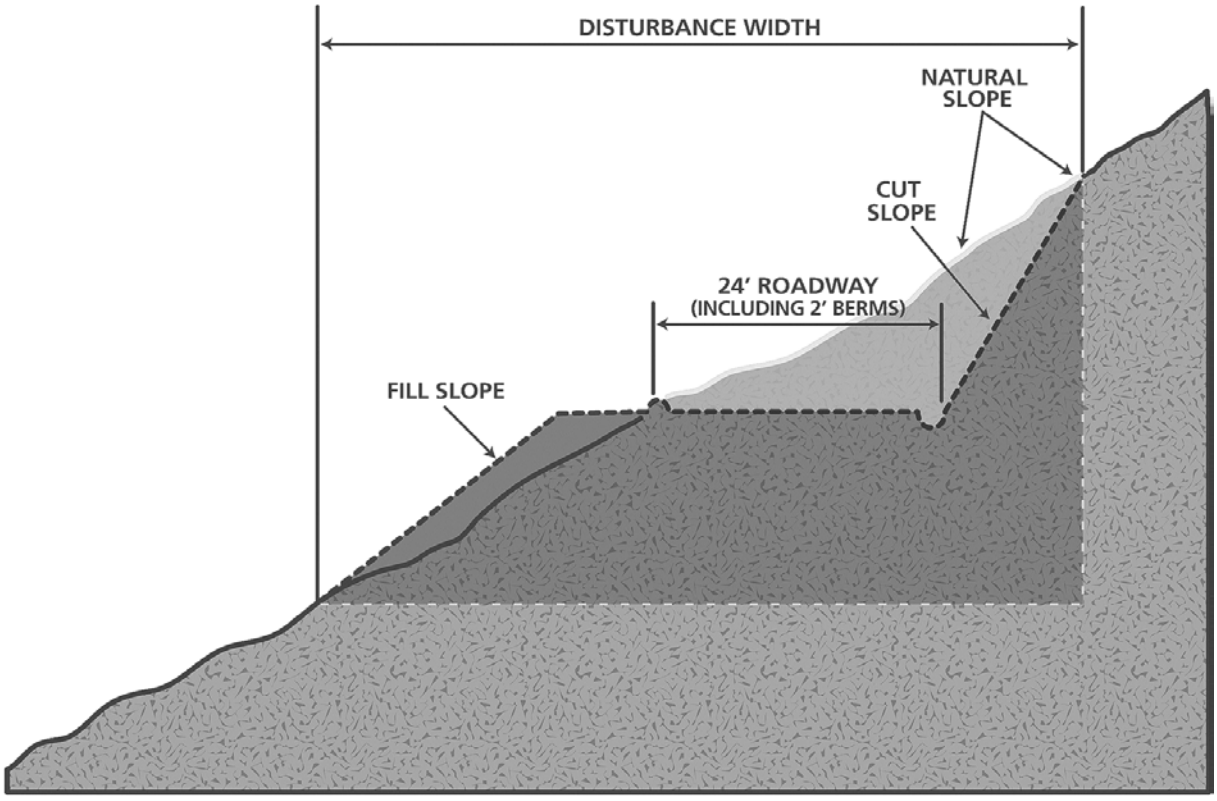


Figure I-2. Typical Roadway Cut and Fill Conditions

2.1.1 Access Road Condition Level 1

Existing roads were designated as Level 1 based on three criteria associated with these roads:

(1) where an existing road suitable for construction activities is within 700 feet of a Project alternative route centerline, and where Project alternatives would be parallel to that existing road for a minimum of 700 feet, or

(2) where an existing road suitable for construction activities crosses the proposed Project right-of-way, and

(3) where an existing road (paved or unpaved) is at least 20 feet wide

2.1.2 Access Road Condition Level 2

Existing roads requiring improvements were designated as Level 2, based on the same criteria as described for Level 1, but where an existing road was less than 20 feet wide. For ground disturbance calculations, it is estimated that Level 2 access roads would be widened an additional 10 feet to be suitable for construction activities.

2.1.3 Access Road Condition Level 3

Where Project alternative route centerlines are greater than 700 feet from existing roads, new access roads would be constructed; this condition is designated as Level 3. In addition, new

roads would be needed in locations where existing roads cross the proposed Project right-of-way but no other road crosses the proposed Project right-of-way within 0.5 mile.

2.2 Assessment of Slope Conditions

Slope conditions throughout the Project study area were identified using GIS software, which interpolated slope conditions using a 30-meter digital elevation model. Slopes were averaged for 360 square meter areas. These areas were then grouped into the following four slope categories: (1) 0-8%, (2) 8-15%, (3) 15-35%, and (4) greater than 35%.

2.3 Access Levels

Access levels have been organized numerically, beginning with the access level of least disturbance.

For the EIS, three access levels (see Section 2.1) were identified with respect to each of the alternative routes and combined with slope classifications, to provide an estimate of the ground disturbance that could result from using existing access roads, upgrading existing roads, or constructing new roads. For all access levels, as the inclination of *slope* increases, the ratio of *miles of access roads to miles of transmission line* increases. Estimates of the ground disturbance ratio for each of the access levels are listed in Table I-1. The ground disturbance ratios for access level categories are based on typical road construction practices; for example, due to the amount of cut and fill required to build a road surface, 1.6 acres would be disturbed for each mile of existing roads in flat terrain (Level 1, 0 to 8%); whereas up to 4.6 acres would be disturbed for each mile of existing road that requires improvement within steep terrain (Level 2, greater than 35%; see Figure I-2).

Table I-1. Access Levels and Associated Potential Ground Disturbance

Access Level	Access Road Condition	Area of Potential Ground Disturbance			
		Slope (percent)	Access Road Miles per Mile of Transmission Line	Spur Road Length1 (feet)	Ground Disturbance Ratio (acres per mile)
1	Minimal road improvements required, 24-foot spur road used for width of disturbance	0 – 8	1.1	770	1.6
		8 – 15	1.5	1,050	2.2
		15 – 35	1.8	1,260	2.6
		35+	2.3	1,610	3.4
2	Road improvements required with 10-foot width used for ground disturbance with 24-foot spur road width of disturbance	0 – 8	1.1	770	2.8
		8 – 15	1.5	1,050	3.4
		15 – 35	1.8	1,260	3.8
		35+	2.3	1,610	4.6
3	Construct new access road with 24-foot width total disturbance	0 – 8	1.1	(1)	3.2
		8 – 15	1.5	(1)	4.4
		15 – 35	1.8	(1)	5.2
		35+	2.3	(1)	6.7

[1] Spur roads are included within temporary structure work areas

Note: In areas of steep terrain, total disturbance would likely exceed 24 feet in width due to cut and fill conditions; however, the roadway width would not exceed 24 feet.

2.4 Access Level Summary

A summary of the access levels are provided below and on Figure I-3.

2.4.1 Access Level 1 Summary – Use Existing Roads

Existing roads can be used if they:

(1) are within 700 feet of the identified project centerline

(2) are paved or graded gravel roads that are at least 20 feet wide

(3) have appropriate drainage (per local requirements)

(4) are approved by the landowner, or land management agency, for use by the applicable right-of-way holder

Typically, spur road construction would be required to provide access between the existing (main) road and tower work pads.

2.4.2 Access Level 2 Summary – Improve Existing Roads

Existing roads would be improved if they:

(1) are not paved or graded

(2) are too narrow (less than 20 feet wide, do not have proper drainage, etc.).

(3) assume 10 feet of roadway width improvement to accommodate construction vehicles and traffic.

(4) require spur road construction, up to 24 feet wide

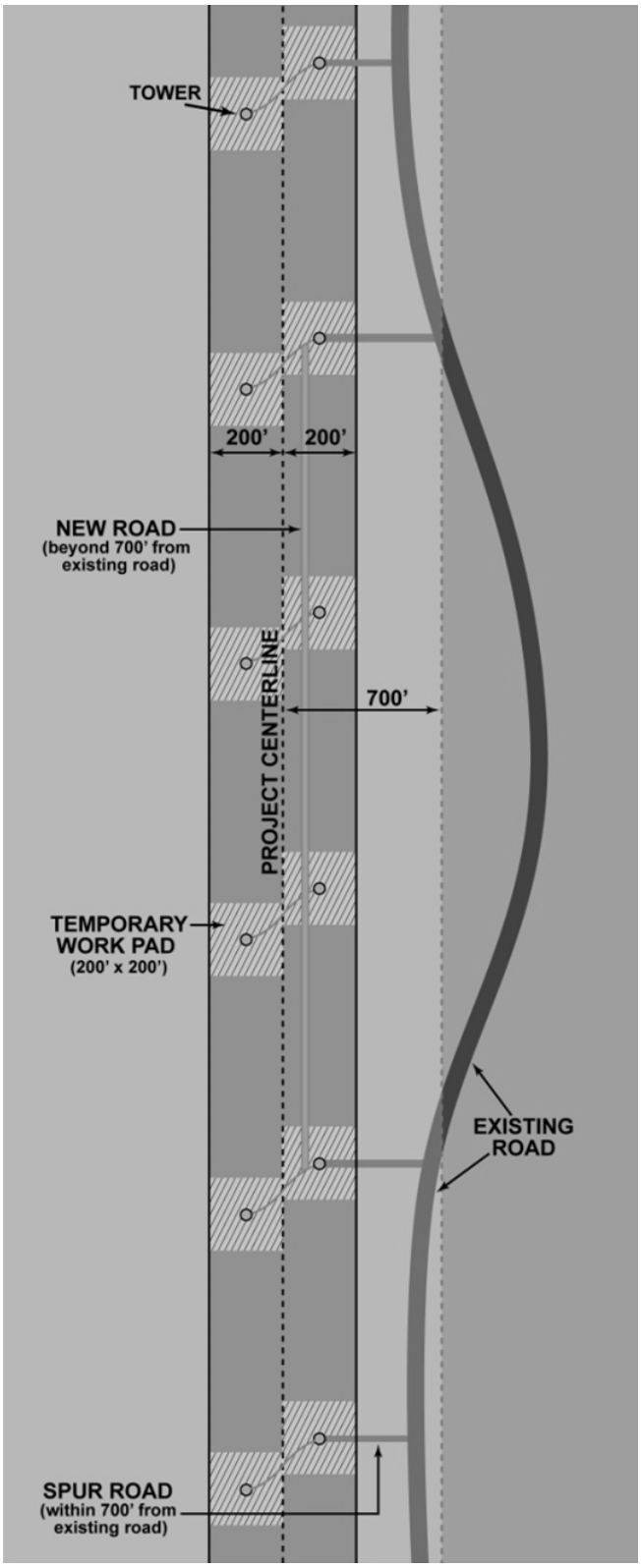


Figure I-3. Example Access Conditions

2.4.3 Access Level 3 Summary – New Access Roads

New access roads would be required for portions of the Project centerline beyond 700 feet of existing access, or where existing roads cross the proposed Project right-of-way but do not have another road cross the proposed Project right-of-way within 0.5 mile.

Spur roads would be built as needed to access Project facilities.

New roads built for the Project would typically be located so that one new road would serve both 500 kV facilities.

3. ACCESS CONDITIONS AND GROUND DISTURBANCE ANALYSIS

3.1.1 Access Conditions

The results of the access conditions analysis are displayed on the maps provided as attachments to this appendix (Access Conditions - East Panel, West Panel), which illustrate the access conditions along all alternatives analyzed in the Final EIS. Access conditions are composed of existing access road locations and conditions, and slope characteristics. Access conditions were identified within a 1,400-foot-wide corridor along each of the Project alternatives, recorded and displayed at 0.1-mile intervals along each corridor centerline.

3.1.2 Potential Ground Disturbance

The results of the ground disturbance analysis are displayed on provided as attachments to this appendix (Potential Ground Disturbance - East Panel, West Panel). These maps indicate potential ground disturbance along each of the Project alternatives analyzed in the Final EIS. Potential ground disturbance was estimated based on access conditions, recorded and displayed at 0.1-mile intervals along each corridor centerline.

Estimated ground disturbance related to access is calculated as follows, where:

$L = Length\ of\ centerline\ segment$

$GD_r = Ground\ disturbance\ ratio\ of\ access\ condition\ (access\ level\ and\ slope\ category)$

$GD_t = Estimated\ total\ acres\ of\ ground\ disturbance$

$L \times GD_r = GD_t$

Example:

$1.5\ miles \times 1.6\ acres\ of\ ground\ disturbance\ per\ mile\ (access\ level\ 1\ with\ 0-8\%\ slope) =$
$2.4\ total\ estimated\ acres\ of\ ground\ disturbance\ for\ that\ 1.5\ mile\ segment$

When calculating ground disturbance for multiple centerline segments, each with different access levels, the estimated total acres of ground disturbance is the sum of all segments.

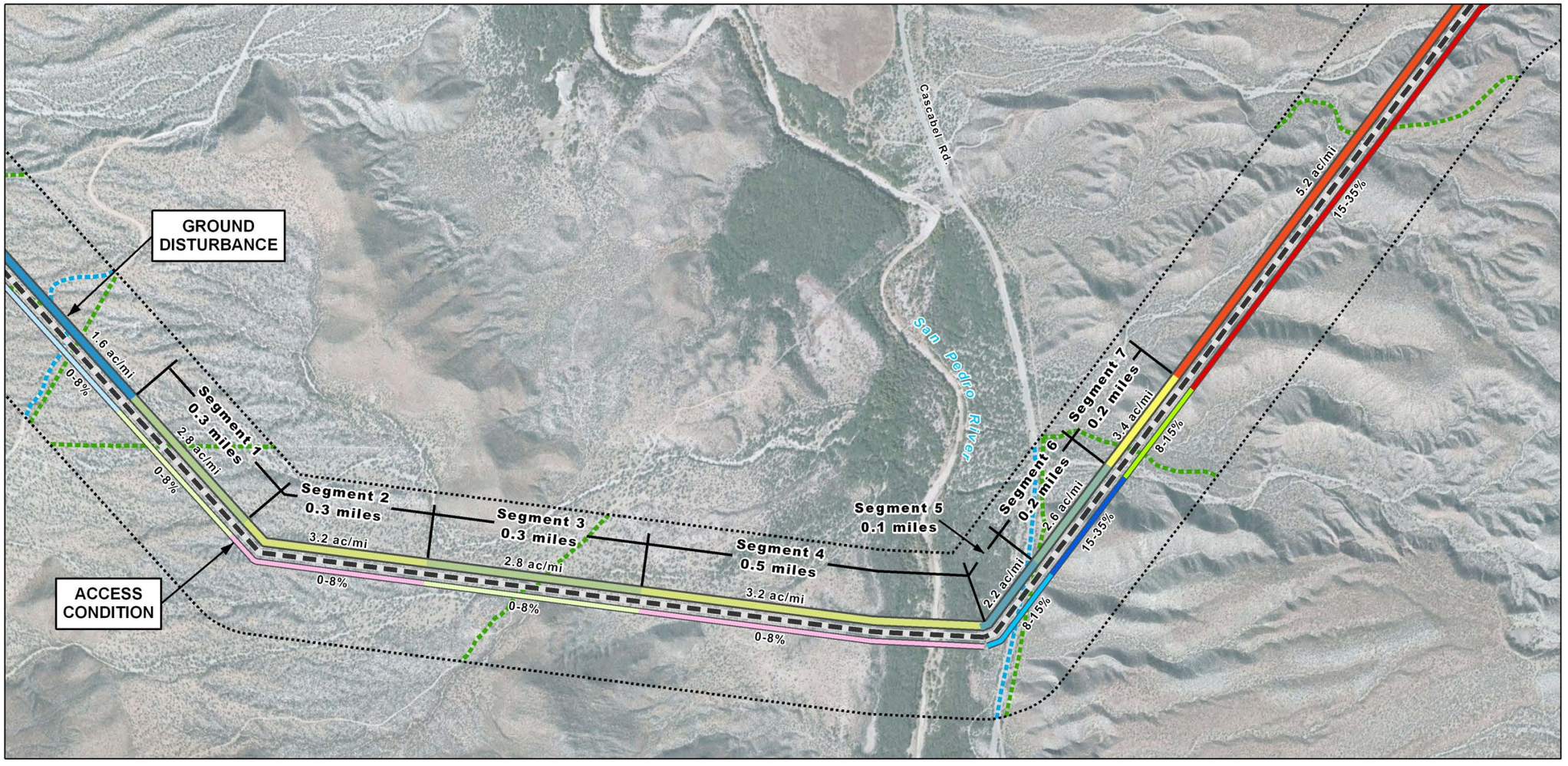
$(L \times GD_r)_{seg\ 1} + (L \times GD_r)_{seg\ 2} + (L \times GD_r)_{seg\ 3} \ldots + (L \times GD_r)_{seg\ x} = GD_t$

3.1.3 Example: Access Conditions and Ground Disturbance (San Pedro River Crossing)

For illustrative purposes, an example of the access conditions and estimated ground disturbance derived from the above access application methodology has been included below. Figure I-4 displays the results of the analysis for portions of Project links C201 and C261 for the BLM Preferred Alternative Subroute 4C2c.

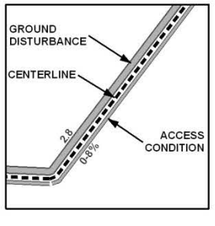
$$(.3\ mi \times 2.8\ ac\ per\ mi)_{seg\ 1} + (.3\ \times 3.2)_{seg\ 2} + (.3\ \times 2.8)_{seg\ 3} + (.5\ \times 3.2)_{seg\ 4} +$$
$$(.1\ \times 2.2)_{seg\ 5} + (.2\ \times 2.6)_{seg\ 6} + (.2\ \times 3.4)_{seg\ 7} =$$
$$5.66\ total\ estimated\ acres\ of\ ground\ disturbance\ for\ 1.4\ miles\ (segments\ 1-7)$$

The Final POD would include detailed design and engineering of the BLM Preferred Alternative as stipulated in the Record of Decision, from its eastern terminus at the proposed SunZia East Substation near Corona, New Mexico, to its western terminus at the Pinal Central Substation near Eloy, Arizona. Figures I-5 through I-7 illustrate typical design characteristics (e.g., structure and access road siting, sensitive environmental features, geographic and spatial limits of selective mitigation measures, etc.) that would be included in the Final POD.



Access Condition and Potential Ground Disturbance - *Example: San Pedro River Crossing*

Inventory Key



Existing Roads

- Existing Road - Minimal Improvement Needed
- Existing Road - Improvement Needed
- Existing Road Inventory Corridor (1400 ft.)

Potential Ground Disturbance (acres/mile)
(Graphic Representation - Offset from Centerline)

1.6, 2.2, 2.6, 2.8, 3.2, 3.4, 3.8, 4.4, 4.6, 5.2, 6.7

Access Condition
(Graphic Representation - Offset from Centerline)

Existing Road - Minimal Improvement Needed
- Slope 0-8%
- Slope 8-15%
- Slope 15-35%
- Slope 35+%

Existing Road - Improvement Needed
- Slope 0-8%
- Slope 8-15%
- Slope 15-35%
- Slope 35+%

No Existing Road
- Slope 0-8%
- Slope 8-15%
- Slope 15-35%
- Slope 35+%

Access Levels and Associated Potential Ground Disturbance

Access Level	Access Road Condition	Area of Potential Ground Disturbance: Slope (percent)	Access Road Miles per Mile of Transmission Line	Spur Road Length[1] (feet)	Ground Disturbance Ratio (acres per mile)
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		15 – 35	1.8	(1)	5.2
		35+	2.3	(1)	6.7

[1] Spur roads are included within temporary structure work areas

S:\EPG\G\Geospatial\Projects\SunZia\SunZiaSWMXDs\PHX_GIS_02\FEIS\mxds\Disturbance_Access_SanPedro_2013FEB.mxd

Figure I-4. Access Conditions and Ground Disturbance–San Pedro River Crossing

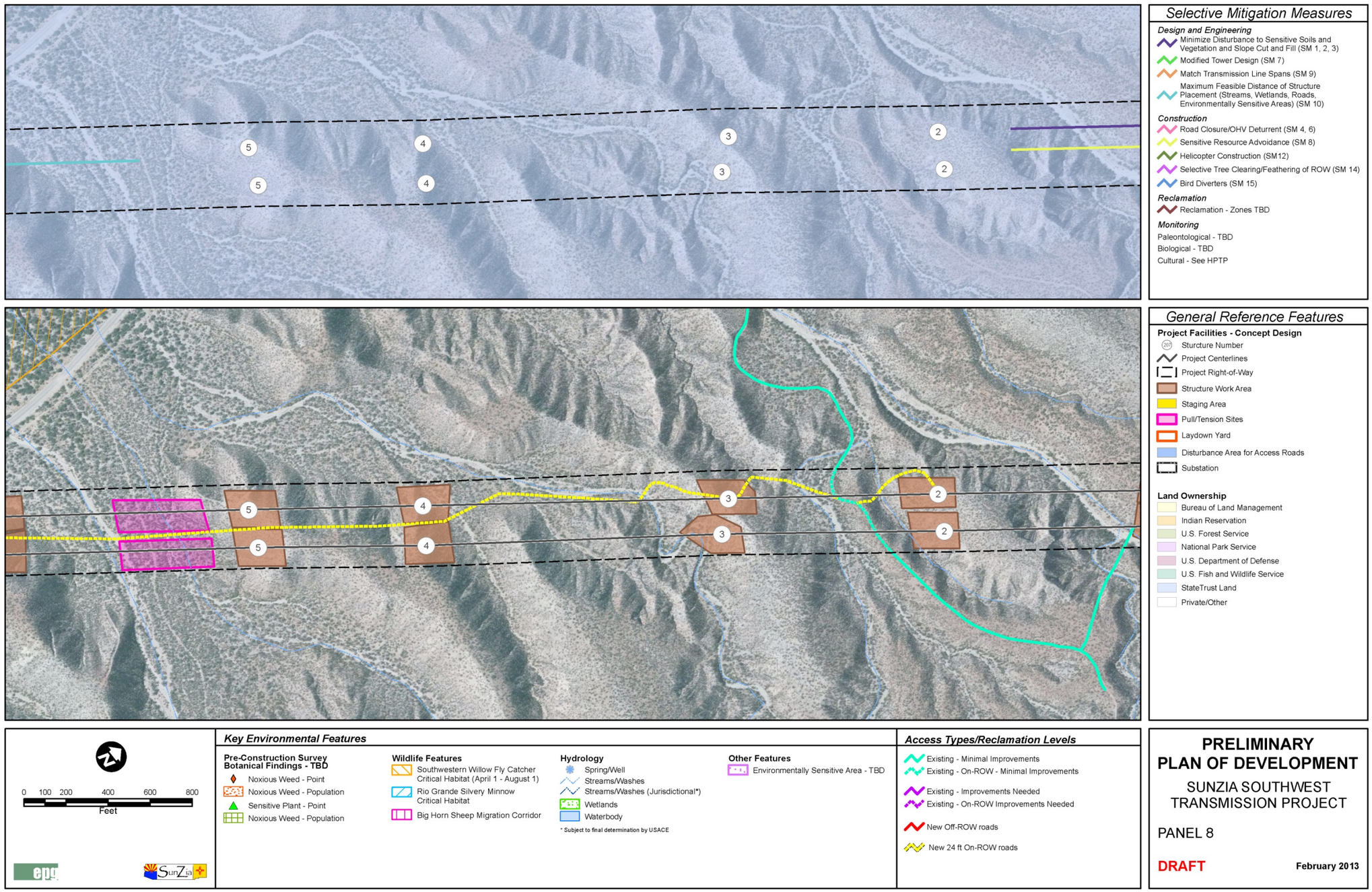

Figure I-5. Example Plan of Development for San Pedro River Crossing

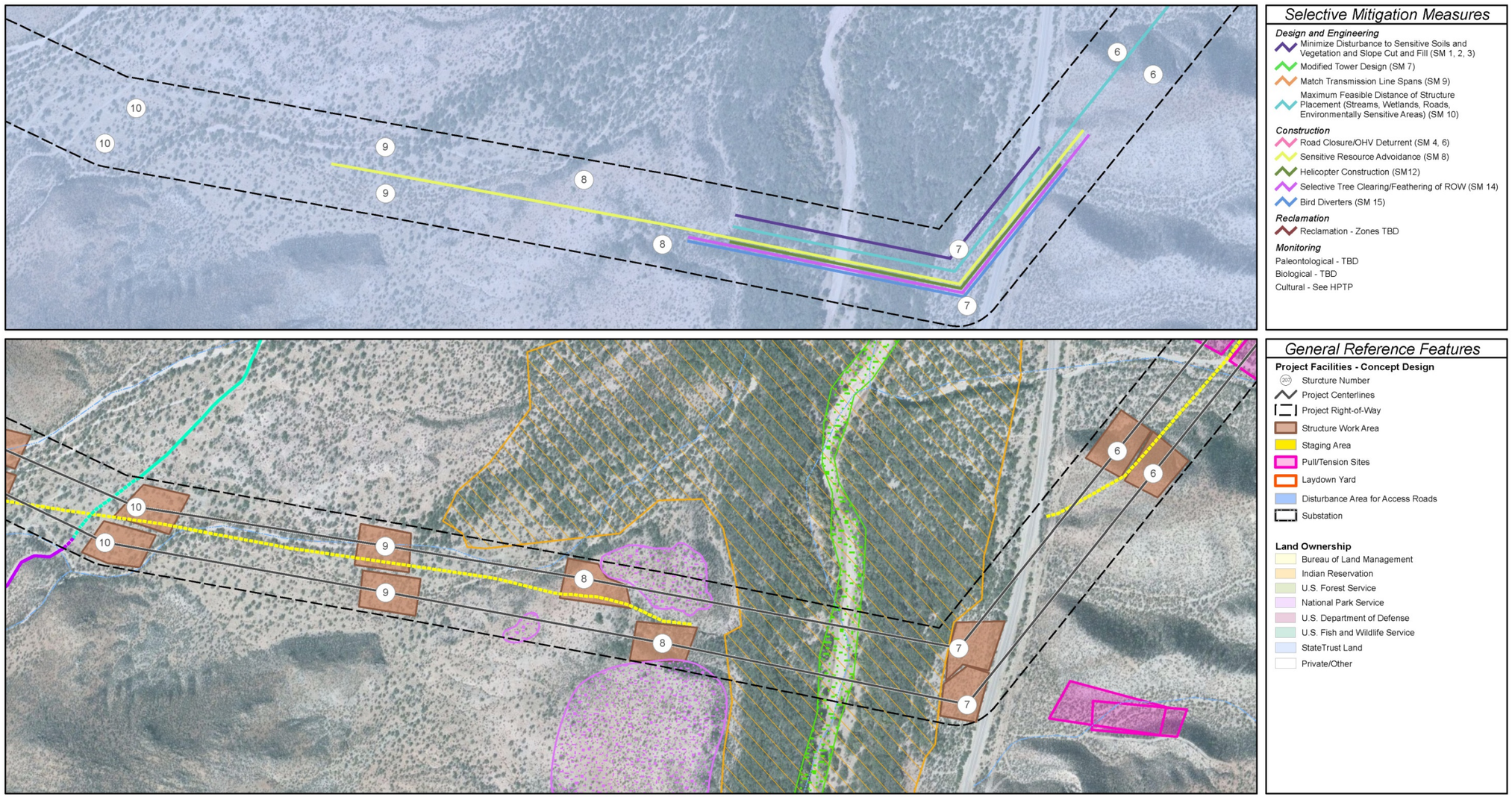

Figure I-6. Example Plan of Development for San Pedro River Crossing

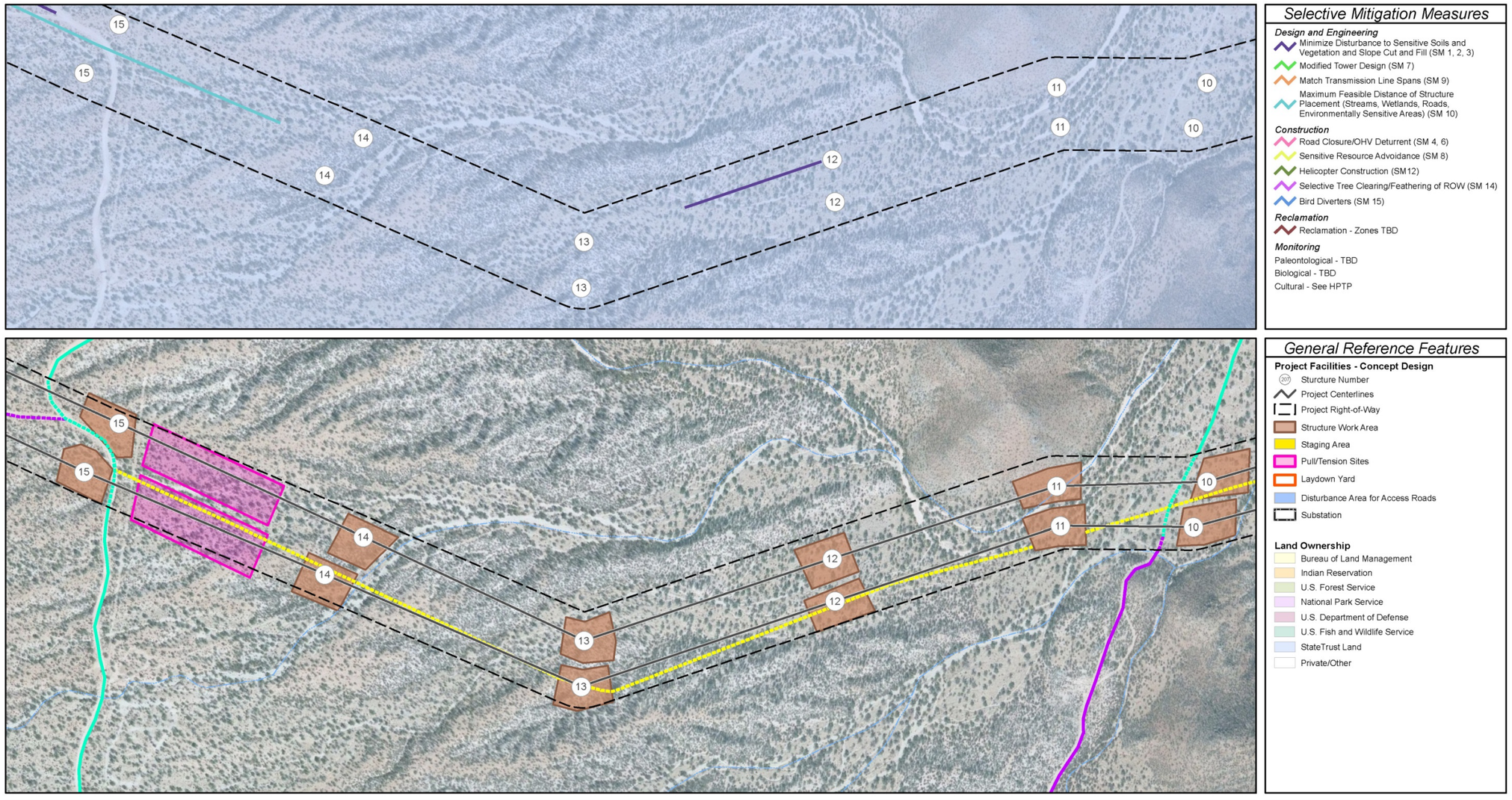

Figure I-7. Example Plan of Development for San Pedro River Crossing