FHWA-AZ-EIS-19-01-D

Draft Tier 1 Environmental Impact Statement and Preliminary Section 4(f) Evaluation

Appendix E12, Geology, Soils, and Prime and Unique Farmlands Technical Memorandum

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Acronyms

ADWR	Arizona Department of Water Resources
amsl	Above Mean Sea Level
AZGS	Arizona Geological Survey
CAP	Central Arizona Project
g	Standard Gravity
NRCS	Natural Resources Conservation Service
Study Area	I-11 Corridor Study Area
USGS	United States Geological Survey
WSS	Web Soil Survey

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E12 Affected Environment

E12.1 Geology

E12.1.1 Study Area Overview and Methodology

Local Geology

Numerous mountains exist within and along the boundaries of the Interstate 11 Corridor Study Area (Study Area). Topography associated with these mountains varies widely and ranges from gently sloping or rolling along the valley edges to extremely steep progressing inward toward the peaks. Elevations associated with the mountains also vary widely. In the higher-elevation in the southern portions of the Study Area (Nogales, Sahaurita, Tucson, and Oro Valley) and northern portions of the Study Area (Wickenburg), elevations generally range from about 3,000 feet above mean sea level (amsl) to 5,500 feet amsl, with some surrounding mountains higher than 6,000 to 9,000 feet amsl. In the central portions of the Study Area (Marana, Eloy, Casa Grande, Gila Bend, Goodyear, and Buckeye), elevations generally range from about 1,000 feet to 3,500 feet amsl, with some mountains somewhat higher than about 4,000 to 4,500 feet amsl. Intervening valley portions of the Study Area range from about 1,000 feet to 3,000 feet amsl in the higher-elevation southern and northern areas and from about 800 feet to 2,000 feet amsl in the lower-elevation central areas (United States Geological Survey [USGS] 2017, 1977, 1969a,b,c, 1962).

Geologic units within the Study Area consist of Quaternary-age (0 to 1.8 million years before present) alluvial deposits along broad alluvial valley floors (Arizona Geological Survey [AZGS] 2000). These deposits include Holocene-age (0 to 11,000 years before present) river alluvium; undivided (non-differentiated) Quaternary-age surficial alluvium and eolian (wind deposited) material; and surficial soils of Holocene-age to Pleistocene-age (11,000 to 1.8 million years before present). The soil deposits are comprised primarily of alluvial mixtures of gravel, sand, and silt in floodplains, river and stream terraces, and alluvial fans bordering the basins. The surficial alluvial soils generally become coarser grained with closer proximity to the bordering mountain ranges.

A total of 12 bedrock units comprise the surface geology of the mountains within and along the boundaries of the Study Area, and include granitic, volcanic, sedimentary, and metamorphic rock units (AZGS 2000). These units include: Holocene to Middle Pliocene (0 to 4 million years before present) basaltic lavas and cinders; Pliocene to Middle Miocene (2 to 16 million years before present) sedimentary rocks; Late to Middle Miocene (8 to 16 million years before present) basalt deposited as lava flows; Middle Miocene to Oligocene (11 to 38 million years before present) sedimentary, volcanic, and granitic rocks; Early Tertiary to Late Cretaceous (50 to 82 million years before present) and Jurassic (150 to 180 million years before present) granitic rocks; and Proterozoic (1,400 to 1,800 million years before present) granitic and metamorphic rocks. Depth to bedrock below surface alluvial deposits in the intervening valleys ranges from as little as about 400 feet near the mountains at the valley edges, to as much as 11,200 feet near the centers of valley basins (AZGS 2007). Shallower bedrock conditions, at depths of about 400 to 4,800 feet below the existing ground surface, are common near southern, central, and northern portions of the Study Area near Nogales, Gila Bend, and Wickenburg, respectively, where mountains comprise the dominant landforms.

Land Subsidence and Earth Fissures

Land subsidence and earth fissures are identified as geologic/geotechnical issues for the Study Area. Both of these geological/geotechnical processes pose a potential risk to the performance of engineered improvements. Specific hazards include: cracked or collapsing roads, flood control structures, dams and impoundments; broken pipes and utility lines; damaged or breached canals and channels; cracked foundations and separated walls; loss of agricultural land, livestock and wildlife injury or death; severed or damaged railroad track; damaged groundwater well casings and wellheads; disrupted drainage patterns; contaminated groundwater; sudden discharge of impounded water; and human injury or death (AZGS 2007).

Both of these geological/geotechnical processes pose a potential risk to the performance of engineered improvements, including roadways and bridges, water conveyance and retention facilities, and utilities. Active land subsidence areas occupy portions of the Study Area from near Sahuarita in the south extending to Buckeye in the north, and comprise large areas near Green Valley and Sahuarita, Tucson, Eloy, Casa Grande, Gila Bend, and Buckeye/Goodyear (Arizona Department of Water Resources [ADWR] 2017). Earth fissure Analysis Areas containing numerous earth fissures occupy portions of the Study Area from near Marana in the south, extending to Buckeye in the north, and comprise large areas near Marana, Picacho, Eloy, Casa Grande, Maricopa, and Buckeye/Goodyear (AZGS 2017).

Land subsidence in the southwestern and western United States has occurred as a result of long-term groundwater pumping/withdrawals and groundwater level declines. Associated with this land subsidence, earth fissures and potential earth fissure features have been identified in Arizona since the late 1980s. Earth fissures are tension cracks which form in deep alluvium-filled basins in response to the land subsidence. Earth fissures commonly parallel nearby mountain fronts or buried bedrock highs and often bisect surface drainage features. They can intercept surface flows and create vertical/near-vertical pathways to the subsurface groundwater table. High surface flow gradients contribute to erosive forces that move sediments along and downward into the fissure, and can create gully features ranging from slightly eroded fissures with occasional small potholes to gullies that are tens of feet wide and tens of feet deep.

Declines in groundwater table elevations in the Study Area could result in future land subsidence and related earth fissure development and could have effects on the design or performance of project elements. Hazards associated with earth fissures include damage to buildings, roads, flood control structures, dams, impoundments and embankments, canals and channels, and sewer, water and other utility lines. Specific hazards directly associated with earth fissures include: cracked or collapsing roads, flood control structures, dams and impoundments; broken pipes and utility lines; damaged or breached canals and channels; cracked foundations and separated walls; loss of agricultural land, livestock and wildlife injury or death; severed or damaged railroad track; damaged groundwater well casings and wellheads; disrupted drainage patterns; contaminated groundwater; sudden discharge of impounded water; and human injury or death (AZGS 2007).

Active Faults and Seismicity

Seismic hazard information for the Study Area was obtained from the on-line USGS Earthquake Hazards Program, Quaternary Faults and Folds Database (USGS 2015) and the National Seismic Hazard Maps, Simplified Hazard Maps (USGS 2014).

The USGS Quaternary Fault and Fold Database was searched to identify known faults located within, or in close proximity to, the Study Area. Based on this search, two faults were identified.

The Santa Rita Fault Zone extends along the east side of the Study Area from just north of Nogales to Sahuarita. The Sand Tank Fault exists a few miles south of the Study Area boundary near Gila Bend. Both faults/fault systems were indicated by the USGS as exhibiting evidence of deformation within the past 750,000 years, with slip rates of less than 0.2 millimeter/year (0.008 inch/year). No other faults with Quaternary-age deformation were identified within a 40-mile radius of the Study Area.

Probabilistic earthquake ground motion values of peak ground acceleration in bedrock expressed as a fraction of standard gravity (g) for 2- and 10-percent probabilities of exceedance in 50 years were obtained for the Study Area and surrounding regions using the USGS National Seismic Hazard Maps, Simplified Hazard Maps (USGS 2014). The mapped peak ground acceleration values are as follows: 10 percent probability of exceedance in 50 years, with a return period of 475 years, 0.02g to 0.05g; and, 2 percent probability of exceedance in 50 years, with a return period of 2,475 years, 0.06g to 0.14g. These peak ground acceleration values are for firm rock (rock with shear-wave velocity of 2,500 to 5,000 feet per second in the upper 100 feet of the underlying profile). These values would need to be evaluated and adjusted as appropriate based on the subsurface profile encountered during final geotechnical investigations for design of roadways, bridges, water conveyance and retention facilities, utilities, and other structures.

E12.1.2 South Section Geology

Local Geology (South Section)

Mountains dominating the South Section from Nogales (located at the south end of the South Section) to Tucson include the Patagonia, San Cayetano, Pajarito, Atascosa, Tumacocori, Santa Rita, Sierrita, Tucson, and Santa Catalina Mountains. From north of Tucson to Eloy the dominant mountains include the Tortolita, Picacho, Silver Bell, Sawtooth, and Silver Reef Mountains.

Topography along and adjacent nearby Corridor Options A, B, and G, trending along the eastern portions of the South Section and Option F extending from the west trending Option D, vary from gently sloping or rolling near Nogales to gently sloping to nearly flat north of Nogales along the Santa Cruz River valley, and continuing north along alluvial valley floors to near Casa Grande where elevations range from about 3,000 feet amsl near Nogales to about 1,600 feet amsl near Eloy. Corridor Options C and D trend toward the west near Sahuarita and traverse the Sierrita Mountains where topography is steeper, and elevations range from about 3,200 feet to 5,000 feet amsl until dropping back down to elevation of about 1,600 feet amsl near Eloy.

Geologic units along and adjacent nearby Corridor Options A, B, and G, trending along the eastern portions of South Section and Option F extending from the west trending Option D, consist almost exclusively of Quaternary alluvial deposits comprised primarily of mixtures of gravel, sand, and silt in floodplains, river and stream terraces, and alluvial fans bordering the adjacent mountains. Corridor Options C and D trend westward near Sahuarita and traverse the Sierrita Mountains. Bedrock units encountered here include Pliocene to Middle Miocene sedimentary rocks, Middle Miocene to Oligocene sedimentary and volcanic rocks, and Early Tertiary to Late Cretaceous and Jurassic granitic rocks. Depth to bedrock below alluvial deposits in the intervening valleys of the South Section ranges from as little as about 400 feet near the mountains to as much as about 11,200 feet near the centers of valley basins.

Figure E12-1 (Topography, South Section) and **Figure E12-2** (Surface Geology and Depth to Bedrock, South Section) illustrate the above described geologic conditions.

Land Subsidence and Earth Fissures (South Section)

A total of three active land subsidence areas exist wholly or partially within the South Section, including the Green Valley Subsidence Area near Sahuarita, the Tucson Subsidence Area in southwestern portions of Tucson, and the Picacho/Eloy Subsidence Area which encompasses the majority of Eloy and Picacho and portions of Casa Grande. No earth fissures are known to exist associated with the Green Valley or Tucson Subsidence Areas. Several earth fissure Analysis Areas including the Tator Hills, Picacho Peak and Friendly Corner, Greene Wash, White Horse Pass, and Toltec Buttes Fissure Study Areas, comprising numerous earth fissures, exist partially or wholly within the Picacho/Eloy Subsidence Area. The Picacho Mountains SE Earth Fissure Study Area is located between Marana and Eloy along the northeast boundary of the South Section, and the Avra Valley Earth Fissure Study Area is located along the southwest boundary of the South Section. Neither of these earth fissure areas Analysis Areas is located within an active land subsidence area.

All of the Corridor Options in the South Section except for Option A encroach upon one or more of the above mentioned active subsidence areas and/or earth Analysis Areas.

Figure E12-3 (Land Subsidence, Earth Fissure, and Quaternary Faults, South Section) illustrates the above described geologic conditions.

The relationship between Corridor Options and land subsidence and earth fissure Analysis Areas as described above is summarized in **Table E12-1** (Subsidence and Fissure Area Encroachment, South Section).

Table E12-1 Subsidence and Fissure Area Encroachment, South Section

	Corridor Options					
	A	B	C*	D*	F	G
Encounters Land Subsidence Area	No	Yes	No	No	Yes	Yes
Encounters Earth Fissure Analysis Area	No	No	Yes	Yes	Yes	Yes

* Includes the Sandario Road and Central Arizona Project (CAP) Design Options
SOURCES: ADWR 2017; AZGS 2017.

Active Faults and Seismicity (South Section)

The Santa Rita Fault Zone extends within and along the east side of the South Section from just north of Nogales to Sahuarita. Portions of Corridor Options A, B, C, and D exist in close proximity to, but do not cross this fault zone. Seismicity for the South Section is as previously described for the Study Area.

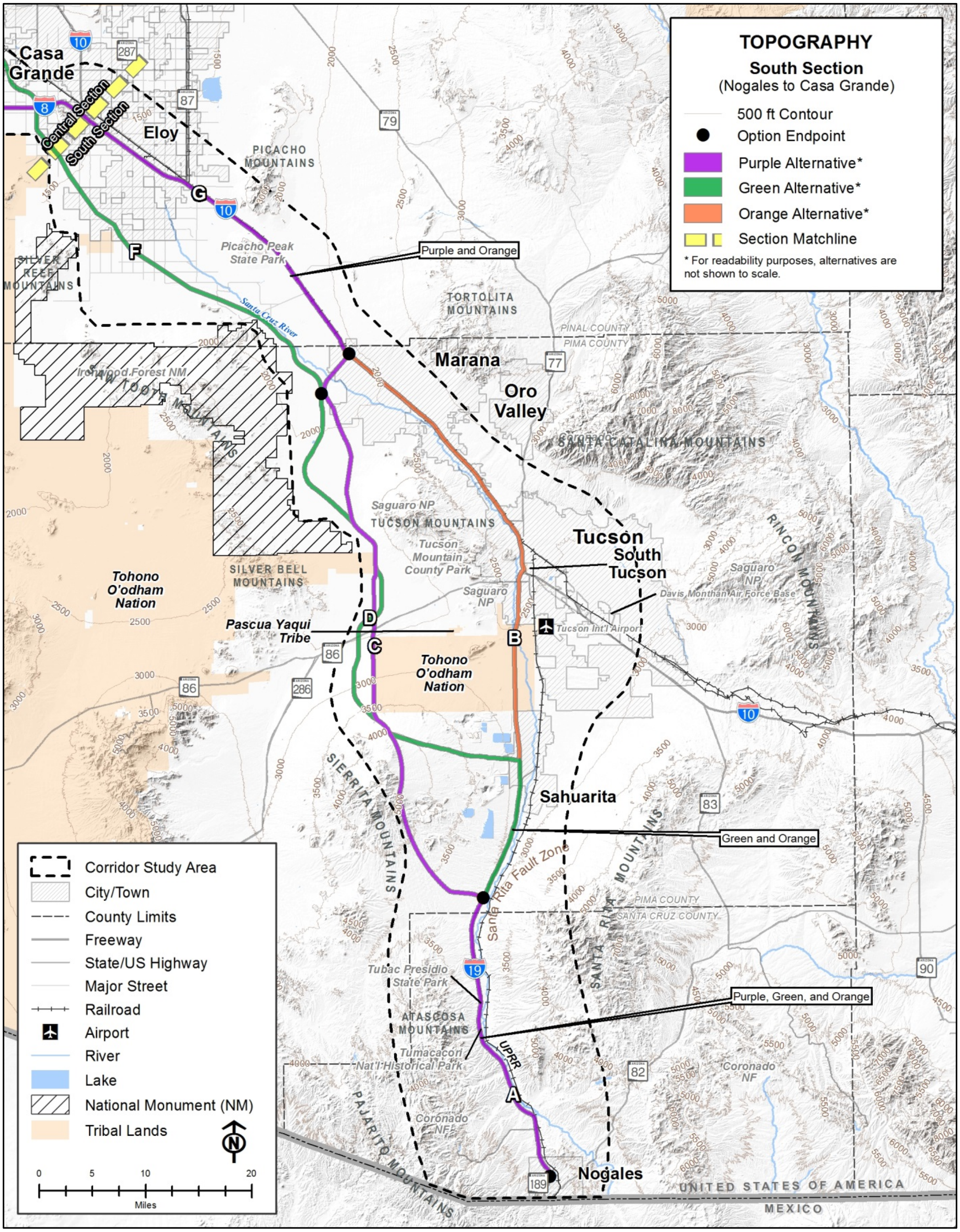

Figure E12-1 Topography, South Section

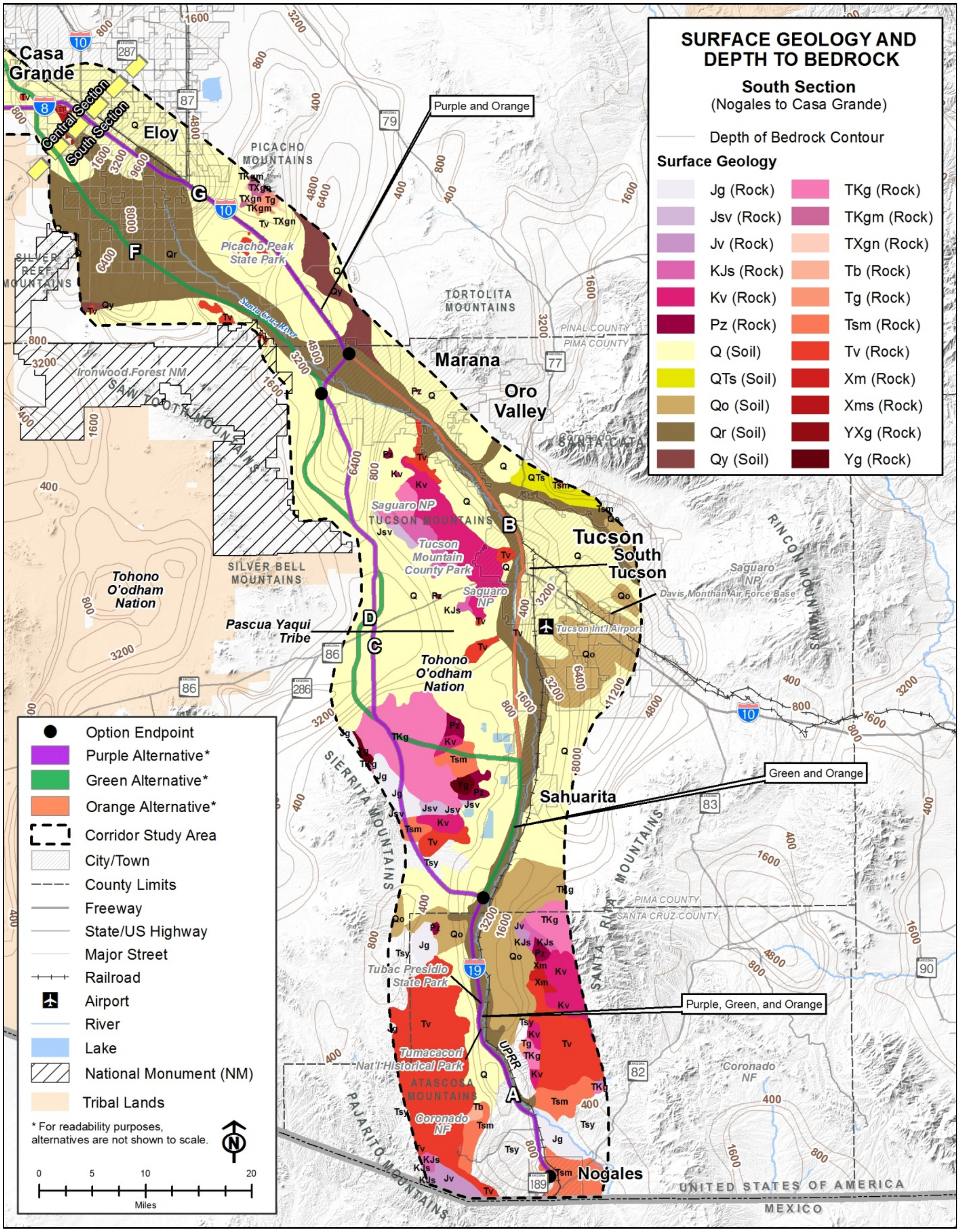

Figure E12-2 Surface Geology and Depth to Bedrock, South Section

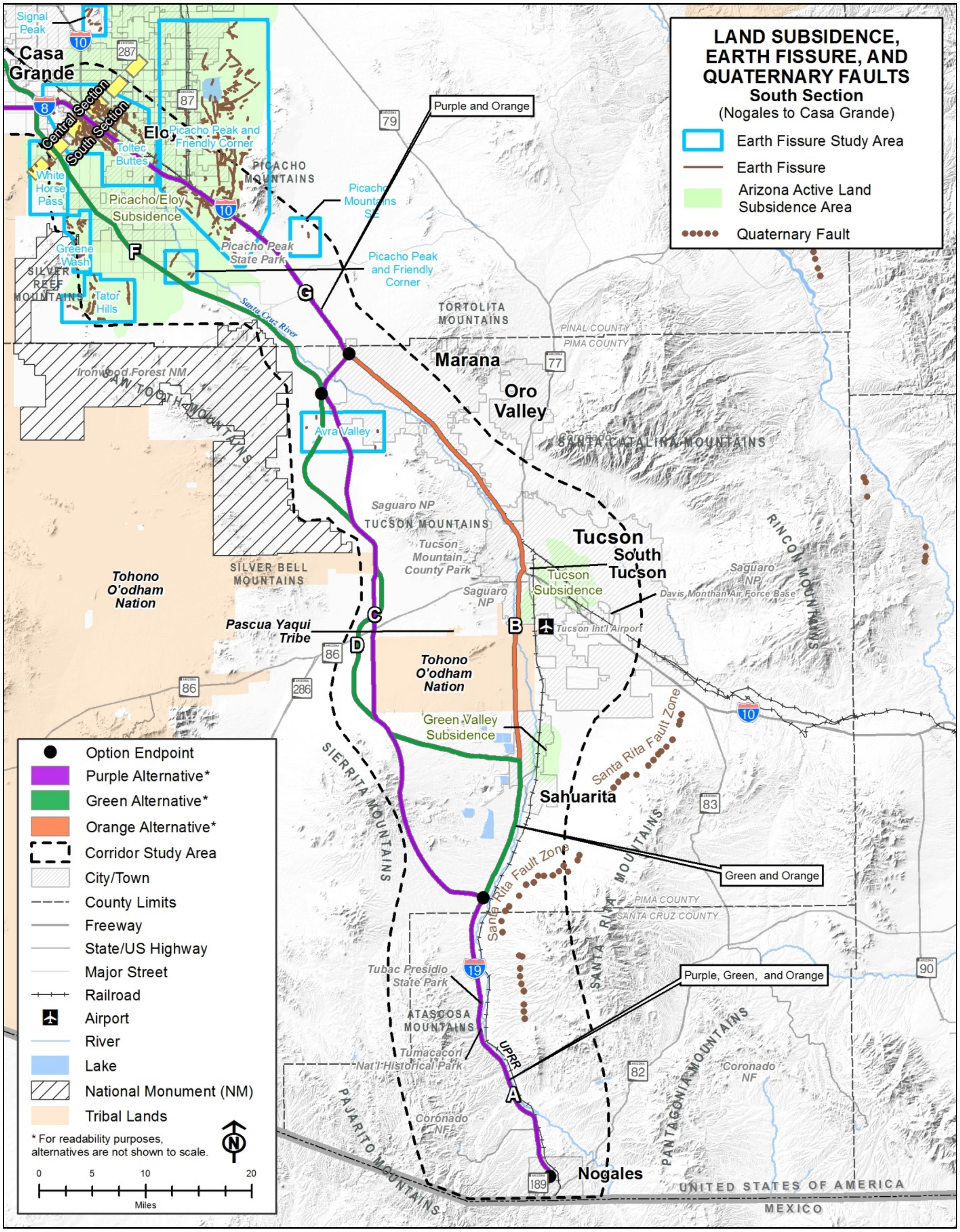

Figure E12-3 Land Subsidence, Earth Fissure, and Quaternary Faults, South Section

Figure E12-3 (Land Subsidence, Earth Fissure, and Quaternary Faults, South Section) illustrates the above described Quaternary fault conditions.

E12.1.3 Central Section Geology

Local Geology (Central Section)

Mountains dominating the Central Section include the Silver Reef, Casa Grande, Sacaton, Table Top, Sand Tank, Gila Bend, Maricopa, and Sierra Estrella Mountains. Topography along the Corridor Options including the northeast trending Options I1, I2, L, M, N, Q2, and Q3 and the southwest trending Options H, K, Q1, and R generally follow valley floors intervening between the mountains and is very similar. Topography varies from nearly flat to gently sloping along valleys to gently to moderately sloping along the flanks of nearby mountains. Elevations generally range from about 1,500 feet amsl near Casa Grande to 800 to 1,000 feet amsl near Gila Bend and Buckeye, except for Options H and K where they flank the Table Top and Maricopa Mountains and elevations range from about 1,600 to 2,000 feet amsl.

Geologic units along the Corridor Options as described above consist predominately of Quaternary alluvial deposits comprised primarily of mixtures of gravel, sand, and silt in floodplains, river and stream terraces, and alluvial fans bordering the adjacent mountains. Corridor Options H, K, Q1, and Q2 traverse portions of the Table Top and Maricopa Mountains and the Buckeye Hills where bedrock units including Middle Miocene to Oligocene volcanic rocks and Proterozoic granitic rocks exist. Depth to bedrock below alluvial deposits in the intervening valleys of the Central Section ranges from about 800 feet near the mountains to about 9,600 feet near the centers of valley basins.

Figure E12-4 (Topography, Central Section) and **Figure E12-5** (Surface Geology and Depth to Bedrock, Central Section) illustrate the above described geologic conditions.

Land Subsidence and Earth Fissures (Central Section)

A total of three active land subsidence areas exist within the Central Section, including the Maricopa/Stanfield Subsidence Area located just west of Casa Grande, the Gila Bend Subsidence Area which encompasses Gila Bend and areas to the west and north, along the Gila River, and the Buckeye Subsidence Area which encompasses southern portions of Buckeye and areas to the southwest, along the Gila River. A total of three earth fissure Analysis Areas including the Santa Rosa Wash, Pete’s Corner, and Heaton Earth Fissure Study Areas comprising numerous earth fissures exist partially or wholly within the Maricopa-Stanfield Subsidence Area. The Wintersburg Earth Fissure Analysis Area is located within the extreme northwestern portion of the Central Section along the extreme west side of Corridor Option R, but is not located within an active land subsidence area.

Corridor Options H, I1, I2, K, Q1, Q2, Q3, and R encroach upon one or more of the above mentioned active land subsidence areas and/or earth fissure Analysis Areas.

Figure E12-6 (Land Subsidence, Earth Fissure, and Quaternary Faults, Central Section) illustrates the above described geologic conditions.

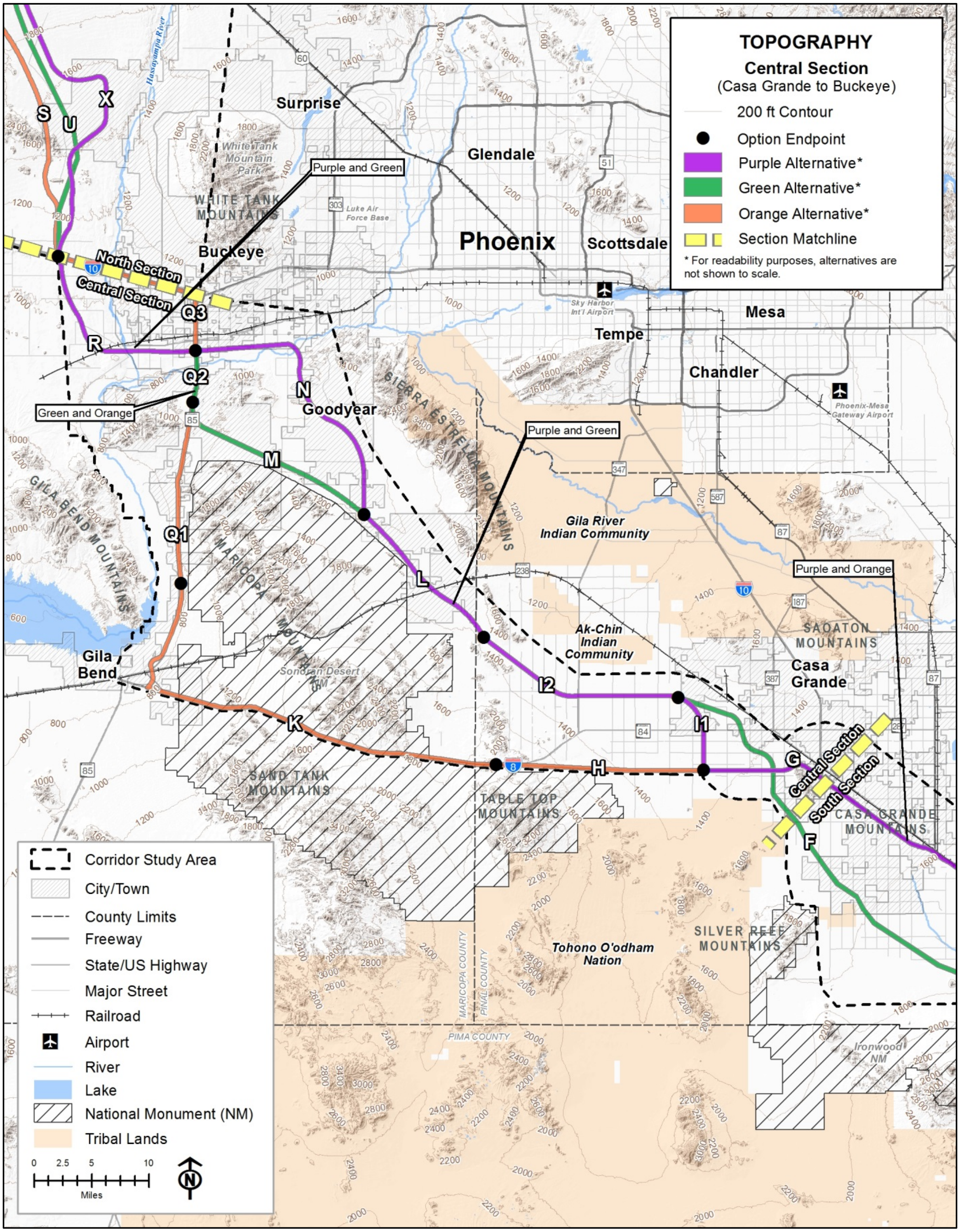

Figure E12-4 Topography, Central Section

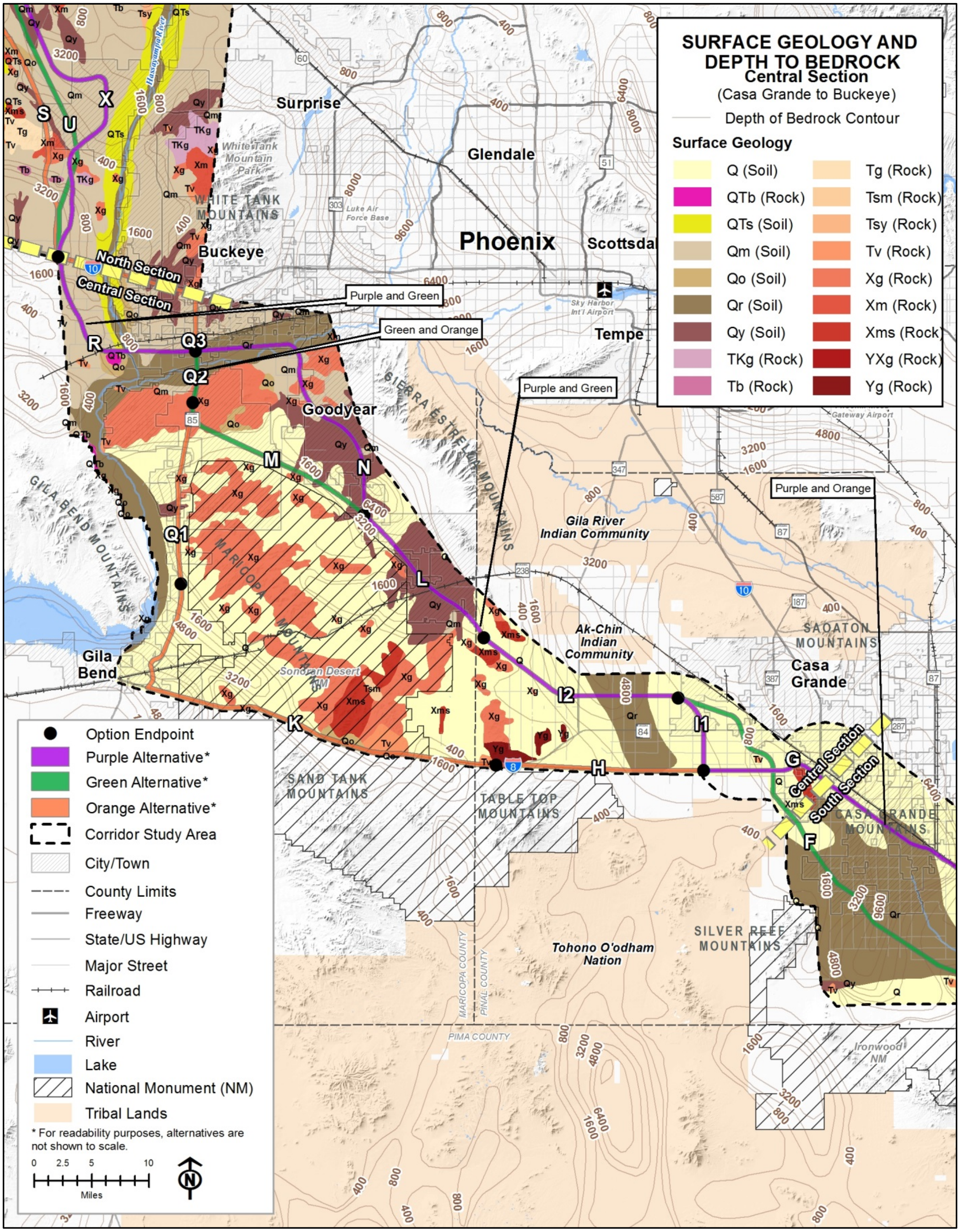

Figure E12-5 Surface Geology and Depth to Bedrock, Central Section

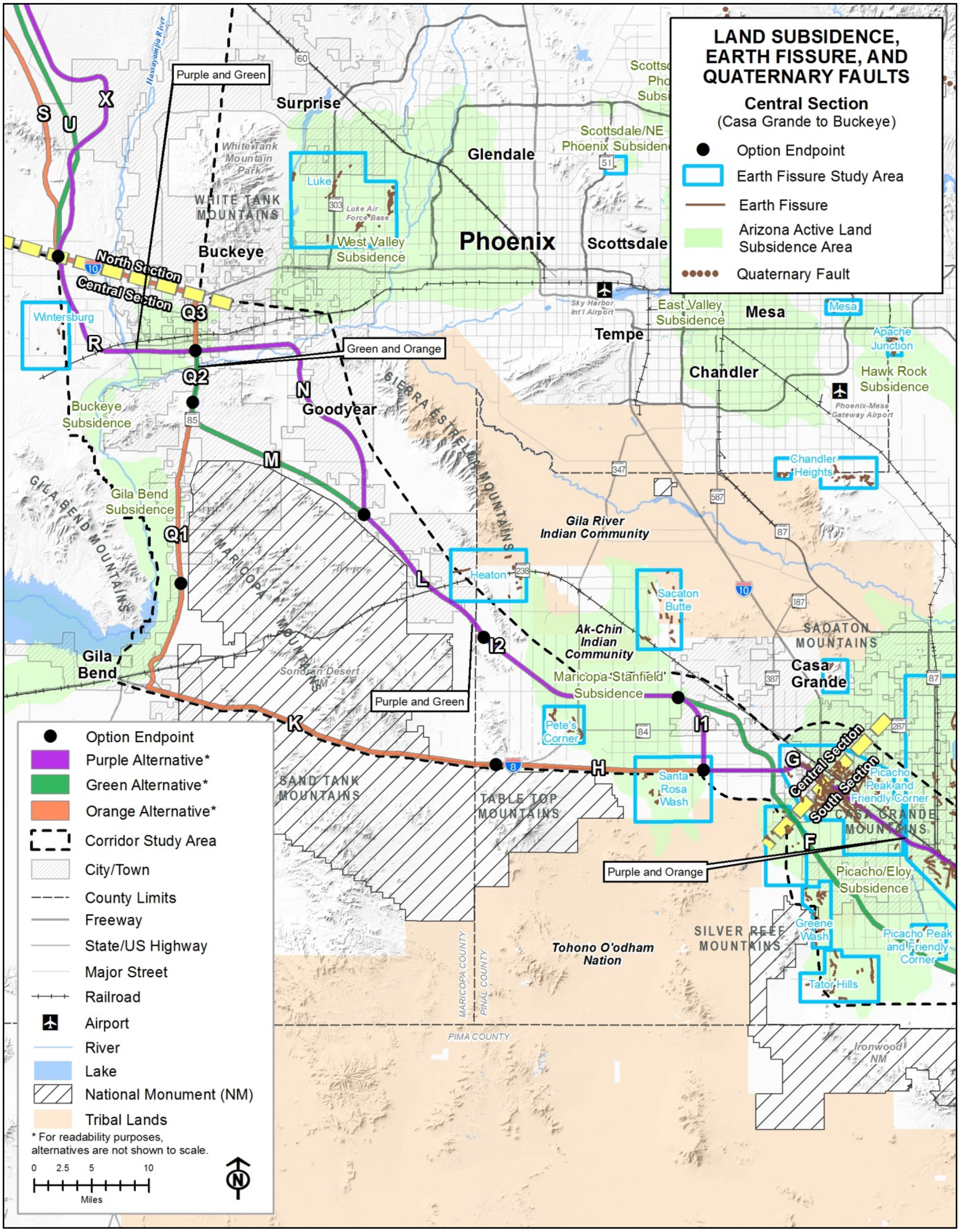

Figure E12-6 Land Subsidence, Earth Fissure, and Quaternary Faults, Central Section

The relationship between the Corridor Options and land subsidence and earth fissure Analysis Areas as described above is summarized in **Table E12-2** (Subsidence and Fissure Area Encroachment, Central Section).

Table E12-2 Subsidence and Fissure Area Encroachment, Central Section

	Corridor Options										
	H	I1	I2	K	L	M	N	Q1	Q2	Q3	R
Encounters Land Subsidence Area	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Encounters Earth Fissure Analysis Area	Yes	Yes	No	No	No	No	No	No	No	No	Yes

SOURCES: ADWR 2017; AZGS 2017.

Active Faults and Seismicity (Central Section)

The Sand Tank Fault exists just south and outside of the Corridor Option K. Seismicity for the Central Section is as previously described for the Study Area.

Figure E12-6illustrates the above described Quaternary fault conditions.

E12.1.4 North Section Geology

Local Geology (North Section)

Mountains dominating the North Section include the White Tank, Belmont, Vulture, and Date Creek Mountains. Topography along the Corridor Options, which generally trend along the west central portion, varies from nearly flat to gently sloping along valley floors, to gently to moderately sloping or rolling along the flanks of nearby mountains, to moderately steep along mountain crossings.

Elevations along all three Corridor Options (Options S, U, and V) range from about 1,000 feet amsl in the south near Buckeye to about 2,000 feet amsl at the flanks of the Vulture Mountains. Elevations across the Vulture Mountains range from about 2,000 feet to 2,800 feet amsl. Beyond the Vulture Mountains, extending to the extreme north end of the North Section, topography is relatively flat with elevation of about 2,400 feet amsl. Near Corridor Option S trends slightly west compared to Options U and X and crosses the Belmont Mountains where topography varies from rolling to moderately sloping and elevations range from about 1,400 to 1,800 feet amsl.

Geologic units along the Corridor Options as described above consist predominately of Quaternary alluvial deposits comprised primarily of mixtures of gravel, sand, and silt in floodplains, river and stream terraces, and alluvial fans bordering the adjacent mountains. Where the Belmont and Vulture Mountains are crossed, bedrock units are encountered including Late to Middle Miocene basaltic rocks, Middle Miocene to Oligocene sedimentary rocks, Early to Late Cretaceous granitic rocks, and Early Proterozoic granitic and metamorphic rocks. Depth to bedrock below alluvial deposits in the intervening valleys of the North Section ranges from about 400 feet near the mountains to about 1,600 feet near the centers of valley basins.

Figure E12-7 (Topography, North Section) and **Figure E12-8** (Surface Geology and Depth to Bedrock, North Section) illustrate the above described geologic conditions.

Land Subsidence and Earth Fissures (North Section)

No active land subsidence areas or earth fissure Analysis Areas exist within the North Section of the Study Area.

Active Faults and Seismicity (North Section)

No active faults exist within the North Section of the Study Area. Seismicity for the North Section is as previously described for the Study Area.

Figure E12-9 (Land Subsidence, Earth Fissure, and Quaternary Faults, Central Section) illustrates the above described geologic conditions.

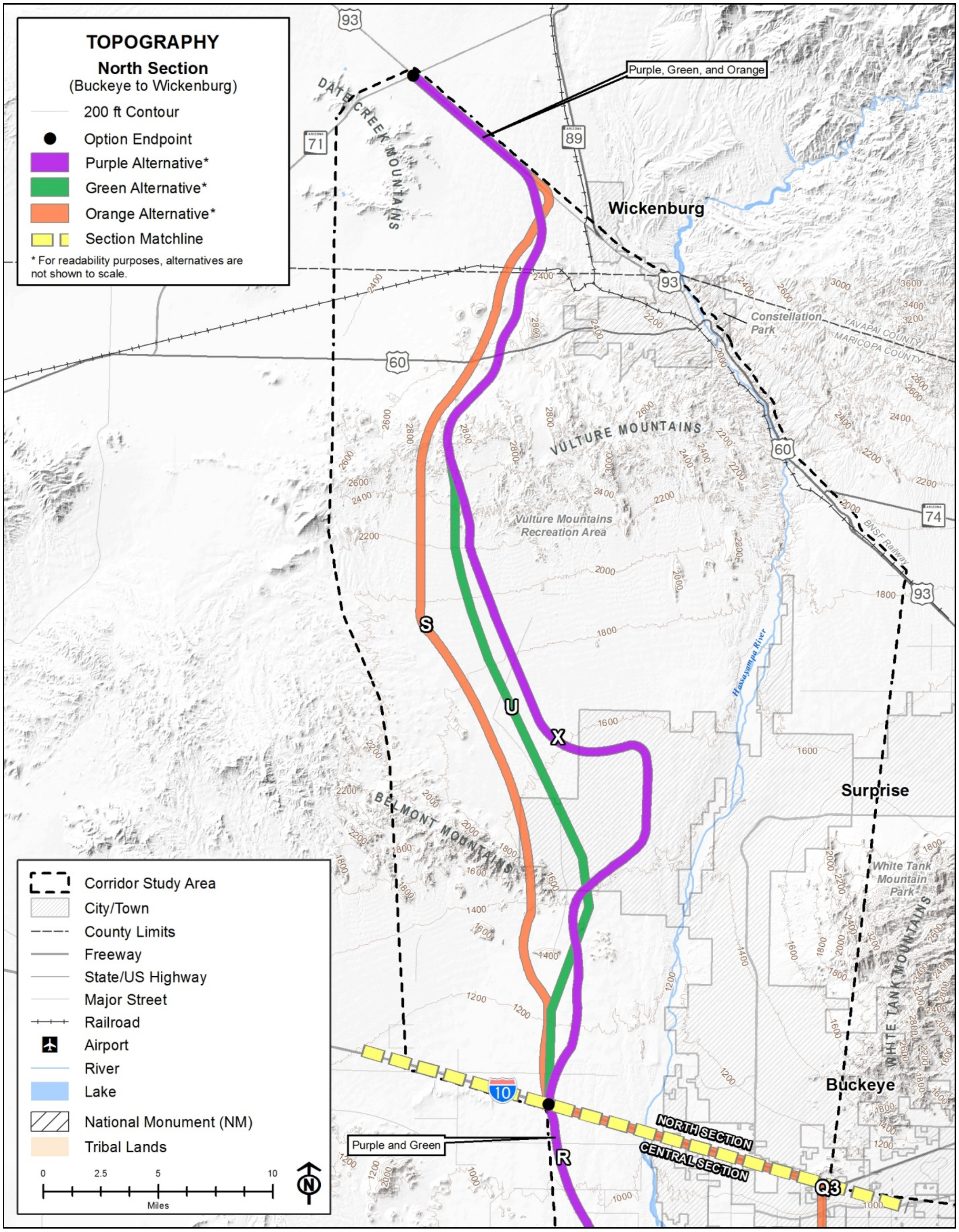

Figure E12-7 Topography, North Section

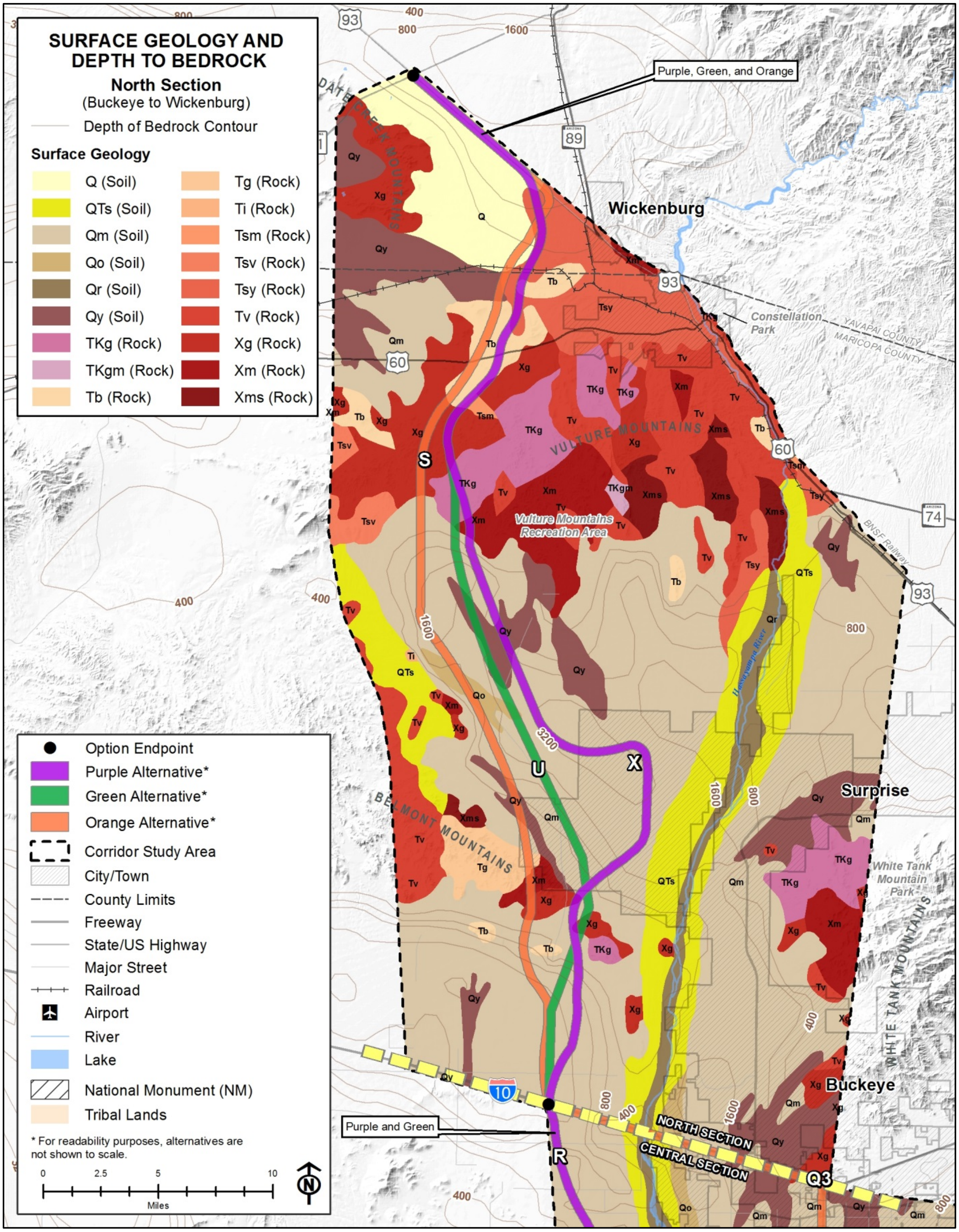

Figure E12-8 Surface Geology and Depth to Bedrock, North Section

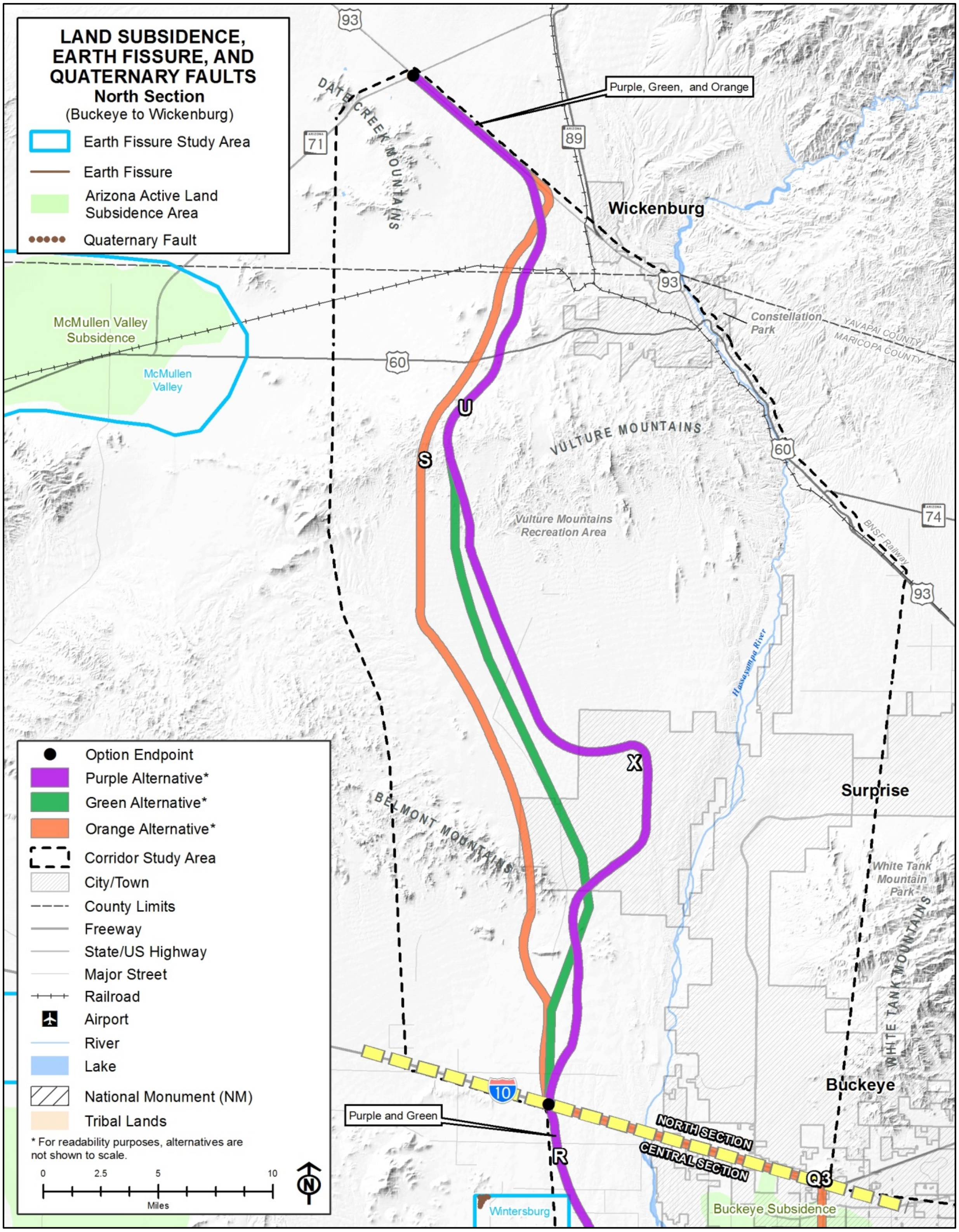

Figure E12-9 Land Subsidence, Earth Fissure, and Quaternary Faults, North Section

E12.2 Soils

E12.2.1 Study Area Overview and Methodology

The Natural Resources Conservation Service (NRCS) web-based Web Soil Survey (WSS) (NRCS 2017) was accessed to obtain Geographic Information System-based near-surface soils data for the Study Area. NRCS compiles and reports data and characteristics for soil types, limited to the upper 60 inches of the soil profile. According to the NRCS WSS, 774 soil types from 13 individual NRCS Soil Surveys (Surveys AZ637, AZ645, AZ647, AZ651, AZ653, AZ655, AZ658, AZ659, AZ661, AZ667, AZ668, AZ669, AZ703) exist across the roughly 2.7 million acre Study Area and comprise the soils that would be encountered in the near-surface within the Corridor Options.

The NRCS ratings are based on soil properties that affect the capacity of the soil to support a load without movement and on soil properties that affect excavation and construction costs. These properties include depth to a water table; ponding and flooding; subsidence; linear extensibility (shrink-swell potential); compressibility (inferred by NRCS from the USGS classification of the soil); slope; depth to bedrock or a cemented/hard soil layer; hardness of bedrock or a cemented/hard soil layer; and the frequency and size of rock fragments.

The NRCS soil conditions described above are illustrated below in section-specific figures.

E12.2.2 South Section Soils

A total of 74,134 acres of soil are contained within the boundaries of the Corridor Options. These soils were evaluated relative to NRCS reported limitations to construction of local roads and streets. Of the total soil acreage comprising the South Section Corridor Options, 39 percent (28,645 acres) are categorized as Very Limited, 46 percent (33,931 acres) as Somewhat Limited, and 15 percent (11,395 acres) as Not Limited. A comparison of these limitations on an individual Corridor Option basis is provided in **Table E12-3** (Roads and Streets Construction Limitations, South Section).

Table E12-3 Roads and Streets Construction Limitations, South Section

	Corridor Options					
	A	B	C*	D*	F	G
% Very Limited	34	25	48	25	42	61
Acres Very Limited	2,396	3,603	6,790 (6,887)	3,922	5,228	6,707
% Somewhat Limited	59	53	39	57	45	23
Acres Somewhat Limited	4,139	7,544	5,454 (5,671)	8,815	5,515	2,465
% Not Limited	6	21	13	18	13	15
Acres Not Limited	426	3,047	1,902 (1,876)	2,834	1,573	1,612
Total Acres in Option	6,960	14,194	14,145 (14,434)	15,571	12,338	10,934

* CAP Design Option data shown in parenthesis.
SOURCE: NRCS 2017.

Figure E12-10 (NRCS Soil Streets and Roads Limitations, South Section) illustrates the above described soil conditions.

E12.2.3 Central Section Soils

A total of 48,437 acres of soil are contained within the boundaries of the Corridor Options. These soils were evaluated relative to NRCS reported limitations to construction of local roads and streets. Of the total soil acreage comprising the Central Section Corridor Options, 30 percent (14,447 acres) are categorized as Very Limited, 8 percent (4,113 acres) as Somewhat Limited, and 60 percent (29,112 acres) as Not Limited. About 2 percent of the Corridor Options soils are not categorized by the NRCS for limitations to construction of local roads and streets. A comparison of these limitations on an individual Corridor Option basis is provided in **Table E12-4** (Roads and Streets Construction Limitations, Central Section).

Table E12-4 Roads and Streets Construction Limitations, Central Section

	Corridor Options										
	H	I1	I2	K	L	M	N	Q1	Q2	Q3	R
% Very Limited	39	67	56	27	47	13	25	27	48	9	11
Acres Very Limited	1,706	1,191	2,546	2,757	1,722	571	1,573	1,027	531	379	474
% Somewhat Limited	7	20	27	3	7	10	4	0	0	9	13
Acres Somewhat Limited	297	335	1,214	346	267	445	258	0	0	379	551
% Not Limited	52	12	17	69	45	77	68	73	44	74	75
Acres Not Limited	2,289	206	756	6,928	1,658	3,437	4,220	2,833	483	3,118	3,184
Total Acres in Option	4,384	1,769	4,517	10,038	3,648	4,479	6,207	3,860	1,101	4,298	4,236

SOURCE: NRCS 2017.

Figure E12-11 (NRCS Soil Streets and Roads Limitations, Central Section) illustrates the above described soil conditions.

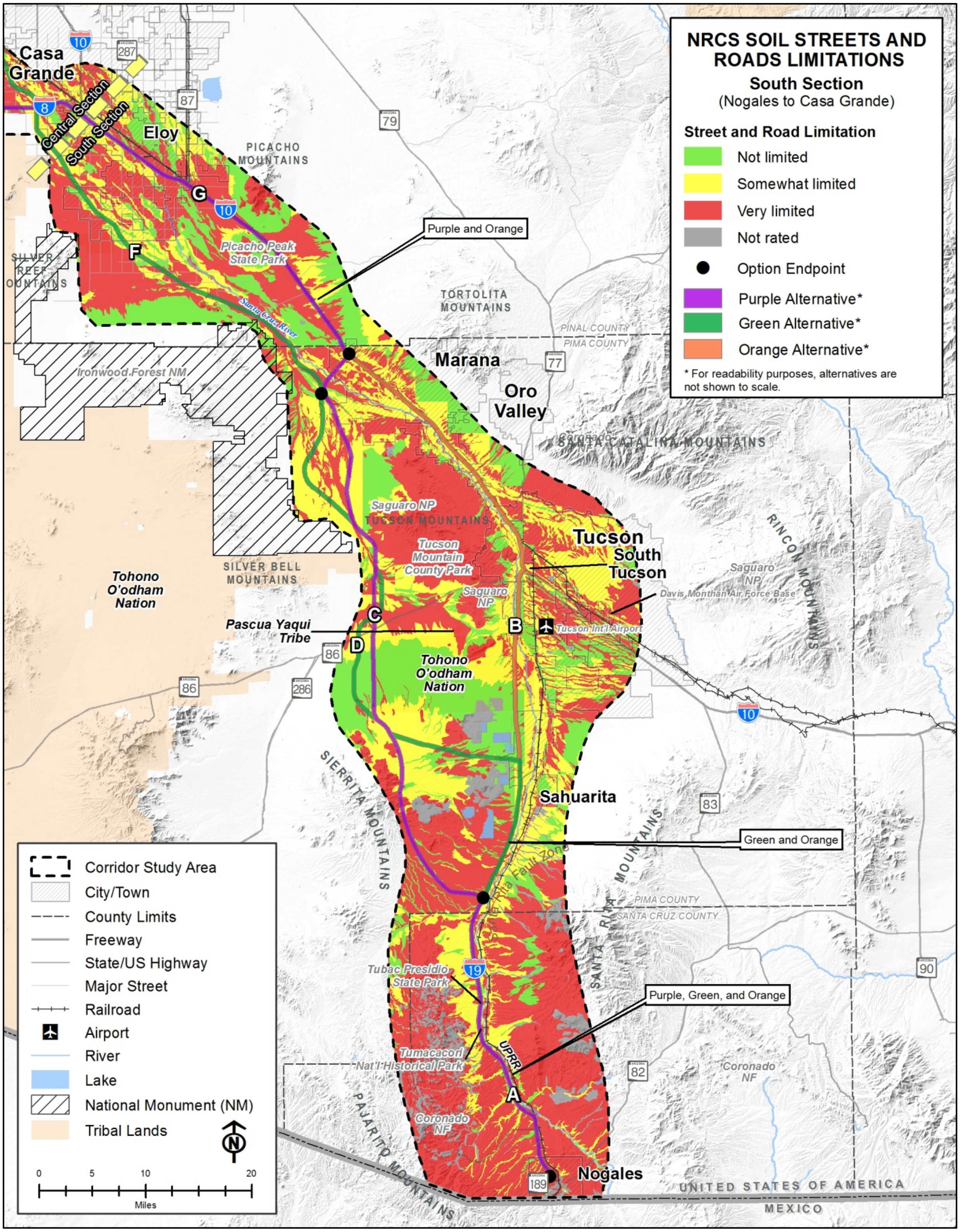

Figure E12-10 NRCS Soil Streets and Roads Limitations, South Section

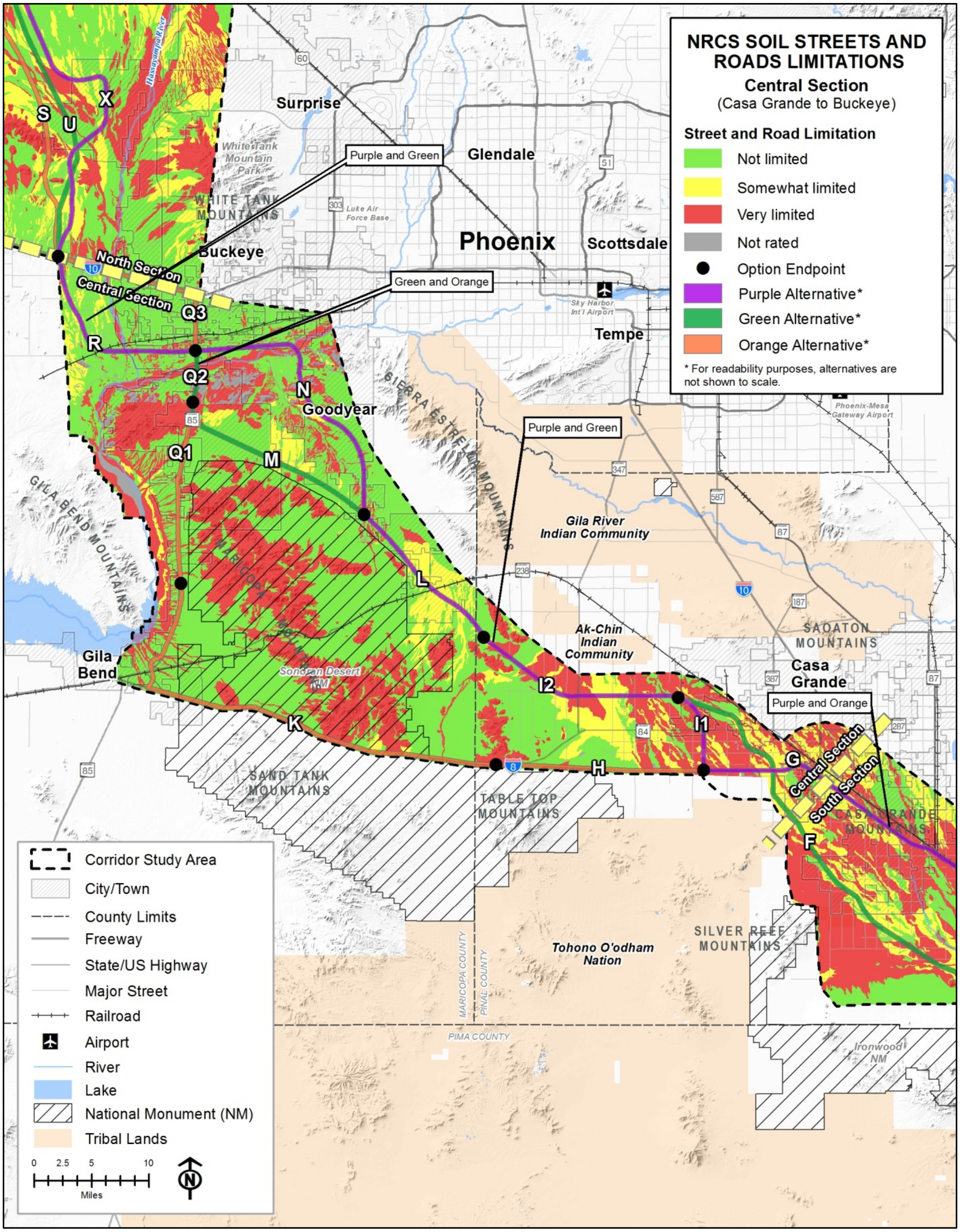

Figure E12-11 NRCS Soil Streets and Roads Limitations, Central Section

E12.2.4 North Section Soils

A total of 37,523 acres of soil are contained within the boundaries of the Corridor Options. These soils were evaluated relative to NRCS reported limitations to construction of local roads and streets. Of the total soil acreage comprising the North Section Corridor Options, 30 percent (11,087 acres) are categorized as Very Limited, 26 percent (9,638 acres) as Somewhat Limited, and 45 percent (16,798 acres) as Not Limited. A comparison of these limitations on an individual Corridor Option basis is provided in **Table E12-5** (Roads and Streets Construction Limitations, North Section).

Table E12-5 Roads and Streets Construction Limitations, North Section

	Corridor Options		
	S	U	X
% Very Limited	32	32	25
Acres Very Limited	3,868	3,851	3,368
% Somewhat Limited	22	26	28
Acres Somewhat Limited	2,718	3,166	3,754
% Not Limited	46	42	46
Acres Not Limited	5,637	5,055	6,106
Total Acres in Options	12,227	12,071	13,228

SOURCE: NRCS 2017.

Figure E12-12 (NRCS Soil Streets and Roads Limitations, North Section) illustrates the above described soil conditions.

E12.3 Prime and Unique Farmlands

E12.3.1 Study Area Overview and Methodology

The NRCS web-based WSS was accessed to obtain Geographic Information System-based soils data for the Study Area (NRCS 2017). NRCS compiles and reports data and characteristics for soil types, limited to the upper 60 inches of the soil profile. According to the NRCS WSS, 774 soil types from 13 individual NRCS Soil Surveys (Surveys AZ637, AZ645, AZ647, AZ651, AZ653, AZ655, AZ658, AZ659, AZ661, AZ667, AZ668, AZ669, AZ703) exist across the roughly 2.7 million acre Study Area and comprise the soils that would be encountered in the near-surface within the Corridor Options.

Prime and Unique Farmlands as defined under the Farmland Protection Policy Act have been identified using existing NRCS information and soil maps collected to develop a description of existing conditions for a comparison of impacts.

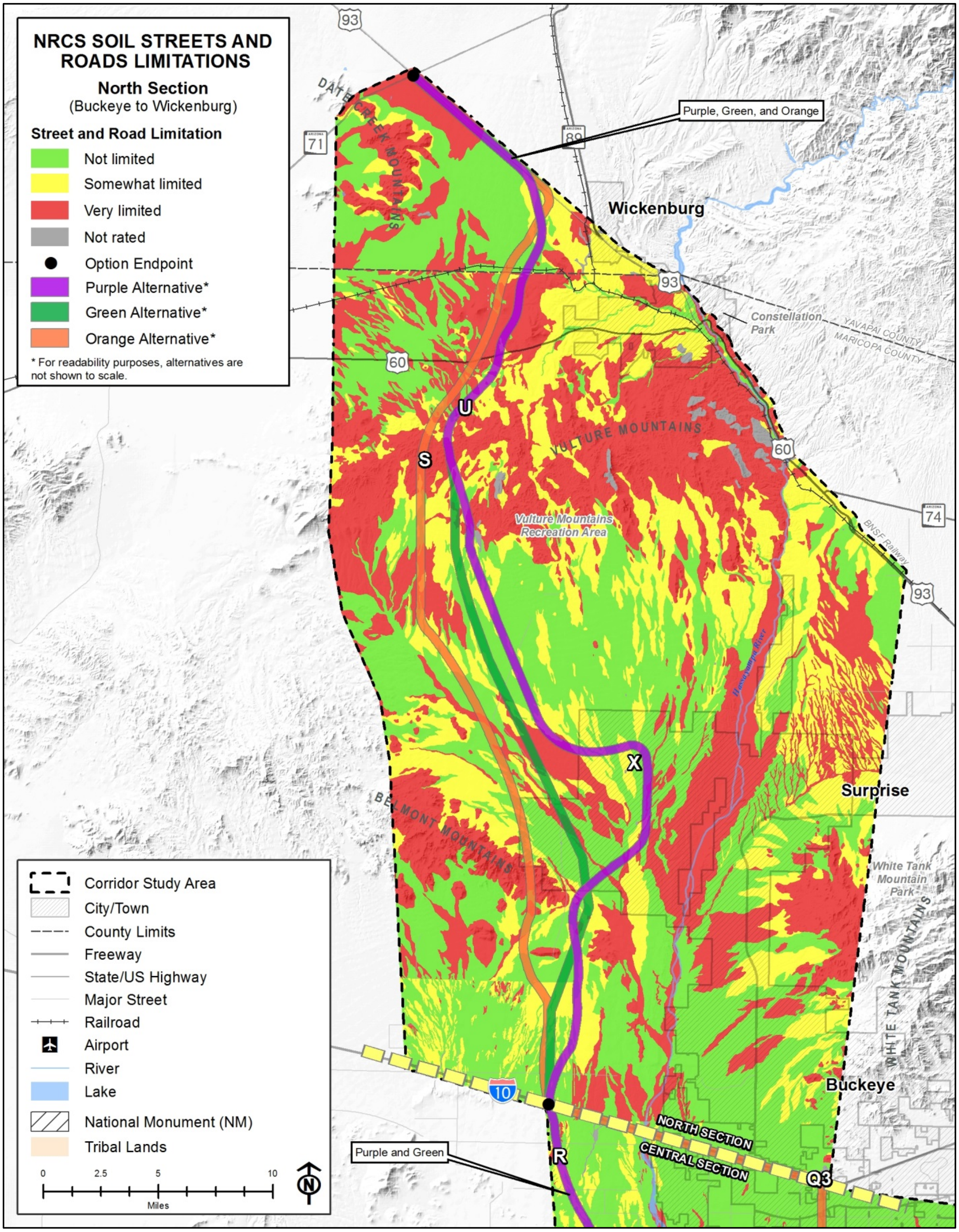

Figure E12-12 NRCS Soil Streets and Roads Limitations, North Section

Definitions of Prime and Unique Farmlands, which determine the existing conditions and environmental concerns related to farmlands in the Build Corridor Alternatives, are as follows.

- Prime Farmland – Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor and without intolerable soil erosion. Prime Farmland includes land that possesses the above characteristics but is being used to produce livestock and timber. It does not include land already in or committed to urban development or water storage (7 Code of Federal Regulations 658.2).
- Unique Farmland – Land other than Prime Farmland that is used for production of specific high-value food and fiber crops. Its characteristics include the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods. Examples of such crops include citrus, tree nuts, olives, cranberries, fruits, and vegetables (7 Code of Federal Regulations 658.2).

Completion and submission of AD-1006 Forms (i.e., Farmland Conversion Impact Rating) to convert farmland to nonagricultural uses in compliance with the Farmland Protection Policy Act is not part of this Tier 1 Environmental Impact Statement and will be deferred to future National Environmental Policy Act documentation.

E12.3.2 South Section Farmlands

A total of 74,134 acres of soil are contained within the boundaries of the Corridor Options. Of the total soil acreage comprising the South Section Options, 66 percent (48,674 acres) are categorized as Prime and Unique Farmlands.

A comparison of the Prime and Unique Farmlands on an individual Corridor Option basis is provided in **Table E12-6** (Prime and Unique Farmlands, South Section).

Table E12-6 Prime and Unique Farmlands, South Section

	Corridor Options					
	A	B	C*	D*	F	G
% Prime and Unique Farmland	54	63	35 (32)	41 (38)	99	94
Acres of Prime and Unique Farmland	3,775	9,006	4,986 (4,531)	6,444 (5,948)	12,268	10,222
Total Acres in Option	6,960	14,194	14,145	15,571	12,338	10,934

* CAP Design Option shown in parenthesis.
SOURCE: NRCS 2017.

E12.3.3 Central Section Farmlands

A total of 48, 437 acres of soil are contained within the boundaries of the Corridor Options. Of the total soil acreage comprising the Central Section Options, 37 percent (18,095 acres) are categorized as Prime and Unique Farmlands. A comparison of the Prime and Unique Farmlands on an individual Corridor Option basis is provided in **Table E12-7** (Prime and Unique Farmlands, Central Section).

Table E12-7 Prime and Unique Farmlands, Central Section

	Corridor Options										
	H	I1	I2	K	L	M	N	Q1	Q2	Q3	R
% Prime and Unique Farmland	46	99	95	8	26	17	83	11	41	29	49
Acres of Prime and Unique Farmland	1,994	1,754	4,297	808	938	752	5,151	408	448	1,233	2,064
Total Acres in Option	4,384	1,769	4,517	10,038	3,648	4,479	6,207	3,860	1,101	4,198	4,236

SOURCE: NRCS 2017.

E12.3.4 North Section Farmlands

A total of 37,503 acres of soil are contained within the boundaries of the Corridor Options. Of the total soil acreage comprising the Central Section Options, 9 percent (3,495 acres) are categorized as Prime and Unique Farmlands. A comparison of the Prime and Unique Farmlands on an individual Corridor Option basis is provided in **Table E12-8** (Prime and Unique Farmlands, North Section).

Table E12-8 Prime and Unique Farmlands, North Section

	Corridor Options		
	S	U	X
% Prime and Unique Farmland	11.6	8.0	8.3
Acres of Prime and Unique Farmland	1,422	971	1,102
Total Acres in Option	12,227	12,071	13,228

SOURCE: NRCS 2017.

Figure E12-13 (Prime and Unique Farmland, South Section), **Figure E12-14** (Prime and Unique Farmland, Central Section), and **Figure E12-15** (Prime and Unique Farmland, North Section) illustrate the above described farmland conditions.

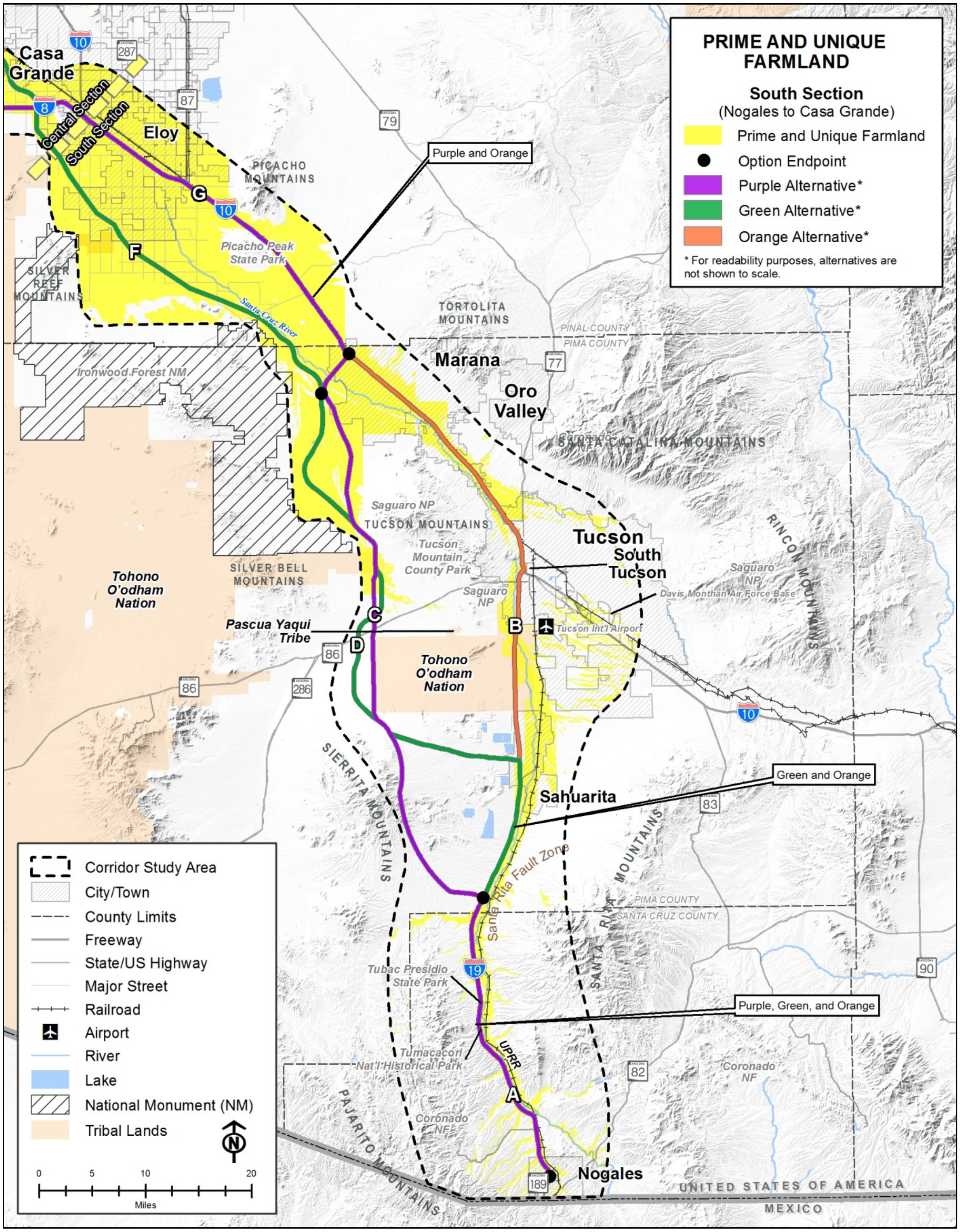

Figure E12-13 Prime and Unique Farmland, South Section

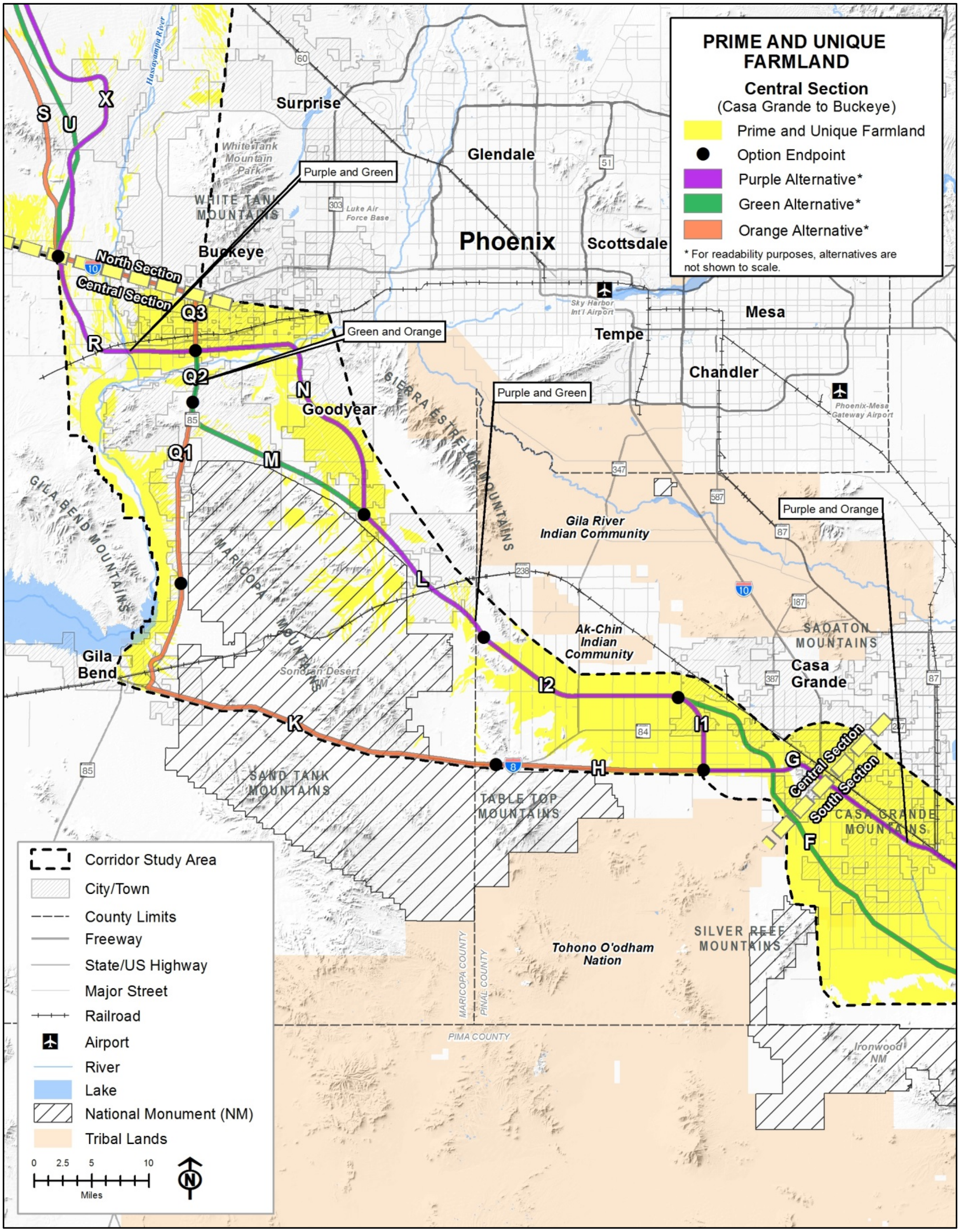

Figure E12-14 Prime and Unique Farmland, Central Section

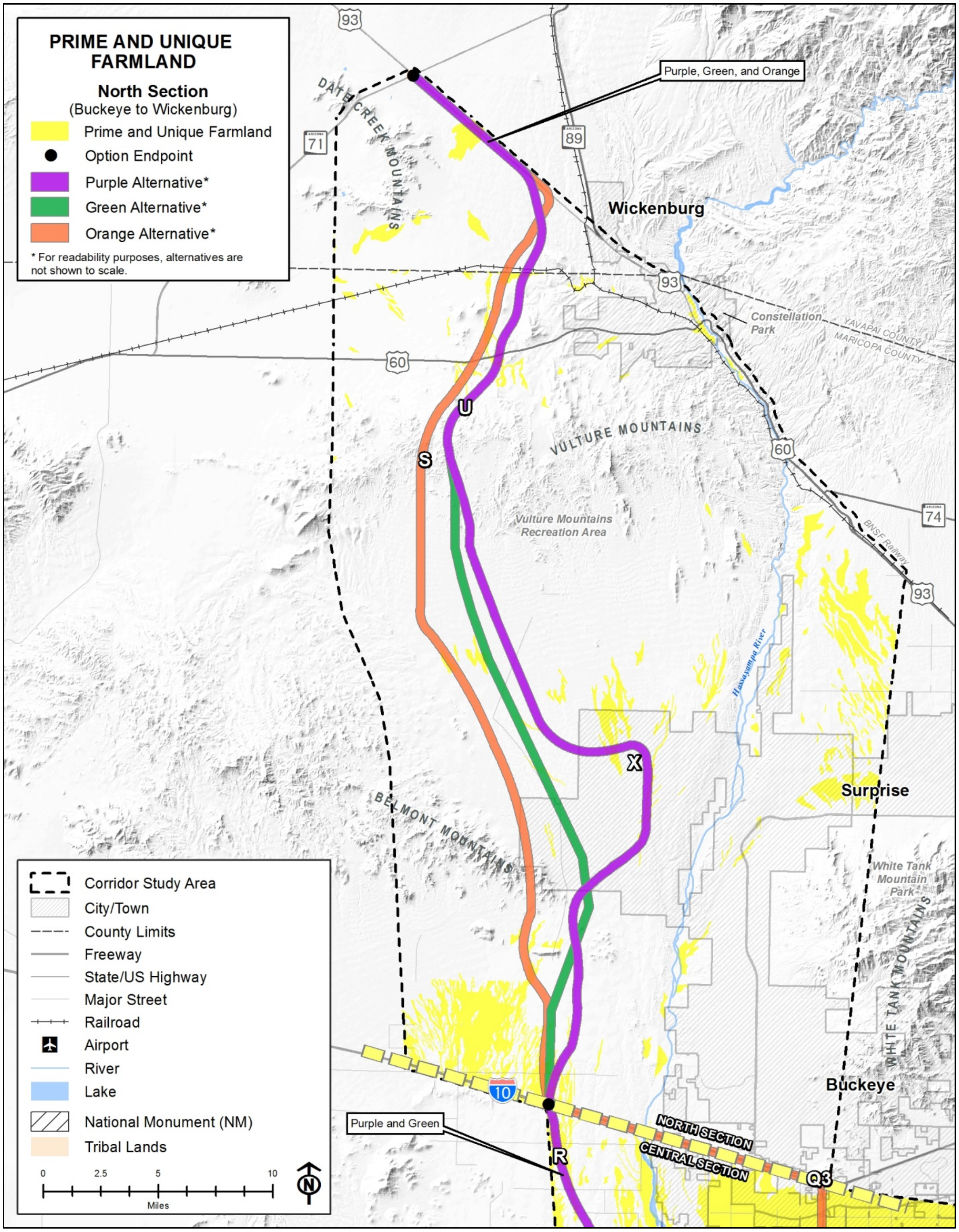

Figure E12-15 Prime and Unique Farmland, North Section

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