U.S. Department of the Interior
Bureau of Land Management
Fish & Wildlife Service

# Northern Corridor – Highway Right-of-Way, Issuance of an Incidental Take Permit Draft Environmental Impact Statement and Draft Resource Management Plan Amendments

June 2020

## Volume 3: Glossary and Appendices

Estimated Total Lead Agencies' Costs Associated with Developing and Producing this Document: $5,583,000

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# Glossary

**Air Quality Index (AQI):** The AQI is an index for reporting daily air quality. It indicates how clean or polluted your air is and what associated health effects might be of concern. The AQI focuses on health effects experienced within a few hours or days after breathing polluted air.

**Allotment:** An area of land where one or more livestock operators graze their livestock. Allotments generally consist of lands managed by the Bureau of Land Management (BLM) but may also include other Federally managed, State-owned, or private lands. An allotment may include one or more separate pastures. Livestock numbers and periods of use are specified for each allotment.

**Ambient noise:** Often referred to as background noise, it is all the noise in a given environment.

**Analysis area:** An area under investigation to determine either adverse or beneficial impacts from a proposed action.

**Allotment:** An area of land where one or more livestock operators graze their livestock. Allotments generally consist of lands managed by the Bureau of Land Management (BLM) but may also include other Federally managed, State-owned, or private lands. An allotment may include one or more separate pastures. Livestock numbers and periods of use are specified for each allotment

**American Community Survey (ACS):** The ACS is compiled by the U.S. Census Bureau and helps local officials, community leaders, and businesses understand the changes taking place in their communities. It is the premier source for detailed population and housing information about our nation.

**American Indian Tribe:** Any Indian or Alaska Native Tribe, band, nation, pueblo, village, or community that the Secretary of the Interior acknowledges to exist as an Indian Tribe pursuant to the Federally Recognized Indian Tribe List Act of 1994 (Public Law 103-454; 108 Statute 4791; 25 U.S.C. 479a-1.).

**Analysis area:** An area under investigation to determine either adverse or beneficial impacts from a proposed action.

**Animal unit month (AUM)***:* A standardized measurement of the amount of forage necessary for the sustenance of one cow unit or its equivalent for 1 month; used to describe the carrying capacity of a given forage or pasture. The measurement is equivalent to approximately 800 pounds of forage.

**Area of Critical Environmental Concern (ACEC):** Areas within public lands where special management attention is required to (1) protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes or (2) protect life and safety from natural hazards.

**Avoidance areas:** Areas with sensitive resource values where rights-of-way would be strongly discouraged. Authorization made in avoidance areas would have to be compatible with the criteria for issuing a right-of-way in the avoidance area.

**Before Present (BP):** A time scale used mainly in archaeology, geology, and other scientific disciplines to specify when events occurred in the past.

**Camping:** Unless otherwise specified, camping in this document refers to vehicle-supported camping, whether at developed or dispersed sites.

**Casual Use:** Any short-term, non-commercial activity that does not cause appreciable damage or disturbance to the public lands, their resources, or improvements and which is not prohibited by closure of the lands to such activities.

**Clean Air Act (CAA):** The CAA (42 U.S.C. 7401 et seq.) is a comprehensive Federal law that regulates all sources of air emissions. The 1970 CAA authorized the U.S. Environmental Protection Agency to establish National Ambient Air Quality Standards to protect public health and the environment.

**Closed:** Generally denotes that an area is not available for a particular use or uses; refer to specific definitions found in law, regulations, or policy guidance for application to individual programs.

***Code of Federal Regulations* (CFR):** The official, legal tabulation of regulations directing Federal government activities.

**Comprehensive Travel and Transportation Management Plan:** A BLM plan that includes the process for planning for and managing access and transportation systems on public lands. The comprehensive plan includes all forms of transportation including travel by foot, horseback, bicycle, and motorized vehicle (motorcycles, off-road vehicles, cars, and trucks).

**Conformance:** Conformance indicates that a proposed action is specifically provided for in the land use plan or, if not specifically mentioned, is clearly consistent with the goals, objectives, or standards of the approved BLM land use plan.

**Contiguous:** Lands or legal subdivisions having a common boundary; lands having only a common corner are not contiguous.

**Cooperating agency:** Assists the lead Federal agency in developing an Environmental Analysis (EA) or Environmental Impact Statement (EIS). The Council on Environmental Quality regulations implementing the National Environmental Policy Act of 1969 (NEPA) defines a cooperating agency as any agency that has jurisdiction by law or special expertise for proposals covered by NEPA. Any Tribe, Federal, State, or local government jurisdiction with such qualifications may become a cooperating agency through an agreement with the lead agency.

**Council on Environmental Quality:** An advisory council to the President of the United States established by NEPA of 1969. It reviews Federal programs for their effect on the environment, conducts environmental studies, and advises the president on environmental matters.

**Covered Activities:** To be eligible for incidental take authorization, covered activities must be: (1) otherwise lawful, (2) non-Federal, and (3) under the direct control of the permittee. In the context of this EIS, Habitat Conservation Plan Covered Activities are those otherwise lawful, non-Federal activities that are reasonably certain to take one or more Mojave desert tortoise and for which authorization for such take would be provided by the Incidental Take Permit. Within the Reserve, Covered Activities are very limited. Outside the Reserve, examples of Covered Activities include land clearing, building construction, recreation, agricultural activities, mining, and other lawful activities.

**Critical habitat:** For listed species, consists of (1) the specific areas within the geographical area occupied by the species at the time they are listed in accordance with the provisions of Section 4 of the Endangered Species Act (ESA) on which are found those physical or biological features (constituent elements) (a) essential to the conservation of the species, and (b) which may require special management considerations or protection, and (2) specific areas outside the geographical area occupied by the species at the time they are listed in accordance with the provisions of Section 4 of the ESA upon a determination by the Secretary of the Interior that such areas are essential for the conservation of the species. Designated critical habitats are described in 50 CFR 17 and 226.

**Cultural resources:** A definite location of human activity, occupation, or use identifiable through field inventory (survey), historical documentation, or oral evidence. The term includes archaeological, historic, or architectural sites, structures, or places with important public and scientific uses and may include definite locations (sites or places) of traditional cultural or religious importance to specified social and/or cultural groups. Cultural resources are concrete, material places and things that are located, classified, ranked, and managed through the system of identifying, protecting, and using for public benefit. They may be, but are not necessarily, eligible for the National Register of Historic Places.

**Cumulative effect (NEPA):** The effect on the environment that results from the incremental effect of the action when added to other past, present, or reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.

**Dispersed camping:** Vehicle accessed and supported camping occurring outside of developed campgrounds.

**Dispersed recreation:** Recreation activities of an unstructured type that are not confined to specific locations such as recreation sites. Example of these activities may be hunting, fishing, off-road vehicle use, hiking, and sightseeing.

**Drought:** Drought is a protracted period of deficient precipitation resulting in extensive damage to crops, resulting in loss of yield.

**Ecoregion:** A region where the type, quality, and quantity of environmental resources are generally similar.

**Endangered species:** Any species that is in danger of extinction throughout all or a significant portion of its range.

**Endangered Species Act (ESA):** A law enacted in 1973 (16 U.S.C. 1531 et seq.) that provides a program for the conservation of threatened and endangered plants and animals and the habitats in which they are found.

**Enforcement and Compliance History Online (ECHO):** The U.S. Environmental Protection Agency's Enforcement and Compliance History Online website is a tool that provides compliance and enforcement information for facilities regulated by the Environmental Protection Agency.

**Environmental Impact Statement (EIS)***:* A detailed written statement required by NEPA when an agency proposes a major Federal action significantly affecting the quality of the human environment.

**Environmental Justice:** Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

**Ephemeral:** A term used to describe a stream that is intermittent or lasts for a short time; this is characteristic of many watersheds in dry, arid, and semi-arid regions.

**Erosion:** The wearing away of the land surface by running water, wind, ice, or other geological agents.

**Exclusion area:** Areas with sensitive resource values where rights-of-way would not be authorized.

**Exclusion fencing:** A barrier to exclude certain types of animals or other users.

**Extensive Recreation Management Area (ERMA):** ERMAs recognize existing recreation use, demand, or recreation and visitor services program investments and are managed to sustain principal recreation activities and associated qualities and conditions, commensurate with other resource and resource uses. Minimal management actions related to the BLM's stewardship responsibilities are adequate in these areas.

**Federal Land Policy and Management Act of 1976 (FLPMA):** Often referred to as the BLM's "Organic Act," FLPMA (Public Law 94-579) provides the majority of the BLM's legislated authority, direction, policy, and basic management guidance.

**Federal Register:** A daily publication that reports presidential and Federal agency documents.

**Fire Regime Condition Class (FRCC):** An interagency, standardized tool for determining the degree of ecological departure from historical, or reference, vegetation, fuels, and disturbance regimes.

**Floodplain:** The relatively flat area or lowlands adjoining a body of standing or flowing water, which has been or might be covered by floodwater.

**Fossil:** Any remains, traces, or imprints of prehistoric, non-human organisms preserved in or on the Earth's crust that provide information about the history of life on Earth.

**Goal:** A broad statement of a desired outcome. Goals are usually not quantifiable and may not have established timeframes for achievement.

**Guidelines:** Actions or management practices that may be used to achieve desired outcomes, sometimes expressed as best management practices. Guidelines may be identified during the land use planning process, but they are not considered a BLM land use plan decision unless the plan specifies that they are mandatory.

**Habitat:** A specific set of physical conditions that surround a species, group of species, or a large community. In wildlife management, the major constituents of habitat are considered to be food, water, cover, and living space.

**Habitat Conservation Plan (HCP):** A land management tool that seeks to balance the needs of endangered or threatened species with the needs of non-Federal land owners. Under section 10(a)(2)(A) of the Endangered Species Act, a planning document that is a mandatory component of an incidental take permit application, also known as a conservation plan.

**Habitat fragmentation:** The disruption (by division) of extensive habitats into smaller habitat patches. The effects of habitat fragmentation include loss of habitat area and the creation of smaller, more isolated patches of remaining habitat.

**Historic property:** Any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places maintained by the Secretary of the Interior. This term includes artifacts, records, and remains that are related to and located within such properties. The term includes properties of traditional religious and cultural importance to an Indian Tribe or Native Hawaiian organization and that meet the National Register of Historic Places criteria (36 CFR 800.16(l)(1)).

**Impact:** A modification of the existing environment caused by an action. These environmental consequences are the scientific and analytical basis for comparison of alternatives. Impacts, also referred to as effects, may be either direct (caused by the action and occur at the same time and place) or indirect (caused by the action and occurring later in time or farther removed in distance, but still reasonably foreseeable or cumulative).

**Incidental Take Permit (ITP):** A permit issued to non-Federal entities undertaking otherwise lawful projects that might result in the take of an endangered or threatened species. Application for an incidental take permit is subject to certain requirements including preparation by the permit applicant of a conservation plan, generally known as a Habitat Conservation Plan (HCP).

**Interior Board of Land Appeals (IBLA):** An appellate review body that exercises the delegated authority of the Secretary of the Interior to issue final decisions for the Department of the Interior.

**Intergovernmental Panel on Climate Change (IPCC):** The United Nations body for assessing the science related to climate change. The IPCC was created to provide policymakers with regular scientific assessments on climate change, its implications, and potential future risks and to put forward adaptation and mitigation options.

**Invasive species:** A species that is not native to a specific location and that has a tendency to spread to a degree believed to cause damage to the environment, human economy, or human health.

**Key Observation Point (KOP):** A representative viewpoint where the project would be prominently visible. KOPs are typically used in the preparation of realistic visual simulations and the evaluation of potential impacts to views and viewers.

**Land and Water Conservation Fund Act of 1965:** Federal law passed to create and maintain a nationwide legacy of high-quality recreation areas and facilities and to stimulate non-Federal investments in the protection and maintenance of recreation resources across the United States.

**Land use plan:** Also referred to as resource management plan, a BLM land use plan as prescribed by the Federal Land Policy and Management Act that establishes, for a given area of land, land use allocations, coordination guidelines for multiple use, objectives, and actions to be achieved.

**Landscape Unit (LU):** A visual analysis term used by the Federal Highway Administration to define visually homogenous viewsheds and landscape types.

**Management decision:** A decision made by the BLM to manage public lands. Management decisions are made on both the BLM land use plan decisions and implementation decisions.

**Mechanized travel:** Travel by use of a machine, either motorized or non-motorized.

**Migratory Bird Treaty Act (MBTA):** A law that makes it illegal to take, possess, import, export, transport, sell, purchase, barter, or offer for sale, purchase, or barter, any migratory bird or the parts, nests, or eggs of such a bird except under the terms of a valid Federal permit.

**Minimize:** To reduce the adverse impact of an operation to the lowest practical level.

**Mitigation measures:** Methods or procedures that reduce or lessen the impacts of an action.

**Mojave desert tortoise:** A species of tortoise that occurs north and west of the Colorado River in California, Nevada, Arizona, and Utah, and is listed as a threatened species.

**National Conservation Area (NCA):** A designation for certain protected areas in the United States managed by the BLM's National Conservations Lands program.

**National Environmental Policy Act of 1969 (NEPA):** An act that establishes the broad national framework for protecting our environment with a policy to assure that all branches of government give proper consideration to the environment prior to undertaking any major Federal action that significantly affects the environment. NEPA encourages productive and enjoyable harmony between man and his environment and promotes efforts to prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man, enriches the understanding or the ecological systems and natural resources important to the Nation, and establishes the Council on Environmental Quality.

**National Historic Preservation Act (NHPA):** Federal legislation enacted to preserve historical and archaeological sites in the United States.

**Natural Resources Conservation Service (NRCS):** Formerly known as the Soil Conservation Service, the NCRS is an agency of the United States Department of Agriculture that provides technical assistance to farmers and other private landowners and managers.

**National Register of Historic Places (NRHP):** The official list of the Nation's historic places worthy of preservation for their historical significance. Authorized by the National Historic Preservation Act of 1966, the National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archeological resources.

**Non-mechanized travel:** Travel by foot or on an animal.

**Notice to Proceed:** Issued to begin and carry on an action, process, or movement.

**Noxious weeds:** A plant species designated by Federal of State law as generally possessing one or more of the following characteristics: aggressive and difficult to manage; parasitic; a carrier or host of serious insects or disease; or non-native, new, or not common to the United States.

**Objective:** A description of a desired condition for a resource. Objectives can be quantified and measured and, where possible, have established time frames for achievement.

**Off-highway vehicle (OHV):** Any motorized vehicle capable of, or designed for, travel on or immediately over land, water, or other natural terrain, excluding (1) any nonamphibious registered motorboat, (2) any military, fire, emergency, or law enforcement vehicle while being used for emergency purposes, (3) any vehicle whose use is expressly authorized by the Authorized Officer, or otherwise officially approved, (4) vehicles in official use, and (5) any combat or combat support vehicle when used in times of national defense emergencies.

**Omnibus Public Lands Management Act (OPLMA):** OPLMA of 2009 is a land management law that resulted in the designation of millions of acres in the United States as protected and established a National Landscape Conservation System. In the context of this EIS, the Act established Red Cliffs National Conservation Area in Washington County, which is managed by the BLM. OPLMA also is relevant to this EIS in its directive to identify (a) alternative(s) for a northern transportation route in the County.

**Open:** Generally denotes that an area is available for a particular use or uses. Refer to specific program definitions found in law, regulations, or policy guidance for application to individual programs.

**Paleontological resources (fossils):** Any fossilized remains, traces, or imprints of organisms, preserved in or on the Earth’s crust, that are of paleontological interest and that provide information about the history of life on Earth.

**Paleontology:** The scientific study of prehistoric life based on the fossil record.

**Perennial plant:** A plant that lives for more than 2 years.

**Perennial water:** A perennial stream or river is one that has continuous flow in parts of its stream bed all year round during years of normal rainfall.

**Permitted Use:** Any use that requires a permit or other special authorization.

**Plan of Development:** A document required to be submitted by an Applicant for a right-of-way across BLM-administered lands that describes the proposed project, lands required, construction techniques, design features of the proposed project, and other information about the construction, operation, and maintenance of the project.

**Planning Area:** A geographical area, including all land ownerships, for which the BLM land use and resource management plans are developed and maintained for the BLM-administered lands within that geographical area.

**Public land:** Land or interest in land owned by the United States and administered by the Secretary of the Interior through the BLM.

**Rangeland:** Land used for grazing by livestock and big game animals on which vegetation is dominated by grasses, grass-like plants, forbs, or shrubs.

**Raptor:** Bird of prey with sharp talons and strongly curved beaks such as hawks, owls, vultures, and eagles.

**Record of Decision:** A document signed by a responsible official recording a decision that was preceded by the preparation of an EIS.

**Recreation Management Zone (RMZ):** A subdivision of a Special Recreation Management Area used to further delineate specific recreation opportunities and recreation setting characteristics.

**Regional Transportation Plan:** A long-term blueprint of a region's transportation system. Usually Regional Transportation Plans are conducted every 5 years and are plans for 30 years into the future, with the participation of dozens of transportation and infrastructure specialists. The plan identifies and analyzes transportation needs of the metropolitan region and creates a framework for project priorities.

**Resource use:** Human uses of resources for the social and economic benefit of society, including mining, energy production, livestock production (grazing), recreation (motorized, non-motorized), forest production (timber, fire wood, fence posts), utility corridors (power lines, pipelines, roads), and communication sites. BLM land use plans identify allowable uses of the public lands and set goals and objectives for desired outcomes for resource uses.

**Resource:** The natural, biological, and cultural components of the environment, including air, soil, water, vegetation, wildlife, minerals, historic and prehistoric (cultural) sites and features, and fossils. Land use plans set goals and objectives for desired outcomes for management of the various resources in a planning area.

**Resource Management Plan:** See Land Use Plan definition.

**Right-of-way (ROW) grant:** A ROW grant is an authorization to use a specific piece of BLM-administered public land for a specific project. The grant authorizes rights and privileges for a specific use of the land for a specific period of time.

**Riparian area:** A form of wetland transition between permanently saturated wetlands and upland areas. Riparian areas exhibit vegetation or physical characteristics that reflect the influence of permanent surface or subsurface water. Typical riparian areas include lands along, adjacent to, or contiguous with perennially and intermittently flowing rivers and streams, glacial potholes, and the shores of lakes and reservoirs with stable water levels. Excluded are ephemeral streams or washes that lack vegetation and depend on free water in the soil.

**Route:** A linear line for motorized, mechanized, or non-mechanized travel.

**Scenic byways:** Highway routes, which have roadsides or corridors of special aesthetic, cultural, or historic value. An essential part of the highway is its scenic corridor. The corridor may contain outstanding scenic vistas, unusual geologic features, or other natural elements.

**Scoping:** The process of identifying the range of issues, management concerns, preliminary alternatives, and other components of an EIS or land-use planning document.

**Section 106 compliance:** The requirement of Section 106 of the National Historic Preservation Act that any project funded, licensed, permitted, or assisted by the Federal government be reviewed for impacts to significant historic properties and that the State Historic Preservation Officer and the Advisory Council on Historic Preservation be allowed to comment on a project.

**Section 7:** The section of the Endangered Species Act of 1973, as amended, outlining procedures for interagency cooperation to conserve Federally listed species and designated critical habitats. Section 7(a)(1) requires Federal agencies to use their authority to further the conservation of listed species. Section 7(a)(2) requires Federal agencies to consult with the services to ensure they are not undertaking, funding, permitting, or authorizing actions likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat.

**Sensitive species:** Bureau sensitive species include all Federal candidate species, proposed species, and delisted species in the 5 years following delisting.

**Slope:** The degree of deviation of a surface from the horizontal.

**Special Recreation Management Area (SRMA):** Areas that require explicit recreation management to achieve recreation objectives and provide specific recreation opportunities.

**Special Recreation Permit:** Special Recreation Permits are issued to businesses, organizations, and individuals to allow the use of specific public land and related waters for commercial, competitive, and organized group use. Special Recreation Permits allow land management agencies to coordinate and track commercial and competitive use of public lands. They also provide resource protection measures to ensure the future enjoyment of those resources by the public.

**Special status species:** Includes proposed species, listed species, and candidate species under the Endangered Species Act; State-listed species; and BLM State Director-designated sensitive species. As defined in the BLM Manual 6840-Special Status Species Policy, the BLM special status species are (1) species listed or proposed for listing under the Endangered Species Act (ESA) and (2) species requiring special management consideration to promote their conservation and reduce the likelihood and need for future listing under the ESA, which are designated as Bureau sensitive by the State Director(s).

**State of Utah School and Institutional Trust Lands Administration (SITLA):** SITLA was created in 1994 to manage the 3.4 million acres of trust land, generating revenue for State public institutions.

**Stipulations:** Requirements that are part of the terms of a BLM land use approval. Some stipulations are standard on all approvals. Other stipulations may be applied to the authorization at the discretion of the BLM to protect valuable surface resources and uses.

**Surface disturbance:** Activities that normally result in more than negligible disturbance to public lands and that accelerate the natural erosive process. These activities normally involve use and/or occupancy of the surface, cause disturbance to soils and vegetation, and are usually caused by motorized or mechanical actions. Surface disturbance may result from activities using earth-moving equipment; off road vehicle travel; the use of pyrotechnics and explosives; and construction of facilities like power lines, pipelines, recreation sites, livestock facilities, wildlife waters, or new roads. Surface disturbance is not normally caused by casual use. Activities that are not typically surface-disturbing include, but are not limited to, proper livestock grazing, cross-country hiking, minimum impact filming and vehicle travel on designated routes.

**Take:** According to Section 3(18) of the Endangered Species Act, the term ‘take’ means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

**Threatened species:** Any plant or animal species defined under the Endangered Species Act as likely to become endangered within the foreseeable future throughout all or a significant portion of its range; listings are published in the Federal Register.

**Transportation Improvement Plan:** Each metropolitan planning organization is required, under 49 U.S.C. 5303(j), to develop a Transportation Improvement Program—a list of upcoming transportation projects—covering a period of at least 4 years. The Transportation Improvement Plan must be developed in cooperation with the State and public transit providers.

**Undertaking: (54 U.S.C. 300320):** A project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; those requiring a Federal permit, license or approval; and those subject to State or local regulation administered pursuant to a delegation or approval by a Federal agency.

**Utility or ROW corridor:** A parcel of land that has been identified by law or Secretarial order, through a land use plan, or by other management decision as being the preferred location for existing and future ROW grants and suitable to accommodate one type of ROW or one or more ROWs which are similar, identical or compatible.

**Vegetation type:** A plant community with distinguishable characteristics described by the dominant vegetation present.

**Visual resources:** The visible physical features of a landscape (topography, water, vegetation, animals, structures, and other features) that constitute the scenery of an area.

**Visual resource management (VRM) classes:** Classification of landscapes according to the types of structures and changes acceptable to meet established visual goals.

**Waters of the United States (WOUS):** All bodies of water that fall under the Federal jurisdiction of the Clean Water Act.

**Water quality:** The chemical, physical, and biological characteristics of water with respect to its suitability for a particular use.

**Watershed:** All lands that are enclosed by a continuous hydrologic drainage divide and lay upslope from a specified point on a stream.

**Wetlands:** Areas where water covers the soil or is present either at or near the surface of the soil all year or for varying periods of time during the year, including during the growing season. Water saturation (hydrology) largely determines how the soil develops and the types of plant and animal communities living in and on the soil. Wetlands may support both aquatic and terrestrial species. The prolonged presence of water creates conditions that favor the growth of specially adapted plants (hydrophytes) and promote the development of characteristic wetland (hydric) soils.

**Wilderness:** A Congressionally designated area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, that is protected and managed to preserve its natural conditions as described in Section 2A of the Wilderness Act of 1964.

**Wildfire:** Unplanned ignition of a wildland fire (such as a fire caused by lightning, volcanoes, and unauthorized and accidental human-caused fires) and escaped prescribed fires.

**Wildland fire:** A general term describing any non-structure fire that occurs in the wildland.

**Woodland:** A forest community occupied primarily by noncommercial species such as juniper, mountain mahogany, or quaking aspen groves; all western juniper forestlands are classified as woodlands, as juniper is classified as a noncommercial species.

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# Appendix A: List of References

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# Appendix A. List of References


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# Appendix B: Maps

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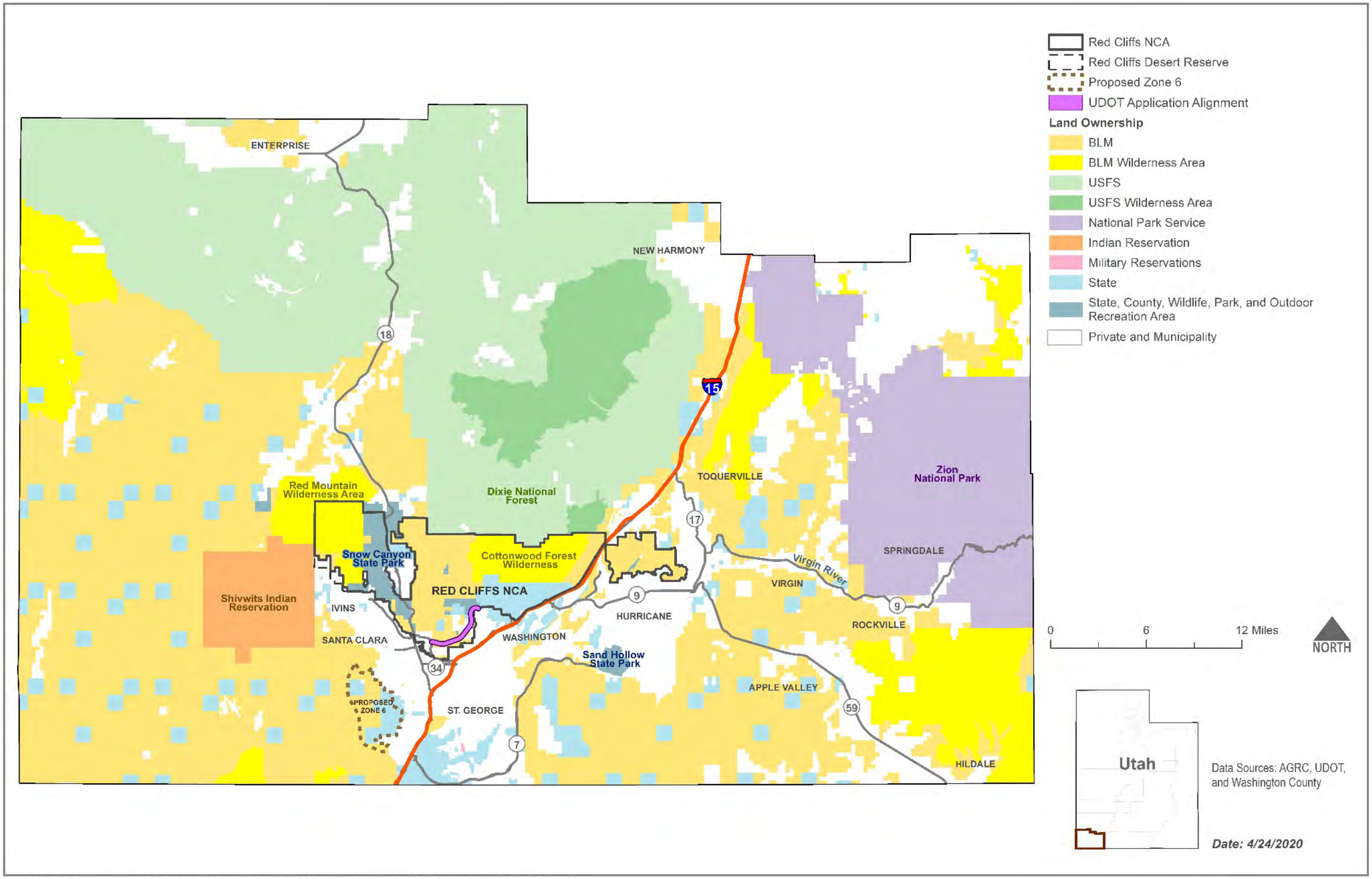
## Map 1.1-1. Planning Area for the Northern Corridor Project

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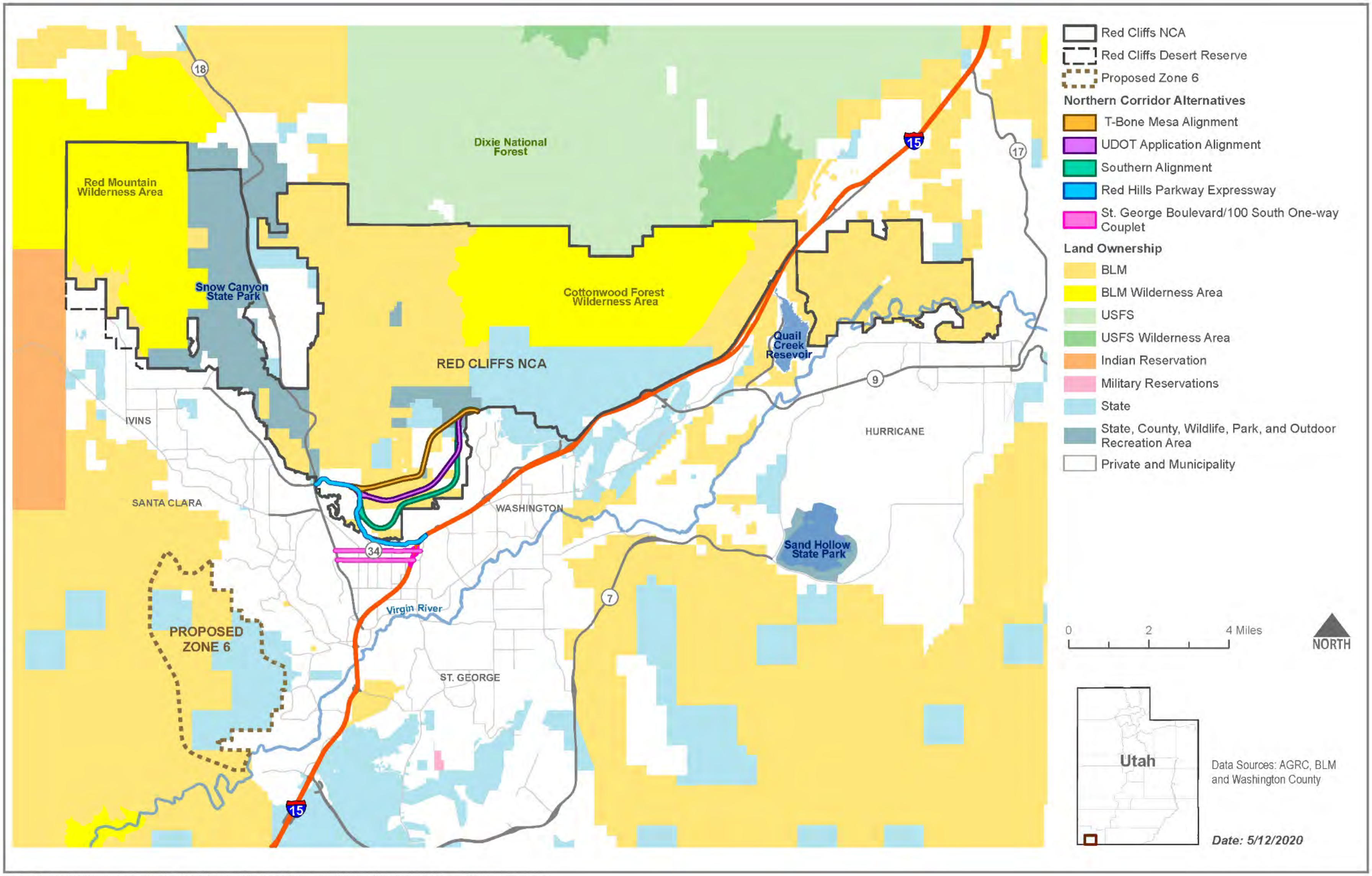
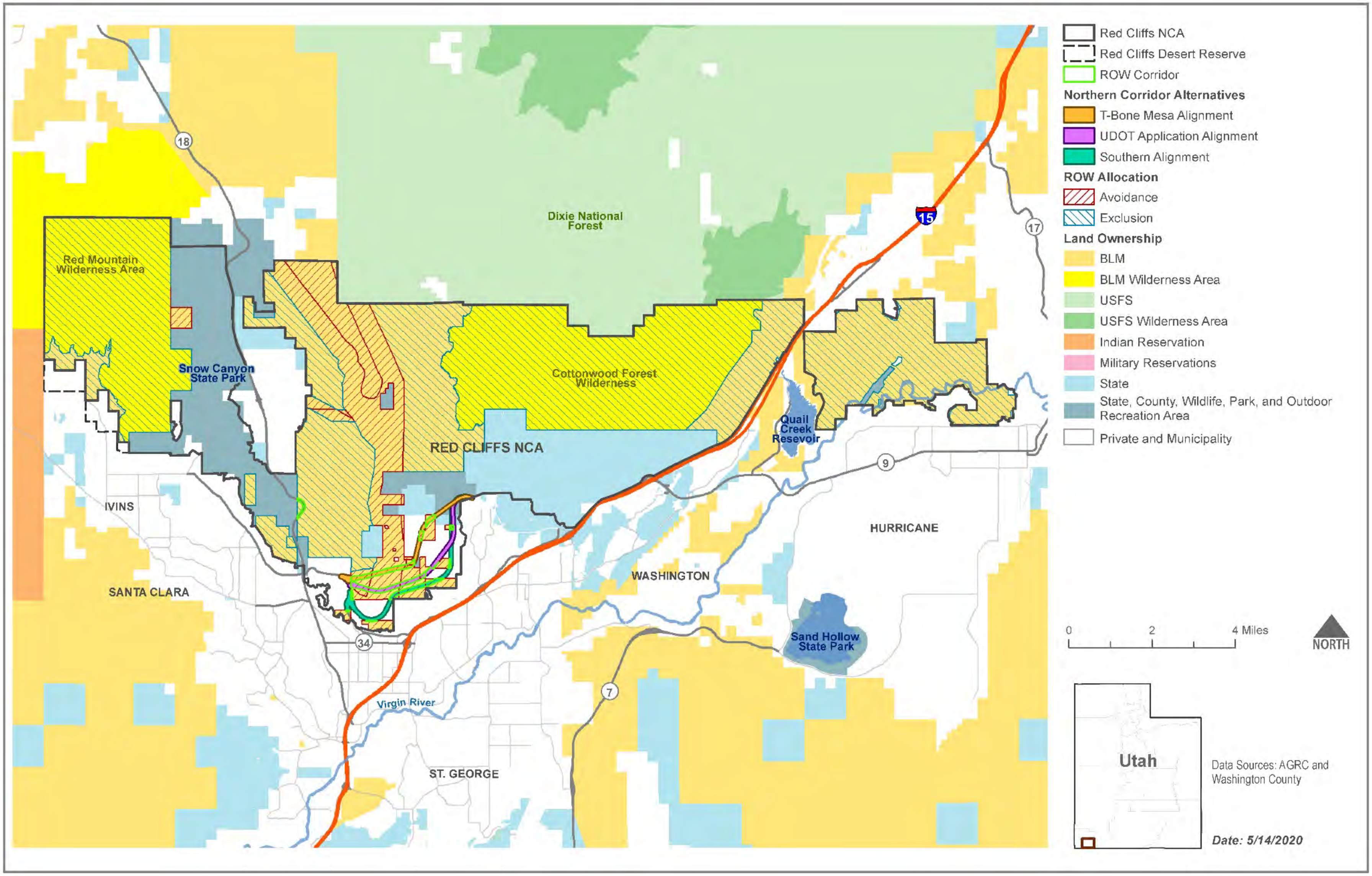
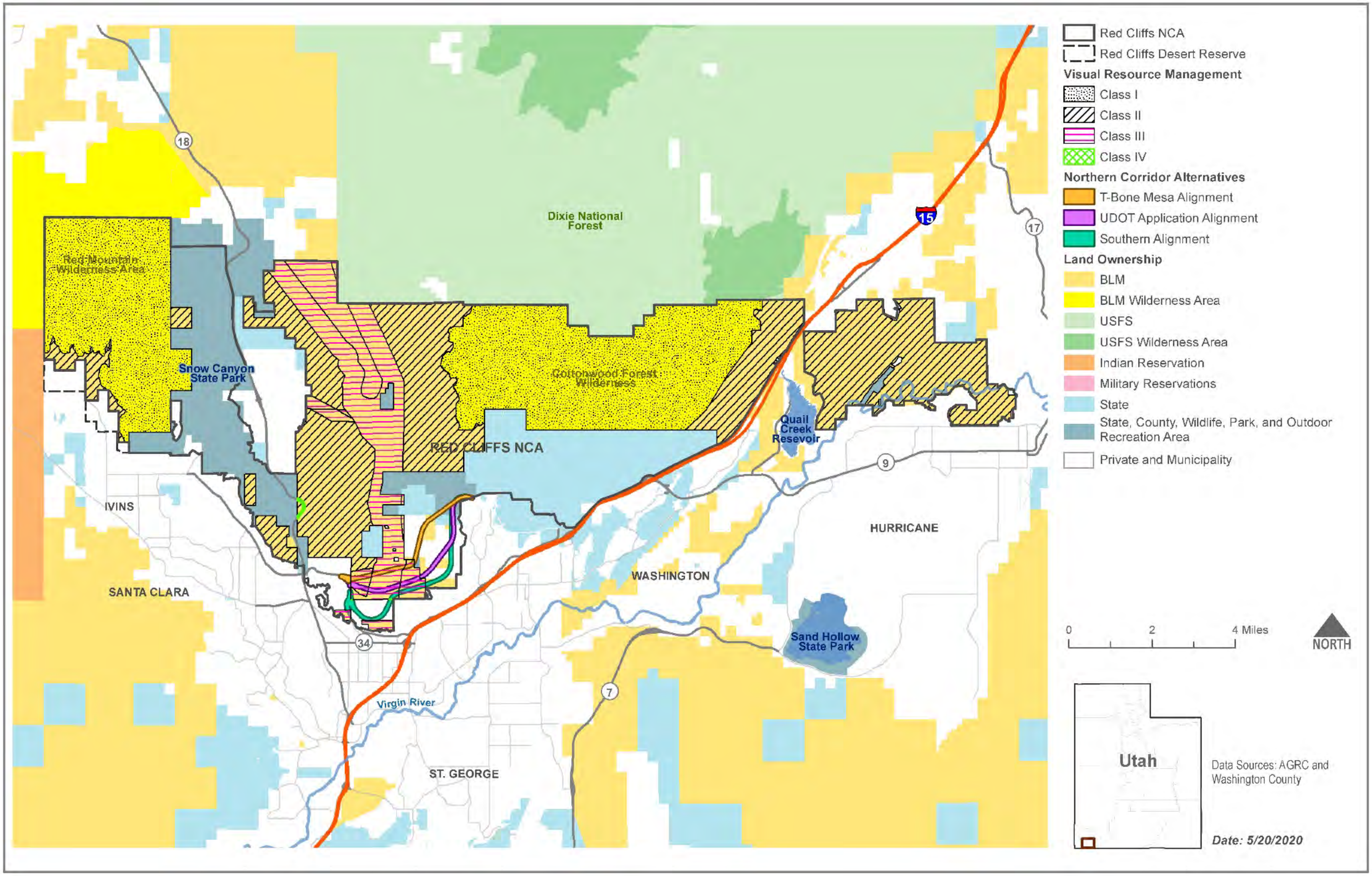
## Map 2.2-1. Northern Corridor Alternatives Considered in Detail



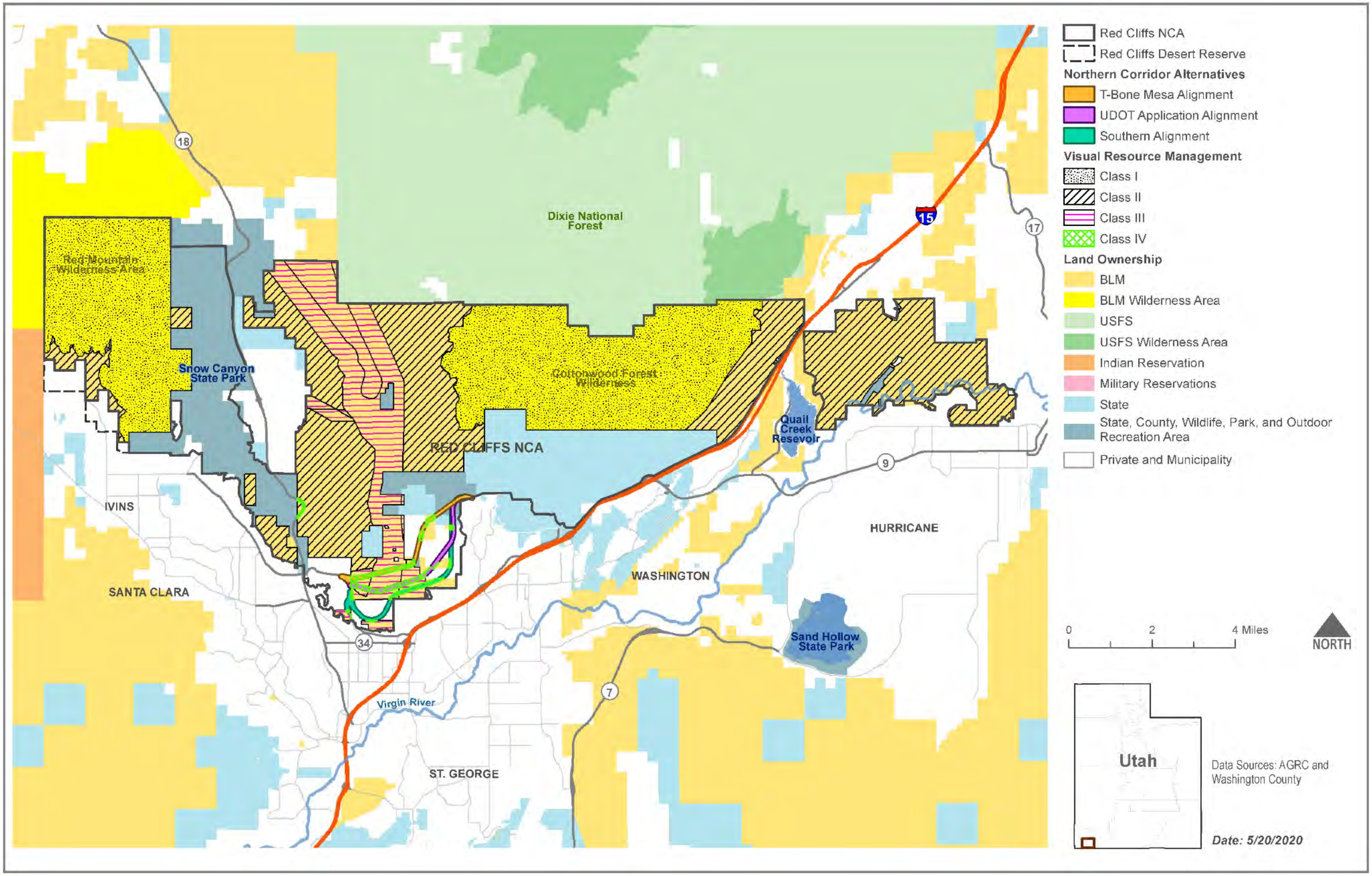
**Map 2.3-1. Red Cliffs NCA: Right-of-way Avoidance and Exclusion Areas – Amendment Alternative Locations**



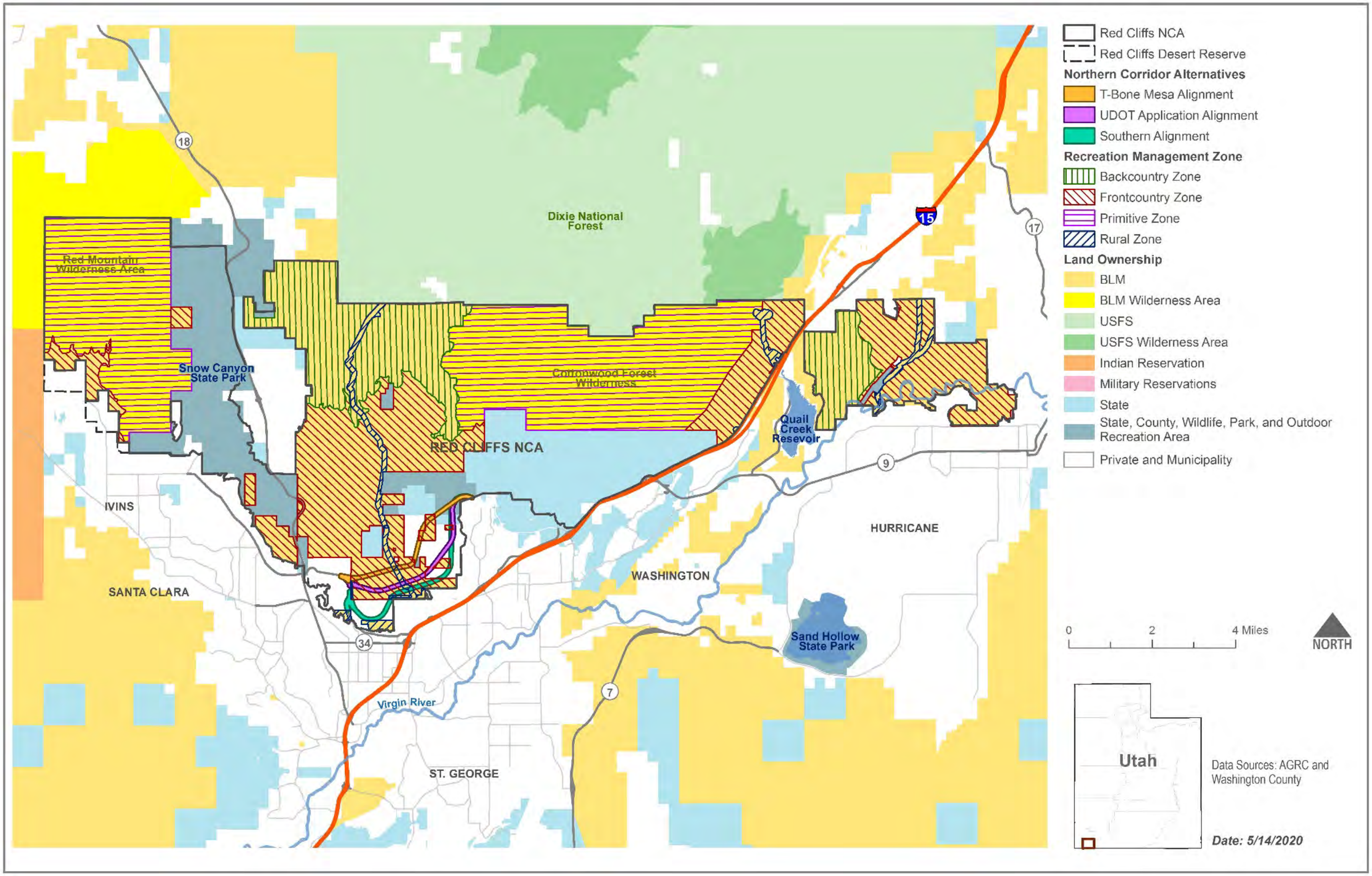
## Map 2.3-2. Red Cliffs NCA: VRM Classes – Red Cliffs NCA RMP Amendment Alternative A



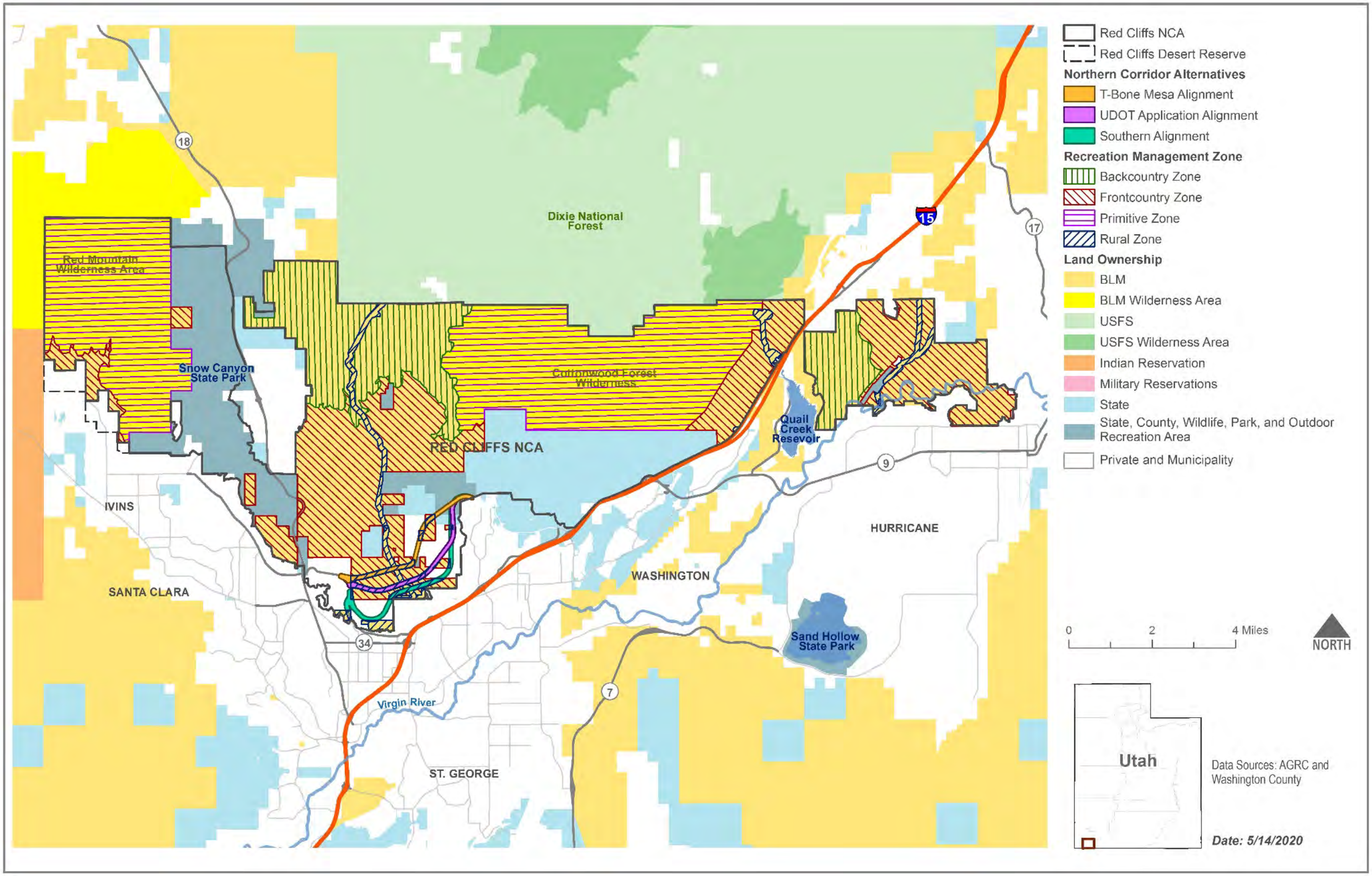
## Map 2.3-3. Red Cliffs NCA: VRM Classes – Red Cliffs NCA RMP Amendment Alternatives B and C



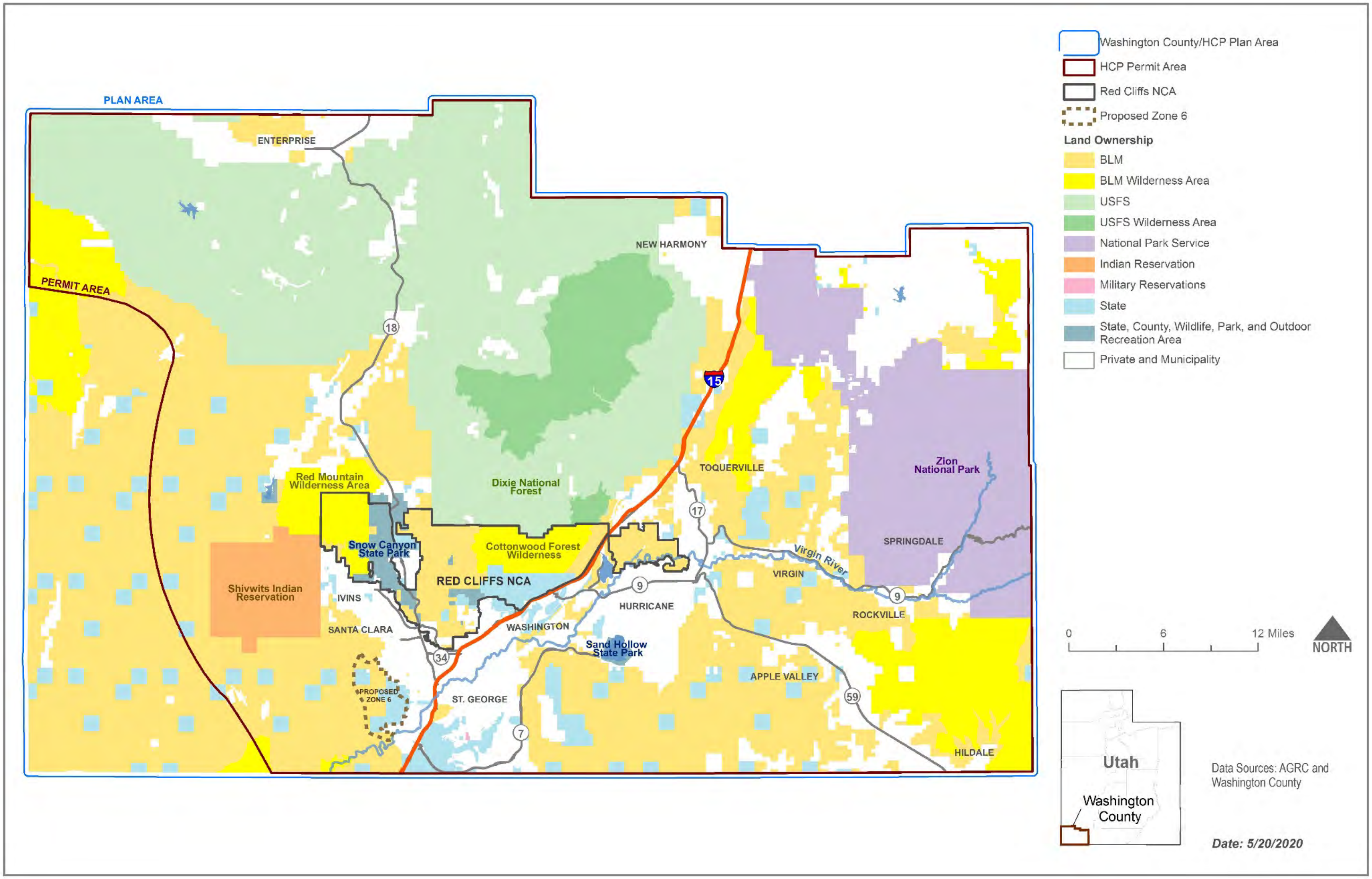
## Map 2.3-4. Red Cliffs NCA: Recreation Management Zones – Red Cliffs NCA RMP Amendment Alternative A



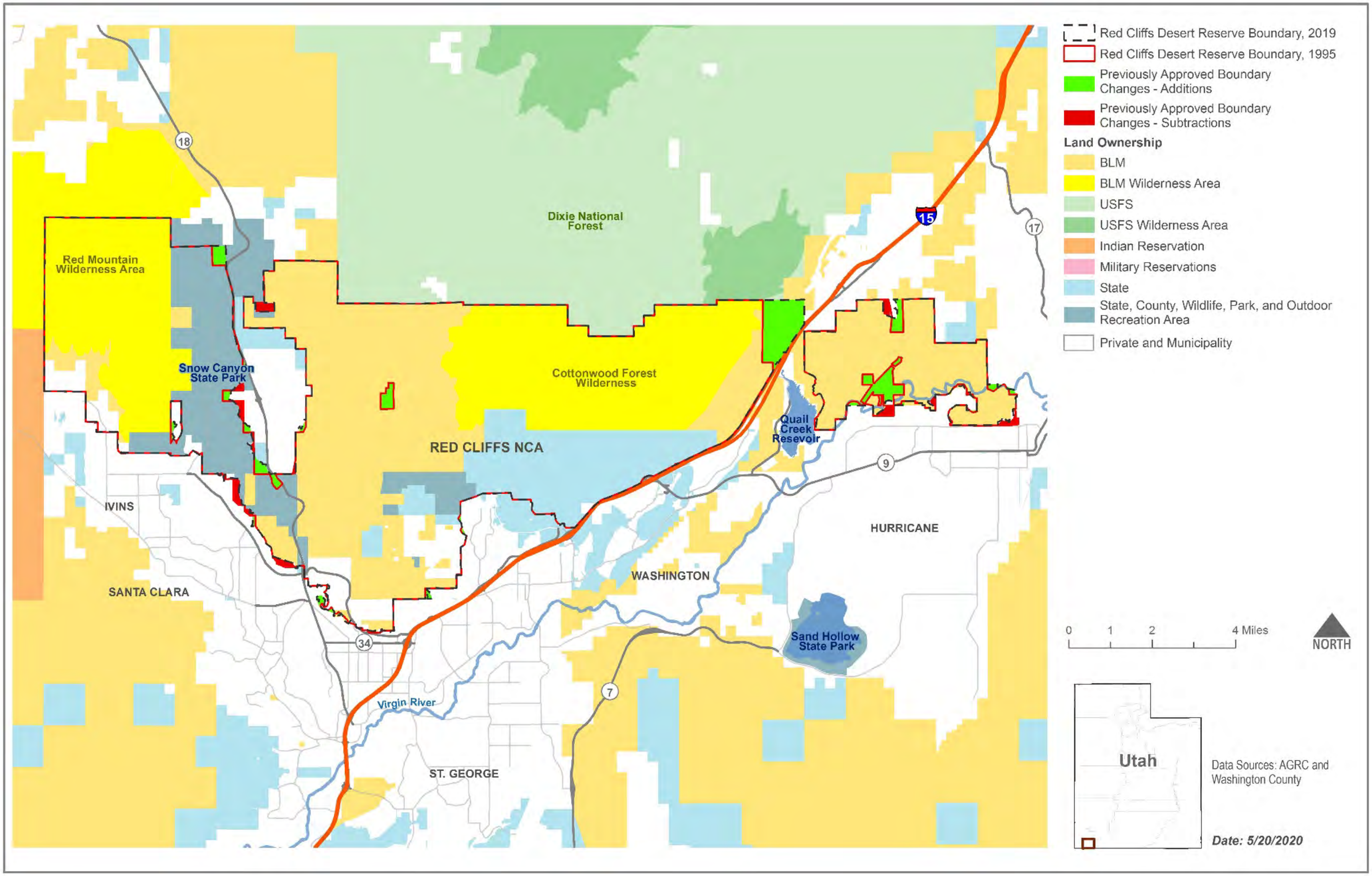
## Map 2.3-5. Red Cliffs NCA: Recreation Management Zones – Red Cliffs NCA RMP Amendment Alternatives B and C



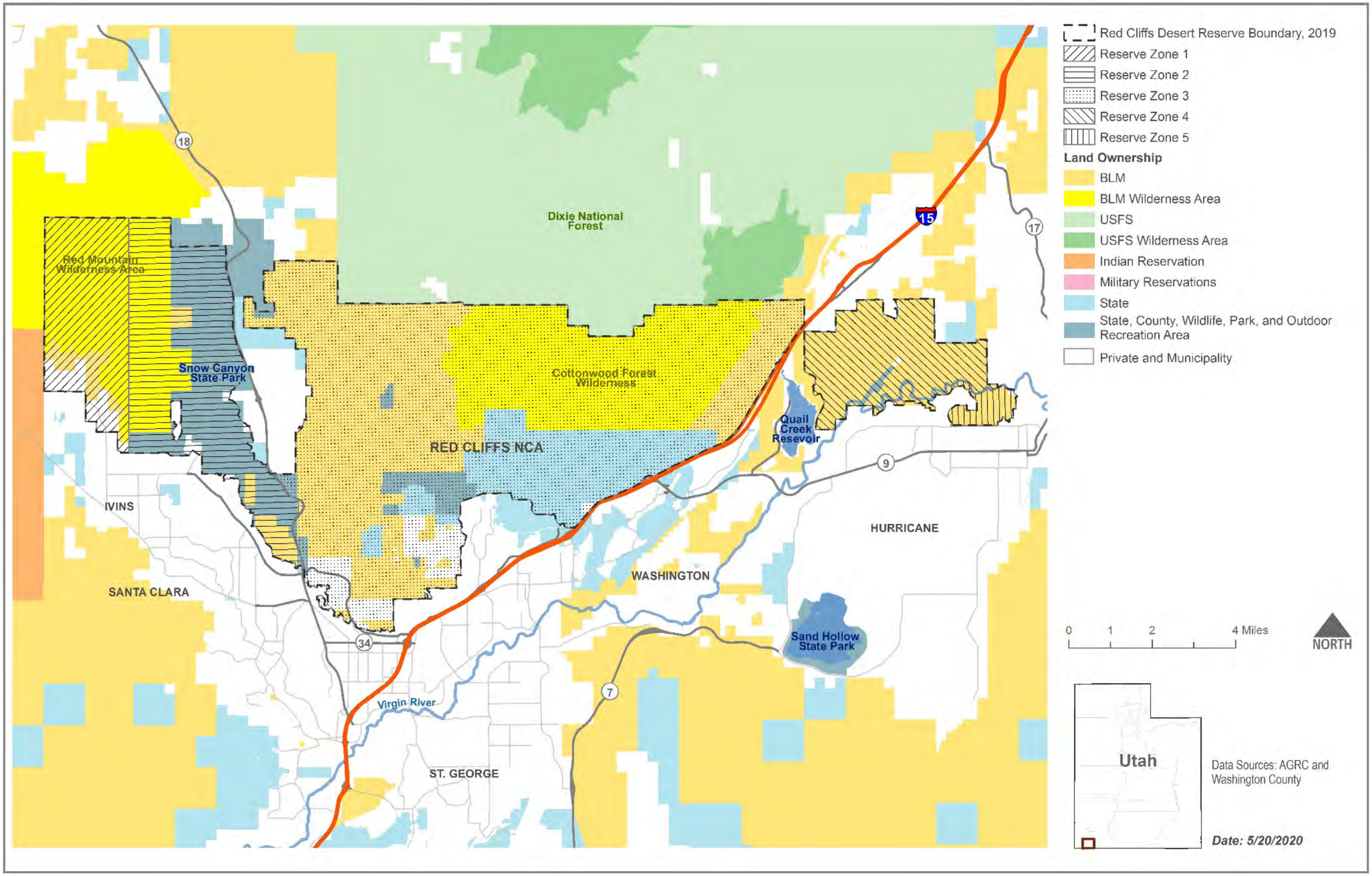
## Map 2.4-1. Washington County HCP/ITP: Permit Area



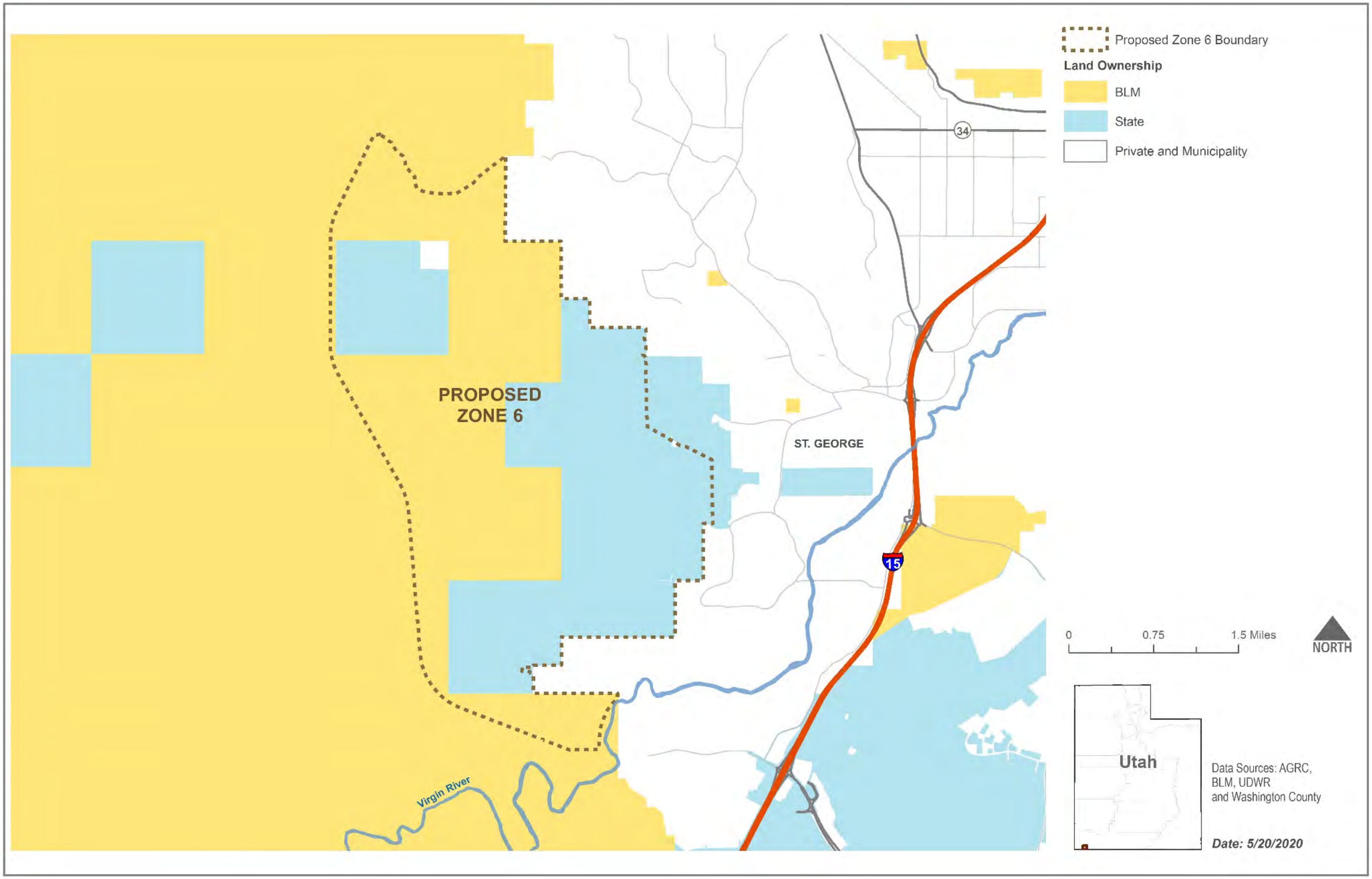
## Map 2.4-2. Washington County HCP/ITP: Red Cliffs Desert Reserve Boundary Changes



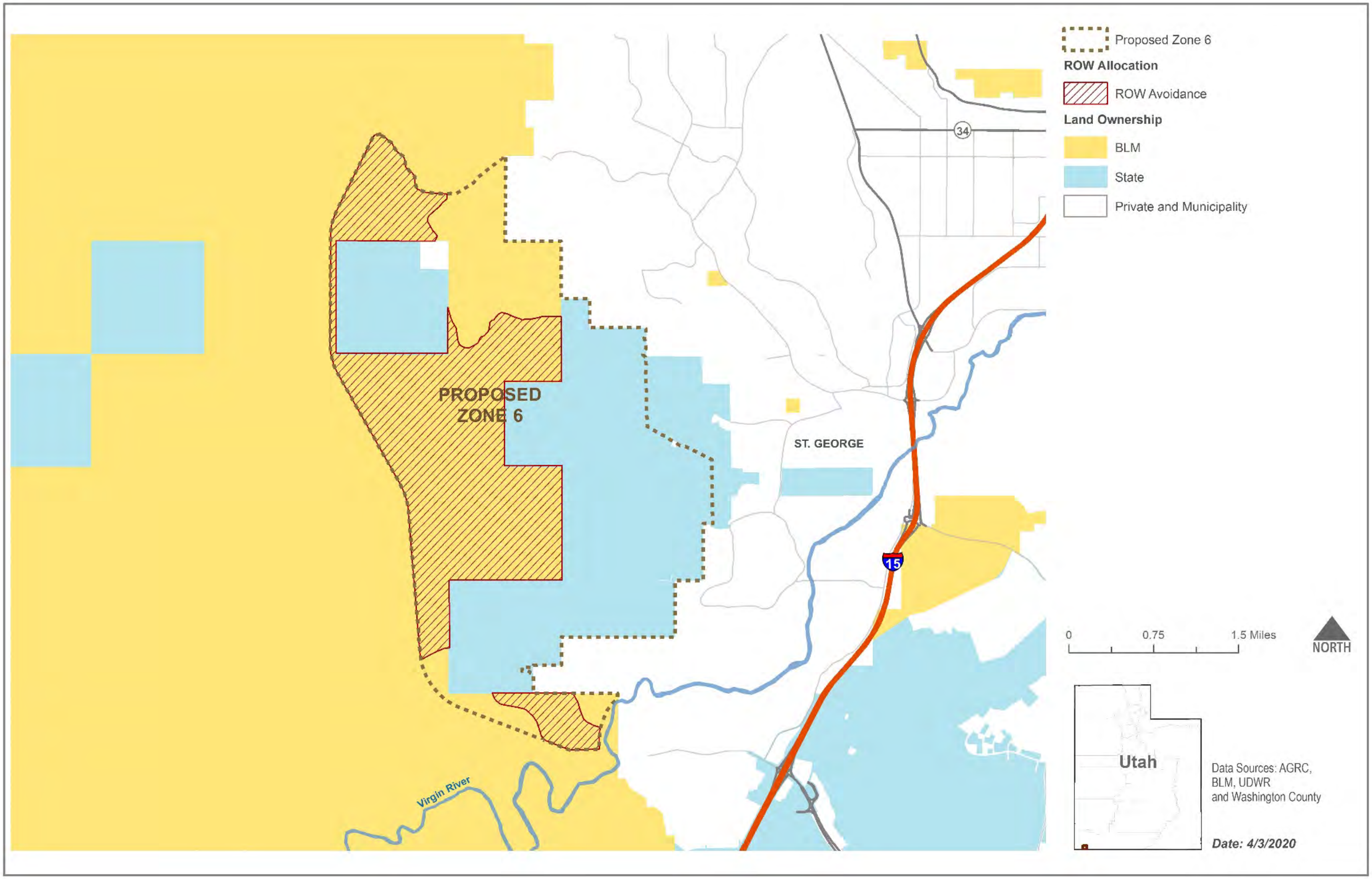
## Map 2.4-3. Washington County HCP/ITP: Red Cliffs Desert Reserve, Zones 1 to 5



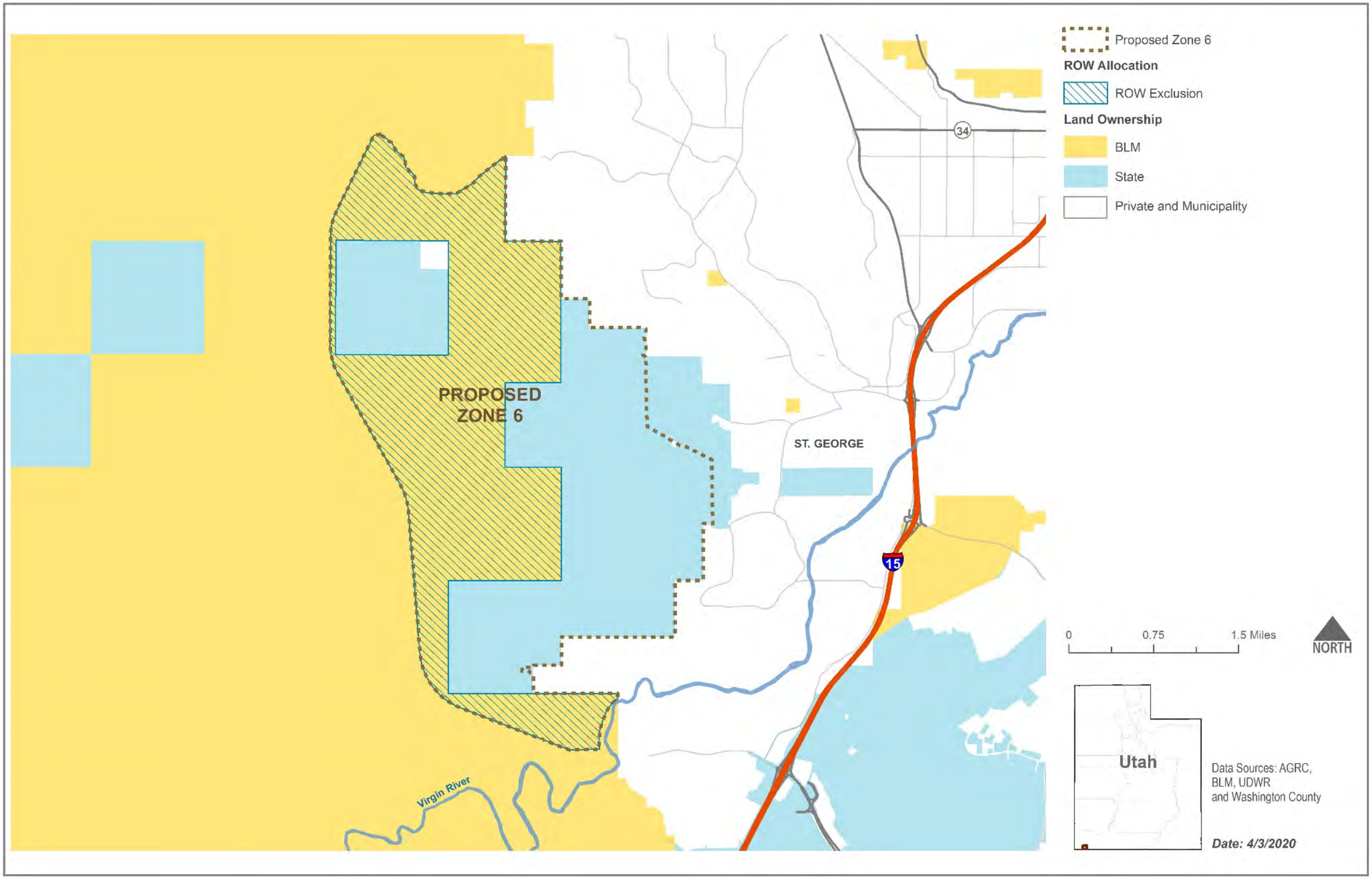
## Map 2.4-4. Washington County HCP/ITP: Proposed Zone 6



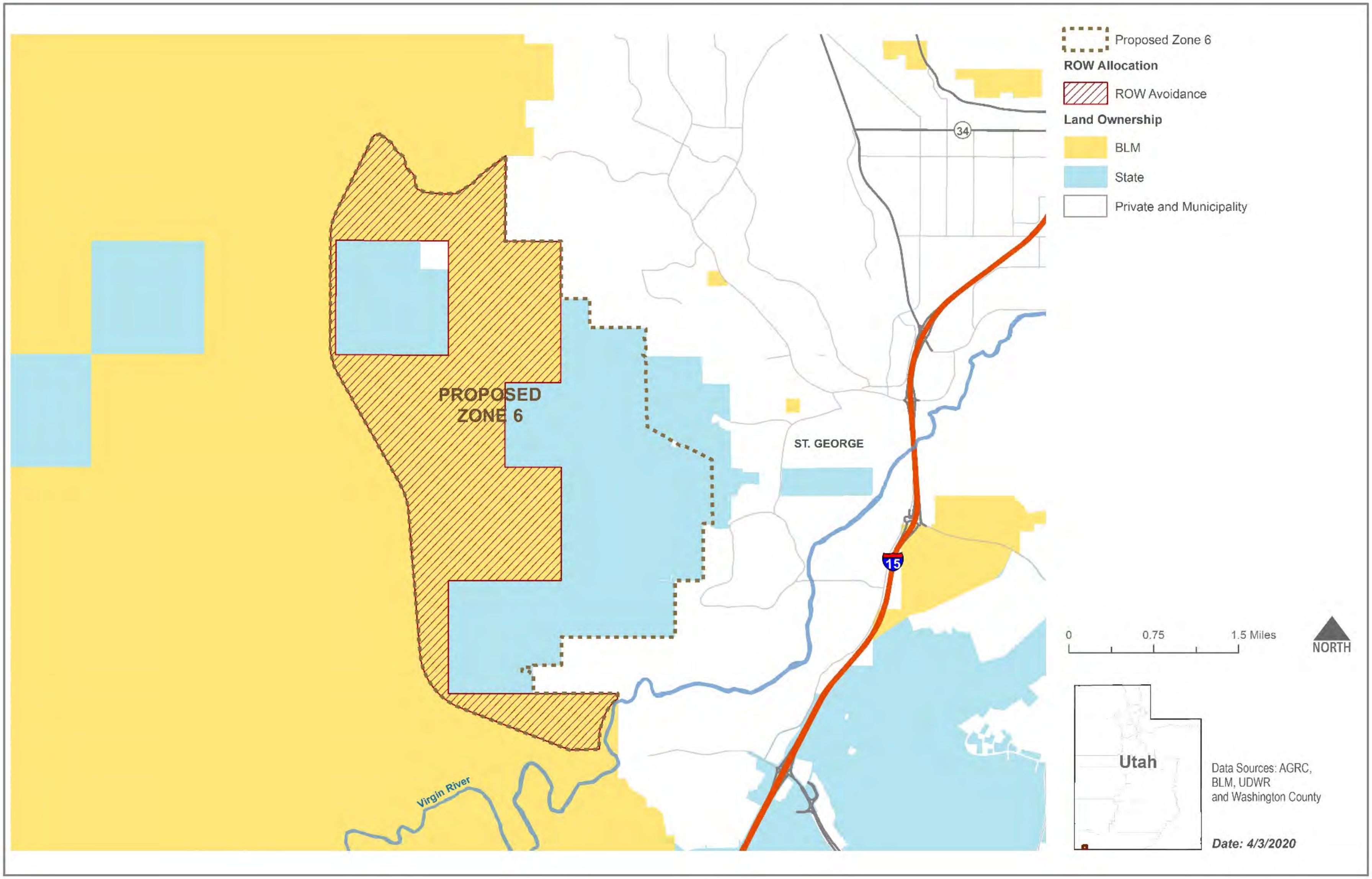
## Map 2.5-1. Proposed Zone 6: Right-of-way Avoidance and Exclusion Areas – SGFO RMP Amendment Alternative A



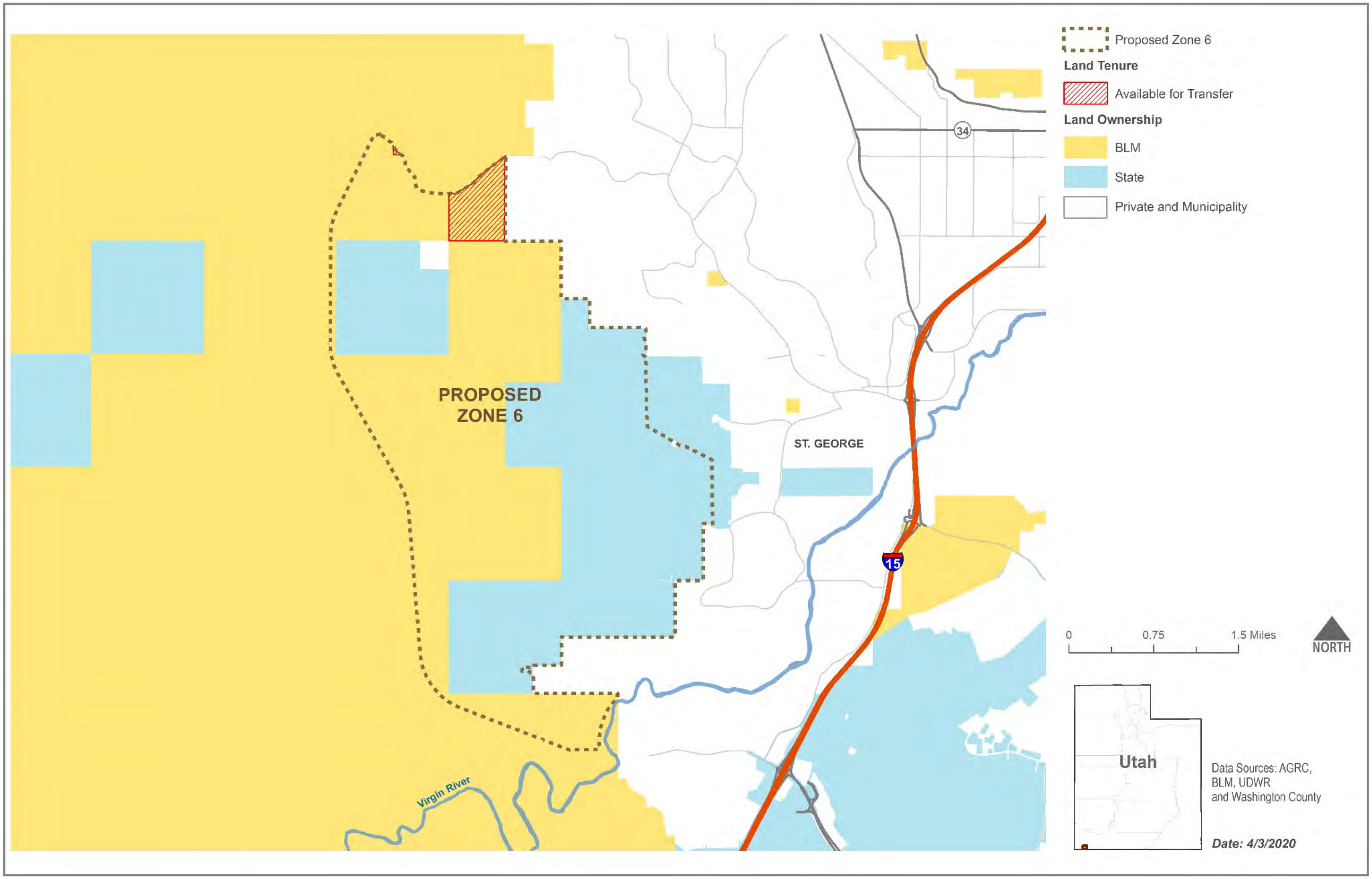
**Map 2.5-2. Proposed Zone 6: Right-of-way Avoidance and Exclusion Areas – SGFO RMP Amendment Alternative B**



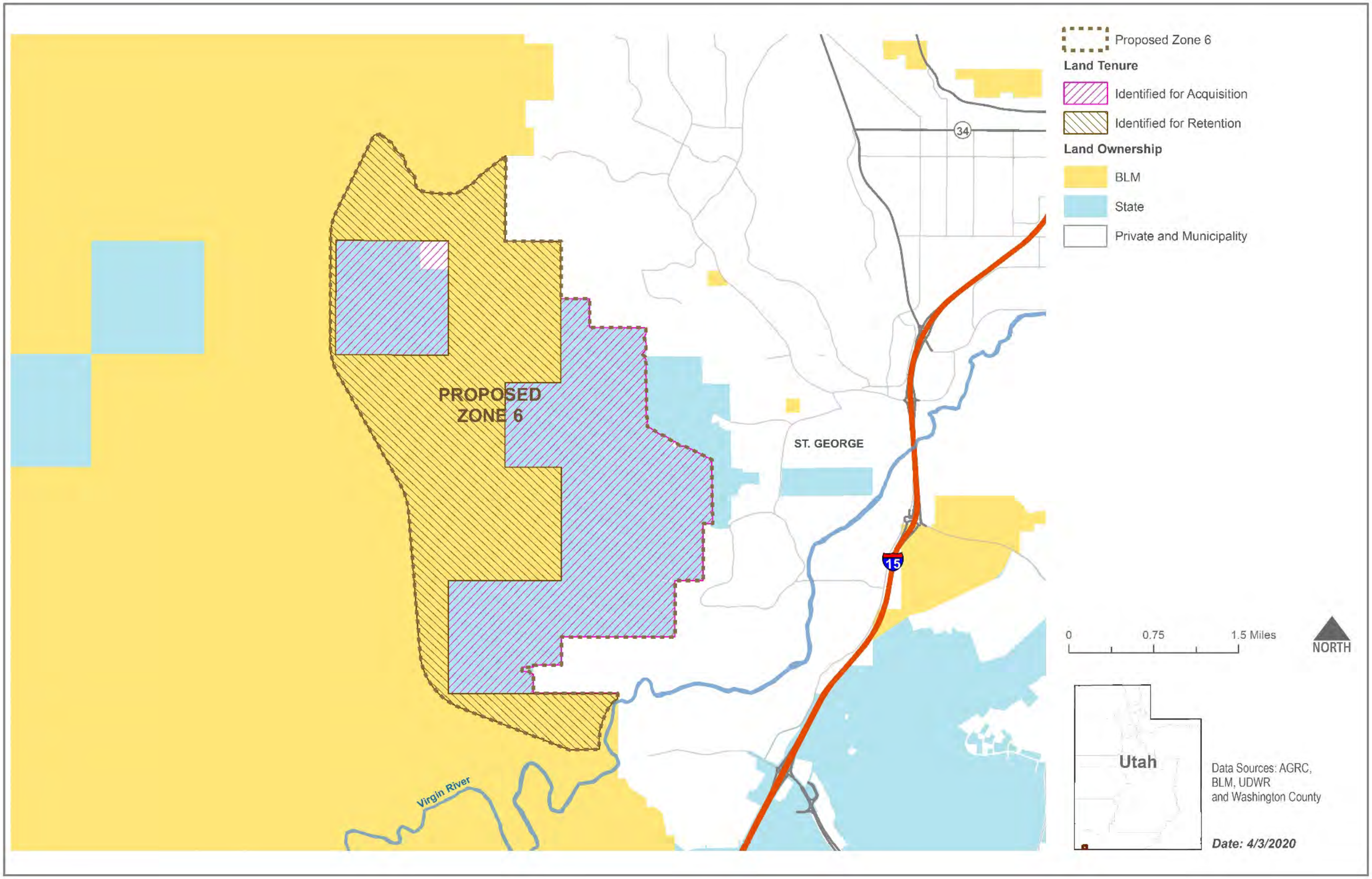
## Map 2.5-3. Proposed Zone 6: Right-of-way Avoidance and Exclusion Areas – SGFO RMP Amendment Alternative C



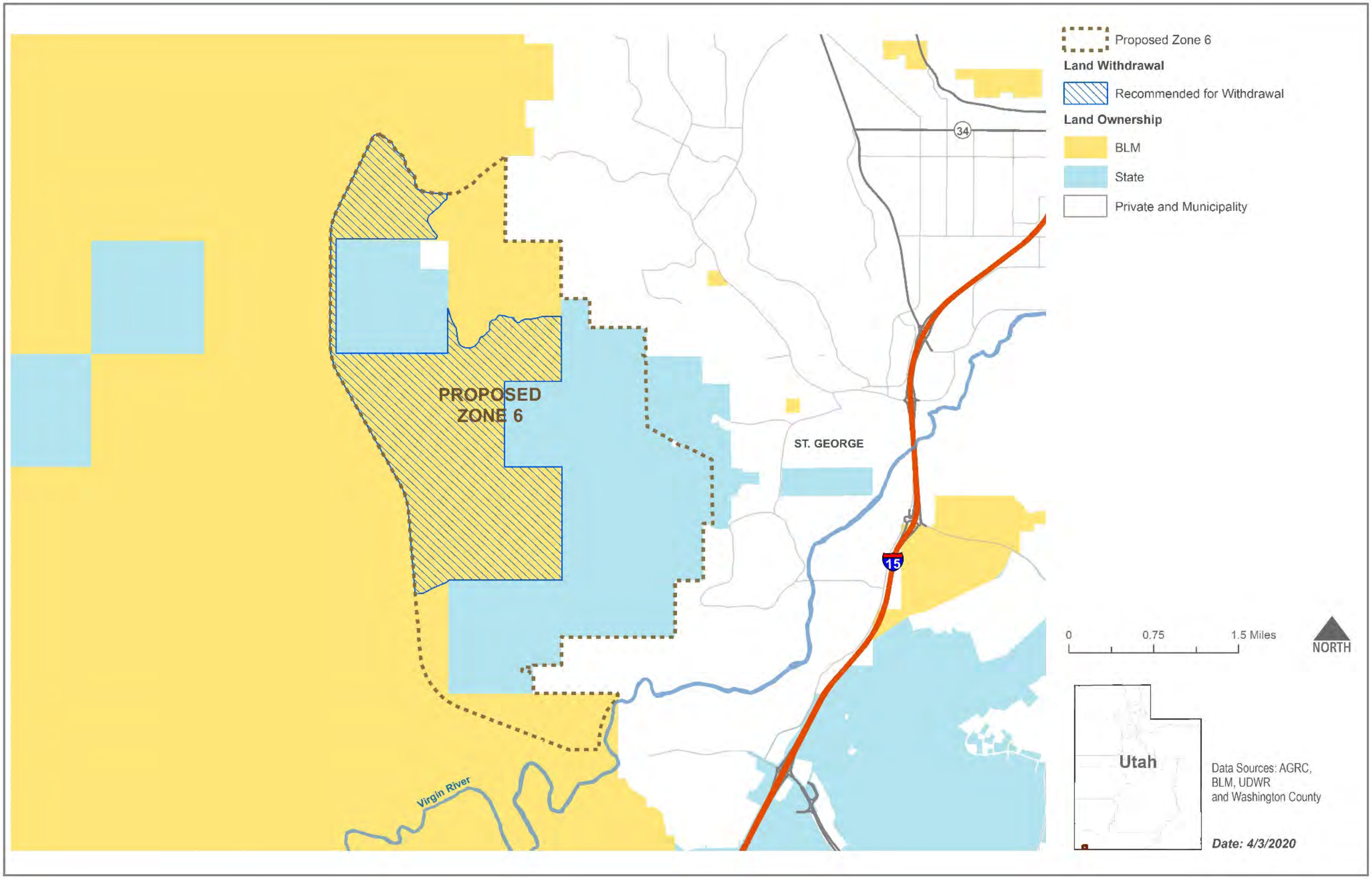
## Map 2.5-4. Proposed Zone 6: Land Tenure – SGFO RMP Amendment Alternative A



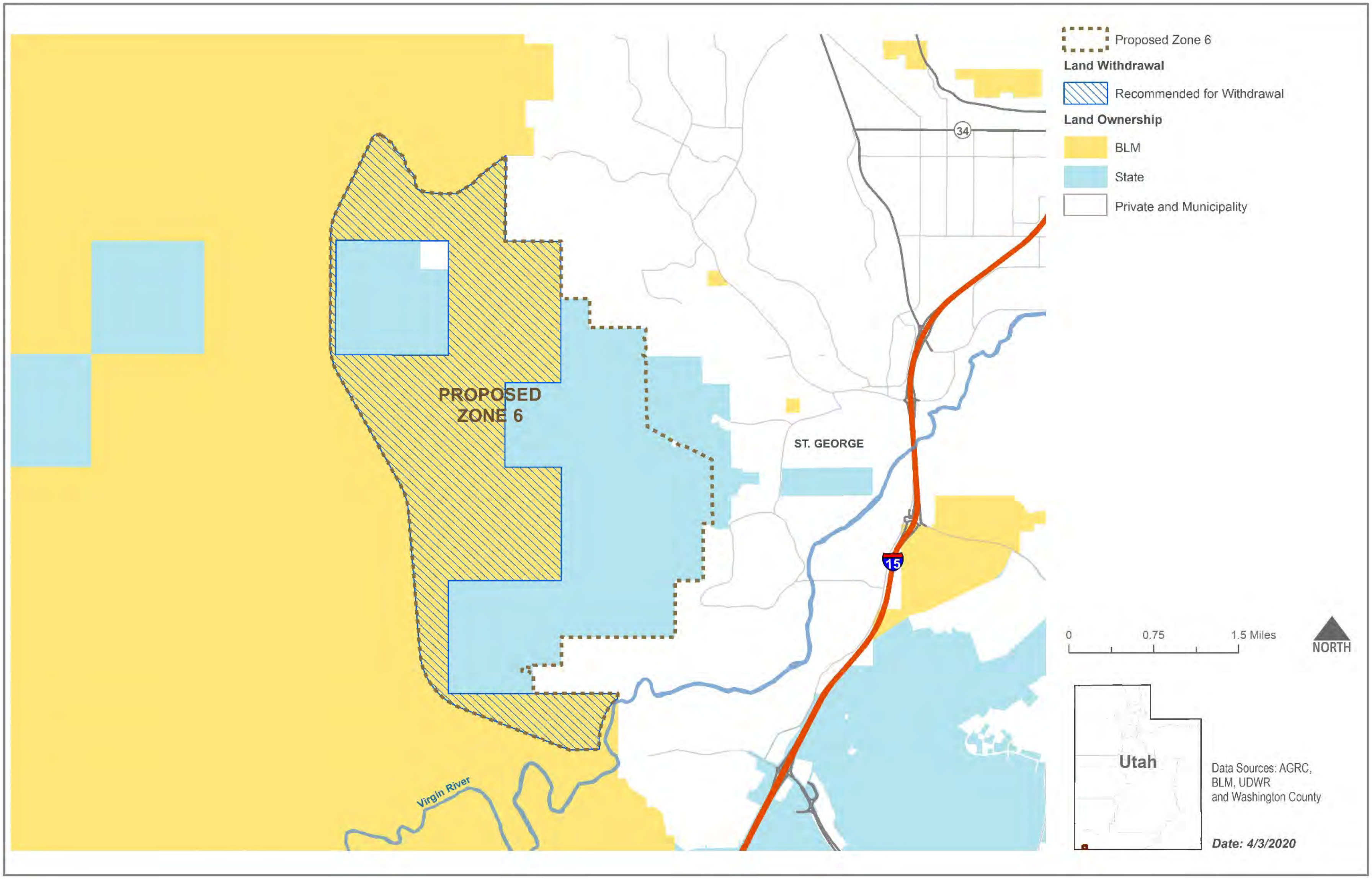
## Map 2.5-5. Proposed Zone 6: Land Tenure – SGFO RMP Amendment Alternatives B and C



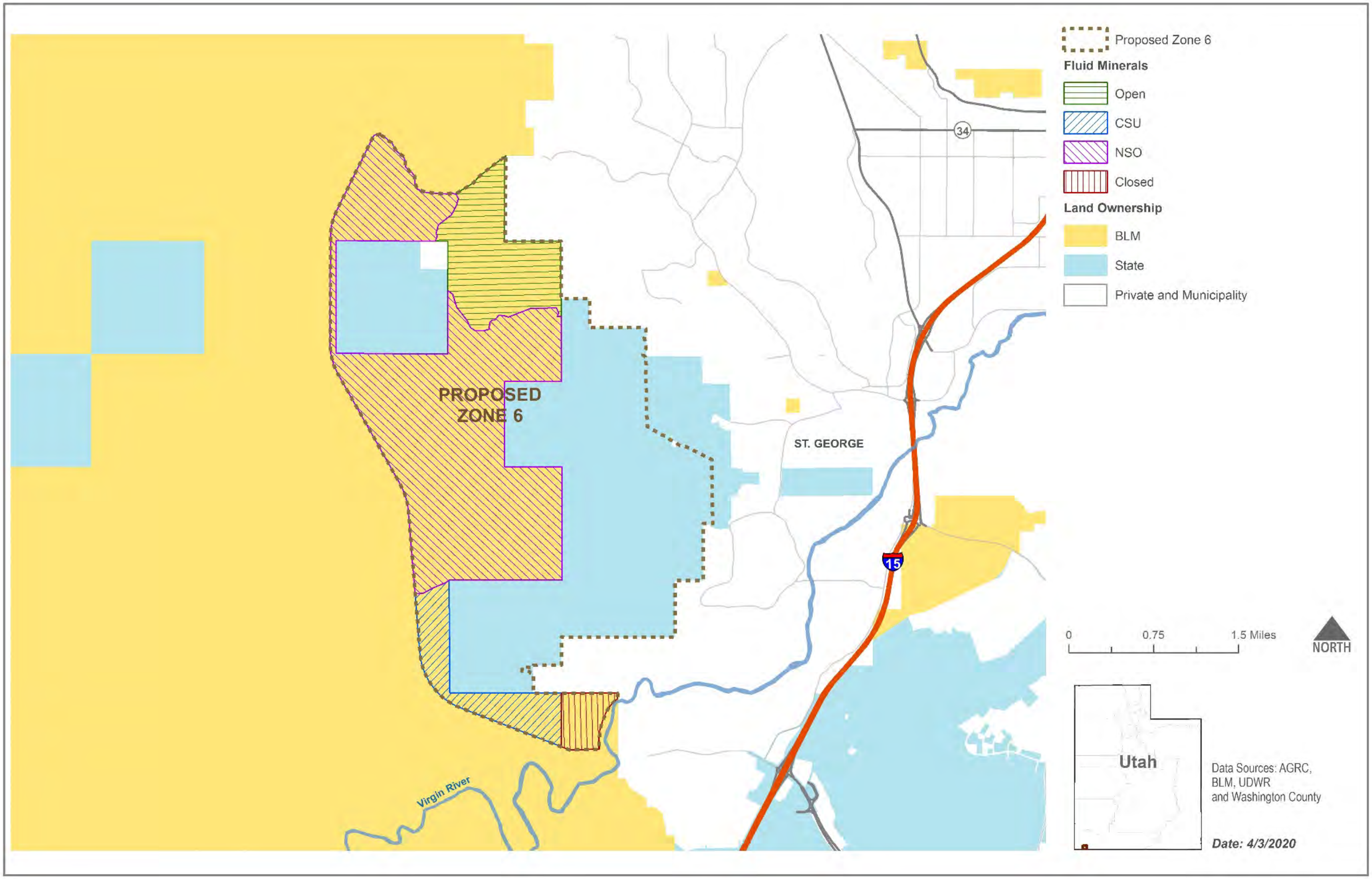
## Map 2.5-6. Proposed Zone 6: Land Withdrawal – SGFO RMP Amendment Alternative A



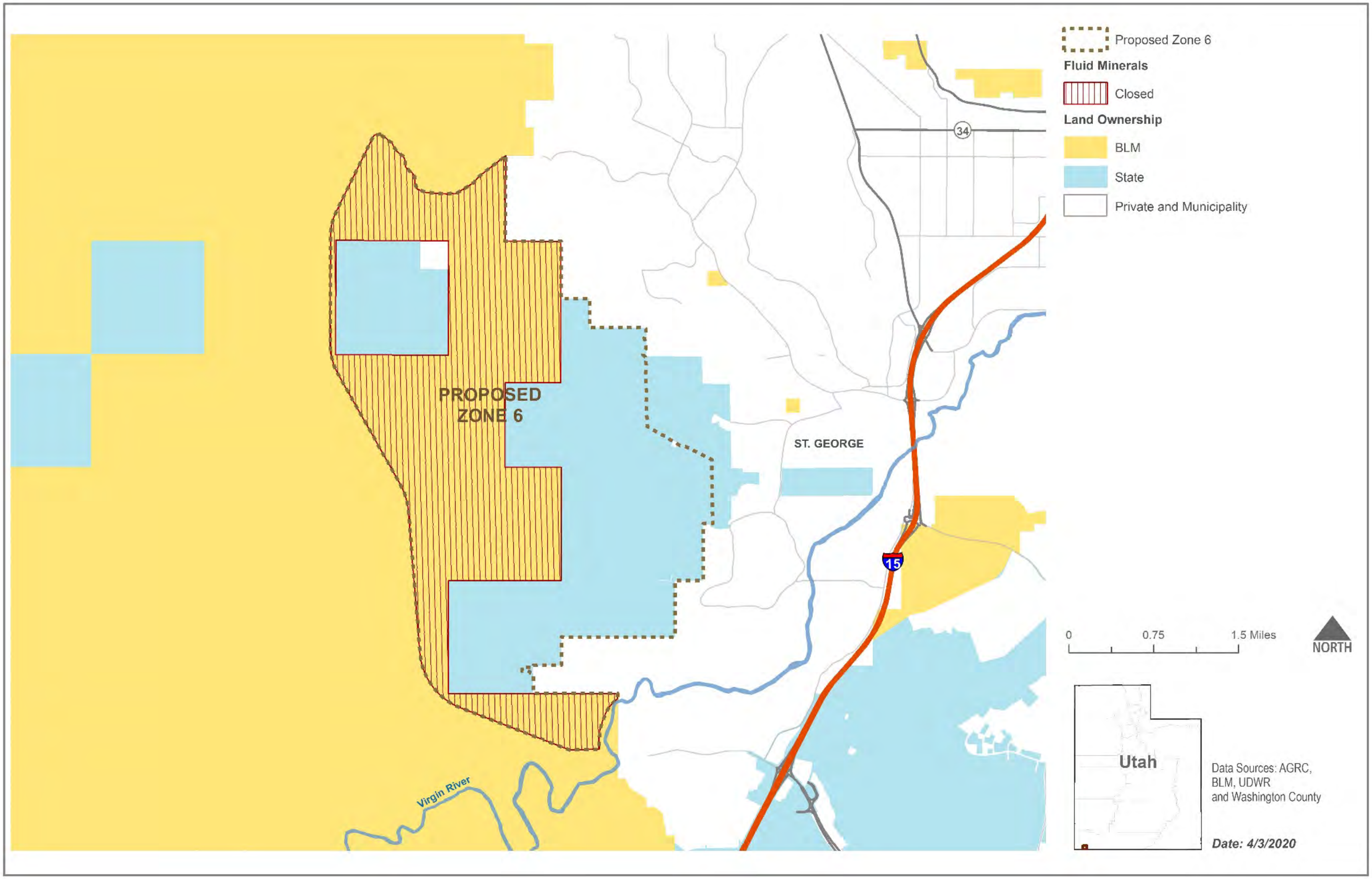
## Map 2.5-7. Proposed Zone 6: Land Withdrawal – SGFO RMP Amendment Alternatives B and C



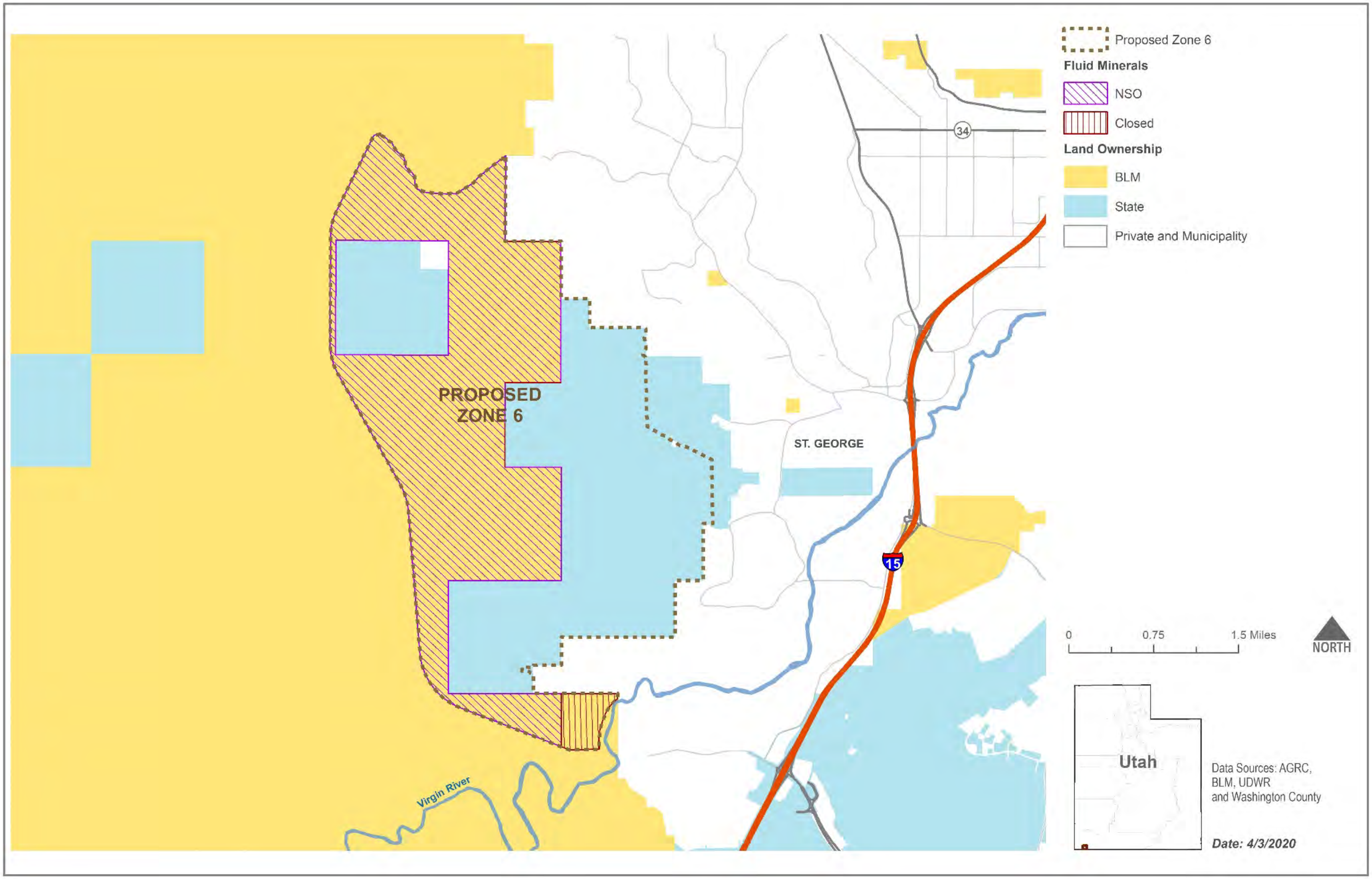
## Map 2.5-8. Proposed Zone 6: Fluid Minerals – SGFO RMP Amendment Alternative A



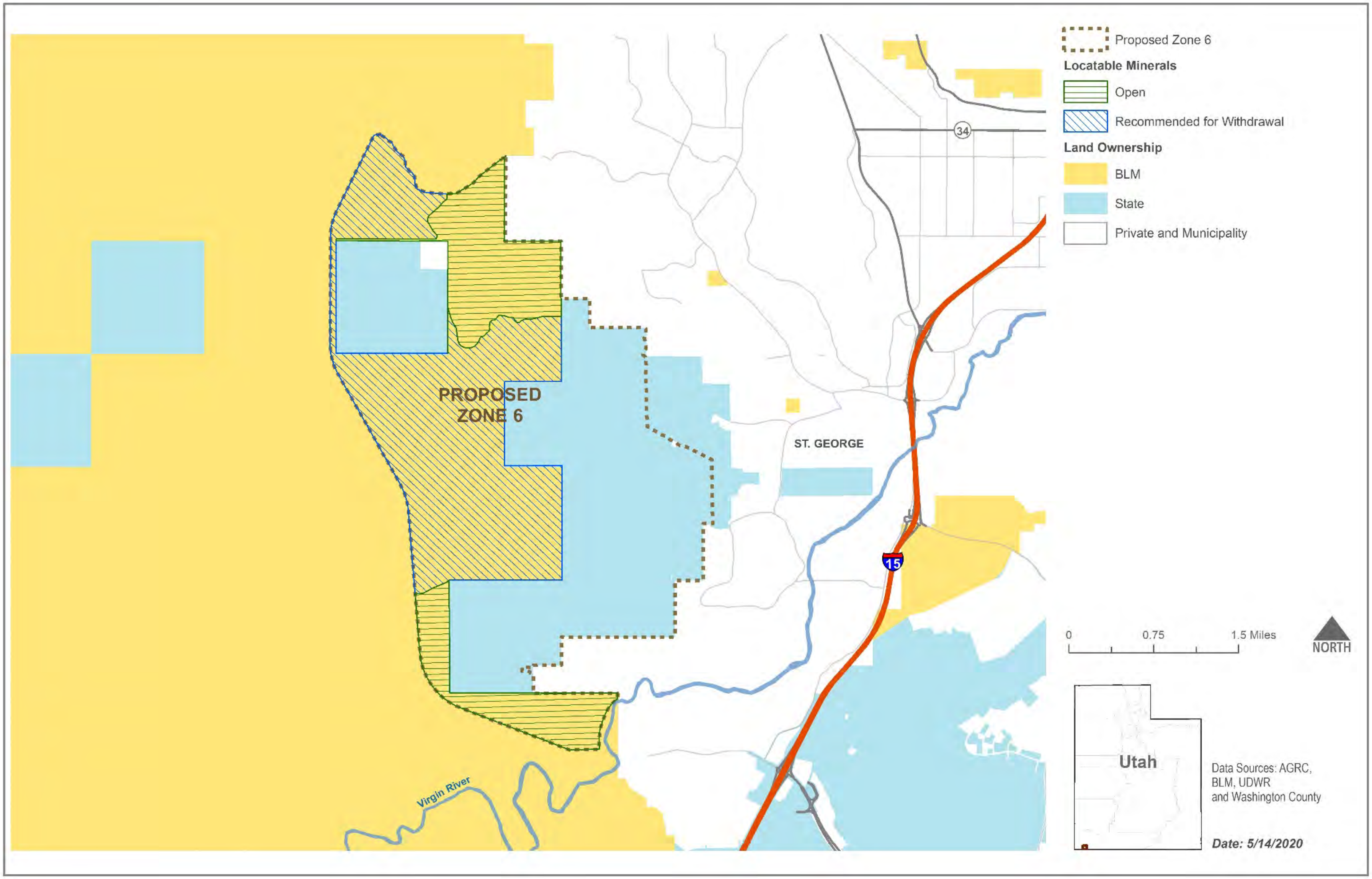
## Map 2.5-9. Proposed Zone 6: Fluid Minerals – SGFO RMP Amendment Alternative B



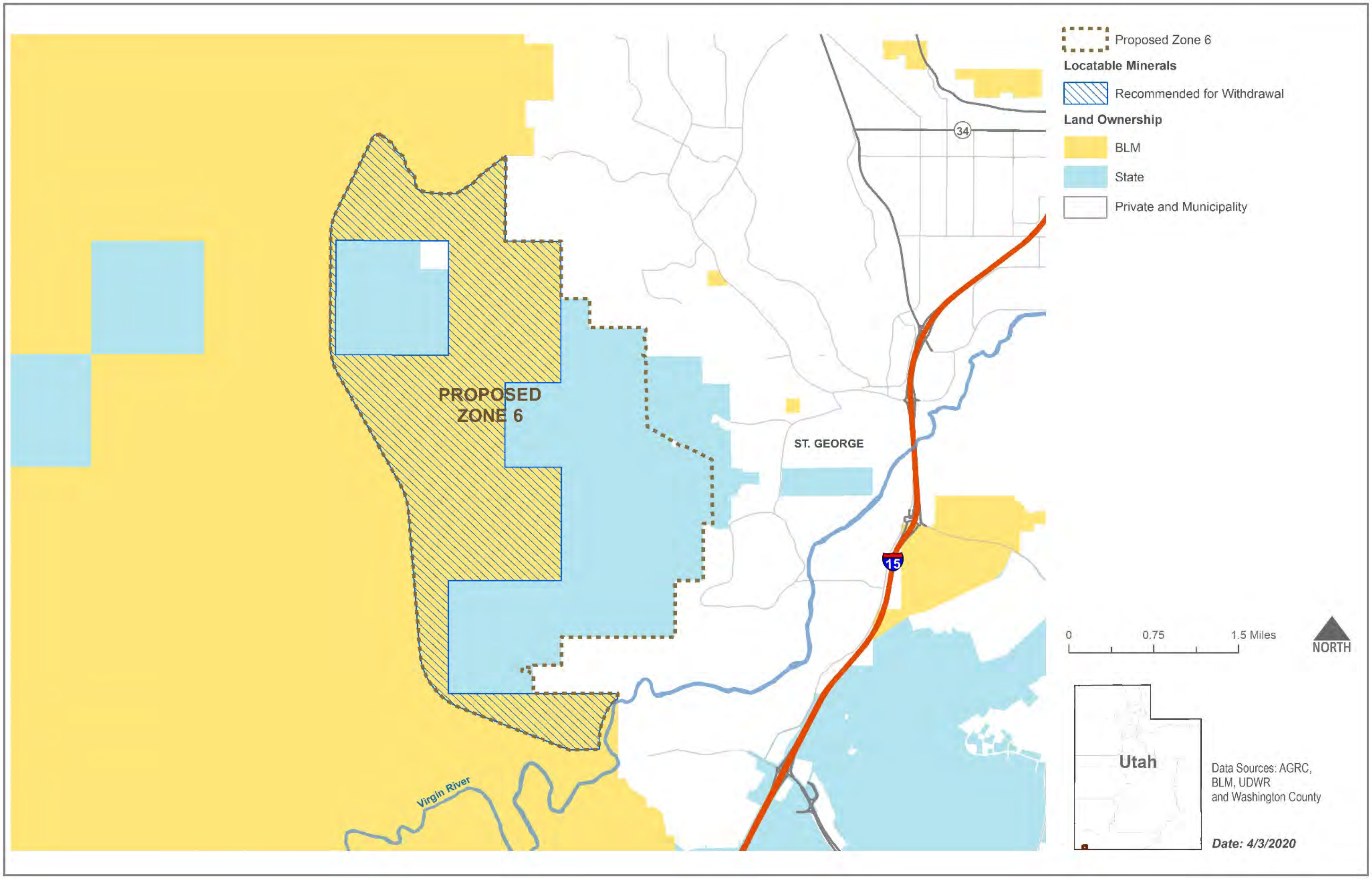
## Map 2.5-10. Proposed Zone 6: Fluid Minerals – SGFO RMP Amendment Alternative C



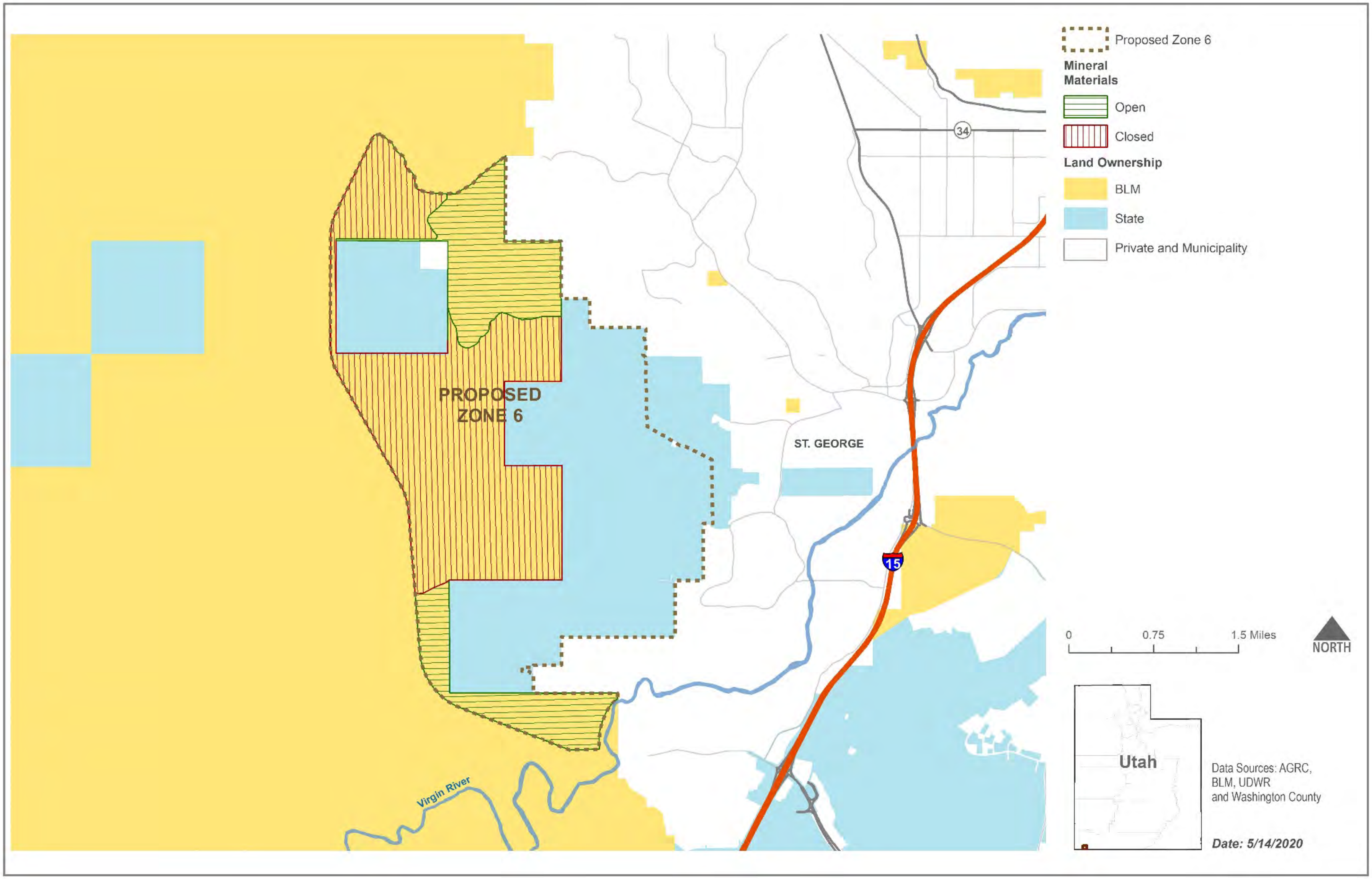
## Map 2.5-11. Proposed Zone 6: Locatable Minerals – SGFO RMP Amendment Alternative A



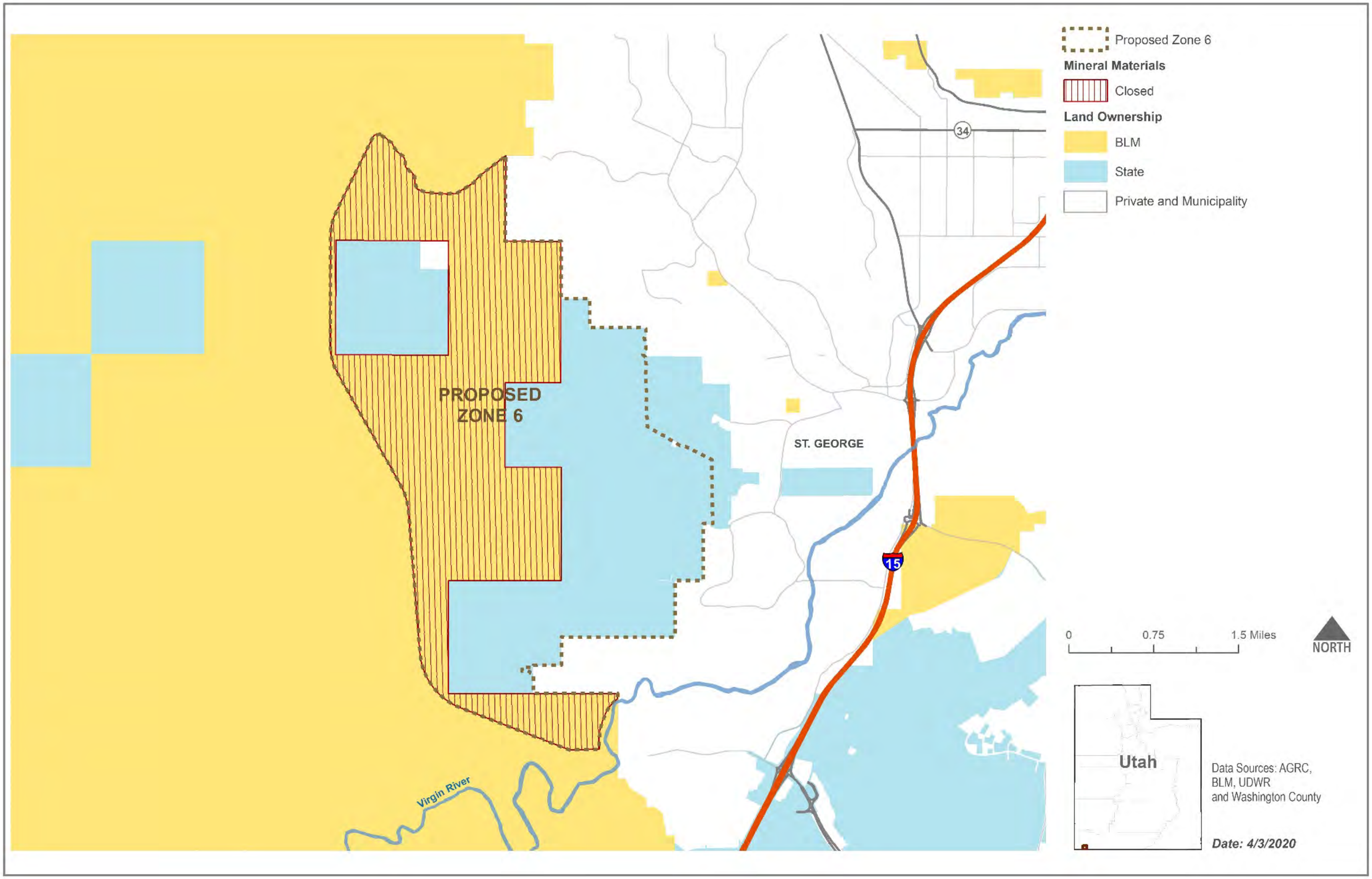
## Map 2.5-12. Proposed Zone 6: Locatable Minerals – SGFO RMP Amendment Alternatives B and C



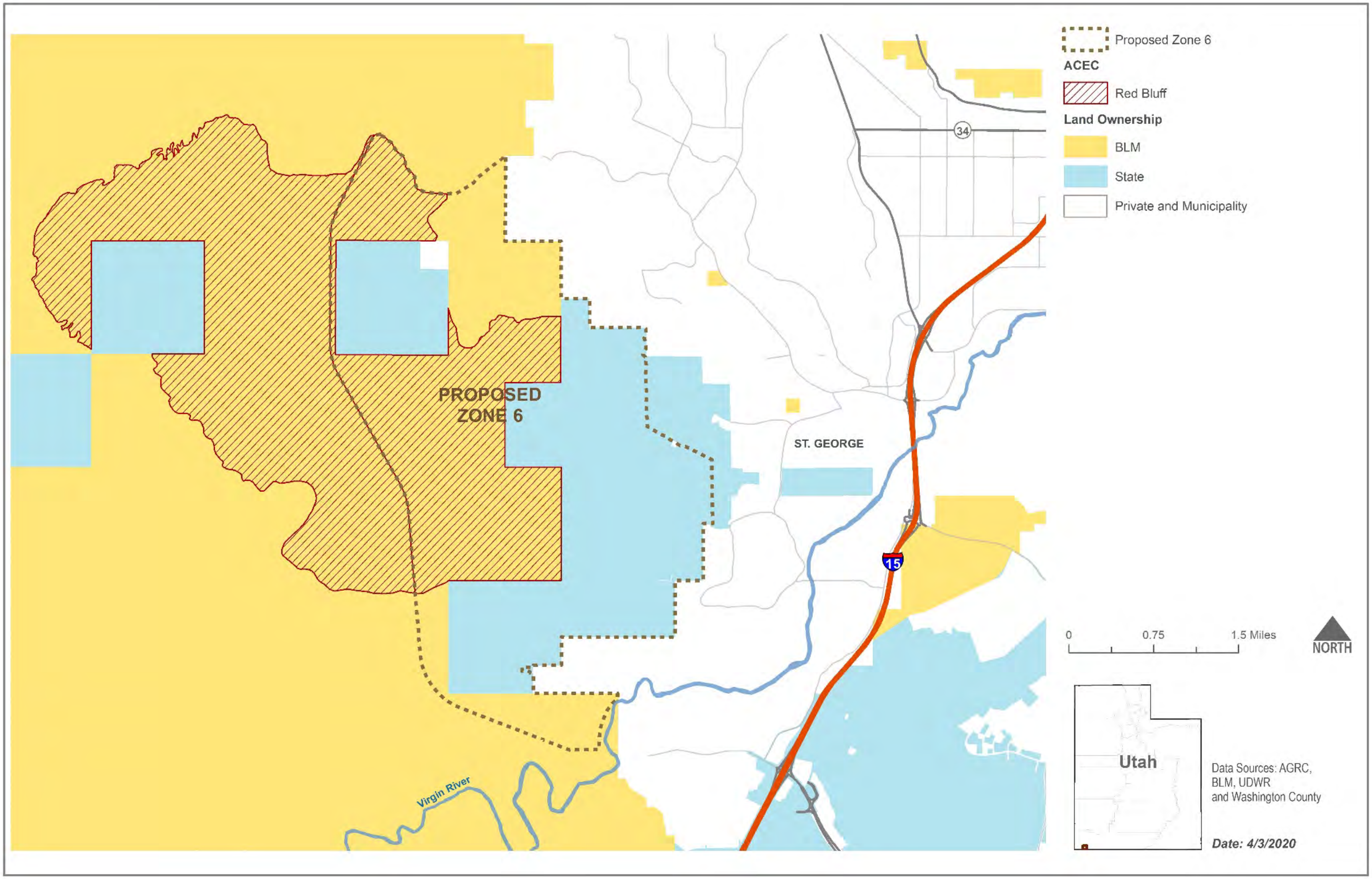
## Map 2.5-13. Proposed Zone 6: Mineral Materials – SGFO RMP Amendment Alternative A



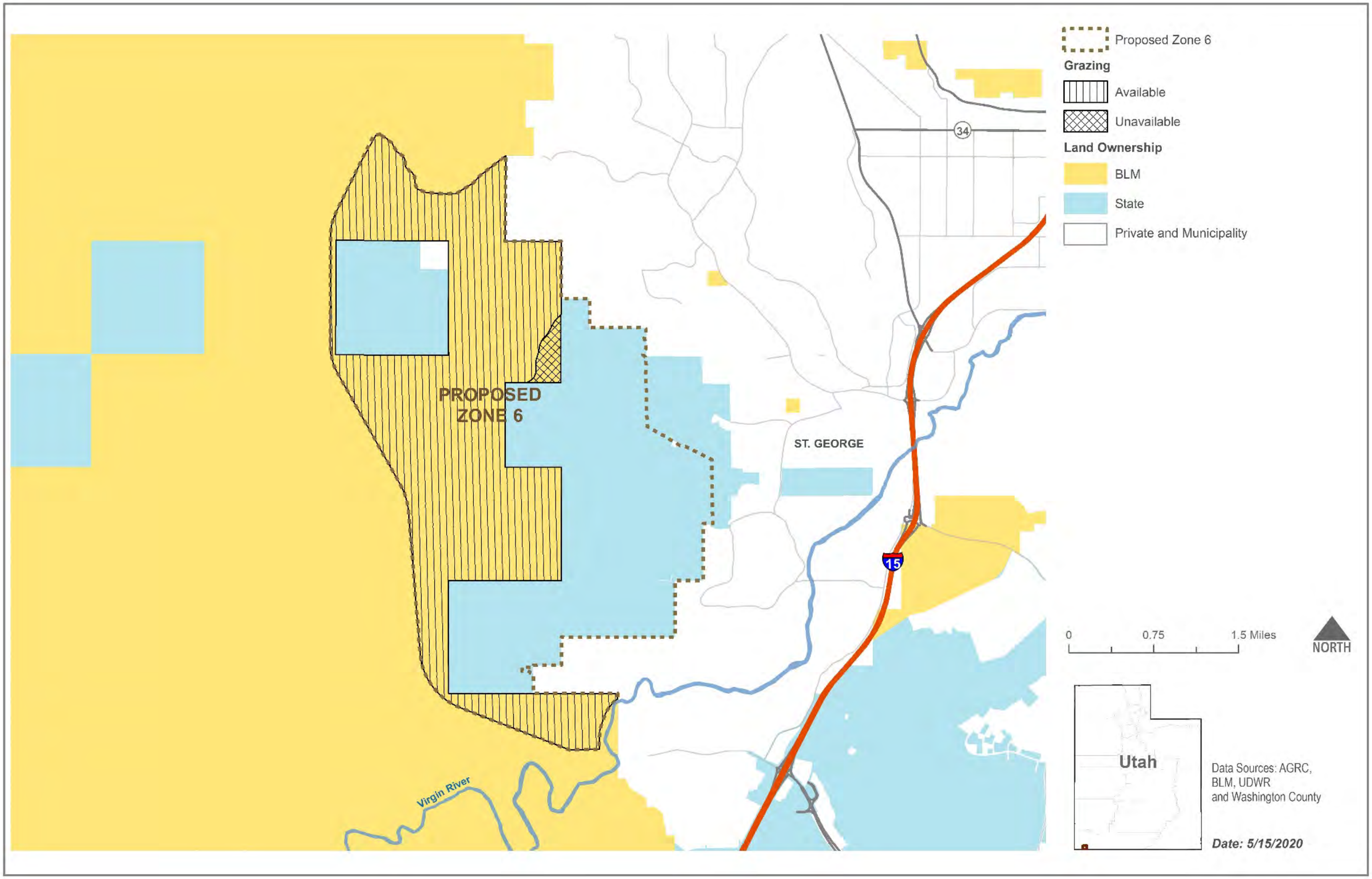
## Map 2.5-14. Proposed Zone 6: Mineral Materials – SGFO RMP Amendment Alternatives B and C



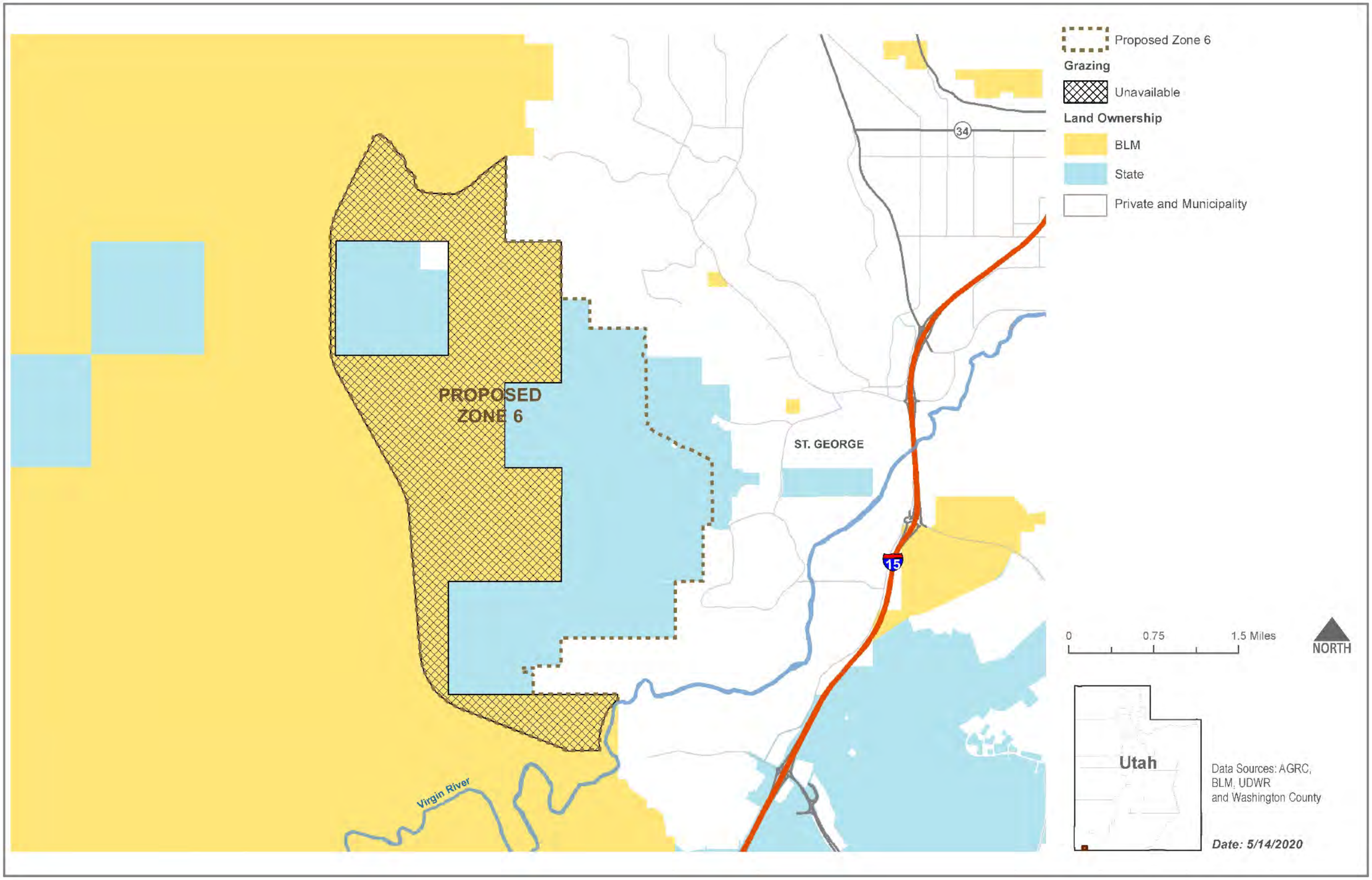
## Map 2.5-15. Area of Critical Environmental Concern within Proposed Zone 6



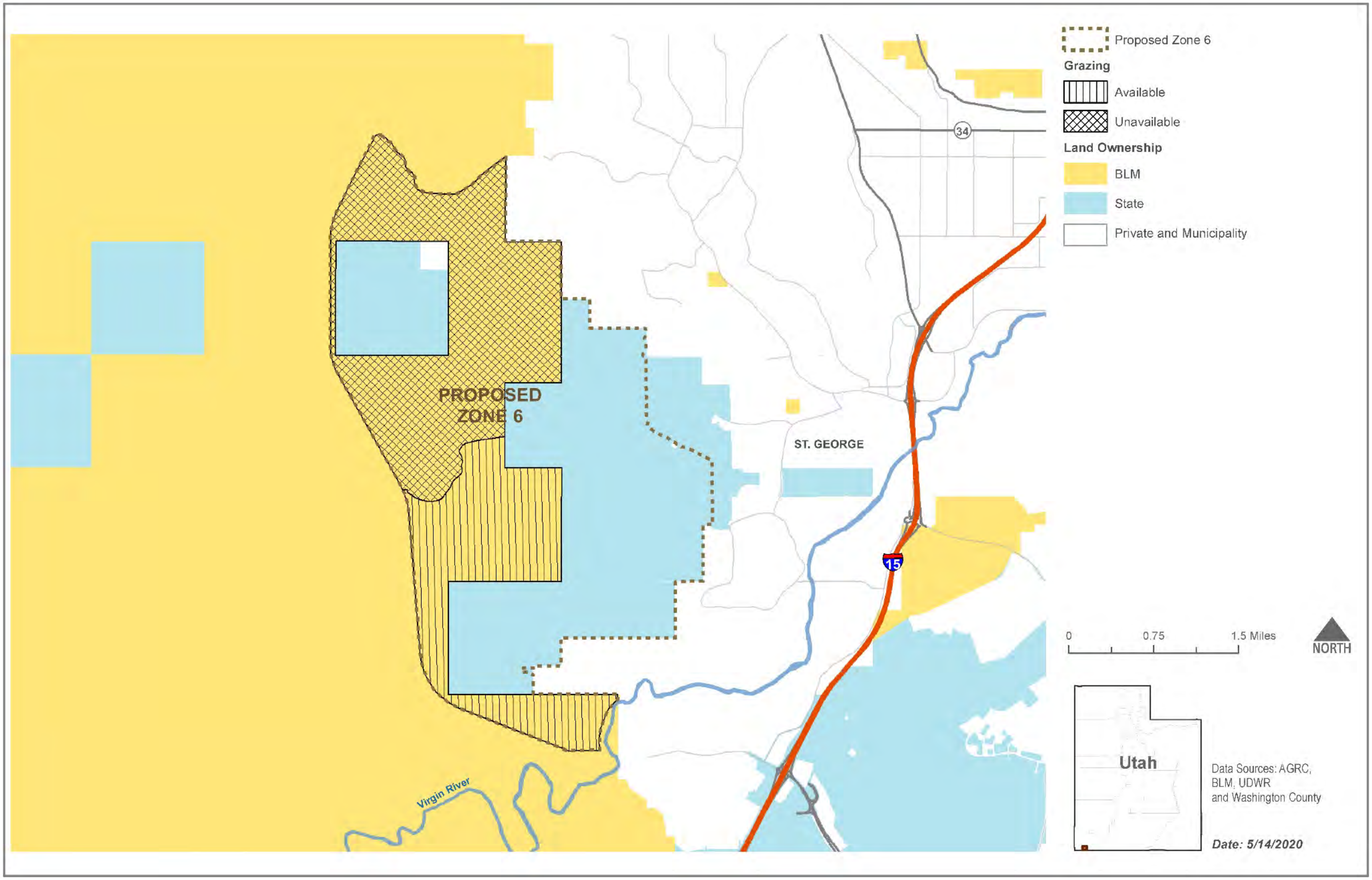
## Map 2.5-16. Proposed Zone 6: Livestock Grazing – SGFO RMP Amendment Alternative A



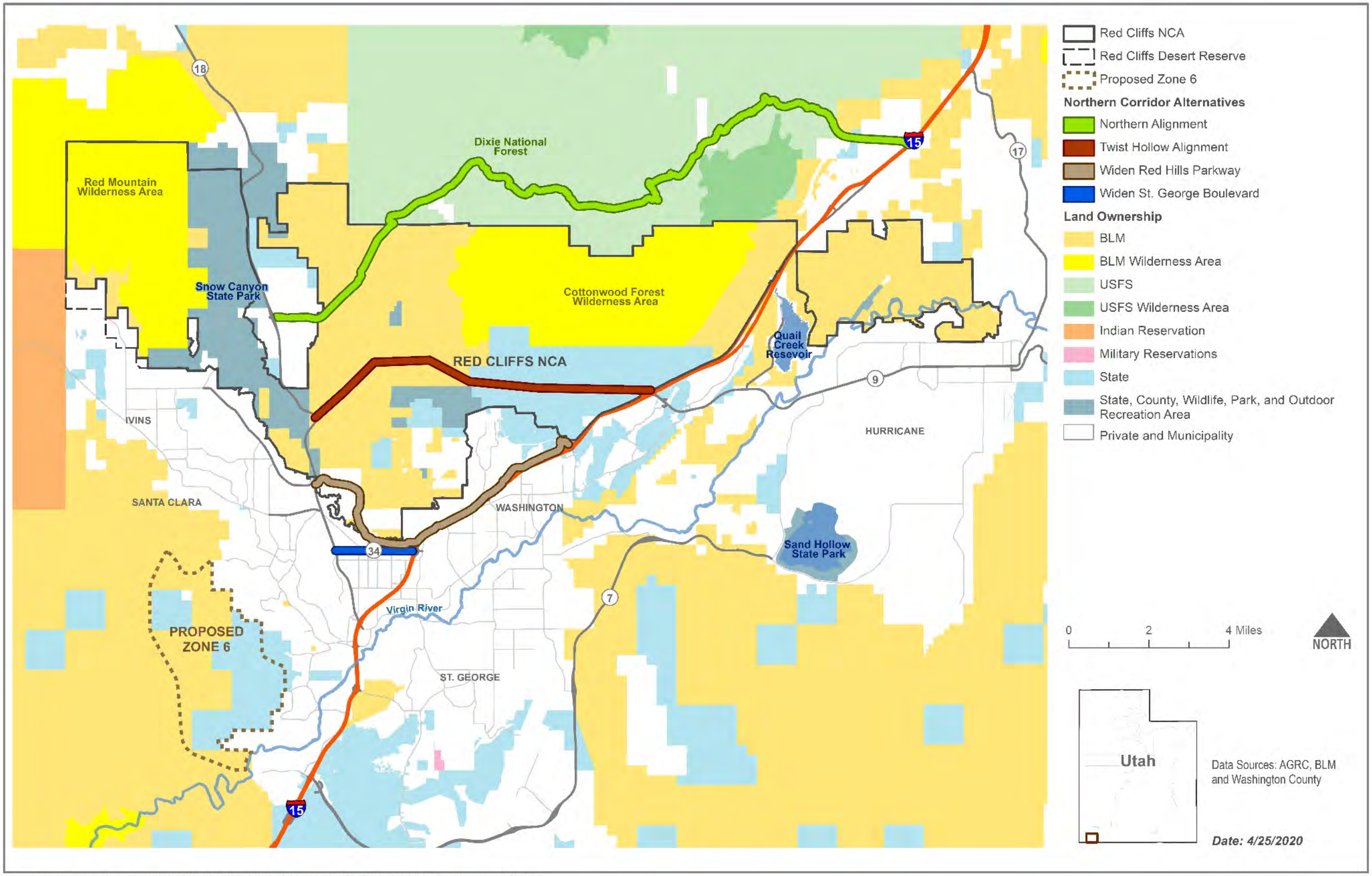
## Map 2.5-17. Proposed Zone 6: Livestock Grazing – SGFO RMP Amendment Alternative B



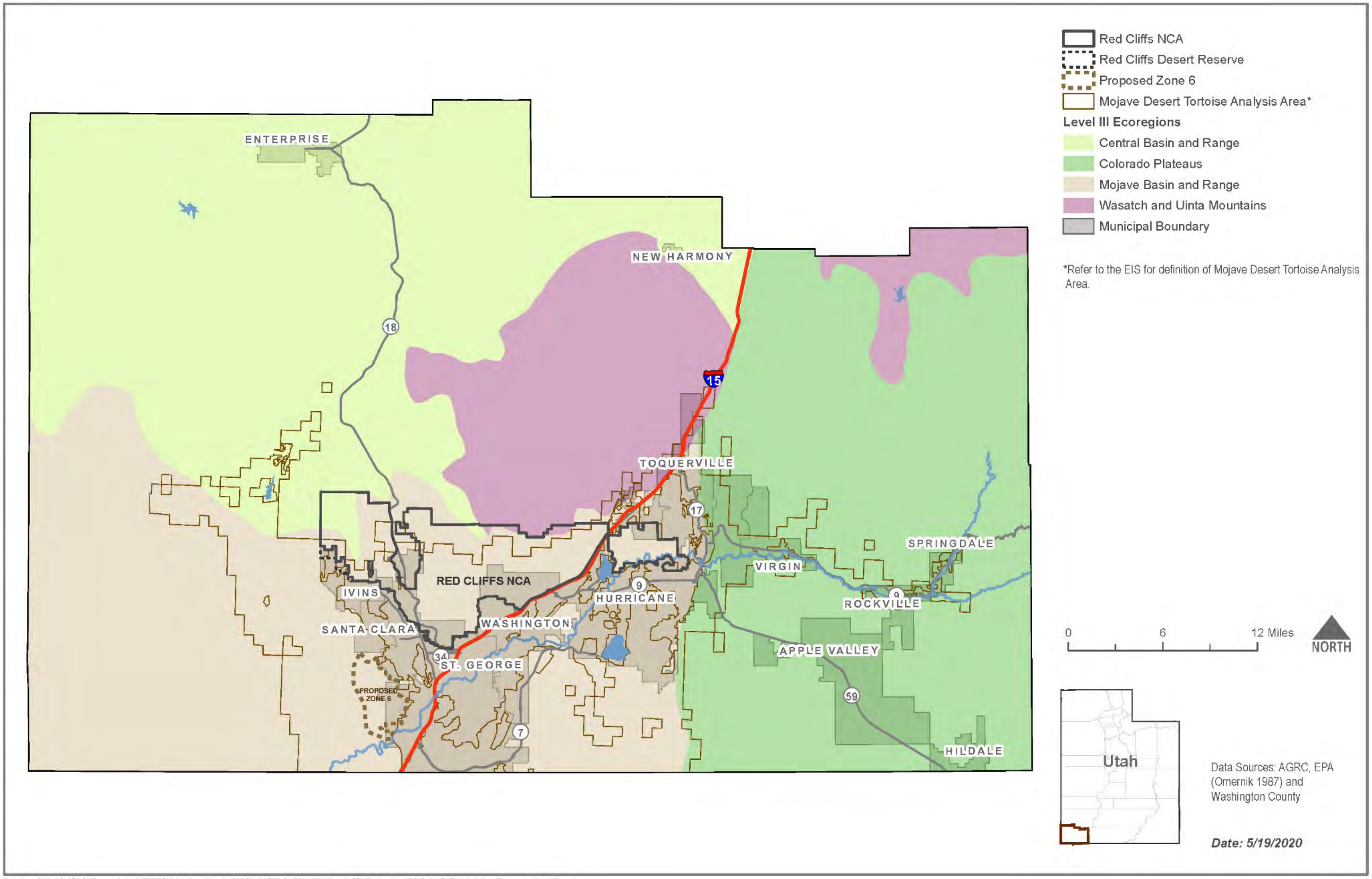
## Map 2.5-18. Proposed Zone 6: Livestock Grazing – SGFO RMP Amendment Alternative C



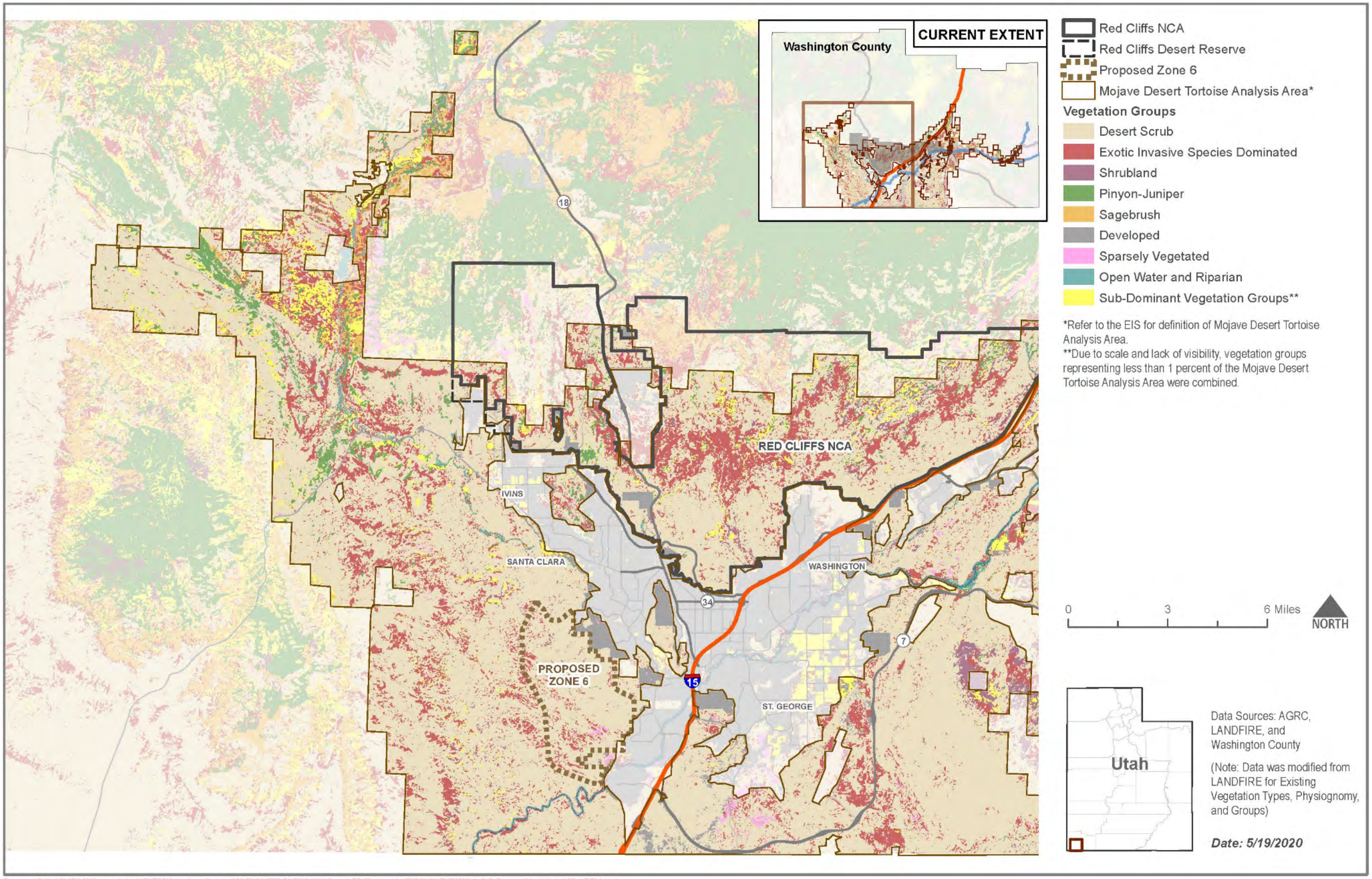
## Map 2.7-1. Northern Corridor Alternatives Considered but Eliminated



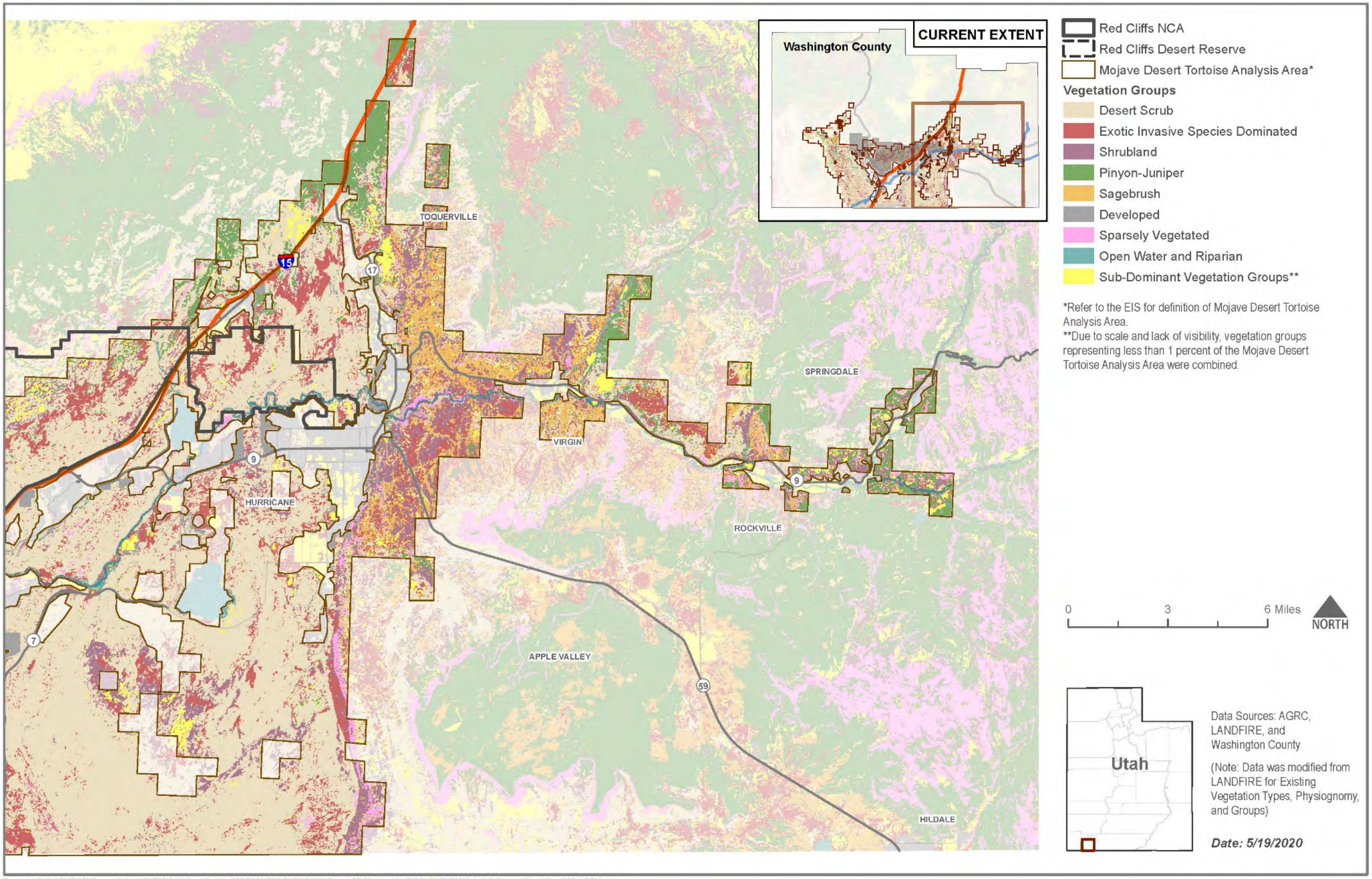
## Map 3.2-1. Ecoregions



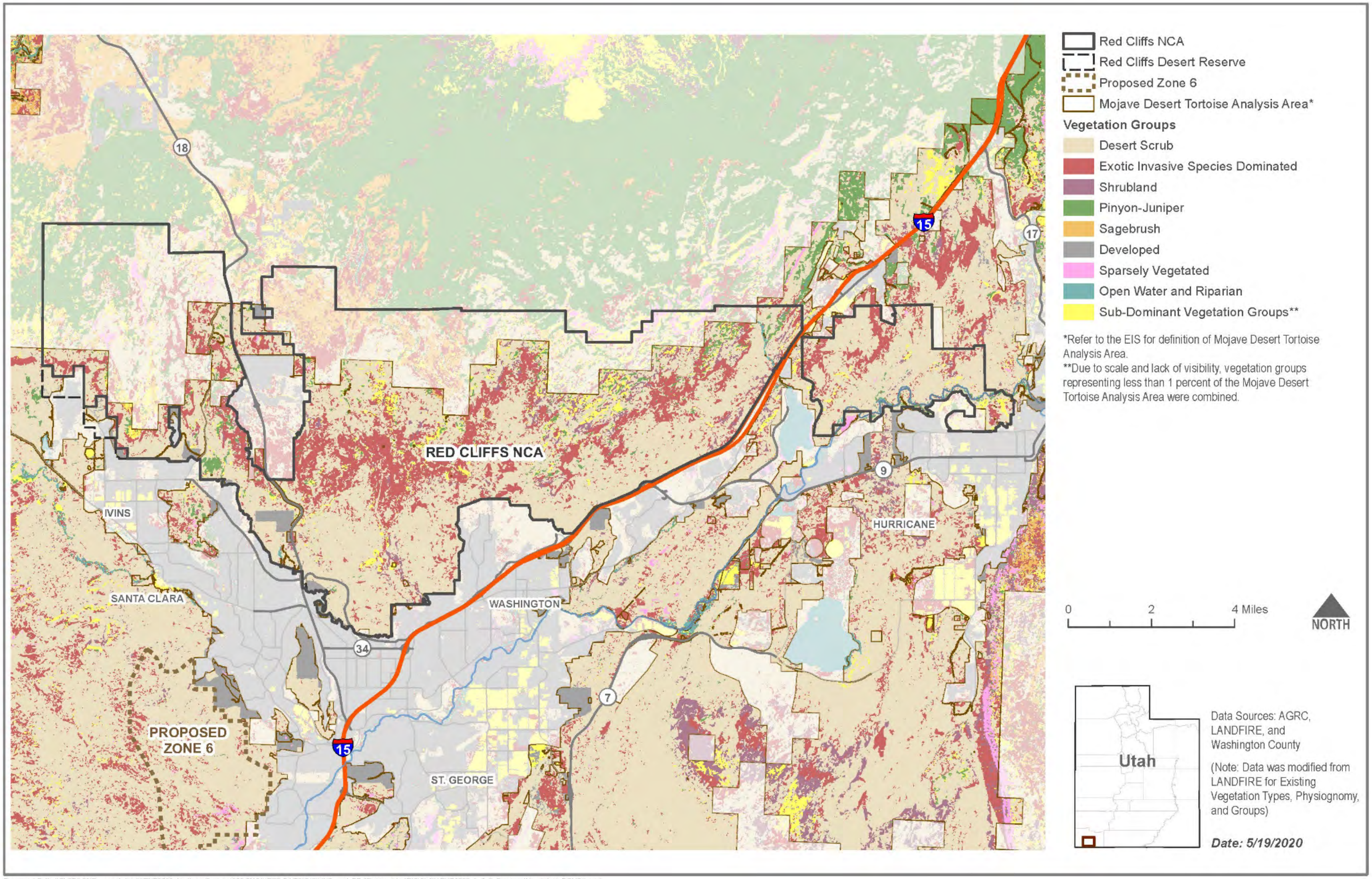
## Map 3.2-2a. Dominant Vegetation Community Groups within the Plan Area (1 of 2)



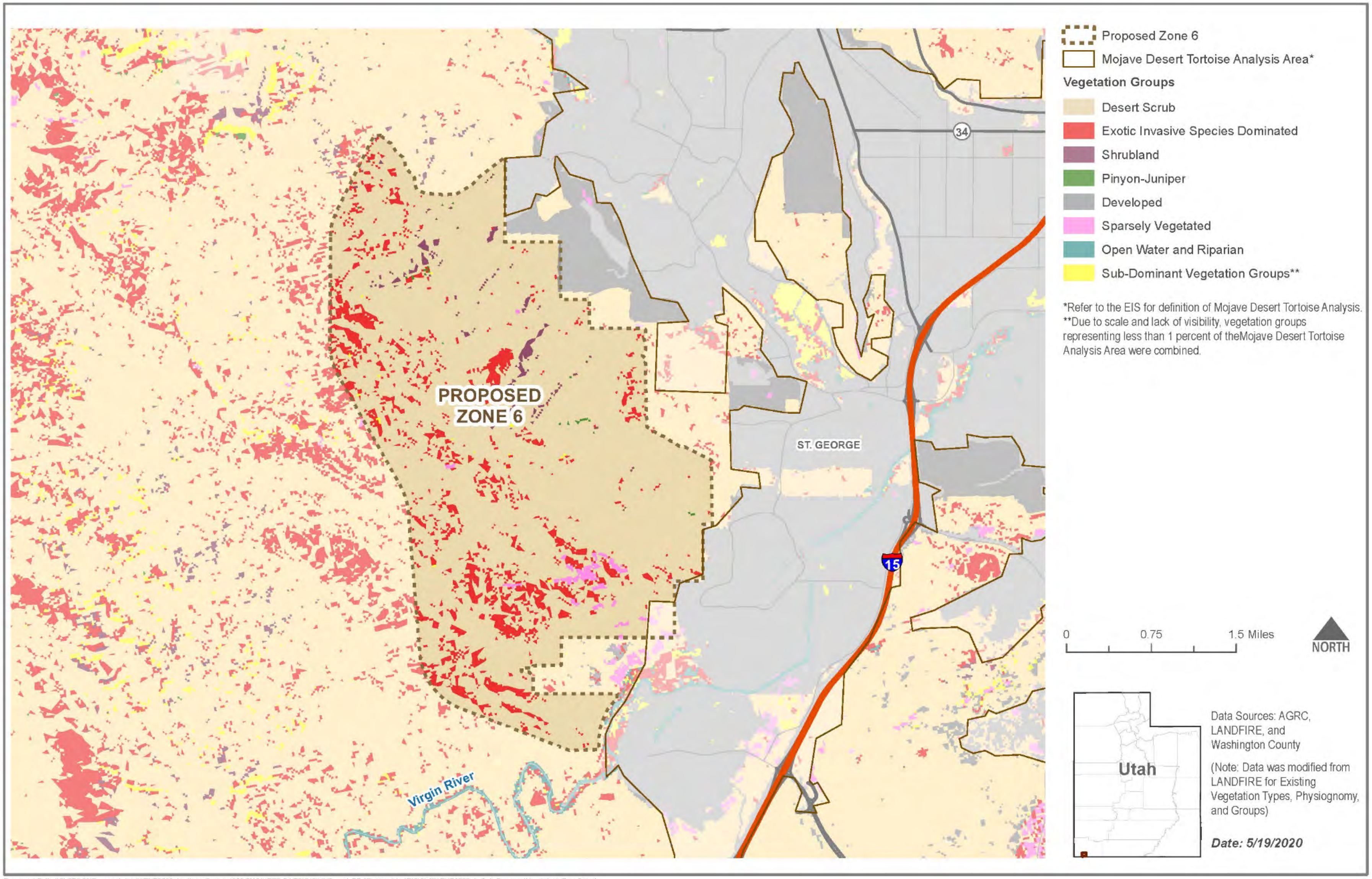
## Map 3.2-2b. Dominant Vegetation Community Groups within the Plan Area (2 of 2)



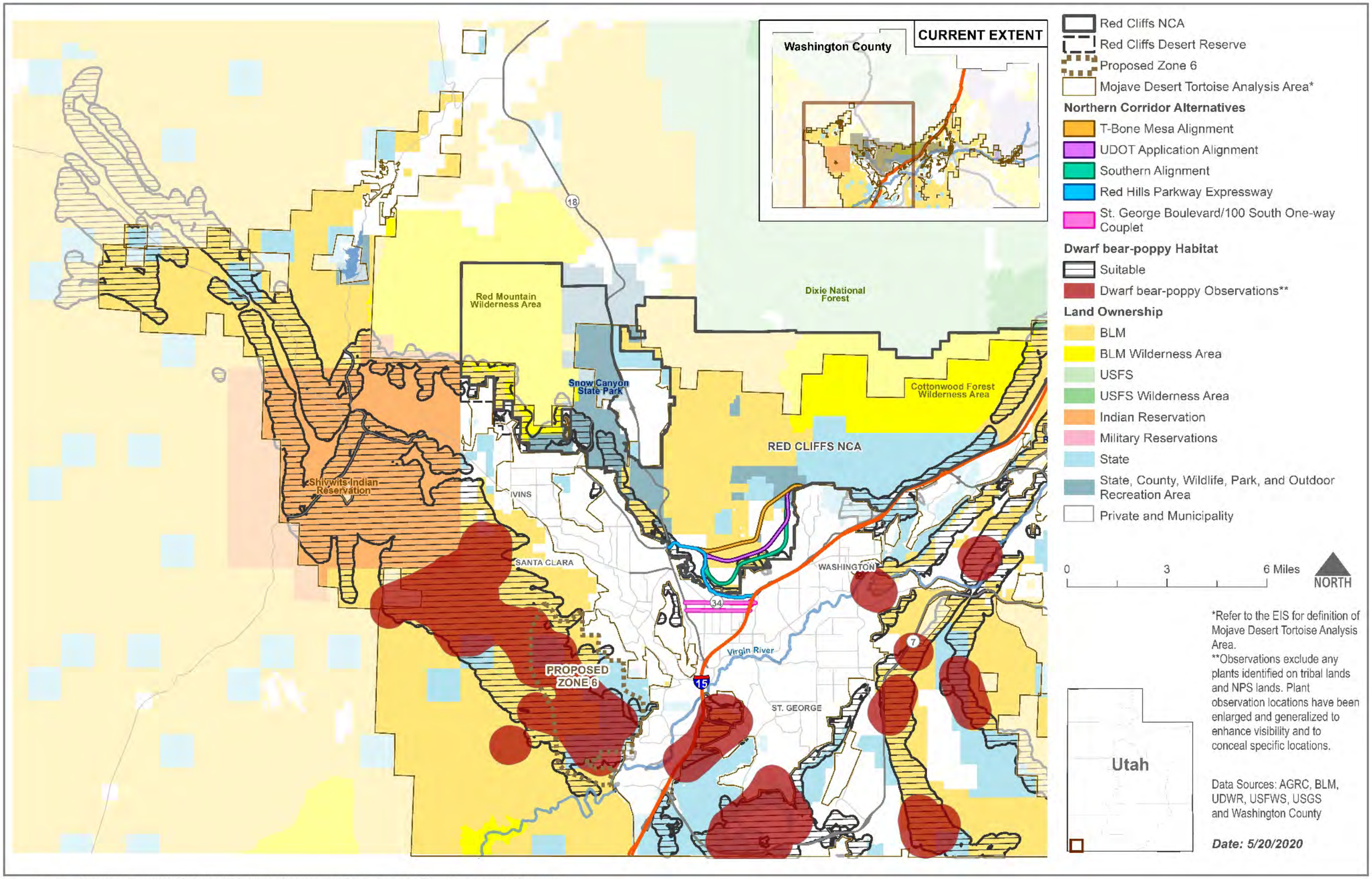
## Map 3.2-3. Dominant Vegetation Community Groups within the Red Cliffs NCA



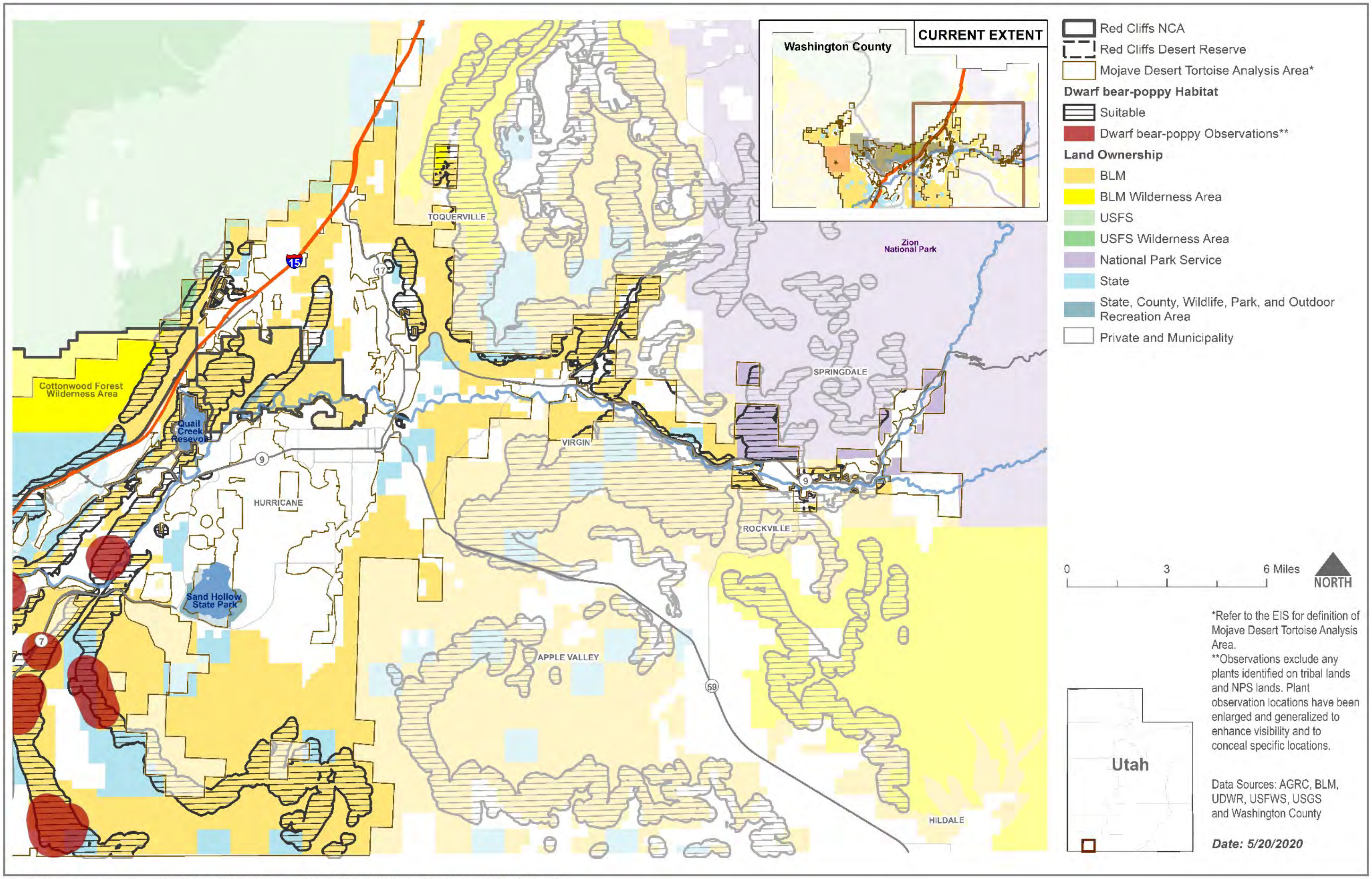
## Map 3.2-4. Dominant Vegetation Community Groups within Proposed Zone 6



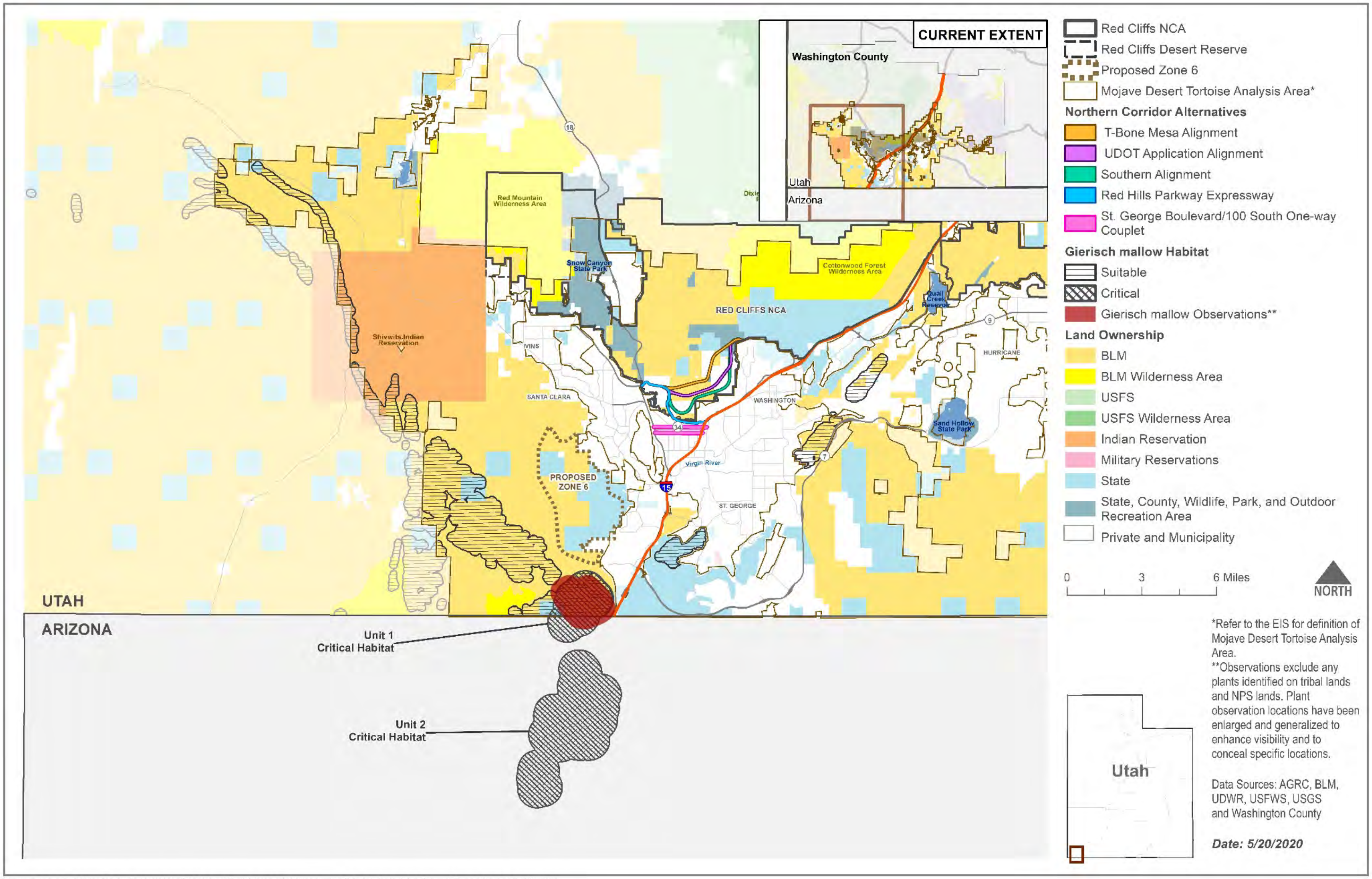
## Map 3.3-1a. Special Status Plants – Dwarf Bear-poppy (1 of 2)



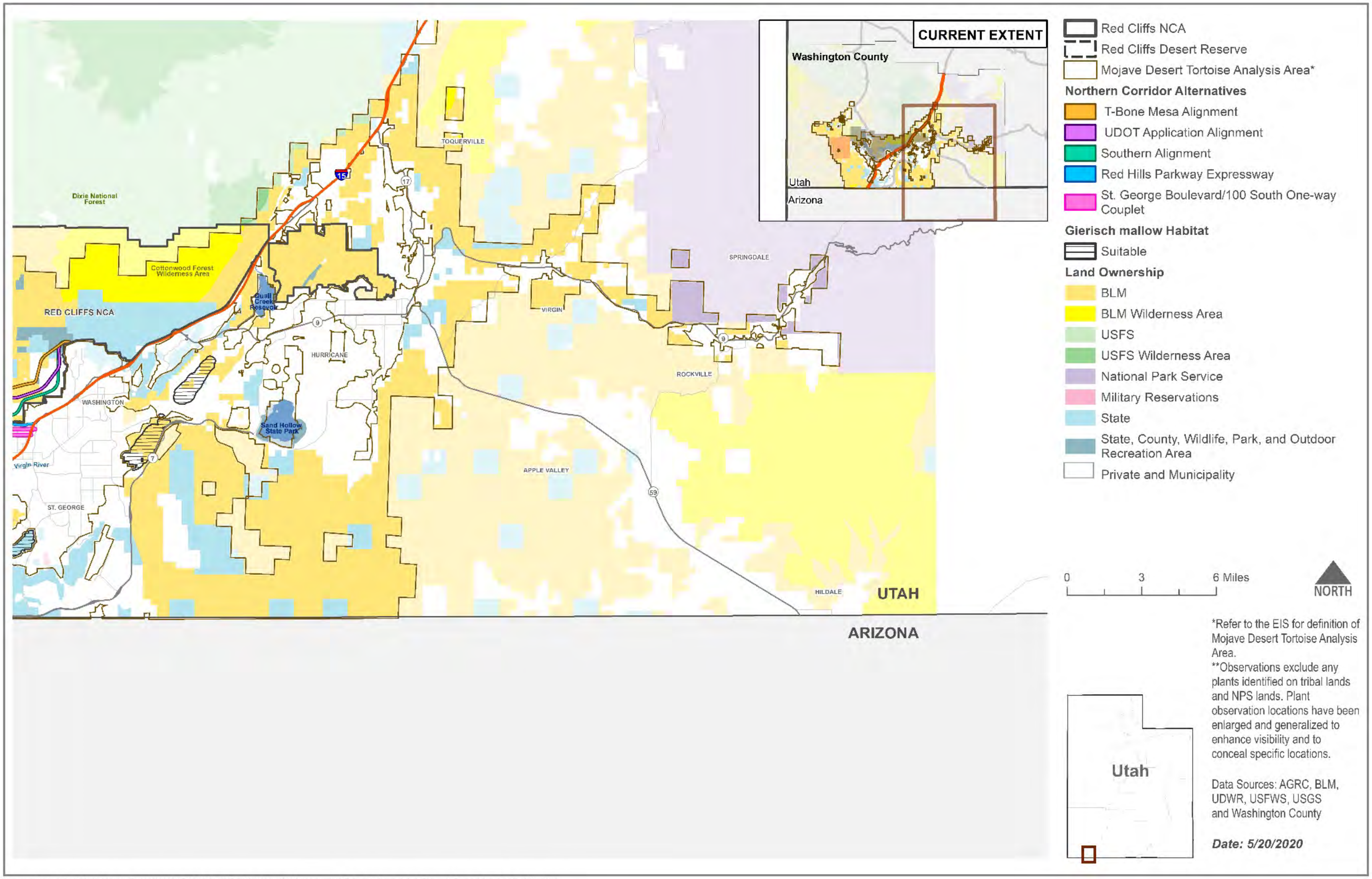
## Map 3.3-1b. Special Status Plants – Dwarf Bear-poppy (2 of 2)



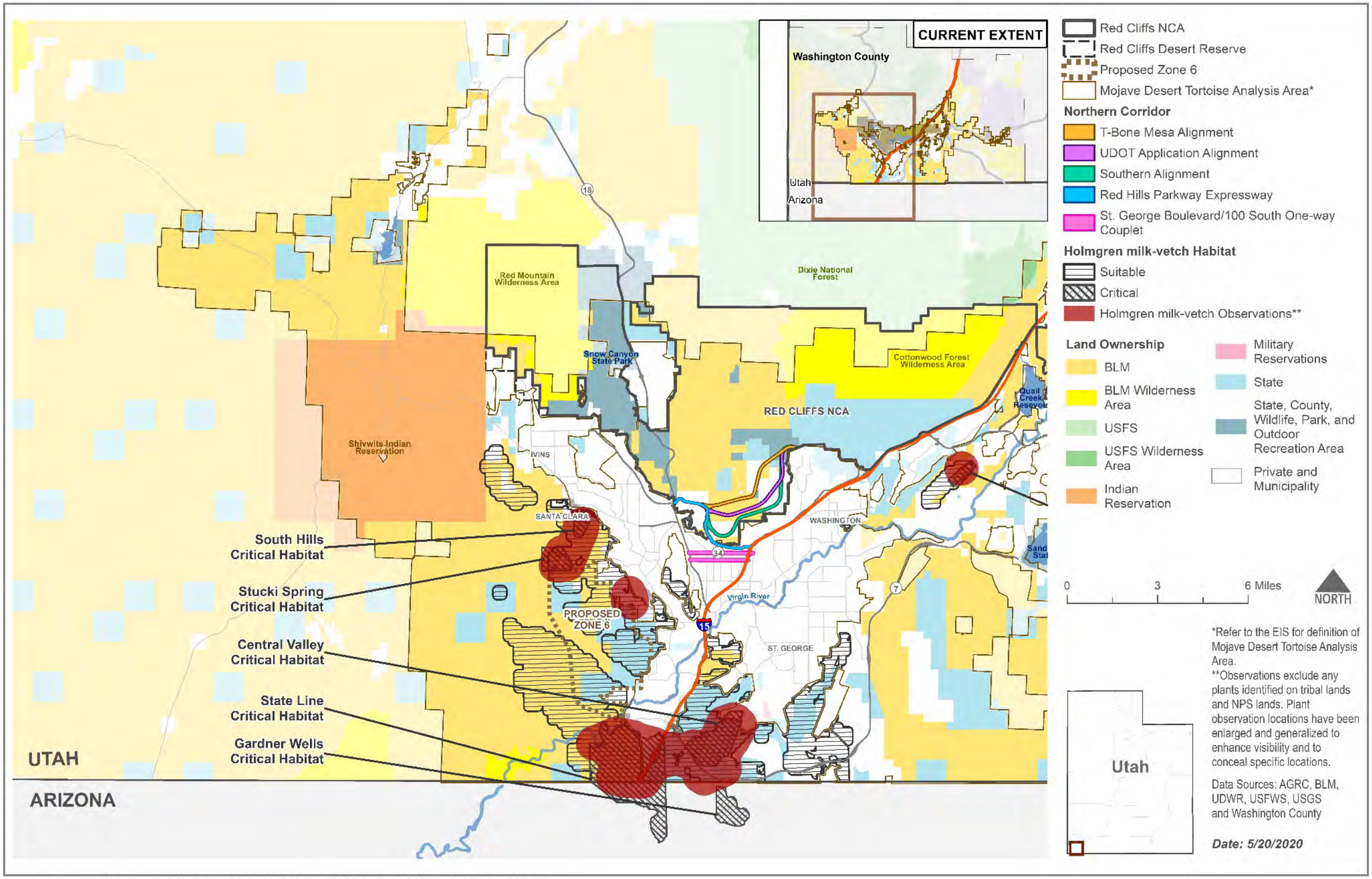
## Map 3.3-2a. Special Status Plants - Gierisch Mallow (1 of 2)



## Map 3.3-2b. Special Status Plants - Gierisch Mallow (2 of 2)



## Map 3.3-3a. Special Status Plants - Holmgren Milk-vetch (1 of 2)

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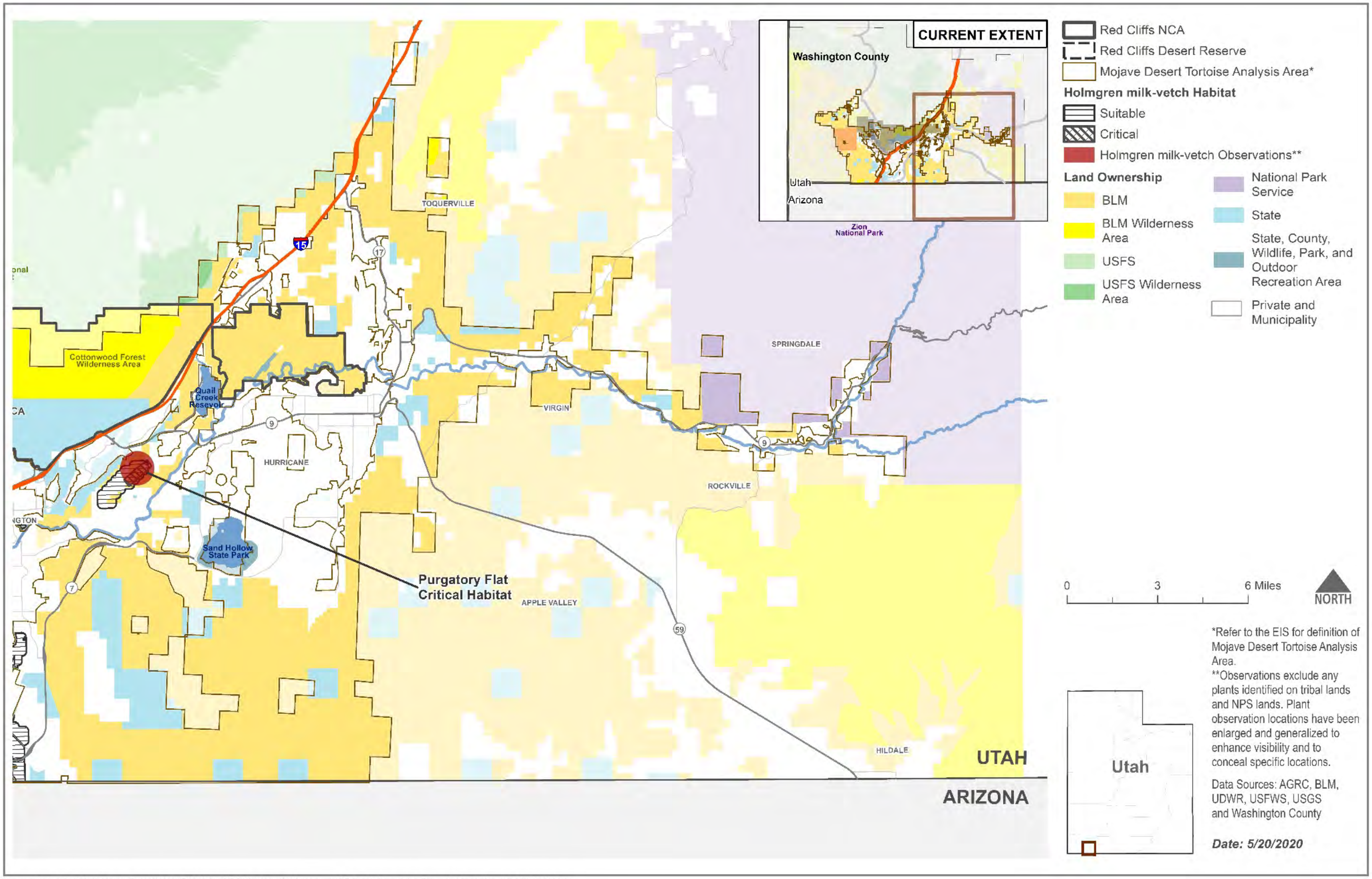
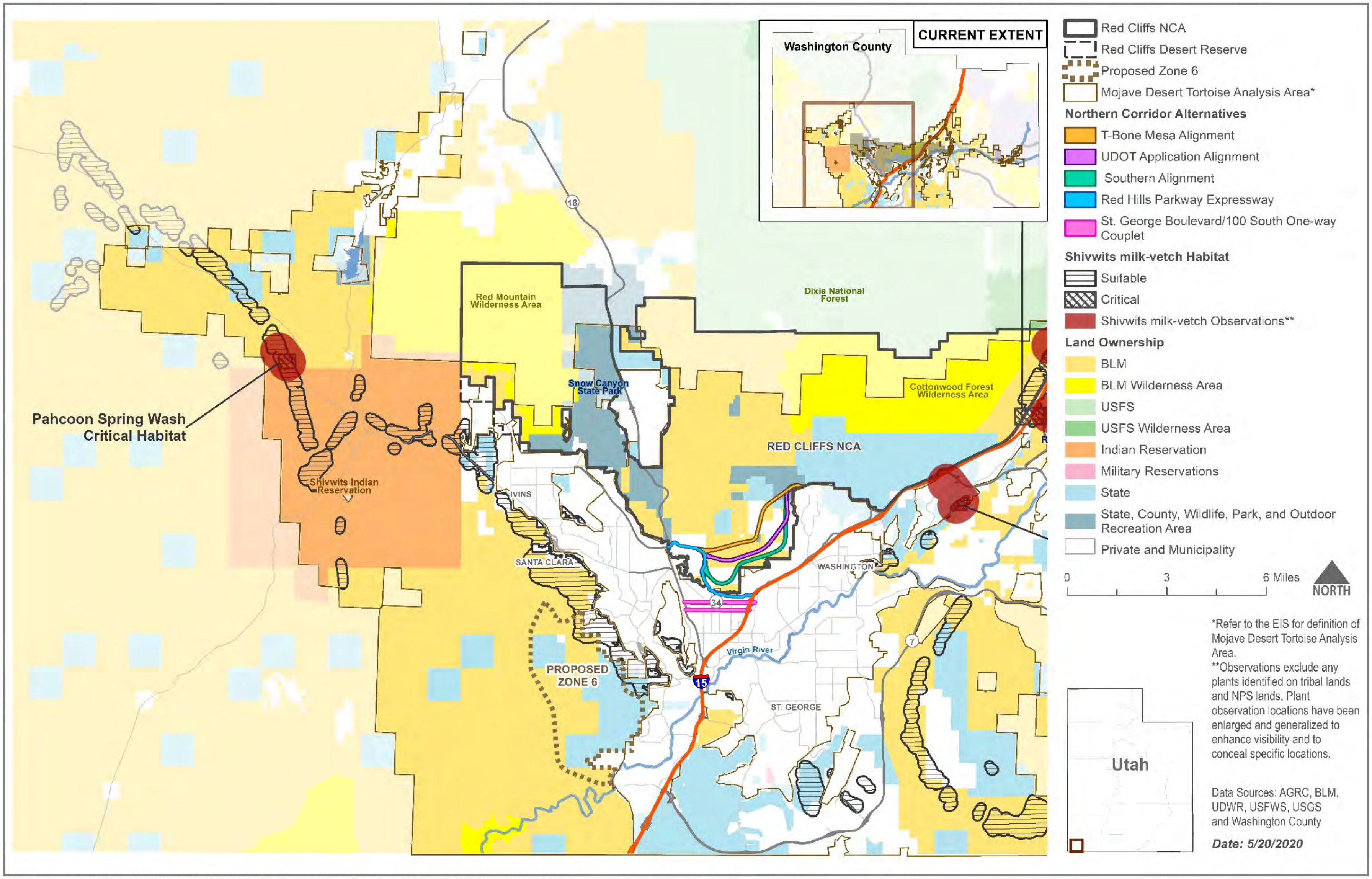
## Map 3.3-3b. Special Status Plants - Holmgren Milk-vetch (2 of 2)



## Map 3.3-4a. Special Status Plants - Shivwits Milk-vetch (1 of 2)

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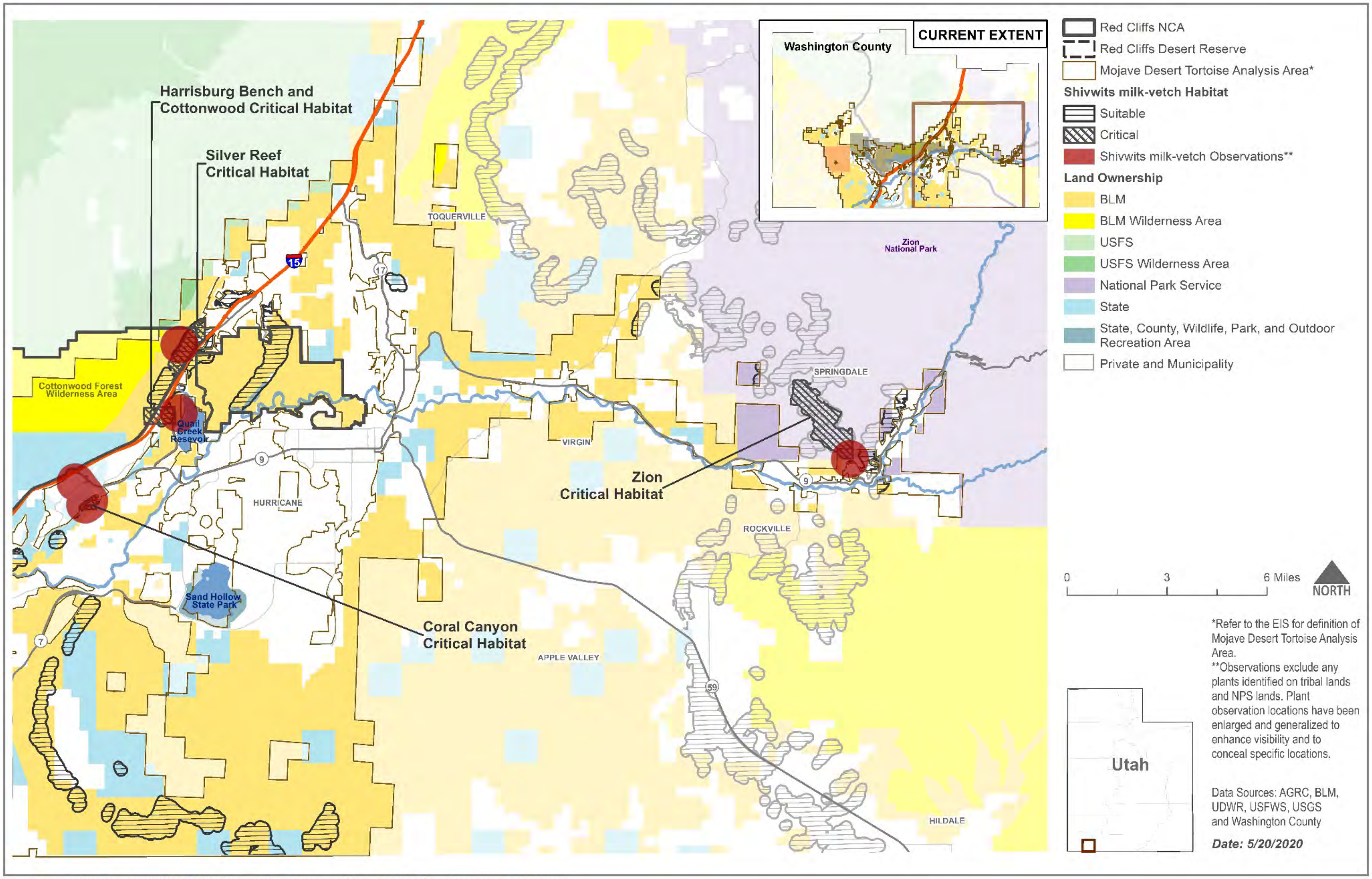
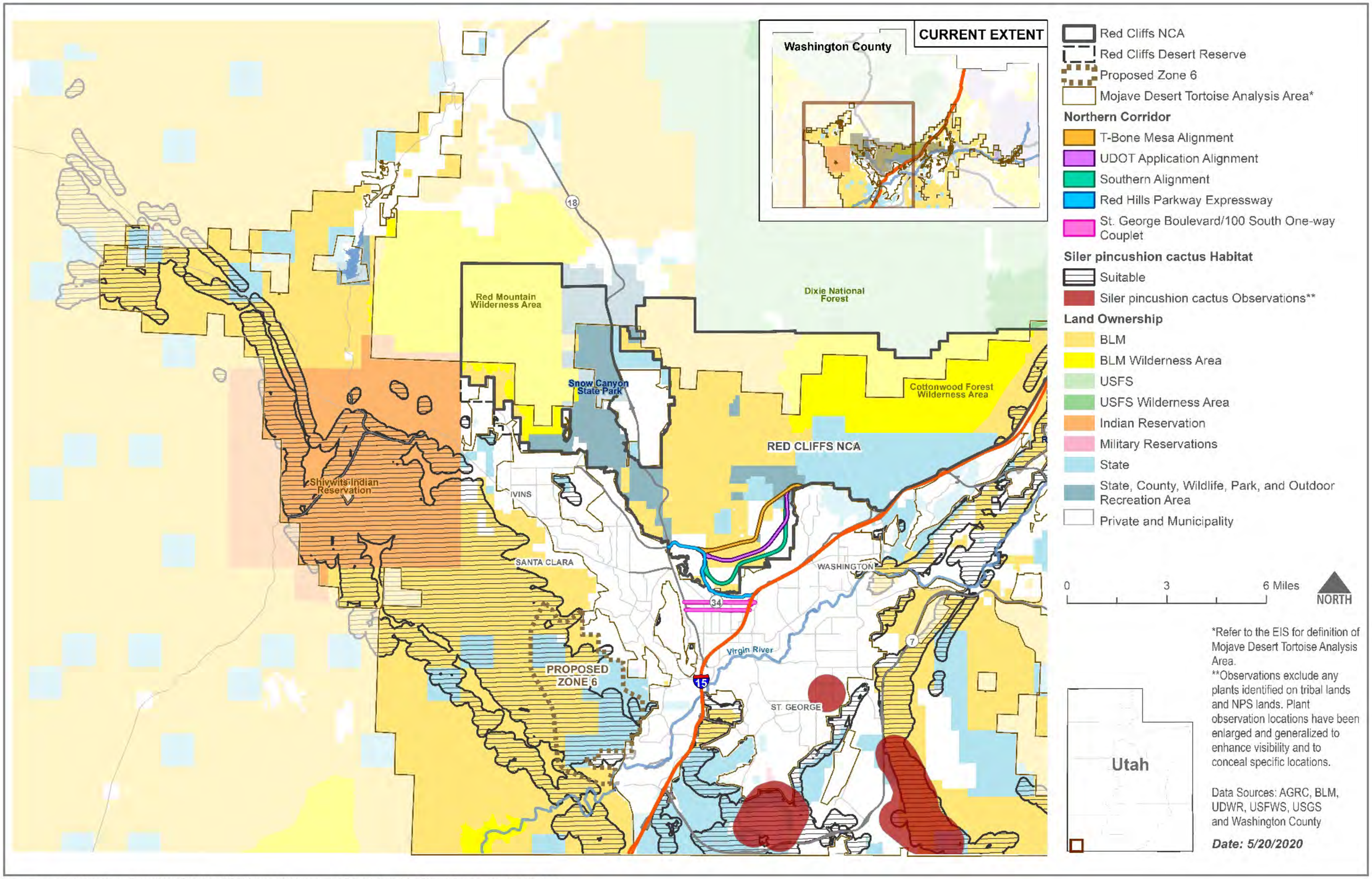
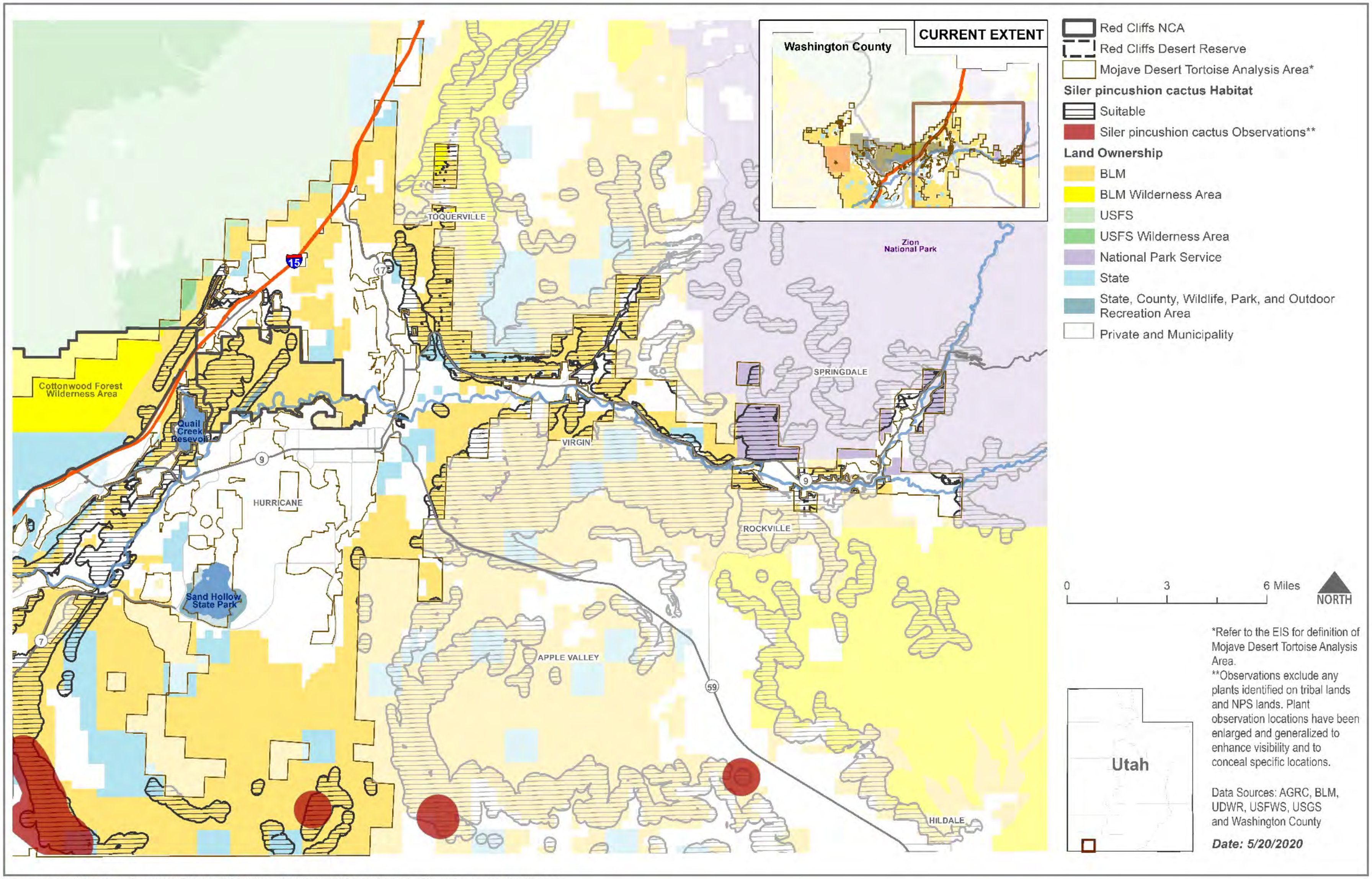
## Map 3.3-4b. Special Status Plants - Shivwits Milk-vetch (2 of 2)



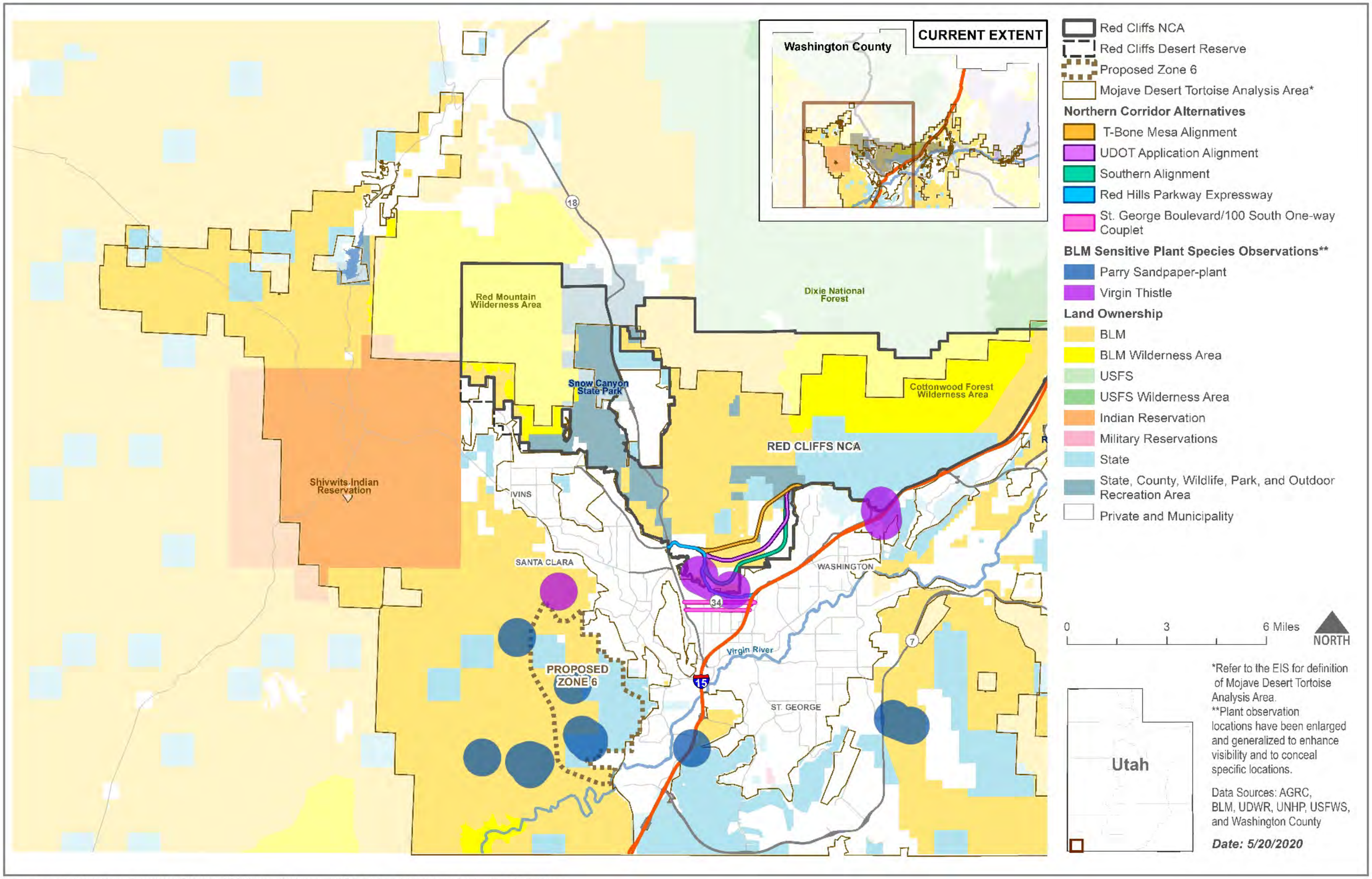
## Map 3.3-5a. Special Status Plants - Siler Pincushion Cactus (1 of 2)



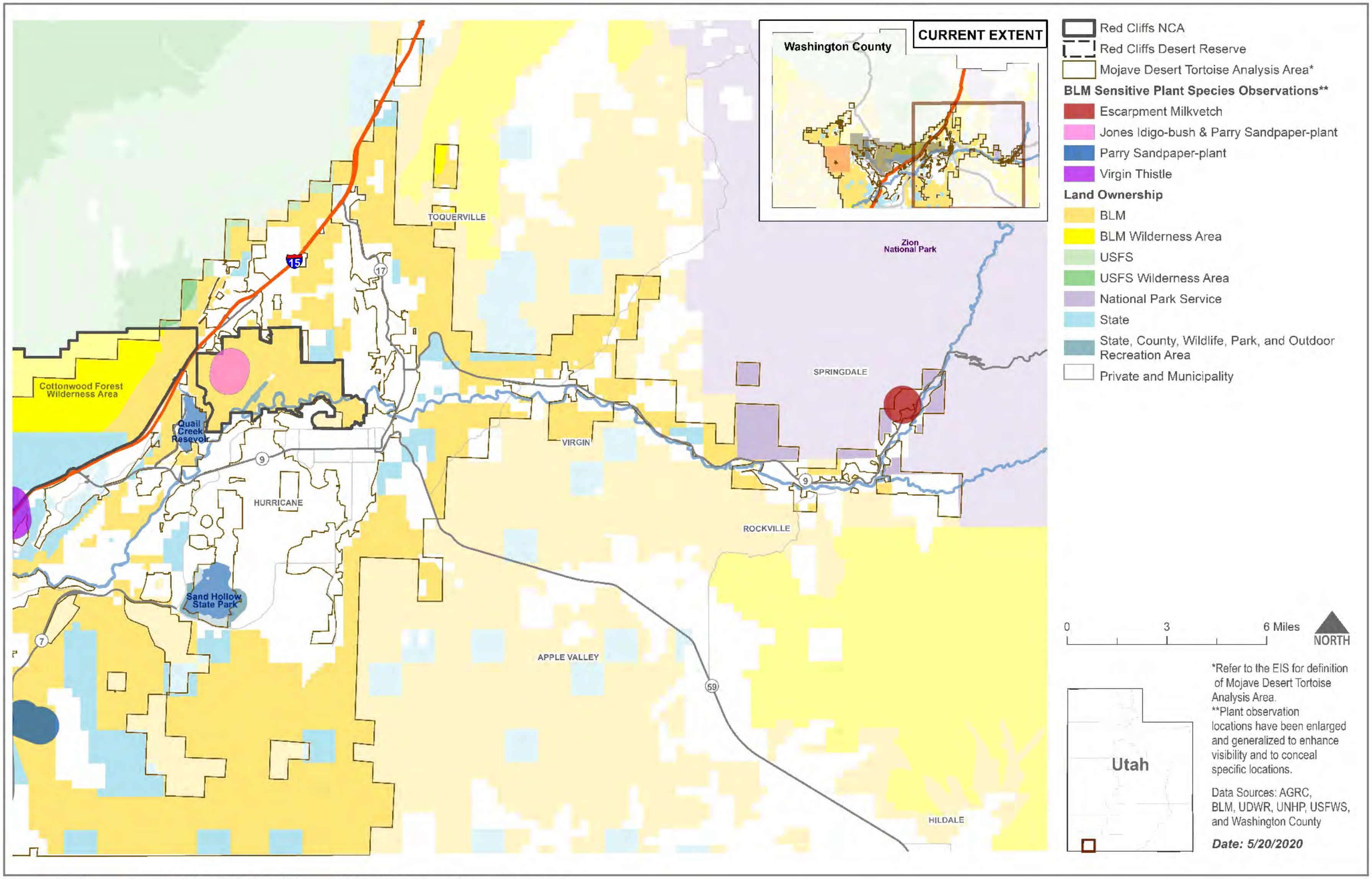
## Map 3.3-5b. Special Status Plants - Siler Pincushion Cactus (2 of 2)



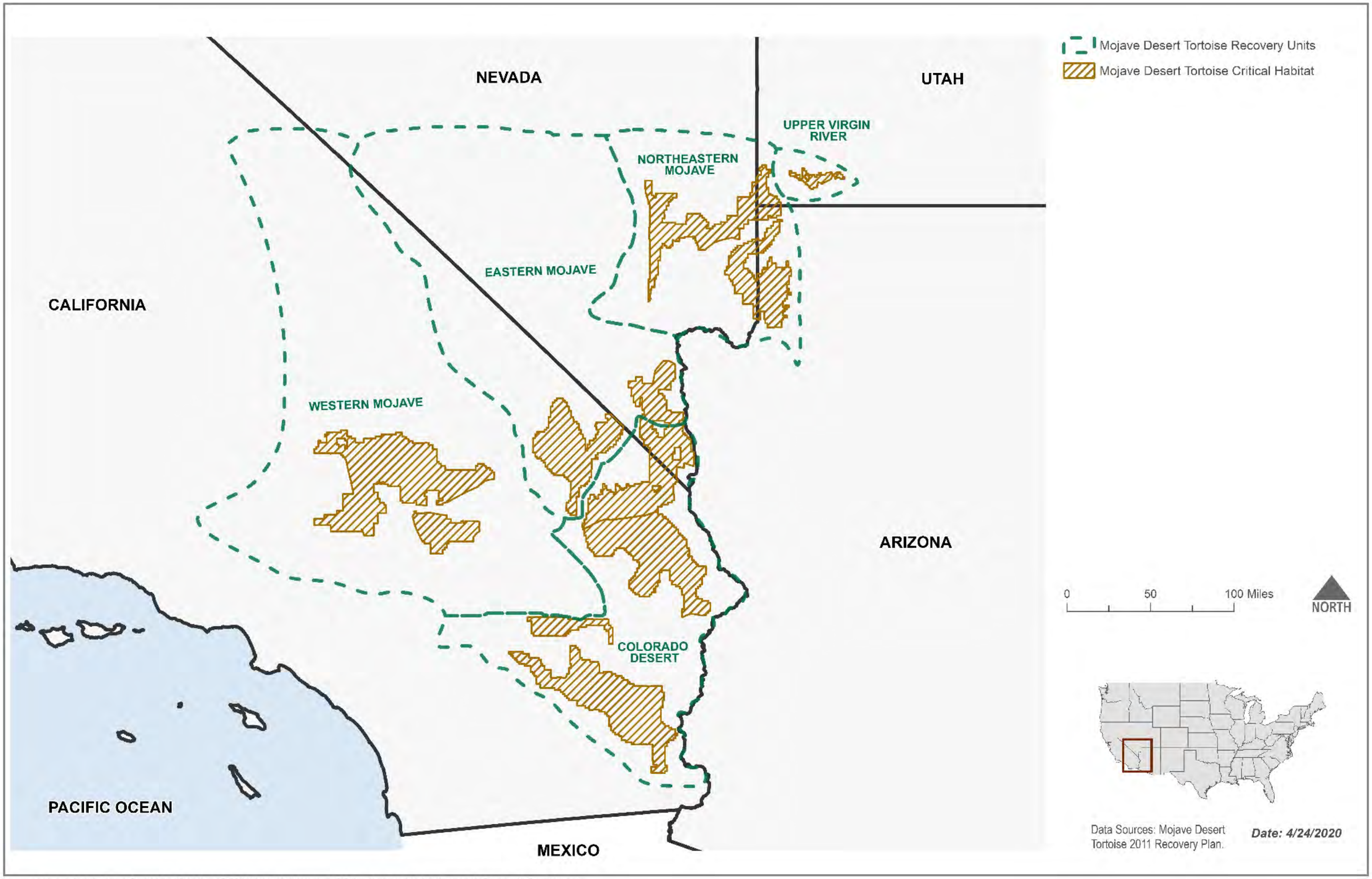
## Map 3.3-6a. BLM Sensitive Plant Species (1 of 2)



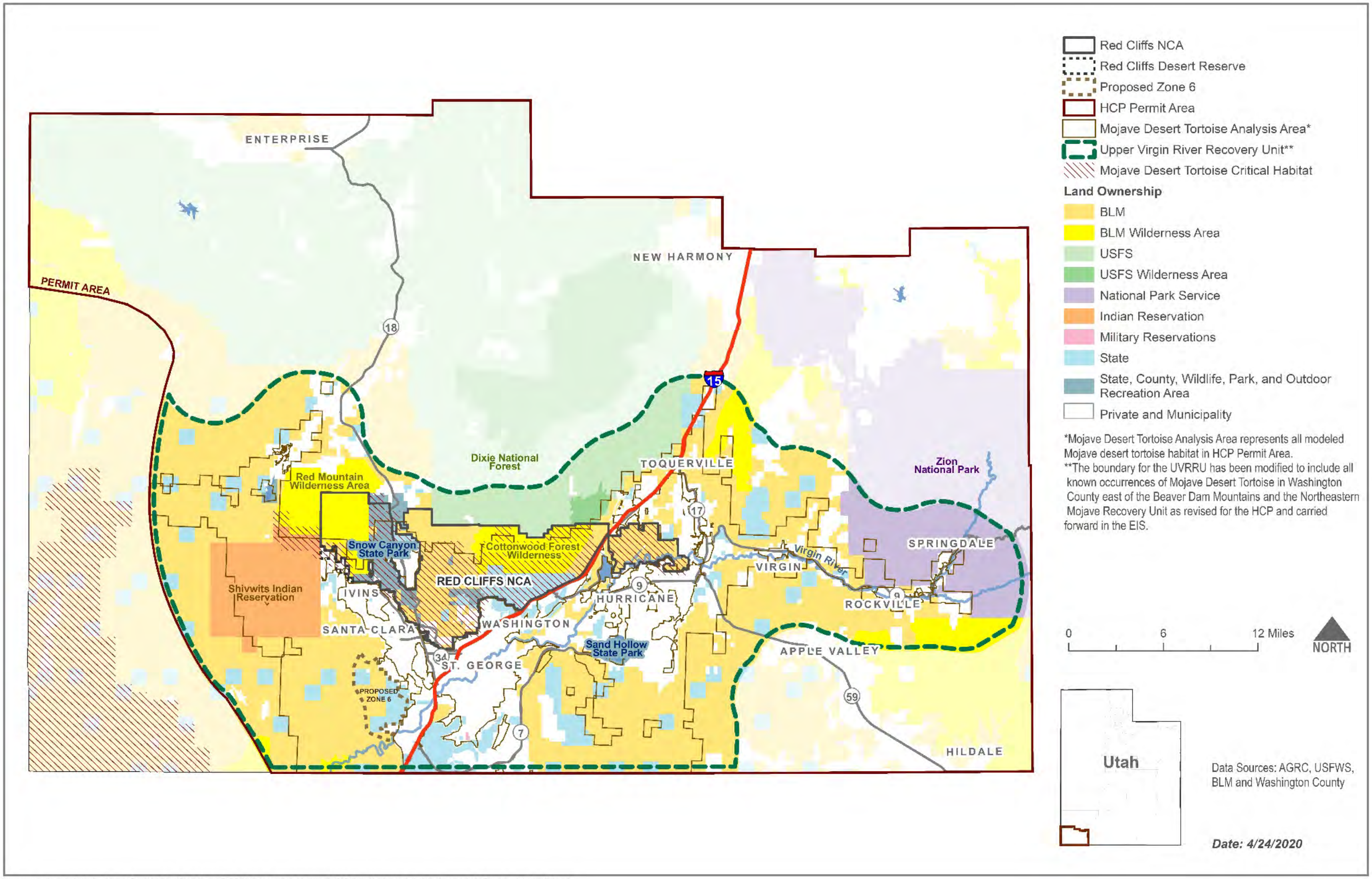
## Map 3.3-6b. BLM Sensitive Plant Species (2 of 2)



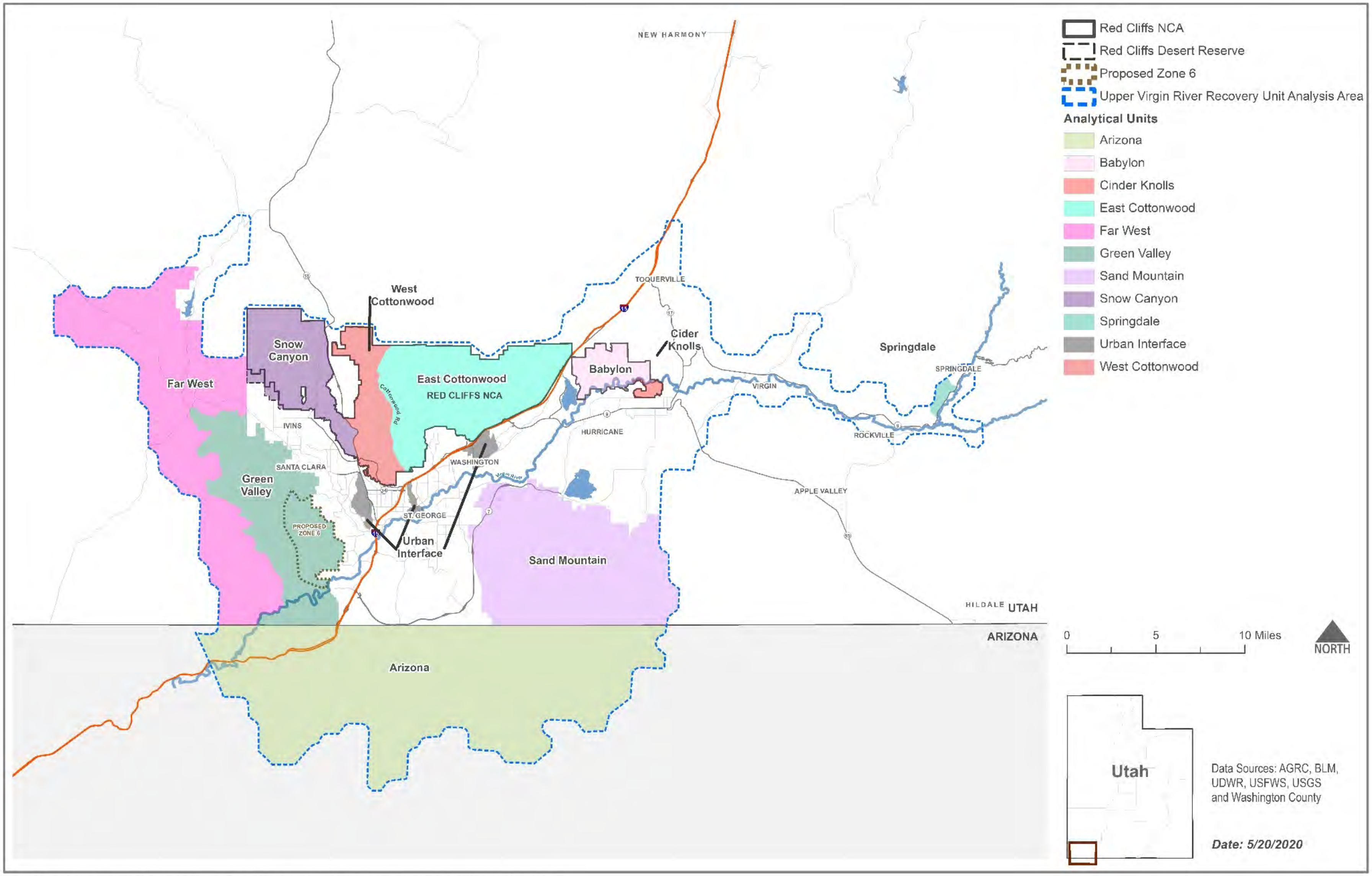
## Map 3.5-1. Mojave Desert Tortoise Recovery Units and Critical Habitat Designations



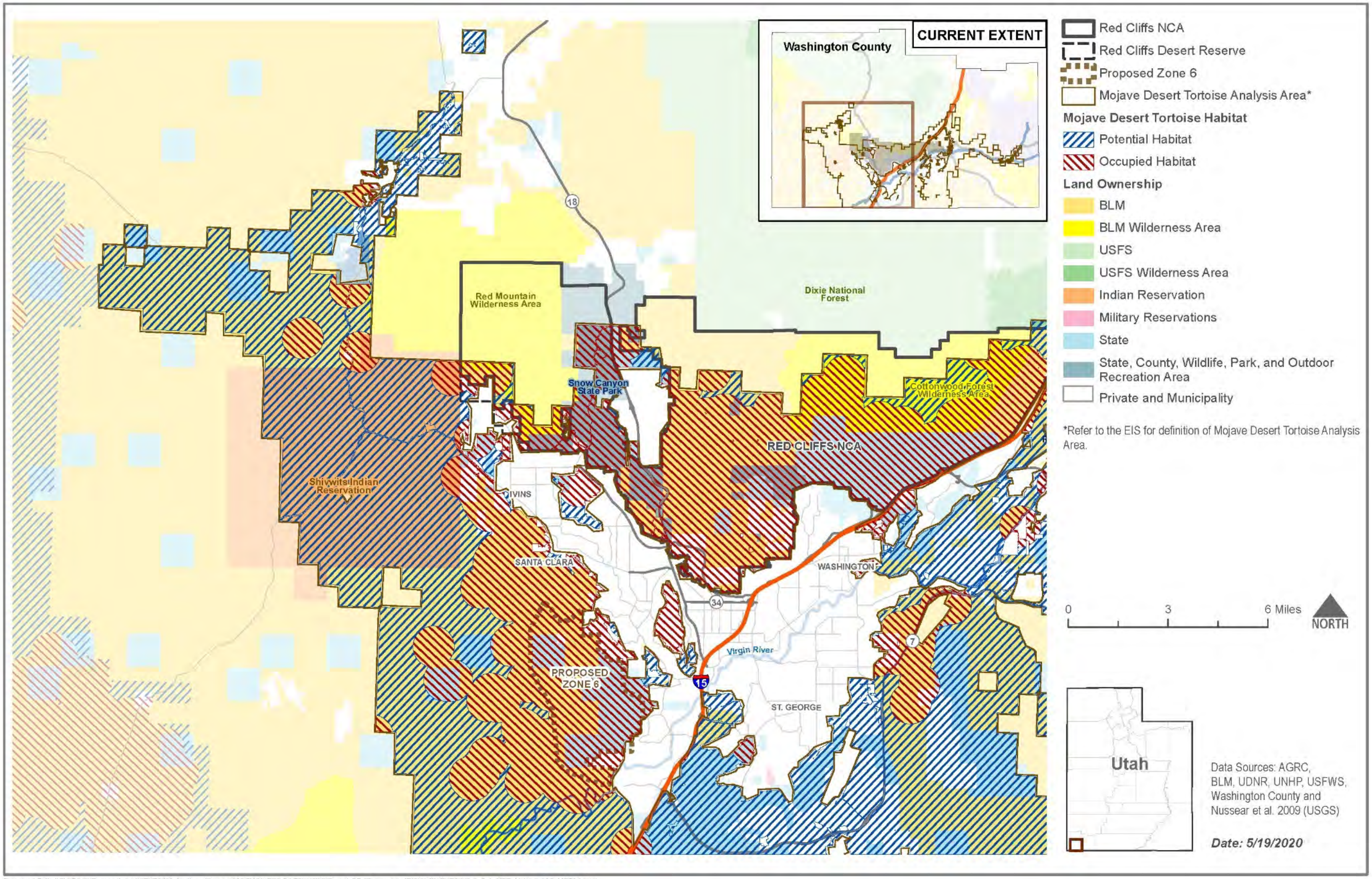
**Map 3.5-2. Mojave Desert Tortoise Recovery Units and Critical Habitat Designations - Washington County (Plan Area)**



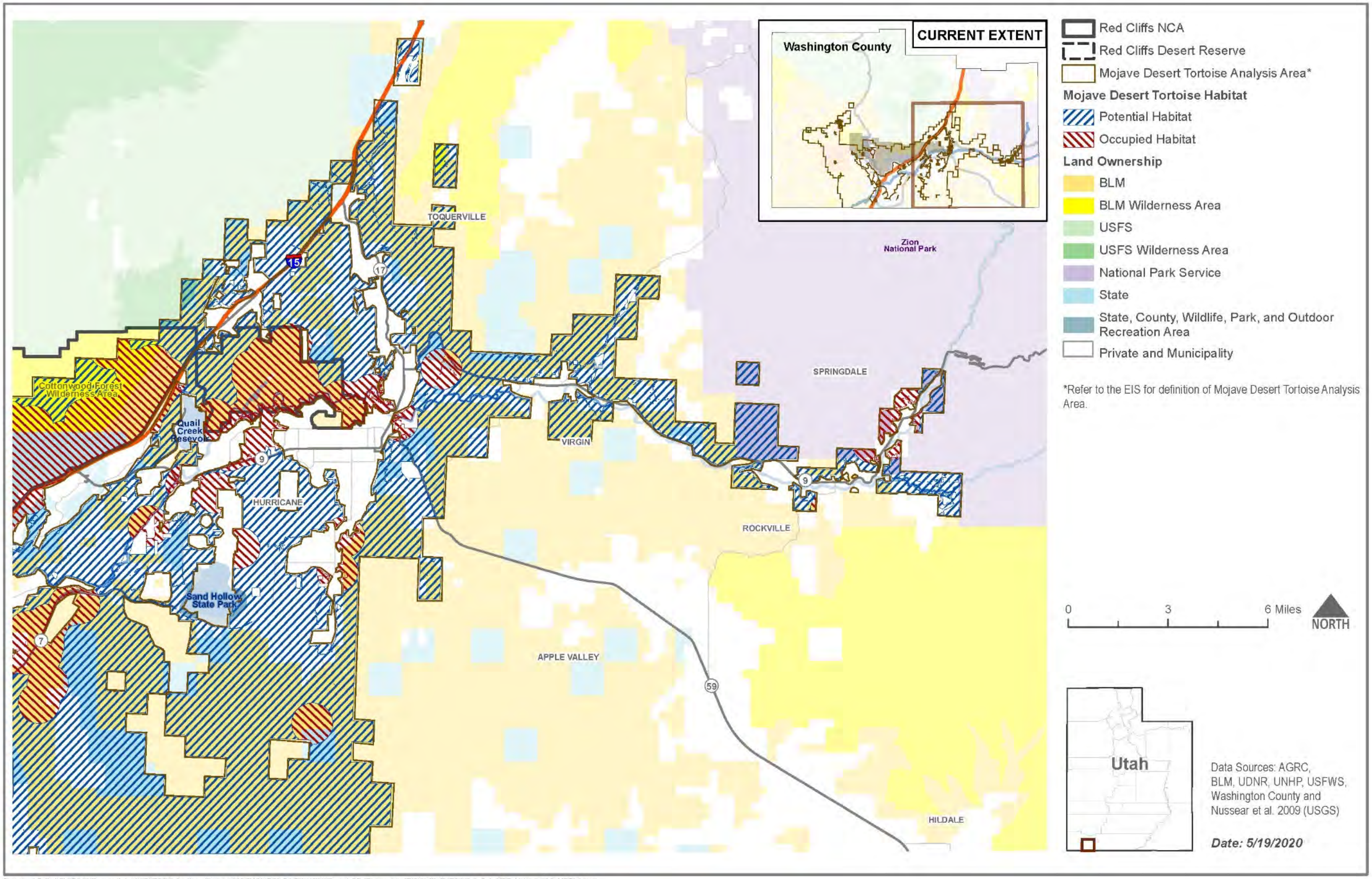
## Map 3.5-3. Analytical Units



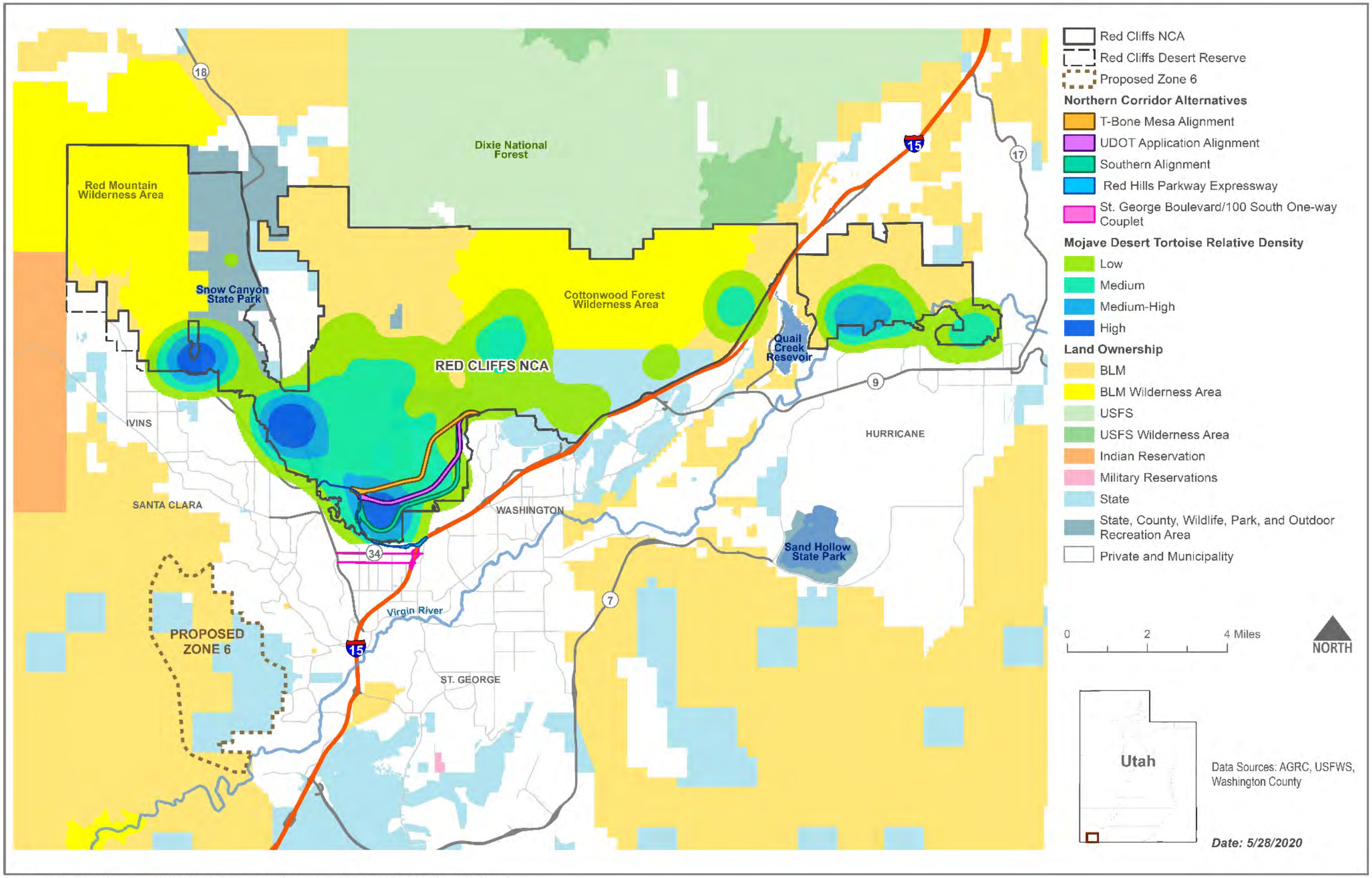
## Map 3.5-4a. Occupied and Potential Mojave Desert Tortoise Habitat (1 of 2)



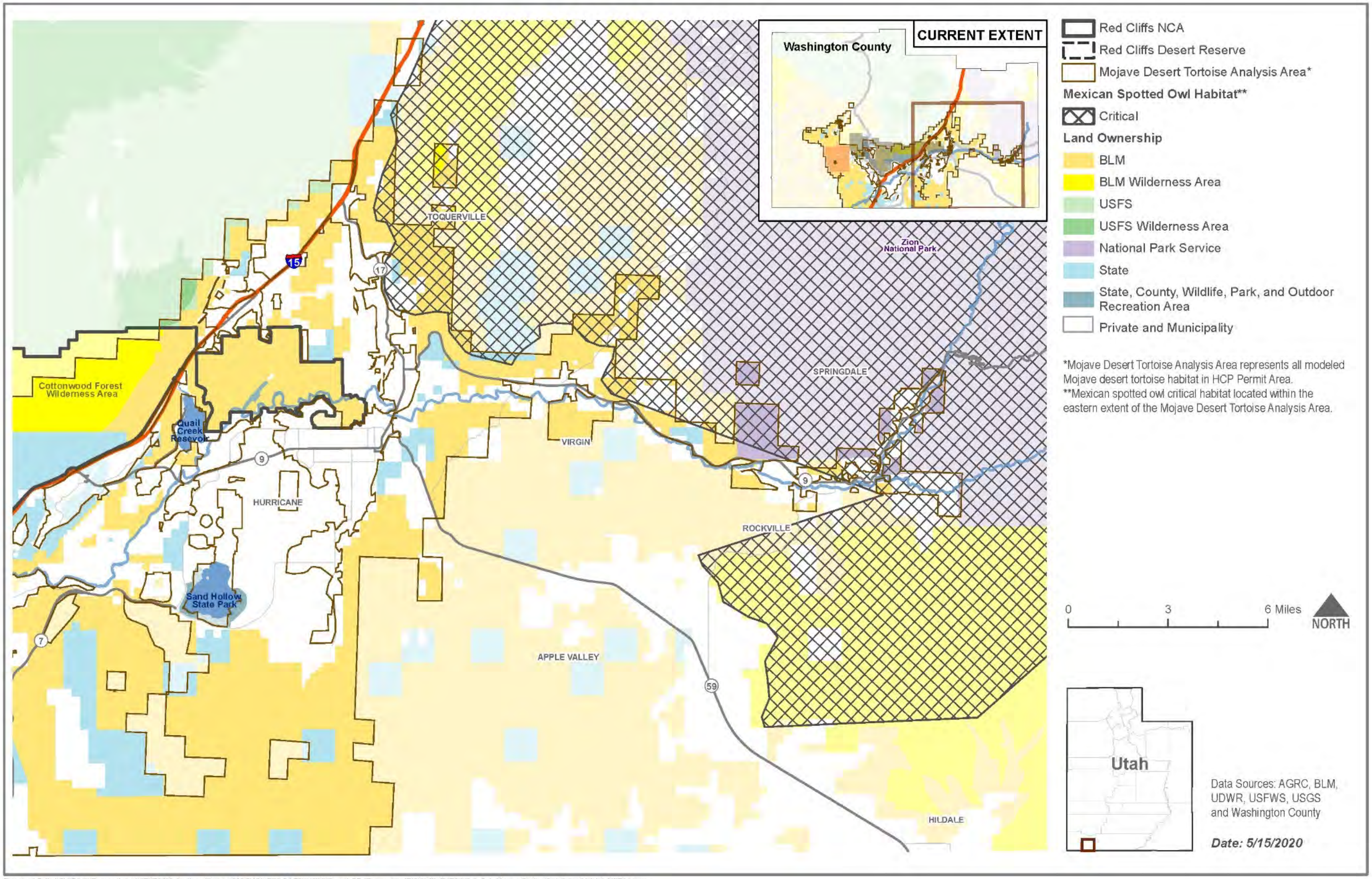
## Map 3.5-4b. Occupied and Potential Mojave Desert Tortoise Habitat (2 of 2)



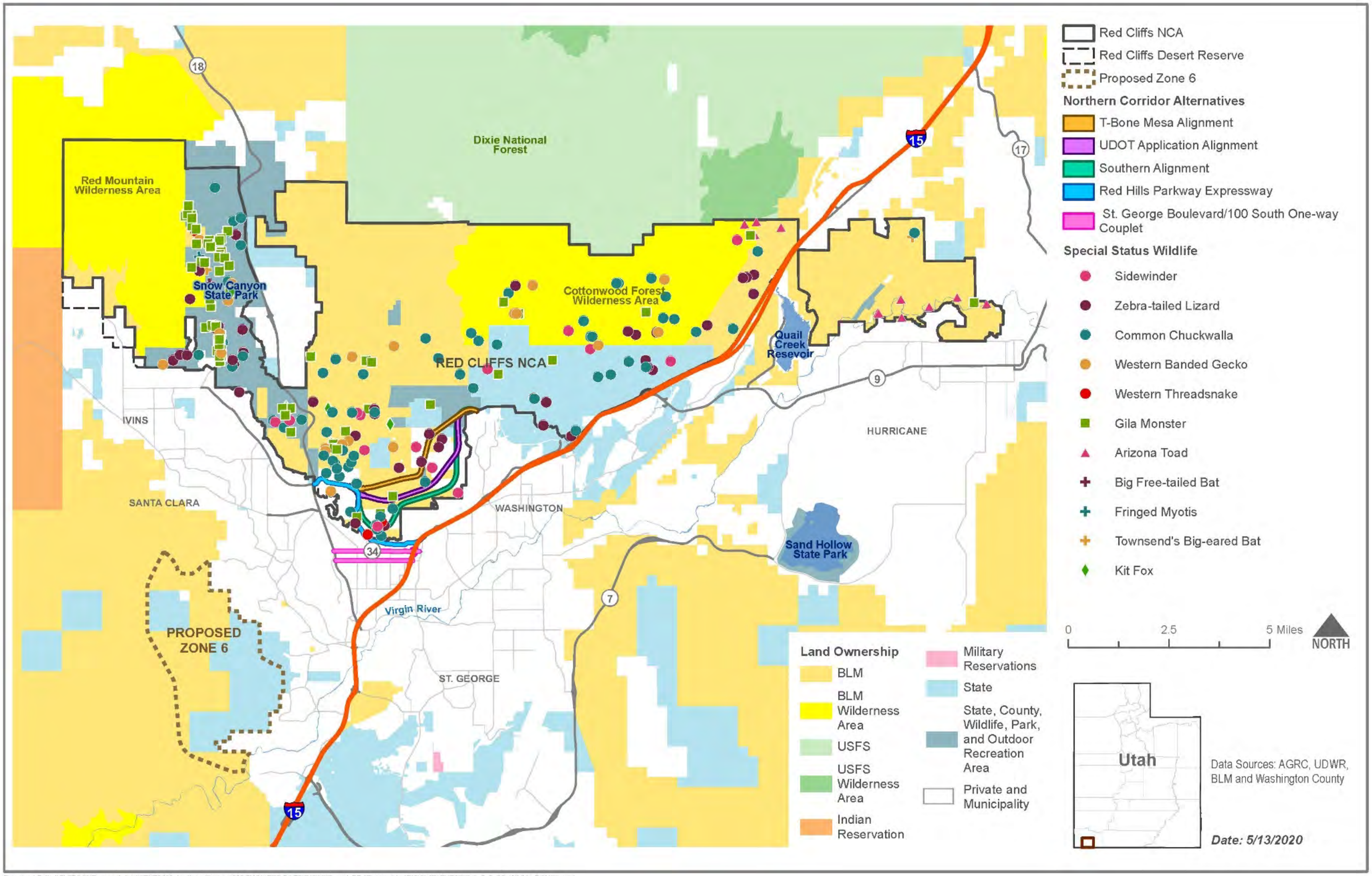
# Map 3.5-5. Mojave Desert Tortoise Relative Density



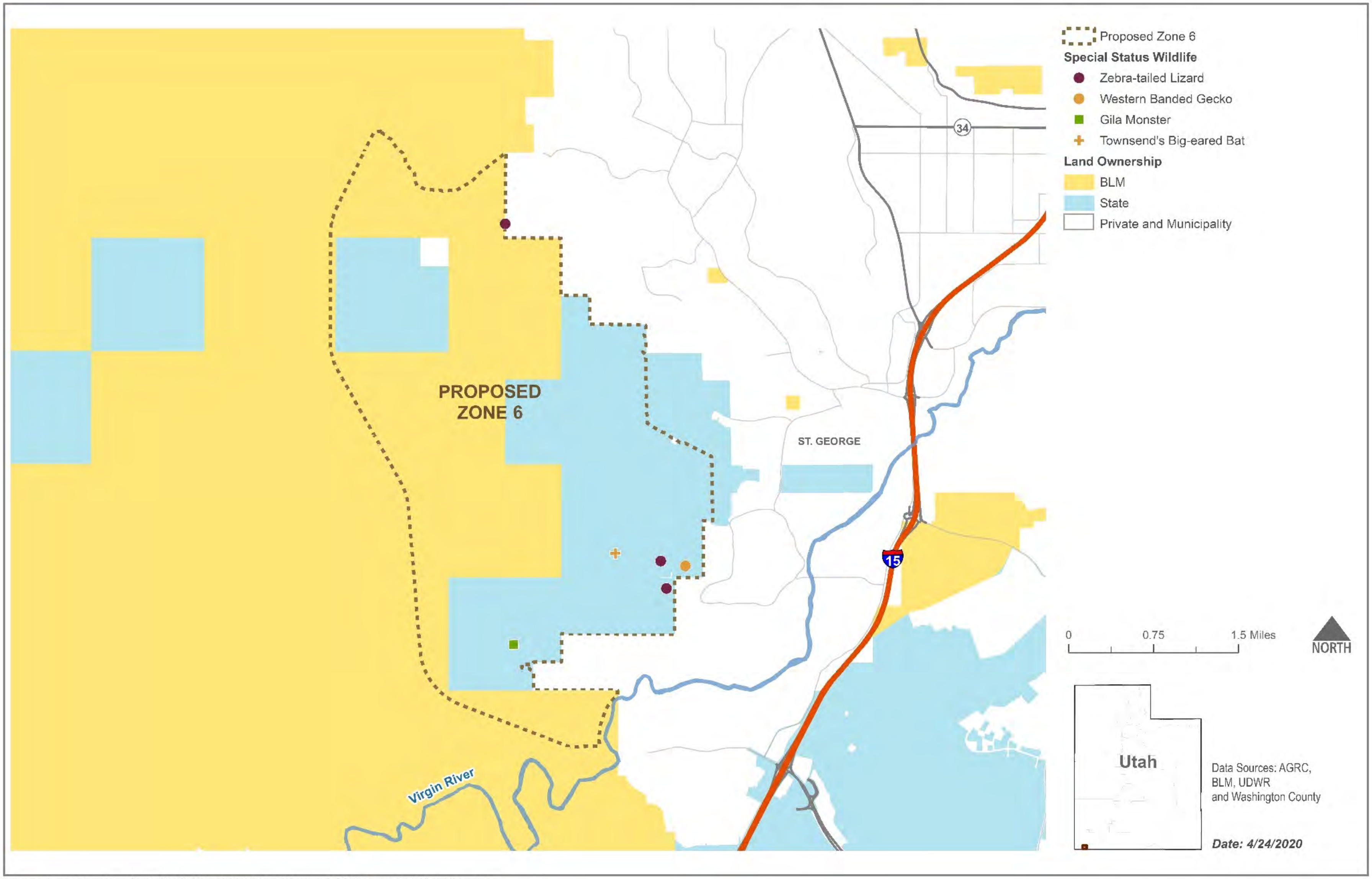
## Map 3.5-6. Mexican Spotted Owl Designated Critical Habitat



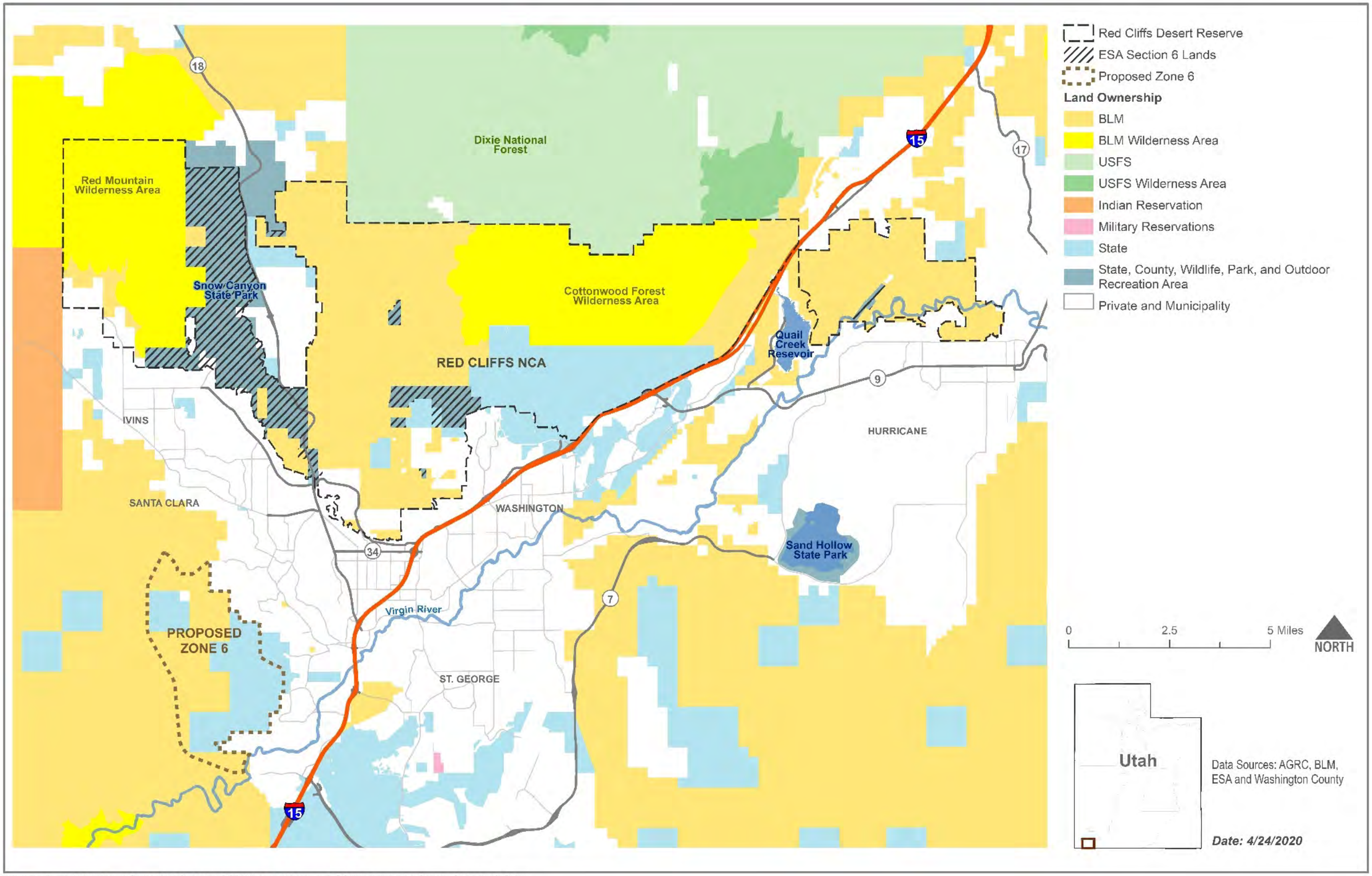
## Map 3.5-7. Special Status Wildlife Species within the Reserve



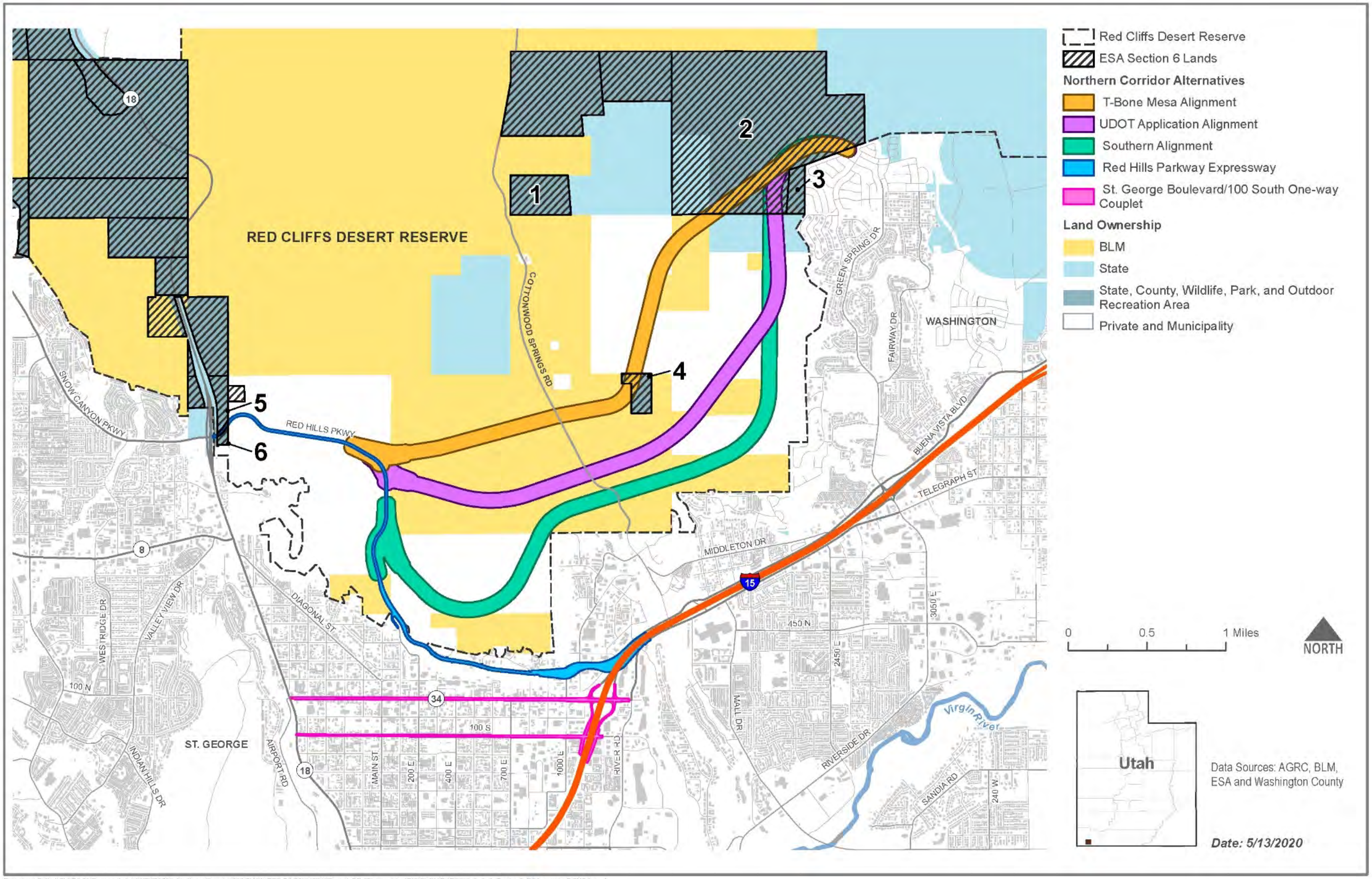
## Map 3.5-8. Special Status Wildlife Species within Proposed Zone 6



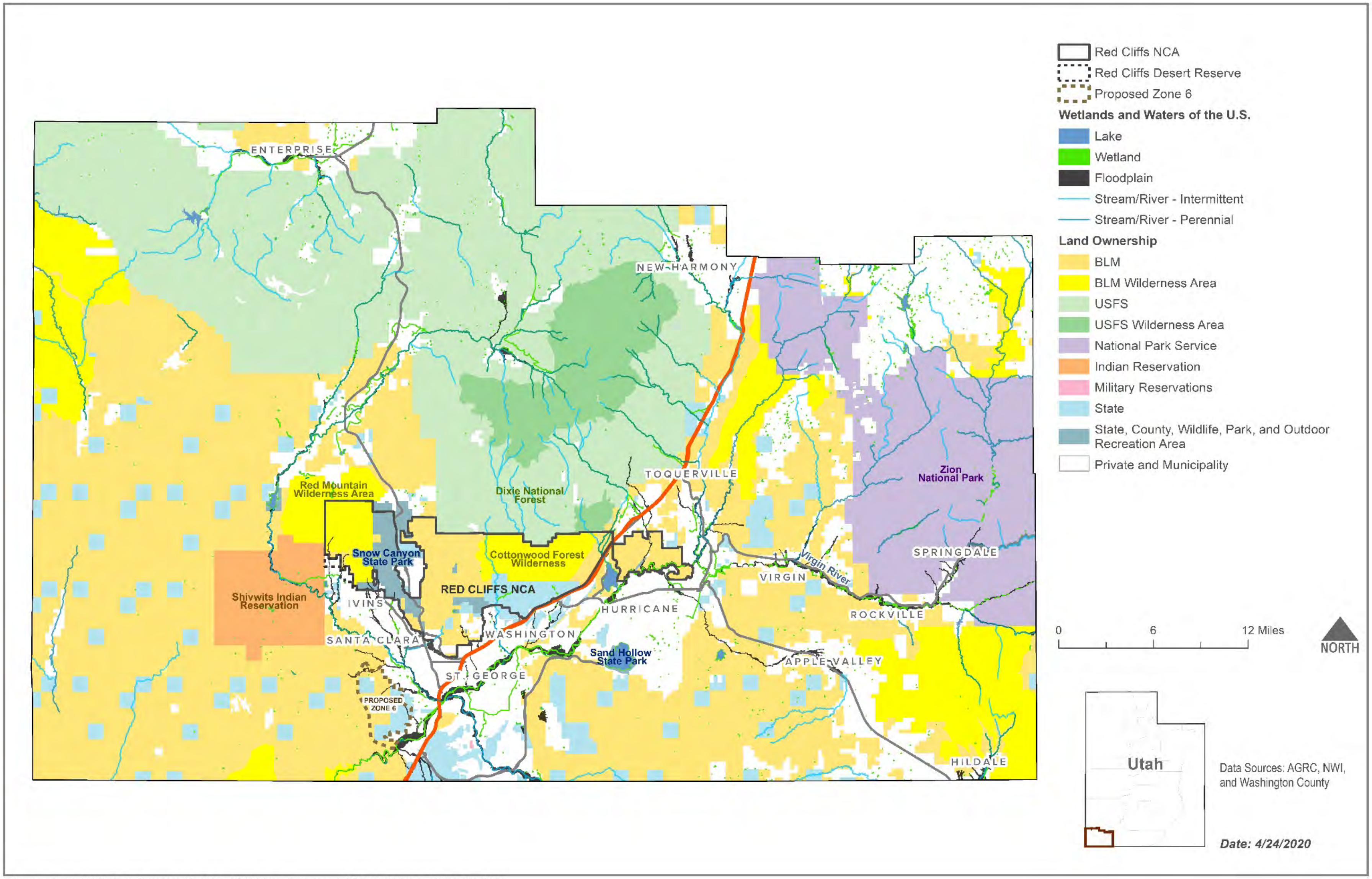
## Map 3.6-1. ESA Section 6 Lands within the Reserve



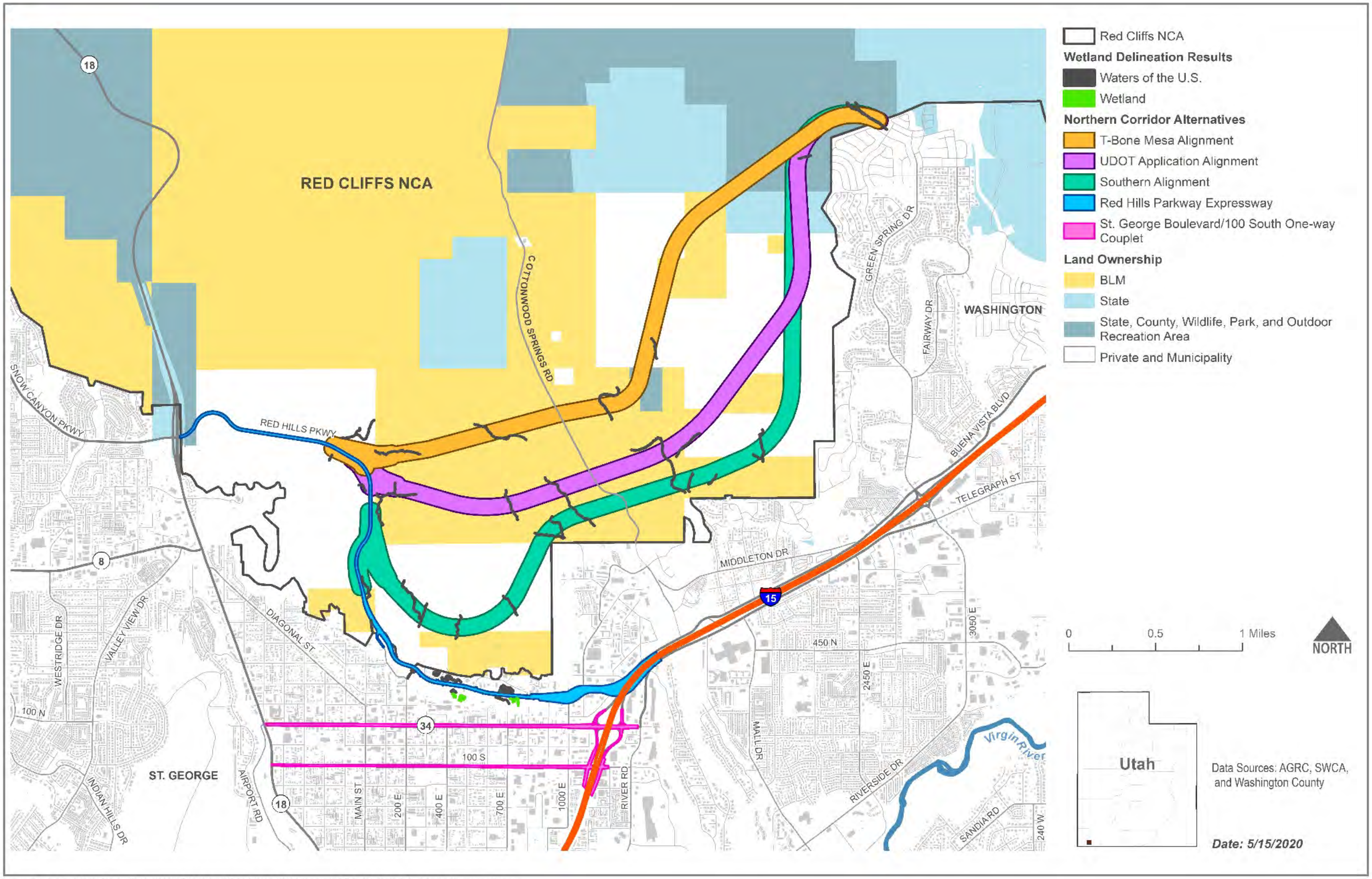
## Map 3.6-2. Northern Corridor ESA Section 6 Land Impacts



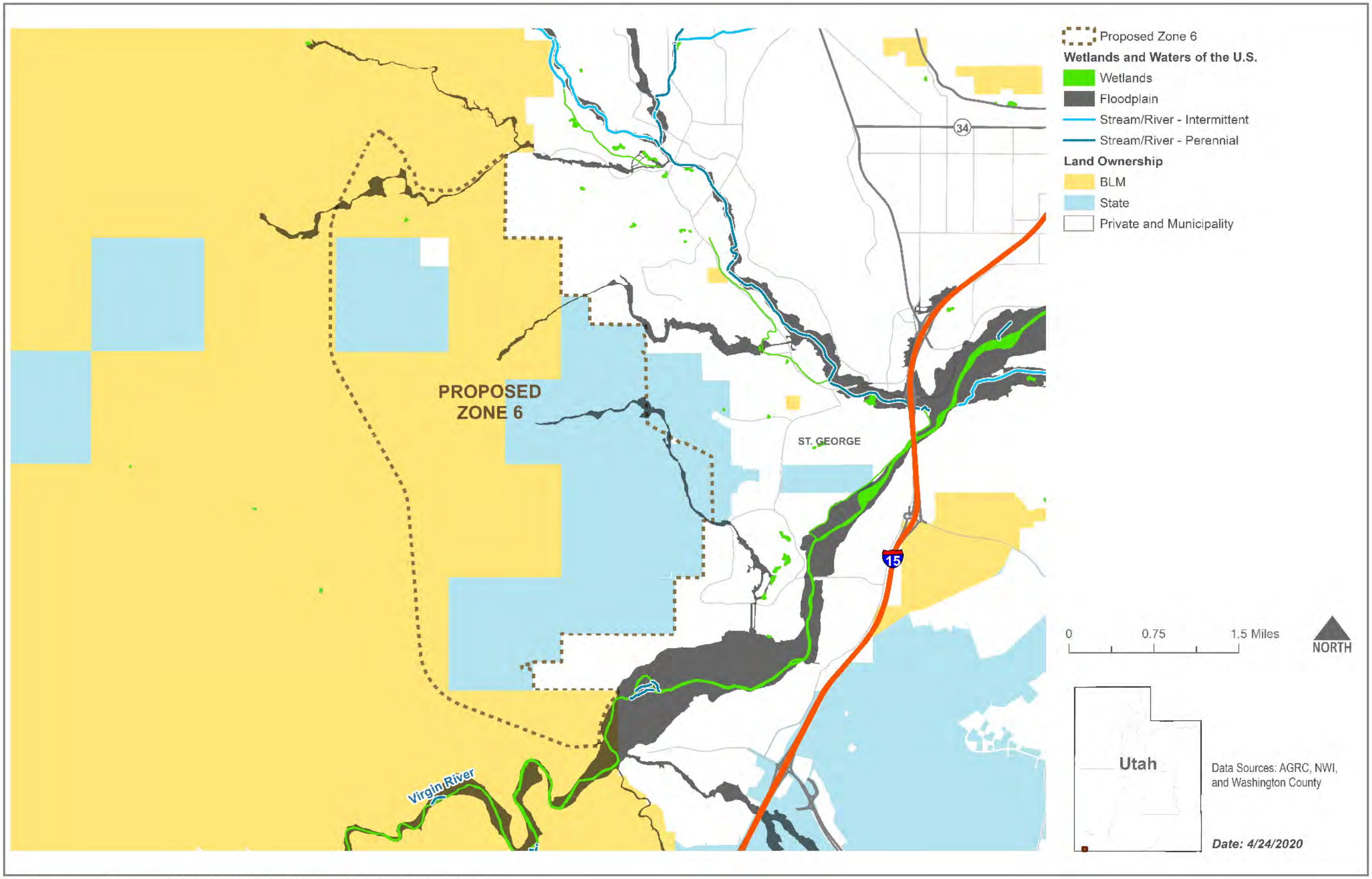
## Map 3.10-1. Wetlands, Waters of the U.S., and Floodplains within Washington County



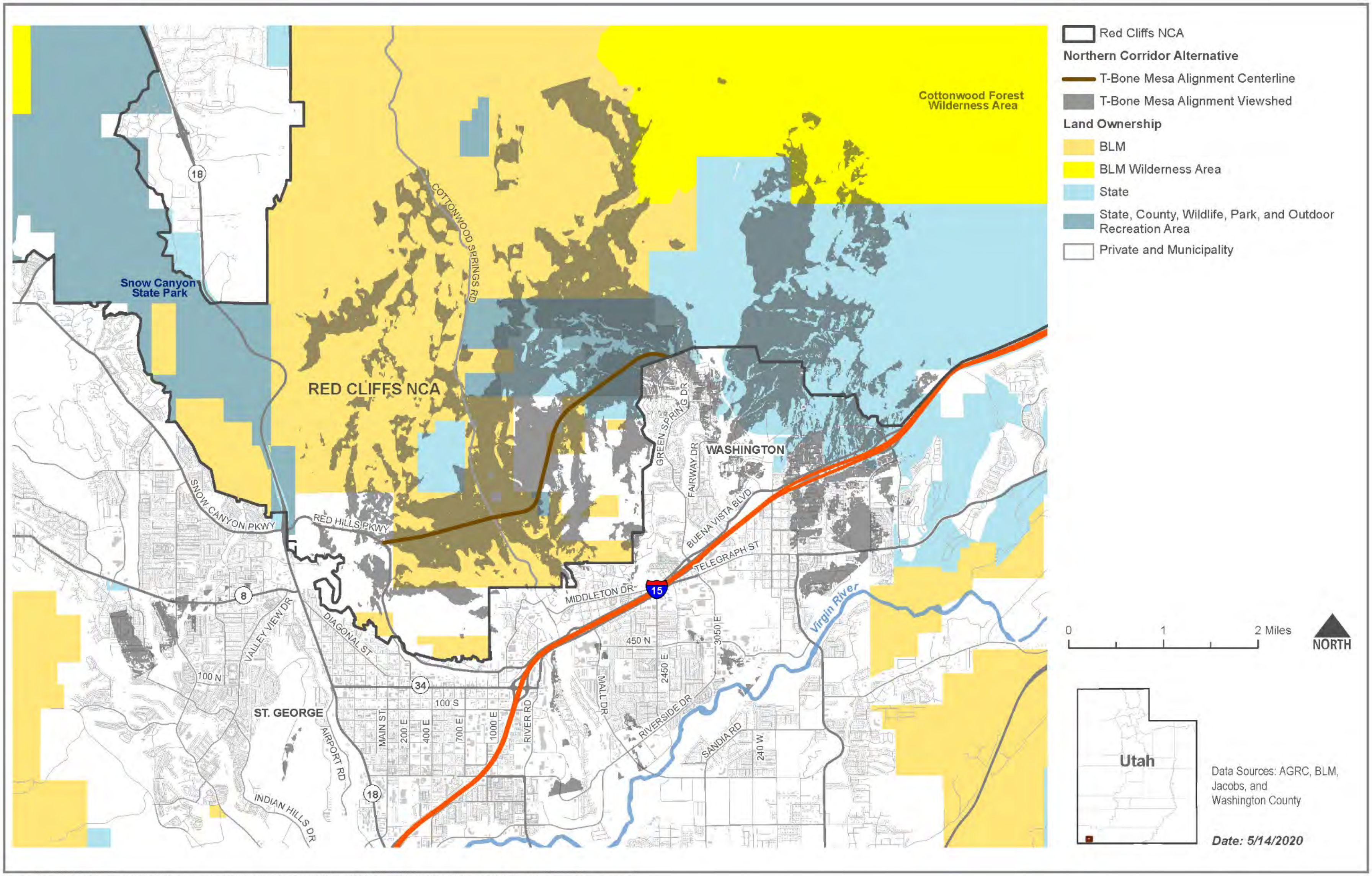
## Map 3.10-2. Wetlands and Waters of the U. S. Delineation Results



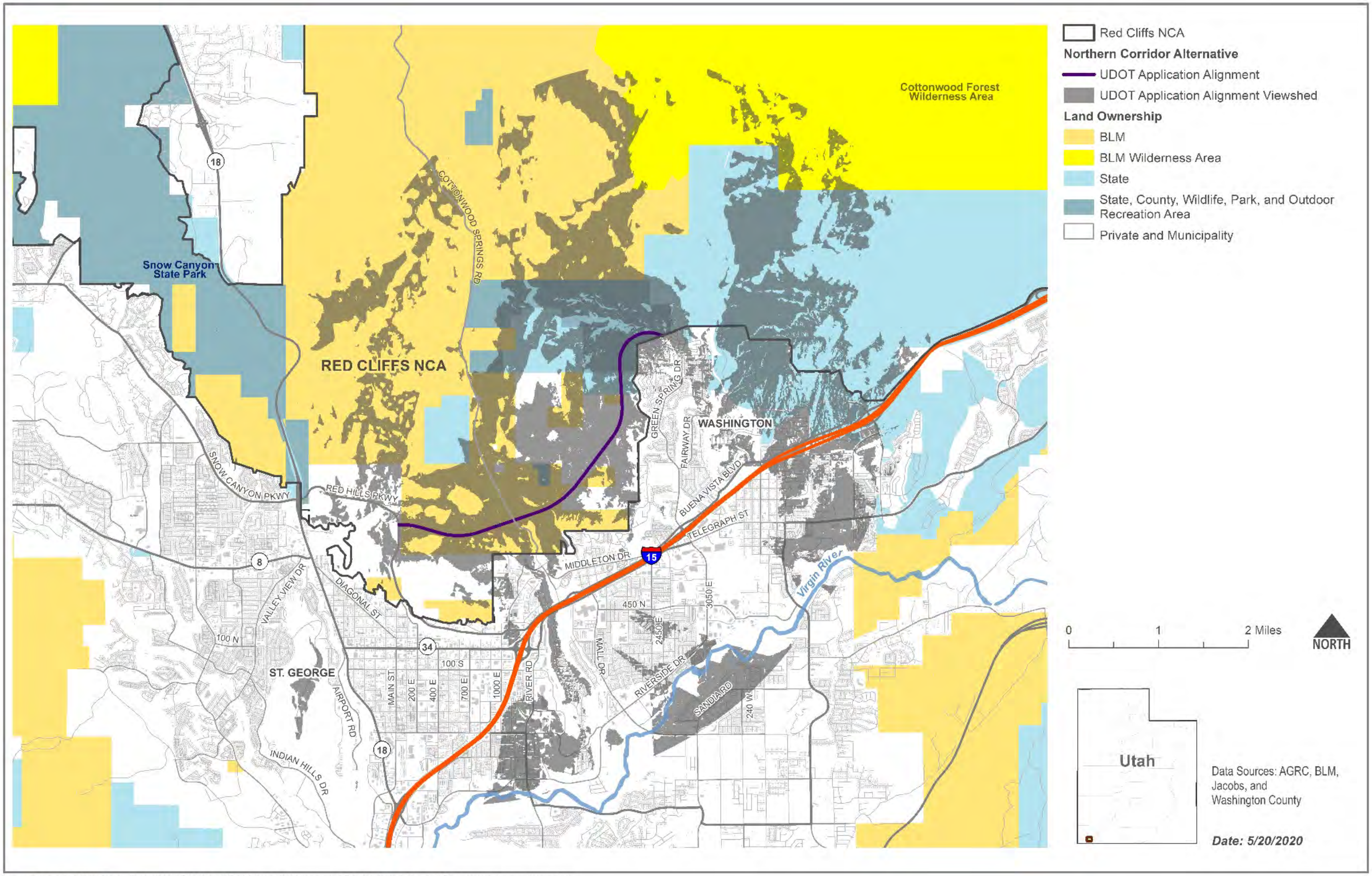
**Map 3.10-3. Wetlands, Waters of the U.S., and Floodplains within Proposed Zone 6**



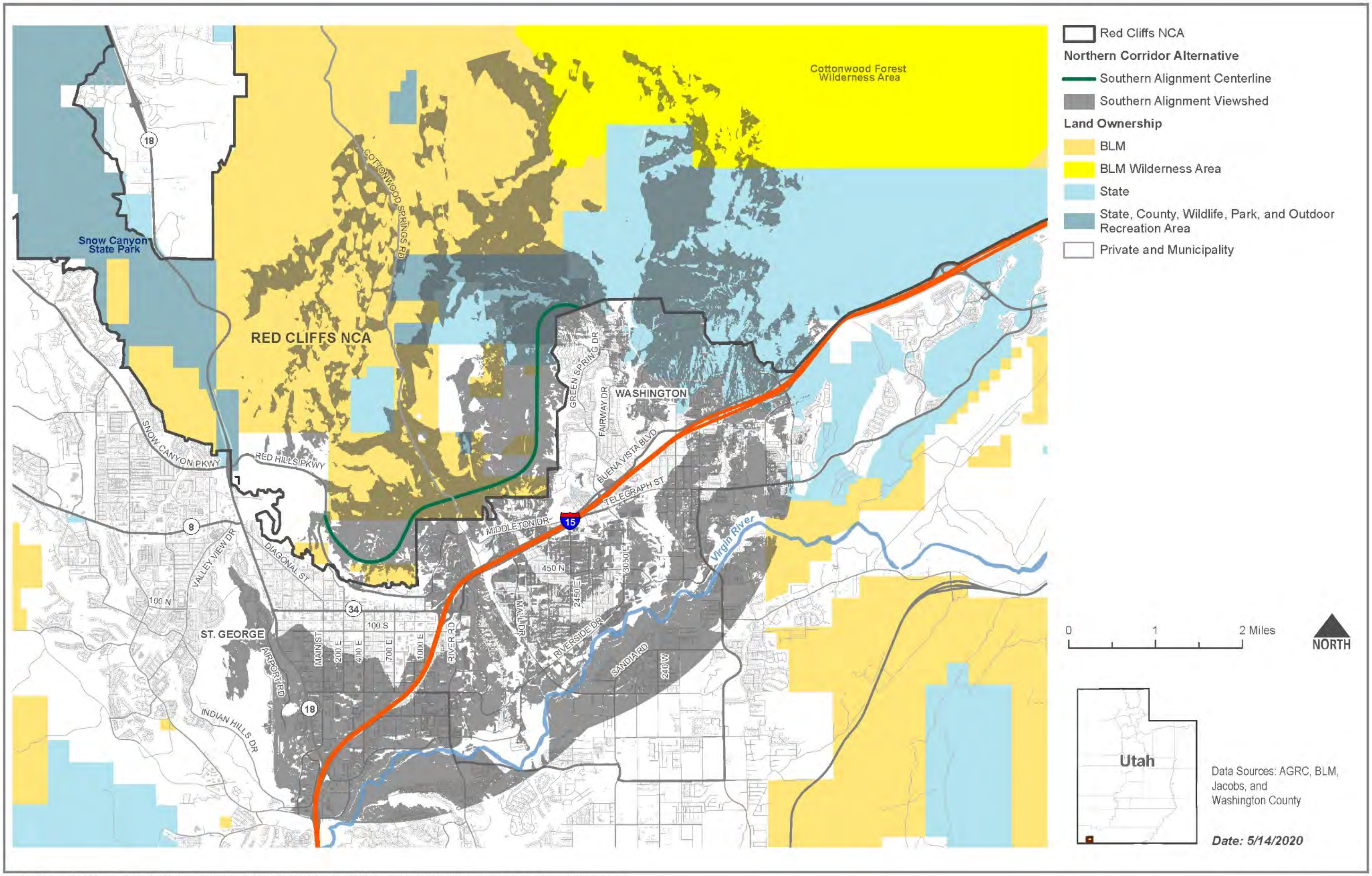
## Map 3.13-1a. Visibility Map: T-Bone Mesa Alignment



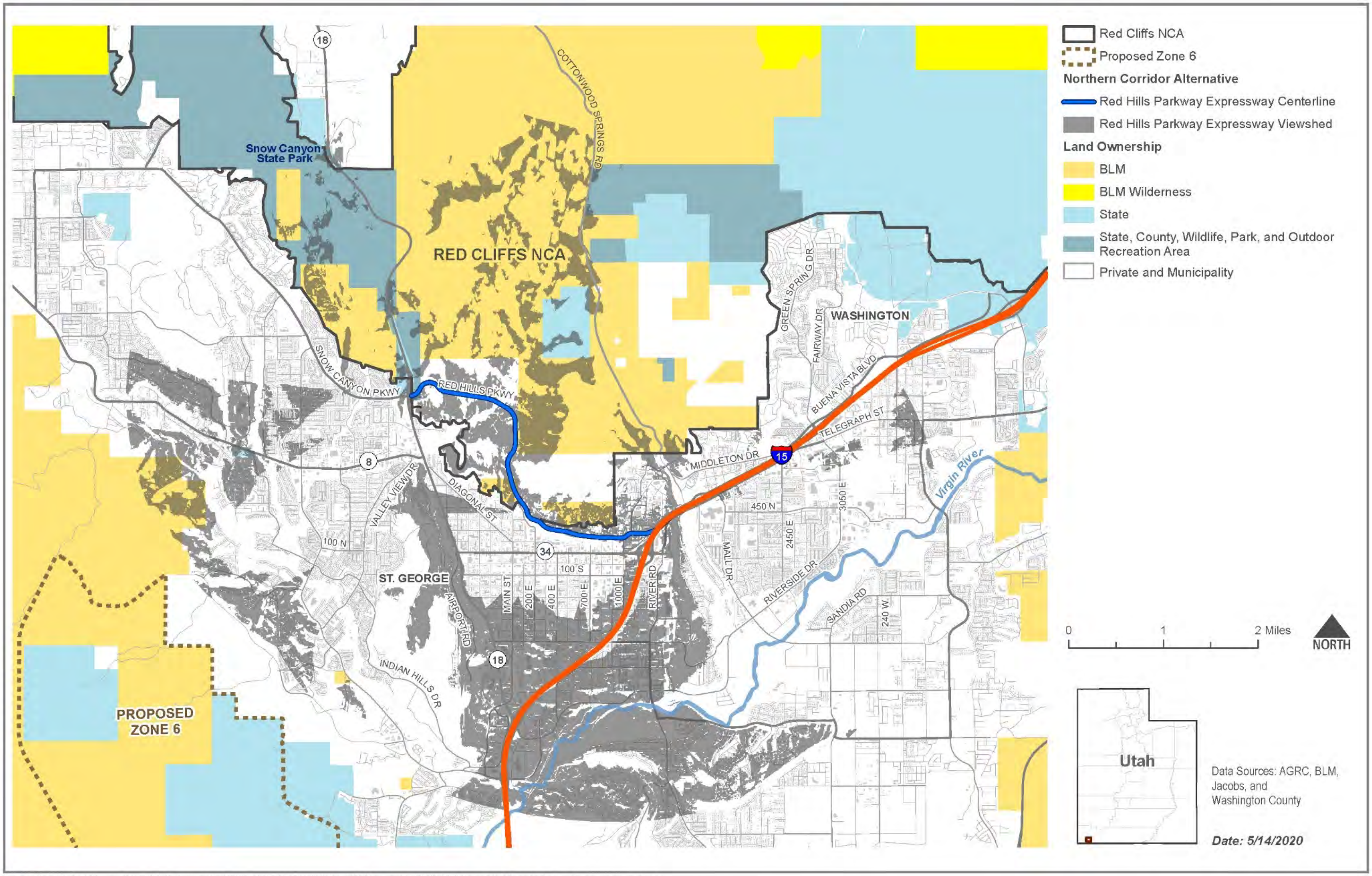
## Map 3.13-1b. Visibility Map: UDOT Application Alignment



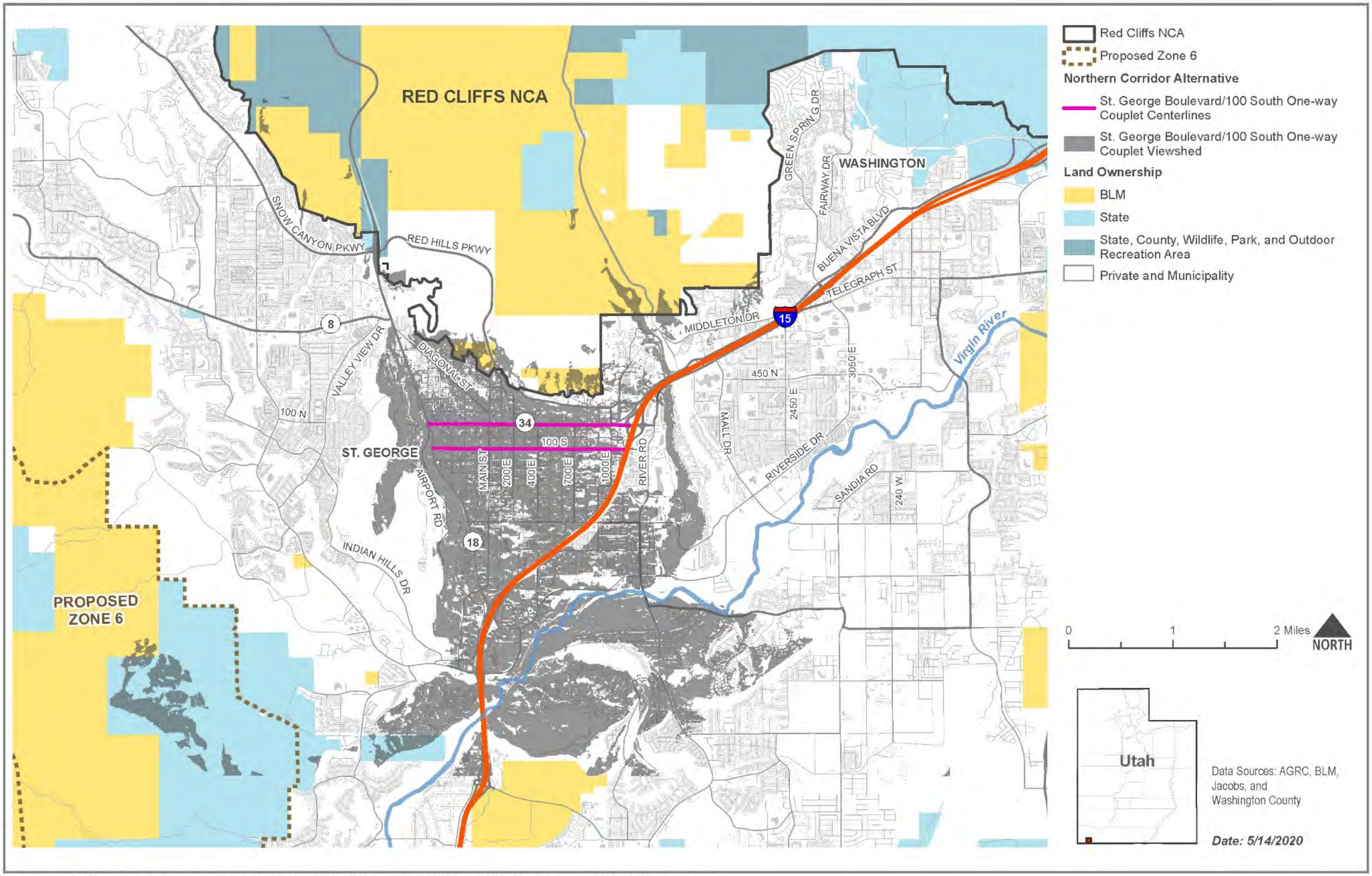
## Map 3.13-1c. Visibility Map: Southern Alignment



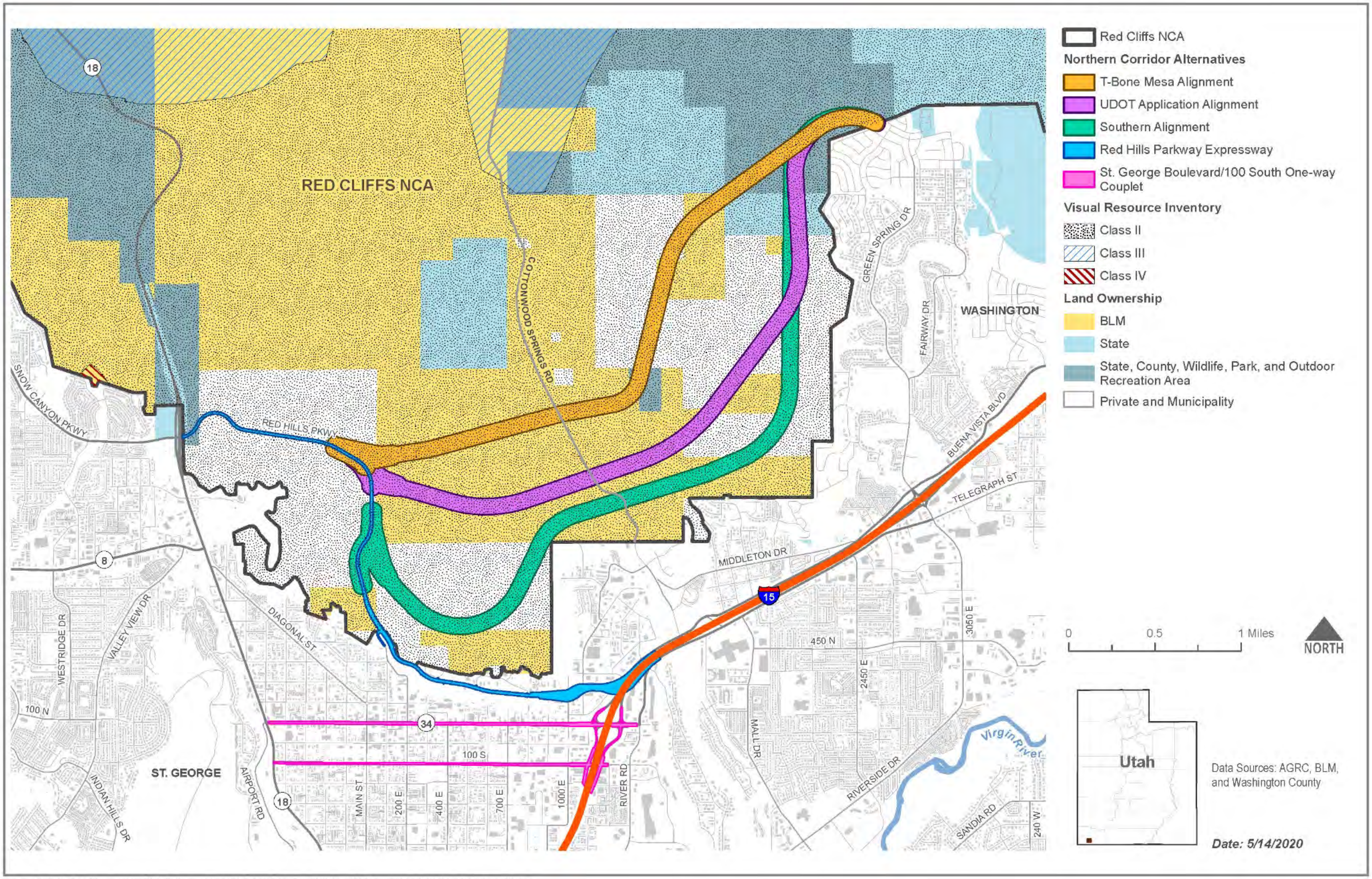
## Map 3.13-1d. Visibility Map: Red Hills Parkway Expressway



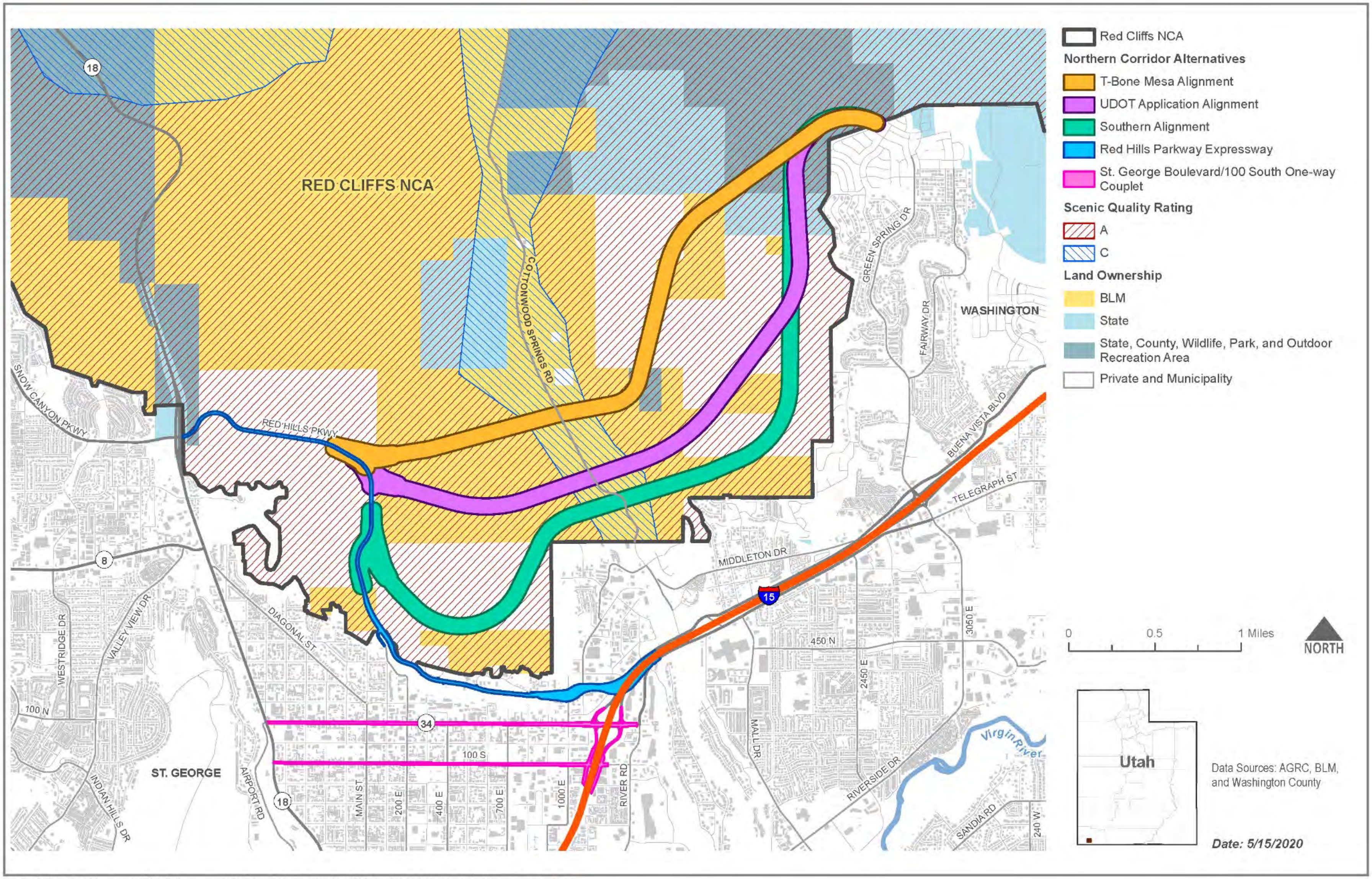
## Map 3.13-1e. Visibility Map: St. George Boulevard/100 South One-way Couplet



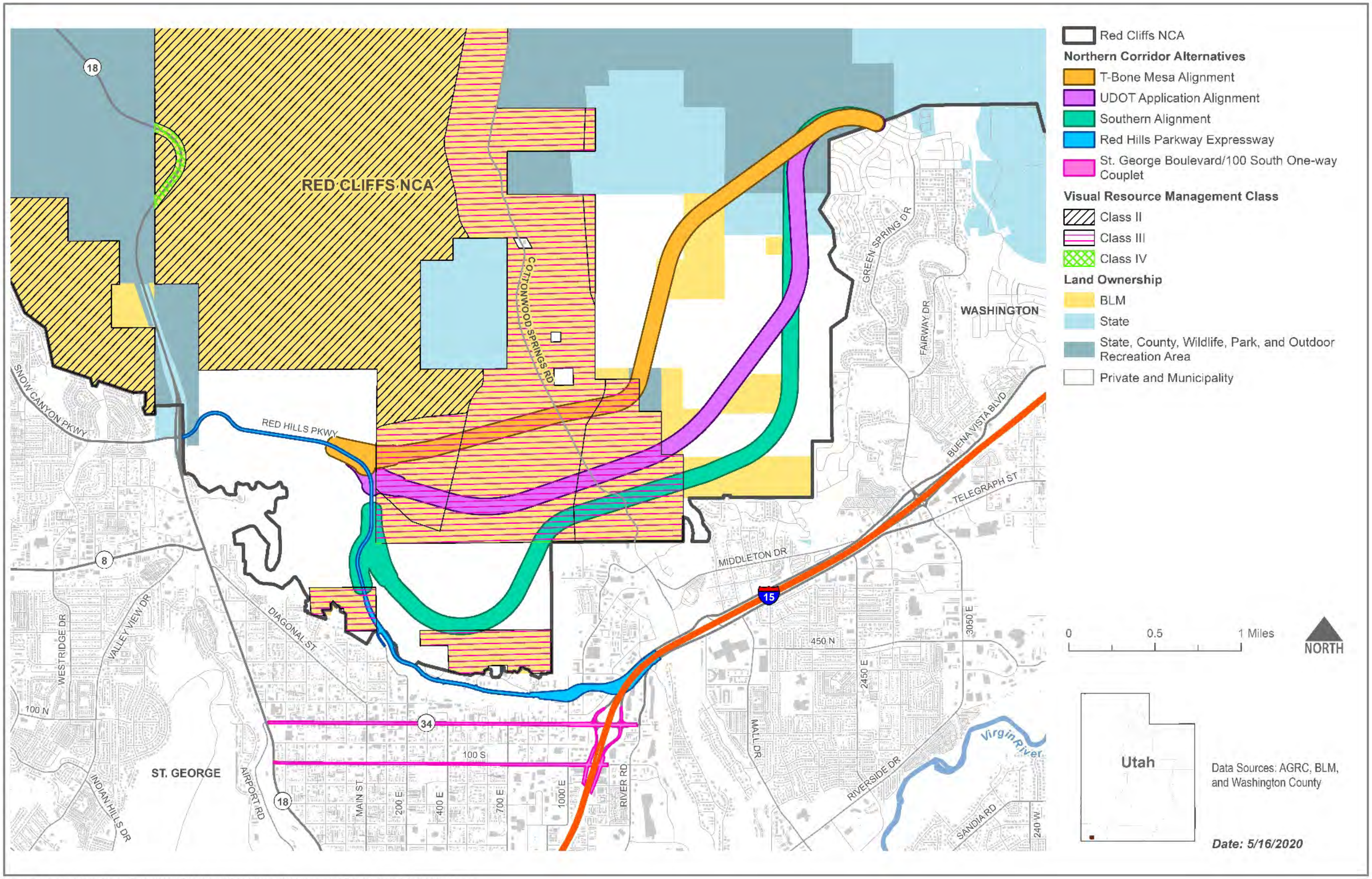
## Map 3.13-2. Visual Resource Inventory Classes within the Red Cliffs NCA



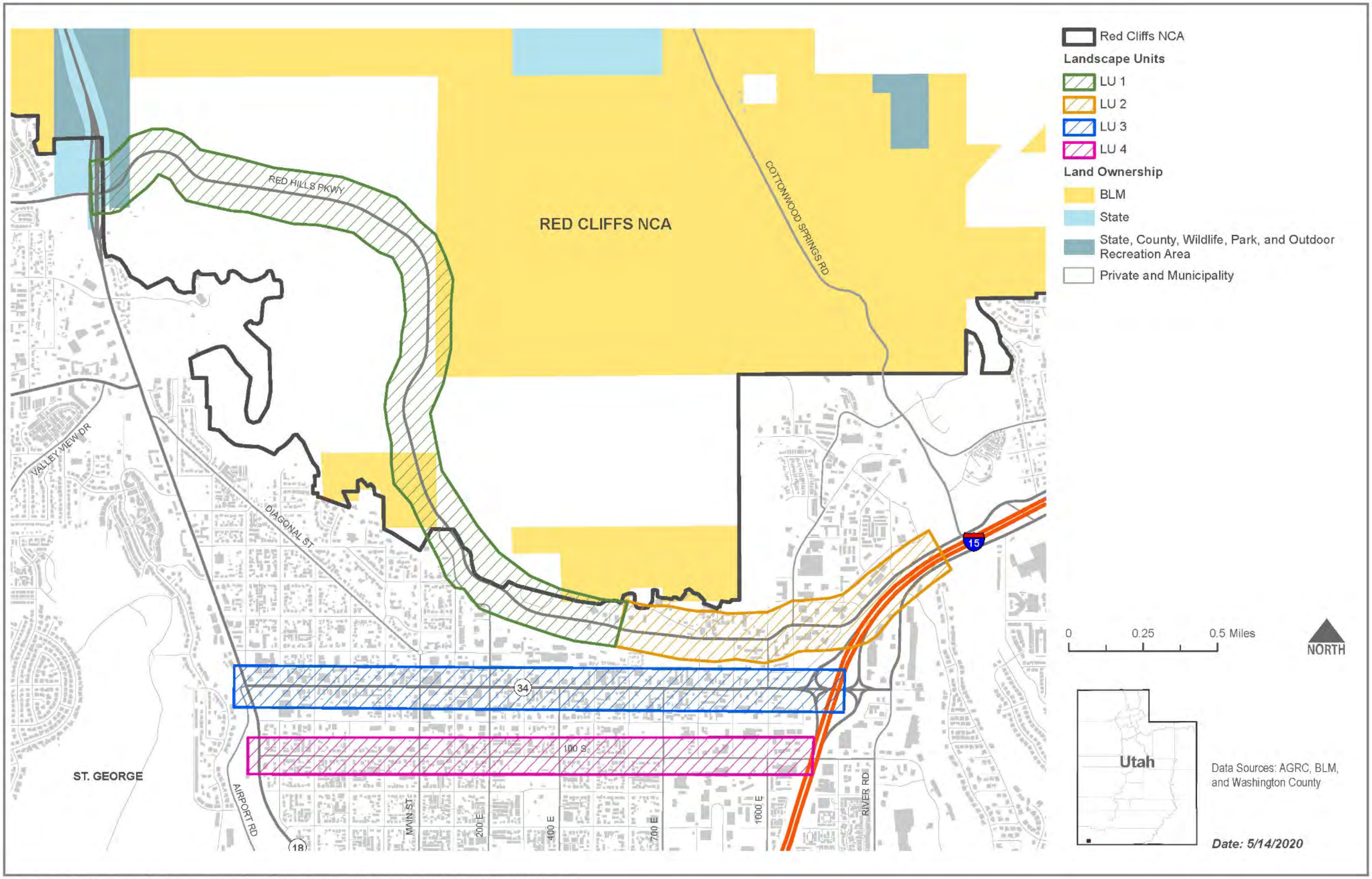
**Map 3.13-3. Visual Resource Inventory Scenic Quality within the Red Cliffs NCA**



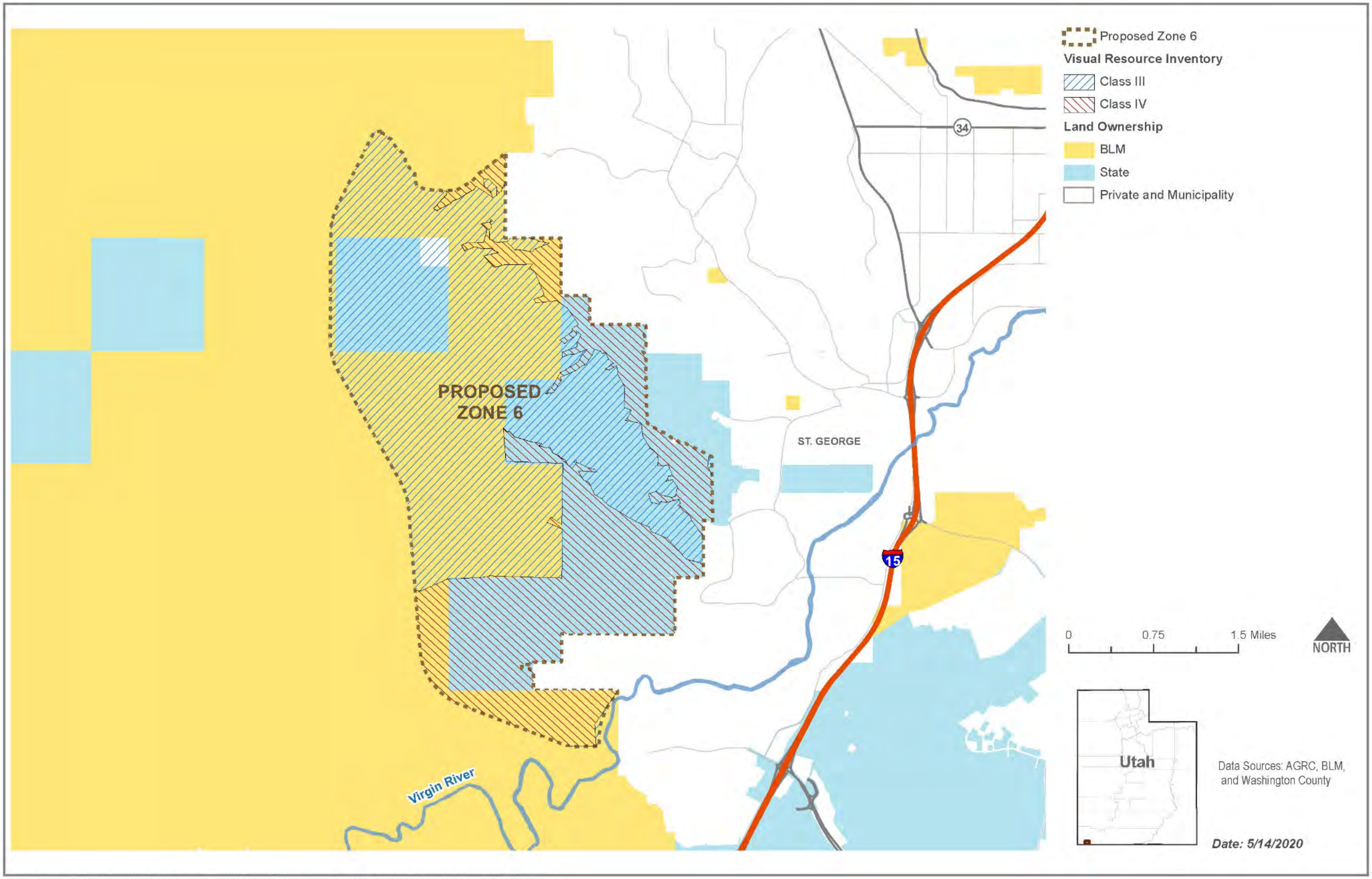
## Map 3.13-4. Visual Resource Management Classes within the Red Cliffs NCA



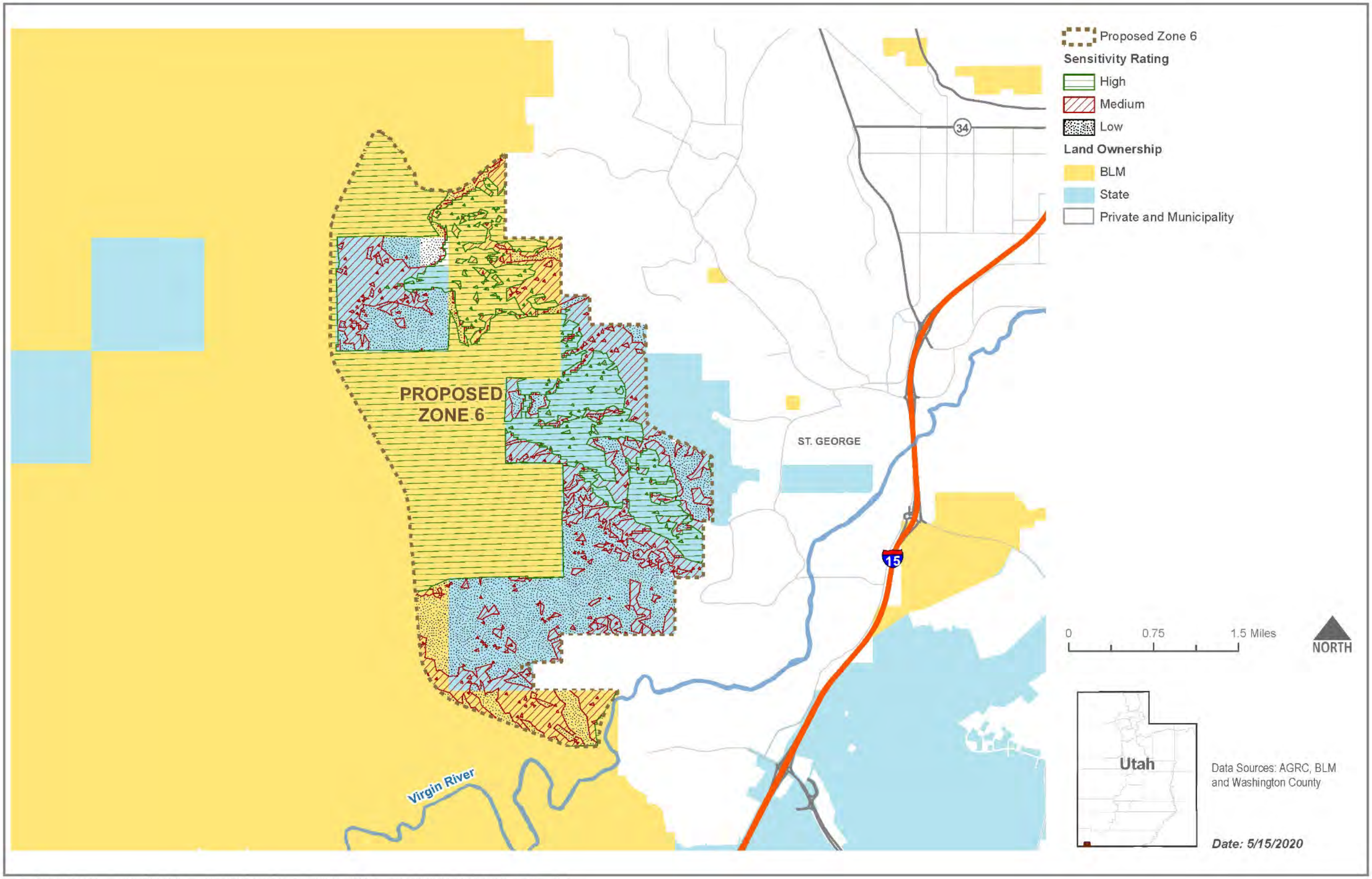
## Map 3.13-5. Landscape Units



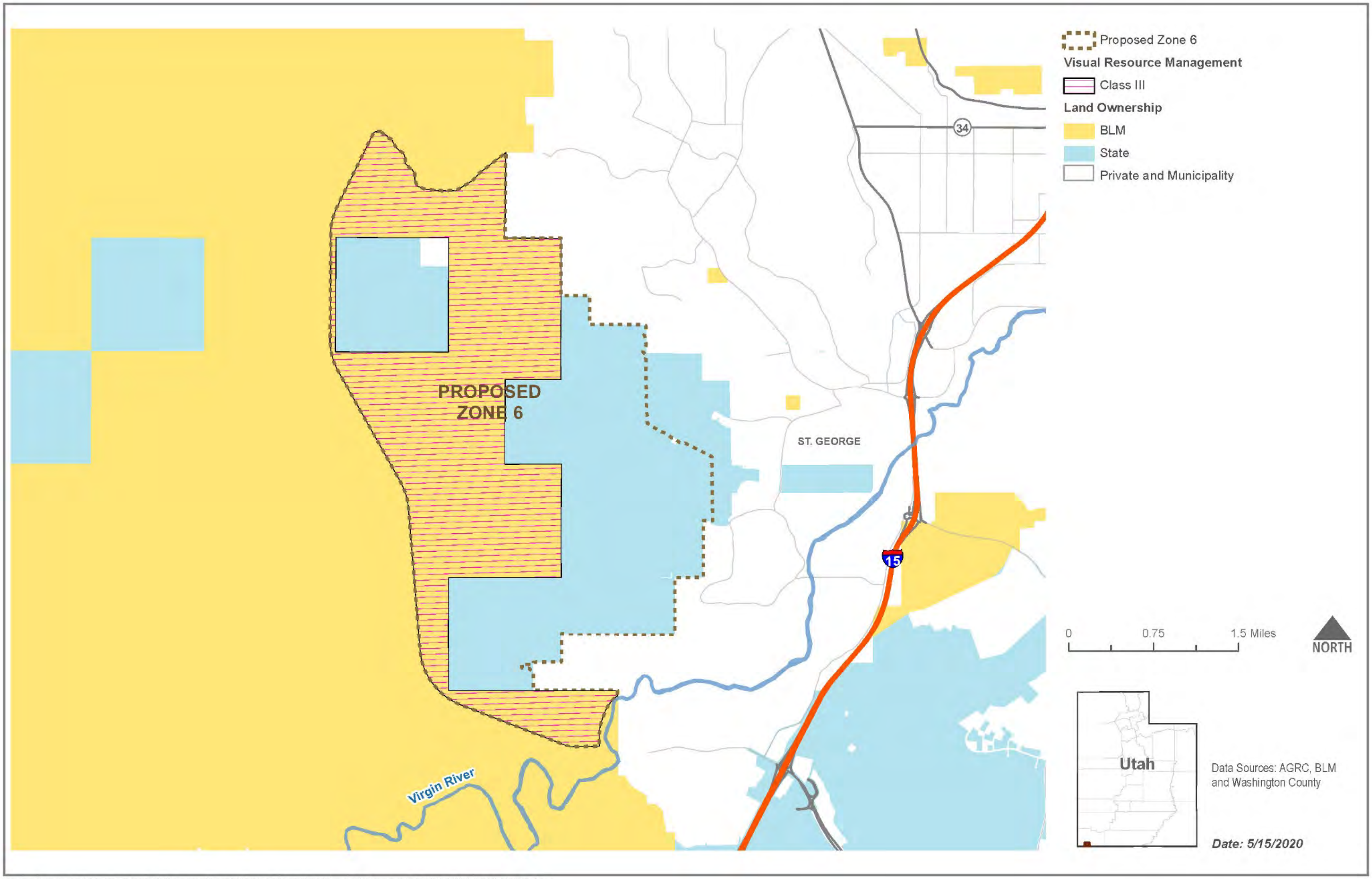
## Map 3.13-6. Visual Resource Inventory Classes within Proposed Zone 6



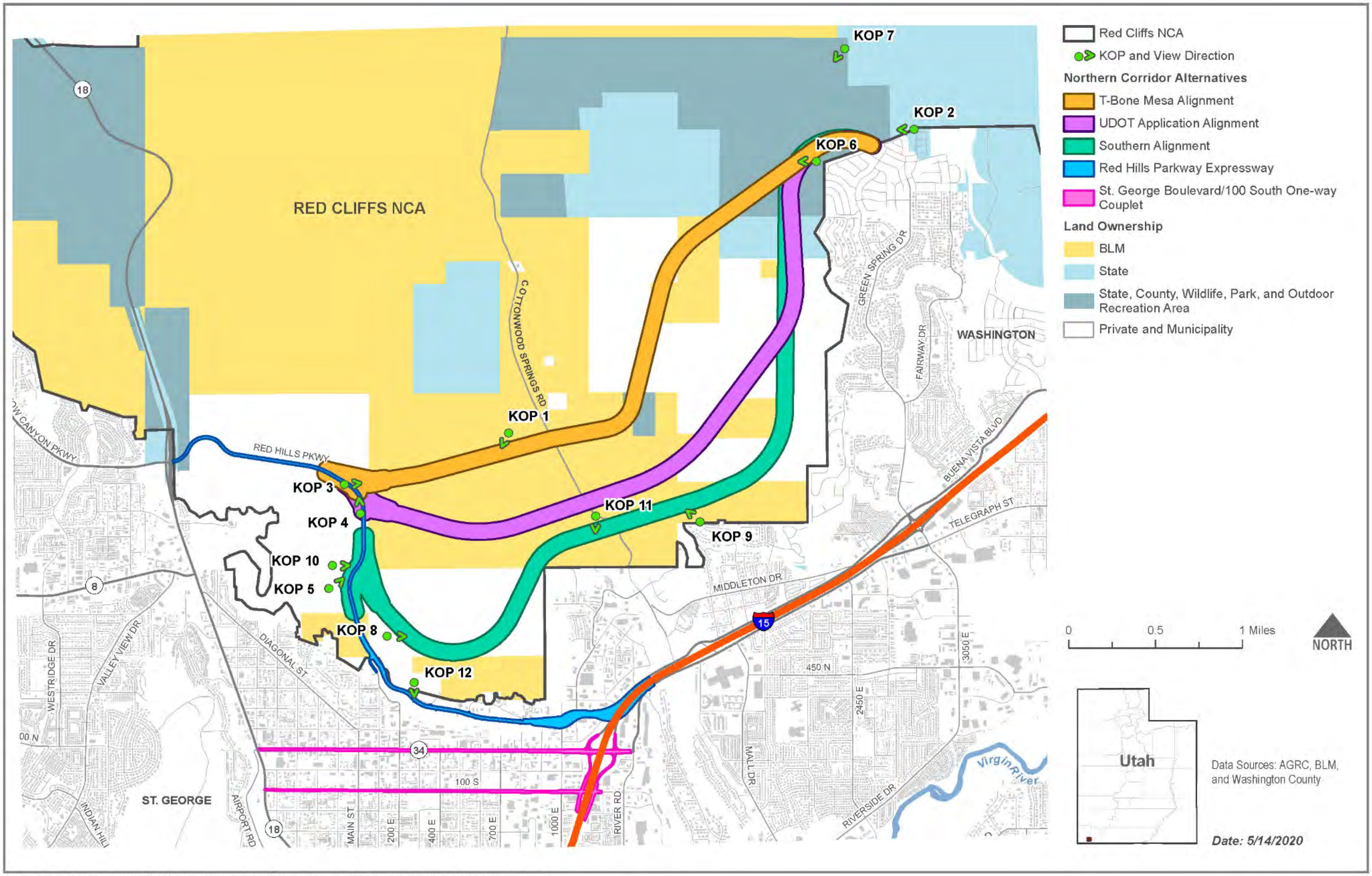
## Map 3.13-7. Visual Resource Inventory Sensitivity Ratings within Proposed Zone 6



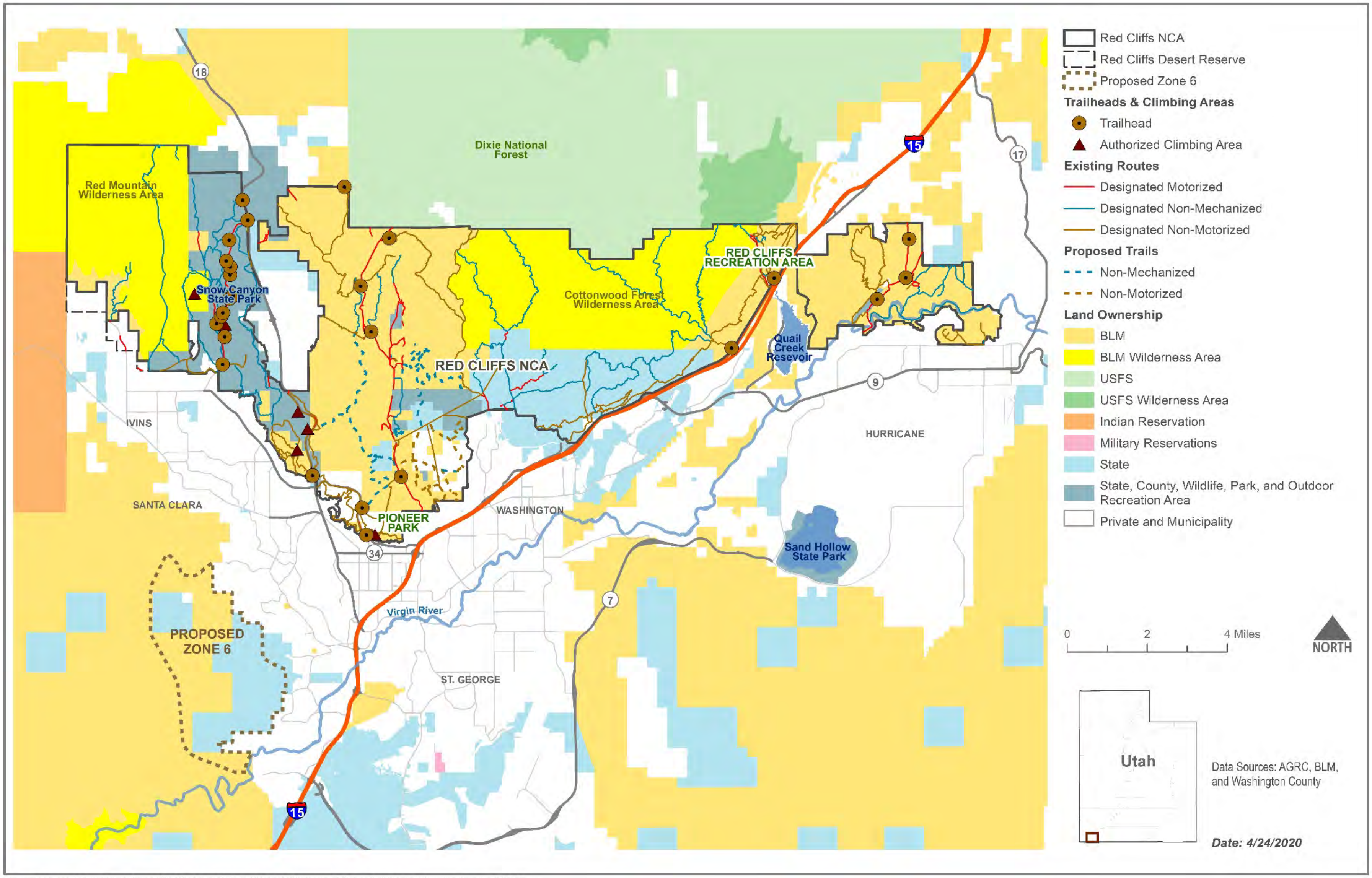
## Map 3.13-8. Visual Resource Management Classes within Proposed Zone 6



## Map 3.13-9. Key Observation Point Locations



## Map 3.15-1. Recreation and Visitor Services within the Red Cliffs NCA

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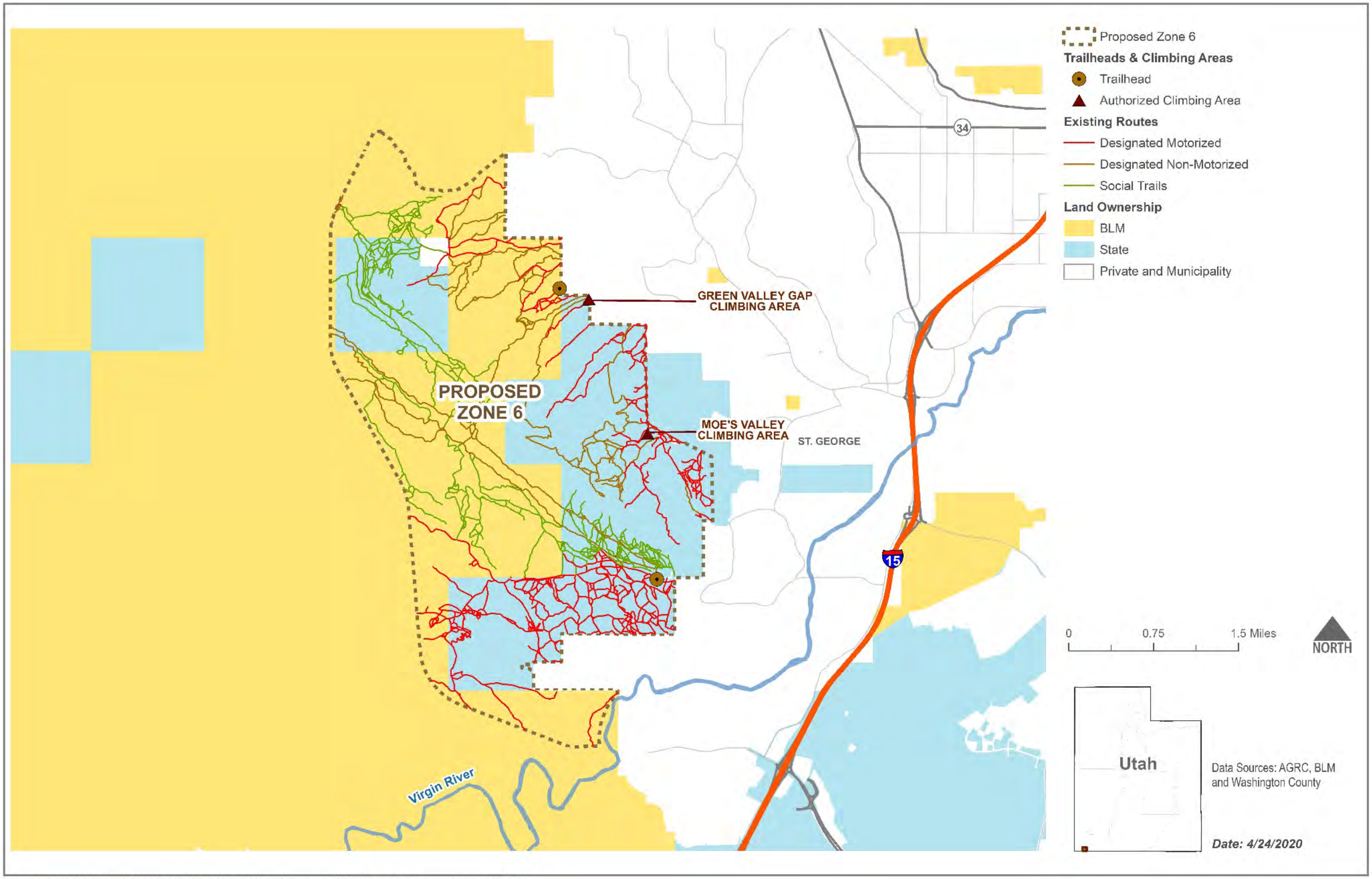
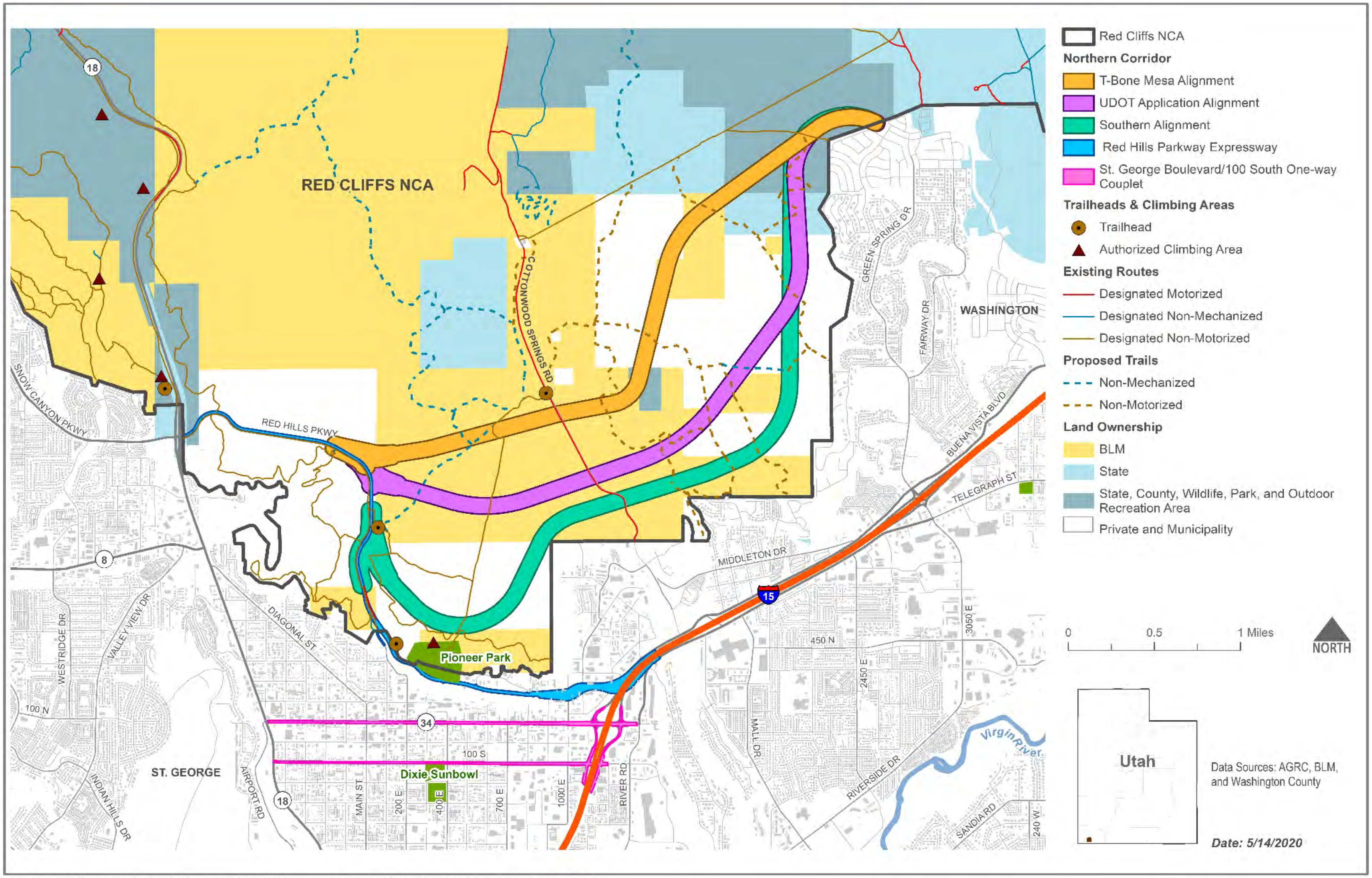
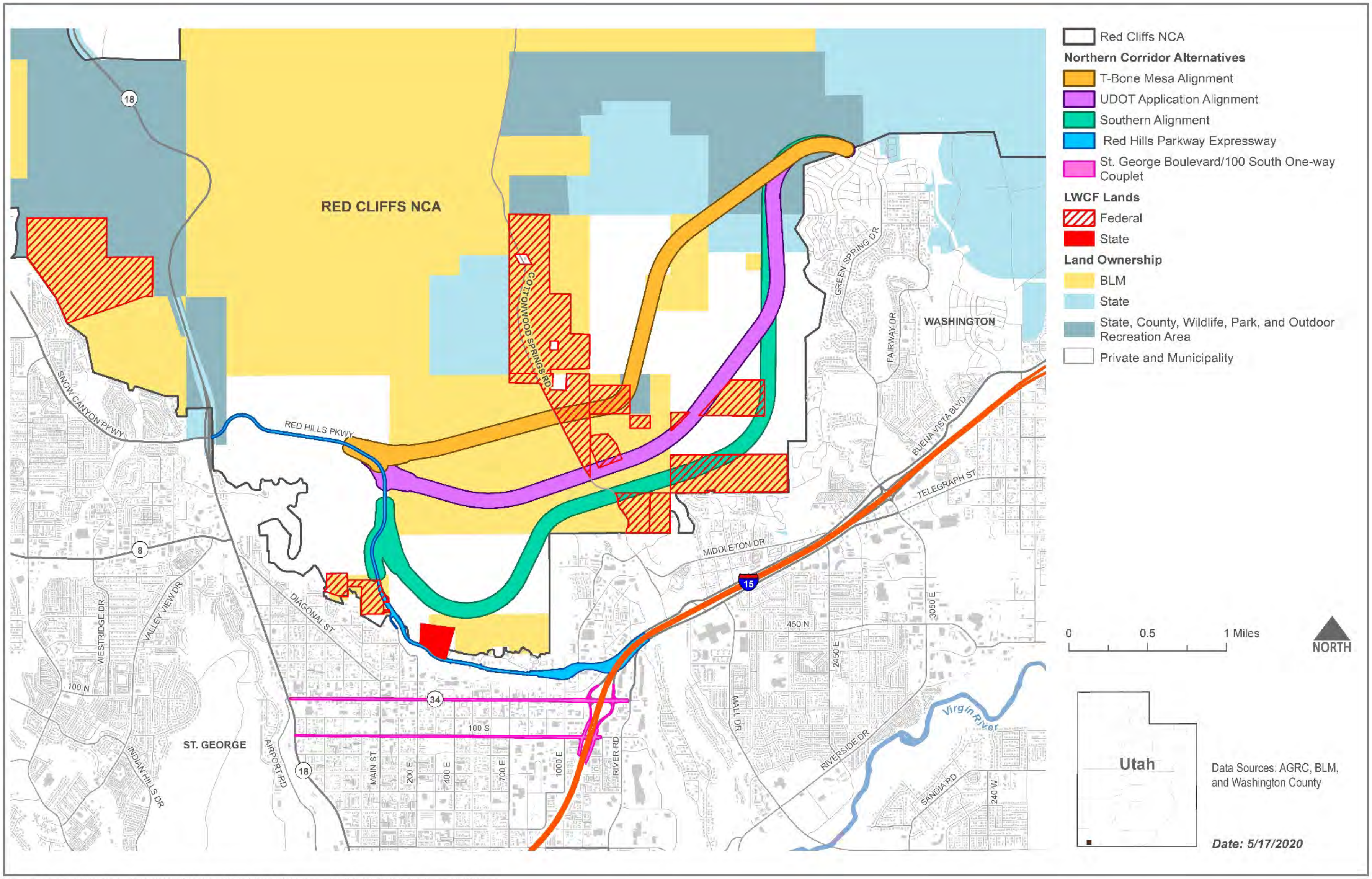
## Map 3.15-2. Recreation and Visitor Services within Proposed Zone 6



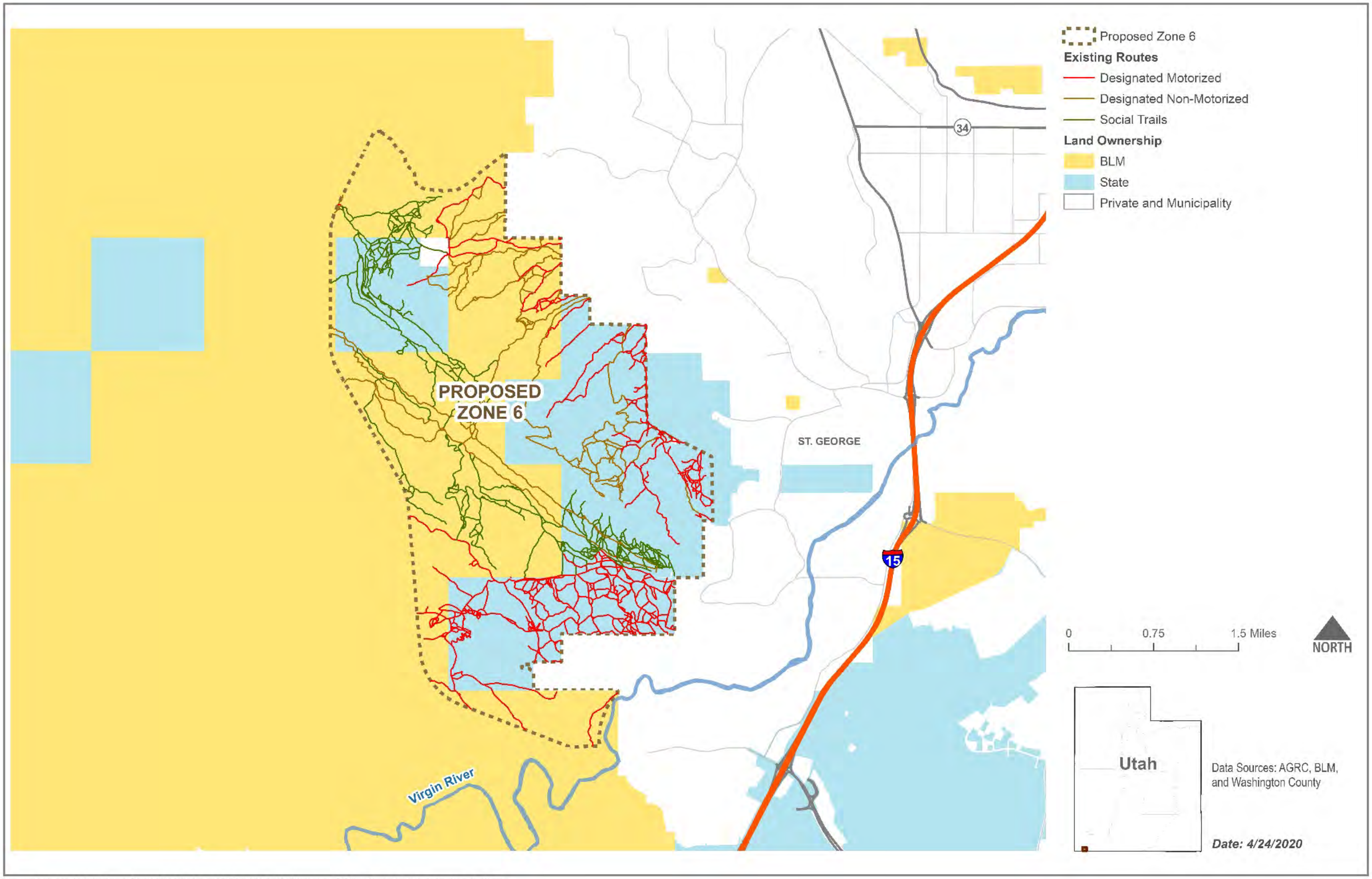
## Map 3.15-3. Recreation and Visitor Services Impacted by the Northern Corridor Alternatives



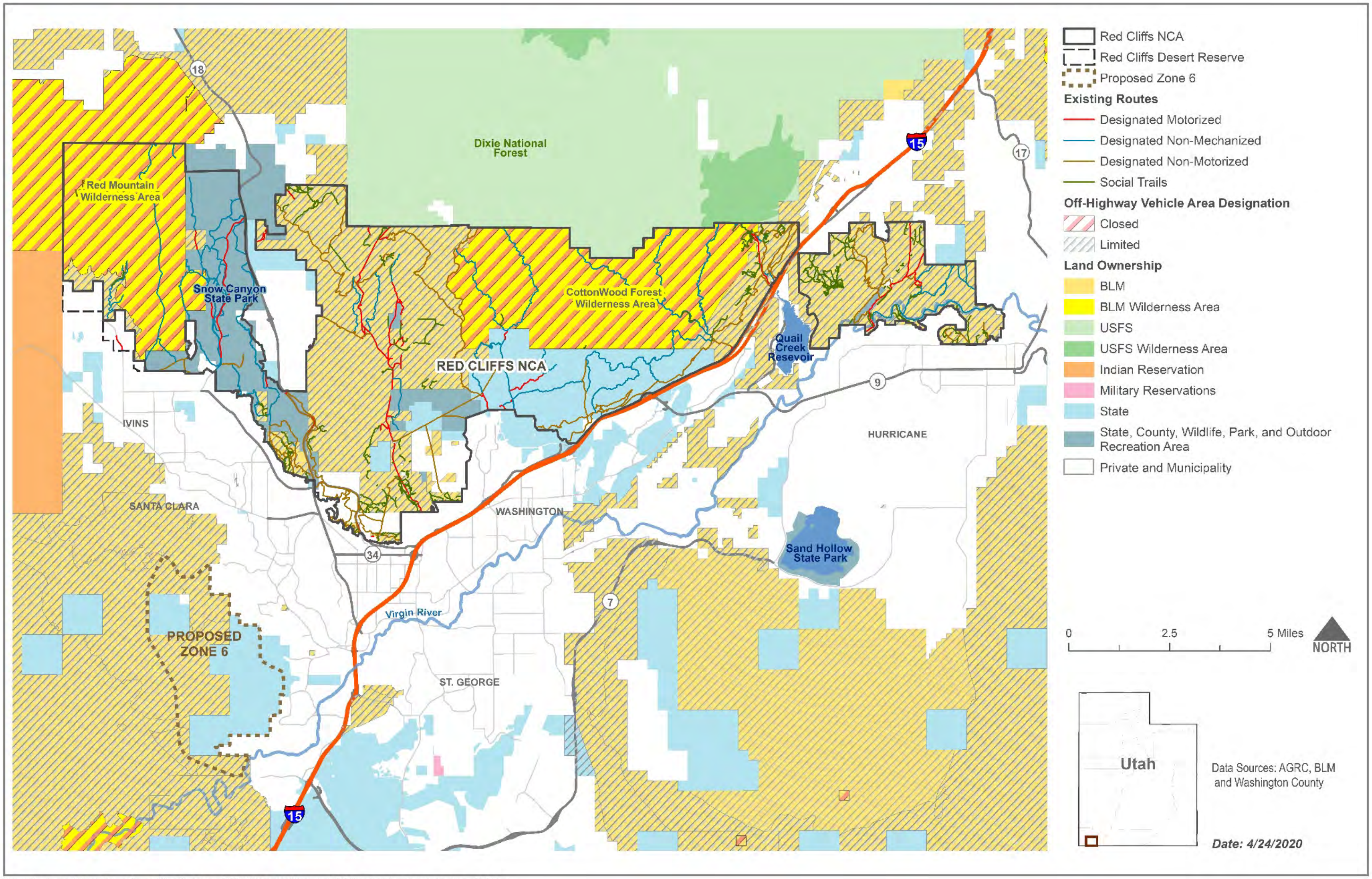
## Map 3.16-1. Land and Water Conservation Fund Act Lands [Section 6(f) Properties] within the Red Cliffs NCA and Reserve



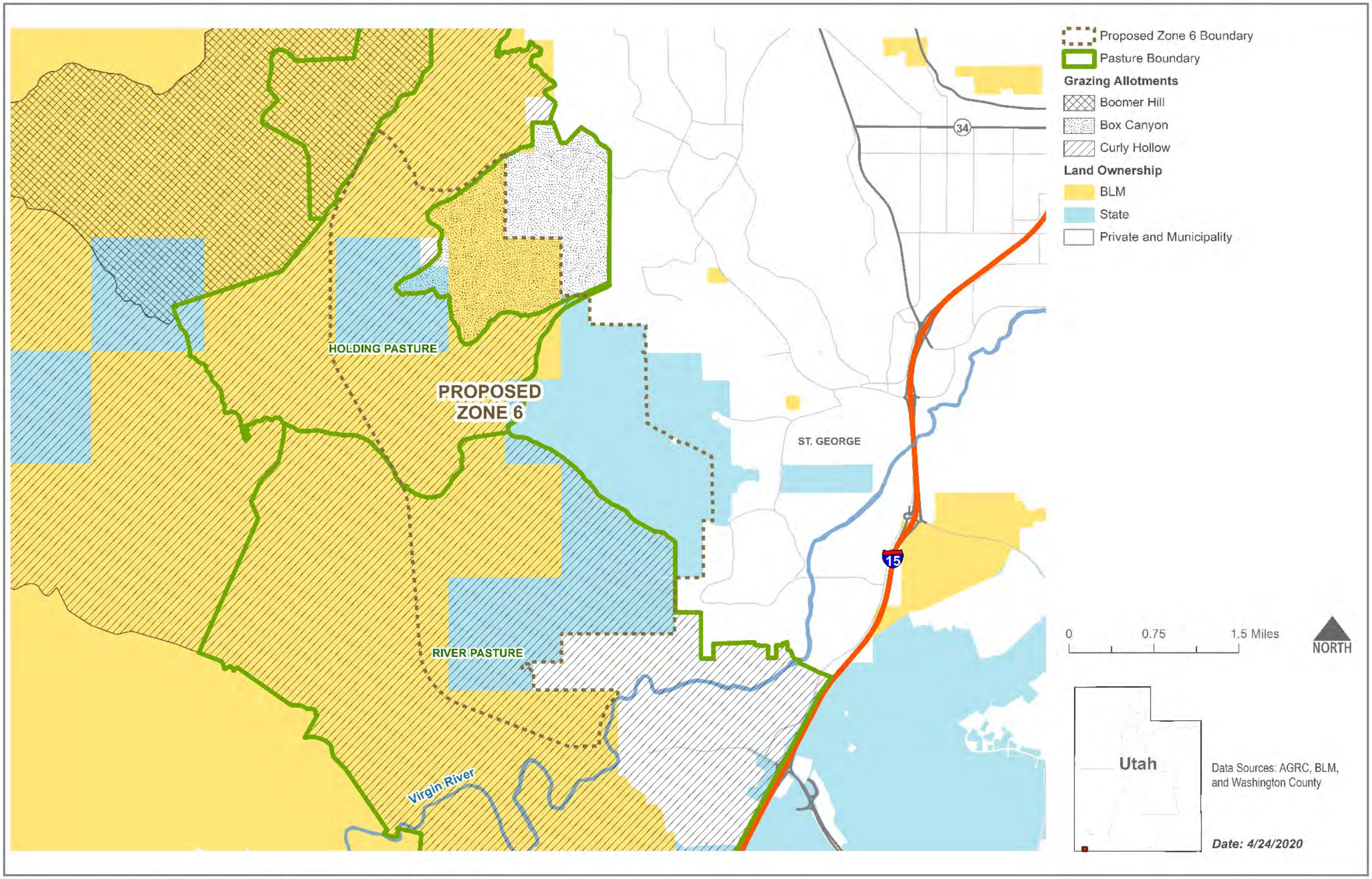
## Map 3.17-1. Existing Routes within Proposed Zone 6



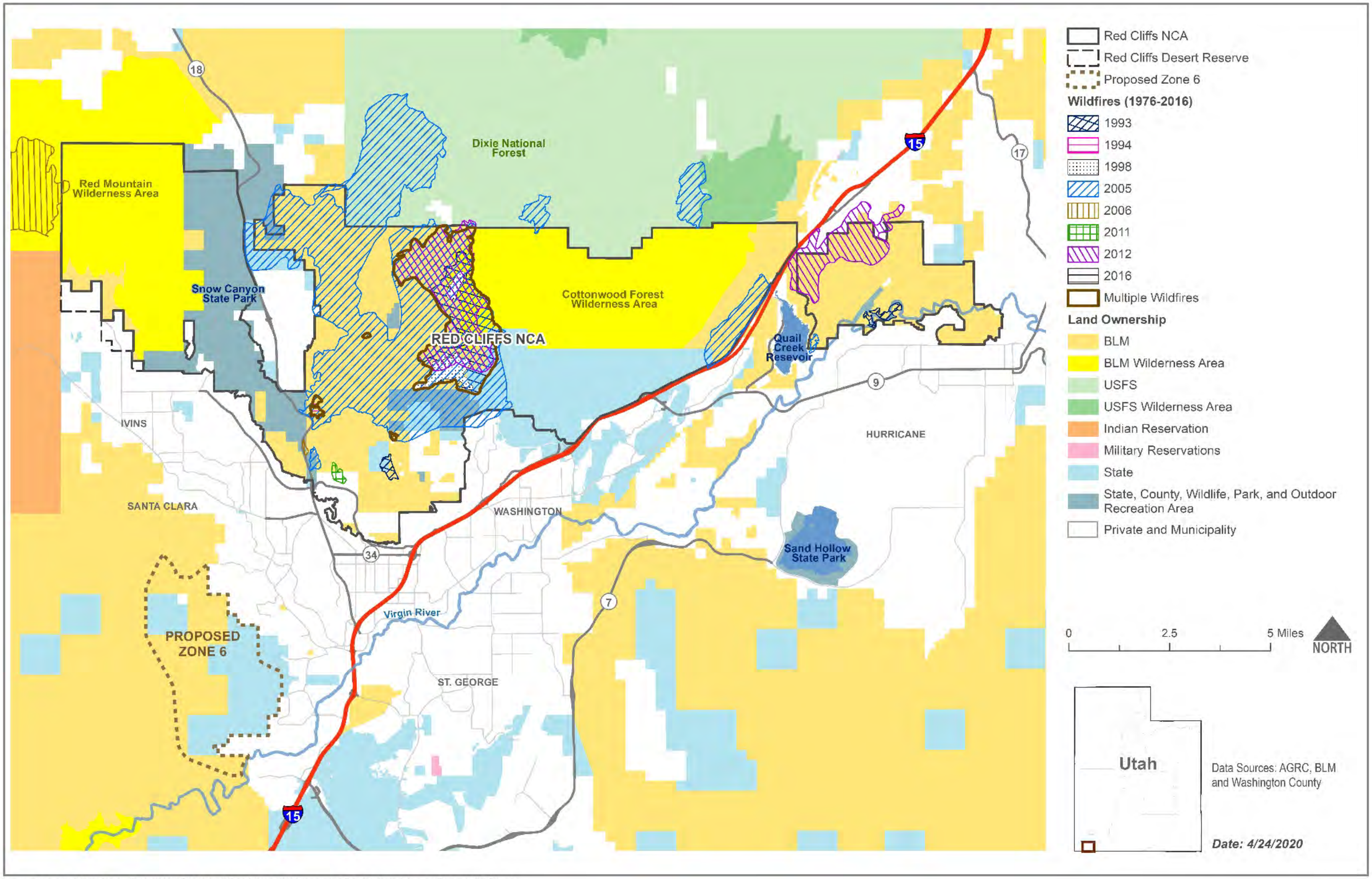
## Map 3.17-2. Existing Routes and Off-Highway Vehicle Area Designations within the Red Cliffs NCA



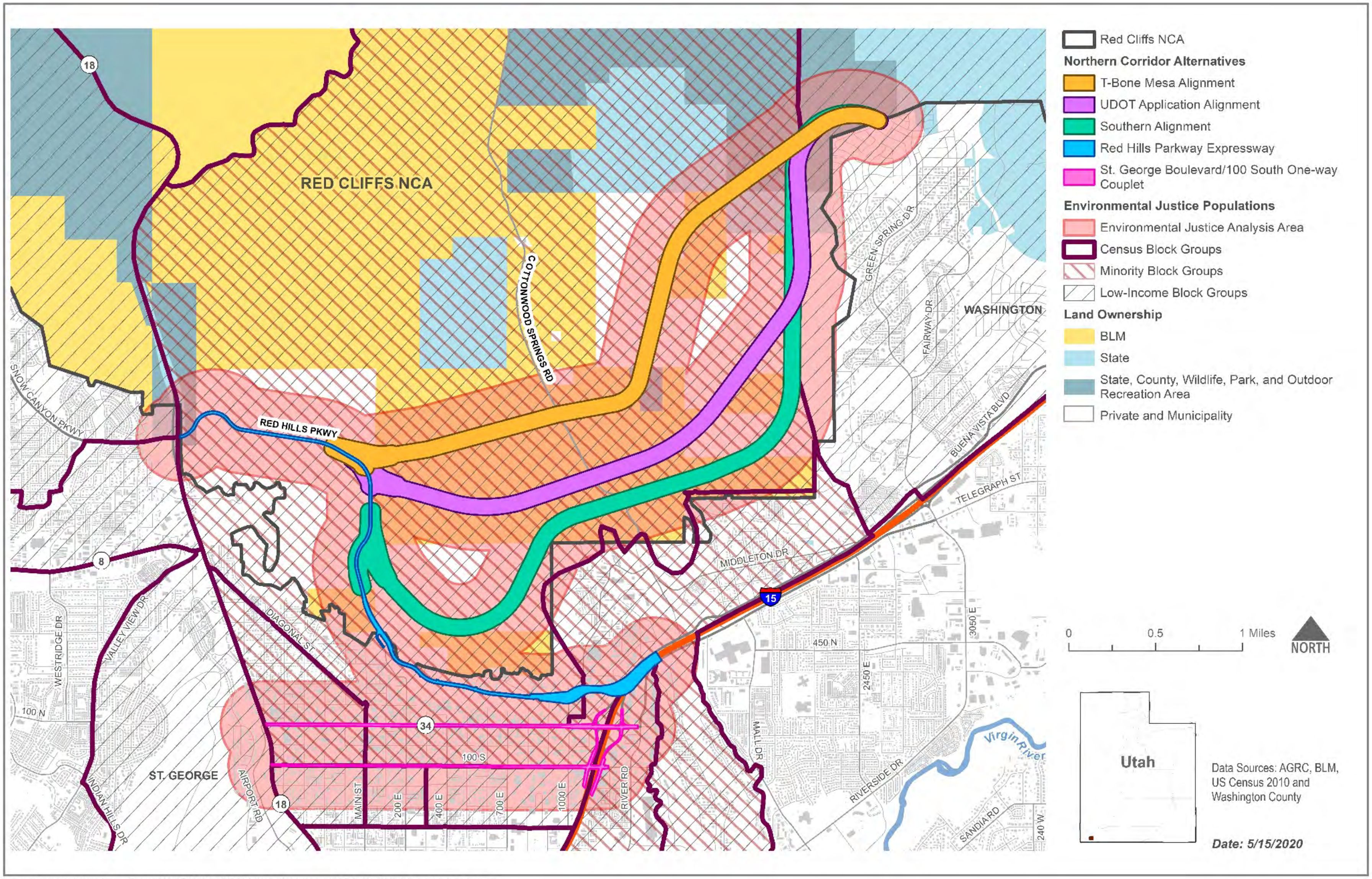
## Map 3.21-1. Livestock Grazing within Proposed Zone 6



## Map 3.22-1. Fire Occurrence within the Red Cliffs NCA



## Map 3.27-1. Environmental Justice Populations



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# Appendix C: Laws, Regulations, Policies, and Plans Considered in the Development of the Environmental Impact Statement

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# Appendix C. Laws, Regulations, Policies, and Plans Considered in the Development of the Environmental Impact Statement

The Bureau of Land Management (BLM) and the U.S. Fish and Wildlife Service (USFWS) have considered and developed the Environmental Impact Statement and Resource Management Plan amendments to be consistent with applicable laws, regulations, policies, and plans including, but not limited to, those listed in this section.

## C.1 Federal Laws

Administrative Procedure Act (Public Law 79–404)

American Indian Religious Freedom Act (42 United States Code [U.S.C.] 1996)

Archaeological Resources Protection Act of 1979 (16 U.S.C. 470aa to 470ee)

Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d)

Clean Air Act of 1970, as amended (42 U.S.C. 7401)

Clean Water Act of 1972 (33 U.S.C. 1251 et seq.)

Endangered Species Act (ESA) (16 U.S.C. 1531 to 1544), as amended

Farmland Protection Policy Act (7 Code of Federal Regulations [CFR] 657.5)

Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701), as amended

Federal Noxious Weed Act of 1974 (7 U.S.C. 2801 and 7 U.S.C. 2814)

Fish and Wildlife Act of 1956 (16 U.S.C. 724a et seq.), as amended

Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901-2911)

Fish and Wildlife Coordination Act of 1934 (16 U.S.C. 661-667)

John D. Dingell Jr. Conservation, Management, and Recreation Act (PL 116-9)

Land and Water Conservation Fund Act (16 U.S.C. 4601 et seq.)

Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712)

National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321-4347)

National Historic Preservation Act of 1966, as amended (54 U.S.C. 300101-307108)

Omnibus Public Land Management Act of 2009 (Public Law 111-11)

Paleontological Resources Preservation Act of 2009 (16 U.S.C. 470)

Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 et seq.)

Taylor Grazing Act of 1934 (Public Law 73–482)

## C.2 Federal Regulations

BLM Resource Regulations (generally 43 CFR Chapter II)

BLM Leases, Permits, and Easements Regulations (43 CFR 2920)

BLM Off-Road Vehicle Regulations (43 CFR 8340)

BLM Planning Regulations (43 CFR 1600)

BLM Rights-of-Way Regulations (43 CFR 2800 and 2880)

BLM Grazing Permits and Leases (43 CFR 4130.2)

BLM Recreation Programs (43 CFR 8340.0-5, 8342.1(a-d))

Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500)

Endangered Species Act Endangered and Threatened Wildlife and Plants (50 CFR 17.22 (b))

Federal Highway Administration Procedures for Abatement of Highway Traffic Noise and Construction Noise (23 CFR 772)

National Register of Historic Places of 1966 (36 CFR 60-63)

Protection of Historic Properties (36 CFR 800)

U.S. Department of the Interior NEPA Regulations (43 CFR 46)

U.S. Environmental Protection Agency National Primary and Secondary Ambient Air Quality Standards (40 CFR part 50)

USFWS General Permit Procedures (50 CFR 13)

USFWS Endangered Species Act regulations (50 CFR 17)

USFWS Permits for Incidental Taking of Species (50 CFR 222.307)

USFWS Habitat Conservation Plan Assurances “No Surprises” Rule (63 FR 8859)

## C.3 Federal Policies

BLM Federal Wildland Fire Management Policy [Instruction Memorandum (IM) 2009-112]

BLM Guidance for Implementation of the New Travel Management Area and Plans Data Standard (IM 2018-102)

BLM Handbook H-1601-1, Land Use Planning

BLM Handbook H-1780-1, Improving and Sustaining BLM-Tribal Relations

BLM Handbook H-1790-1, NEPA Handbook

BLM Handbook H-8270-1, General Procedural Guidance for Paleontological Resource Management

BLM Handbook H-8320-1, Planning for Recreation and Visitor Services

BLM Handbook H-8342, Travel and Transportation Handbook

BLM Handbook H-8431-1, Visual Resource Contrast Rating

BLM Manual 1601 - Land Use Planning

BLM Manual 1613 - Areas of Critical Environmental Concern

BLM Manual 1626 - Travel and Transportation Management Manual

BLM Manual 1780 - Tribal Relations

BLM Manual 4100 - Grazing Administration

BLM Manual 6100 - National Landscape Conservation System Management

BLM Manual 6220 - National Monuments, National Conservation Areas, and Similar Designations

BLM Manual 6500 - Wildlife and Fisheries Management

BLM Manual 6840 - Special Status Species Management

BLM Manual 7240 - Water Quality Manual

BLM Manual 7300 - Air Resource Management

BLM Manual 8110 - Identifying and Evaluating Cultural Resources

BLM Manual 8140 - Protecting Cultural Resources

BLM Manual 8400 - Visual Resource Management

BLM Manual 8431 - Visual Resource Contrast Rating

Council on Environmental Quality Handbook Considering Cumulative Effects Under NEPA

Executive Order 11988, Floodplain Management

Executive Order 11990, Protection of Wetlands

Executive Order 12898, Federal Actions to Address Environmental Justice to Minority Populations and Low-Income Populations

Executive Order 13084, Consultation and Coordination with Indian Tribal Governments

Executive Order 13112, Preventing the Introduction and Spread of Invasive Species, as amended by Executive Order 13751, Safeguarding the Nation from the Impacts of Invasive Species

Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds

Federal Highway Administration Guidelines for the Visual Impact Assessment of Highway Projects (2015)

National Park Service Land and Water Conservation Fund State Assistance Program Federal Financial Assistance Manual (2008)

Secretarial Order 3355, Streamlining National Environmental Policy Act Reviews and Implementation of Executive Order 13807, “Establishing Discipline and Accountability in the Environmental Review and Permitting Process for Infrastructure Projects”

Secretarial Order 3366, Increasing Recreational Opportunities on Lands and Waters Managed by the U.S. Department of the Interior

Secretarial Order 3372, Reducing Wildfire Risks on Department of the Interior Land Through Active Management

Secretarial Order 3373, Evaluating Public Access in Bureau of Land Management Public Land Disposals and Exchanges

USFWS Habitat Conservation Planning and Incidental Take Permit Processing Handbook

## C.4 State and Local Policies and Plans

City of St. George General Plan (2002)

City of Santa Clara 2010- 2035 General Plan (2010)

City of Hurricane General Plan (2011)

Dixie Metropolitan Planning Organization’s 2019-2050 Regional Transportation Plan

General Plan of Washington County (2012)

Ivins City General Plan (2015)

Red Cliffs Desert Reserve Public Use Plan (2000)

St. George City Code (Title 4, Chapter 9)

State of Utah Resource Management Plan (2018)

Utah Department of Transportation (UDOT) Noise Abatement Policy (08A2-01)

UDOT 2017 Standard Specification for Road and Bridge Construction (Section 01355, Sub-Section 3.6)

UDOT Standard Specifications and Standard Drawing Books (2017)

UDOT Long Range Transportation Plan (2015-2040)

UDOT State Transportation Improvement Program (2019)

Utah Administrative Code (R307-205)

Utah Pollutant Discharge Elimination System, UAC R317-8

Utah Strategic Plan for Managing Noxious and Invasive Weeds (2004)

Utah Wildlife Action Plan (2015)

Utah's Nonpoint Source Pollution Management Plan (2000)

Utah's State Comprehensive Outdoor Recreation Plan (2014)

Washington City General Plan (2017)

Washington County Vision Dixie (2006)

# Appendix D: Design Features of the Proposed Action and Mitigation Measures and Conditions of Approval

# Appendix D. Design Features of the Proposed Action and Mitigation Measures and Conditions of Approval

As described in Section 2.2.9, the Bureau of Land Management (BLM) requires the application of avoidance, minimization, and mitigation measures to reduce impacts associated with the Northern Corridor Project. These measures would be applied as either design features of the proposed action for environmental protection or mitigation measures and conditions of approval.

## D.1 Design Features of the Proposed Action for Environmental Protection

The design features of the proposed action for environmental protection, or design features, were developed based on the Plan of Development (POD) submitted by the applicant and the best management practices included in the BLM Red Cliffs National Conservation Area (NCA) Resource Management Plan (RMP). Table D-1 includes a summary description of each design feature and the details of the design feature components from the applicant's POD and the Red Cliffs NCA RMP.

**Table D-1. Design Features of the Project for Environmental Protection**

| Design Feature | UDOT Construction Specification (UDOT 2017) | Applicability | Mitigation Effectiveness |
|---|---|---|---|
| **In consultation with appropriate land-management agencies and the State Historic Preservation Officers and in accordance with the Programmatic Agreement (to comply with Section 106 of the National Historic Preservation Act), develop specific mitigation measures for cultural resources.** | Not applicable | Construction, Operations and Maintenance | Cultural Resources and Native American Concerns |
| 1. Obtain authorization before starting any ground-disturbing activity not previously cleared by the department, such as wasting project-generated material; excavating borrow material; and locating equipment, storage areas, office sites, utility lines, or holding ponds.<br>2. Cultural and paleontological. Perform and provide a cultural survey as determined by the engineer to verify no cultural or paleontological resources are affected by the activity. | 01355 Environmental Compliance<br>Part 3.7 Environmental Clearance by the Contractor | Construction | Not applicable |
| 1. Suspend work within the vicinity if historical, archaeological, or paleontological objects, features, sites, or human remains are discovered during construction:<br>a) Provide a 100-feet minimum buffer around the perimeter of the discovery.<br>b) Protect the discovery area.<br>c) Contact the engineer, and send notice of the nature and exact location of the discovery.<br>d) Provide written documentation to the engineer within 2 calendar days of discovery.<br>2. Do not recommence work within the area of discovery until the engineer provides notice. | 01355 Environmental Compliance<br>Part 3.8 Discovery of Historical, Archaeological, or Paleontological Objects, Features, Sites, or Human Remains | Construction, Operations and Maintenance | Not applicable |
| 1. Temporarily discontinue work if remains of prehistoric dwelling sites or artifacts of historical or archaeological significance are encountered. Refer to Section 01355. | 00820<br>Legal Relations and Responsibility to the Public<br>1.12 Protecting and Restoring Property and Landscape | Construction, Operations and Maintenance | Not applicable |
| Red Cliffs NCA RMP BMP (cultural resources): Where proposed projects or development will adversely affect a cultural resource, testing, data recovery, or full excavation to recover scientific information may be required as mitigation. The applicant or operator bears the full cost of mitigation and is encouraged to consider avoiding adverse effects through project relocation or redesign rather than mitigating adverse effects. | Not applicable | Construction | Not applicable |
| **Prepare biological assessment in coordination with, and receive approval from, the BLM and U.S. Fish and Wildlife Service (USFWS) prior to beginning surface-disturbing activities.** | Not applicable | Design, Construction, Operations and Maintenance | Vegetation, Special Status Plants, Wildlife, Special Status Wildlife |
| **BLM-Sensitive Species**<br>1. Obtain authorization before starting any ground-disturbing activity not previously cleared by the department, such as wasting project-generated material; excavating borrow material: and locating equipment, storage areas, office sites, utility lines, or holding ponds.<br>2. Threatened or endangered species. A qualified biologist, through coordination with the BLM and USFWS biologists and managers, must perform a clearance survey to verify no threatened or endangered or other sensitive species are affected by the activity. | 01355 Environmental Compliance<br>3.7 Environmental Clearance by the Contractor | Construction | Not applicable |

| Design Feature | UDOT Construction Specification (UDOT 2017) | Applicability | Mitigation Effectiveness |
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| **Federally Listed Species**<br>1. Obtain authorization before starting any ground-disturbing activity not previously cleared by the department, such as wasting project-generated material; excavating borrow material; and locating equipment, storage areas, office sites, utility lines, or holding ponds.<br>2. Threatened or endangered species. A qualified biologist, through coordination with the BLM and USFWS biologists and managers, must perform a clearance survey to verify no threatened or endangered or other sensitive species are affected by the activity. | 01355 Environmental Compliance<br>3.7 Environmental Clearance by the Contractor | Construction | Not applicable |
| Red Cliffs NCA RMP BMP (fish and wildlife management and special status species):<br>• Existing plant location records will be consulted and site inventories will be conducted to identify suitable habitat for these plants. Surveys for occupied suitable habitat will be conducted prior to any ground disturbance. Surveys will take place when the plants can be positively identified, during the appropriate flowering periods. Surveys will be conducted by qualified field botanists/biologists who will provide documentation of their qualifications, experience, and knowledge of the species prior to starting work.<br>• For BLM-sensitive species surface-disturbing activities will be avoided within 100 meters of occupied plant habitat wherever possible and where geography and other resource concerns allow. Fragmentation of existing populations and identified areas of suitable habitat will be avoided wherever possible.<br>• Where development is allowed within 100 meters of occupied habitat for Threatened, Endangered, Proposed, and Candidate species or BLM-sensitive species, unauthorized disturbance of plant habitat will be avoided by on-site guidance from a biologist, and by fencing the perimeter of the disturbed area, or such other method as agreed to by the USFWS. In such instances, a monitoring plan approved by the Service will be implemented for the duration of the project to assess impacts to the plant population or seed bank. If detrimental effects are detected through monitoring, corrective action will be taken through adaptive management. | Not applicable | Design, Construction, Operations and Maintenance | Not applicable |
| **Install barrier fencing for Mojave desert tortoise.** | Not applicable | Design, Construction, Operations and Maintenance | Special Status Wildlife |
| Red Cliffs NCA Biological Opinion: Install tortoise barrier fencing along heavily traveled public use roadways in the NCA to minimize tortoise injuries and mortalities caused by motorized vehicles. | Not applicable | Design, Construction, Operations and Maintenance | Not applicable |
| Red Cliffs NCA RMP BMP (fish and wildlife management and special status species): Fences constructed will comply with applicable wildlife fence standards, such as those described in BLM Handbook H-1741-1, Fencing (BLM 1989). Current standards for fencing cattle out in deer and elk range is a 4-strand fence, 40 inches high, with a spacing of wires from ground to top of 60 inches (smooth bottom wire), 6 inches (second wire barbed), 6 inches (third wire barbed), and 12 inches (top wire preferably smooth but may need to be barbed in areas of intense cattle use). | Not applicable | Design, Construction, Operations and Maintenance | Not applicable |
| **Protect Shivwits milkvetch habitat through the use of protective measures.** | Not applicable | Design, Construction, Operations and Maintenance | Wildlife |
| Red Cliffs NCA Biological Opinion: Use protective measures, such as natural barriers, fencing, signing, and trail designation, to protect populations of and habitat for Shivwits milkvetch habitat. | Not applicable | Design, Construction, Operations and Maintenance | Not applicable |
| **Use wildlife escape ramps, as appropriate, through coordination with BLM and USFWS.** | Not applicable | Design, Construction | Wildlife |
| 1. Locate wildlife escape ramps by type as shown.<br>2. Clear and grade within the footprint of the wildlife escape ramp to permit proper installation.<br>3. Install wildlife escape ramp according to FG Series Standard Drawings.<br>4. Place embankment material for ramp as shown on the isometric view. Refer to FG Series Standard Drawings.<br>5. Cover the wildlife escape ramp with topsoil, broadcast seed, and HECP Type 1 mulch after placing embankment. Refer to Sections 02912, 02922, and 02911. | 02827 Wildlife Escape Ramps<br>3.1 Installation | Design, Construction | Not applicable |

| Design Feature | UDOT Construction Specification (UDOT 2017) | Applicability | Mitigation Effectiveness |
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| **Coordinate with public and private land owners to receive legal right to access before any work is performed and continue through construction to avoid damage to property or other resources (e.g., property markers, trees to remain, etc.) in the area.** | Not applicable | Design, Construction, Operations and Maintenance | Cultural Resources and Native American Concerns, Land Uses |
| 1. Preserve public and private property during the work.<br>2. Secure legal right to access the property before any work is performed on public or private property. All damage as a result of trespass will be the financial responsibility of the contractor, including additional acquisition costs.<br>3. Accept liability for any damage to public or private property resulting from defective work, materials, or non-execution of the contract until contract completion.<br>4. Restore damaged property and items removed temporarily during construction to a condition similar or equal to that existing before the damage. | 00820<br>Legal Relations and Responsibility to the Public<br>1.12 Protecting and Restoring Property and Landscape | Construction, Operations and Maintenance | Not applicable |
| 1. Land monuments, property markers, or official datum points:<br>a) Protect until their removal is approved.<br>b) Reference for re-establishment before removing.<br>2. Protect trees from damage to roots and branches if they are designated to remain.<br>3. Protect other vegetation and objects designated to remain. | 02231 Site Clearing and Grubbing<br>3.6 Protection | Design, Construction | Not applicable |
| 1. Preserve public and private property during the work.<br>2. Secure legal right to access the property before any work is performed on public or private property. All damage as a result of trespass will be the financial responsibility of the contractor, including additional acquisition costs.<br>3. Accept liability for any damage to public or private property resulting from defective work, materials, or non-execution of the contract until contract completion.<br>4. Restore damaged property and items removed temporarily during construction to a condition similar or equal to that existing before the damage.<br>5. Temporarily discontinue work if remains of prehistoric dwelling sites or artifacts of historical or archaeological significance are encountered. Refer to Section 01355. | 00820 Legal Relations and Responsibility to the Public<br>1.12 Protecting and Restoring Property and Landscape | Design, Construction | Not applicable |
| 1. Stop Work Order:<br>a) The engineer can order work on a project stopped, wholly or in part, when it is determined a situation exists that requires that work be stopped until the situation can be corrected.<br>b) The engineer will provide a Stop Work Order, within 3 calendar days of verbal notification, that describes the reason for ordering work to stop and what actions need to be taken or how conditions need to change before work may resume.<br>c) The engineer will notify the contractor when to resume work.<br>2. Work may be stopped for any of the following reasons:<br>a) Contractor's failure to comply with the contract.<br>b) Contractor's failure to keep insurance coverage according to 00820 and this Section of the Standard Specifications.<br>c) Contractor's failure to provide workers or equipment as previously mentioned in this Section of the Standard Specifications.<br>d) Abandonment of work or default of contract upon notice as provided in this Section of the Standard Specifications.<br>e) Unsuitable weather or soil conditions.<br>f) Unusual conditions that affect the work and are not usually associated with the highway construction.<br>g) Conditions exist that threaten the safety of workers, public, or nearby property. | 00555 Prosecution and Progress<br>1.14 Stop Work Orders | Construction | Not applicable |
| 1. Perform work within or adjacent to state or national forest under regulations of the state fire marshal, conservation commission, forestry department, or other authority having jurisdiction governing the protection of forests.<br>2. Prevent and assist with the suppression of forest fires.<br>3. Cooperate with responsible forestry officials. | 00820 Legal Relations and Responsibility to the Public<br>1.7 Protecting Forests | Construction, Operations and Maintenance | Not applicable |
| 1. Establish a local public information office. Office may be located within the contractor's regular office provided the telephone number is a local call or toll-free number for project stakeholders.<br>a) Maintain established working hours and days.<br>b) Provide a telephone or cell phone with voice mail capability dedicated to project public information services.<br>2. Maintain daily communication with the engineer.<br>3. Maintain and document weekly communications with region public involvement manager, affected residents, businesses, organizations, and public agencies, such as local emergency services, public works, transit authorities, city offices, and other stakeholders. | 01540 Public Information Services<br>1.7 PIC Responsibilities | Construction | Not applicable |

| Design Feature | UDOT Construction Specification (UDOT 2017) | Applicability | Mitigation Effectiveness |
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| 1. Maintain and document weekly communication and project updates with the following:<br>a) Department, region, and public involvement manager<br>b) Affected local public agencies<br>c) Emergency service agencies<br>1) Fire departments<br>2) Police departments and highway patrol<br>3) Ambulance services<br>d) Local city offices<br>e) Public works departments<br>f) Local transit authorities<br>g) Local school districts<br>h) Local U.S. Postal Service<br>i) Affected businesses<br>j) Affected trucking and carrier associations<br>k) Local organizations interested in the project<br>l) Private citizens when requested<br>m) Engineer and region public involvement manager, providing copies of logbook documentation<br>n) Other stakeholders as required | 01540 Public Information Services<br>3.1 Establish Local Public Information Services | Construction | Not applicable |
| 1. Responsibilities and duties are to coordinate project traffic control with emergency services and local law enforcement agencies. | 01554 Traffic Control<br>1.10 Traffic Control Maintainer | Construction | Not applicable |
| 1. Provide emergency maintenance on a 7-day per week, 24-hour basis until substantial completion of the project.<br>2. Respond within 15 minutes and be on site within 30 minutes, plus travel time, when contacted by the dispatcher.<br>3. Provide contacts and telephone numbers to the engineer for the emergency service. | 02892 Traffic Signal<br>3.24 Traffic Signal Maintenance During Construction | Construction | Not applicable |
| **Site clearing will be conducted in accordance with BLM BMPs and UDOT specifications, including vegetation removal and topsoil stockpiling.** | Not applicable | Design, Construction | Vegetation, Special Status Plants, Wildlife, Special Status Wildlife, Geology, Mineral Resources, and Soils, Paleontology, Water Resources, Wetlands, Floodplains, and Waters of the U.S., Visual Resources, Cultural Resources and Native American Concerns, Land Uses |
| 1. Backfill all stump holes, cuts, depressions, and other holes resulting from clearing and grubbing within areas to receive embankment.<br>a) Compact backfilled areas to the density of the surrounding ground.<br>2. Measure and pay separately for materials used for backfilling under roadway excavation or borrow.<br>3. Consider roadway excavation and borrow as incidental to the work when these items are not included in the bid proposal.<br>a) No separate measurement or payment made in this case. | 02231 Site Clearing and Grubbing<br>3.3 Backfilling | Construction | Not applicable |

| Design Feature | UDOT Construction Specification (UDOT 2017) | Applicability | Mitigation Effectiveness |
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| 1. Dispose of material. Refer to Section 01355.<br>2. Do not dispose of material within the designated roadbed.<br>3. Outside the right-of-way:<br>a) Acceptable when done according to prevailing laws, including environmental laws, ordinances, regulations, and rules.<br>4. Inside the right-of-way:<br>a) Bury material at locations specified by or acceptable to the engineer.<br>b) Use material to widen embankments and flatten embankment side slopes as approved by the engineer.<br>c) Cover disposed material with at least 2 feet of earth and grade to drain properly.<br>d) Reduce wood to chips a maximum of.5 inch thick for mulching cut and fill slopes.<br>1) Chips may be buried or distributed uniformly on the ground surface and mixed with the underlying earth so the mixtures will not sustain burning. | 02231 Site Clearing and Grubbing<br>3.4 Disposal | Construction | Not applicable |
| 1. Grub the areas 2 feet below natural ground, within the limits of clearing, of all stumps, roots, buried logs, and all other underground obstructions.<br>2. Stumps, roots, and non-perishable solid objects may remain in cleared areas where the embankment is:<br>a) 2 feet or more above the natural ground.<br>b) At least 2 feet away outside the slope stake lines.<br>3. Completely grub stumps and roots where a structure is to be constructed, piles are to be driven, or unsuitable material is to be removed. | 02231 Site Clearing and Grubbing<br>3.2 Vegetation Removal | Construction | Not applicable |
| 1. Strip the topsoil:<br>a) Only from areas shown or determined by engineer.<br>b) To a depth determined by the engineer.<br>2. Remove and dispose of any roots larger than 2 inches in diameter or 12 inches in length.<br>3. Stockpile stripped topsoil:<br>a) At locations acceptable to the engineer.<br>b) So that placement or activity around the stockpile does not damage or impact any existing trees, shrubs, or environmentally sensitive areas. Obtain appropriate clearances if such impacts are unavoidable.<br>4. Grade to minimize erosion on and around the stockpiles. | 02912 Topsoil<br>3.2 Strip and Stockpile Topsoil | Design, Construction | Not applicable |
| 1. Topsoil free of:<br>a) Subsoils (no B or C horizon soils).<br>b) Coarse sand and gravel.<br>c) Stiff clay, hard clods, or hard pan soils.<br>d) Rock larger than 3 inches in any dimension.<br>e) Trash, litter, or refuse.<br>f) Noxious weeds and weed seeds. | 02912 Topsoil<br>2.1 Contractor-Furnished Topsoil | Construction | Not applicable |
| Red Cliffs NCA RMP BMP (noxious and invasive weed prevention): Minimize soil disturbance. To the extent practical, native vegetation shall be retained in and around project activity areas and soil disturbance kept to a minimum. | Not applicable | Construction | Not applicable |
| Red Cliffs NCA RMP BMP (fish and wildlife management and special status species): Where linear disturbance is proposed edges of vegetation shall be feathered to avoid long linear edges of habitat and allow for greater habitat complexity for wildlife. | Not applicable | Design, Construction | Not applicable |
| **Grade roadway and adjacent slopes according to BLM and UDOT specifications.** | Not applicable | Design, Construction | Vegetation, Special Status Plants, Geology, Mineral Resources, and Soils, Paleontology, Water Resources, Wetlands, Floodplains, and Waters of the U.S., Visual Resources, Land Uses |
| Red Cliffs NCA RMP BMP (visual resources): All new roads will be designed and constructed to a safe and appropriate standard, "no higher than necessary" to accommodate intended vehicular use. Roads will follow the contour of the land where practical. | Not applicable | Design, Construction | Not applicable |

| Design Feature | UDOT Construction Specification (UDOT 2017) | Applicability | Mitigation Effectiveness |
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| 1. Environmental clearance by the contractor:<br>a) Obtain authorization before starting any ground-disturbing activity not previously cleared by the department, such as wasting project-generated material, excavating borrow material, locating equipment, storage areas, office sites, utility lines, or holding ponds.<br>2. Federal Emergency Management Agency (FEMA) floodplains. Provide documentation as determined by the engineer to verify no FEMA Special Flood Hazard Areas (SFHA) are impacted by the activity. | 01355 Environmental Compliance<br>3.7 Environmental Clearance by the Contractor | Design, Construction | Not applicable |
| **Paint all facilities a color that best allows the facility to visually blend with the background.** | Not applicable | Design, Construction, Operations and Maintenance | Visual Resources |
| Red Cliffs NCA RMP BMP (visual resources): Paint all facilities a color that best allows the facility to blend with the background. | Not applicable | Design, Construction, Operations and Maintenance | Not applicable |
| **Any lighting proposed for the roadway will be designed to reduce impacts to dark night skies.** | Not applicable | Operations and Maintenance | Visual Resources |
| Red Cliffs NCA RMP BMP (visual resources): Impacts to dark night skies will be prevented or reduced through the application of specific mitigation measures identified in activity level planning and National Environmental Policy Act (NEPA) level review. These measures may include directing all light downward, using shielded lights, using only the minimum illumination necessary, using lamp types, such as sodium lamps (less prone to atmospheric scattering), using circuit timers, and using motion sensors. | Not applicable | Operations and Maintenance | Not applicable |
| **Minimize noise generated by construction activities.** | Not applicable | Construction | Wildlife, Special Status Wildlife, Land Uses |
| 1. Avoid construction activities causing sound levels to exceed 95 decibels (dBA) in daytime (7 a.m. to 9 p.m.) or 55 dBA in nighttime (9 p.m. to 7 a.m.) within 10 feet of the nearest noise receptor.<br>2. Schedule work to minimize noise disturbance on Sundays and holidays in areas with noise receptors.<br>3. Percussive noise:<br>a) Notify the engineer, the affected noise receptors, and the local government authority (if applicable) at least 2 weeks in advance of percussive noise activity. | 01355 Environmental Compliance<br>3.6 Noise Control | Construction | Not applicable |
| **Reclaim site, including cleaning up of construction materials, establishing clear zone adjacent to the roadway and placing topsoil.** | Not applicable | Construction | Vegetation, Special Status Plants, Wildlife, Special Status Wildlife, Geology, Mineral Resources, and Soils, Water Resources, Wetlands, Floodplains, and Waters of the U.S., Visual Resources, Land Uses |
| 1. Remove and dispose of flagging, lath, stakes, and other staking material after the project has reached physical completion and the engineer has approved removal. | 01721 Survey<br>3.15 Cleanup | Construction | Not applicable |

| Design Feature | UDOT Construction Specification (UDOT 2017) | Applicability | Mitigation Effectiveness |
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| 1. Clean and finish areas within the clear zone as follows:<br>a) Remove protrusions or depressions greater than 3 inches within the clear zone, such as rocks, boulders, ridges, and stumps.<br>b) Remove trees and provide proper sight distance.<br>c) Determine clear zone according to American Association of State Highway Transportation Officials (AASHTO) Roadside Design Guide when not shown.<br>2. Clean drainage facilities of debris and obstructions caused by construction.<br>a) Dispose of material removed.<br>3. Remove or cover with fine material from roadway excavation or borrow, large rocks or boulders on fill slopes with the following exception:<br>a) Large rocks and boulders protruding from the final graded surface 6 inches or less, on slopes steeper than 3:1 or beyond the clear zone.<br>4. Do not undercut the slope on cut slopes.<br>a) Remove all overhanging rocks.<br>b) Solid ledge rock or partially buried boulders 0.33 cubic yards or more may be left in place on slopes steeper than 4:1 beyond the clear zone.<br>5. Clean and finish areas within right-of-way limits as follows:<br>a) Remove all dead trees and shrubs.<br>b) Prune trees and shrubs as required.<br>c) Trim and shape trees to provide horizontal sight distance and 20 feet vertical clearances above the roadway.<br>d) Remove undesirable live trees, shrubs, and all fruit trees to a depth of 18 inches below natural ground.<br>e) Dispose of trash and debris.<br>6. Clean and finish areas within staging and office sites as follows:<br>a) Clean up and finish as specified for finishing local material source sites, including seeding and mulching. Refer to Section 01455. | 01741 Final Cleanup | Construction | Not applicable |
| 1. Complete final grading, trench settling, and surface preparation before placing topsoil.<br>2. Place and spread topsoil as the slope is being constructed on steep cut slopes steeper than 2:1 and higher than 15 feet that require the placement of topsoil. Finish according to this Section, Article 3.3, paragraph D.<br>3. Provide a suitable topsoil surface just before seeding on the remaining top soiled areas not covered under this article, paragraph B. Suitable topsoil surface is:<br>a) Non-compacted and finished according to this Section, Article 3.3.<br>b) Weed free.<br>c) Finish grade uniform surface with smooth transitions between grade changes and disturbed areas.<br>4. Do not strip or handle wet topsoil.<br>5. Establish finish grade at 1 inch below the top of all walks, curbs, mow strips, and other hard surfaces for areas receiving seed or turf seed and 1.5-inches for areas receiving turf sod. | 02912 Topsoil<br>3.1 General Requirements | Construction | Not applicable |
| 1. Clear area to receive topsoil of all trash, debris, weeds, and rock 3 inches or larger, and dispose of objectionable material in an approved manner.<br>2. Place and spread the stockpiled topsoil over the prepared slopes to the plan depths. Use 4 inches if no depth is indicated in the plans.<br>3. Disc or harrow the placed topsoil along the contour on slopes 3:1, and flatter or cat-track the slopes to create continuous cleat tracks that run parallel with the contours.<br>4. Cat-track slopes steeper than 3:1 to create continuous cleat tracks that run parallel with the contours. | 02912 Topsoil<br>3.3 Spread Stockpiled and Contractor-Furnished Topsoil | Construction | Not applicable |
| Red Cliffs NCA RMP BMP (soils): Determine the volume of available topsoil existing on the site. Topsoil shall be spread at a minimum compacted depth of 4 inches (or as appropriate determined by soil type). | Not applicable | Construction | Not applicable |
| Red Cliffs NCA RMP BMP (water resources): Use mechanical treatment methods to roughen and aerate soils in degraded sites identified for reclamation. | Not applicable | Construction | Not applicable |
| **Revegetate site according to BLM and UDOT specifications, including reseeding with BLM-approved seed mixes and planting requirements established by Washington County and/or St. George City.** | Not applicable | Design, Construction, Operations and Maintenance | Vegetation, Special Status Plants, Wildlife, Special Status Wildlife, Geology, Mineral Resources, and Soils, Water Resources, Wetlands, Floodplains, and Waters of the U.S., Visual Resources, Land Uses |

| Design Feature | UDOT Construction Specification (UDOT 2017) | Applicability | Mitigation Effectiveness |
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| 1. Complete all final grading, irrigation work, trench settling, topsoil placement, and surface preparation before seed or sod application.<br>2. Prepare general seedbed for all seeded and sodded areas.<br>a) Verify that a suitable topsoil surface has been prepared according to Section 02912 before seeding.<br>b) Do not work topsoil or seed when the soil is saturated or frozen.<br>3. Prepare turf seedbed:<br>a) Review finish grade to confirm that topsoil is 1 inch below the top of all walks, curbs, mow strips, and other hard surfaces.<br>b) Apply fertilizer at the rate of 2 pounds/100 square yards, and mix thoroughly into upper 2 inches of topsoil.<br>c) Do not apply fertilizer and seed at the same time in the same machine.<br>4. Prepare turf sod surface:<br>a) Review finish grade to confirm that topsoil is 1.5 inches blow the top of all walks, curbs, mow strips, and other hard surfaces.<br>b) Apply fertilizer at the rate of 2 pounds per 100 cubic yards, and mix thoroughly into upper 2 inches of topsoil.<br>c) Level and roll prepared areas using a 21-gallon, water-filled hand roller containing 8 to 10 gallons of water.<br>d) Lightly rake and dampen with water the top.125 to.625 inches of soil just before laying the sod. | 02922 Seed, Turf Seed, And Turf Sod<br>3.1 Preparation | Construction | Not applicable |
| 1. Notify the engineer 7 working days before seeding.<br>2. Apply seed at the rate indicated in the seed schedule as shown. Note that drill seed and broadcast seed are applied at different rates. | 02922 Seed, Turf Seed, And Turf Sod<br>3.2 Seeding - General | Construction | Not applicable |
| 1. Use the drill method of seeding on accessible slopes 3:1 and flatter.<br>2. Use a drill equipped with the following:<br>a) Depth band.<br>b) Seed box agitator.<br>c) Seed metering device.<br>d) Furrow opener.<br>e) Packer wheels or drag chains.<br>3. Use the drill manufacturer's directions in the presence of the engineer. Calibrate the drill to apply seed at the rate indicated in the seeding schedule.<br>4. Space drill rows a minimum of 6 inches and a maximum of 8 inches.<br>5. Fill the seed boxes no more than half full when drilling on a slope.<br>6. Set depth bands to drill seeds to a.5 inch depth.<br>7. Drill along the contour.<br>8. Maintain the drill at the calibrated setting throughout the seeding operation.<br>9. Allow the furrows that are created by the drill to remain. | 02922 Seed, Turf Seed, And Turf Sod<br>3.3 Drill Seeding Method | Construction | Not applicable |
| 1. Use the broadcast method of seeding under the following conditions:<br>a) Slopes steeper than 3:1.<br>b) Slopes 3:1 and flatter where the area to be seeded is inaccessible to drill.<br>c) The area to be seeded is not large enough to justify using a drill.<br>d) Rocky surface conditions will damage a drill.<br>2. Obtain approval of the broadcast method by demonstrating the procedure on a 100-cubic-yard area.<br>3. Evenly broadcast seed using either:<br>a) A cyclone seeder or other approved mechanical seeder.<br>b) A hydroseeder.<br>1) Apply seed, water, and 300 pounds of cellulose fiber mulch (tracer) per acre.<br>4. Do not seed during windy weather or when soil is saturated.<br>5. Incorporate the seed into the soil by one of three methods:<br>a) Cat-tracking by running the dozer up and down the slope, creating continuous cleat tracks that run parallel with the contours.<br>b) Hand-raking the seed.5-inch deep and along the contours of the slope.<br>c) Slope-chaining by pulling the chain along the contour until the seed is covered.<br>6. Obtain approval from the engineer that the seed has been adequately incorporated into the soil before applying wood fiber mulch, erosion control blanket, flexible growth medium, flexible channel liner, or other topdressing. | 02922 Seed, Turf Seed, and Turf Sod<br>3.4 Broadcast Seeding Method | Construction | Not applicable |

| Design Feature | UDOT Construction Specification (UDOT 2017) | Applicability | Mitigation Effectiveness |
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| 1. Verify that the area prepared to receive plants is graded properly according to the plan, all work is completed in the area, and that topsoil has been placed. Refer to Section 02912.<br>2. Install the irrigation system, and have it fully operational before installing plants.<br>3. Stake or delineate plant locations for approval before installation. | 02932 Trees, Shrubs, and Groundcovers<br>3.1 Preparation | Construction | Not applicable |
| 1. General:<br>a) Install plants using the plan details.<br>b) Water the plants within 1 hour of installation to saturate the root ball to a minimum of 4 inches below and around the plant hole.<br>1) Add more backfill if settling occurs.<br>2. Containerized plants:<br>a) Excavate plant holes to twice the diameter and the same depth of the root ball.<br>b) Carefully remove the plant from its container, scarify the sides and bottom of the root ball if needed, and place it in the prepared hole.<br>c) Place excavated soil in 4-inch lifts around the root ball, and eliminate voids by tamping the soil between each lift.<br>3. Balled and burlapped plants:<br>a) Excavate plant holes to twice the diameter and the same depth of the root ball.<br>b) Gently place the plant in the prepared hole with burlap securely intact.<br>c) Do not mishandle or break root balls.<br>d) Carefully remove any wire baskets and the top half of the burlap without disturbing the root ball.<br>4. Tubeling plants:<br>a) Auger a hole the same size as the tube.<br>b) Gently place watered tubeling in the prepared plant pit immediately following excavation of the hole so the roots are not tangled, compacted, or curled up at the ends.<br>c) Compress the soil at the base of the tubeling to eliminate voids between the root ball and existing soil. | 02932 Trees, Shrubs, and Groundcovers<br>3.1 Installation | Construction | Not applicable |
| Red Cliffs NCA RMP BMP (water resources): Use vegetation or structures to stabilize and protect banks of streams, lakes, or excavated channels against scour and erosion. | Not applicable | Design, Construction, Operations and Maintenance | Not applicable |
| **Prepare Traffic Control Plan to minimize interference with traffic during performance of the work.** | Not applicable | Design, Construction | Land Uses |
| 1. Perform work with minimal obstruction to traffic.<br>2. Follow the safety provisions of all applicable laws, rules, codes, and regulations to protect the safety and convenience of the public and property.<br>3. Provide, erect, and maintain all traffic control devices, such as barriers, barricades, and warning signs, according to the Traffic Control Series Standard Drawings and Section 01554 requirements to protect the work and the public safety.<br>a) Use barriers and barricades to delineate highway sections closed to traffic.<br>b) Illuminate obstructions during darkness, and provide warning signs to control and direct traffic.<br>4. Erect warning signs for work that may interfere with traffic or where new work crosses or coincides with an existing road.<br>a) Place and maintain warning signs according to the authorized Traffic Control Plan.<br>b) Obtain approval before dismantling or removing traffic control devices.<br>5. Pedestrians:<br>a) Place and maintain warning signs according to the authorized Traffic Control Plan.<br>b) Provide Americans with Disabilities Act-compliant access in areas where construction interferes with existing access. | 00820 Legal Relations and Responsibility to the Public<br>1.11 Public Convenience and Safety | Design, Construction | Not applicable |

| Design Feature | UDOT Construction Specification (UDOT 2017) | Applicability | Mitigation Effectiveness |
|---|---|---|---|
| 1. Minimize interference with traffic during performance of the work.<br>2. Sunday and Category I holiday work:<br>a) Provide advance notice to the engineer no later than noon on Wednesday or 4 calendar days prior, whichever is greater, before any Sunday or Category I holiday work, unless otherwise restricted in the contract.<br>3. Category II holiday work:<br>a) Do not perform any work without approval except for repairing or servicing equipment, protecting work, maintaining or curing concrete, and maintaining traffic on Category II holiday.<br>b) Provide notice to the engineer no later than noon on the Wednesday or 4 calendar days prior, whichever is greater, before any Category II holiday work, unless otherwise restricted in the contract.<br>4. Night work:<br>a) Notify the engineer at least 5 calendar days before starting night work.<br>b) Provide adequate lighting for safely performing satisfactory inspection and construction operations.<br>c) Control noise. | 00555 Prosecution and Progress<br>1.9 Limitation of Operations | Design, Construction | Not applicable |
| 1. Keep roads open to traffic during the work and work suspensions, or provide and maintain detour roads as specified or directed.<br>a) Maintain all necessary accesses to areas, such as parking lots, garages, businesses, residences, and farms.<br>b) Exclude snow removal.<br>2. The department does not provide additional compensation for maintenance. Failure to maintain traffic is cause for the department to take action to meet the requirements of this specification.<br>a) The department deducts its costs incurred in such actions from money due. | 00725 Scope of Work<br>1.8 Maintaining Traffic | Design, Construction | Not applicable |
| 1. Maintain work included in the contract during construction until physical completion.<br>a) Maintain traffic detour routes and project travel ways according to the Traffic Control Plan.<br>2. The engineer immediately notifies the contractor of failure to meet these provisions.<br>a) The department maintains the project if unsatisfactory maintenance is not remedied within 24 hours after receiving notice.<br>b) The department deducts the entire cost to maintain the work from the money due or to become due the contractor. | 00727 Control of Work<br>1.17 Maintain the Work During Construction | Construction | Not applicable |
| 1. Follow the authorized Traffic Control Plan. | 01554 Traffic Control | Design, Construction | Not applicable |
| **Prepare Stormwater Pollution Prevention Plan.** | Not applicable | Design, Construction, Operations and Maintenance | Vegetation, Special Status Plants, Wildlife, Special Status Wildlife, Geology, Mineral Resources, and Soils, Paleontology, Water Resources, Wetlands, Floodplains, and Waters of the U.S., Visual Resources, Cultural Resources and Native American Concerns, Land Uses |
| 1. Remove temporary environmental controls when surrounding disturbed areas have met final stabilization measures, except as follows:<br>a) Do not remove perimeter controls, such as silt fence, fiber rolls, or straw bales, when they protect a wetland or waterway unless the surrounding area meets final stabilization requirements identified within the Utah Construction General Permit (UCGP).<br>b) When the engineer determines that controls should remain in place.<br>2. Remove temporary environmental fence and posts upon completion of construction. | 01571 Temporary Environmental Controls<br>3.4 Removal | Construction, Operations and Maintenance | Not applicable |
| 1. Install appropriate controls as shown before beginning earth-disturbing activities.<br>2. Refer to installation procedures outlined in EN Series Standard Drawings and the AASHTO Construction Stormwater Field Guide.<br>3. Install temporary environmental fence in the required locations before construction activities begin.<br>a) Install posts at a 12-feet maximum spacing so the fence does not sag more than 2 inches between posts.<br>b) Weave the fence over the support posts alternating every two loops, and secure it to the posts with fasteners.<br>4. Install gutter-inlet barrier according to manufacturer's recommendations. | 01571 Temporary Environmental Controls<br>3.1 Installation | Construction | Not applicable |

| Design Feature | UDOT Construction Specification (UDOT 2017) | Applicability | Mitigation Effectiveness |
|---|---|---|---|
| 1. Check installed controls before and after each rain event to verify proper working function and compliance with the UCGP.<br>2. Replace controls that are not properly working to prevent erosion and sedimentation. | 01571 Temporary Environmental Controls<br>3.2 Inspection | Construction | Not applicable |
| 1. Maintain controls to function properly until surrounding disturbed areas have met final stabilization measures.<br>2. Remove accumulated sediments from controls when depth reaches 50 percent of the control height or when it interferes with the performance of the control.<br>3. Properly dispose of accumulated sediment. | 01571 Temporary Environmental Controls<br>3.3 Maintenance | Construction | Not applicable |
| 1. Complete all required grading, topsoil placement, and seeding in designated areas before installing Rolled Erosion Control Products (RECP).<br>2. Make soil surface stable and firm and free of rocks, roots, and other obstructions.<br>3. Apply the RECP within 24 hours after seeding. | 02376 Rolled Erosion Control Products<br>3.1 Preparation | Construction | Not applicable |
| 1. Minimize disturbance of the prepared seedbed when installing the product.<br>2. Install product according to manufacturer’s recommendations.<br>3. Unroll product parallel to the primary direction of flow, and place it in direct contact with the soil.<br>a) Do not stretch the product or allow it to “tent” or bridge over surface inconsistencies during installation.<br>4. Install flexible channel liner or turf reinforcement mat within a channel, ditch, or swale to allow runoff to flow directly to the centerline of ditch, not undermining or bypassing the lined ditch.<br>5. Place additional staples in areas, such as swales, base of humps, against rock outcrops, and as required, achieving maximum contact between the product and the soil. | 02376 Rolled Erosion Control Products<br>3.2 Installation | Construction | Not applicable |
| 1. Complete required grading, topsoil placement, and seeding in designated areas before applying Hydraulic Erosion Control Products (HECP).<br>2. Apply HECP within 24 hours after seeding.<br>3. Provide sufficient time for HECP to cure according to manufacturer’s recommendation before precipitation falls. | 02911 Hydraulic Erosion Control Products<br>3.1 Preparation | Construction | Not applicable |
| 1. Check installed controls before and after each rain event to verify proper working function and compliance with the UCGP.<br>2. Replace controls that are not properly working to prevent erosion and sedimentation. | 01571 Temporary Environmental Controls<br>3.2 Inspection | Design, Construction, Operations and Maintenance | Not applicable |
| 1. Comply with the Utah State Stream Alteration Program.<br>2. Comply with Section 10 of the Rivers and Harbors Act.<br>3. Comply with Section 404 of the Clean Water Act.<br>4. Comply with UCGP requirements for projects with one or more acres of soil disturbances (clearing, grading, or excavating).<br>a) Designate an individual, other than the superintendent, as the Environmental Control Supervisor (ECS) with the following responsibilities:<br>1) Coordinate with the engineer about UCGP requirements and environmental commitments.<br>2) Manage implementation, modification, and record-keeping of the project Stormwater Pollution Prevention Plan (SWPPP).<br>3) Supervise the installation, maintenance, and removal of BMPs.<br>4) Conduct SWPPP inspections.<br>5) Be available 24 hours a day, 7 days a week, and be on site within a reasonable amount of time from notification as determined by the engineer.<br>b) Complete the draft SWPPP for the project.<br>c) Submit the Notice of Intent (NOI) to the Utah Division of Water Quality (DWQ) after the SWPPP has been signed by the engineer.<br>d) Conduct SWPPP inspections at least once a week and within 24 hours following a storm event with a total rainfall amount of.5 inch or greater once earth-disturbing activities have begun.<br>e) Coordinate with the engineer to determine if the project has met UCGP requirements before submitting the Notice of Termination (NOT) to DWQ.<br>5. Comply with the National Flood Insurance Program for a project within a SFHA, as defined by FEMA. | 01355 Environmental Compliance<br>3.3 Water Resource Permits | Design, Construction, Operations and Maintenance | Not applicable |
| 1. Obtain authorization before starting any ground-disturbing activity not previously cleared by the department, such as wasting project-generated material, excavating borrow material, and locating equipment, storage areas, office sites, utility lines, or holding ponds.<br>2. Federal- or state-regulated waters. Provide documentation as determined by the engineer to verify no Waters of the U.S. and State of Utah waters are impacted by the activity. | 01355 Environmental Compliance<br>Part 3.7 Environmental Clearance by the Contractor | Construction | Not applicable |

| Design Feature | UDOT Construction Specification (UDOT 2017) | Applicability | Mitigation Effectiveness |
|---|---|---|---|
| SWPPP for approval. | 01355 Environmental Compliance<br>1.5 Submittals | Construction | Not applicable |
| 1. Environmental clearance by the contractor<br>a) Obtain authorization before starting any ground-disturbing activity not previously cleared by the department, such as wasting project-generated material, excavating borrow material, and locating equipment, storage areas, office sites, utility lines, or holding ponds.<br>2. UCGP. Provide a separate SWPPP for UCGP compliance as determined by the engineer when disturbing more than 1 acre of soil off the project site. | 01355 Environmental Compliance<br>3.7 Environmental Clearance by the Contractor | Construction | Not applicable |
| Red Cliffs NCA RMP BMP (soils):<br>• Minimize soil exposure to erosional forces of wind and water by waiting until just before beginning construction to clear vegetation and to disturb the soil.<br>• Disperse stormwater to areas of undisturbed forest/rangeland floor wherever possible, rather than concentrating it into channels.<br>• All construction and travel on the road and right-of-way shall stop until soils dry if ruts greater than 3 inches are formed by vehicles and equipment.<br>• The grant holder shall provide satisfactory reclamation of all sites disturbed by their activity. This may include installation of additional erosion control devices and seeding at the discretion of the BLM authorized officer.<br>• Storm water. BMPs identified in the Storm Water Management Plan shall be in place prior to any earth-disturbing activity. Additional BMPs will be installed as determined necessary by the BLM authorized officer. All temporary BMPs shall be removed once site stabilization and reclamation efforts have been deemed successful by the BLM authorized officer. | Not applicable | Construction | Not applicable |
| Red Cliffs NCA RMP BMP (water resources): Storm water BMPs identified in the applicant's state-approved SWPPP shall be in place prior to any earth-disturbing activity. | Not applicable | Construction | Not applicable |
| **Prepare a Fugitive Dust Control Plan in coordination with the Utah Department of Air Quality.** | Not applicable | Construction, Operations and Maintenance | Land Uses |
| Do not conduct open burning along highway right-of-way without approval from the Utah Department of Air Quality (DAQ). | 01355 Environmental Compliance<br>3.4 Open Burning | Construction, Operations and Maintenance | Not applicable |
| 1. Submit a Fugitive Dust Control Plan (FDCG) to DAQ for construction activities as defined in UAC R30, such as:<br>a) Disturbing a ground surface greater than.25 acre.<br>b) Demolition activities, including razing homes, buildings, or other structures.<br>c) Material storage, hauling, or handling operations.<br>2. Minimize fugitive dust from construction activities using methods such as watering and chemical stabilization of potential fugitive dust sources or other methods approved by the DAQ.<br>a) Do not exceed 10-percent opacity caused by fugitive dust at the project boundary and 20 percent within the project site. This requirement does not apply when wind speeds exceed 25 miles per hour, and the operator is taking appropriate actions to control fugitive dust.<br>b) Conduct opacity observations according to U.S. Environmental Protection Agency (EPA) Method 9 for stationary sources. Refer to http://www.udot.utah.gov/go/standardsreferences.<br>c) Use procedures similar to EPA Method 9 to conduct opacity observations for intermittent and mobile sources.<br>1) The requirement for observations to be made at 15-second intervals over a 6-minute period does not apply.<br>Minimize fugitive dust from material storage, handling, or hauling operations through the use of covers, stabilization, or other methods approved by the DAQ. | 01355 Environmental Compliance<br>3.5 Fugitive Dust | Construction | Not applicable |
| Apply water for dust control in quantities and locations as directed by the engineer and to maintain environmental compliance.<br>1. Dust control may be required at any time.<br>2. Do not waste water. | 01572 Dust Control and Watering<br>3.1 Application | Construction | Not applicable |

| Design Feature | UDOT Construction Specification (UDOT 2017) | Applicability | Mitigation Effectiveness |
|---|---|---|---|
| 1. Refer to Section 01355.<br>2. Contact DAQ and obtain the appropriate Air Quality Permit for the project. Permit application forms can be obtained from DAQ's website. Refer to http://www.udot.utah.gov/go/standardsreferences.<br>Utah Division of Air Quality<br>195 North 1950 West<br>P.O. Box 144820<br>Salt Lake City, UT 84116<br>Phone: (801) 536-4000<br>Fax: (801) 536-4099<br>3. Do not proceed with work affecting air quality without an Air Quality Approval Order, Notice of Intent to Approve letter, or a Temporary Approval Order for the project, process, or equipment to be used. | 00820 Legal Relations and Responsibility to the Public<br>1.19 Air Quality Protection | Construction | Not applicable |
| **Prepare a Blasting Plan.** | Not applicable | Construction | Wildlife, Special Status Wildlife, Land Uses |
| 1. Use explosives, delay fuses, and all blasting materials as recommended by the explosives firm. Refer to National Fire Protection Association (NFPA) 495 – Explosive Materials Code. | 02316 Roadway Excavation<br>2.3 Explosives | Construction | Not applicable |
| 1. Store all explosives securely in compliance with laws and regulations. Refer to Section 00820. Refer to NFPA 495 – Explosive Materials Code.<br>2. Mark all storage places clearly. | 02316 Roadway Excavation<br>3.2 Blasting Material Storage | Construction | Not applicable |
| 1. Comply with Occupational Safety and Health Administration Constructions Standards 1926 Subpart U – Blasting and the Use of Explosives.<br>2. Comply with NFPA 495 – Explosive Materials Code.<br>3. Provide a qualified explosives expert to act as an advisor and consultant during drilling and blasting operations.<br>4. Do not blast beyond designated areas. | 02316 Roadway Excavation<br>3.7 Rock Removal – Explosive Method | Construction | Not applicable |
| **Prepare a Noxious Weed Management Plan.** | Not applicable | Construction | Vegetation, Visual Resources |
| Red Cliffs NCA RMP BMP (transportation and access). All highway rights-of-way and other road authorizations will contain noxious and invasive weed stipulations that include prevention, inventory, treatment, and revegetation or rehabilitation. | Not applicable | Construction | Not applicable |
| **Prepare Hazard Materials, Hazardous Waste, and Spill Prevention Plan.** | Not applicable | Construction | Land Uses |
| 1. Suspend work immediately in an area if abnormal conditions are encountered or exposed during construction that indicate the presence of a hazardous waste.<br>a) Notify the engineer.<br>2. Do the following if a waste discovered or spilled on site is considered hazardous by meeting the definition for disclosure as defined in Title 40 CFR Part 261, Subpart D – Lists of Hazardous Wastes. Refer to http://www.udot.utah.gov/go/standardsreferences for a link to a list of hazardous wastes.<br>a) Take appropriate actions to minimize the threat to human health and the environment.<br>b) Contact the engineer, and send notice if waste found on site is determined hazardous.<br>c) Follow appropriate testing measures to determine if waste is considered hazardous.<br>d) Notify Department of Environmental Quality's (DEO) 24-hour answering service at (801) 536-4123.<br>e) Follow requirements in UAC R315.<br>3. Coordinate with the engineer to initiate development of a remediation plan according to DEQ and EPA regulations and requirements.<br>a) Pay for costs to address hazardous waste discovery or spill cleanup when caused by contractor's activities.<br>4. Complete the work required by the remediation plan before resuming operations in the affected area. | 01355 Environmental Compliance<br>3.1 Hazardous Waste | Construction | Not applicable |

| Design Feature | UDOT Construction Specification (UDOT 2017) | Applicability | Mitigation Effectiveness |
|---|---|---|---|
| Spill of petroleum-based product and used oil;<br>1. Petroleum-based product:<br>a) Contact the engineer if a spill occurs adjacent to waterbody or storm drain inlet.<br>1) Send notice following the discovery of the spill.<br>2) Notify DEQ's 24-hour answering service at (801) 536-4123.<br>3) Coordinate with the engineer to remedy petroleum contaminated soils according to UAC R315-8.<br>2. Used-oil product:<br>a) Contact the engineer if a spill occurs that exceeds 25 gallons or that poses a potential threat to human health or the environment, such as discharging to groundwater, surface water, or storm drain inlet.<br>1) Send notice following the discovery of the spill.<br>2) Notify DEQ's 24-hour answering service at (801) 536-4123.<br>3) Coordinate with the engineer to develop a remediation plan for spilled used oil according to UAC R315-15.<br>3. Clean up petroleum-based or used-oil product when caused by contractor's activities. | 01355 Environmental Compliance<br>3.2 Spill of Petroleum-Based Product and Used Oil | Construction | Not applicable |
| Pollution prevention and general housekeeping:<br>1. Concrete washout:<br>a) Provide a watertight container on site before concrete placement activities begin and where concrete trucks, tools, and equipment are to be washed.<br>1) Size the container to prevent overflows.<br>2) Do not place within 50 feet of storm drain inlets, open ditches, or watercourses.<br>b) Remove and properly dispose of concrete waste and washout water.<br>2. Maintain active traffic lanes free from debris, such as mud, dirt, gravel, and other material.<br>3. Prevent material from entering in storm drain inlets and drainage pipes. | 01355 Environmental Compliance<br>3.9 Pollution Prevention and General Housekeeping | Construction | Not applicable |
| Red Cliffs NCA RMP BMP (water resources). No operations using chemical processes (except for vegetation management) or other pollutants in their activities will be allowed to occur within 200 feet of any water bodies. | Not applicable | Construction | Not applicable |
| **Prepare Paleontological Resources Protection Plan.** | Not applicable | Construction | Paleontology |
| 1. Obtain authorization before starting any ground-disturbing activity not previously cleared by the department, such as wasting project-generated material, excavating borrow material, and locating equipment, storage areas, office sites, utility lines, or holding ponds.<br>a) Cultural and paleontological. Perform and provide a cultural survey as determined by the engineer to verify no cultural or paleontological resources are affected by the activity. | 01355 Environmental Compliance<br>3.7 Environmental Clearance by the Contractor | Construction | Not applicable |
| 1. Suspend work within the vicinity if historical, archaeological, or paleontological objects, features, sites, or human remains are discovered during construction.<br>a) Provide a 100-feet minimum buffer around the perimeter of the discovery.<br>b) Protect the discovery area.<br>c) Contact the engineer, and send notice of the nature and exact location of the discovery.<br>d) Provide written documentation to the engineer within 2 calendar days of discovery.<br>2. Do not recommence work within the area of discovery until the engineer provides notice. | 01355 Environmental Compliance<br>3.8 Discovery of Historical, Archaeological, or Paleontological Objects, Features, Sites, or Human Remains | Construction | Not applicable |

## D.2 Mitigation Measures and Conditions of Approval

Mitigation measures and conditions of approval are specific BLM requirements for a Notice to Proceed (NTP) with construction to be issued. As discussed in Section 2.2.9.2, two of these mitigation measures were identified by the BLM in coordination with the USFWS as required for mitigating potential impacts on Mojave Desert tortoise. The USFWS documentation outlining those mitigation measures are included in this appendix as follows:

- Attachment 1: Shade structures for desert tortoise exclusion fence: design guidance
- Attachment 2: Passages for connectivity of Mojave desert tortoise populations across fenced roads

# Attachment 1: Shade Structures for Desert Tortoise Exclusion Fence: Design Guidance

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# Shade Structures for Desert Tortoise Exclusion Fence: Design Guidance

**U.S FISH AND WILDLIFE SERVICE**

**SEPTEMBER 2018**

This U.S. Fish and Wildlife Service guidance document is intended to inform the design and construction of shade structures for projects that implement desert tortoise exclusion fence as a protective measure. Shade structures should be placed at regular intervals along fence line to provide shade for desert tortoises that pace the fence line in order to allow cooling and prevent hyperthermia. While there may not be a singular *correct* way to construct a shade structure, we advise that there are certainly designs that can range anywhere from being ineffective to potentially lethal. The following are considerations to be made when constructing and placing shade structures along fence lines:

1) A shade structure could consist of any material, but PVC pipe is overall the most durable. Schedule 80 PVC has a thicker wall diameter than schedule 40 PVC, and would be the best option for long-term, durable shade structures. However, it may be cost prohibitive for many projects. Schedule 40 PVC is less expensive and would not provide as much resistance to weight placed on top of the structure, however it is most likely adequate for many applications. We recommend against using cardboard concrete forming tubes or similar materials for long-term application, as these are unlikely to maintain structural integrity in harsh environmental conditions (e.g., rainfall). However, such materials may be adequate for short-term use depending on the overall purpose and need.
2) The interior diameter of the shade structure should be at minimum 12-15" in order to allow large desert tortoises to rotate within the structure and to prevent them from becoming trapped inside the shelter.
3) We recommend the length of each shade structure to be at minimum 6 feet. Shade structures that are too short may not provide adequate shade throughout the day as the sun moves from east to west. Each structure should also be able to accommodate more than one desert tortoise.
4) Shade structures should be spaced at minimum 1,000 feet apart, and placed directly against the exclusion fence. The appropriate distance between structures could vary depending on considerations such as the number of desert tortoises that have been moved to the outside of the exclusion fence and existing shelter (e.g., vegetation) along the fence line.

5) Shade structures should be covered with 3-4 inches of soil and rocks. The soil insulates the interior of the structure and prevents it from radiating too much heat inward, and rocks help keep the soil in place on top of the structure. Inward radiative heat caused by an uninsulated structure (particularly PVC pipe) may increase the risk of hyperthermia to a desert tortoise within the structure. While beneficial to the effectiveness of an individual structure, care should be taken to not pile soil and rocks too high on top of a structure; if too high and close to the top of the exclusion fence this may enable a desert tortoise to climb to the top of the structure and climb over the fence.
6) Shade structures require routine maintenance to keep clear of debris, particularly following precipitation events. They may also fill up over time with debris such as growing vegetation, windblown sediment, rocks, etc. Structures should have two openings (i.e., open on each end) to enable a desert tortoise to escape if one end becomes obstructed by debris.
7) Monitoring of a fence line and shade structures should be conducted regularly when temperatures are high enough to raise a tortoise's body temperature above the critical maximum (critical maximum=103-112 degrees Fahrenheit). Keep in mind that ambient temperatures do not need to be this high to cause a tortoise's body temperature to exceed critical maximum. We recommend regular monitoring when temperatures are approaching and exceed 95 degrees Fahrenheit, with the 1-2 hours immediately before and after this threshold being the most critical.
8) Monitoring of a fence line and shade structures should be conducted after all precipitation events that result in sediment runoff. Such events can obstruct one or both openings of a shade structure, potentially leading to entrapment of a desert tortoise within a structure.
9) When monitoring a shade structure, keep in mind that many different species of wildlife may be present within the shelter. These may include snakes, owls, birds, rabbits, rodents, ringtailed cats, badgers, and foxes. Caution should be taken when approaching and reaching into a structure to remove debris.

The following photos illustrate what we consider to be a range in effectiveness of shade structures:

Photo 1: Schedule 80 PVC pipe, 6-feet in length, 3-4 inches of soil/rocks on top to insulate the structure. This is an example of an effective and durable structure.

Photo 2: Cardboard concrete forming tube, approximately 2-feet in length, no soil/rocks on top of structure. This is an example of a structure that may be adequate for short-term use but would not be appropriate for long-term use. Cardboard is not durable in harsh environmental conditions, and if the structure collapsed during or after rainfall the cinder blocks could potentially trap small desert tortoises. Cardboard may, however, produce less radiative heat than PVC. The structure may also be too short to provide adequate cover for multiple animals or individual animals throughout a day.

Photo 3: Schedule 80 PVC pipe, approximately 18 inches in length, no soil/rocks on top of structure. This is an example of a structure that is poorly constructed and could potentially be lethal to desert tortoises. Without adequate soil/rock insulation on top, radiative heat could be detrimental to desert tortoises inside the structure. The structure may also be too short to provide adequate cover for multiple animals or individual animals throughout a day.

We emphasize that these recommendations are meant to be general guidance when constructing and placing shade structurers along desert tortoise exclusion fence. Please contact the appropriate U.S. Fish and Wildlife Field Office with questions about the design and placement of shade structures:

For California projects:
Palm Springs Fish and Wildlife Office
760.322.2070

For Nevada projects:
Southern Nevada Fish and Wildlife Office
702.515.5450

For Utah projects:
Utah Ecological Services Office
801.975.3330

For Arizona projects:
Arizona Ecological Services Office
928.556.2106

Recommended Citation: U.S. Fish and Wildlife Service. 2018. Shade Structures for Desert Tortoise Exclusion Fence: Design Guidance. U.S. Fish and Wildlife Service, Palm Springs, California.

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# Attachment 2: Passages for Connectivity of Mojave Desert Tortoise Populations Across Fenced Roads

**U.S. Fish and Wildlife Service**
DESERT TORTOISE RECOVERY OFFICE
1340 Financial Blvd., Suite 234
Reno, Nevada 89502
Ph: 775-861-6300 ~ Fax: 775-861-6301

# PASSAGES FOR CONNECTIVITY OF MOJAVE DESERT TORTOISE POPULATIONS ACROSS FENCED ROADS

March 27, 2014

## Recommendations

1. Desert tortoise exclusion fencing should be strongly considered for roads with an average daily traffic volume over 200.
2. Passages associated with desert tortoise road fencing spaced 670 meters apart have the potential to restore adult connectivity to pre-road conditions[1].
3. Passages should be placed as close to the 670 m spacing as possible, especially where roads bisect occupied tortoise habitat. Passages should not be created in areas of extremely low habitat potential or where one side of the road is no longer habitable by tortoises.
4. Flexibility of spacing should accommodate placement of passages in association with washes where possible, because tortoises preferentially use washes for foraging and movement.
5. Culverts or other under-road passages should have an openness ratio (the structure's cross-section/length) of 0.4.
6. Regular maintenance should be performed as necessary to maintain road fencing and open corridors for tortoise movement, especially after storm events where fencing is damaged and debris blocks narrow passages.
7. Additional research is necessary to investigate the effects of roads and passages on desert tortoise genetics, demography, and population connectivity. It will also be helpful to conduct additional research on optimal design criteria (*e.g.*, width, height, placement) to ensure maximum use of passages.
8. Although culverts have been the primary type of wildlife passage used throughout the range of the Mojave desert tortoise, other forms of passage should be explored to encourage wildlife (tortoise) use.

In an unobstructed desert landscape, home ranges of individual tortoises overlap such that breeding and other types of social interactions occur (Harless *et al*. 2009), maintaining genetic and demographic connectivity among individuals and populations. However, depauperate desert tortoise populations have been observed along highways (LaRue 1993; Boarman *et al.* 1997), thereby reducing population connectivity across the road. Abundance of tortoise sign decreases closer to unfenced roadways (LaRue 1993; Hoff and Marlow 2002), resulting in a zone of population depletion of up to 2 miles from highways with the highest traffic volumes (Nicholson 1978; Karl 1989; Hoff and Marlow 2002; Boarman and Sazaki 2006). For animals like tortoises, long-lived and with low reproductive rates, negative population effects of roads can be particularly pronounced (Rytwinski and Fahrig 2012).

[1] The role of juvenile tortoise movements in connectivity is important to consider, but existing information did not allow for specific inclusion in these recommendations.

Fences reduce road mortality of desert tortoises and other wildlife species (Boarman *et al.* 1997) and facilitate successful reoccupation of habitat adjacent to roadways (Boarman 2009, USFWS, unpubl. data). Desert tortoise exclusion fencing (USFWS 2009) should be strongly considered for roads with an average daily traffic volume over 200 (based on results of Hoff and Marlow [2002] and Nafus *et al.* [2013]). However, fences do not alleviate the fragmenting effects of roads. Populations of tortoises are known to be at historically low densities (USFWS 2011) so that isolation due to roads increases susceptibility of populations to demographic and environmental stochasticity (Boarman *et al.* 1997; Boarman and Sazaki 1996, 2006; Forman and Alexander 1998; Trombulak and Frissell 2000; Latch *et al.* 2011). There are few data to evaluate the design and effectiveness of passages at minimizing the fragmenting effects of roads. Ultimate effectiveness would occur by restoring connections between tortoises whose home ranges would have overlapped if the road was not there. When encountering a physical barrier such as a fence, tortoises will follow the barrier for great distances, presumably to find a way around it (Fusari 1982; Ruby *et al.* 1994). Exclusion fencing interrupted by safe passages therefore has the potential to reduce animal-vehicle collisions and maintain landscape connectivity (Boarman *et al.* 1997).

To restore historical (*i.e.*, pre-road) connectivity potential, passages should be spaced approximately one home range apart so that tortoises living along the road have access to at least one road passage. Annual or seasonal home ranges for adult Mojave desert tortoises are 10 and 26 hectares for females and males respectively, estimated as averages across the set of studies described in Table 3 of Harless *et al.* (2010). However, guidelines for providing opportunities for demographic and genetic exchange may be based more practically on a multi-year home range estimate than a single-year estimate. Home ranges based on several years incorporate inter-annual variation in space use and reflect greater use of an area and greater potential overlap of home ranges by individual tortoises; basing recommendations for passage spacing on longer, lifetime (*i.e.*, 60+ years) home ranges could underestimate effects of routine, pre-road interactions. Moderate-term movement data (≥4 years) from Joshua Tree National Park produced average home range estimates of 43 and 44 hectares for adult female and male tortoises, respectively (Vamstad *et al.* 2013). Therefore, we use a multi-year home range estimate of 45 hectares on which to base ideal passage-spacing recommendations, subject to change based on future data and research.

Home ranges depicted as abutting 45-hectare squares would be 670 meters on a side. This home range size was generated in relatively high-density tortoise habitat, which is also where more tortoises and more tortoise interactions would be disrupted by road construction; thus, where high-potential tortoise habitat exists on both sides of a road, passages should be closer to this ideal to restore pre-road levels of connectivity, with wider spacing in areas of lower habitat potential (see Nussear *et al.* 2009 for estimation of habitat potential). Passages should not be created in areas of extremely low habitat potential or where one side of the road is no longer habitable by tortoises. These determinations should be made by USFWS biologists for each project.

The spacing recommendations above address *physical barriers* to movement across a fenced road. In addition, most wildlife, including tortoises, have demonstrated through their aversion to using suboptimal passages that *behavioral obstacles* also exist (Lesbarrères and Fahrig 2012). Physical as well as behavioral obstacles to movement must be overcome to restore connectivity. Desert tortoises have been documented to use storm-drain culverts to cross beneath fenced highways (Boarman *et al.* 1998). Culvert substrate (*e.g.*, sand, silt, gravel) has been shown to determine whether a tortoise uses the culvert as a passage (Foreman 2003). Examples of attempts to improve passability over rough substrate are found on the Federal Highway Administration's website:

http://www.fhwa.dot.gov/environment/wildlife_protection/index.cfm?fuseaction=home.viewArticle&articleID=110

http://www.fhwa.dot.gov/environment/wildlife_protection/index.cfm?fuseaction=home.viewArticle&articleID=138.

Cement box culverts rather than corrugated metal culverts are preferred because they hold the appropriate substrate conducive to tortoise passage (Boarman pers. comm. in McLuckie *et al.* 2004). Because tortoises preferentially use desert washes for foraging and movement (Jennings 1993), placement of passages in washes may facilitate tortoises using passages in those areas. The ability of tortoises to see light is an issue for whether they will use a tunnel, but exact thresholds are unknown; experience has shown that tortoises will generally use tunnels less than 100 feet long on their own (Caltrans Division of Research and Innovation 2012). In general, shorter culverts of a larger diameter are preferred (Arizona Interagency Desert Tortoise Team 2008), and an "openness ratio" – the structure's cross-section/length – of 0.4 has been recommended for medium-sized animals (Meese *et al.* 2007). Figure 1 illustrates examples of various passages.

Meese et al. (2007) Ann McLuckie River Mts, Kevin Purdy: Every Trail website

**Figure 1.** Examples of road passages. For a typical 4-lane interstate (86 ft wide), square passages should be at least 5.9 ft on a side and circular passages should be at least 6.6 ft in diameter to achieve an openness ratio of 0.4.

Although lighting may entice a tortoise to use the passage, noise and visual cues from passing vehicles have been shown to discourage movement by tortoises (Ruby *et al.* 1994). Other wildlife also have been observed to avoid entering passages in situations with high traffic volume, so recommendations have been made that sound-attenuating walls be placed above the entrance to reduce noise and light disturbance from passing vehicles (Tewes and Hughes 2001). Passages should be designed so that flooding does not lead to blockage with debris, and in particular so that there is sufficient unwetted width clear of debris to encourage use by desert tortoises (Ruediger 2001; Lovich *et al.* 2011; Lesbarrères and Fahrig 2012). Maintenance should be performed as necessary to ensure passageways for tortoise movement. If an existing drainage culvert is so small as to be an entrapment hazard to tortoises, it does not contribute to connectivity potential and should be blocked with wire mesh (Lovich *et al.* 2011). Additionally, erosion below the ends of a passage can result in the passage becoming inaccessible to tortoises. Designs that minimize erosion potential are preferred, and issues should be corrected as they arise.

While we predict that implementation of these recommendations will strongly alleviate population-level impacts to connectivity while eliminating tortoise mortality on roads, the recommendations should be implemented through a process of adaptive management. Uncertainties surround the effectiveness of our specific quantitative recommendations and the ultimate effects of passage engineering and spacing on desert tortoise population genetics and demographic connectivity. Effective monitoring should occur in coordination with the installation of passages. Sites with existing data on tortoise populations surrounding a road and/or sites with ongoing monitoring already in place may provide important opportunities to refine recommendations and answer key questions. Is tortoise mortality negligible, or otherwise unimportant at the population level, along unfenced roadways with average daily traffic volumes less than 200? Does incorporation of passages at 670-meter intervals alleviate population-level effects of fragmentation; does a larger interval accomplish the same goal? Is the 670-meter interval appropriate when juvenile tortoise movements and contribution to connectivity are considered in the broader context of processes that maintain a population's viability? To what extent does an openness ratio of 0.4 (or other value) and other design features facilitate tortoise use of under-road passages? Answers to these questions will allow recommendations to be refined to meet the objective of maintaining ecologically relevant connectivity of desert tortoise populations.

Although our recommendations for passage spacing are based on ensuring that as many tortoises living along roads as possible can encounter a passage across the road, effectiveness of these passages will also depend on the willingness of tortoises to cross through them. Designs other than modified drainage culverts, such as open-span, extended stream crossings or bridges over larger washes, may be more effective at providing passage opportunities for tortoises as well as other Mojave Desert species (Lesbarrères and Fahrig 2012). Movement considered in the current recommendations may be important for accessing resources throughout different parts of a tortoise's home range, mate-searching by adults, or dispersal by smaller tortoises, but there is no information on how passage spacing may affect these movements differently. In general, we have no information on whether the constraint of movement for tortoises that live near fencing affects their survival and reproductive success. Research on any of these topics may inform us not only about effects of roads, fencing, and various passage types, but also about minimizing fragmentation effects of transmission and other infrastructure corridors.

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# Appendix E: Ecological Systems (Vegetation Communities) within the Mojave Desert Tortoise Analysis Area

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# Appendix E. Ecological Systems (Vegetation Communities) within the Mojave Desert Tortoise Analysis Area

This table represents the Existing Vegetation Types mapped by the shared U.S. Department of Agriculture Forest Service and U.S. Department of the Interior Landscape Fire and Resource Management Planning Tools (LANDFIRE) program that are within the boundaries of the Mojave Desert Tortoise Analysis Area for the Northern Corridor Project. The Mojave Desert Tortoise Analysis Area includes all modeled Mojave desert tortoise habitat within the Habitat Conservation Plan Permit Area. The Existing Vegetation Types were grouped, predominantly by physiognomy, for mapping and analysis purposes within the Draft Environmental Impact Statement. Existing Vegetation Types that make up less than 1 percent of the total Mojave Desert Tortoise Analysis Area were lumped together into the Subdominant group on the maps.

| Existing Vegetation Types | Physiognomy | Acres |
|---|---|---|
| Colorado Plateau Blackbrush-Mormon-tea Shrubland | Shrubland | 11,414.5 |
| Colorado Plateau Mixed Bedrock Canyon and Tableland | Sparsely Vegetated | 1,234.2 |
| Colorado Plateau Mixed Low Sagebrush Shrubland | Shrubland | 4.8 |
| Colorado Plateau Pinyon-Juniper Shrubland | Shrubland | 6.6 |
| Colorado Plateau Pinyon-Juniper Woodland | Conifer | 630.2 |
| Developed-High Intensity | Developed-High Intensity | 1.1 |
| Developed-Low Intensity | Developed-Low Intensity | 46.0 |
| Developed-Medium Intensity | Developed-Medium Intensity | 5.3 |
| Developed-Roads | Developed-Roads | 47.4 |
| Great Basin & Intermountain Introduced Annual and Biennial Forbland | Exotic Herbaceous | 169.7 |
| Great Basin & Intermountain Introduced Annual Grassland | Exotic Herbaceous | 4,348.3 |
| Great Basin & Intermountain Introduced Perennial Grassland and Forbland | Exotic Herbaceous | 200.5 |
| Great Basin & Intermountain Ruderal Shrubland | Exotic Tree-Shrub | 19,663.2 |
| Great Basin Foothill and Lower Montane Riparian Herbaceous | Riparian [a] | 0.2 |
| Great Basin Foothill and Lower Montane Riparian Shrubland | Riparian [a] | 27.9 |
| Great Basin Foothill and Lower Montane Riparian Woodland | Riparian | 39.9 |
| Great Basin Pinyon-Juniper Woodland | Conifer | 9,351.2 |
| Great Basin Semi-Desert Chaparral | Shrubland | 1,175.7 |
| Great Basin Xeric Mixed Sagebrush Shrubland | Shrubland | 62.1 |
| Interior West Ruderal Riparian Forest | Exotic Tree-Shrub | 165.3 |
| Interior West Ruderal Riparian Scrub | Riparian [a] | 275.6 |
| Interior Western North American Temperate Ruderal Grassland | Riparian [a] | 17.4 |

| Existing Vegetation Types | Physiognomy | Acres |
|---|---|---|
| Interior Western North American Temperate Ruderal Shrubland | Exotic Tree-Shrub | 32.1 |
| Inter-Mountain Basins Active and Stabilized Dune | Sparsely Vegetated | 3.1 |
| Inter-Mountain Basins Big Sagebrush Shrubland | Shrubland | 7,223.4 |
| Inter-Mountain Basins Big Sagebrush Steppe | Shrubland | 0.2 |
| Inter-Mountain Basins Cliff and Canyon | Sparsely Vegetated | 93.5 |
| Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland | Conifer | 4.5 |
| Inter-Mountain Basins Greasewood Flat | Shrubland | 103.8 |
| Inter-Mountain Basins Juniper Savanna | Conifer | 0.2 |
| Inter-Mountain Basins Mixed Salt Desert Scrub | Shrubland | 867.5 |
| Inter-Mountain Basins Montane Sagebrush Steppe | Shrubland | 21.9 |
| Inter-Mountain Basins Semi-Desert Grassland | Grassland | 259.6 |
| Inter-Mountain Basins Semi-Desert Shrub-Steppe | Shrubland | 3,948.4 |
| Inter-Mountain Basins Shale Badland | Sparsely Vegetated | 408.4 |
| Inter-Mountain Basins Volcanic Rock and Cinder Land | Sparsely Vegetated | 46.0 |
| Inter-Mountain Basins Wash | Sparsely Vegetated | 0.2 |
| Mogollon Chaparral | Shrubland | 479.9 |
| Mojave Mid-Elevation Mixed Desert Scrub | Shrubland | 102,752.4 |
| North American Arid West Emergent Marsh | Riparian | 20.8 |
| North American Warm Desert Badland | Sparsely Vegetated | 2.9 |
| North American Warm Desert Bedrock Cliff and Outcrop | Sparsely Vegetated | 242.1 |
| North American Warm Desert Cienega | Riparian | 40.9 |
| North American Warm Desert Lower Montane Riparian Shrubland | Riparian [a] | 0.8 |
| North American Warm Desert Lower Montane Riparian Woodland | Riparian | 2.2 |
| North American Warm Desert Pavement | Sparsely Vegetated | 360.0 |
| North American Warm Desert Playa | Sparsely Vegetated | 23.5 |
| North American Warm Desert Riparian Herbaceous | Riparian [a] | 23.0 |
| North American Warm Desert Riparian Mesquite Bosque Shrubland | Riparian [a] | 2.4 |
| North American Warm Desert Riparian Mesquite Bosque Woodland | Riparian | 2.9 |
| North American Warm Desert Riparian Shrubland | Riparian [a] | 38.7 |
| North American Warm Desert Riparian Woodland | Riparian | 157.8 |
| North American Warm Desert Ruderal & Planted Grassland | Riparian [a] | 302.2 |
| North American Warm Desert Ruderal & Planted Scrub | Shrubland | 9,736.1 |
| North American Warm Desert Volcanic Rockland | Sparsely Vegetated | 12.7 |

| Existing Vegetation Types | Physiognomy | Acres |
|---|---|---|
| North American Warm Desert Wash Shrubland | Wash [a] | 6.4 |
| North American Warm Desert Wash Woodland | Riparian | 0.2 |
| Open Water | Open Water | 307.6 |
| Quarries-Strip Mines-Gravel Pits-Well and Wind Pads | Quarries-Strip Mines-Gravel Pits-Well and Wind Pads | 132.4 |
| Recently Burned-Herb and Grass Cover | Grassland | 8.3 |
| Recently Burned-Shrub Cover | Shrubland | 177.7 |
| Recently Burned-Tree Cover | Conifer | 12.0 |
| Recently Disturbed Other-Herb and Grass Cover | Grassland | 0.6 |
| Rocky Mountain Cliff Canyon and Massive Bedrock | Sparsely Vegetated | 7.5 |
| Rocky Mountain Gambel Oak-Mixed Montane Shrubland | Shrubland | 138.7 |
| Rocky Mountain Lower Montane-Foothill Riparian Woodland | Riparian | 56.6 |
| Rocky Mountain Lower Montane-Foothill Shrubland | Shrubland | 16.7 |
| Rocky Mountain Subalpine-Montane Mesic Meadow | Grassland | 0.2 |
| Sonora-Mojave Creosotebush-White Bursage Desert Scrub | Shrubland | 55,242.0 |
| Sonora-Mojave Mixed Salt Desert Scrub | Shrubland | 335.8 |
| Sonora-Mojave Semi-Desert Chaparral | Shrubland | 2,864.3 |
| Southern Colorado Plateau Sand Shrubland | Shrubland | 926.7 |
| Western Cool Temperate Close Grown Crop | Agricultural | 41.1 |
| Western Cool Temperate Developed Ruderal Evergreen Forest | Developed | 2.4 |
| Western Cool Temperate Developed Ruderal Grassland | Developed | 1.6 |
| Western Cool Temperate Developed Ruderal Herbaceous Wetland | Developed | 1.2 |
| Western Cool Temperate Developed Ruderal Mixed Forested Wetland | Developed | 2.5 |
| Western Cool Temperate Developed Ruderal Shrub Wetland | Developed | 5.3 |
| Western Cool Temperate Developed Ruderal Shrubland | Developed | 68.6 |
| Western Cool Temperate Fallow/Idle Cropland | Agricultural | 0.1 |
| Western Cool Temperate Pasture and Hayland | Agricultural | 340.4 |
| Western Cool Temperate Row Crop | Agricultural | 0.5 |
| Western Cool Temperate Urban Deciduous Forest | Developed | 12.6 |
| Western Cool Temperate Urban Evergreen Forest | Developed | 22.6 |
| Western Cool Temperate Urban Herbaceous | Developed | 28.8 |
| Western Cool Temperate Urban Mixed Forest | Developed | 2.3 |
| Western Cool Temperate Urban Shrubland | Developed | 111.0 |
| Western North American Ruderal Wet Meadow & Marsh | Wetland [a] | 47.8 |
| Western North American Ruderal Wet Shrubland | Riparian | 0.7 |

| Existing Vegetation Types | Physiognomy | Acres |
|---|---|---|
| Western Warm Temperate Close Grown Crop | Agricultural | 78.4 |
| Western Warm Temperate Developed Ruderal Deciduous Forested Wetland | Developed | 7.2 |
| Western Warm Temperate Developed Ruderal Evergreen Forest | Developed | 58.4 |
| Western Warm Temperate Developed Ruderal Grassland | Developed | 179.2 |
| Western Warm Temperate Developed Ruderal Herbaceous Wetland | Developed | 4.4 |
| Western Warm Temperate Developed Ruderal Mixed Forested Wetland | Developed | 7.2 |
| Western Warm Temperate Developed Ruderal Shrub Wetland | Developed | 9.0 |
| Western Warm Temperate Developed Ruderal Shrubland | Developed | 3,533.3 |
| Western Warm Temperate Fallow/Idle Cropland | Agricultural | 3.2 |
| Western Warm Temperate Pasture and Hayland | Agricultural | 270.0 |
| Western Warm Temperate Row Crop | Agricultural | 56.2 |
| Western Warm Temperate Urban Deciduous Forest | Developed | 96.9 |
| Western Warm Temperate Urban Evergreen Forest | Developed | 15.7 |
| Western Warm Temperate Urban Herbaceous | Developed | 69.8 |
| Western Warm Temperate Urban Mixed Forest | Developed | 23.1 |
| Western Warm Temperate Urban Shrubland | Developed | 130.3 |

Source: NatureServe 2018; LANDFIRE Remap 2016 (updated 2019).

[a] Physiognomy was absent from the database for this existing vegetation type; physiognomy is presumed based on vegetation type descriptions.

# Appendix F: Migratory Birds of Conservation Concern

# Appendix F. Migratory Birds of Conservation Concern

### Table F-1. Migratory Birds of Conservation Concern

| Species | Common | Status |
|---|---|---|
| *Amphispiza belli* | Sage sparrow | Bird of Conservation Concern, Utah Partners in Flight Priority Species |
| *Aquila chrysaetos* | Golden eagle | Bird of Conservation Concern |
| *Athene cunicularia* | Burrowing owl | Bird of Conservation Concern |
| *Baeolophus ridgewayi* | Juniper titmouse | Bird of Conservation Concern |
| *Buteo regalis* | Ferruginous hawk | Bird of Conservation Concern, Utah Partners in Flight Priority Species |
| *Callipepla gambelii* | Gambel's quail | Utah Partners in Flight Priority Species |
| *Carpodacus cassinii* | Cassin's finch | Bird of Conservation Concern |
| *Centrocercus urophasianus* | Sage-grouse | Bird of Conservation Concern, Utah Partners in Flight Priority Species |
| *Coccyzus americanus* | Yellow-billed cuckoo | Bird of Conservation Concern, Utah Partners in Flight Priority Species |
| *Dendroica graciae* | Grace's warbler | Bird of Conservation Concern |
| *Dendroica nigrescens* | Black-throated gray warbler | Utah Partners in Flight Priority Species |
| *Empidonax traillii* | Willow flycatcher | Bird of Conservation Concern |
| *Falco mexicanus* | Prairie falcon | Bird of Conservation Concern |
| *Falco peregrinus* | Peregrine falcon | Bird of Conservation Concern |
| *Gymnorhinus cyanocephalus* | Pinyon jay | Bird of Conservation Concern |
| *Haliaeetus leucocephalus* | Bald eagle | Bird of Conservation Concern |
| *Lanius ludovicianus* | Loggerhead shrike | Bird of Conservation Concern |
| *Leiothlypus luciae* | Lucy's warbler | Bird of Conservation Concern, Utah Partners in Flight Priority Species |
| *Leucosticte atrata* | Black rosy-finch | Bird of Conservation Concern |
| *Melanerpes lewis* | Lewis's woodpecker | Bird of Conservation Concern, Utah Partners in Flight Priority Species |
| *Numenius americanus* | Long-billed curlew | Bird of Conservation Concern |
| *Oreoscoptes montanus* | Sage thrasher | Bird of Conservation Concern |
| *Pipilo aberti* | Abert's towhee | Utah Partners in Flight Priority Species |
| *Pipilo Chlorurus* | Green-tailed towhee | Bird of Conservation Concern |
| *Podiceps nigricollis* | Eared grebe | Bird of Conservation Concern |
| *Selasphorus platycercus* | Broad-tailed hummingbird | Utah Partners in Flight Priority Species |
| *Setophaga pepetechia* | Yellow warbler | Bird of Conservation Concern |
| *Spizella atrogularis* | Black-chinned sparrow | Bird of Conservation Concern |
| *Spizella breweri* | Brewer's sparrow | Bird of Conservation Concern, Utah Partners in Flight Priority Species |

| Species | Common | Status |
|---|---|---|
| *Toxostoma bendirei* | Bendire's thrasher | Bird of Conservation Concern |
| *Toxostoma lecontei* | LeConte's thrasher | Bird of Conservation Concern |
| *Vermivora virginiae* | Virginia's warbler | Utah Partners in Flight Priority Species |
| *Vireo bellii* | Bell's vireo | Bird of Conservation Concern, Utah Partners in Flight Priority Species |
| *Vireo vicinior* | Gray vireo | Bird of Conservation Concern, Utah Partners in Flight Priority Species |

Sources: Parrish et al. 2002, USFWS 2008

## F.1 References

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# Appendix G: Listed Species Considered for Analysis

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# Appendix G. Endangered Species Act Listed Species Considered for Analysis

The U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation decision support system was accessed on December 19, 2019, to obtain an official list of Endangered Species Act threatened, endangered, proposed, and candidate species, along with designated and proposed critical habitats potentially present in the project vicinity (USFWS 2019). Official species lists are only valid for 90 days, so an updated species list was requested on April 10, 2020 (USFWS 2020b). The species list was reviewed by a qualified biologist (Kay Nicholson, Jacobs Engineering Group Inc.) to determine if any special status species or critical habitats have the potential to occur in the action area. Table G-1 includes the official species list and identifies the potential for each species to be present in the areas affected by the proposed actions. For species potentially present but not expected to be affected by proposed actions, the justification for excluding species from further analysis follows Table G-1.

**Table G-1. Endangered Species Act Listed Species that May Occur within the Area Affected by the Proposed Actions**

| Species | Status | Habitat Description | Potential Presence in the Area Affected by the Proposed Actions |
|---|---|---|---|
| California condor (*Gymnogyps californianus*) | Endangered, Experimental Population, Non-essential | High desert canyon lands and plateaus for nesting and open grasslands and savannahs for foraging at elevations of 2,000 to 6,500 feet. | Potentially present. Nesting and roosting habitat are not present where Habitat Conservation Plan (HCP) Covered Activities are expected, in proposed Zone 6, or in the Red Cliffs National Conservation Area (NCA). Potential foraging habitat is present in the open foothills and grasslands where HCP Covered Activities are expected, in proposed Zone 6, and in the Red Cliffs NCA. The justification for excluding this species from analysis in Chapter 3 is included following this table. |
| Dwarf bear-poppy (*Arctomecon humilis*) | Endangered | Mixed warm desert shrub communities with sparse vegetation and soil types of the geologic Moenkopi Formation that are gypsum-rich and highly erosive. Found at elevations of 2,700 to 3,300 feet. | Present. Occupied habitat is present in proposed Zone 6 and the Analysis Area for the HCP. Modeled suitable habitat is present in proposed Zone 6, the Analysis Area for the HCP, and Red Cliffs NCA. This species would be affected by project activities, therefore it is analyzed in detail in Chapter 3. |
| Gierisch mallow (*Sphaeralcea gierischii*) | Endangered, Critical Habitat present | Warm desert scrub on gypsum outcrops of the geologic Kaibab Formation. Many are found on hillsides or steep slopes. | Present. Critical habitat and modeled suitable habitat is present in the Analysis Area for the HCP. This species would be affected by project activities, therefore it is analyzed in detail in Chapter 3. |

| Species | Status | Habitat Description | Potential Presence in the Area Affected by the Proposed Actions |
|---|---|---|---|
| Holmgren (*Paradox*) milk-vetch (*Astragalus holmgreniorum*) | Endangered, Critical Habitat present | Associated with geological layers or parent materials found within the Moenkopi Formation. Found at elevations of 2,480 to 2,999 feet and adjacent to, or above, drainages that are tributary to the Santa Clara and Virgin Rivers. Areas with less than 15% living cover. | Present. Occupied habitat, modeled suitable habitat, and critical habitat is present in proposed Zone 6 and the Analysis Area for the HCP. This species would be affected by project activities, therefore it is analyzed in detail in Chapter 3. |
| Jones cycladenia (*Cycladenia humilis var. jonesii*) | Threatened | Found in mixed desert scrub, juniper, or wild buckwheat-Mormon tea vegetation communities at 4,390- to 6,000- foot elevation. Found on gypsiferous, saline soils of Cutler, Summerville, and Chinle Formations. | Not Present. This species is not currently known to occur in Washington County, therefore the proposed actions are outside the geographic range for the species. This species is excluded from further analysis. |
| Mexican spotted owl (*Strix occidentalis lucida*) | Threatened, Critical Habitat present | Rocky canyon habitats with branching watersheds and numerous tributary canyons, a variety of vegetation communities (ranging from arid to mesic), and prominent vertical-walled or overhanging cliffs. Protected caves or ledges on cliff faces are used for nesting and roosting. Small patches of riparian trees are also used for roosting. Foraging occurs among caves, cliff faces, and rim or canyon-bottom vegetation. | Present. HCP Covered Activities may occur near occupied nesting, roosting, and foraging habitat. This species may be affected by project activities, therefore it is analyzed in detail in Chapter 3. |
| Mojave desert tortoise (*Gopherus agassizii*) | Threatened, Critical Habitat present | Mojave desert scrub (north and west of the Colorado River) in basins and bajadas and rocky slopes less than 4,500 feet in elevation. | Present. This species has been detected within the vicinity of the Northern Corridor alternatives, within proposed Zone 6, and within Washington County. This species would be affected by project activities, therefore it is analyzed in detail in Chapter 3. |
| Shivwits milk-vetch (*Astragalus ampullarioides*) | Endangered, Critical Habitat present | Isolated pockets of purple-hued, soft clay soil found on Chinle formation around St. George, Utah. Found at 3,018 to 4,363 feet in elevation with sparse habitat (approximately 12% coverage). | Present. Occupied habitat, modeled suitable habitat, and critical habitat are present in the Red Cliffs NCA and the Analysis Area for the HCP. Modeled suitable habitat is present in proposed Zone 6. This species would be affected by project activities, therefore it is analyzed in detail in Chapter 3. |

| Species | Status | Habitat Description | Potential Presence in the Area Affected by the Proposed Actions |
|---|---|---|---|
| Siler pincushion cactus (*Pediocactus [Echinocactus utahia] sileri*) | Threatened | Found in Great Basin Desert shrub, Mohave desert scrub, pinyon-juniper forestlands, and grasslands on gypsiferous clay and sandy soils from the Moenkopi Formation at elevations of 2,800 to 5,400 feet. | Present. Occupied habitat and modeled suitable habitat are present in the Analysis Area for the HCP. Modeled suitable habitat is present in the Red Cliffs NCA and proposed Zone 6. This species would be affected by project activities, therefore it is analyzed in detail in Chapter 3. |
| Southwestern willow flycatcher (*Empidonax traillii extimus*) | Endangered, Critical Habitat present | Dense riparian woodland communities along rivers, streams, lakesides, and wetlands less than 8,500 feet in elevation. Prefers dense canopy cover, large volume of understory foliage, and surface water during mid-summer. | Unlikely to occur. Nesting and roosting habitat are not present where HCP Covered Activities are expected, in proposed Zone 6, or near any of the highway alignment alternatives in the Red Cliffs NCA. However, potential foraging habitat may be present near where HCP Covered Activities may occur. The justification for excluding this species from analysis in Chapter 3 is included following this table. |
| Virgin River chub (*Gila seminuda =robusta*) | Endangered, Critical Habitat present | Virgin River system of southwestern Utah, southern Nevada, and northwestern Arizona. Spawns over gravel or rock substrate. Associated with deep, protected areas of swift water. | Unlikely to occur. The Virgin River chub is a fully aquatic species. Habitat for the Virgin River chub does not overlap with desert tortoise habitat. However, Virgin River chub critical habitat includes portions of the 100-year floodplain of the Virgin River (USFWS 1995b and 2008), which could be near locations where HCP Covered Activities may occur. The justification for excluding this species from analysis in Chapter 3 is included following this table. |
| Woundfin (*Plagopterus argentissimus*) | Endangered, Critical Habitat present | Highly mineralized, warm streams of turbid waters. Prefers a stream speed of 1 to 2 feet per second and a depth of 8 to 18 inches. Historically occupied the lower Colorado River basin, the Virgin River, and Gila River. | Unlikely to occur. The woundfin is a fully aquatic species. Habitat for the woundfin does not overlap with desert tortoise habitat. However, woundfin critical habitat includes portions of the 100-year floodplain of the Virgin River (USFWS 1995b and 2008), which could be near locations where HCP Covered Activities may occur. The justification for excluding this species from analysis in Chapter 3 is included following this table. |

| Species | Status | Habitat Description | Potential Presence in the Area Affected by the Proposed Actions |
|---|---|---|---|
| Yellow-billed cuckoo (*Coccyzus americanus*), western distinct population segment | Threatened | Large contiguous patches of multi-layered riparian habitat, such as cottonwood-willow gallery forests along rivers and streams less than 6,600 feet in elevation. Commonly found in lowland riparian woodlands where Fremont cottonwood, willow, velvet ash, Arizona walnut, mesquite, and tamarisk are dominant, but also uses mesquite bosques and small stands of isolated cottonwoods intermixed with mesquite. | Unlikely to occur. The HCP Permit Area, proposed Zone 6, and the highway alignment alternatives are located within the geographic and elevational range of the species; however, suitable riparian habitat does not occur within the areas affected by the proposed actions. Potentially suitable foraging habitat may be present near where HCP Covered Activities may occur within the floodplains of the Virgin River. The justification for excluding this species from analysis in Chapter 3 is included following this table. |
| Yuma Ridgway's [clapper] rail (*Rallus obsoletus [=longirostris] yumanensis*) | Endangered | Variety of marshes dominated by emergent plants, including cattail, bullwhip bulrush, three-square bulrush, and sedges. Ideal habitat is a mosaic of emergent plant stands of different ages, interspersed with shallow pools of open water less than 4,500 feet in elevation. | No potential for occurrence. Marshes supporting emergent plants do not occur within or along the highway alignment alternatives, proposed Zone 6, or the HCP Permit Area. This species is excluded from further analysis. |

## G.1 Species Excluded from Detailed Evaluation

### G.1.1 California Condor

#### *G.1.1.1 Background and Status*

The California condor (*Gymnogyps californianus*) was listed as endangered under the Endangered Species Preservation Act on March 11, 1967, and noted to occur only in California (USFWS 1967). By 1987, the last wild condor was captured and taken to the San Diego Wild Animal Park (USFWS 1996). Beginning with the first successful breeding of California condors in 1988, the population grew. In 1992, releases to the wild began, first in California, followed in 1996 in Arizona. As of April 2019, there were a total of 488 living birds, of which 312 were free-flying (188 in California, 88 in Arizona, and 36 in Mexico; AZGFD no date).

In December 1996, USFWS released California condors at the Vermilion Cliffs in northern Arizona as a designated non-essential experimental population, as provided by Section 10(j) of the Endangered Species Act (USFWS 1996), to allow regulatory flexibility. Releases have been conducted every year since. California condors from the experimental population area forage throughout the Grand Canyon of Arizona and frequently into southwestern Utah, including Washington County. Most California condor habitat use in Utah occurs in and around Zion National Park (Southwest Condor Working Group 2017), east of the Proposed Actions area. The experimental non-essential population extends north to I-15 in Washington County; foraging condors occasionally may leave the experimental population area, where there are no exemptions to the application of Endangered Species Act.

The USFWS designated final critical habitat for the California condor in 1977, including "an area of land, water, and airspace to an elevation of not less than 3,000 feet above the terrain" for several areas within California. Critical habitat is designated only in California; none exists in Utah (USFWS 1977).

#### *G.1.1.2 Species Description, Habitat, and Range*

California condors are opportunistic scavengers; food is typically found via long-distance reconnaissance flights. Telemetry data show condors cover great distances, including one flight from southern Utah to Wyoming that was more than 400 miles. Inland foraging habitat is typically composed of open terrain that supports populations of deer, elk, and cattle; condors have also been observed feeding in more wooded areas. California condors repeatedly use roosting sites on ridgelines, rocky outcrops, steep canyons, and tall trees or snags near foraging grounds (USFWS 1996). Condors require high perches from which strong updrafts provide the lift needed for flight. They are primarily a cavity-nesting species, and typically nest in cavities located on steep terrain with rock outcroppings, cliffs, and caves or in the burned-out hollows of old-growth conifers (USFWS 2013a).

Condors are most abundant in Utah from June through August (UDWR 2019). From spring through fall, condors concentrate near Zion National Park and the Kolob Plateau to the north. Suitable condor nesting habitat is present in the 10(j) non-essential population area in the finger of the Mojave Desert Tortoise Analysis Area northeast of Springdale. Condors have not been observed using habitat in the Reserve or proposed Zone 6; they have been seen in Pine Valley (north of the Reserve) a couple of times but were not observed nesting, roosting, or foraging there. Condors typically return to Arizona for the winter (USFWS 2017a) and can fly between Zion National Park and the Grand Canyon in 1 day (UDWR 2019). Nesting and roosting habitat for the condor are distinct from foraging, requiring steep slopes or cliffs or tall trees to allow for approach and landing and to become airborne again (USFWS 2013a). These habitat features do not overlap with terrain that the Mojave desert tortoise would inhabit in Washington County, and nesting or roosting birds would not be subject to disturbance from noise or human activity associated with project actions.

Condors travel widely in search of carrion. They primarily seek to scavenge on big game and other dead wildlife. The primary threat to the recovery of the species is the consumption of lead bullets from hunter-killed wildlife. Hunting on private lands in Washington County may or may not occur based on various State laws and local ordinances, regardless of HCP Covered Activities. The development of private lands allowed under the amended HCP and ITP would result in a reduction of the discharge of firearms due to the presence of people and structures. In addition, authorized development of Mojave desert tortoise habitat is primarily associated with private lands in the urban interface, though other Covered Activities are conducted across scattered parcels of State and private lands. Some areas of potential condor foraging habitat may be lost (i.e., developed) or disturbed (e.g., noise or human presence) due to HCP Covered Activities. However, consistent with condor foraging behavior, the birds would likely be attracted to on-ground activities as this often indicates a potential source of food.

#### *G.1.1.3 Exclusion Justification*

Though foraging habitat for the California condor is so extensive and feeding opportunities are widely dispersed across the landscape (USFWS 2013a), the areas where Mojave desert tortoise are found does not provide the topography, wind conditions, or density of potential big game prey to attract condors to forage in desert scrub habitats occupied by Mojave desert tortoise in Washington County. Foraging condors occasionally may leave the experimental population area. However, all free-flying birds from the experimental population are visibly marked, and the origin of birds foraging in Utah are known through patagial markings and intensive monitoring to be from the experimental non-essential population. Therefore, the conditions of the Endangered Species

Act 10(j) rule are fully applicable to these birds. Any regulations or restrictions placed on otherwise lawful activities (e.g., hunting resulting in lead consumption by condors) as a result of the presence of condors is explicitly precluded by the 10(j) rule. Foraging in desert tortoise habitat has not been documented. Furthermore, foraging habitat for California condors is abundant throughout Washington County and beyond, and California condors forage widely searching for feeding opportunities. Therefore, loss of habitat in Washington County because of HCP Covered Activities would not affect the ability of condors to forage.

When a proposed action may potentially affect the California condor 10(j) non-essential experimental population, the Bureau of Land Management has the option to conference on the species under the threshold of likely to jeopardize. Under the requirements of the National Environmental Protection Act, the 10(j) population should be addressed (and their status defined) but then are not required to be carried forward for further analysis within the National Environmental Protection Act document. The analysis area lacks all primary constituent elements of California condor habitat (USFWS 1976), and no nests, roosts, or other special use areas for condors have been identified in or anywhere near the analysis area. There is also no suitable condor foraging habitat. Therefore, it is anticipated that HCP Covered Activities would have no effect on the California condor or its critical habitat.

### G.1.2 Southwestern Willow Flycatcher

#### *G.1.2.1 Background and Status*

The USFWS listed the southwestern willow flycatcher (*Empidonax trailii extimus*) as endangered under the Endangered Species Act in February 1995 (USFWS 1995a). In Utah, southwestern willow flycatchers are known only from the Virgin River riparian habitats. The Utah Division of Wildlife Resources (UDWR) has conducted surveys in the St. George, Utah, area since 2008, and has recorded occupied breeding habitat at nine sites along the Virgin River. In 2018, the UDWR observed a total of 16 nesting female flycatchers, the highest number observed since the agency surveys began (UDWR 2018). Current threats to southwestern willow flycatchers include loss of riparian habitat, alteration in stream hydrology (e.g., water withdrawal and impoundments), reservoir management, and brood parasitism by brown-headed cowbirds.

The Virgin River Resource Management and Recovery Program (also known as the Virgin River Program) conserves and monitors riparian bird species, including the southwestern willow flycatcher, in the Virgin River Basin. The Virgin River Program works to enhance riparian habitats and reduce threats to the flycatchers by reducing threats from predators and avian brood-parasites (UDNR 2002).

Washington County zoning restrictions protect aquatic and riparian habitats within the Virgin River Basin in unincorporated areas of the county by adopting zoning and ordinances that preserve open spaces within the 100-year floodplains (Washington County 2012). Local municipalities along the Virgin River (i.e., St. George, Washington City, La Verkin, and Hurricane) have each adopted zoning restrictions and ordinances that preserve open space within the 100-year floodplains (City of St. George 2002, Washington City 2017, La Verkin City 2018, City of Hurricane 2011 and 2019).

#### *G.1.2.2 Species Description, Habitat, and Range*

The southwestern willow flycatcher is one of four recognized subspecies of the willow flycatcher (USFWS 2017b). The geographic distribution for the southwestern subspecies includes southern Nevada, southern Utah, southern Colorado, southern California east to western Texas, and extreme-northwestern Mexico. Southwestern willow flycatchers are migratory, arriving in breeding territories by mid-May and then migrating to southern wintering grounds in August and September (USFWS 2002). Areas preferred for nesting include mature riparian habitat consisting of cottonwood-willow forests or salt cedar thickets along still or slow-moving watercourses at elevations that range from near sea level to 8,500 feet (USFWS 2002). Usually only one brood is produced per year.

The USFWS originally designated critical habitat for the species in 1997; after several revisions, it was most recently finalized in 2013 (USFWS 2013b). Critical habitat for the southwestern willow flycatcher includes riparian areas and stream segments, the lateral extent of which incorporates the 100-year floodplain or flood-prone areas surrounding the stream segments. A 94.4-mile critical habitat unit extends along a segment of the Virgin River beginning at Berry Springs in Hurricane, Utah, flowing southwest through Arizona and into Nevada. The Virgin River, including this segment, flows just south of St. George. The critical habitat in the permit area is located within the Virgin River Management Unit of the larger Lower Colorado Recovery Unit (USFWS 2013b).

There is predicted habitat (based on geographic information system modeling) for the southwestern willow flycatcher along riparian corridors mapped throughout the HCP Permit Area, particularly the Virgin River and the Santa Clara River north and south of the Gunlock Reservoir and its tributaries (e.g., Manganese Wash, Magotsu Creek, Moody Wash, and Pakoon Spring Wash) (Boykin et al. 2007, USGS 2007). Other predicted habitat areas include Grapevine Wash, Ash Creek, La Verkin Creek, North Creek, and tributaries to Leeds Creek (Boykin et al. 2007, USGS 2007). However, known occupied habitat is limited to the Virgin River (UDWR 2018).

#### *G.1.2.3 Exclusion Justification*

The habitats for southwestern willow flycatcher and desert tortoise generally do not overlap, because desert tortoises are not typically found in dense riparian areas. However, the southwestern willow flycatcher and desert tortoise may use similar habitats near or within the 100-year floodplains of the Virgin River Basin (USFWS 2002 and 2011).

Washington County zoning restrictions protect aquatic and riparian habitats within the Virgin River Basin in unincorporated areas of the county by adopting zoning and ordinances that preserve open spaces within the 100-year floodplains (Washington County 2012). Local municipalities along the Virgin River (i.e., St. George, Washington City, La Verkin, and Hurricane) have each adopted zoning restrictions and ordinances that preserve open space within the 100-year floodplains (City of St. George 2002, Washington City 2017, La Verkin City 2018, City of Hurricane 2011 and 2019). These zoning restrictions and ordinances, called for in the Virgin River Program, protect riparian habitats and water quality for sensitive species in the Virgin River Basin, including species that use habitat within the 100-year floodplain (UDNR 2002). Furthermore, activities that directly affect the habitat of this species also are likely to have a Federal nexus through authorizations by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act that would trigger review under Section 7 of the Endangered Species Act.

Noise, vibrations, and other construction-related activities are temporary disturbances that have the potential to affect the nesting and foraging activities of flycatchers. Noise above certain decibel levels can present a potential impact to the birds, whether from direct damage to hearing, masking of communication signals between birds, or response to predators. Studies have shown that different sound levels can produce different impacts when certain noise thresholds are exceeded, including hearing loss and permanent hearing sensitivity modifications (Dooling and Popper 2007, FHWA 2005, Delaney and Grubb 2004). However, nest sites in noisy habitats are exposed to higher levels of noise and visual disturbances, which is below the upper threshold to cause abandonment of the site but above ambient noise levels found in natural sites. HCP Covered Activities include land clearing, construction, drilling, and mining, which are activities that have potential to produce variable noise levels. Construction activities occurring near floodplains may result in noise that could cause disturbance to flycatchers. Because flycatchers are migratory, activities near nesting sites during the breeding season could disturb birds; however, application of existing ordinances and regulations protect riparian habitats within the 100-year floodplain.

Although some portions of southwestern willow flycatcher critical habitat may overlap with occupied desert tortoise habitat and modeled suitable desert tortoise habitat, especially within the Virgin River 100-year floodplain, HCP Covered Activities are not reasonably certain to cause take of flycatchers in these areas because of existing floodplain protection and the dissimilar habitat preferences of these species. Southwestern willow flycatchers and desert tortoises are unlikely to occupy the same habitat within Washington County, because desert tortoise habitat generally lacks the physical and biological features for flycatcher habitat (USFWS 2013b). In addition, the HCP Permit Area habitats used by the southwestern willow flycatcher and desert tortoise do not typically overlap (USFWS 2002 and 2011). Effects of noise from HCP Covered Activities are not reasonably certain to cause take of the southwestern willow flycatcher. Therefore, it is anticipated that HCP Covered Activities would have no effect on the southwestern willow flycatcher or its critical habitat.

No suitable or critical habitat for the southwestern willow flycatcher is present in proposed Zone 6 or within the right-of-way associated with the alternative alignments for the Northern Corridor. Therefore, it is anticipated that activities in proposed Zone 6 and the Northern Corridor would have no effect on the southwestern willow flycatcher or its critical habitat.

### G.1.3 Virgin River Chub and Woundfin

The Virgin River chub (*Gila seminuda* [*robusta*]) and woundfin (*Plagopterus argentisssimus*) occupy the same habitat, so for the purposes of this document, they are discussed together.

#### *G.1.3.1 Background and Status*

The USFWS listed the Virgin River chub as endangered in August 1989 (USFWS 1989). The USFWS listed the woundfin as endangered in October 1970 (USFWS 1970) and listed an introduced Gila River population of woundfin as a non-essential experimental population in July 1985 (USFWS 1985). According to the USFWS 5-Year review report, there were more than a million woundfin in the Virgin River in the 1970s and 1980s; by 2008, there were at most 1,000 woundfin. Sampling from 2007 showed the woundfin population was “functionally extirpated” throughout its critical habitat (USFWS 2008). Since 2003, the USFWS and Virgin River Program have stocked approximately 200,000 hatchery-raised woundfin and 40,000 Virgin River chub into the Virgin River (Virgin River Program 2019a).

Threats to both species include water development projects that cause flow reductions, and non-native fish, specifically the red shiner (USFWS 2008). The Virgin River chub and woundfin have declined in numbers due to the cumulative effects of dewatering from numerous diversion projects, proliferation of non-native fishes, and alterations to natural flow, temperature, and sediment regimes (USFWS 2000).

The Virgin River Program conserves and monitors riparian and aquatic species, including the woundfin and Virgin River chub within the Virgin River Basin (see HCP Chapter 6.5). The Virgin River Program works to enhance riparian and aquatic habitats by acquiring and maintaining instream flows necessary to support aquatic species and protecting water quality through actions such as land use restrictions within the 100-year floodplain (UDNR 2002). The Virgin River Program also controls and eliminates non-native fish that compete with native fish populations, monitors habitats and populations of fishes, and develops and maintains brood stocks of fishes used to stock native habitats of the Virgin River Basin (UDNR 2002).

Washington County zoning restrictions protect aquatic and riparian habitats within the Virgin River Basin in unincorporated areas of the county by adopting zoning and ordinances that preserve open spaces within the 100-year floodplains (Washington County 2012). Local municipalities along the Virgin River (i.e., St. George, Washington City, La Verkin, and Hurricane) have each adopted zoning restrictions and ordinances that preserve open space within the 100-year floodplains (City of St. George 2002 and 2009, Washington City 2017, La Verkin City 2018, City of Hurricane 2011 and 2019).

#### *G.1.3.2 Species Description, Habitat, and Range*

The Virgin River chub is a silvery medium-sized minnow that is endemic to 134 miles of the Virgin River spanning from southwest Utah to northwest Arizona and into southeast Nevada. At the time of listing, it occurred only in a 50-mile stretch of the Virgin River between Mesquite, Nevada, and Hurricane, Utah (USFWS 1989 and 1995b). The woundfin is a small minnow that historically occurred in Arizona's Salt River and Gila River and portions of the Colorado River and the Moapa River in Nevada, but currently occurs only in the Virgin River in Utah, Arizona, and Nevada (USFWS 1995b).

Woundfin habitat includes runs and quiet water habitats with sand substrates adjacent to riffles. (USFWS 1994 and 2008). Virgin River chub habitat includes deep runs or pools associated with instream cover (USFWS 1994). Virgin River chub are longer lived than woundfin and grow to 18 inches in length, while woundfin grow to 4 inches in length (Virgin River Program 2019b).

Virgin River chub are more abundant in the upper river core area (river mile 90 to 97.5 near the confluence of Ash Creek west of Hurricane, Utah) than the lower river core area (river mile 34 to 39.5, near the Beaver Dam Wash) because red shiner and other non-native fish are absent in the upper river. The population estimated for the Virgin River chub within the upper river core (Utah) was more than 8,000 small and large fish, approximately 10 times higher than in the lower river core (i.e., Arizona and Nevada) area (USFWS 2008).

Critical habitat for the Virgin River chub and the woundfin was designated in January 2000 and encompasses 87.5 miles of the Virgin River and its 100-year floodplain in parts of Utah, Arizona, and Nevada (USFWS 2000). Critical habitat for both fish occurs within the HCP Plan Area and within the Reserve in Zones 4 and 5, where it overlaps with desert tortoise designated critical habitat (USFWS 2000).

#### *G.1.3.3 Exclusion Justification*

The Virgin River chub and woundfin both inhabit the Virgin River in Washington County (UDNR 2002). The USFWS has designated critical habitat for both species of fish within the Virgin River, including its 100-year floodplain, which supports nutrient and food resources for these species. Portions of this critical habitat overlap with desert tortoise habitat, and desert tortoise may use portions of the Virgin River 100-year floodplain for foraging. However, the aquatic habitats used by the woundfin and Virgin River chub generally do not overlap with habitats used by desert tortoise, and desert tortoise habitat generally lacks the physical and biological features (e.g., water and instream flow) of the Virgin River fish habitats (USFWS 2000).

Washington County zoning restrictions protect aquatic and riparian habitats within the Virgin River Basin in unincorporated areas of the county by adopting zoning and ordinances that preserve open spaces within the 100-year floodplains (Washington County 2012). Local municipalities along the Virgin River (i.e., St. George, Washington City, La Verkin, and Hurricane) have each adopted zoning restrictions and ordinances that preserve open space within the 100-year floodplains (City of St. George 2002 and 2009, Washington City 2017, La Verkin City 2018, City of Hurricane 2011 and 2019). These zoning restrictions and ordinances, called for in the Virgin River Program, protect riparian habitats and water quality for several sensitive species in the Virgin River Basin, including species that use habitat within the 100-year floodplain (UDNR 2002). Therefore, HCP Covered Activities are not reasonably certain to directly cause take of either Virgin River fish species.

Aquatic habitat for Virgin River chub and woundfin generally does not overlap desert tortoise habitat within the plan area, and local restrictions protect the 100-year floodplain where their habitats and critical habitats do coincide (Washington County 2012, City of St. George 2002 and 2009, Washington City 2017, La Verkin City 2018, City of Hurricane 2011 and 2019). Furthermore, activities that directly affect the habitat of these species also are likely to have a Federal nexus through authorizations by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act that would trigger review under Section 7 of the Endangered Species Act. Therefore, it is anticipated that HCP Covered Activities would have no effect to the Virgin River chub, the woundfin, or their critical habitats.

No suitable or critical habitat for the Virgin River chub or the woundfin is present in proposed Zone 6 or within the right-of-way associated with the alternative alignments for the Northern Corridor. Therefore, it is anticipated that activities in proposed Zone 6 and the Northern Corridor would have no effect on the Virgin River chub, the woundfin, or their critical habitats.

### G.1.4 Yellow-Billed Cuckoo

#### *G.1.4.1 Background and Status*

The USFWS proposed the western population of the yellow-billed cuckoo (*Coccyzus americanus*) for listing in 2013 and listed the species as threatened under the Endangered Species Act in October 2014 (USFWS 2014). As of the 2013 proposed listing, there were fewer than 10 breeding pairs and likely no more than 20 pairs of cuckoos identified within the state of Utah. The decline of the yellow-billed cuckoo is a result of riparian habitat loss and degradation (USFWS 2014).

The Virgin River Program conserves and monitors riparian birds and aquatic species in the Virgin River Basin. The Virgin River Program works to enhance riparian habitats and reduce threats to the riparian species by reducing threats from predators and avian brood-parasites (UDNR 2002). Washington County zoning restrictions protect aquatic and riparian habitats within the Virgin River Basin in unincorporated areas of the county by adopting zoning and ordinances that preserve open spaces within the 100-year floodplains (Washington County 2012). Local municipalities along the Virgin River (i.e., St. George, Washington City, La Verkin, and Hurricane) have each adopted zoning restrictions and ordinances that preserve open space within the 100-year floodplains (City of St. George 2002, Washington City 2017, La Verkin City 2018, City of Hurricane 2011 and 2019).

#### *G.1.4.2 Species Description, Habitat, and Range*

The yellow-billed cuckoo is a neotropical bird that winters in South America and breeds in North America. This species is a medium-sized bird, reaching approximately 12 inches in length. Males and females are indistinguishable in the field, and the birds are secretive and difficult to detect (USFWS 2014). According to the proposed listing (USFWS 2013c), the cuckoo nests almost exclusively in low- to mid-elevation riparian woodlands that span 50 acres or more within arid to semiarid areas. Preferred cuckoo breeding habitat include a contiguous or nearly contiguous patch of woodlands within a floodplain that is at least 220 acres in extent and has both understory and overstory components (USFWS 2020a). The majority of nests are placed in willow trees, but alder, cottonwood, mesquite, walnut, box elder, sycamore, and tamarisk also are used (USFWS 2013c). Little is known about the cuckoo’s migration; however, it appears they may be found in smaller riparian patches when migrating than what is typically required for nesting (USFWS 2013c). Likewise, little information is available about foraging activities, but observations indicate that cuckoos tend to forage within riparian habitat with abundant leafy vegetation (USFWS 2013c).

The USFWS proposed critical habitat that included the Virgin River on August 15, 2014 (USFWS 2014). On February 27, 2020, the USFWS issued a revised proposal that no longer included critical habitat in Washington County (USFWS 2020a). There is no proposed critical habitat located within the HCP Permit Area.

Although limited occupied habitat is known to exist within Utah, there is predicted habitat, based on geographic information system modeling, mapped throughout the permit area along riparian corridors, particularly the Virgin River, and the Santa Clara River north and south of the Gunlock Reservoir and its tributaries (e.g., Manganese Wash, Magotsu Creek, Moody Wash, and Pakoon Spring Wash) (Boykin et al. 2007, U.S. Geological Survey 2007). Other predicted habitat areas include Grapevine Wash, Ash Creek, La Verkin Creek, North Creek, and tributaries to Leeds Creek. According to the UDWR ( pers. com. Day 2019), the yellow-billed cuckoo has been periodically observed in Washington County. The species has been intermittently detected along the Virgin River and the Beaver Dam Wash, and there is one known detection along the Santa Clara River. However, there are no locations with consistent sightings and no indication or evidence of breeding by the species within the St. George area (pers. com. Day 2019).

#### *G.1.4.3 Exclusion Justification*

No proposed critical habitat is present within the HCP Permit Area. Yellow-billed cuckoo nesting and foraging habitat may be present in the HCP Permit Area where larger-scale riparian areas exist within the desert tortoise's range. The habitats for yellow-billed cuckoo and desert tortoise generally do not overlap, because desert tortoises are not typically found in dense riparian areas and desert tortoise habitat lacks the physical and biological features of cuckoo habitat. However, yellow-billed cuckoos and desert tortoises may use similar habitats within the 100-year floodplains of the Virgin River Basin (USFWS 2011 and 2014).

Washington County zoning restrictions protect aquatic and riparian habitats within the Virgin River Basin in unincorporated areas of the county by adopting zoning and ordinances that preserve open spaces within the 100-year floodplains (Washington County 2012). Local municipalities along the Virgin River (i.e., St. George, Washington City, La Verkin, and Hurricane) have each adopted zoning restrictions and ordinances that preserve open space within the 100-year floodplains (City of St. George 2002, Washington City 2017, La Verkin City 2018, City of Hurricane 2011 and 2019). These zoning restrictions and ordinances, called for in the Virgin River Program, protect riparian habitats and water quality for sensitive species in the Virgin River Basin, including species that use habitat within the 100-year floodplain (UDNR 2002). Furthermore, activities that directly affect the habitat of this species also are likely to have a Federal nexus through authorizations by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act that would trigger review under Section 7 of the Endangered Species Act.

Noise, vibrations, and other construction-related activities are temporary disturbances that have the potential to affect the nesting and foraging activities of yellow-billed cuckoos. Noise above certain decibel levels can present a potential impact to the birds, whether from direct damage to hearing, masking of communication signals between birds, or response to predators. Studies have shown that different sound levels can produce different impacts when certain noise thresholds are exceeded, including hearing loss and permanent hearing sensitivity modifications (Dooling and Popper 2007, FHWA 2005, Delaney and Grubb 2004). However, nest sites in noisy habitats are exposed to higher levels of noise and visual disturbances, which is below the upper threshold to cause abandonment of the site but above ambient noise levels found in natural sites. HCP Covered Activities include land clearing, construction, drilling, and mining, which are activities that have potential to produce variable noise levels. Construction activities occurring near floodplains may result in noise that could cause disturbance to cuckoos. Because cuckoos are migratory, activities near nesting sites during the breeding season could disturb birds; however, application of existing ordinances and regulations protect riparian habitats within the 100-year floodplain.

Although some portions of yellow-billed cuckoo habitat may overlap with occupied desert tortoise habitat and modeled suitable desert tortoise habitat, especially within the 100-year floodplain, HCP Covered Activities are not reasonably certain to cause take of cuckoos in these areas due to existing floodplain protection and the dissimilar habitat preferences of these species. Yellow-billed cuckoos and desert tortoises are unlikely to occupy the same habitat within Washington County as desert tortoise habitat generally lacks suitable nesting habitat for cuckoo habitat. In addition, the HCP Permit Area habitats used by the yellow-billed cuckoo and desert tortoise do not typically overlap (USFWS 2002 and 2011). The effects of noise from HCP Covered Activities are not reasonably certain to cause take of the yellow-billed cuckoo. Therefore, it is anticipated that HCP Covered Activities would have no effect on the yellow-billed cuckoo.

No suitable or proposed critical habitat for the yellow-billed cuckoo, and no riparian habitats are present in proposed Zone 6 or within the right-of-way associated with the alternative alignments for the Northern Corridor. Therefore, it is anticipated that activities in proposed Zone 6 and the Northern Corridor would have no effect on the yellow-billed cuckoo or its proposed critical habitat.

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# Appendix H: Inconsistencies between the Northern Corridor Project and the Land Use Plans, Policies, and Controls of Washington County and the City of St. George

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# Appendix H. Inconsistencies Between the Northern Corridor Project and the Land Use Plans, Policies, and Controls of Washington County and the City of St. George

The National Environmental Policy Act (NEPA) requires an Environmental Impact Statement (EIS) to discuss certain factors (see 42 United States Code § 4332(2) (C)(i-v)). As set forth by NEPA's implementing regulations, one of these factors is potential conflicts between a proposed action and the objectives of Federal, regional, State and local land use plans, policies, and controls for the area concerned (40 *Code of Federal Regulations* [CFR] § 1502.16). Where an inconsistency exists between the proposed Federal action and any approved State or local plan or law, the EIS should describe the extent to which the agency would reconcile its proposed action with the plan or law.

Also related to state and local planning, 40 CFR § 1506.2(d) requires that the EIS "discuss any inconsistency of a proposed action with any approved State or local plan and laws," and if an inconsistency exists, describe "the extent to which the agency would reconcile its proposed action with the plan or law."

The Council on Environmental Quality (CEQ) regulations at 40 CFR 1502.16(c) require the Environmental Consequences section of an EIS to disclose "possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian Tribal) land use plans, policies and controls for the area concerned." This appendix is referenced in Chapters 3 and 4 of this Draft EIS and provides a complete discussion of any inconsistencies with the plans adopted by Washington County or the City of St. George in compliance with the CEQ regulations.

The CEQ has also provided guidance for situations where a proposed action conflicts with local plans, policies, and controls through their publication *Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations* (46 Federal Register 18026 [1981]). Question 23c asks, "What options are available for the decisionmaker when conflicts with such plans or policies are identified?" CEQ's answer states, "After identifying any potential land use conflicts, the decisionmaker must weigh the significance of the conflicts, among all the other environmental and non-environmental factors that must be considered in reaching a rational and balanced decision. Unless precluded by other law from causing or contributing to any inconsistency with the land use plans, policies or controls, the decisionmaker retains the authority to go forward with the proposal, despite the potential conflict…."

On April 3, 2020, the Bureau of Land Management (BLM) sent an email to Washington County with a list of potential inconsistencies between the proposed conservation measures related to the establishment of Zone 6 supported by an amendment to the BLM St. George Field Office Resource Management Plan (RMP) and the land use plans, policies, and controls adopted by Washington County. There were no potential inconsistencies identified for the Northern Corridor right-of-way (ROW) alternatives, Red Cliffs National Conservation Area RMP amendment, or the remaining sections of the Washington County Habitat Conservation Plan (HCP).

On April 7, 2020, the BLM sent an email to the City of St. George with a list of potential inconsistencies between the alternatives for the Northern Corridor ROW and the land use plans, policies, and controls adopted by the City of St. George. There were no potential inconsistencies identified for the Washington County HCP or the St. George Field Office or Red Cliffs National Conservation Area RMP amendments.

Each of the following items lists the potential inconsistencies as described in the documents adopted by Washington County and the City of St. George. Where there is potential for an inconsistency, each item also includes a discussion of the extent to which the BLM could reconcile the proposed action with the applicable State or local plan or law.

## H.1 Washington County – Item 1 (Applicable under Environmental Impact Statement Alternatives 2, 3, and 4)

### H.1.1 Washington County Resource Management Plan: Land – Land Use 1.a.iv

*"Washington County has a no-net-gain policy for federally managed public lands. Land swaps and conservation should not result in an increase in federally managed acres within the county unless the County Commission makes a specific exception that is in the best interest of the County."*

Washington County prepared an Amended HCP to support its application for renewal of the 1996 Incidental Take Permit for Mojave desert tortoise. The HCP's description of the proposed Zone 6 includes the following provision:

"Washington County and the HCP Partners will expand the target acquisition area for the Reserve to include the proposed Reserve Zone 6 boundary. Washington County and the HCP Partners intend and agree to prioritize opportunities for the SITLA-owned lands to be acquired by Washington County or other conservation entities to support the recovery of the MDT. Washington County and the HCP Partners anticipate that the acquisition of SITLA-owned lands within Reserve Zone 6 will use the same mechanisms and be subject to the same provisions as described in Chapter 6.3.1.2."

HCP Section 6.3.1.2, Reserve Acquisition Strategy, states that "the Reserve boundary defines a target acquisition area for the consolidation of most remaining private and SITLA-owned lands into BLM or UDNR ownership or management." Non-Federal lands account for approximately 20,000 acres within Zones 1 through5 and the proposed Zone 6 and, if acquired by the BLM, would likely lead to a net increase of Federally managed public lands within Washington County.

While this level of net gain of Federally managed public lands may be inconsistent with the Washington County RMP, an exception by the County Commission would officially be documented through the approval of the Amended HCP it has prepared and the Chairperson's signature on the accompanying Implementation Agreement.

## H.2 Washington County – Item 2 (Applicable under Environmental Impact Statement Alternatives 2, 3, and 4)

### H.2.1 Washington County Resource Management Plan: Land – Livestock Grazing 3.a.ii

*"Washington County opposes any loss of AUMs absent scientific proof of resource degradation."*

Alternatives for livestock grazing management on BLM-administered lands within Zone 6 range from maintaining all allotments as available for livestock grazing to designating all allotments as unavailable. There is no current "scientific proof of resource degradation" specifically due to livestock grazing within Zone 6. If allotments are made unavailable through the St. George Field Office RMP amendment, it would be inconsistent with the Washington County RMP. However, HCP Section 9.1.1.1, Add Reserve Zone 6, states:

"Washington County and the HCP Partners will coordinate with the holders of active grazing permits applicable to Reserve Zone 6 and negotiate the acquisition of such grazing permits from willing sellers. However, like Reserve land acquisitions, no entity will be required or compelled to sell, donate, transfer, purchase, or receive interest in lands for the purpose of this Amended HCP.

Nor does this establish a timetable for completing grazing permit acquisitions for Reserve Zone 6. Nevertheless, Washington County and the HCP Partners have demonstrated the ability to successfully and expeditiously negotiate such transactions. This conservation action will benefit both MDT and listed plants within Reserve Zone 6. Estimated cost over 25 years = $259,540."

While a reduction in the per animal unit month (AUM) that is not linked to resource degradation may be inconsistent with the Washington County RMP, an exception by the County Commission would officially be documented through the approval of the Amended HCP it has prepared and the Chairperson's signature on the accompanying Implementation Agreement.

## H.3 Washington County – Item 3 (Applicable under Environmental Impact Statement Alternatives 2, 3, and 4)

### H.3.1 Washington County Resource Management Plan: Land – Livestock Grazing 3.b.iv

*"AUMs within the county remain at or above current levels unless a scientific need for reduction is demonstrated to the satisfaction of the county."*

See response to Washington County – Item 2.

## H.4 Washington County – Item 4 (Applicable under Environmental Impact Statement Alternatives 2, 3, and 4)

### H.4.1 Washington County Resource Management Plan: Land – Land Access 4.d.i

*"Property necessarily includes access. Livestock trails, historic trails, historic roads, and any other similar access routes should be maintained wherever they don't interfere with private property rights."*

Alternatives for the management of BLM-administered Zone 6 include potential closure of some existing routes located on BLM-administered lands. Although specific routes have not been identified, the closures in this area would not likely be the result of interference with private property rights and would not be consistent with the Washington County RMP. However, HCP Section 9.1.1.1, Add Reserve Zone 6, states that "Washington County, BLM, and the other HCP Partners agree to reduce the total mileage of designated recreation access routes within Reserve Zone 6."

While route closures that are not linked to interference with private property rights may be inconsistent with the Washington County RMP, an exception by the County Commission would be officially documented through the approval of the Amended HCP it has prepared and the Chairperson's signature on the accompanying Implementation Agreement.

## H.5 Washington County – Item 5 (Applicable under Environmental Impact Statement Alternatives 2, 3, and 4)

### H.5.1 Washington County Resource Management Plan: Other Resources – Mining and Minerals 1.b.iii

*"Federally managed public lands remain open to mining and mineral claims, including claims for aggregate materials, sand, gravel, picture rock, and similar products except where the county agrees that extraction activities would be inappropriate."*

Alternatives for the management of BLM-administered lands within Zone 6 include potential closures to saleable (for example, sand and gravel) and fluid (for example, oil and gas) minerals, as well as recommending the withdrawal from locatable minerals. The management of the Red

Bluff Area of Critical Environmental Concern, covering approximately 67 percent of the subsurface minerals in Zone 6, already includes these closures and a recommended withdrawal. Additional closures on the remaining areas within the BLM-administered portion of Zone 6 would not be consistent with the Washington County RMP.

However, HCP Section 6.1.2, Biological Goals and Objectives, states:

*"1. To the maximum extent practicable, conserve the Upper Virgin River population of MDT within the Plan Area by*

*d. removing land uses from the Reserve that are not Covered Activities and that impact the MDT, such as land development, grazing, off-road use, mining, and others;"*

Limiting or prohibiting disturbance associated with mining within the proposed Zone 6 would be consistent with management of other portions of the existing Reserve. An exception by the County Commission would officially be documented through the approval of the Amended HCP it has prepared and the Chairperson's signature on the accompanying Implementation Agreement.

## H.6 City of St. George – Item 1 (Applicable under Environmental Impact Statement Alternative 6)

### H.6.1 St. George General Plan: Section 7.2.1., Downtown Strategies

*"8. Re-install on-street parking throughout the downtown—possible in conjunction with a one-way couplet to accommodate traffic capacities."*

The conceptual design for the Northern Corridor portion of Alternative 6 would involve the conversion of two downtown streets—St. George Boulevard and 100 South—each to opposing one-way streets. They are projected to be three lanes wide, which may or may not leave enough remaining width in the public ROW to accommodate on-street parking. In addition, the conceptual design of Alternative 6 is intended to promote maximum movement of vehicles through the corridor to address congestion concerns in the larger area, which would be counter to the traffic-calming and business-friendly intent of providing on-street parking. The final design of the one-way couplet, if implemented, would be completely outside the jurisdiction of the Federal agencies, and the City of St. George would resolve any potential inconsistencies as it sees fit.

## H.7 City of St. George – Item 2 (Applicable under Environmental Impact Statement Alternative 6)

### H.7.1 St. George General Plan: Section 7.2.1., Downtown Strategies

*"14. Promote a pedestrian-friendly downtown atmosphere through the use of neck-downs at street corners, sidewalk paving accents, coordinated street furniture (lights, benches, trash bins, etc.), awnings, and street trees or shrubs in or adjacent to sidewalks."*

See response to City of St. George – Item 1. The remaining ROW width may not provide enough space for the improvements listed in this item. In addition, creating a pedestrian-friendly atmosphere would depend on the speed limits and design improvements incorporated in the final design. The final design of the one-way couplet, if implemented, would be completely outside the jurisdiction of the Federal agencies, and the City of St. George would resolve any potential inconsistencies as it sees fit.

## H.8 City of St. George – Item 3 (Applicable under Environmental Impact Statement Alternative 6)

### H.8.1 St. George General Plan: Section 7.2.1., Downtown Strategies

*"15. Develop a landscaped median in the core section of St. George Boulevard."*

The conversion of St. George Boulevard from its existing two-way configuration to a one-way street would not accommodate medians between the travel lanes. Existing landscape medians would likely be removed as part of the reconstruction. The final design of the one-way couplet, if implemented, would be completely outside the jurisdiction of the Federal agencies, and the City of St. George would resolve any potential inconsistencies as it sees fit.

## H.9 References

Council of Environmental Quality (CEQ). 1981. "Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations." Memorandum for Federal NEPA Liaisons, Federal, State, and Local Officials and Other Persons Involved In The NEPA Process. *Federal Register.* Vol. 46, No. 18026. (March 1981).

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# Appendix I: Air Quality Technical Report

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# Northern Corridor

## Air Quality Technical Report

Draft

May 22, 2020

Prepared for:
U.S. Department of the Interior Bureau of Land Management
Fish & Wildlife Service

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# Contents

## Tables



## Figures

# Acronyms and Abbreviations

| | |
|---|---|
| °C | degree(s) Celsius |
| °F | degree(s) Fahrenheit |
| $\mu g/m^3$ | microgram(s) per cubic meter |
| BLM | Bureau of Land Management |
| CAA | Clean Air Act |
| CAP | criteria air pollutant |
| CFR | *Code of Federal Regulations* |
| $CH_4$ | methane |
| CO | carbon monoxide |
| EIS | Environmental Impact Statement |
| EPA | U.S. Environmental Protection Agency |
| FHWA | Federal Highway Administration |
| GHG | greenhouse gas |
| HAP | hazardous air pollutant |
| I-15 | Interstate 15 |
| IPCC | Intergovernmental Panel on Climate Change |
| MOVES | Motor Vehicle Emissions Simulator |
| MSAT | Mobile Source Air Toxic |
| $N_2O$ | nitrous oxide |
| NAAQS | National Ambient Air Quality Standards |
| NCA | National Conservation Area |
| NEPA | National Environmental Policy Act |
| NOAA | National Oceanic and Atmospheric Administration |
| $NO_2$ | nitrogen dioxide |
| $O_3$ | ozone |
| Pb | lead |
| $PM_{10}$ | particulate matter, 10 micrometers or less in diameter |
| $PM_{2.5}$ | particulate matter, 2.5 micrometers or less in diameter |
| ppb | part(s) per billion |
| ppm | part(s) per million |
| RCP | Representative Concentration Pathways |
| ROW | right-of-way |
| SAFE | Safer Affordable Fuel-Efficient |

| | |
|---|---|
| SIP | State Implementation Plan |
| $SO_2$ | sulfur dioxide |
| UDAQ | Utah Division of Air Quality |
| UDOT | Utah Department of Transportation |
| VMT | vehicle miles traveled |
| VOC | volatile organic compound |

# 1. Introduction

Transportation models show the existing transportation network in Washington County does not have enough capacity for the increased demand of a growing population. In response, the Utah Department of Transportation (UDOT) filed a right-of-way (ROW) application for a proposed highway, referred to as the Northern Corridor, on the Bureau of Land Management (BLM)-administered Red Cliffs National Conservation Area (NCA). This action initiated the National Environmental Policy Act (NEPA) process requiring preparation of an Environmental Impact Statement (EIS). This Air Quality Technical Report is being prepared in support of the Draft EIS.

# 2. Proposed Action and Alternatives – Northern Corridor

If the BLM selects an alternative that would cross BLM-administered public lands, the BLM's action would be to grant a ROW to UDOT for the construction, operation, and maintenance of the Northern Corridor across those lands. The ROW would be subject to BLM terms and conditions.

The three Northern Corridor alternatives within the Red Cliffs NCA (the T-Bone Mesa Alignment, UDOT Application Alignment, and Southern Alignment) vary in location and tie-in locations with Red Hills Parkway, but all share the following common features:

- Up to 500-foot-wide ROW.
- 4-lane highway with two, 12-foot-wide travel lanes in each direction, 8-foot shoulders, and a center median.
- A combination of curb and gutter, drainage swales, and ditches.
- Bicycle and pedestrian trail(s).
- Associated signage.
- A new intersection for connection to Red Hills Parkway, as well as a new intersection at Cottonwood Spring Road (also known as Old Dump Road or Turkey Farm Road).

The Red Hills Parkway Expressway and St. George Boulevard/100 South One-way Couplet alternatives lie predominantly or entirely outside the NCA and propose improvements to existing roadway infrastructure rather than a new highway within the NCA.

Under the No Action Alternative, the BLM would deny UDOT's application for a ROW across the Red Cliffs NCA for the Northern Corridor. The alternative reflects all the roadway and transit improvements from the applicable local, regional, and statewide transportation plans that would be completed by 2050, absent the Northern Corridor.

The alternatives are shown on Figure 1.

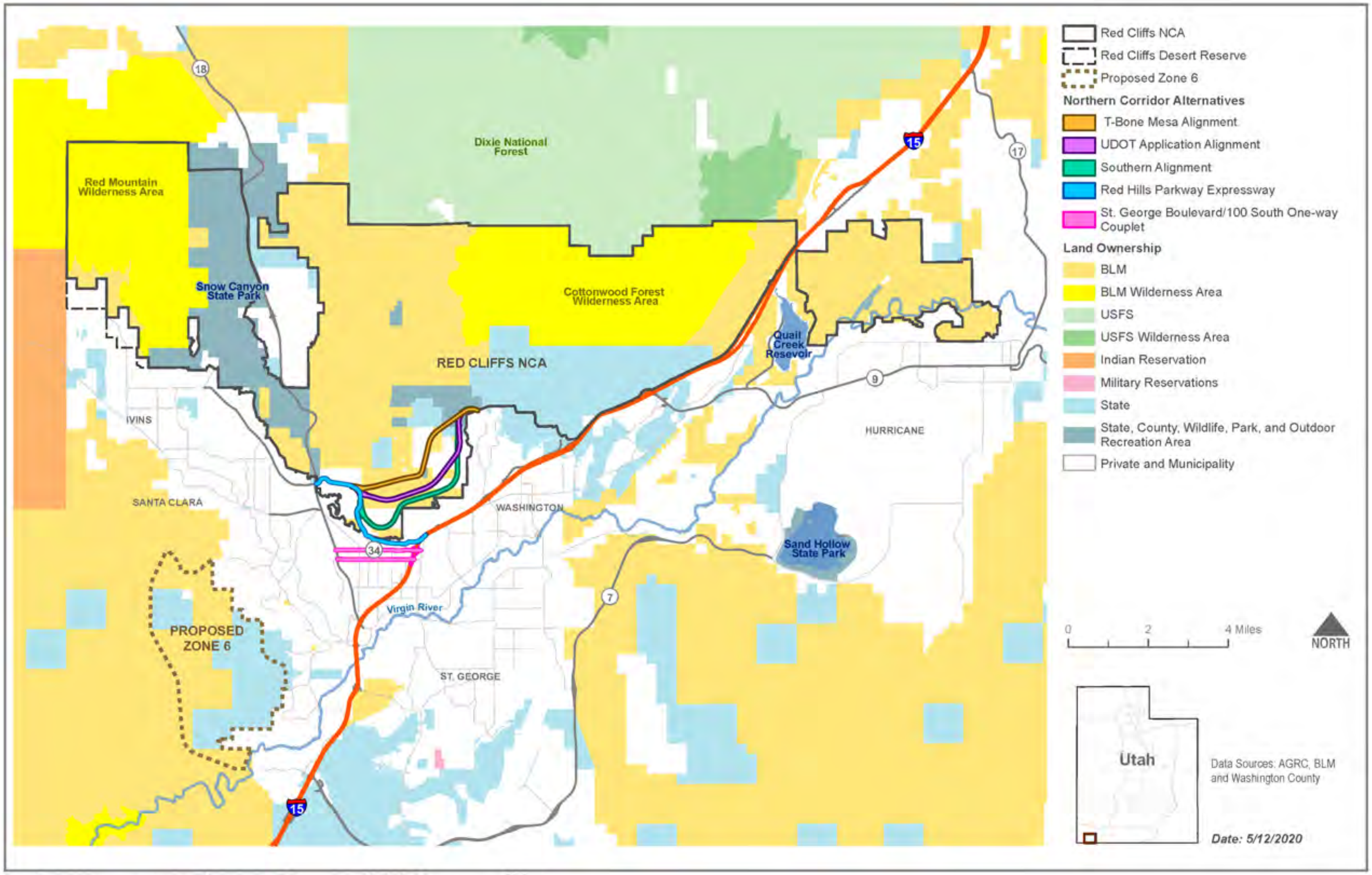


Figure 1. Proposed Northern Corridor Alternatives

# 3. Regulatory Setting

Federally funded transportation projects must meet the requirements of the 1970 Federal Clean Air Act (CAA) (42 United States Code Section 7401), which governs air quality in the United States. The U.S. Environmental Protection Agency (EPA) is responsible for enforcing the CAA. The EPA has established nationwide air quality standards to protect public health and welfare with an adequate margin of safety. These Federal standards, known as the National Ambient Air Quality Standards (NAAQS), are required under the 1977 CAA and subsequent amendments (Table 1).

## 3.1 Ambient Air Quality Standards

**Table 1. NAAQS Standards for Criteria Air Pollutants**

| Pollutant | Primary or Secondary | Averaging Time | Level | Form |
|---|---|---|---|---|
| **Carbon Monoxide (CO)** | Primary | 8 hours | 9 ppm | Not to be exceeded more than once per year |
| **Carbon Monoxide (CO)** | Primary | 1 hour | 35 ppm | Not to be exceeded more than once per year |
| **Lead (Pb)** | Primary and Secondary | Rolling 3-month average | 0.15 μg/m$^3$ [a] | Not to be exceeded |
| **Nitrogen Dioxide ($NO_2$)** | Primary | 1 hour | 100 ppb | 98th percentile of 1-hour daily maximum concentrations, average over 3 years |
| **Nitrogen Dioxide ($NO_2$)** | Primary and Secondary | Annual | 53 ppb [b] | Annual mean |
| **Ozone** | Primary and Secondary | 8 hours | 0.070 ppm [c] | Annual fourth-highest maximum 8-hour concentration, averaged over 3 years |
| **$PM_{2.5}$** | Primary | Annual | 12.0 μg/m$^3$ | Annual mean, averaged over 3 years |
| **$PM_{2.5}$** | Secondary | Annual | 15.0 μg/m$^3$ | Annual mean, averaged over 3 years |
| **$PM_{2.5}$** | Primary and Secondary | 24 hours | 35 μg/m$^3$ | 98th percentile, averaged over 3 years |
| **$PM_{10}$** | Primary and Secondary | 24 hours | 150 μg/m$^3$ | Not to be exceeded more than once per year on average over 3 years |
| **Sulfur Dioxide ($SO_2$)** | Primary | 1 hour | 75 ppb [d] | 99th percentile of 1-hour daily maximum concentrations, average over 3 years |
| **Sulfur Dioxide ($SO_2$)** | Secondary | 3 hours | 0.5 ppm | Not to be exceeded more than once per year |

Source: EPA 2019a

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

[b] The level of the annual $NO_2$ standard is 0.053 ppm. It is shown here in terms of ppb for the purposes of clearer comparison to the 1-hour standard level.

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

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

Notes:

$\mu g/m^3$ = microgram(s) per cubic meter
ppb = part(s) per billion
ppm = part(s) per million

Under the CAA, NAAQS have been established for six criteria air pollutants (CAPs): carbon monoxide (CO), lead (Pb), nitrogen dioxide ($NO_2$), particulate matter (10 micrometers or less in diameter [$PM_{10}$] and 2.5 micrometers or less in diameter [$PM_{2.5}$]), ozone ($O_3$), and sulfur dioxide ($SO_2$). The NAAQS represent safe levels of each pollutant to avoid specific adverse effects to human health and the environment.

The Utah Division of Air Quality (UDAQ) is responsible for ensuring the air in Utah meets health and visibility standards established under the Federal CAA. These standards are known as the NAAQS and have been adopted by the State of Utah. The UDAQ also endorses rules pertaining to air quality standards, develops plans to meet the Federal standards when necessary, issues preconstruction and operating permits to stationary sources, and ensures compliance with State and Federal air quality rules. In addition, UDAQ collects air quality data through monitoring stations.

## 3.2 Attainment Status

The Federal CAA requires EPA to classify areas in the country as attainment or non-attainment with respect to each criteria pollutant, depending on whether the areas meet the applicable NAAQS. If the air quality in a geographic region meets or measures less than the standards, it is called an attainment area; areas that do not meet or exceed the standards are called non-attainment areas. Once a non-attainment area meets the standards and additional re-designation requirements in the CAA (Section 107(d)(3)(E)), EPA will designate the area as a "maintenance area."

The study area is located within the City of St. George in Washington County, Utah. Washington County is designated as an attainment or unclassifiable area for all criteria pollutants. Figure 2 shows the project area in relation to the State attainment and non-attainment areas.

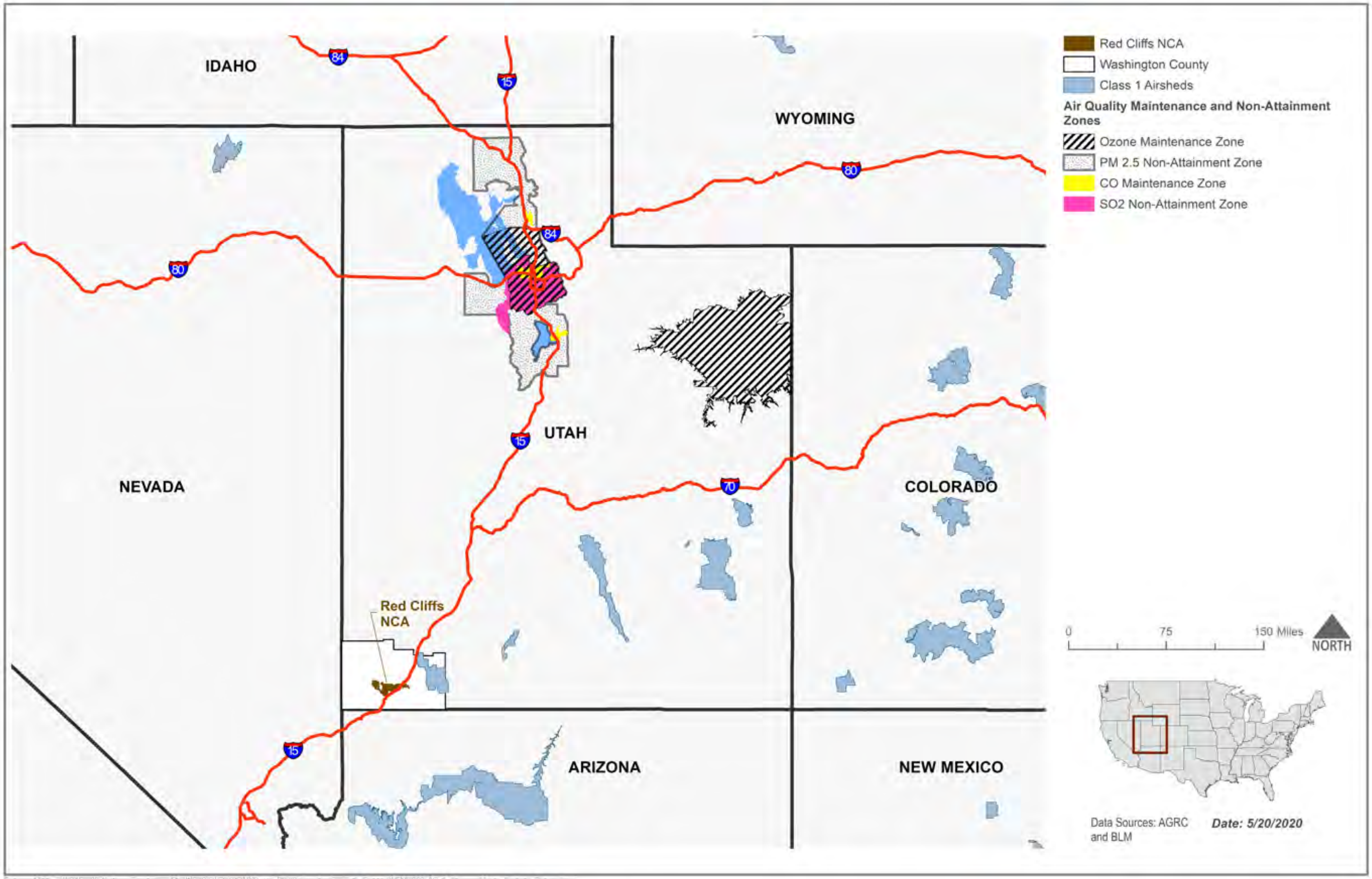


**Figure 2. Air Quality Attainment Areas and Class I Airsheds**

## 3.3 Transportation Conformity

Transportation conformity applies to transportation projects and takes place on two levels: the regional—or planning and programming—level, and the project level. A transportation project must conform at both levels to be approved. Regional conformity is demonstrated when a project is included in a financially constrained conforming Transportation Improvement Program and Long-Range Transportation Plan. At the project level, a project must not cause a new local violation of the NAAQS or exacerbate an existing violation of the Federal standards for CO, $PM_{10}$, and $PM_{2.5}$.

Conformity requirements apply only in non-attainment and maintenance areas for the NAAQS and only for the specific NAAQS that are or were violated. Conformity requirements do not apply in unclassifiable/attainment areas for NAAQS. Because the proposed improvements are located in an attainment area, the project is not subject to the transportation conformity regulations, and regional and project level hot spot analyses are not required.

## 3.4 Mobile Source Air Toxics

Controlling air toxic emissions became a national priority with the passage of the Clean Air Act Amendments of 1990, whereby Congress mandated that the EPA regulate 188 air toxics, also known as hazardous air pollutants (HAPs). The EPA assessed this expansive list in its rule on the Control of HAPs from Mobile Sources (*Federal Register, Vol. 72, No.* 37, page 8430, February 26, 2007) and identified a group of 93 compounds emitted from mobile sources that are part of EPA's Integrated Risk Information System (2019d). In addition, EPA identified nine compounds with significant contributions from mobile sources that are among the national and regional-scale cancer risk drivers or contributors and non-cancer hazard contributors from the 2011 National Air Toxics Assessment. These are 1,3-butadiene,acetaldehyde, acrolein, benzene, diesel particulate matter (diesel PM), ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter. While the Federal Highway Administration (FHWA) considers these the priority mobile source air toxics (MSAT), the list is subject to change and may be adjusted in consideration of future EPA rules.

## 3.5 Climate Change and Greenhouse Gases

Human activity is changing the earth's climate by causing the buildup of heat-trapping greenhouse gas (GHG) emissions through the burning of fossil fuels and other human activities. Carbon dioxide ($CO_2$) from transportation sources is the largest component of human-produced emissions in the United States; other prominent emissions include methane ($CH_4$), nitrous oxide ($N_2O$), and hydrofluorocarbons (EPA 2019c). These emissions are different from CAPs because their effects in the atmosphere are global rather than local, and also because they remain in the atmosphere for decades to centuries, depending on the substance.

Climate change affects human health and natural ecosystems. Observed changes include, but are not limited to, an increase in sea level, high temperatures, melting of glaciers, stronger storms and hurricanes, wildfires, and shifting of habitats. Scientists have warned that significant and potentially dangerous shifts in climate and weather are possible without substantial reductions in GHG emissions. They commonly have cited 2 degrees Celsius (°C) (1°C beyond warming that has already occurred) as the total amount of warming the earth can tolerate without serious and potentially irreversible climate effects (Intergovernmental Panel on Climate Change [IPCC] 2014).

## 3.6 Air Quality Regulations for Construction Emissions

Construction activities have the potential to generate fugitive dust emissions, which are subject to the following codes:

- St. George City Code, Title 4: Health and Safety, Chapter 9: Air Quality Regulations.
- Utah Administrative Code R307-205, Emissions Standards: Fugitive Emissions and Fugitive Dust.

Per St. George City Code, preparation of a dust control plan would be required to specify best practical methods that would be used to control the generation of fugitive dust. In addition, a dust control permit would be required.

# 4. Methodology

## 4.1 Mobile Source Air Toxics

The FHWA *Updated Interim Guidance on Mobile Source Air Toxics Analysis in NEPA Documents* (FHWA 2016) was used to assess potential emissions from MSATs. FHWA has developed a tiered approach for analyzing MSATs in NEPA documents. Depending on the specific project circumstances, FHWA has identified three levels of analysis:

1) *No analysis for projects with the potential for meaningful MSAT effects.*

   Projects of this level are those qualifying as a categorical exclusion under 23 CFR part 777.117 (c), or exempt under the CAA conformity rule under 40 CFR part 93.126, or with no meaningful impact on traffic volumes or vehicle mix.

2) *Qualitative analysis for projects with low potential MSAT effects.*

   Projects at this level include those that serve to improve operations of highway, transit, or freight without adding substantial new capacity or without creating a facility that is likely to meaningfully increase emissions.

3) *Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects.*

   Projects at this level are those with the potential for meaningful differences among project alternatives. To fall under this category, the project must create or significantly alter a major intermodal freight facility that has the potential to concentrate high levels of diesel PM in a single location or create new or add significant capacity to urban highways such as interstates, urban arterials, or urban collector-distributor routes with traffic volumes where the annual average daily traffic is projected to be in the range of 140,000 to 150,000 or greater, by design year.

Table 2 shows that future year traffic for each of the roadway segments under all alternatives is anticipated to be lower than this threshold. Therefore, a level II qualitative analysis for projects with low potential for MSAT effects was conducted.

**Table 2. Annual Average Daily Traffic**

| Roadway | Segment | 2017 Existing | No Action | T-Bone Mesa Alignment | UDOT Application Alignment | Southern Alignment | Red Hills Parkway Expressway | St. George Boulevard/ 100 South One-way Couplet |
|---|---|---|---|---|---|---|---|---|
| Bluff Street | Snow Canyon to Sunset | 15,000 | 31,000 | 33,000 | 32,000 | 31,000 | 32,000 | 33,000 |
| Bluff Street | Sunset to St. George | 41,000 | 65,000 | 61,000 | 61,000 | 63,000 | 55,000 | 62,000 |
| St. George Boulevard | Bluff to Main | 19,000 | 26,000 | 23,000 | 23,000 | 25,000 | 19,000 | 16,000 |
| St. George Boulevard | Main to 1000 East | 31,000 | 36,000 | 34,000 | 34,000 | 36,000 | 32,000 | 26,000 |
| St. George Boulevard | 1000 East to I-15 ramps | 44,000 | 55,000 | 50,000 | 52,000 | 55,000 | 47,000 | 47,000 |
| Red Hills Parkway | Bluff to Skyline | 12,000 | 31,000 | 39,000 | 38,000 | 32,000 | 47,000 | 32,000 |
| Red Hills Parkway | Skyline to 1000 East | 20,000 | 38,000 | 28,000 | 23,000 | 36,000 | 54,000 | 38,000 |
| Red Hills Parkway | 1000 East to I-15 crossing | 12,000 | 20,000 | 18,000 | 22,000 | 20,000 | 24,000 | 23,000 |
| 100 South | Bluff to Main | 9,000 | 12,000 | 12,000 | 13,000 | 12,000 | 11,000 | 17,000 |
| 100 South | Main to 1000 East | 16,000 | 24,000 | 22,000 | 23,000 | 24,000 | 20,000 | 29,000 |
| 100 South | 1000 East to River | 16,000 | 34,000 | 32,000 | 33,000 | 34,000 | 31,000 | 27,000 |

Source: Horrocks Engineers, 2020

Note: I-15 = Interstate 15

In April 2020, the National Highway Traffic Safety Administration (NHTSA) and EPA, on behalf of the Department of Transportation, issued a final Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021 – 2026 Passenger Cars and Light Trucks. This final rule amends and establishes carbon dioxide and fuel economy standards and is effective on June 29, 2020. Motor Vehicle Emissions Simulator (MOVES) modeling conducted for the MSAT analysis as documented in the FHWA 2016 guidance has not been revised with these updated fuel economy standards. Therefore, the qualitative analysis addresses how this rule may affect MSATs.

## 4.2 Climate Change and Greenhouse Gases

The Council on Environmental Quality has published draft guidance (Council on Environmental Quality 2019) on how GHG emissions should be addressed in NEPA analyses and documents. If finalized, this guidance would replace the final guidance issued on August 1, 2016, which was withdrawn effective April 5, 2017, per Executive Order 13783 of March 28, 2017. The proposed project is located in an attainment area where the air quality is generally good. Therefore, consistent with the methods for other pollutants, a qualitative discussion of GHGs was conducted.

## 4.3 Construction

The proposed project is located in an attainment or unclassifiable area. Construction activities would be temporary, and emissions generated during construction would not affect the long-term attainment. Therefore, a qualitative discussion of temporary construction emissions will be conducted.

# 5. Affected Environment

## 5.1 Climate

The proposed project, at an elevation of approximately 3,300 feet above sea level, is located within portions of Washington County in the southwestern corner of the State of Utah. According to the Western Regional Climate Center, the St. George Station is the closest weather data station to the proposed project, located in the Dixie climate division of Utah. Data were measured at this station from 1893 to 2016. The average minimum temperature during the winter months is approximately 30 degrees Fahrenheit (°F), while the average maximum temperature during the summer months is approximately 90°F. Annual average snowfall is approximately 3 inches and occurs mostly within the month of January. Annual average precipitation is approximately 8 inches and occurs mostly within the month of January. Prevailing wind directions are primarily from a west or east-northeast direction (BLM 2018).

## 5.2 Existing Air Quality

The UDAQ operates a network of monitoring stations within the State of Utah and is responsible for reporting results to the EPA. Monitoring data were downloaded from the EPA Interactive Map of Air Quality Monitors. Table 3 summarizes the maximum concentrations of CAPs at nearby monitoring stations and displays the NAAQS for comparison. None of the monitored pollutants have violated the NAAQS for at least the past 5 years. Figure 3 shows the location of the monitoring station.

**Table 3. Maximum Pollutant Concentrations at Nearby Monitoring Stations**

| Pollutant | Monitoring Stations | Averaging Time | NAAQS | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|
| Nitrogen Dioxide (ppb) | Hurricane – 147 North 870 West | 1-hour (2nd max) | 100 | 14 | 36 | 27 | 30 | 26 |
| Ozone (ppm) | Hurricane – 147 North 870 West | 8-hour (4th max) | 0.070 | 0.069 | 0.062 | 0.067 | 0.069 | 0.064 |
| Particulate Matter less than 2.5 microns (μg/m$^3$) | Hurricane – 147 North 870 West | 24-hour (2nd max) | 35 | 15 | 9.4 | 27.7 | 23.4 | 10.9 |

Source: EPA 2019b

The EPA calculates daily air quality index based on local air monitoring data. Within the St. George area pollutants of most concern are $NO_2$, ozone, and $PM_{2.5}$. According to the BLM Air Monitoring Report (BLM 2018), the air quality index within Washington County is good approximately 76 percent of the days and moderate 24 percent of the days based on 2015 to 2017 monitoring data. During this time, Washington County has not had an air quality index category of unhealthy.

## 5.3 Class I and II Areas

Under the prevention of significant deterioration provisions of the CAA, land classifications have been established for areas with air quality better than the NAAQS (attainment areas). The CAA gives protection to national parks and national wilderness areas, known as Class I areas. All other areas are designated as Class II areas unless designated as non-attainment areas. Class II areas allow for a moderate amount of air quality deterioration.

According to the National Park Service, Zion National Park is designated as a Class I area and is within Washington County approximately 20 miles east from the proposed project (Figure 3). The highest elevation at Zion National Park is approximately 7,000 feet, significantly higher compared to an approximate elevation of 3,300 feet for the proposed highway alternatives. All other areas of Washington County are designated as Class II areas because the county is in attainment for all NAAQS.

Per 40 CFR part 52.21, prevention of significant deterioration of air quality, construction of the proposed project would not be considered a major stationary source that would result in significant emission increases. Therefore, a qualitative discussion was conducted.

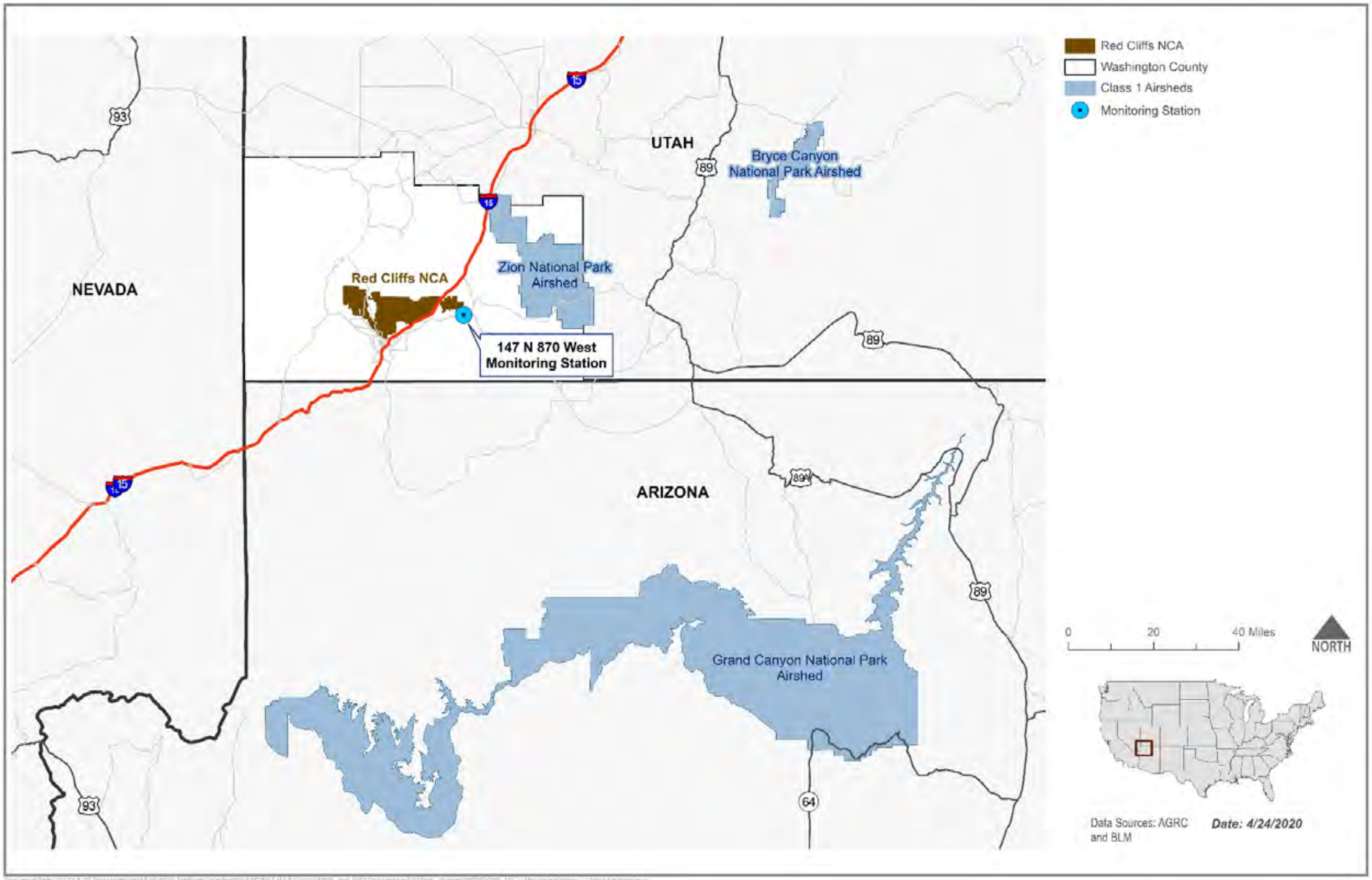


**Figure 3. Air Quality Monitoring Station within Washington County**

### 5.4 Air Quality Emissions Data

According to the UDAQ 2018 Annual Report, the 2014 triennial inventory is the most recent statewide inventory available. The 2017 triennial data will be used in the 2019 annual report once reviewed and approved. Figure 4 summarizes the triennial emissions by source category and shows the largest sources of CAPs in Utah are on-road mobile sources for CO, point sources for nitrogen oxides ($NO_x$) and $SO_x$, area sources[1] for $PM_{10}$ and $PM_{2.5}$, and biogenic sources[2] for volatile organic compounds (VOCs). Compared to the 2011 statewide inventory, on-road emissions have decreased as a result of newer vehicle fleets statewide as well as EPA's Tier 2 emissions standards for newer vehicles.

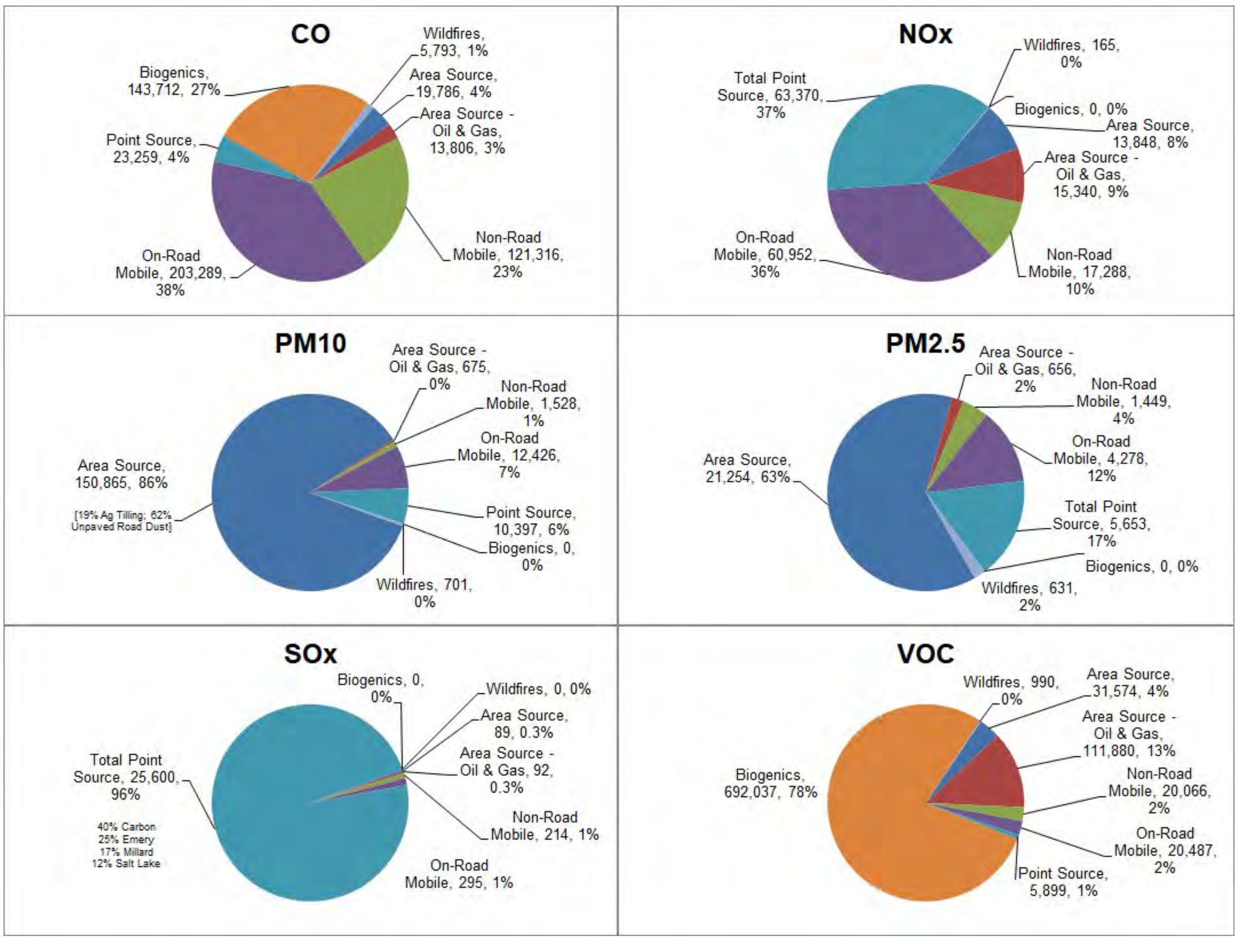


**Figure 4. 2014 Triennial Emissions Inventory by Source Category – Statewide, Annual (Tons/Year)**

*Source: UDAQ 2018*

Table 4 summarizes the CAP emissions for the St. George area and shows the largest sources of CAPs in the area are on-road mobile sources for CO, $NO_x$, and $SO_x$, area sources for $PM_{10}$ and $PM_{2.5}$, and biogenic sources for VOCs.

1 **Area sources** are sources of pollution that emit less than 10 tons annually of a single hazardous air pollutant or less than 25 tons annually of a combination of hazardous air pollutants from a specific area.

2 Examples of **biogenic sources** include animal management operations and oak and pine tree forests.

**Table 4. 2014 CAP Emissions in tons per year by Source for the St. George Field Office in Washington County**

| Source | CO | $NO_x$ | $PM_{10}$ | $PM_{2.5}$ | $SO_x$ | VOCs |
|---|---|---|---|---|---|---|
| Area | 330.11 | 146.45 | 3,910.88 | 527.27 | 1.52 | 287.47 |
| Area (Oil and Gas) | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Non-Road Mobile | 1,537.14 | 147.51 | 22.21 | 20.95 | 1.23 | 477.56 |
| On-Road Mobile | 2,650.00 | 880.60 | 209.69 | 70.92 | 3.53 | 270.00 |
| Point | 17.67 | 2.99 | 7.72 | 3.73 | 0.34 | 3.48 |
| Biogenics | 1,679.96 | 0.00 | 0.00 | 0.00 | 0.00 | 11,416.92 |
| Wildfires | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **County Total** | **6,214.88** | **1,177.55** | **4,150.50** | **622.87** | **6.62** | **12,455.43** |

Source: BLM 2018

Construction activities can generate temporary PM emissions within the project area as a result of earth-moving and use of heavy equipment, and land clearing, ground excavation, cut-and-fill operations, and the roadway construction. Fugitive dust is typically generated directly from construction sites, unpaved roads, wildfires, wood burning, gravel pits, and agricultural activities. Secondary particulates usually form in the atmosphere as a result of complex reactions of chemicals such as $SO_2$, VOCs, and $NO_x$ from power plants, industries, and automobiles. Area sources of $PM_{10}$ and $PM_{2.5}$ account for approximately 31 percent and 4 percent, respectively, of emissions within Washington County. The majority of the $PM_{2.5}$ emissions within the county are from secondary particulates, while $PM_{10}$ emissions are generally caused by fugitive dust.

## 5.5 Mobile Source Air Toxics

The EPA has developed the MOVES model and it is periodically updated to ensure it provides accurate emission estimates. MOVES2014 incorporates the latest Federal emissions standard rules at the time of its release, including Tier 3 emissions and fuel standards starting in 2017 (79 *Federal Register* 60344), heavy-duty greenhouse gas regulations that phase in during model years 2014 to 2018 (79 *Federal Register* 60344), and the second phase of light duty greenhouse gas regulations that phase in during model years 2017 to2025 (79 *Federal Register* 60344). Since the release of MOVES2014, EPA has released MOVES2014a, which incorporates inputs of local vehicle miles traveled (VMT), minor updates to the default fuel tables, and corrects an error in MOVES2014 brake wear emissions. Since the release of MOVES2014a, the SAFE rule was issued and will be effective June 26, 2020. The MOVES model has not been updated with the new fuel economy and carbon dioxide standards. However, the projections summarized below should not substantially change since these standards would only change for $CO_2$ emissions and not overall air pollution. All vehicles built under the new SAFE rule will comply with the EPA's pollution rules, and because new vehicles are subject to stricter anti-pollution rules, air pollution is expected to be reduced as older vehicles that emit more harmful pollution will be retired and replaced by newer, cleaner vehicles (NHTSA 2020).

Using EPA's MOVES2014a model, as shown on Figure 5, FHWA estimates that even if VMT increases by 45 percent from 2010 to 2050 as forecasted, a combined reduction of 91 percent in the total annual emissions for the priority MSAT is projected for the same time period.

Diesel PM is the dominant component of MSAT emissions, making up 50 to 70 percent of all priority MSAT pollutants by mass, depending on calendar year.

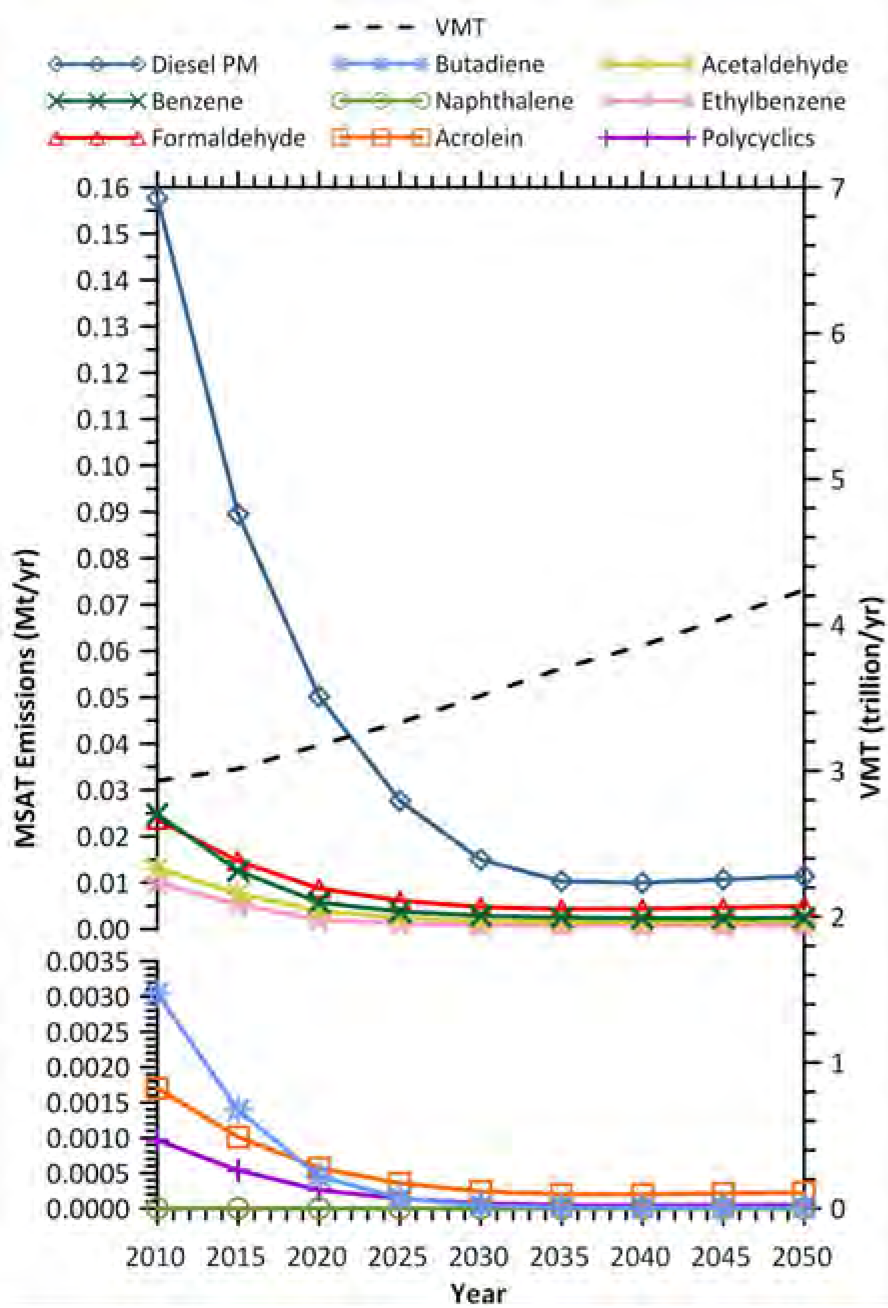


**Figure 5. FHWA Projected National MSAT Emission Trends 2010–2050 for Vehicles Operating on Roadways Using EPA's MOVES2014a Model**

*Source: FHWA 2016*

Note: Trends for specific locations may be different, depending on locally derived information representing VMT, vehicle speeds, vehicle mix, fuels, emission control programs, meteorology, and other factors.

## 5.6 Incomplete or Unavailable Information for Project-Specific MSAT Health Impact Analysis

In FHWA's view, information is incomplete or unavailable to credibly predict the project-specific health impacts as a result of changes in MSAT emissions associated with a proposed set of highway alternatives. The outcome of such an assessment, adverse or not, would be influenced more by the uncertainty introduced into the process through assumption and speculation rather than any genuine insight into the actual health impacts directly attributable to MSAT exposure associated with a proposed action.

The EPA is responsible for protecting the public health and welfare from any known or anticipated effect of an air pollutant. It is the lead authority for administering the CAA and its amendments and has specific statutory obligations with respect to HAPs and MSAT. The EPA is in the continual process of assessing human health effects, exposures, and risks posed by air pollutants.

The methodologies for forecasting health impacts include emissions modeling, dispersion modeling, exposure modeling, and then final determination of health impacts—each step in the process building on the model predictions obtained in the previous step. All are encumbered by technical shortcomings or uncertain science that prevents a more complete differentiation of the MSAT health impacts among a set of project alternatives.

There are considerable uncertainties associated with the existing estimates of toxicity of the various MSAT because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population. This is a concern expressed by the Health Effects Institute, an organization that is also active in the research and analyses of the human health effects of MSAT (FHWA 2016). As a result, there is no national consensus on air dose-response values assumed to protect the public health and welfare for MSAT compounds, and in particular, for diesel PM. The EPA states that with respect to diesel engine exhaust, "[t]he absence of adequate data to develop a sufficiently confident dose-response relationship from the epidemiologic studies has prevented the estimation of inhalation carcinogenic risk (EPA 2019d)."

Because of the limitations in the methodologies for forecasting health impacts described, any predicted difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with predicting the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against project benefits, such as reducing traffic congestion, accident rates, and fatalities, plus improved access for emergency response, which are better suited for quantitative analysis.

## 5.7 Climate Change and Greenhouse Gases

GHG emissions have accumulated rapidly as the world has industrialized, with concentrations of atmospheric $CO_2$ increasing from roughly 300 ppm in 1900 to more than 400 ppm today. During this timeframe, global average temperatures have increased by roughly 1.5°F (1°C), and the most rapid increases have occurred during the past 50 years. Scientists have warned that significant and potentially dangerous shifts in climate and weather are possible without substantial reductions in GHG emissions. They commonly have cited 2°C (1°C beyond warming that has already occurred) as the total amount of warming the earth can tolerate without serious and potentially irreversible climate effects. For warming to be below 2°C limited to this level, atmospheric concentrations of $CO_2$ would need to stabilize at a maximum of 450 ppm, requiring annual global emissions to be reduced 40 to 70 percent below 2010 levels by 2050 (IPCC 2014). To build upon its Fifth Assessment Report, the IPCC prepared a special report to assess the impacts of 1.5°C global warming above pre-industrial levels (that is, from 1850 to 1900). Emissions would need to decline by about 45 percent from 2010 levels by 2030 reaching net zero around 2050. Human-induced warming reached approximately 1°C above pre-industrial levels in 2017, increasing at 0.2°C per decade.

According to the EPA Inventory of U.S. GHG Emissions and Sinks 1990–2017 (EPA 2019c), total emissions of GHGs have increased approximately 1.3 percent from 1990 to 2017. However, from 2016 to 2017, GHG emissions decreased approximately 0.5 percent. The decline in emissions was as a result of the transition of coal to natural gas, other non-fossil fuel energy sources, and other factors. Table 5 summarizes recent trends in U.S. GHG emissions.

**Table 5. Recent Trends in U.S. Greenhouse Gas Emissions in million metric tons of $CO_2$**

| Gas/Source | 1990 | 2005 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|
| $CO_2$ | 5121.2 | 6130.6 | 5522.9 | 5572.1 | 5423.0 | 5306.7 | 5270.7 |
| Fossil Fuel Combustion | 4738.8 | 5744.8 | 5157.4 | 5199.3 | 5047.1 | 4961.9 | 4912.0 |
| Transportation | 1469.1 | 1857.0 | 1682.7 | 1721.6 | 1734.0 | 1779.0 | 1800.6 |
| Electric Power Sector | 1820.0 | 2400.0 | 2038.3 | 2037.1 | 1900.6 | 1808.9 | 1732.0 |
| Industrial | 857.4 | 853.4 | 840.0 | 819.6 | 807.9 | 807.6 | 810.7 |
| Residential | 338.2 | 357.9 | 329.3 | 346.8 | 317.8 | 292.9 | 294.5 |
| Commercial | 226.5 | 226.8 | 224.6 | 232.9 | 245.5 | 232.1 | 232.9 |
| U.S. Territories | 27.6 | 49.7 | 42.5 | 41.4 | 41.4 | 41.4 | 41.4 |
| Other | 382.4 | 385.8 | 365.5 | 372.8 | 375.9 | 344.8 | 358.7 |

Source: EPA 2019c

According to Utah's Public Health Data Resource, Public Health Indicator Based Information System, GHG emissions within Utah have ranged from 35.5 million metric tons of $CO_2$ in 1980 to 58.5 million metric tons of $CO_2$ in 2017, with a peak of 70 million metric tons of $CO_2$ in 2007 (Figure 6). GHG emissions from transportation sources account for approximately 25 to 30 percent of overall GHG emissions in the state (Table 6). Peak increases during 2007 and 2008 were a result of warm temperatures in the Arctic in 2007 and increased precipitation in the tropics during 2007 and 2008.

According to the National Oceanic and Atmospheric Administration (NOAA) Annual Greenhouse Gas Index, there has been a 43 percent increase to climate forcing (also called radiative forcing) since 1990 because of increasing atmospheric concentrations of GHGs. The $CO_2$ increase is accelerating; while it averaged about 1.6 ppm per year in the 1980s and 1.5 ppm per year in the 1990s, the growth rate increased to 2.3 ppm per year during the last decade (2009 to 2018) (NOAA 2020).

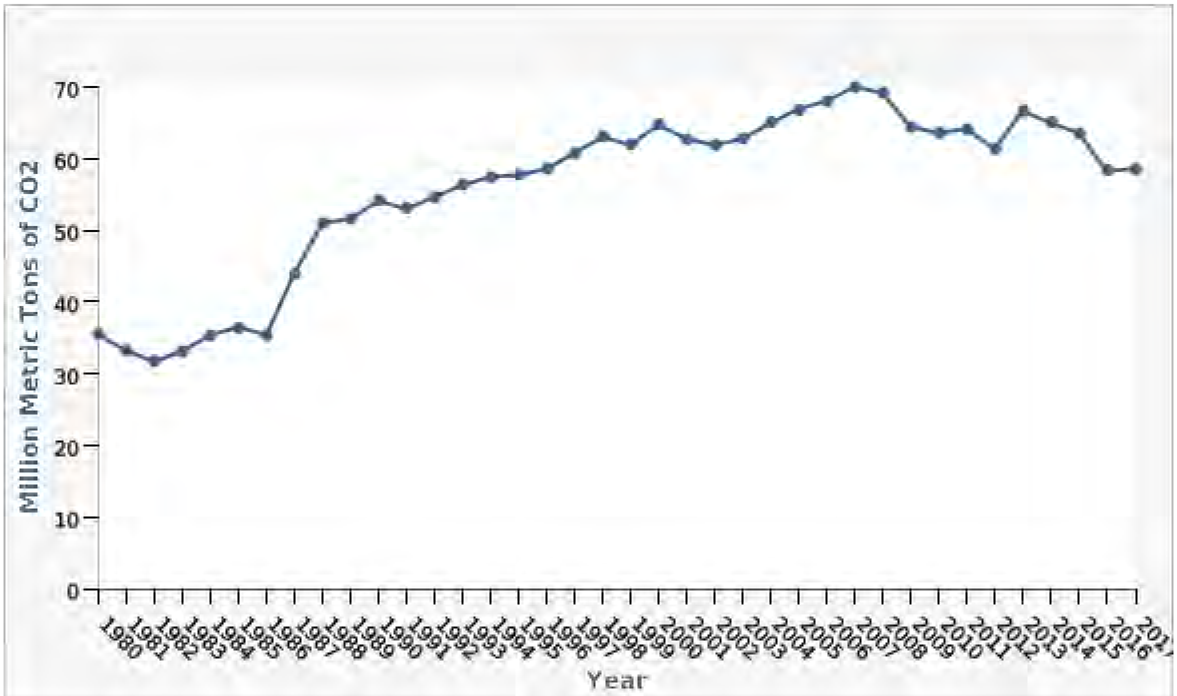


**Figure 6. Overall GHG Emission Trends in Utah**

*Source: IBIS 2020*

**Table 6. GHG Emissions in Utah in million metric tons of $CO_2$**

| Year | Utah Total GHG Emissions | GHG Emissions from Transportation Sources |
|---|---|---|
| 1980 | 35.5 | 9.0 |
| 2007 | 70 | 18.2 |
| 2016 | 58.5 | 17.7 |

Source: IBIS 2020

# 6. Environmental Consequences

## 6.1 Class I Area

Mobile sources are a contributor to the visibility impairment within Class I areas. Analysis and modeling have been conducted for the Utah SIP to determine the potential impact of the regional haze program on visibility. According to the Utah SIP for Regional Haze, $NO_x$ and VOC emissions from mobile sources decreased by approximately 55 percent from 2003 to 2018. Federal programs (such as low sulfur diesel, vehicle emission standards, and similar) have helped to reduce mobile source emissions, which benefits Class I areas. Emissions from the action alternatives are not likely to significantly affect these inventories because Zion National Park is located approximately 20 miles away and sits at a much higher elevation compared to the proposed Northern Corridor.

## 6.2 Air Quality Emissions

Traffic volumes are anticipated to increase as population increases, resulting in increased air emissions. As shown in the Traffic Analysis Memorandum (Appendix L), the T-Bone Mesa Alignment, UDOT Application Alignment, Red Hills Parkway Expressway, and St. George Boulevard/100 South One-way Couplet alternatives would operate at Level of Service D or better conditions by 2050 for most intersections studied. However, the intersections of

Sunset Boulevard/Bluff Street and Green Spring/Telegraph Street would continue to operate at Level of Service D, E, or worse conditions by 2050 under all alternatives. In addition, the intersections of St. George Boulevard/Bluff Street and Red Hills Parkway/1000 East would operate at Level of Service F conditions under the Southern Alignment. As a result, air quality would continue to worsen at these intersections. Although air quality emissions may degrade at individual intersections, improving the level of service on roadways and at intersections within the entire traffic network equates to less congestion and delay, and better air quality conditions within the project area.

## 6.3 Construction

Construction activities are a source of dust and exhaust emissions resulting from earth-moving and use of heavy equipment, land clearing, ground excavation, cut-and-fill operations, and the highway construction. Emissions can vary substantially day to day, depending on the level of activity, the specific operations, and the prevailing weather. A major portion of dust emissions for the proposed project would likely be caused by construction traffic on temporary areas. Construction of the proposed project would be phased to limit emissions and disruptions to the surrounding communities. Per St. George City Code, preparation of a dust control plan would be required to specify best practical methods that would be used to control the generation of fugitive dust, such as watering of construction areas, maintaining equipment, and minimizing idle time.

Construction and subsequent maintenance of the project would generate GHG emissions. Preparation of the roadway corridor (for example, earth-moving activities) involves a considerable amount of energy consumption and resulting GHG emissions; manufacture of the materials used in construction and fuel used by construction equipment also contributes GHG emissions. Typically, construction emissions associated with a new highway account for approximately 5 percent of the total 20-year lifetime emissions from the highway, although this can vary widely with the extent of construction activity and the number of vehicles that use the highway.

The addition of new highway miles to the study area highway network also would increase the energy and GHG emissions associated with maintaining those new highway miles in the future. The increase in maintenance needs from the addition of new highway infrastructure would be partially offset by the reduced need for maintenance on existing routes (because of lower total traffic and truck volumes on those routes).

## 6.4 Mobile Source Air Toxics

For each alternative in this Draft EIS, the amount of MSATs emitted would be proportional to the VMT, assuming that other variables such as fleet mix are the same for each alternative. The VMT estimated for each of the action alternatives is slightly higher (less than 1 percent) than that for the No Action Alternative (i.e., the baseline scenario), because the additional capacity increases the efficiency of the Northern Corridor and attracts rerouted trips from elsewhere in the transportation network (Table 7). This minor increase in VMT would lead to slightly higher MSAT emissions for the action alternatives, along with a corresponding decrease in MSAT emissions along the parallel routes, primarily I-15, within the study area. The emissions increase is offset somewhat by lower MSAT emission rates due to increased speeds; according to the EPA MOVES2014 model, emissions of all of the priority MSAT decrease as speed increases. Because the estimated VMT under each of the alternatives are nearly the same, varying by less than 0.2 percent, it is expected there would be no appreciable difference in overall MSAT emissions among the various alternatives.

**Table 7. Washington County Vehicle Miles Traveled**

| Year | Scenario | Daily VMT | Increase Above No Action | Variation per St. George Boulevard/100 South One-way Couplet Alternative | Evening Peak Period (4 to 6 p.m.) VMT | Increase Above No Action | Variation per St. George Boulevard/100 South One-way Couplet Alternative |
|---|---|---|---|---|---|---|---|
| 2019 | Existing | 4,367,738 | Not Applicable | Not Applicable | 1,087,122 | Not Applicable | Not Applicable |
| 2050 | No Action | 10,287,036 | Not Applicable | Not Applicable | 2,557,253 | Not Applicable | Not Applicable |
| 2050 | T-Bone Mesa Alignment | 10,296,900 | 0.10% | 0.06% | 2,560,121 | 0.11% | 0.06% |
| 2050 | UDOT Application Alignment | 10,295,127 | 0.08% | 0.04% | 2,560,028 | 0.11% | 0.06% |
| 2050 | Southern Alignment | 10,291,067 | 0.04% | 0.001% | 2,559,754 | 0.10% | 0.05% |
| 2050 | Red Hills Parkway Expressway | 10,311,945 | 0.24% | 0.20% | 2,563,923 | 0.26% | 0.21% |
| 2050 | St. George Boulevard/ 100 South One-way Couplet | 10,290,984 | 0.04% | 0% | 2,558,499 | 0.05% | 0% |

Source: Horrocks Engineers 2020

Also, regardless of the alternative chosen, emissions would likely be lower than present levels in the design year as a result of EPA's national control programs that are projected to reduce annual MSAT emissions by more than 90 percent between 2010 and 2050 (FHWA 2016). Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area would likely be lower in the future in nearly all cases.

The new travel lanes contemplated as part of the action alternatives within the NCA (T-Bone Mesa Alignment, UDOT Application Alignment, and Southern Alignment) would have the effect of moving some traffic closer to nearby homes and businesses; therefore, under each action alternative, there may be localized areas where ambient concentrations of MSAT could be higher under certain action alternatives than the No Action Alternative. The localized increases in MSAT concentrations would likely be most pronounced along the T-Bone Mesa Alignment. However, the magnitude and the duration of these potential increases compared to the No Action Alternative cannot be reliably quantified due to incomplete or unavailable information in forecasting project-specific MSAT health impacts. MSAT concentrations along Red Hills Parkway Expressway and St. George Boulevard/100 South One-way Couplet alternatives would be similar to the No Action Alternative because improvements include a change in facility type but no roadway widening.

When a new highway is constructed, the localized level of MSAT emissions for the action alternatives could be higher relative to the No Action Alternative, but this could be offset by increases in speeds and reductions in congestion (which are associated with lower MSAT emissions). Also, MSAT would be lower in other locations when traffic shifts away from them. However, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover will, over time, cause substantial reductions that, in almost all cases, will cause region-wide MSAT levels to be significantly lower than today. Localized increases in MSAT concentrations would be progressively less pronounced under the Southern Alignment, UDOT Application Alignment, and T-Bone Mesa Alignment, respectively.

Each of the action alternatives includes a new or modified interchange with an existing highway, which also has the potential for moving some traffic closer to nearby homes, parks, schools, and businesses; therefore, under each action alternative, there may be localized areas where ambient concentrations of MSAT could be higher under certain action alternatives than the No Action Alternative. The T-Bone Mesa Alignment, UDOT Application Alignment, Southern Alignment, and Red Hills Parkway Expressway action alternatives would all tie into and modify the North Bluff Street/Snow Canyon Parkway interchange on the western terminus. The St. George Boulevard/100 South One-way Couplet action alternative would tie in to the I-15/East St. George Boulevard interchange on its eastern terminus. The localized increases in MSAT emissions would likely be most pronounced along the new highway sections that would be built at these interchange locations. However, even if these increases do occur, they too would be substantially reduced in the future through implementation of EPA's vehicle and fuel regulations.

In summary, under all action alternatives in the 2050 design year, it is expected there would be reduced MSAT emissions in the immediate area of the project relative to the No Action Alternative, because of the reduced VMT associated with more direct routing. In addition, the EPA MSAT reduction programs would likely reduce MSAT emissions for all action alternatives and the No Action Alternative.

## 6.5 Greenhouse Gases

GHG emissions from vehicles using roads are a function of distance traveled (expressed as VMT), vehicle speed, and road grade. Under the action alternatives, changes in land use due to employment and population increases lead to an increase in VMT relative to the No Action Alternative. However, under the action alternatives, VMT in Washington County would increase by less than 1 percent compared to no action levels.

$CO_2$ accounts for 95 percent of transportation GHG emissions in the United States. The highest levels of $CO_2$ and GHGs by proxy from mobile sources such as automobiles occur at stop-and-go speeds (0 to 25 miles per hour) and speeds over 55 miles per hour; the most severe emissions occur from 0 to 25 miles per hour (Barth and Boriboonsomsin 2010). Speed limits along the project corridors range between 30 miles per hour (mph) and 55 mph. To the extent that a project relieves congestion by enhancing operations and improving travel times in high-congestion travel corridors, GHG emissions, particularly $CO_2$, may be reduced. Table 8 shows the current and estimated 2050 design year travel times on three existing routes connecting I-15 north of Exit 13 to West Sunset Boulevard. As shown in Table 8, travel times more than double and indicate that average vehicle speeds would substantially decrease relative to current conditions under the No Action Alternative. Although the action alternatives would improve traffic flow and reduce stop-and-go conditions relative to the No Action Alternative, potential reductions in $CO_2$ emissions and GHG emissions by proxy would be somewhat diminished if a higher percentage of vehicle traffic maintains a 55-mile-per-hour operating speed under free flow conditions.

**Table 8. Current and Estimated Travel Times**

| Sunset Boulevard to I-15 North of Exit 13 Route | 2019 Travel Time (minutes) | 2050 Travel Time (minutes) |
|---|---|---|
| Bluff Street and St. George Boulevard (Route A) | 14 | 24 |
| Red Hills Parkway and Buena Vista Boulevard (Route B) | 14 | 25 |
| Red Hills Parkway and Green Spring Drive (Route C) | 14 | 40 |

Source: Horrocks Engineers 2020

A major factor in mitigating increases in VMT is EPA GHG emissions standards, implemented in concert with national fuel economy standards. The U.S. Energy Information Administration projects that vehicle energy efficiency (and thus, GHG emissions) on a per-mile basis will improve by approximately 55 percent by 2050 (EIA 2020). This improvement in vehicle emissions rates is more than sufficient to offset the increase in VMT (Table 7).

#### 6.5.1 Projection Scenarios

Per Utah Legislature, the Kem C. Gardner Policy Institute at the University of Utah published *The Utah Roadmap* report, which identified positive solutions to reduce air emissions and improve the climate and air quality for Utah (Gardner 2020). Based on the best available data, the Gardner Institute was able to graph current and projected levels of GHG emissions (Figure 7). As shown on Figure 7, the “Business as Usual” scenario considers population and energy demand increases where as the “Planned Reduction” scenario includes foreseeable emissions reductions from the closure of coal power plants and the increased use of electric vehicles. Existing annual GHG emissions for Utah are approximately 60 MMT $CO_2e$. Under the “Business as Usual” scenario, GHG emissions are projected to increase to approximately 95 MMT $CO_2e$ by 2050, an increase of approximately 37 percent above current emissions. However, under the “Planned Reduction” scenario, GHG emissions are projected to decrease to approximately 32 MMT $CO_2e$ by 2050, a decrease of approximately 66 percent below current emissions.

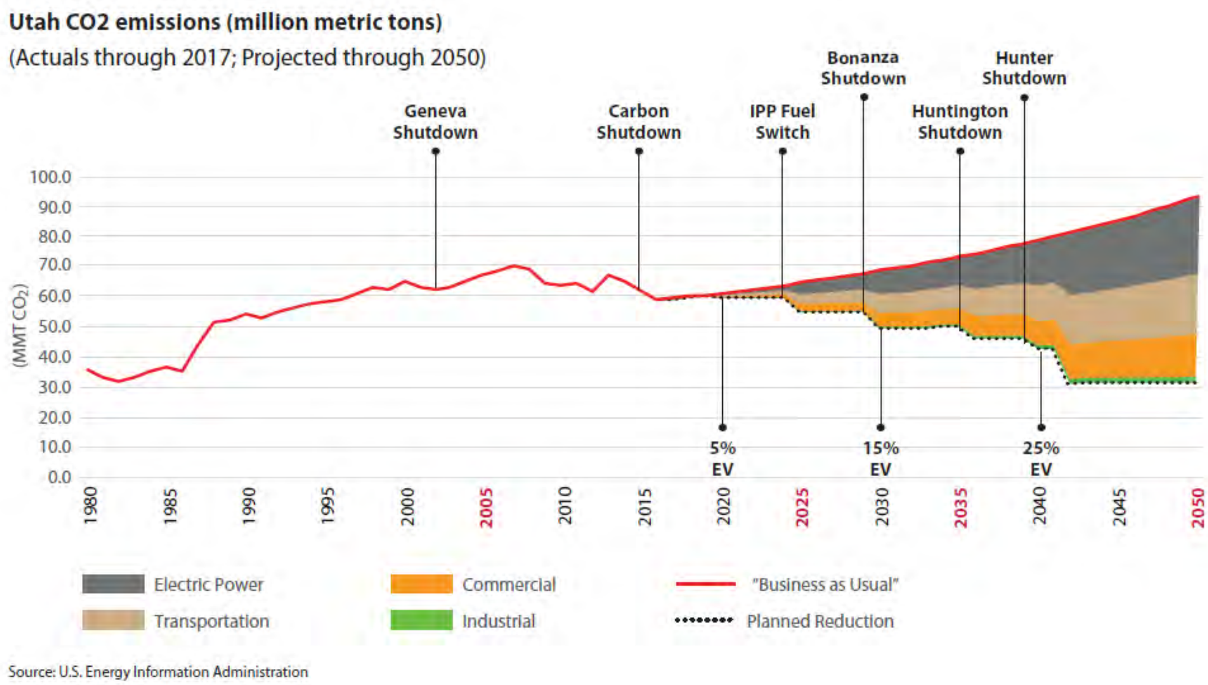


**Figure 7. Utah $CO_2$ Emissions (million metric tons)**
*Source: Gardner 2020*

The IPCC developed emissions scenarios, called Representative Concentration Pathways (RCP), used for impact and adaptation assessments. There are four RCP scenarios that project concentrations of GHGs by the year 2100 based on the amount of radiative forcing in watts per square meter (RCP2.6, RCP4.5, RCP6, and RCP8.5). Figure 8 depicts the four RCP scenarios through year 2100. Figure 9 depicts the range of warming projected with each RCP. Scenario RCP2.6 includes a stringent mitigation and is the representative scenario that aims to keep global warming likely below 2 °C above pre-industrial temperatures (IPCC 2014). However, global emissions in 2030 are on track to follow the RCP4.5 and RCP 6.0, resulting in a global warming of about 3 °C by 2100 (IPCC 2018).

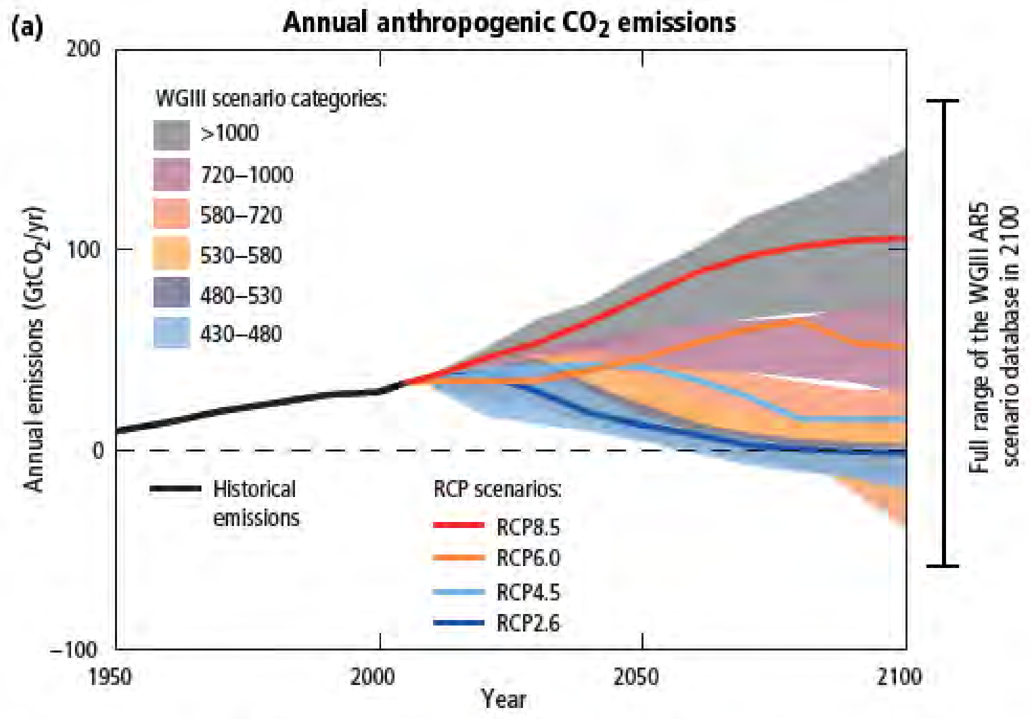


**Figure 8. Annual Anthropogenic $CO_2$ Emissions**

*Source: IPCC 2014*

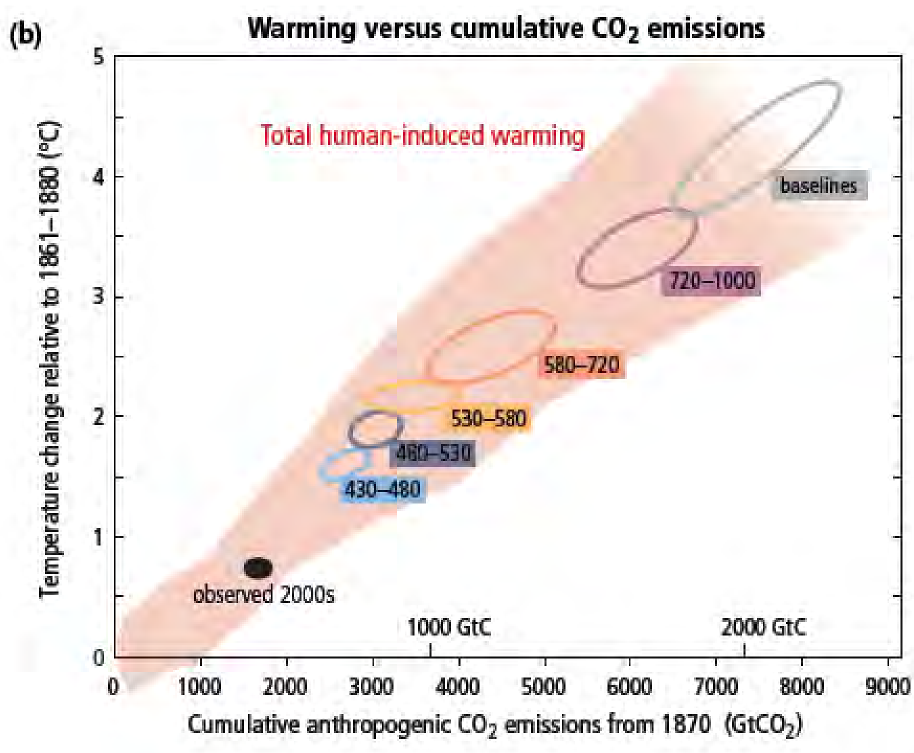


**Figure 9. Warming versus Cumulative $CO_2$ Emissions**

*Source: IPCC 2014*

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# Appendix J: Highway Alternatives Development Technical Report

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# Northern Corridor

## Highway Alternatives Development Technical Report

May 22, 2020

Prepared for:
U.S. Department of the Interior Bureau of Land Management
Fish & Wildlife Service

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**Tables**



**Figures**

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# Acronyms and Abbreviations

| | |
|---|---|
| BLM | Bureau of Land Management |
| CFR | Code of Federal Regulations |
| DMPO | Dixie Metropolitan Planning Organization |
| EIS | Environmental Impact Statement |
| ESA | Endangered Species Act |
| FLPMA | Federal Land Policy and Management Act of 1976 |
| I-15 | Interstate 15 |
| LOS | level of service |
| mph | miles per hour |
| NCA | National Conservation Area |
| NEPA | National Environmental Policy Act |
| OPLMA | Omnibus Public Lands Management Act of 2009 |
| ROW | right-of-way |
| RTP | Regional Transportation Plan |
| TDM | travel demand model |
| UDOT | Utah Department of Transportation |

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# 1. Introduction

The purpose of this report is to document the alternatives development process for the Northern Corridor highway alternatives in support of the *Northern Corridor – Highway Right-of-Way, Issuance of an Incidental Take Permit and Draft Environmental Impact Statement (Draft EIS) and Draft Resource Management Plan (RMP) Amendments*. This report focuses specifically on the details of the alternative development process for the Northern Corridor highway, and describes the following:

- The background of the proposed Northern Corridor.
- The purpose and need and applicant's objectives for the proposed action.
- The process used to develop a reasonable range of alternatives that address the purpose and need, per the Council on Environmental Quality's implementing regulations for the National Environmental Policy Act (NEPA) at 40 Code of Federal Regulations (CFR) 1502.14.
- The alternatives considered and process used to compare the alternatives.
- The alternatives carried forward for detailed analysis in the Draft EIS.

The purpose and need and description of the alternative development processes used for other Federal actions related to the proposed Northern Corridor are specifically discussed in Chapter 1 and Chapter 2 of the Northern Corridor Draft EIS.

## 1.1 Background and Previous Studies

The Utah Department of Transportation (UDOT) applied to the Bureau of Land Management (BLM) for a right-of-way (ROW) grant on September 18, 2018, to construct a multi-lane, divided highway (referred to as the Northern Corridor) across the Red Cliffs National Conservation Area (NCA). The Red Cliffs NCA was designated by Congress through the Omnibus Public Land Management Act of 2009 (OPLMA) (16 USC 460www; Public Law 111-11, Title 1, Subtitle O, Section 1974). The Congressionally defined purpose of the 45,000-acre NCA is to conserve, protect, and enhance for the benefit and enjoyment of present and future generations the ecological, scenic, wildlife, recreational, cultural, historical, natural, educational, and scientific resources of the Red Cliffs NCA and to protect each species that is located in the NCA and listed as a threatened or endangered species under the Endangered Species Act. Section 1974 states that the NCA shall be managed by the Secretary of the Interior through the BLM and that the Secretary shall only allow uses of the NCA that the Secretary determines would further a purpose for which the NCA was designated.

OPLMA Subtitle O, Section 1977 also directs the Secretary to develop a comprehensive travel management plan for the land managed by the BLM in Washington County and, in accordance with the Federal Land Policy and Management Act of 1976 (FLPMA) (43 USC 1701 et seq.), "in developing the travel management plan, the Secretary shall—(A) in consultation with appropriate Federal agencies, State, tribal, and local governmental entities (including Washington County and St. George City, Utah), and the public, identify one or more alternatives for a northern transportation route in the County."

The BLM is considering several alternative northern transportation routes as part of the Draft EIS in response to the UDOT ROW application.[1] The BLM is utilizing the National Environmental Policy Act

[1] The term "Northern Corridor" is a general reference to the concept of a corridor between Interstate 15 and Utah State Highway 18, while "northern transportation route" is the specific term of art connecting in Section 1977 of OPLMA. Although the terms "Northern Corridor," "northern transportation route," and ROW are used throughout the DEIS, UDOT's ROW application has not been designated the "Northern Corridor."

of 1969 (NEPA) process to, in addition to analyzing the potential impacts of the proposed ROW, evaluate if the ROW application is consistent with the statutory purposes of the Red Cliffs NCA and whether it is necessary to amend the Red Cliffs NCA RMP to accommodate a ROW, or deny UDOT's application. If a ROW is granted and the RMP is also amended, BLM will then be able to fully consider that ROW as a specific northern transportation route (i.e. a Northern Corridor) as part of a future travel management planning process as Congress has instructed in Section 1977 of OPLMA.

Fully evaluating UDOT's ROW application and potential amendments to the Red Cliffs NCA RMP will also further the Department of the Interior's policy goals, as stated in the Strategic Plan for Fiscal Years 2018-2022, to "enhance conservation stewardship whereby all levels of government and private landowners work cooperatively together in an atmosphere of mutual respect to achieve shared natural resource management goals across landscapes" and to "[develop] and [maintain] strong partnerships with State, local, and private stakeholders in shared conservation stewardship." UDOT is seeking to meet the transportation demands of Washington County's anticipated continued growth through 2050 and Washington County is also seeking a renewed Incidental Take Permit in order to meet the needs of its increasing population. Washington County's current transportation infrastructure may not accommodate the County's projected growth, and it is trying to balance that future growth with the statutory and regulatory provisions governing the Red Cliffs NCA and larger Red Cliffs Desert Reserve, and the protected wildlife that resides on those lands.

The Red Cliffs NCA comprises 73 percent of the land base of a multi-jurisdictional, 62,000-acre reserve known locally as the Red Cliffs Desert Reserve (the Reserve). The Reserve was established in 1996 in connection with the U.S. Fish and Wildlife Service's (USFWS) approval of the County's Habitat Conservation Plan (HCP) for the threatened Mojave desert tortoise. Also in 1996, the USFWS issued an Incidental Take Permit (ITP) to the County for the take associated with otherwise lawful activities in the County. As a result of the ITP and protective management of the Reserve's land base by the respective land managing agencies, necessary development has been able to occur in tortoise habitat on non-Federal lands in the County.

Planning for the Northern Corridor has been ongoing for two decades and has been led by the Dixie Metropolitan Planning Organization (DMPO), the governmental agency responsible for regional transportation planning in Washington County. The DMPO has conducted these efforts in coordination with the County, the City of St. George, Washington City, City of Ivins, City of Santa Clara, City of Hurricane, UDOT, and other communities in the St. George and Hurricane urbanized area.

Through transportation plans, environmental documents, and various other studies, variations of an additional east-west route north of Red Hills Parkway have been studied as an option to provide another connection between the communities of Ivins, Santa Clara, and the western urbanized area of St. George to the west and Washington and Hurricane to the east. The highway has also been envisioned as an option to reduce traffic volumes on key corridors such as Bluff Street, Red Hills Parkway, and St. George Boulevard that are currently congested and are expected to experience worse congestion in the future as the Washington County population grows and the associated east-west travel demand increases. The proposed corridor has been referred to by various names, including the Northern Corridor, Great Northern Corridor, and the Washington Parkway. "Northern Corridor" is used throughout this document. The following list summarizes key studies that have been undertaken relating to the Northern Corridor and their outcomes or relevance to this study:

- *Washington Parkway Study: Integration of East-West Transportation Needs with Conservation Objectives for Desert Tortoise in Washington County, Utah* (2012): This study was prepared for the DMPO, UDOT, the County, City of St. George, and Washington City by Jacobs and Logan Simpson. The study addresses the perceived conflict between transportation and tortoise conservation, and supports the responsibilities of the local government entities, as identified in OPLMA (Public Law 111-11, Title 1, Subtitle O; March 30, 2009), to assist in the identification of a potential northern transportation route. This study does not identify a specific location for a new transportation route, nor does it provide specific solutions to tortoise and transportation issues on the Red Cliffs Desert Reserve (the Reserve). The study determines if there is justification for further evaluation of a transportation corridor that has as its primary objective conservation, protection, and enhancement of the tortoise and its habitat.

- *Washington County General Plan* (Amended 2012): The County's plan describes the need to identify one or more routes "making up a Northern Corridor" in response to OPLMA (Public Law 111-11, Title 1, Subtitle O). The Washington County Transportation Map displays four alternative routes as options for the Northern Corridor; they vary in location and are all identified as future arterials.
- *Red Hills Parkway State Route 18 (Bluff Street) to Industrial Road Environmental Assessment* (2009): UDOT analyzed options and potential environmental impacts, in compliance with NEPA, for the widening of Red Hills Parkway (formerly Skyline Drive). The Northern Corridor was analyzed as one of the alternatives in this study. In the study, the Northern Corridor was identified as a 3-lane roadway (in each direction), with an unpaved center median, beginning at Red Hills Parkway approximately 1 mile east of Bluff Street, continuing eastward through the Red Cliffs Desert Reserve, and connecting to Interstate 15 (I-15) at milepost 13. The Northern Corridor was eliminated from consideration because in 2009 the Northern Corridor did not meet the purpose and need to better accommodate east/west travel demand on Red Hills Parkway between Bluff Street and Industrial Road. The City of St. George, UDOT, and the Federal Highway Administration determined that the anticipated implementation challenges and the potential environmental effects, as previously described, would be substantial and thereby eliminated the Northern Corridor alternative from further consideration.
- *Washington Parkway Cost/Benefit Study* (2011): This study was performed by Horrocks Engineers for the DMPO, in conjunction with the County and UDOT. The study explored several alternative alignments for the Northern Corridor to determine which route would provide the greatest congestion relief on critical arterial roads in St. George and Washington City. For the study, the road in its entirety was referred to as the Washington Parkway, and was analyzed using the DMPO Regional Travel Demand Model (TDM). The model analyzed six alternatives and their ability to relieve congestion on the surrounding street network at the highest benefit for drivers in terms of congestion relief and travel time. The study also considered engineering design and construction feasibility to determine probable costs for the construction of the corridor. The study did not explicitly consider environmental issues or consequences of the proposed corridor alignments. The study determined that the T-Bone Mesa Alignment (called Option 3 in the study) provided the highest benefit relative to its cost with respect to traffic congestion relief.
- *Red Cliffs National Conservation Area Resource Management Plan* (2016): Completed by the BLM, the document analyzes all potential ROW within the NCA at a land management planning level and chooses an alternative management strategy that best achieves the purpose and requirements of the guiding legislation and regulations found in FLPMA and OPLMA. The Red Cliffs NCA RMP includes the Northern Corridor as a new ROW under Alternative D. Alternative D planned for a ROW to be granted within the NCA and higher intensity of access and resource use across the NCA. Alternative D was not chosen as the Preferred Alternative as it did not satisfy the planning and land management criteria set forth in guiding legislation and public scoping.
- DMPO Regional Transportation Plan: The Northern Corridor is identified in the DMPO's Regional Transportation Plan (RTP). It is listed as project number 68—a Phase 1 project (2019–2029)—for the construction of the first two lanes of the proposed roadway. It is also listed as project number 82—a Phase 2 project (2020–2030)—for the construction of the remaining two lanes.

# 2. Purpose and Need for Right-of-way Application

UDOT has applied for a ROW to construct a multi-lane, divided highway on BLM-administered lands within the Red Cliffs NCA and the overlapping Red Cliffs Desert Reserve with the objective of reducing congestion, increasing capacity, and improving east-west mobility on arterial and interstate roadways between State Route 18 (SR 18) and I-15 at milepost 13. In accordance with and taking into account the provisions of OPLMA and Department of the Interior policies, the BLM's purpose and need for action is to respond to UDOT's application for a ROW grant under Title V of FLPMA, BLM's ROW regulations, 43 CFR part 2800, and other applicable Federal laws. In the Draft EIS, the BLM will consider the potential impacts of the proposed ROW (Alternative 3, as described in Chapter 2 of the DEIS; referred to herein as the UDOT Application Alignment) and reasonable alternatives. At the conclusion of the NEPA process, the BLM will decide whether to approve, approve with modifications, or deny issuance of a ROW grant to UDOT for the Northern Corridor and whether to approve an amendment to the RMP.

In particular, under OPLMA Subtitle O, Section 1977, the BLM is required to develop a comprehensive travel management plan for the land managed by the BLM in Washington County and, in doing so, to "identify one or more alternatives for a northern transportation route" in the county. In 2016, as part of developing the current Red Cliffs NCA RMP, BLM considered an alternative that included a Northern Corridor in the NCA. However, at that time, BLM did not have a specific ROW application to consider as part of that planning process. Instead, the BLM relied on several conceptual alignments from the Dixie Metropolitan Planning Organization that were based on Washington County's, a cooperating agency in developing that RMP, recommendations. While the BLM eventually selected a different alternative that did not include a corridor, the selected alternative did create an avoidance area that could accommodate a Northern Corridor alignment in the NCA. Under the 2016 RMP, an avoidance area is an area identified through resource management planning to be avoided but that may be available for ROW location with special stipulations.

The BLM has now received a specific ROW application from UDOT. The ROW application is designed to address the growing population and transportation needs in Washington County. However, the application seeks a ROW in the NCA that is larger than the current avoidance area can accommodate and, thus, cannot be granted without also amending the Red Cliffs NCA RMP.

Responding to UDOT's ROW application also furthers the Department of the Interior's policy goals, as stated in the Strategic Plan for Fiscal Years 2018-2022, to "enhance conservation stewardship whereby all levels of government and private landowners work cooperatively together in an atmosphere of mutual respect to achieve shared natural resource management goals across landscapes" and to "[develop] and [maintain] strong partnerships with State, local, and private stakeholders in shared conservation stewardship." UDOT is seeking to meet the transportation demands of Washington County's anticipated continued growth through 2050 and Washington County is also seeking a renewed Incidental Take Permit in order to meet the needs of its increasing population. Washington County's current transportation infrastructure may not accommodate the County's projected growth, and it is trying to balance that future growth with the statutory and regulatory provisions governing the Red Cliffs NCA and larger Red Cliffs Desert Reserve, and the protected wildlife that resides on those lands.

## 2.1 Right-of-Way Applicant's Objectives and Transportation Need

UDOT submitted a ROW application for construction, operation, and maintenance of a new highway with the objective of reducing congestion, increasing capacity, and improving east-west mobility on arterial and interstate roadways between SR 18 and I-15 at milepost 13. This objective is driven by the current and forecasted population growth within the county, which will continue to increase demand on the transportation network. Currently, the existing transportation network between SR 18 and I-15 is not adequate to meet future (2050) travel demand in the northeastern and northwestern areas of St. George based on traffic projections from the DMPO's Regional TDM (Horrocks Engineers 2020a).

The transportation need for the applicant's proposed action is the result of the growing population and increased future travel demand on the transportation system within the northern City of St. George, Washington City, City of Santa Clara, and the City of Ivins metropolitan areas, hereinafter referred to as the St. George urbanized area, and is what the proposed action is intended to address. The need for the applicant's proposed action is based on the following transportation deficiencies and is further described below:

- Lack of east-west corridors that cross within the St. George urbanized area, resulting in travel delay and decreased mobility.
- Increased traffic congestion along key regional roadways, including Red Hills Parkway, St. George Boulevard, and Bluff Street.
- Increased traffic congestion and decreased mobility at key intersections and interchanges within the St. George urbanized area.

### 2.1.1 Regional Travel Demand Model Overview

The following summarizes key aspects of the travel modeling conducted for the Northern Corridor project; further details are included in the Northern Corridor Traffic Analysis Memorandum (Horrocks Engineers 2020a). The transportation need is based on future travel demand forecasts for the county that were developed using the DMPO TDM. The TDM predicts future travel demand based on projections of land use, socioeconomic patterns, and transportation system characteristics. At the time of this study, the DMPO official version of the TDM is 3.0, which is calibrated to represent 2019 base-year travel conditions and projects traffic out to 2050 (Horrocks Engineers 2020a).

Specific inputs to the model include socioeconomic forecasts and transportation system data. For the DMPO TDM, the Washington County area was divided into roughly 850 smaller geographical parts called traffic analysis zones, which are populated with socioeconomic data used for trip generation. The socioeconomic data includes population, households, employment, and average household income. The transportation system data includes both roadway and transit networks. The roadway network includes freeways, arterial routes, and collector routes. The transit network includes local bus routes.

Existing socioeconomic and transportation system data were used to create a base-year (2019) model. Future year (2050) forecasts were prepared by running the model using future year socioeconomic and transportation system data.

Deficiencies in the St. George urbanized area were identified by comparing the present (2019) and future (2050) transportation conditions assuming that the Northern Corridor is not built but all other transportation improvements as identified in the DMPO RTP (DMPO 2019) have been implemented.

### 2.1.2 Washington County Population

Population and employment forecasts used in the DMPO TDM come from The University of Utah's Gardner Policy Institute, which provides demographic information for the Utah State Legislature and Office of the Governor. The county-level forecasts from the Gardner Policy Institute were then distributed at a city level by the DMPO using land use plans, information provided by local community planners, and growth trends. It is forecasted that during the next 30 years the population in Washington County will more than double, with heavy growth expected in Hurricane, St. George's south block area, Washington

City Fields area, Santa Clara, and Ivins. Table 1 shows the population of the cities in Washington County between 2010 and 2050 (Horrocks Engineers 2020a).

**Table 1. City Population Growth in Washington County**

| City | 2010 | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|
| Apple Valley | 712 | 841 | 1,152 | 1,470 | 1,805 |
| Enterprise | 1,900 | 2,206 | 2,480 | 3,165 | 3,886 |
| Hildale | 2,812 | 3,074 | 4,546 | 5,803 | 7,124 |
| Hurricane | 12,697 | 17,820 | 26,565 | 36,990 | 51,090 |
| Ivins | 6,912 | 11,940 | 14,867 | 17,396 | 20,580 |
| La Verkin | 3,844 | 4,607 | 5,285 | 6,747 | 8,283 |
| Leeds | 854 | 1,023 | 1,381 | 1,929 | 2,551 |
| New Harmony | 261 | 313 | 422 | 538 | 661 |
| Rockville | 249 | 298 | 402 | 514 | 631 |
| Santa Clara | 6,182 | 8,204 | 11,732 | 14,975 | 18,385 |
| Springdale | 571 | 685 | 924 | 1,179 | 1,448 |
| St. George | 74,837 | 96,543 | 125,576 | 156,489 | 177,692 |
| Toquerville | 1,061 | 1,272 | 2,248 | 3,311 | 9,274 |
| Unincorporated | 5,250 | 6,294 | 8,490 | 10,837 | 13,305 |
| Virgin | 659 | 732 | 864 | 1,103 | 1,355 |
| Washington | 17,921 | 28,270 | 41,509 | 54,421 | 68,296 |
| County Total | **136,721** | **184,122** | **248,443** | **316,867** | **386,364** |

Source: Horrocks Engineers 2020a

### 2.1.3 East-to-West Travel Demand

East-west travel demand was analyzed using "districts," which are combinations of several traffic analysis zones that are created to be able to evaluate travel characteristics of larger areas. Using the model's output for 2019 and 2050, travel demand between District 1 (Ivins, Santa Clara, west St. George, and the Ledges area) and the surrounding districts was compared to determine, at a higher level, the expected increase in east-west travel demand across the county between 2019 and 2050 (see Figure 1 in Attachment 1 for details). As shown on Figure 1, the travel demand between District 1 and the surrounding areas is expected to increase at a similar rate to the population increase with travel demand nearly doubling over the next 30 years (Horrocks Engineers 2020a).

### 2.1.4 Intersection Operations

An intersection operational analysis was conducted to determine how future growth would be expected to impact traffic operations at various intersections and interchanges within the St. George urbanized area. The primary measure of effectiveness used for the intersection operational analysis was Level of Service (LOS), a term used to describe the traffic operations of an intersection based on congestion and delay. LOS ranges from A (almost no congestion or delay) to F (traffic demand exceeds capacity and the intersection experiences long delay). LOS D is generally acceptable for urbanized intersections.

Using the results of the 2019 evening peak hour intersection volumes and the DMPO TDM, evening peak hour intersection volumes for 2050 were developed and then used to determine the LOS for each intersection. Full details of the traffic analysis results are contained in the Traffic Analysis Memorandum (Horrocks Engineers 2020a). Based on the intersection analysis, Table 2 indicates key intersections within the St. George urbanized area expected to experience failing operations, with LOS E or F, by 2050.

**Table 2. Intersections Experiencing Failing Operations (2050)**

| Intersection | Traffic Volume | Total Delay (averaged) (second) | LOS | Max Queue (feet) |
|---|---|---|---|---|
| Sunset Boulevard/Bluff Street | 5,594 | 79 | F | 2,398 |
| Bluff Street/St. George Boulevard | 6,158 | 139 | F | -4,612 |
| Red Hills Parkway/1000 East | 3,050 | 214 | F | -3,630 |
| Green Spring Drive/Telegraph Street | 7,411 | 82 | E | 1,316 |

Source: Horrocks Engineers 2020a

Based on the no action 2050 traffic analysis, most of the issues are centered around the primary east-west corridors of Red Hills Parkway, St. George Boulevard, Bluff Street, and Green Spring Drive, and the primary intersections that access these routes (Table 2). The 1000 East and Red Hills Parkway intersection experienced the highest degree of congestion with queues that extended nearly 1 mile. Congested conditions at several intersections restrict traffic so other intersections that appear to be operating at an acceptable LOS may only be doing so because they do not experience the full travel demand as a result of upstream congestion that limits the amount of traffic that can access these intersections.

# 3. Alternative Development

Per the BLM NEPA Handbook H-1790-1, “In determining the alternatives to be considered, the emphasis is on what is ‘reasonable’ rather than on whether the proponent or applicant likes or is itself capable of implementing an alternative. ‘Reasonable alternatives include those that are *practical* or *feasible* from the technical and economic standpoint and using common sense, rather than simply *desirable* from the standpoint of the applicant’” (BLM 2008).

When preparing an EIS, the BLM analyzes a range of reasonable alternatives, including those that are technically and economically practical or feasible and that satisfy the purpose and need of the proposed action. The BLM may eliminate an action alternative from detailed analysis if one or more of the following is true:

1) It does not respond to the purpose and need.
2) It is not technically or economically feasible.
3) It is not consistent with the overall policy objectives for the area.
4) Its implementation is remote or speculative.
5) It is not substantively different in design from an alternative being analyzed in detail.
6) It would have substantively similar effects from an alternative being analyzed in detail.

A reasonable range of alternatives has been developed, per 40 CFR 1502.14, including the No Action Alternative, the applicant’s proposed alternative, and additional action alternatives that vary from the applicant’s proposal. Northern Corridor alternatives were developed as the range of alternatives for consideration based on previous planning studies; through collaborative discussions with the interdisciplinary planning team including traffic engineers, roadway design engineers, environmental resource specialists, and agency stakeholders; and through input from cooperating agencies and the public during the Draft EIS public scoping period.

## 3.1 Scoping

The BLM and USFWS received public and agency input during the scoping process that was used in the development of the Northern Corridor alternatives. The public scoping process is described in more detail in the Northern Corridor Scoping Report (Horrocks Engineers 2020b); it began December 5, 2019, and extended through January 6, 2020. A public scoping meeting was held in St. George, Utah, on December 17, 2019. A total of 17,258 submissions were received from the public during the scoping period, many of which specifically provided suggestions for alternatives to consider or posited questions about the alternative development process. Public input on alternatives has been considered as part of the alternative development and planning process.

## 3.2 Agency Coordination

Input from the community, local governments, and State and Federal agencies was critical in identifying, refining, and evaluating preliminary alternatives to meet the transportation purpose and need. Input was collected through various methods including holding a public scoping meeting and meeting with representatives from the cooperating agencies. A number of State agencies, including the Utah Division of Wildlife Resources, provided data and input that assisted the development of alternatives. The State of Utah, Utah School and Institutional Trust Lands Administration, the County, DMPO, City of St. George, City of Ivins, Washington City, City of Hurricane, and Santa Clara City were involved as formal cooperating agencies to this planning process and development of preliminary alternatives.

Preliminary alternatives were presented at a cooperating agency meeting held on January 28, 2020, in St. George, Utah. Updates were provided to cooperating agencies following this meeting based on additional refinement of alternatives, and the project team sought input from these agencies throughout the alternative development process. The Northern Corridor Scoping Report (Horrocks Engineers 2020b) and Chapter 4 of the Draft EIS provide additional detail on consultation and coordination related to this planning process.

# 4. Alternatives Considered

Thirteen Northern Corridor alternatives were developed as part of the range of alternatives and are described below. Each alternative was developed at a conceptual design level using the best available topographical and design-related information. Elements (for example, exact locations and sizes of bridges, culverts, cut/fill slopes, and retaining walls) were not specifically determined for each alternative. Horizontal and vertical design elements met applicable Federal, State, and local design standards. Sufficient engineering evaluation was applied to ensure that the alternatives could be constructed within the identified corridor widths.

If an alternative did not meet one or more of the BLM's criteria to move forward, it was eliminated from further analysis in the Draft EIS. For several alternatives, additional analysis was needed to assess if the alternative met the BLM's criteria. To assist the planning team with this determination, analysis was done to verify each alternative's technical and economic feasibility, substantial differences in design between alternatives, and key effects to environmental resources. The BLM identified several alternatives that do not meet the criteria for alternatives to be analyzed in detail, as described herein and in Section 5.2.2.

The No Action Alternative was retained as a basis of comparison and is also described herein.

## 4.1 No Action Alternative

Under the No Action Alternative, the BLM would deny UDOT's application for a ROW grant across public lands in the Red Cliffs NCA for the Northern Corridor and the existing management of the NCA would remain unchanged. The No Action Alternative is required by NEPA and serves as a baseline against which to compare the environmental consequences that could be associated with implementation of other alternatives. In determining the transportation need, the No Action Alternative reflects all the roadway and transit improvements in the DMPO RTP (DMPO 2019), absent the Northern Corridor.

## 4.2 Northern Alignment (North of Cottonwood Wilderness Area)

Because this alternative crosses BLM-administered public lands, the BLM's action would be the issuance of a ROW grant to UDOT for the construction, operation, and maintenance of the Northern Corridor and subject to the terms and conditions as determined by the BLM. For the purposes of the alternative development process, this alternative was assumed to have a 500-foot ROW width. This alternative proposes a 50-mile per hour (mph) 4-lane, divided highway with two, 12-foot-wide travel lanes in each direction, 8-foot shoulders, a 20-foot center median, and a 10- to 14-foot-wide multi-use trail accommodating bicyclists and pedestrians (UDOT 2018). The Northern Alignment would cross the Red Cliffs NCA and Dixie National Forest north of the Cottonwood Wilderness Area (Figure 2). Under the Northern Alignment, the BLM would issue a ROW grant to UDOT for the portion of the alignment that crosses the Red Cliffs NCA. The highway would connect to the I-15/Leeds exit and SR 18 with either existing or new grade-separated interchanges.

The Northern Alignment was evaluated through the transportation and resource analysis to determine if the alignment met the BLM's criteria for moving forward for detailed analysis; specifically, if it was technically and economically feasible and if its effects differed from the other Northern Corridor alternatives, as described in Section 5.

## 4.3 Twist Hollow Alignment (Northern T-Bone)

Because this alternative crosses BLM-administered public lands, the BLM's action would be the issuance of a ROW grant to UDOT for the construction, operation, and maintenance of the Northern Corridor and subject to the terms and conditions as determined by the BLM. For the purposes of the alternative development process, this alternative was assumed to have a 500-foot ROW width. This alternative proposes a 50-mph 4-lane, divided highway with two, 12-foot-wide travel lanes in each direction, 8-foot shoulders, a 20-foot center median, and a 10- to 14-foot-wide multi-use trail accommodating bicyclists and pedestrians (UDOT 2018). The Twist Hollow Alignment came from agency input as part of the alternative development process and is a northern variation to the location of T-Bone Mesa Alignment. Under the Twist Hollow Alignment, the BLM would issue a ROW grant to UDOT for the portion of the alignment crossing the Red Cliffs NCA. This alignment would cross the Red Cliffs NCA north of T-Bone Mesa. It would connect with I-15 at milepost 16 on the east and with SR 18 on the west, approximately 1.5 miles north of the Red Hills Parkway/Snow Canyon Parkway interchange. The alignment was developed to be located as far north as possible in the Red Cliffs NCA while still connecting to I-15 and Bluff Street at locations closer to the urbanized areas to increase the corridor's transportation use.

The Twist Hollow Alignment was not carried forward for detailed analysis in the Draft EIS. The Twist Hollow Alignment only partially meets the BLM's purpose and need. Although the location may address some resource conflicts with the Mojave desert tortoise, it would not meet the purpose and need to provide for consistency with the statutory purposes of the Red Cliffs NCA, which includes other ecological and scenic resources. Discussions with BLM and USFWS biologists indicate that the Twist Hollow area is a highly sensitive and diverse biological area for many species besides the Mojave desert tortoise and would likely result in comparatively more effects to wildlife and sensitive species than to similar alternatives carried forward for detailed analysis in the Draft EIS.

## 4.4 T-Bone Mesa Alignment

Because this alternative crosses BLM-administered public lands, the BLM's action would be the issuance of a ROW grant to UDOT for the construction, operation, and maintenance of the Northern Corridor and subject to the terms and conditions as determined by the BLM. For the purposes of the alternative development process, this alternative was assumed to have a 500-foot ROW width. This alternative proposes a 50-mph 4-lane, divided highway with two, 12-foot-wide travel lanes in each direction, 8-foot shoulders, a 20-foot center median, and a 10- to 14-foot-wide multi-use trail accommodating bicyclists and pedestrians (UDOT 2018).

Under the T-Bone Mesa Alignment, the BLM would issue a ROW grant to UDOT for the portion of the alignment that crosses the Red Cliffs NCA. This alignment would connect Green Spring Drive on the east to Red Hills Parkway on the west just north of the Pioneer Hills trailhead parking area. The BLM would also make any necessary ROW amendments to the existing FLPMA Title V ROW for the Red Hills Parkway. Under this alternative, the Northern Corridor would skirt the southern edge of T-Bone Mesa (Figure 2). The Northern Corridor would be approximately 4.0 miles long, approximately 2.2 of which would be across BLM-administered lands.

The T-Bone Mesa Alignment was evaluated through the transportation and resource analysis to determine if the alignment met the BLM's criteria for moving forward for detailed analysis; specifically, if it was technically and economically feasible and if its effects differed from the other Northern Corridor alternatives, as described in Section 5 below.

## 4.5 UDOT Application Alignment

Because this alternative crosses BLM-administered public lands, the BLM's action would be the issuance of a ROW grant to UDOT for the construction, operation, and maintenance of the Northern Corridor and subject to the terms and conditions as determined by the BLM. For the purposes of the alternative development process, this alternative was assumed to have a 500-foot ROW width. This alternative proposes a 50-mph, 4-lane, divided highway with two, 12-foot-wide travel lanes in each direction, 8-foot shoulders, a 20-foot center median, and a 10- to 14-foot-wide multi-use trail accommodating bicyclists and pedestrians (UDOT 2018).

Under the UDOT Application Alignment, the BLM would issue a ROW grant to UDOT for the portion of the alignment that crosses the Red Cliffs NCA. This alignment would connect Green Spring Drive on the east to Red Hills Parkway on the west just north of the Pioneer Hills trailhead parking area. The BLM would also make any necessary ROW amendments to the existing FLPMA Title V ROW for the Red Hills Parkway. Under this alternative, the Northern Corridor would be approximately 4.3 miles long, approximately 1.9 of which would be across BLM-administered lands (Figure 2).

The UDOT Application Alignment was evaluated through the transportation and resource analysis to determine if the alignment met the BLM's criteria for moving forward for detailed analysis; specifically, if it was technically and economically feasible and if its effects differed from the other Northern Corridor alternatives, as described in Section 5.

## 4.6 Southern Alignment

Because this alternative crosses BLM-administered public lands, the BLM's action would be the issuance of a ROW grant to UDOT for the construction, operation, and maintenance of the Northern Corridor and subject to the terms and conditions as determined by the BLM. For the purposes of the alternative development process, this alternative was assumed to have a 500-foot ROW width. This alternative proposes a 50-mph, 4-lane, divided highway with two, 12-foot-wide travel lanes in each direction, 8-foot shoulders, a 20-foot center median, and a 10- to 14-foot-wide multi-use trail accommodating bicyclists and pedestrians (UDOT 2018).

Under the Southern Alignment, the BLM would issue a ROW grant to UDOT for the portion of the alignment that crosses the Red Cliffs NCA. The Southern Alignment would skirt the southern border of the NCA, connecting Green Spring Drive on the east to Red Hills Parkway on the west just north of the Pioneer Hills trailhead parking area (Figure 2). The BLM would also make any necessary ROW amendments to the existing FLPMA Title V ROW for the Red Hills Parkway. The Northern Corridor would be approximately 5.3 miles long, approximately 1.5 of which would be across BLM-administered lands.

The Southern Alignment was evaluated through the transportation and resource analysis to determine if the alignment met the BLM's criteria for moving forward for detailed analysis; specifically, if it was technically and economically feasible and if its effects differed from the other Northern Corridor alternatives, as described in Section 5.

## 4.7 Widen Red Hills Parkway to Six Lanes

This alternative would not require BLM to issue a ROW grant to UDOT across the Red Cliffs NCA. It would, however, necessitate that the BLM make any necessary ROW amendments to the existing FLPMA Title V ROW for the Red Hills Parkway. This alternative would widen Red Hills Parkway from four to six lanes between the Bluff Street and Green Spring Drive intersection and would widen Buena Vista Boulevard from two to six lanes between Green Spring Drive and Washington Parkway (Figure 2). It would also include improvements to existing intersections within these limits such as adding exclusive right- and/or left-turn lanes. Speed limits along Red Hills Parkway would be 40 to 50 mph.

The Widen Red Hills Parkway to Six Lanes Alternative was evaluated through the transportation and resource analysis to determine if the alignment met the BLM's criteria for moving forward for detailed analysis; specifically, if it was technically and economically feasible and if its effects differed from the other alternatives, as described in Section 5.

## 4.8 Red Hills Parkway Expressway

The Red Hills Parkway Expressway alternative proposes changes to Red Hills Parkway instead of a new road across BLM-administered lands within the NCA (Figure 2). This alternative assumes that the BLM would not issue UDOT a ROW grant across the Red Cliffs NCA for the Northern Corridor. Rather, the BLM would need to grant necessary ROW amendments to the City of St. George's existing FLPMA Title V ROW for the Red Hills Parkway. This alternative would convert Red Hills Parkway into a grade-separated expressway between I-15 and Bluff Street. Improvements would include new east-to-north and south-to-west connections to I-15 to connect Red Hills Parkway directly to I-15, including an additional lane in each direction extending most of the length between 200 East and 900 East. The alternative would also convert the existing at-grade signalized intersections at 200 East (Skyline Drive) and 1000 East to grade-separated interchanges with necessary modifications to the mainline roadway to accommodate the new interchanges. New flyover ramps would be constructed to connect Red Hills Parkway to I-15.

The intersections at 900 East and Industrial Road would be closed and/or converted to right-in-right-out movements only because of their proximity to the 1000 East interchange and the I-15 flyover ramps. The intersection at Highland Drive would be closed. Existing driveways along the existing roadway to public and private properties would either be closed or converted to right-in-right-out movements only; all left turns in and out would be prohibited.

Additional widening of Red Hills Parkway at various locations between 200 East and 900 East would be required to add exclusive turn lanes for access to individual properties and/or public use areas where feasible. Section 3.26 of the main Draft EIS details these areas requiring widening and lists the partial and full acquisitions and changes in access that would be required to accommodate the widening. The existing pedestrian trail along Red Hills Parkway would be relocated in various locations between 200 East and 900 East to accommodate improvements including lengthening of the existing pedestrian tunnel under Red Hills Parkway in the Pioneer Park area. The speed limit with the expressway alternative would be from 45- to 50-miles per hour.

The Red Hills Expressway was evaluated through the transportation and resource analysis to determine if the alignment met the BLM's criteria for moving forward for detailed analysis; specifically, if it was technically and economically feasible and if its effects differed from the other Northern Corridor alternatives, as described in Section 5.

## 4.9 Widen St. George Boulevard

The Widen St. George Boulevard Alternative assumes that the BLM would not issue UDOT a ROW grant across the Red Cliffs NCA. St. George Boulevard is currently two lanes in each direction; this alternative would widen the roadway by approximately 24 feet to expand the road to three lanes in each direction between Bluff Street and River Road. Additional improvements to existing intersections and property accesses would be required to accommodate this alternative. Speed limits along St. George Boulevard would remain at 35 mph as they currently are (Figure 2).

The Widen St. George Boulevard Alternative was evaluated through the transportation and resource analysis to determine if the alignment met the BLM's criteria for moving forward for detailed analysis; specifically, if it was technically and economically feasible and if its effects differed from the other Northern Corridor alternatives, as described in Section 5.

## 4.10 St. George Boulevard/100 South One-way Couplet

The One-way Couplet Alternative proposes changes to existing St. George Boulevard and 100 South instead of a new road across BLM-administered lands within the NCA (Figure 2). This alternative assumes that the BLM would not issue UDOT a ROW grant across the Red Cliffs NCA for the Northern Corridor. Rather, the alternative would include modifications to St. George Boulevard and 100 South to respond to future transportation demands in Washington County. The two roadways would be converted into a one-way couplet system between I-15 and Bluff Street, where St. George Boulevard would only accommodate westbound traffic and 100 South would only accommodate eastbound traffic. St. George Boulevard would be converted from its existing two lanes in each direction (with a raised center median and turn pockets) to three westbound lanes. Modifications to the cross streets between I-15 and Bluff Street would disallow eastbound left and right turns from the cross streets. Similarly, 100 South would be converted from its existing one lane in each direction, with a center turn lane, to three eastbound lanes. Modifications to the intersections at cross streets between I-15 and Bluff Street would disallow westbound left and right turns from the cross streets. There may also be other minor reconstructions to storm drain and utility systems that would be required to safely convert these streets to one-way operations.

On St. George Boulevard, the raised and landscaped medians and irrigation systems would be removed and the median lighting would be replaced/relocated to the sides of the road. In addition, the Diverging Diamond Interchange at I-15/St. George Boulevard would be reconfigured to a more conventional diamond intersection configuration. On 100 South, the center two-way-left-turn median and shoulders would be reconfigured.

In addition, the existing interchange with I-15 at St. George Boulevard would be reconfigured and combined with a new interchange at 100 South to provide a split interchange system between these two roadways connected by one-way ramps. Southbound I-15 traffic would exit I-15 at St. George Boulevard and enter I-15 from 100 South. Similarly, northbound I-15 traffic would exit I-15 at 100 South and enter I-15 from St. George Boulevard. Speed limits would be 35-miles-per-hour along St. George Boulevard and 30- to 35-miles-per-hour along 100 South, depending on location.

The St. George Boulevard/100 South One-way Couplet Alternative was evaluated through the transportation and resource analysis to determine if the alignment met the BLM’s criteria for moving forward for detailed analysis, specifically if it was technically and economically feasible and if its effects differed from the other Northern Corridor alternatives, as described in Section 5.

## 4.11 Increased Use of Mass Transit

Comments received during the scoping process suggested the increased use of mass transit as a Northern Corridor alternative for consideration. Transit usage in the St. George urbanized area is currently limited by the size of the area, the number of routes, and the locations served. With full implementation of the transit improvements shown in the DMPO RTP, 2050 transit use accounts for less than 1 percent of all trips (DMPO 2019). Based on local planning and available funding, it is unreasonable to assume the St. George urbanized area could develop a robust transit system within the planning horizon represented by the Draft EIS that would eliminate a substantial amount of vehicle trips from the transportation system. The Increased Use of Mass Transit Alternative would be substantially similar to the No Action Alternative and was not carried forward for detailed analysis in the Draft EIS.

## 4.12 Active Transportation

Comments received during the scoping process suggested active transportation including pedestrian and bicycle facilities, as a Northern Corridor alternative for consideration. Non-motorized travel in the St. George urbanized area represents a miniscule amount of all travel and is insignificant when it comes to serving the area’s transportation needs. The Active Transportation Alternative would not meet the future east-west travel demand and reduce future intersection congestion within the St. George urbanized area and would be substantially similar to the No Action Alternative. This alternative was not carried forward for detailed analysis.

## 4.13 Land Use/Growth Regulation

Comments received during the scoping process suggested limiting development in Washington County, or setting growth regulations as a Northern Corridor alternative for consideration. Land use planning, including existing and planned development, is controlled by the local municipalities within Washington County as outlined in city general planning documents. Limiting development in Washington County, or setting growth regulations, is inconsistent with current local government general land use and zoning plans. The Land Use/Growth Regulation Alternative would be inconsistent with the managing objectives of the local municipalities over land use planning and its implementation is remote or speculative. Therefore, the alternative has been eliminated from detailed analysis in the Draft EIS.

### 4.14 Conserve Southwest Utah Community Transportation Alternative(s)

During the scoping process, the nonprofit organization Conserve Southwest Utah presented its proposed "Community Transportation Alternative," which includes the following alternatives, ranging from roadway, land use, and transit to active transportation options:

- Alternative 1: Red Hills Parkway – I-15 Viaduct/Flyover Connection.
- Alternative 2: Improvements to Red Hills Parkway between I-15 Exits 8 and 13.
- Alternative 3: More Porous I-15 to Move Traffic North-South around Congestion Areas. This sub-alternative suggests new I-15 underpass crossings on 400 East, 700 East and 1240 East.
- Alternative 5: Implement/Plan for Technological Improvements (i.e., traffic management using technology).
- Alternative 6: Implement Congestion Reduction Land Use Principles (Vision Dixie).
- Alternative 7: Downtown St. George Loop.
- Alternative 8: Address Moving People Rather than Vehicles Transit Options.
- Alternative 9: Long-term Thru-Traffic St. George Bypass.
- Alternative 10: Industrial Park Reuse.

Several of the alternatives suggested as part of the Conserve Southwest Utah's Community Transportation Alternative are similar to other alternatives that have been considered as part of the alternative development in the planning process for the Draft EIS. Based on the following conclusions, the Community Transportation Alternative has been eliminated from detailed analysis in the Draft EIS:

- Alternatives 1, 2, and 7 include suggested roadway projects that are being considered as standalone Northern Corridor alternatives, including the Red Hills Parkway Expressway, Widen Red Hills Parkway Alternative, and the St. George/100 South One-way Couplet Alternative, as previously described.
- Land use planning, including existing and planned development, is controlled by the local municipalities within Washington County as outlined in each city's general planning documents. Alternatives 5, 6, and 10 of the Community Transportation Alternative, as it relates to land use planning and traffic management, are not in the decision space of this planning process. Land use planning and traffic management are under the decision authority of the local jurisdictions and are outside the decision space for this Draft EIS; therefore, this alternative has not been carried forward for detailed analysis in the Draft EIS.
- Alternatives 3, 8, and 9 are suggested roadway and transit improvements that would not considerably improve east-west travel demand in the St. George urbanized area when compared to other alternatives analyzed in the Draft EIS and would be substantially similar to the No Action Alternative. Therefore, these alternatives were not carried forward for detailed analysis in the Draft EIS.

# 5. Transportation and Resource Considerations

A transportation analysis and resource assessment for the remaining eight Northern Corridor alternatives was performed to better compare the differences in effects between the alternatives and assess the alternatives' ability to meet the criteria for reasonableness. The eight Northern Corridor alternatives evaluated for the transportation analysis and the resource assessment include (Figure 2):

- Northern Alignment
- T-Bone Mesa Alignment

- UDOT Application Alignment
- Southern Alignment
- Red Hills Parkway Expressway
- Widen Red Hills Parkway
- St. George Boulevard/100 South One-way Couplet
- Widen St. George Boulevard

## 5.1 Transportation Analysis

The transportation analysis evaluated the alternatives' ability to meet the applicant's objective and transportation purpose and need of the project. The transportation analysis focused on several performance measures used to determine if an alternative met the transportation purpose and need and to compare how well each alternative performed based on these measures. Table 3 describes the performance measures used to compare the alternatives. The transportation analysis included evening peak hour intersection LOS at key intersections along the primary east-west roadways and travel time for routes along similar roadways for the different Northern Corridor alternatives.

**Table 3. Transportation Performance Measures**

| Criterion | Performance Measure |
|---|---|
| LOS | LOS D is a minimum standard goal for urban areas; LOS C is desirable. LOS is reported as average minutes of delay per vehicle. |
| Travel Time | Travel time compared to the No Action Alternative. Travel time is reported as average minutes of travel per vehicle. |

### 5.1.1 Transportation Results

Tables 4 and 5 contain the results of the transportation analysis for LOS and travel time, respectively. Travel times were measured between I-15 north of exit 13 and Sunset Boulevard just west of Bluff Street using seven separate routes (Figure 3).

To determine if an alternative met the applicant's objective and transportation purpose and need, each alternative's performance was compared to the No Action Alternative. The results of the LOS analysis and the travel time comparison indicate that the Northern Alignment does not improve conditions over the No Action Alternative, and therefore, does not meet the applicant's objective and transportation purpose and need. The alternatives that improved LOS and travel time comparatively better than the other alternatives evaluated were the T-Bone Mesa Alignment, UDOT Application Alignment, Red Hills Parkway Expressway, and the St. George Boulevard/100 South One-way Couplet Alternative.

Although the Southern Alignment, Widen Red Hills Parkway to Six Lanes Alternative, and Widen St. George Boulevard Alternative met the overall applicant's objective and transportation purpose and need, they performed similarly to each other and did not show stronger improvements to LOS or travel time when compared to the T-Bone Mesa Alignment, UDOT Application Alignment, Red Hills Parkway Expressway, and the St. George Boulevard/100 South One-way Couplet Alternative. Associated specifically with the One-way Couplet Alternative is the additional intersection of Bluff Street/100 South, which would also be affected by the one-way couplet. Analysis shows this intersection would operate at LOS C in 2050 (result not shown in Table 4). The One-way Couplet Alternative would have additional travel time impacts to other local streets within the downtown St. George area not reflected in Table 5. This is due to vehicles having to undertake more out-of-direction travel to access the one-way couplet system to get to their destinations.

**Table 4. Transportation Analysis: 2050 Evening Peak Hour Intersection LOS Results**

| Alternative | No Action | Northern | T-Bone Mesa | UDOT Application | Southern | Red Hills Parkway Expressway | Widen Red Hills Parkway | St. George Boulevard/100 South One-way Couplet | Widen St. George Boulevard |
|---|---|---|---|---|---|---|---|---|---|
| Intersection | LOS | LOS | LOS | LOS | LOS | LOS | LOS | LOS | LOS |
| Red Hills Parkway/Bluff Street | C | C | C | C | C | C | C | C | C |
| Sunset/Bluff Street | F | F | F | E | F | E | E | E | E |
| St. George Boulevard/Bluff Street | F | F | D | D | F | C | E | B | D |
| St. George Boulevard/Main Street | C | C | C | C | C | C | C | C | C |
| St. George Boulevard/1000 East | D | D | C | D | D | C | E | B | D |
| I-15 Exit 8 Southbound Ramps | C | C | C | C | C | C | F | C | C |
| I-15 Exit 8 Northbound Ramps | B | B | C | C | C | C | C | B | D |
| St. George Boulevard/River Road | D | D | D | D | D | D | D | C | D |
| Red Hills Parkway/200 East | B | B | A | A | B | A | A | B | A |
| Red Hills Parkway/1000 East | F | F | B | B | F | C | F | C | F |
| I-15 Exit 10 | C | C | C | C | C | C | C | B | C |
| Green Spring/Buena Vista | C | C | C | C | C | C | C | D | C |
| Green Spring/Telegraph Street | E | E | D | E | E | E | D | E | E |
| I-15 Exit 13 Southbound Ramps | B | B | C | B | B | B | B | B | B |
| I-15 Exit 13 Northbound Ramps | A | A | B | B | B | A | A | A | A |

Source: Horrocks Engineers 2020a

**Table 5. Transportation Analysis: 2050 Evening Peak Hour Travel Time Results**

| Alternative | No Action | Northern | T-Bone Mesa | UDOT Application | Southern | Red Hills Parkway Expressway | Widen Red Hills Parkway | St. George Boulevard/100 South One-way Couplet | Widen St. George Boulevard |
|---|---|---|---|---|---|---|---|---|---|
| Route | Minutes | Minutes | Minutes | Minutes | Minutes | Minutes | Minutes | Minutes | Minutes |
| Route A | 24 | 24 | 15 | 16 | 21 | 14 | 24 | 14 | 14 |
| Route B | 25 | 25 | 15 | 15 | 22 | 15 | 21 | 17 | 20 |
| Route C | 40 | 40 | 15 | 16 | 33 | 16 | 16 | 18 | 31 |
| Route D | Not applicable | Not applicable | Not applicable | Not applicable | 17 | Not applicable | Not applicable | Not applicable | Not applicable |
| Route E | Not applicable | Not applicable | Not applicable | 15 | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable |
| Route F | Not applicable | Not applicable | 14 | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable |
| Route G | Not applicable | Not applicable | Not applicable | Not applicable | Not applicable | 12 | Not applicable | Not applicable | Not applicable |

Source: Horrocks Engineers 2020a

In addition to the LOS traffic analysis and the travel time analysis, a traffic volume shift analysis was prepared to demonstrate the relative shift in traffic off existing roadways to the Northern Corridor based on location. Figure 4 displays the shift of traffic off existing roadways onto the new Northern Corridor alignment as a percent reduction of traffic volumes. For each alignment, the overall volume of vehicles that are projected to use the alignment are represented as the raw number (i.e., 2K meaning 2,000).

The T-Bone Mesa Alignment and UDOT Application Alignment both attract a higher percentage of vehicles over the Southern Alignment and would alleviate congestion off existing roadways. This is because of the overall length of the alternatives as well as proximity and similar routing of the Southern Alignment to Red Hills Parkway.

## 5.2 Resource Impact Assessment

A preliminary resource assessment was performed to better compare the effects between alternatives. This was accomplished by quantifying, at a high level, impacts to select resources and comparing the impacts of one alternative to another. Specifically, potential impacts to the Mojave desert tortoise and impacts to property were considered. The impacts were assessed based on high-level conceptual engineering design. A 500-foot corridor was used for the alternatives within the NCA and a variable design width was assumed for the alternatives outside the NCA. Impacts were assessed by using readily available data and were estimated only for the purpose of providing a comparison between preliminary alternatives. Chapter 3 of the Draft EIS describes the affected environment and environmental consequences for all resources and alternatives carried forward for detailed analysis in this planning process. Descriptions of impacts may differ in Chapter 3 of the Draft EIS from what is presented here, as this analysis was completed with preliminary design assumptions that were further refined during the impact analysis carried out during development of the Draft EIS.

Table 6 describes the resource criteria and measures used for the resource assessment.

**Table 6. Resource Criteria Measures**

| Criterion | Measure |
|---|---|
| Mojave Desert Tortoise Impacts | Acres of suitable habitat impacted; fragmentation represented by acreage of contiguous fragment. |
| Property Impacts | Number of properties impacted, number of relocations, total acres impacted. |

### 5.2.1 Resource Comparison Results

Tables 7 and 8 contain the results of the Mojave desert tortoise and property impact assessments, respectively.

Two criteria were used to assess Mojave desert tortoise impacts: suitable habitat and fragmentation. Suitable habitat was modeled using readily available data and is defined as areas where ecological conditions are adequate to support the species; this dataset includes occupied habitat. Fragmentation was reported in total acres of contiguous suitable habitat fragment assuming a break in a contiguous area was made by the alternative and the existing Cottonwood Road. The total acreage of suitable habitat was reported for the areas located northwest, northeast, southwest, southeast, and total for northwest and northeast and total for southwest and southeast for each alternative. Alternatives outside the Red Cliffs NCA were assumed not to produce any Mojave desert tortoise suitable habitat fragments.

In summary of the Mojave desert tortoise results, the T-Bone Mesa Alignment, UDOT Application Alignment, and the Southern Alignment would have similar effects to the Mojave desert tortoise. The

Southern Alignment results in slight differences with a larger contiguous northwest/northeast fragment, smaller southwest/southeast contiguous fragment but slightly more acres of suitable habitat impacted. The UDOT and T-Bone Mesa have similar effects in fragmentation and acreage of suitable habitat impacted. Alternatives outside of the NCA including Red Hills Parkway Expressway, Widen Red Hills Parkway, St. George/100 South One-way Couplet, and Widen St. George Boulevard are assumed to the have no impact to Mojave desert tortoise based on this comparative analysis.

Table 8 contains the results of the property impact assessment for each alternative. Impacts were assessed by overlaying the conceptual design for each alternative with readily available Washington County parcel data. Property impacts were measured in total number of non-residential and residential properties impacted, total number of business and residential relocations, and total acreage and type of property impacted. Relocations were determined by several factors: if the alternative came within 15 feet of a residential or business structure, it was determined to be a relocation; and if access to a residential or commercial property was removed with the alternative, then it was considered a relocation.

In summary, the alternatives outside of the NCA resulted in similar effects to properties with a few variations. The Widen St. George Boulevard Alternative had the most property impacts for both total properties impacted and relocations. Overall, the T-Bone Mesa Alignment, UDOT Application Alignment, and Southern Alignment had similar effects to properties with one variation: the Southern Alignment impacted slightly more acreage of property and resulted in one potential relocation.

**Table 7. Mojave Desert Tortoise Impact Assessment Results**

| Alternative | Acres of Suitable Habitat Impacted [a] | Acres of Contiguous Suitable Fragment Northwest | Acres of Contiguous Suitable Fragment Northeast | Acres of Contiguous Suitable Fragment Southwest | Acres of Contiguous Suitable Fragment Southeast | Acres of Contiguous Suitable Fragment Total Northwest/Northeast Total Southwest/Southeast |
|---|---|---|---|---|---|---|
| T-Bone Mesa Alignment | 248 | 8,793 | 27,380 | 1,072 | 1,363 | 36,173<br>2,435 |
| UDOT Application Alignment | 263 | 9,151 | 28,106 | 716 | 620 | 37,257<br>1,336 |
| Southern Alignment | 346 | 9,650 | 28,510 | Multiple fragments ranging from 19 to 133 acres | Multiple fragments ranging from 19 to 133 acres | 38,160<br>349 |
| Red Hills Parkway Expressway | 0 | 0 | 0 | 0 | 0 | 0 |
| Widen Red Hills Parkway | 7 | 0 | 0 | 0 | 0 | 0 |
| St George Boulevard/100 South One-way Couplet | 0 | 0 | 0 | 0 | 0 | 0 |
| Widen St. George Boulevard | 0 | 0 | 0 | 0 | 0 | 0 |

[a] Suitable habitat, modeled by U.S. Geological Survey, is defined as areas where ecological conditions are adequate to support the species. This dataset includes occupied habitat.

**Table 8. Property Impact Assessment Results**

| Alternative | Property Impacts – Non-residential [a] | Property Impacts – Residential [b] | Number of Relocations – Business [c] | Number of Relocations – Residential [d] | Acres Impacted – Non-Residential [e] | Acres Impacted – Residential [f] |
|---|---|---|---|---|---|---|
| No Action | 0 | 0 | 0 | 0 | 0 | 0 |
| T-Bone Mesa Alignment | 0 | 0 | 0 | 0 | 249 (Vacant) | 0 |
| UDOT Application Alignment | 0 | 0 | 0 | 0 | 266 (Vacant) | 0 |
| Southern Alignment | 0 | 6 | 0 | 1 (Relocation)<br>5 (Potential) | 6.2 (Commercial)<br>338 (Vacant)<br>9.3 (Other) | 3.5 |
| Red Hills Parkway Expressway | 34 (Commercial)<br>3 (Vacant)<br>23 (Other) | 0 | 31 (Relocation)<br>29 (Potential) | 0 | 37 (Commercial<br>68 (Vacant)<br>26 (Other) | 0 |
| Widen Red Hills Parkway | 20 (Commercial)<br>2 (Null) | 6 | 18 (Relocation)<br>4 (Potential) | 5 (Relocation)<br>1 (Potential) | 30 (Commercial)<br>7 (Vacant)<br>8 (Null) | 0.8 |
| St. George Boulevard/100 South One-way Couplet | 11 (Commercial) | 0 | 11 (Potential) | 0 | 0.2 (Commercial)<br>0.1 (Null) | 0 |
| Widen St. George Boulevard | 68 (Commercial) | 1 | 38 (Relocation)<br>30 (Potential) | 1 (Relocation) | 4 (Commercial)<br>0.1 (Null) | 0.3 |

[a] Total number of businesses potentially impacted by the proposed alternative; non-residential properties include commercial, vacant, or exempt.

[b] Total number of homes potentially impacted by the proposed alternative.

[c] Total businesses that would be relocated as a result of the proposed alternative.

[d] Total households that would be relocated as a result of the proposed alternative.

[e] Total acres of non-residential parcels that would experience some level of impact from the proposed alternative; non-residential properties include commercial, vacant, or exempt.

[f] Total acres of residential parcels that would experience some level of impact from the proposed alternative.

### 5.2.2 Alternatives Considered but Not Analyzed in Detail

Based on the outcome of the transportation analysis and resource assessment, several additional alternatives were not carried forward for detailed analysis in the Draft EIS.

**The Northern Alignment (Cottonwood Wilderness**) would result in the same traffic conditions as the No Action Alternative, showing no improvement to future congestion or east-west connectivity in the St. George urbanized area. The implementation of this alternative is remote or speculative due to the increased length of the potential roadway and the associated increased cost, which may make it economically infeasible to construct because it does not result in reduced congestion. Therefore, the Northern Alignment is not considered a reasonable alternative to the proposed action and was not carried forward for detailed analysis.

**The Widen Red Hills Parkway Alternative** would have substantially similar effects to many resources as the Red Hills Parkway Expressway Alternative carried forward in the Draft EIS, but would result in comparatively greater effects to some resources such as socioeconomics due to the potential need to expand on to adjoining properties. In addition, its implementation is remote or speculative and it may not be economically feasible due to the amount of private property that may need to be acquired to accommodate the larger footprint. Therefore, this alternative was not carried forward for detailed analysis in the Draft EIS.

**The Widen St. George Boulevard Alternative** would have substantially similar effects to many resources as the St. George Boulevard/100 South One-way Couplet Alternative carried forward in the Draft EIS, but would result in comparatively greater effects to some resources such as socioeconomics due to the need to expand onto more adjoining properties. In addition, its implementation is remote or speculative since it completely falls outside the jurisdiction of the Federal agencies and it may not be economically feasible due to the amount of private property that may need to be acquired to accommodate the larger footprint. Therefore, the Widen St. George Boulevard Alternative was eliminated from detailed analysis in the Draft EIS.

# 6. Alternatives Considered in Detail in the Draft EIS

The following Northern Corridor alternatives are being carried forward for detailed analysis in the Northern Corridor Draft EIS (Figure 5):

- No Action Alternative.
- T-Bone Mesa Alignment.
- UDOT Application Alignment.
- Southern Alignment.
- Red Hills Parkway Expressway.
- St. George Boulevard/100 South One-way Couplet.

The Northern Corridor alternatives carried forward would have independent utility because they would be usable and be a reasonable expenditure of public funds, even if no additional transportation improvements in the area are made.

The No Action Alternative is required by NEPA and serves as a baseline against which to compare the environmental consequences that could be associated with implementation of other alternatives. The alternatives are described in Section 4 of this report and displayed on Figure 5. Figure 6 displays the proposed typical section for the T-Bone Mesa Alignment, UDOT Application Alignment, and Southern Alignment, and Figures 7 through 9 contain a more detailed plan view for these alignments, which share the same design details. Figures 10 and 11 display the plan view for the Red Hills Parkway Expressway

Alternative and the St. George Boulevard/100 South One-way Couplet Alternative, respectively. The exact widths and footprints have not been determined based on the high-level, conceptual design performed as part of the Draft EIS. However, sufficient design has been done to estimate the impact footprint for each alternative and to satisfy the level of detailed analysis required for the Draft EIS.

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# Attachment 1. Figures

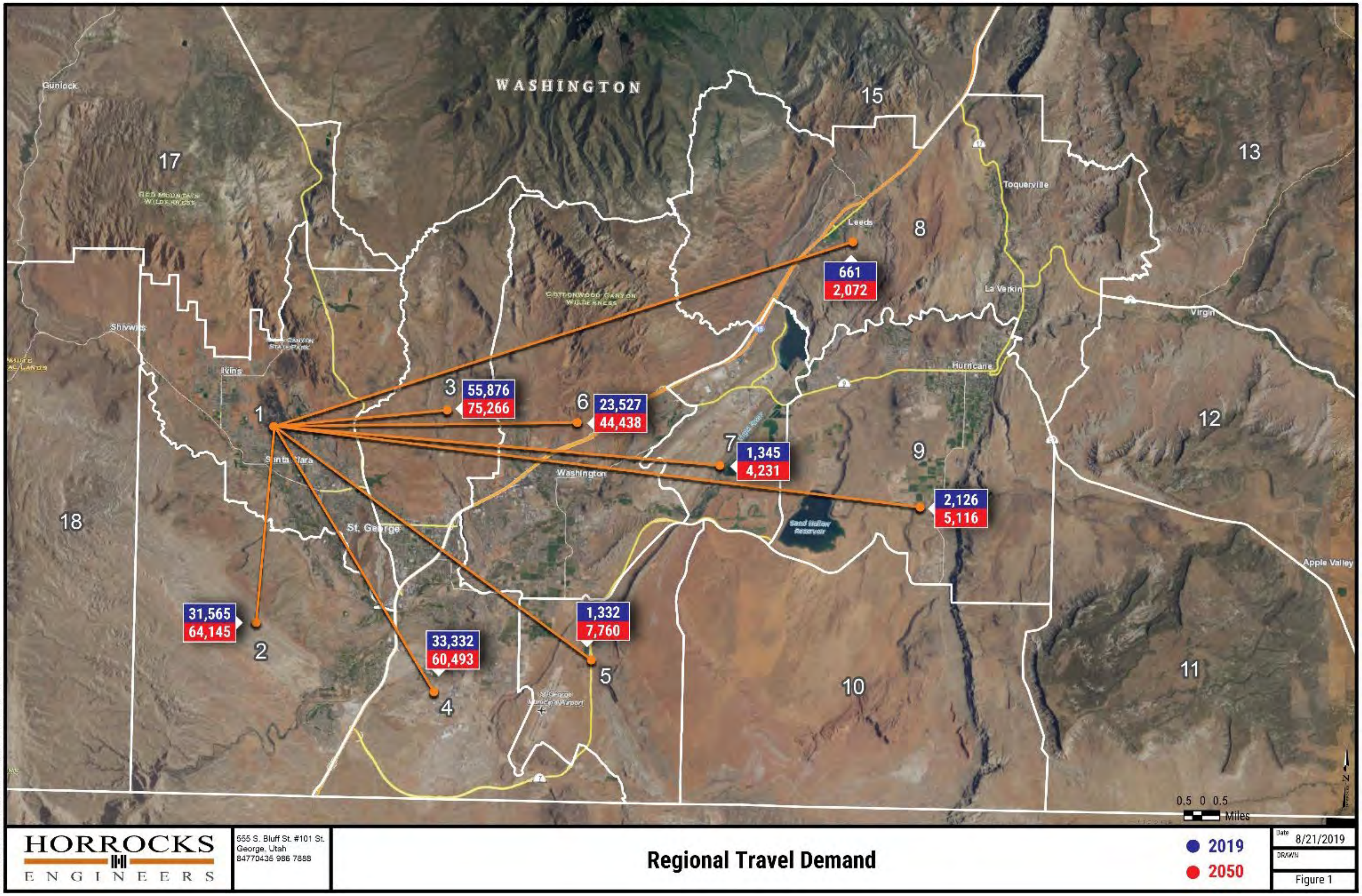



**Figure 1. Regional Travel Demand**

*Source: Horrocks Engineers 2020a.*

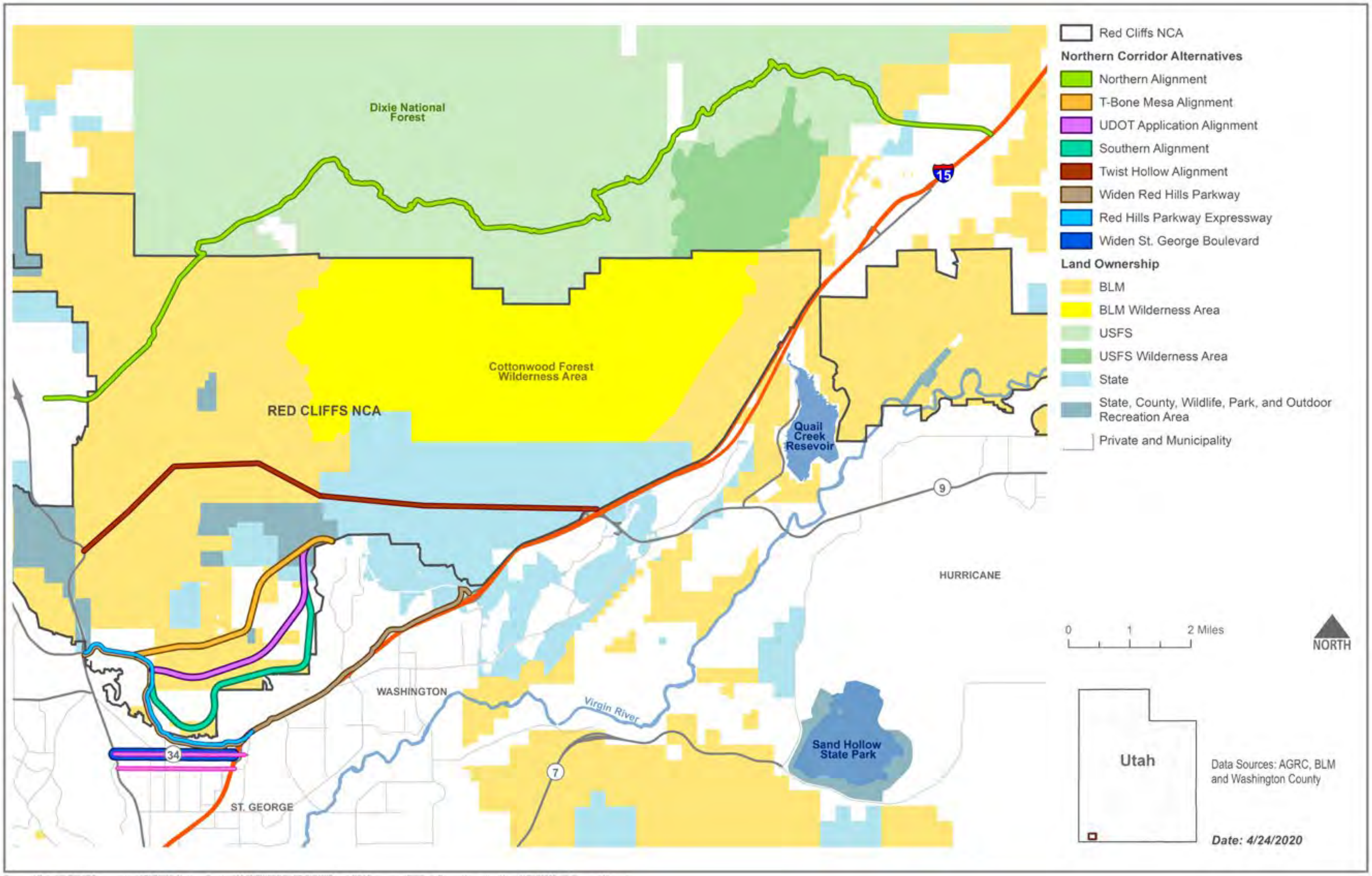



**Figure 2. Alternatives Considered for Transportation and Resource Effects Analysis**

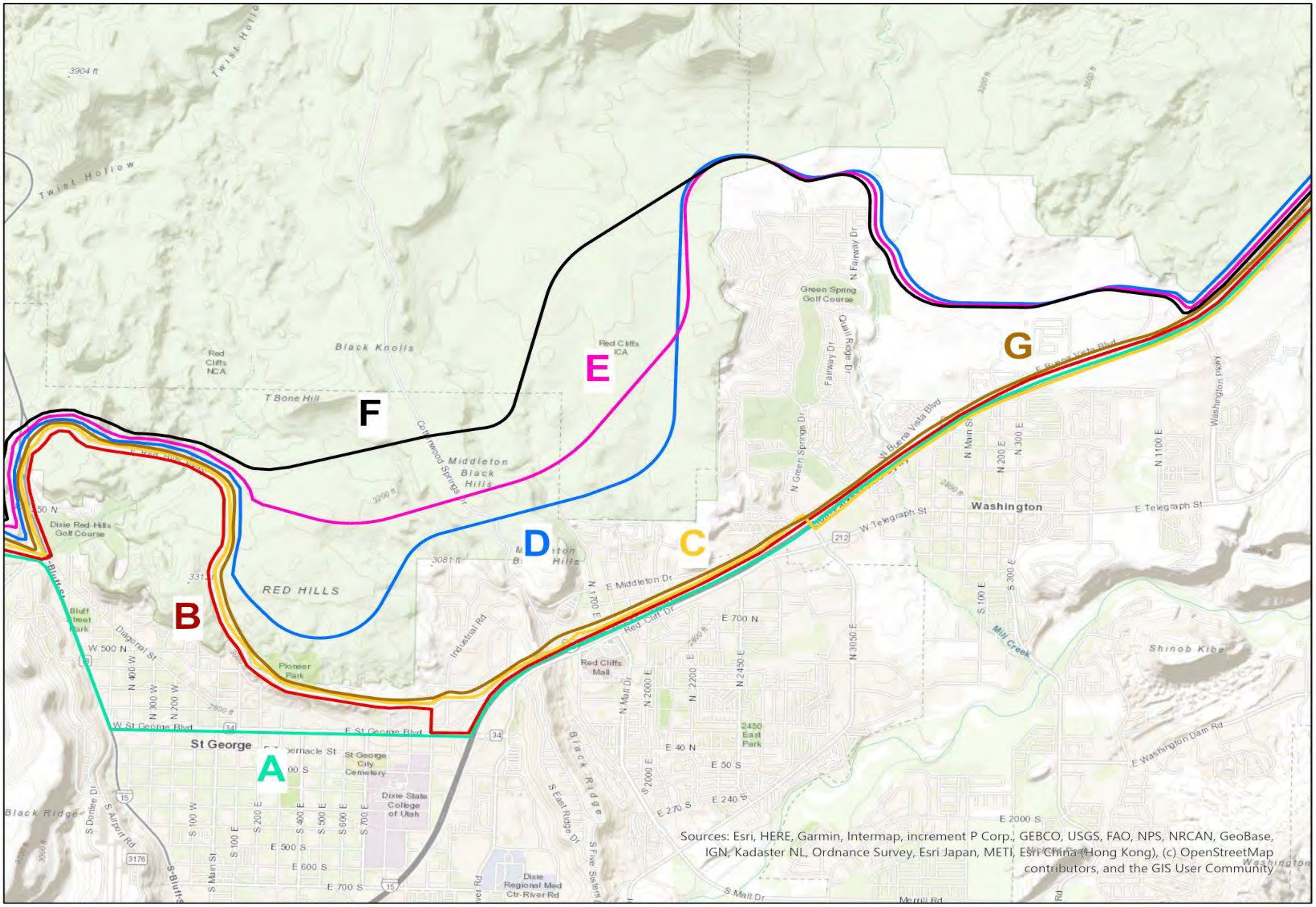
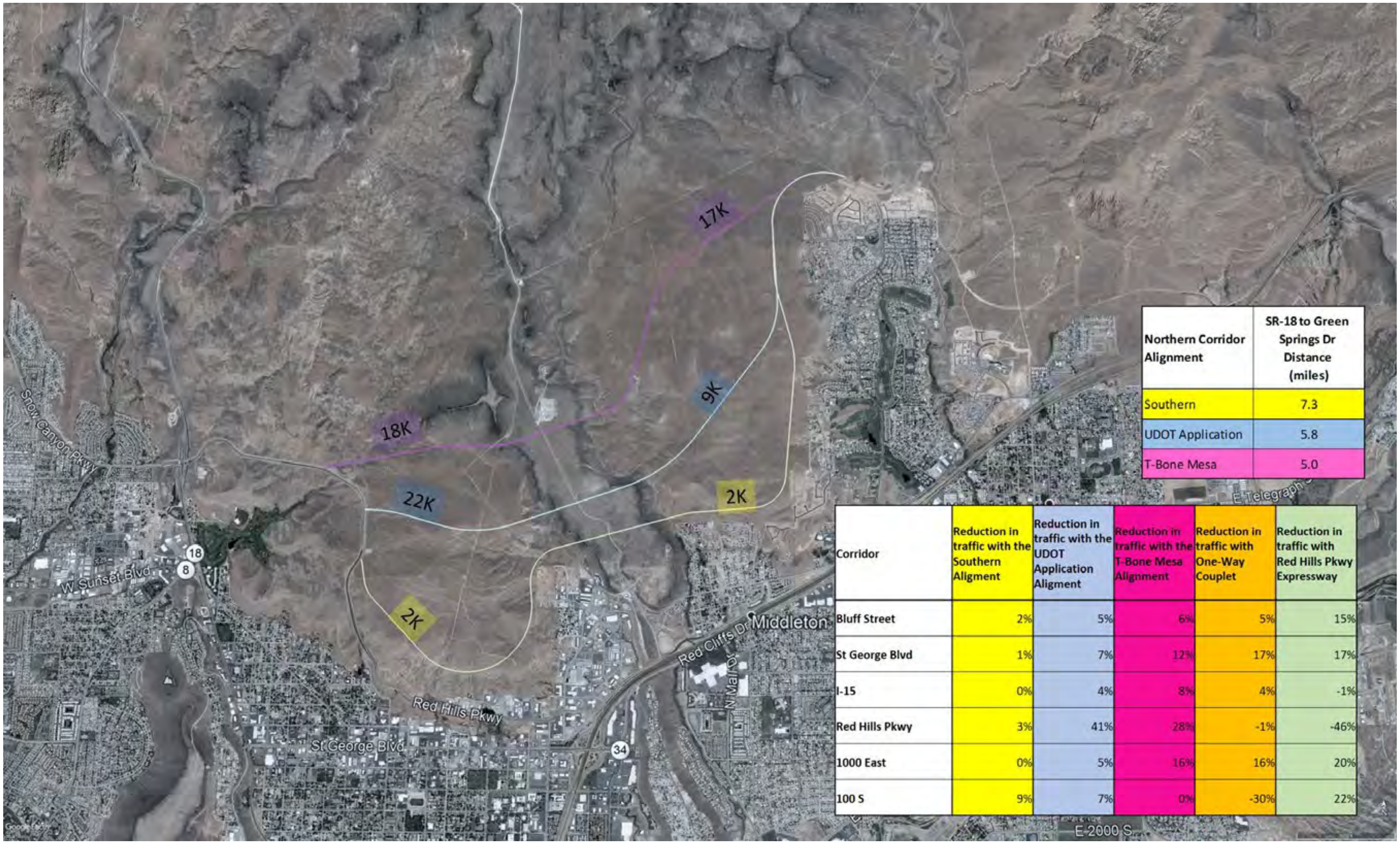



**Figure 3. Routes Used for Travel Time Comparison**

*Source: Horrocks Engineers. 2020a.*




| Northern Corridor Alignment | SR-18 to Green Springs Dr Distance (miles) |
|---|---|
| Southern | 7.3 |
| UDOT Application | 5.8 |
| T-Bone Mesa | 5.0 |

| Corridor | Reduction in traffic with the Southern Aligment | Reduction in traffic with the UDOT Application Aligment | Reduction in traffic with the T-Bone Mesa Alignment | Reduction in traffic with One-Way Couplet | Reduction in traffic with Red Hills Pkwy Expressway |
|---|---|---|---|---|---|
| Bluff Street | 2% | 5% | 6% | 5% | 15% |
| St George Blvd | 1% | 7% | 12% | 17% | 17% |
| I-15 | 0% | 4% | 8% | 4% | -1% |
| Red Hills Pkwy | 3% | 41% | 28% | -1% | -46% |
| 1000 East | 0% | 5% | 16% | 16% | 20% |
| 100 S | 9% | 7% | 0% | -30% | 22% |

**Figure 4. Daily Volume Comparison (Alternatives within the NCA)**

*Source: Horrocks Engineers. 2020a.*

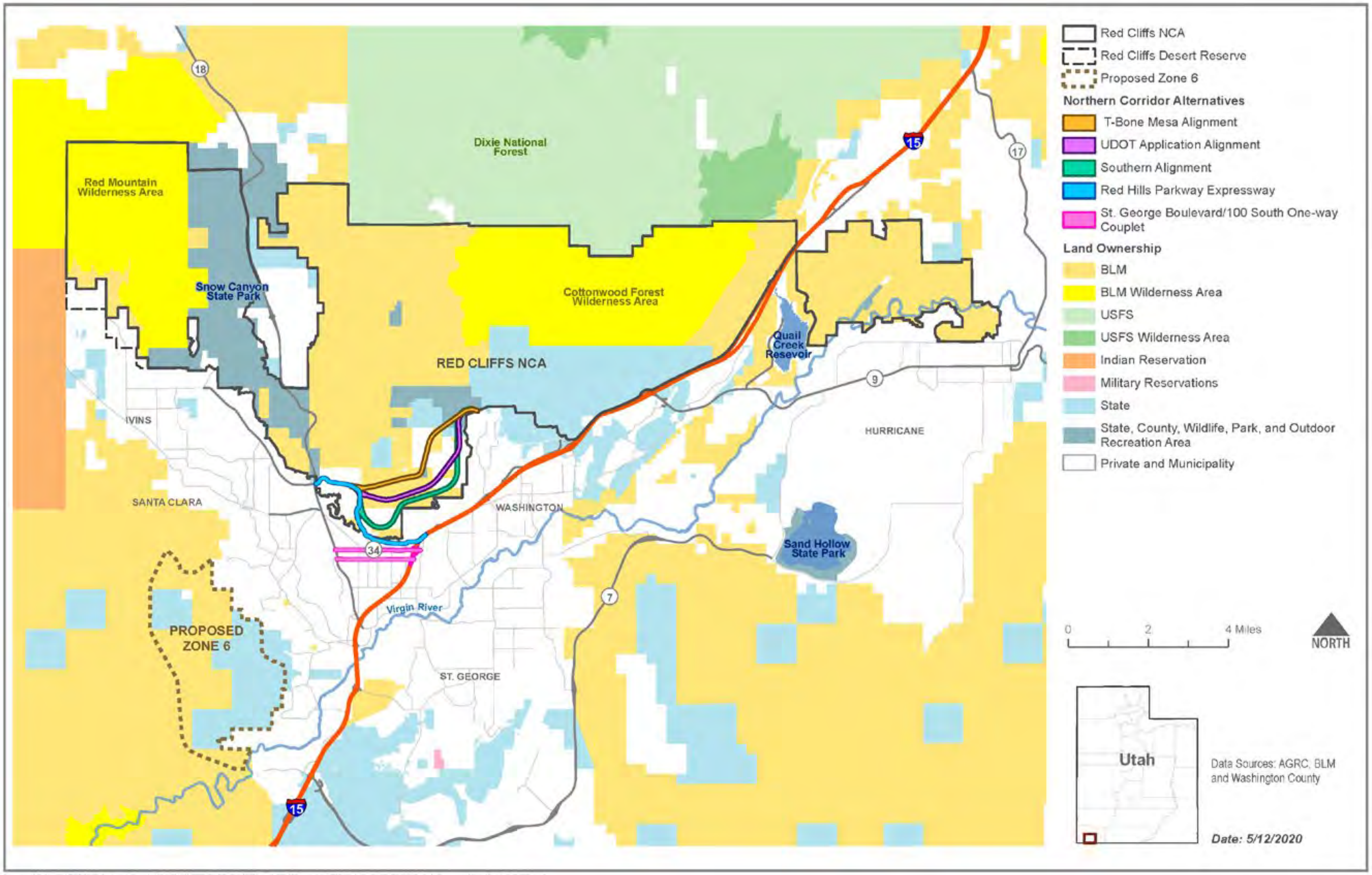
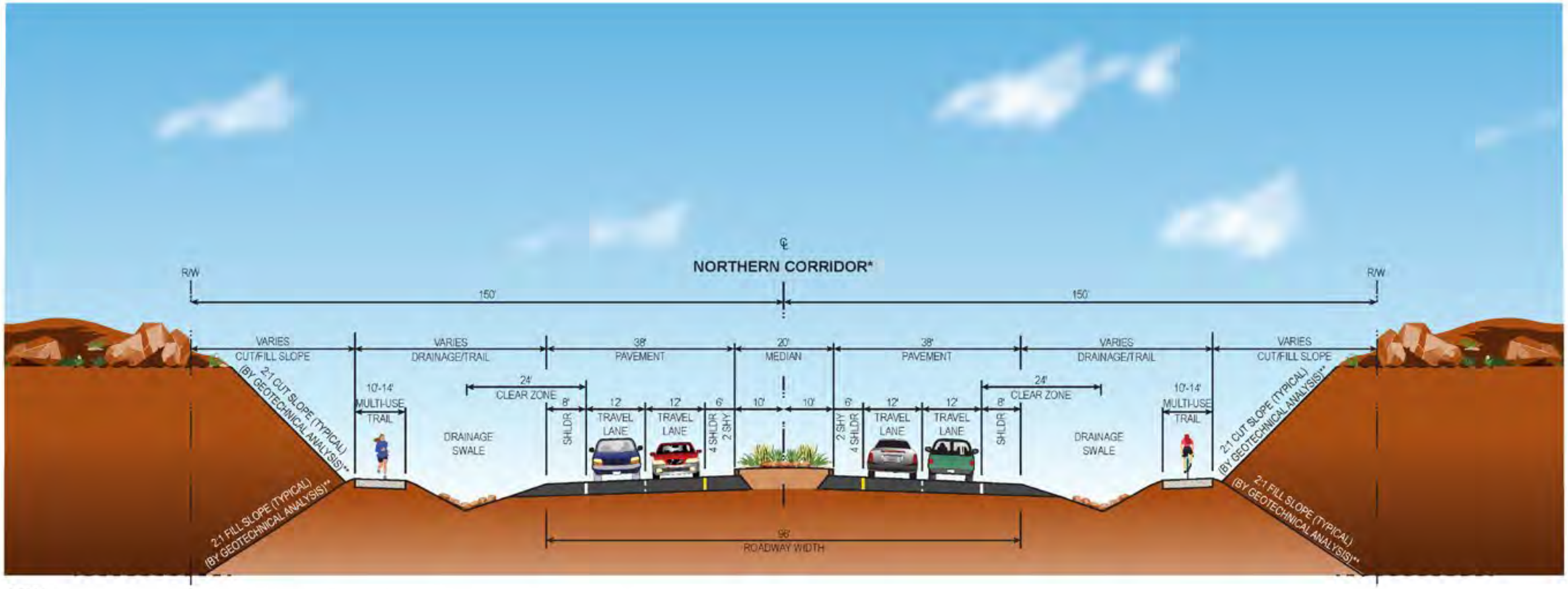



**Figure 5. Alternatives Carried Forward for Detailed Analysis in Draft EIS**




NOTES:
*TOTAL ROW 300' – 500' DEPENDING ON SLOPE AND CONSTRUCTION REQUIREMENTS.
**THE FINAL SLOPE WILL BE BASED ON GEOTECHNICAL ANALYSIS, TERRAIN TYPE (E.G., ROCK OR DIRT), AND FURTHER DESIGN TO ACHIEVE A "BEST FIT" DESIGN THAT MINIMIZES IMPACTS AND BLENDS IN WITH THE NATURAL ENVIRONMENT.

**Figure 6. T-Bone Mesa Alignment, UDOT Application Alignment, and Southern Alignment – Highway Cross Section, Eastbound within the NCA**

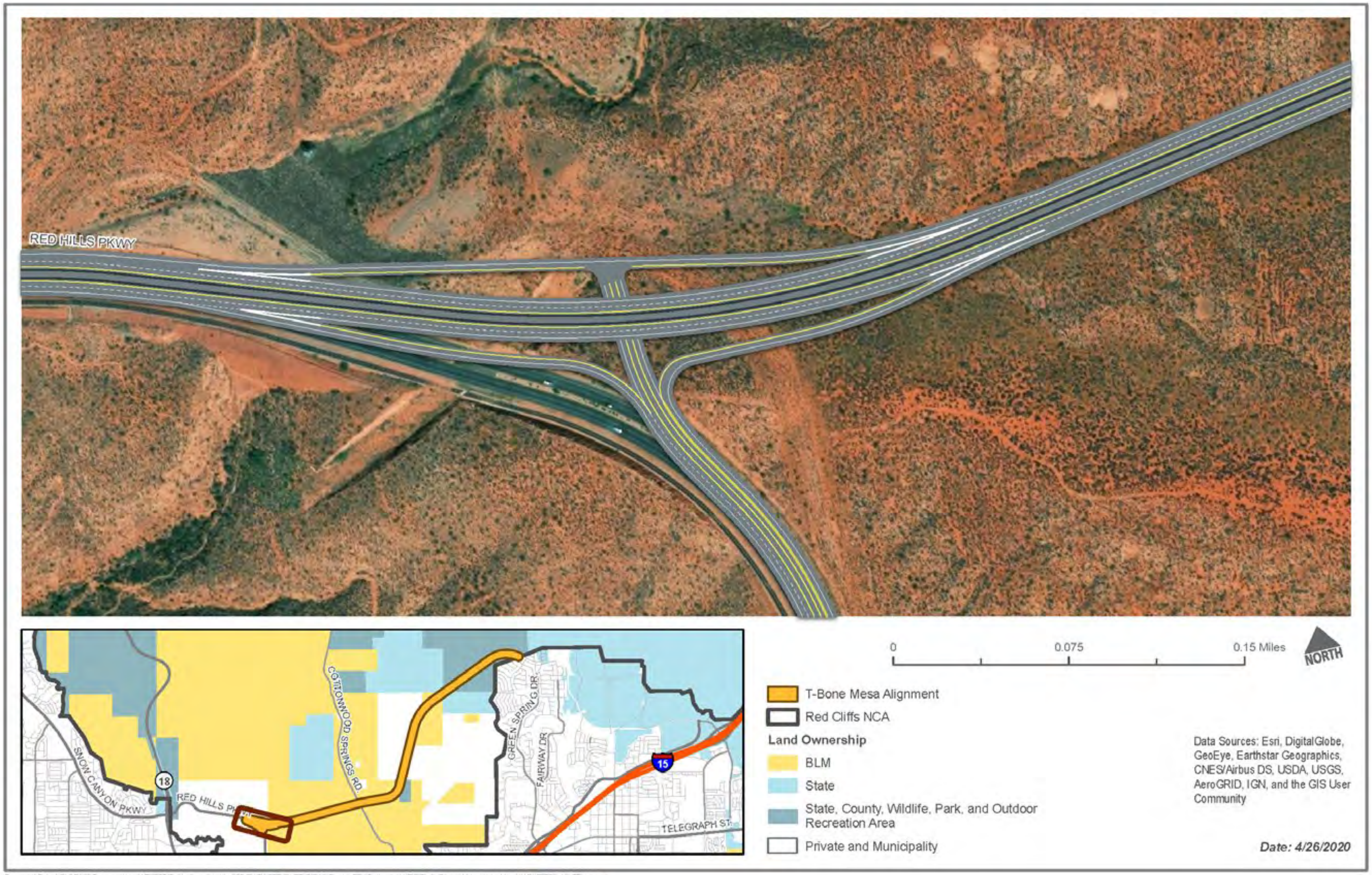



**Figure 7a. T-Bone Mesa Alignment Plan View (1 of 8)**

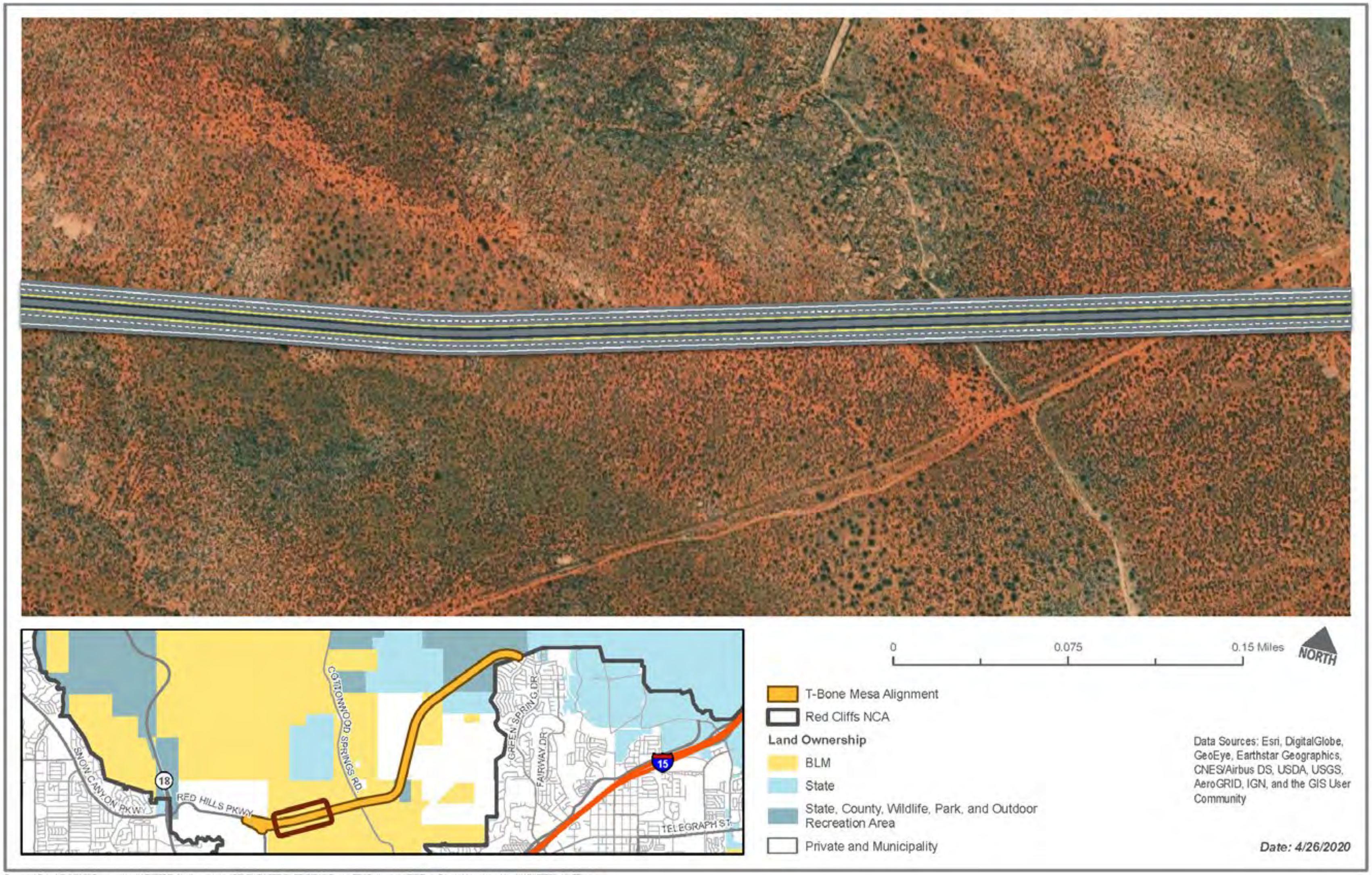



**Figure 7b. T-Bone Mesa Alignment Plan View (2 of 8)**

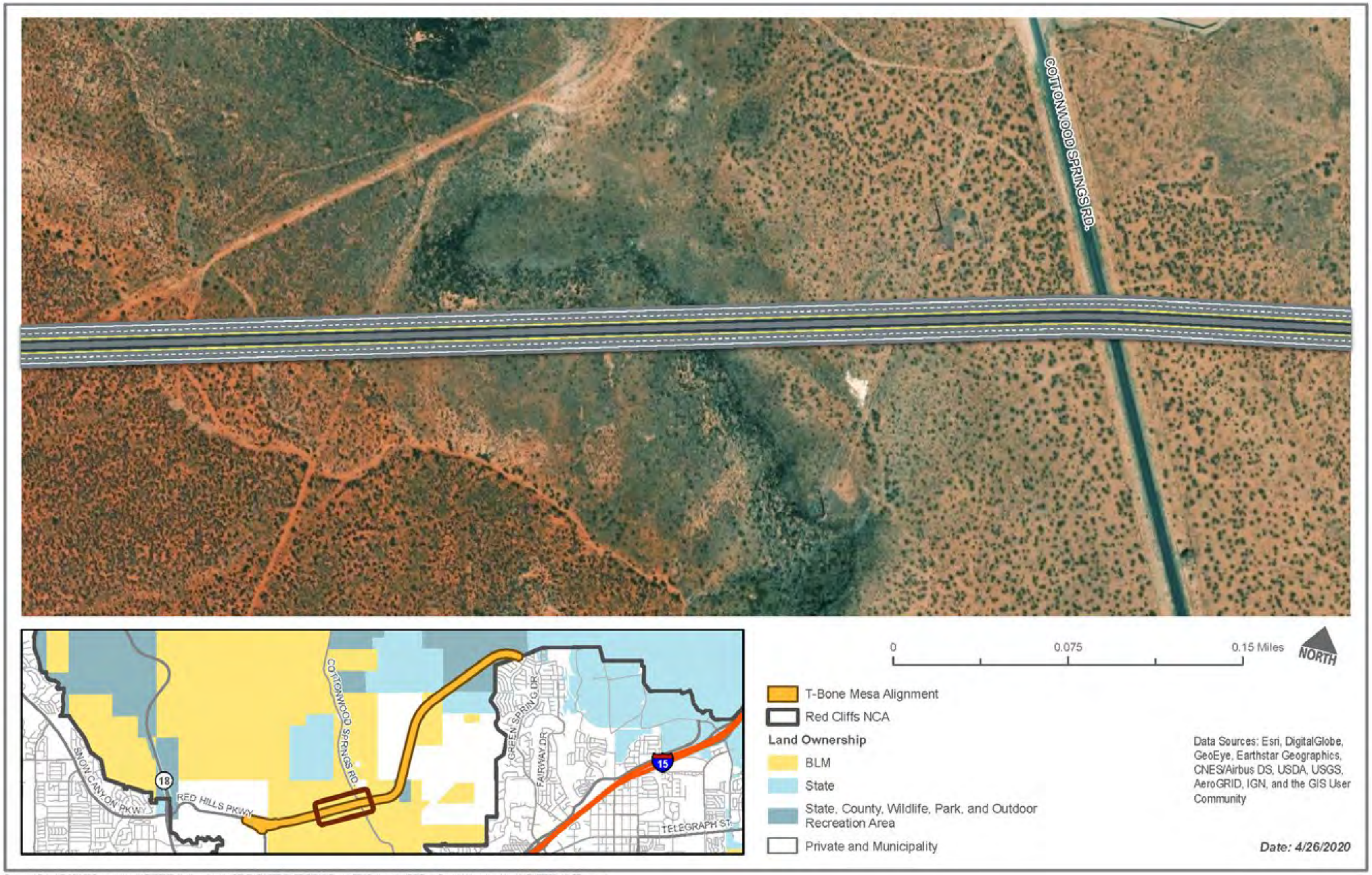



**Figure 7c.** **T-Bone Mesa Alignment Plan View (3 of 8)**

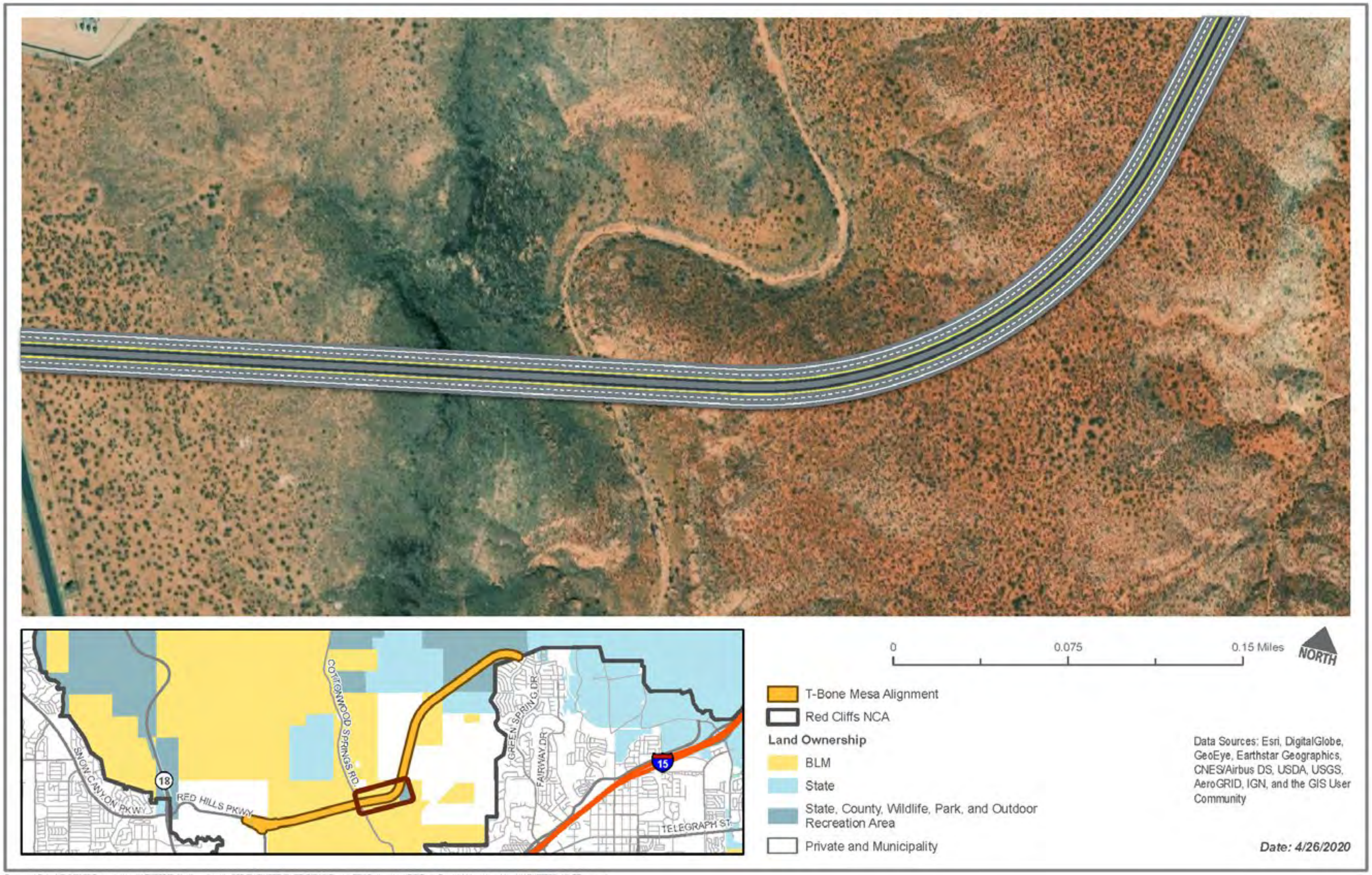



**Figure 7d.** **T-Bone Mesa Alignment Plan View (4 of 8)**

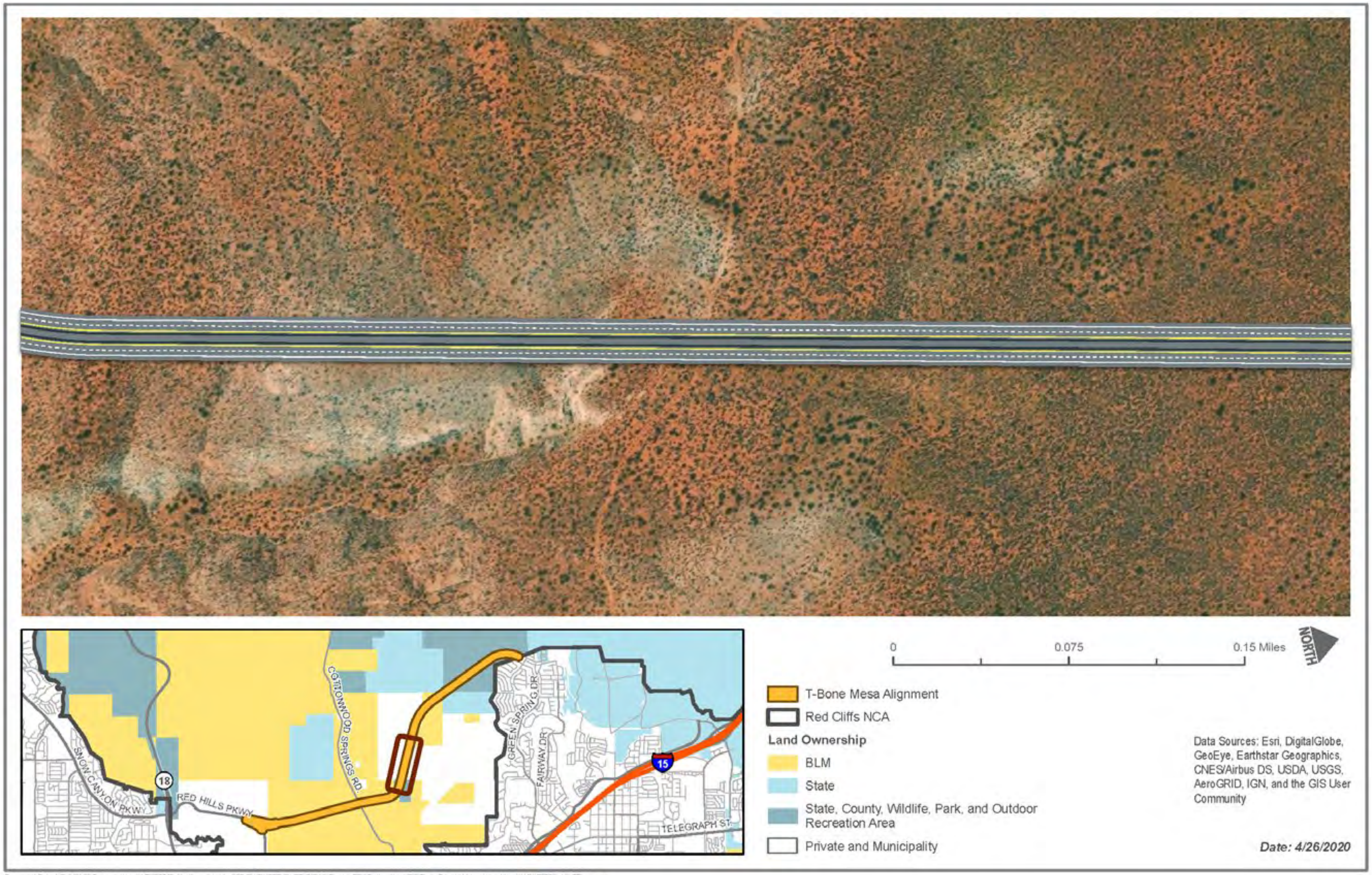



**Figure 7e. T-Bone Mesa Alignment Plan View (5 of 8)**

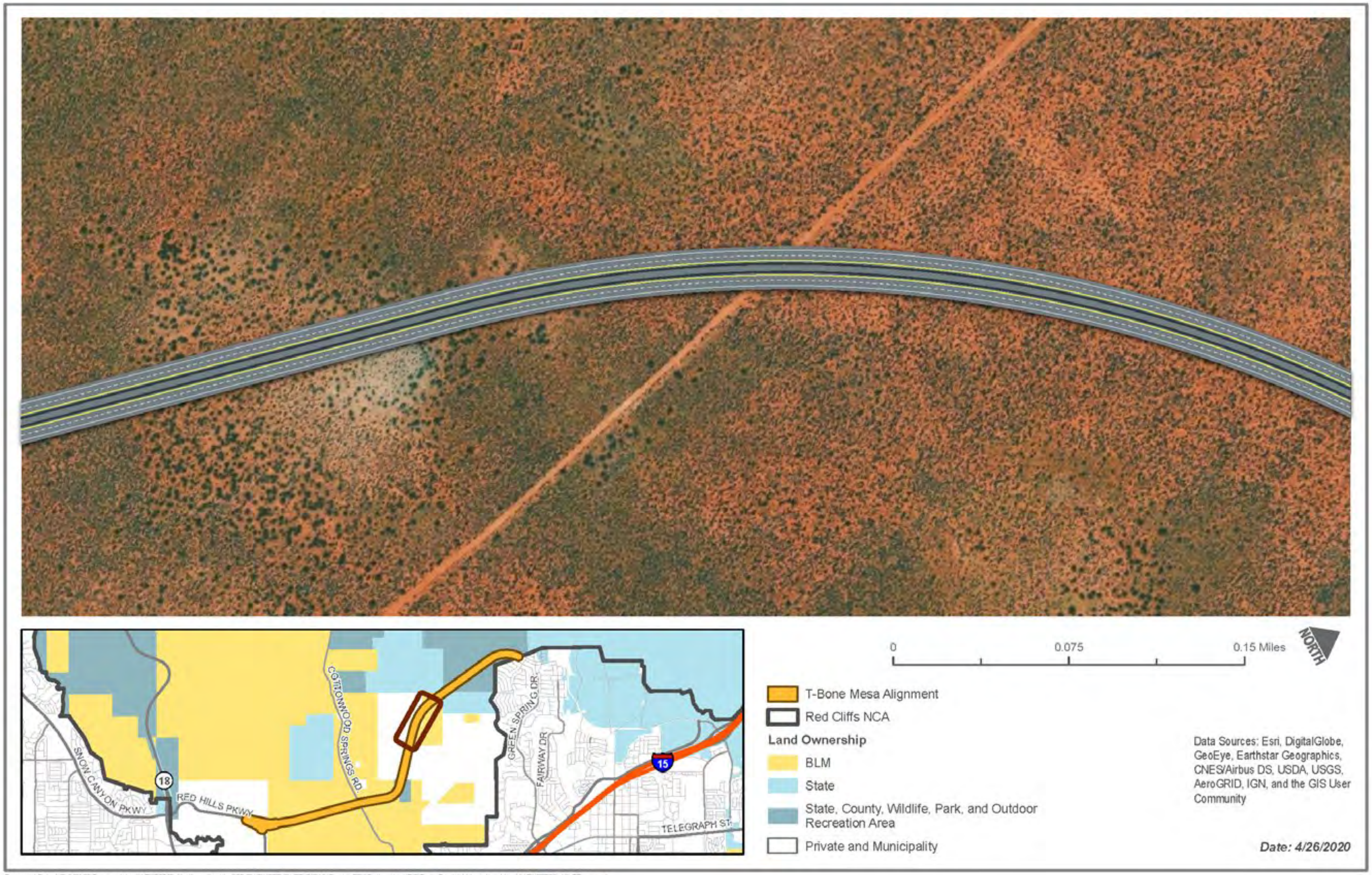



**Figure 7f. T-Bone Mesa Alignment Plan View (6 of 8)**


**Figure 7g. T-Bone Mesa Alignment Plan View (7 of 8)**

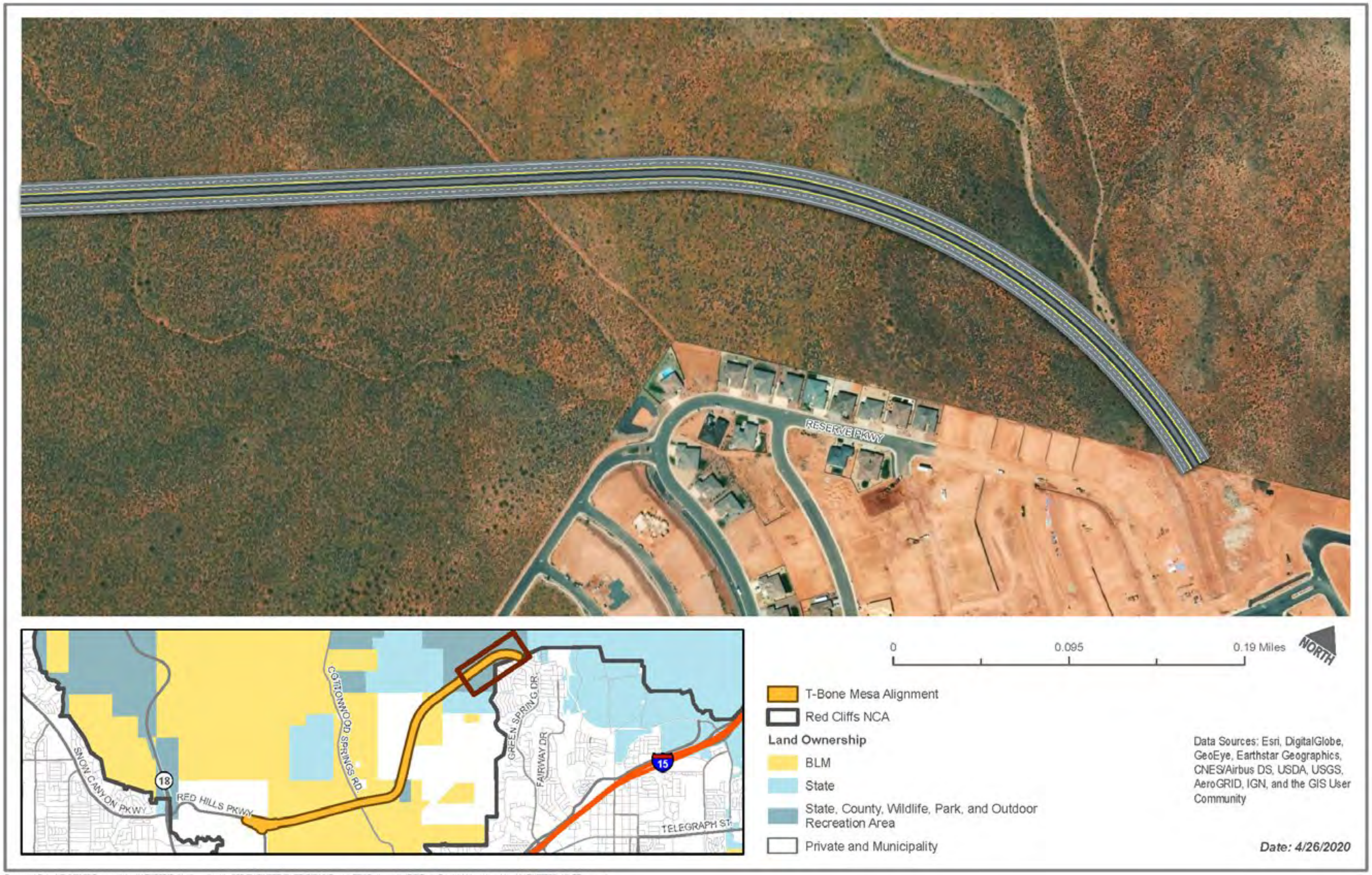



**Figure 7h. T-Bone Mesa Alignment Plan View (8 of 8)**

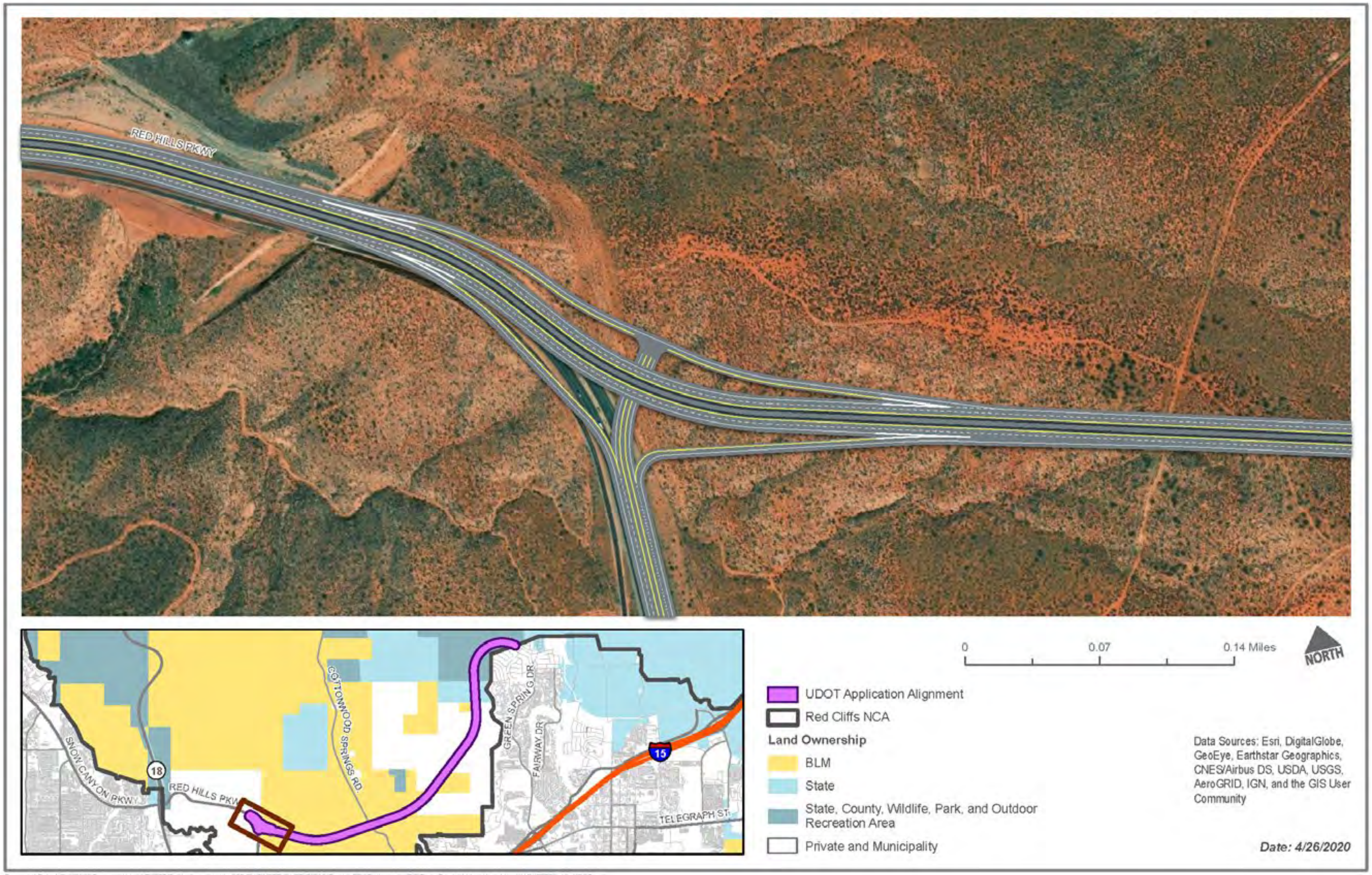



**Figure 8a. UDOT Application Alignment Plan View (1 of 9)**

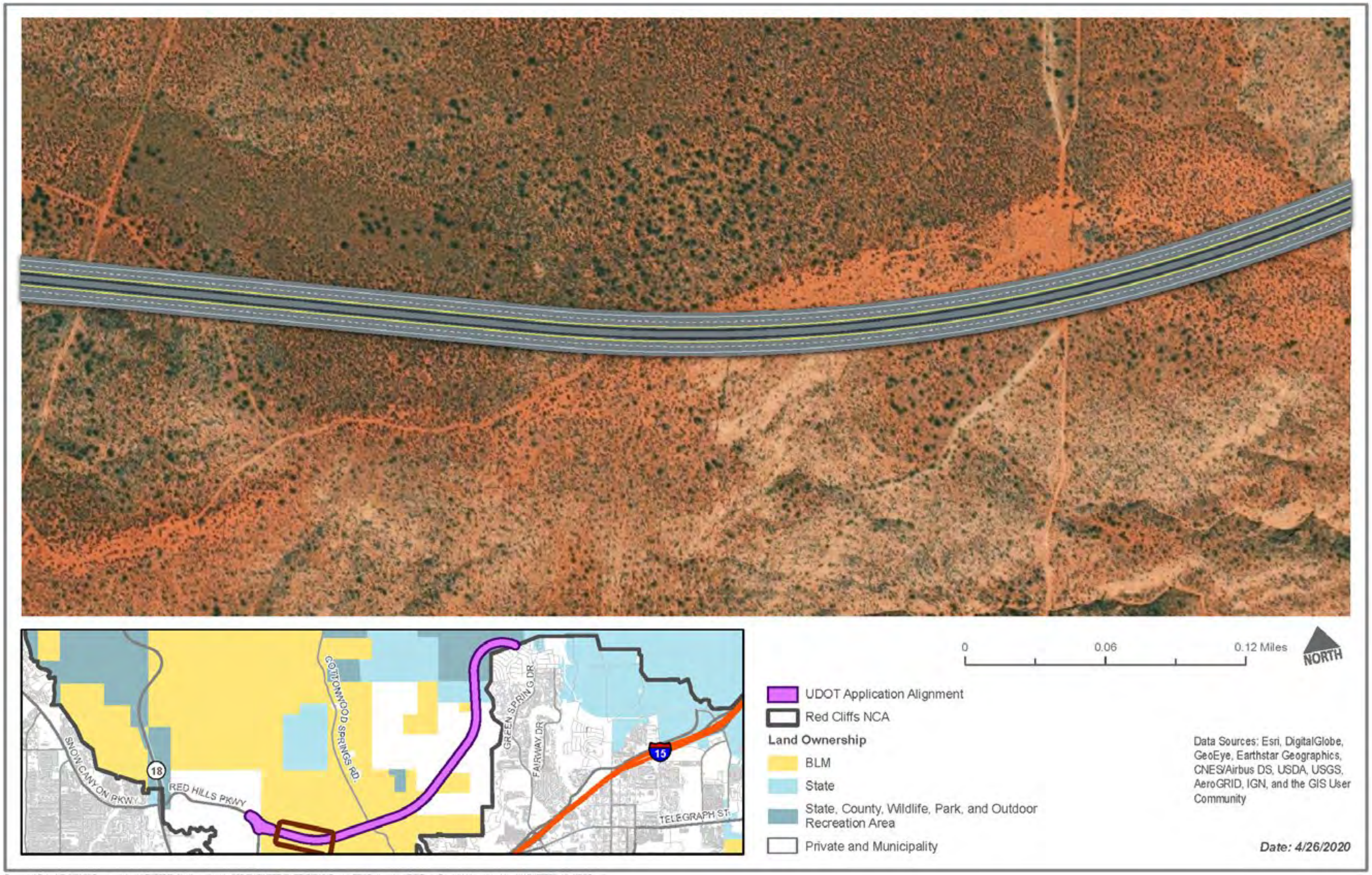



**Figure 8b. UDOT Application Alignment Plan View (2 of 9)**

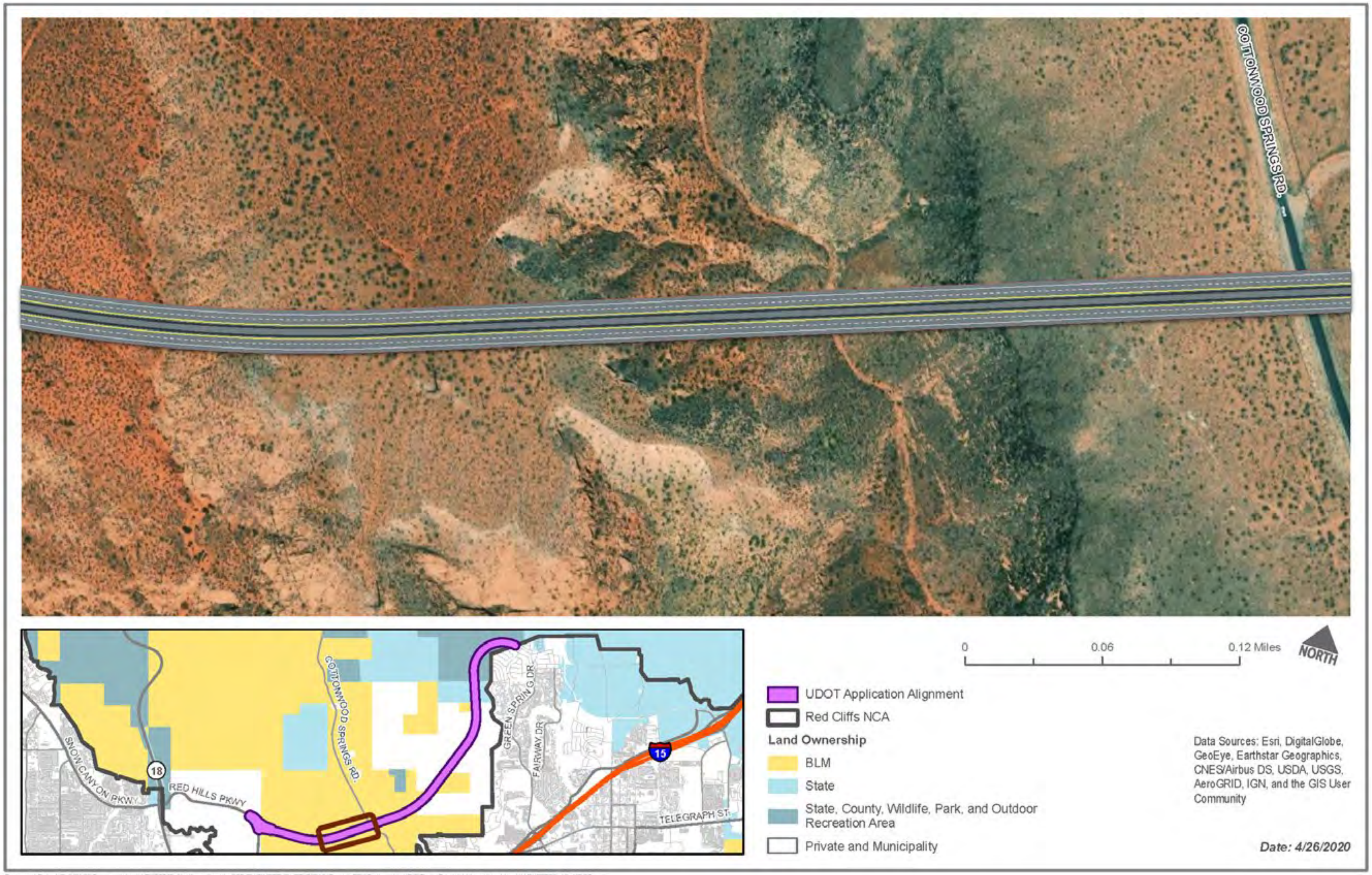



**Figure 8c.** **UDOT Application Alignment Plan View (3 of 9)**

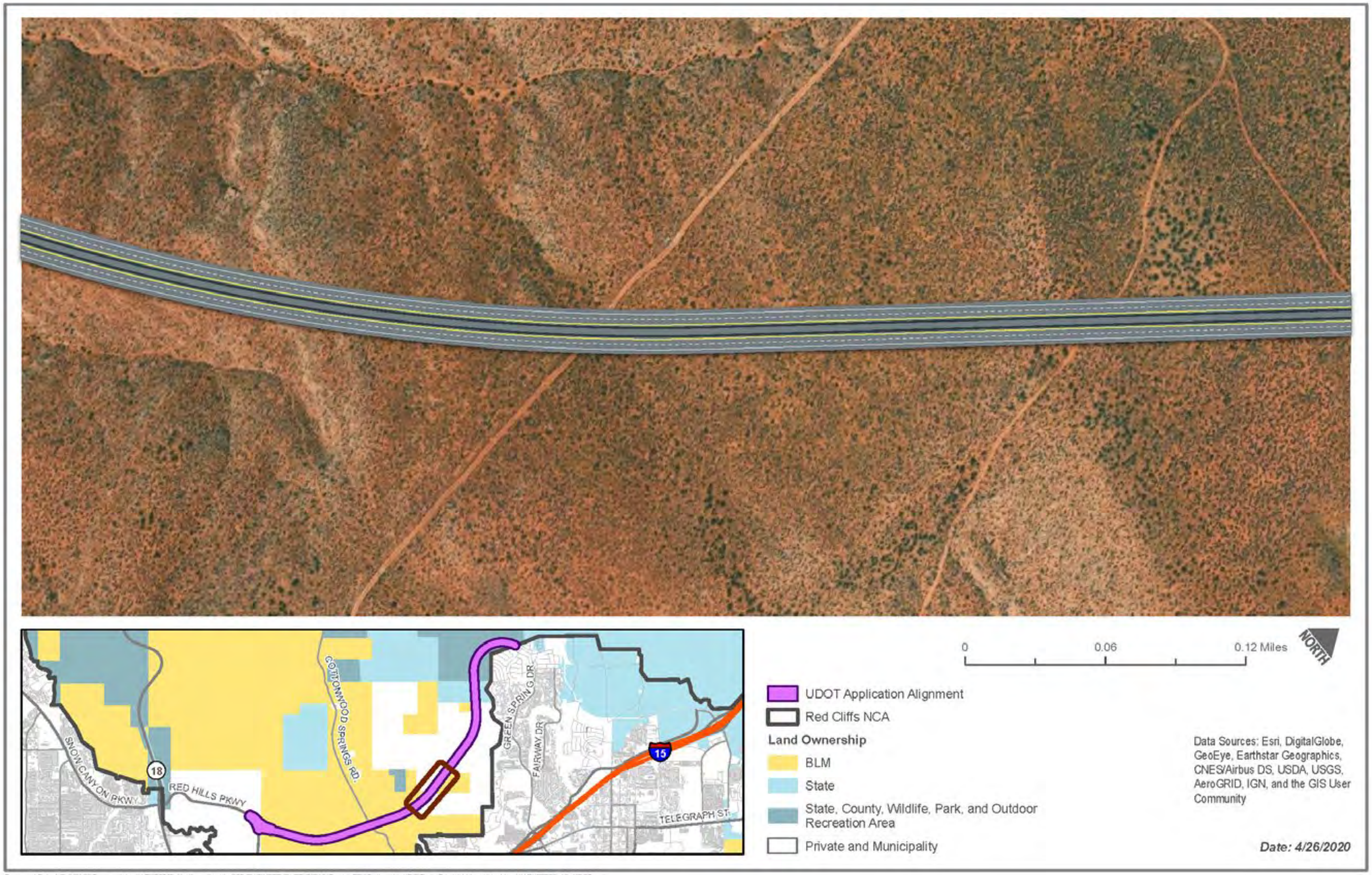



**Figure 8d. UDOT Application Alignment Plan View (4 of 9)**

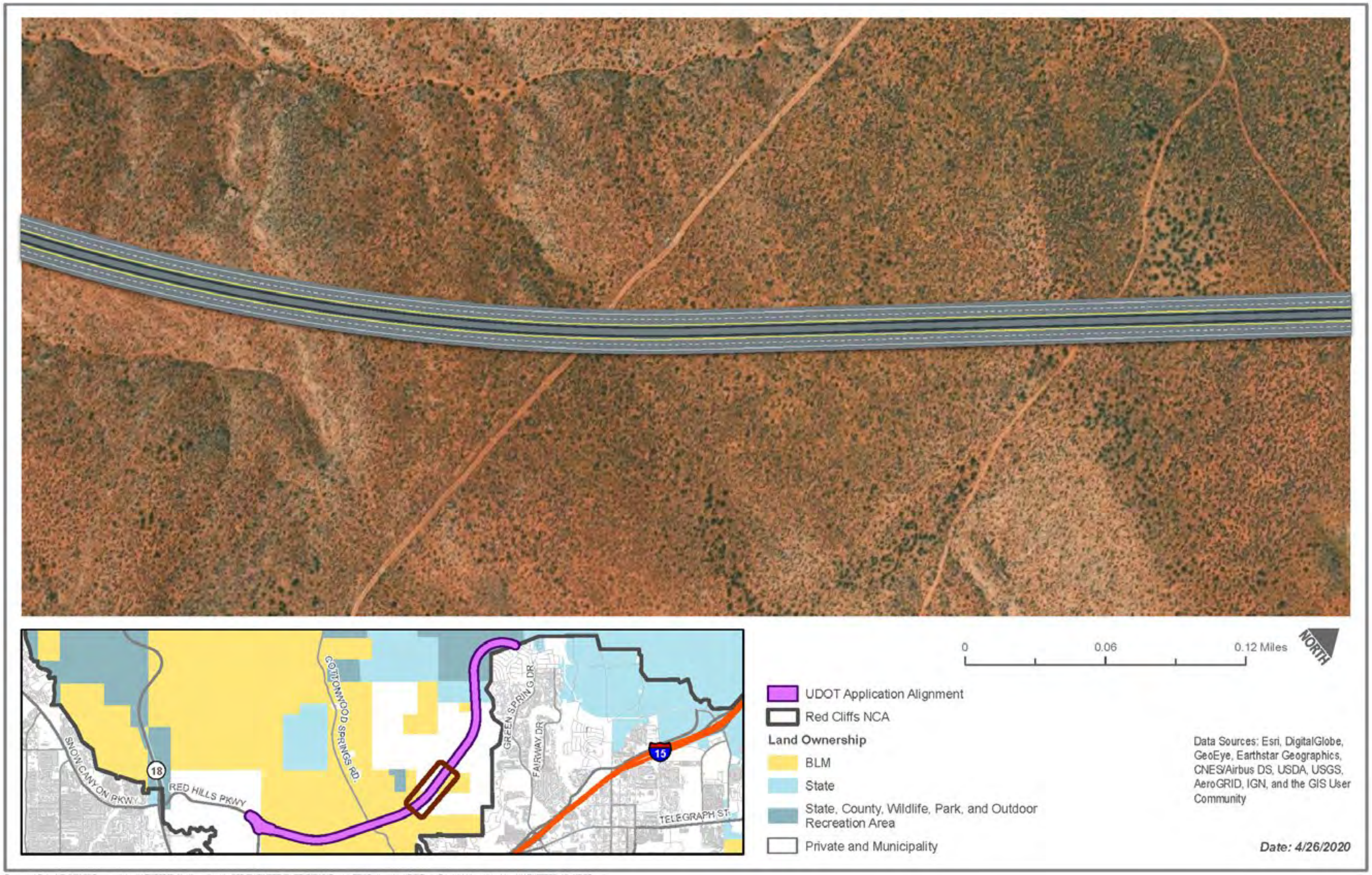



**Figure 8e. UDOT Application Alignment Plan View (5 of 9)**

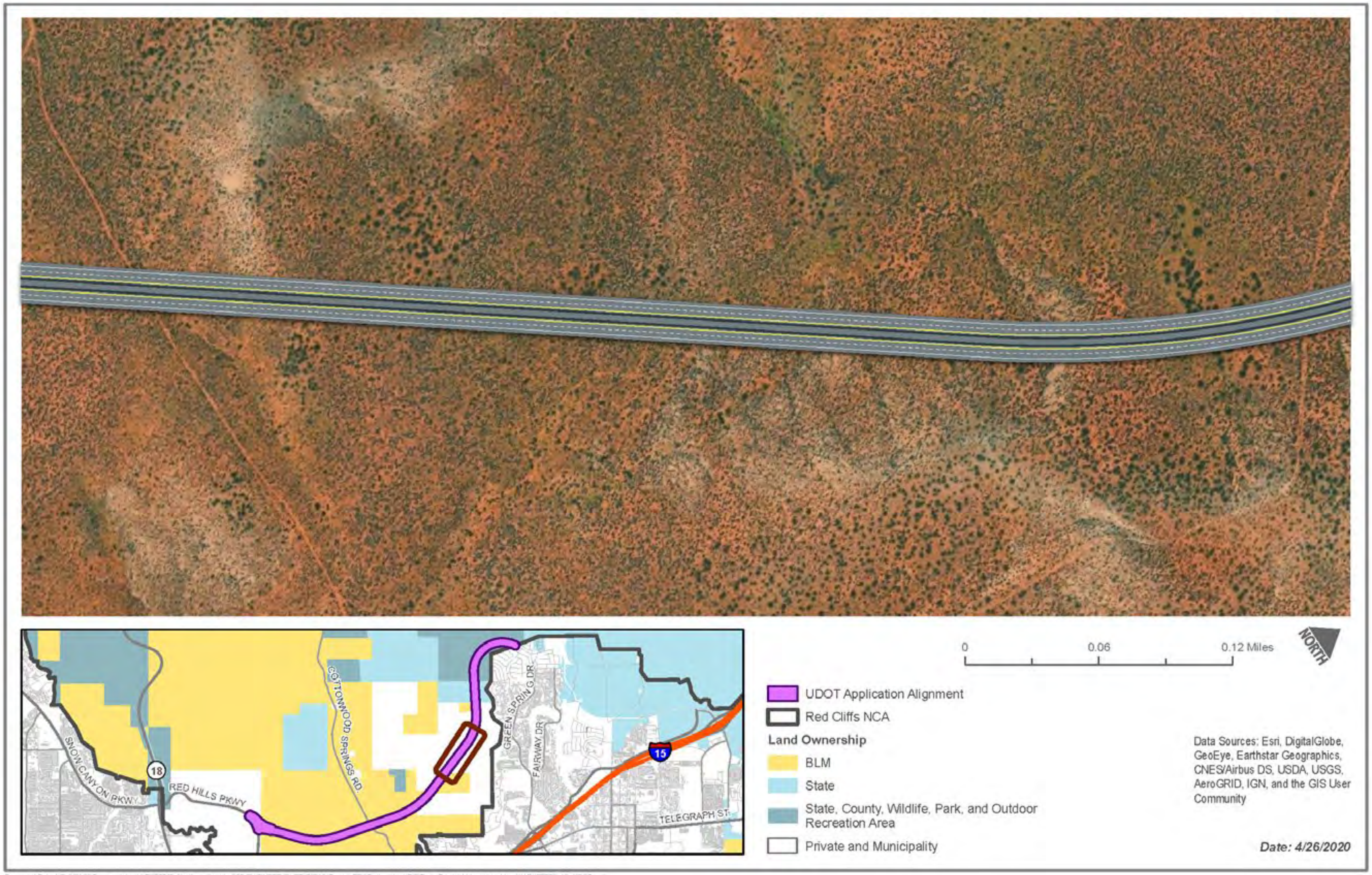



**Figure 8f. UDOT Application Alignment Plan View (6 of 9)**

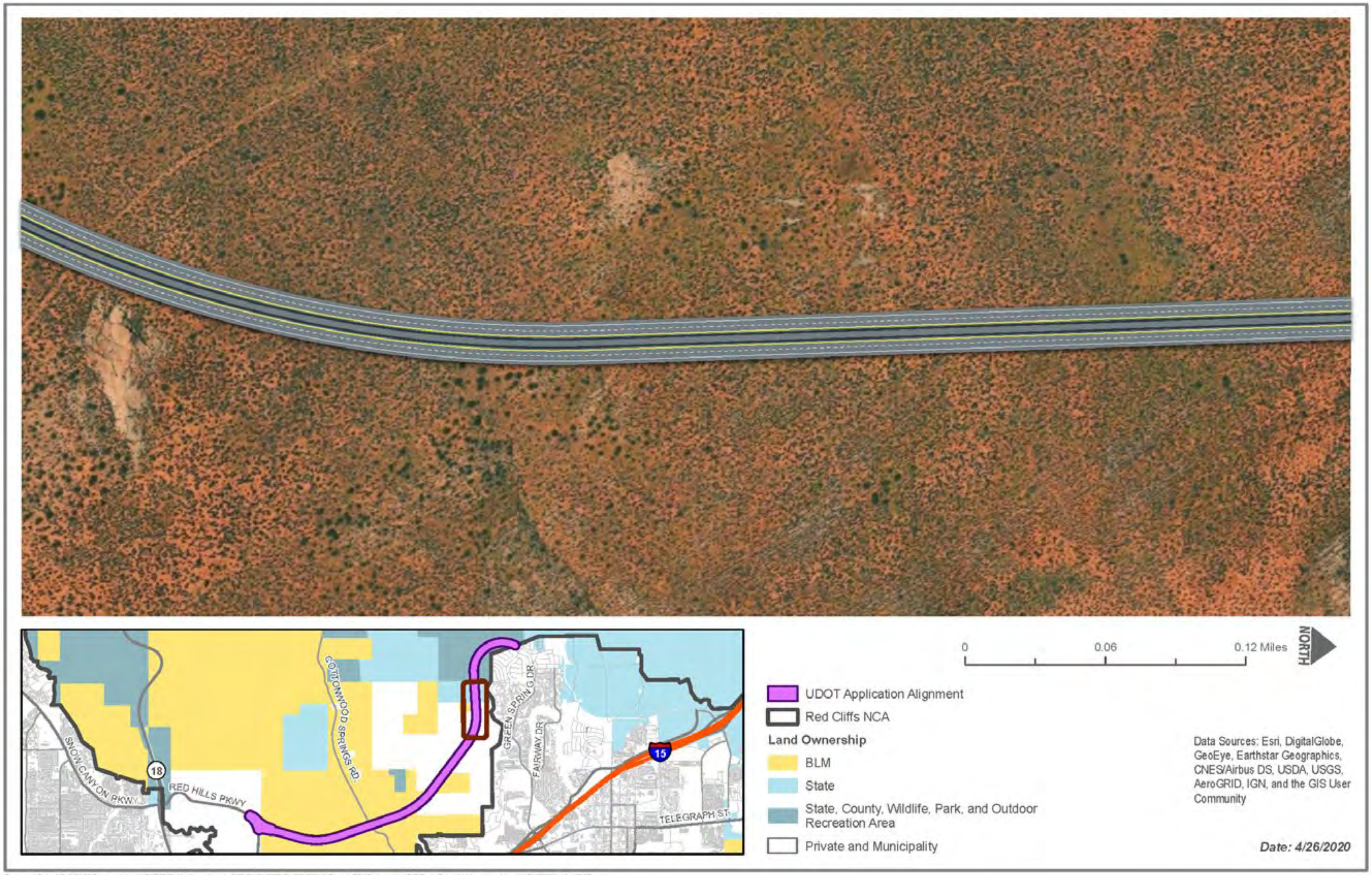



**Figure 8g. UDOT Application Alignment Plan View (7 of 9)**

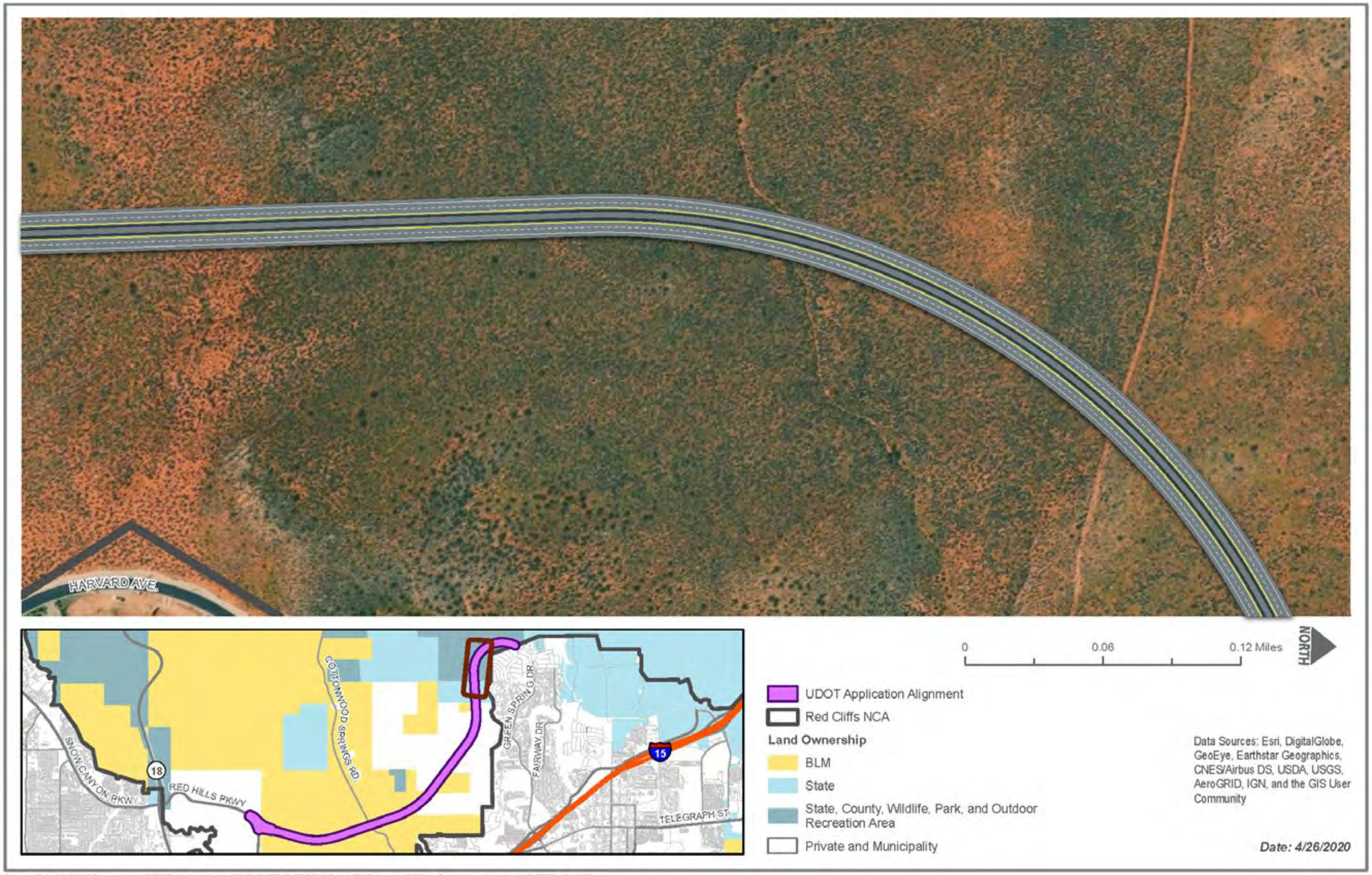



**Figure 8h. UDOT Application Alignment Plan View (8 of 9)**

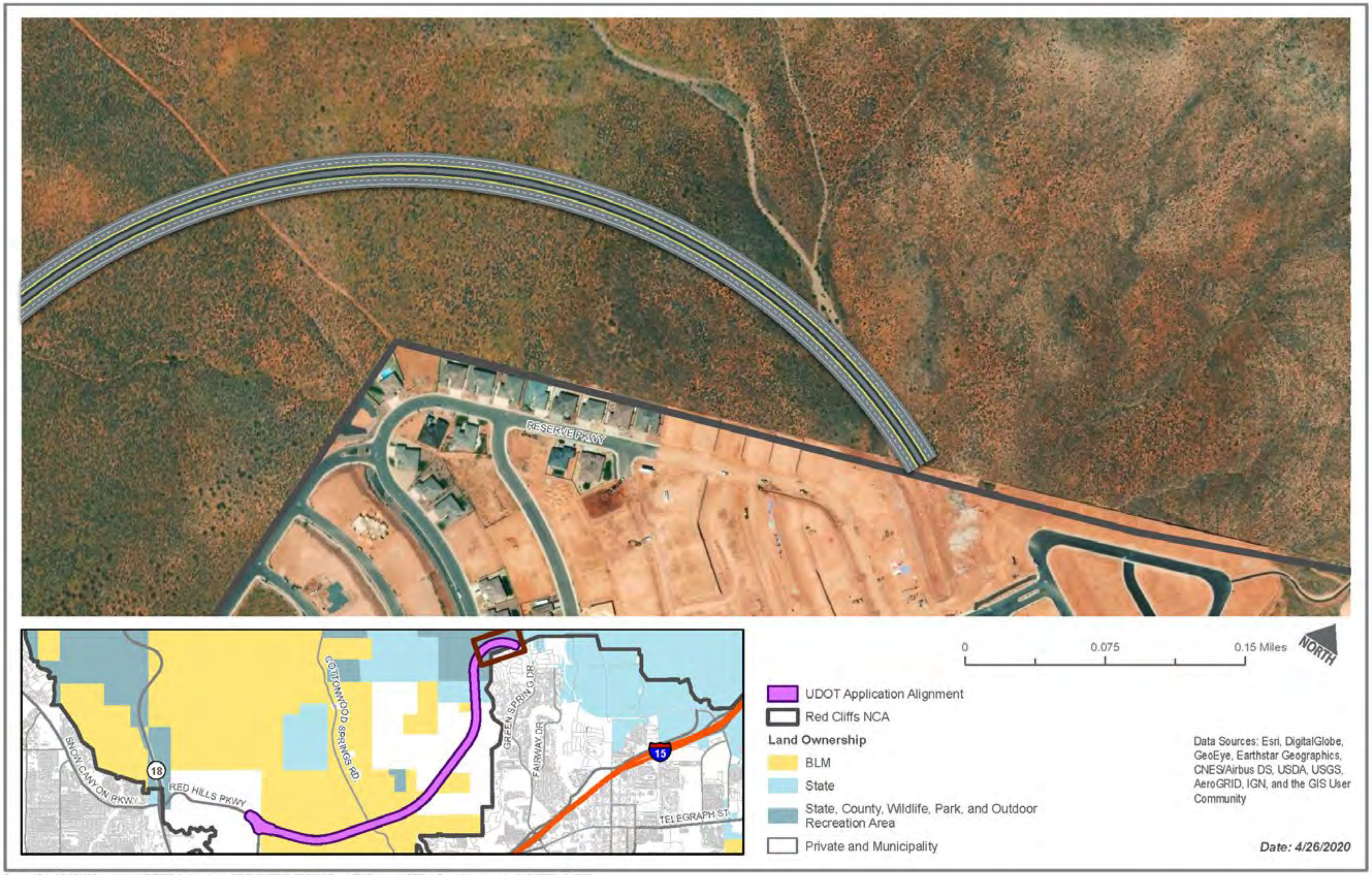



**Figure 8i. UDOT Application Alignment Plan View (9 of 9)**

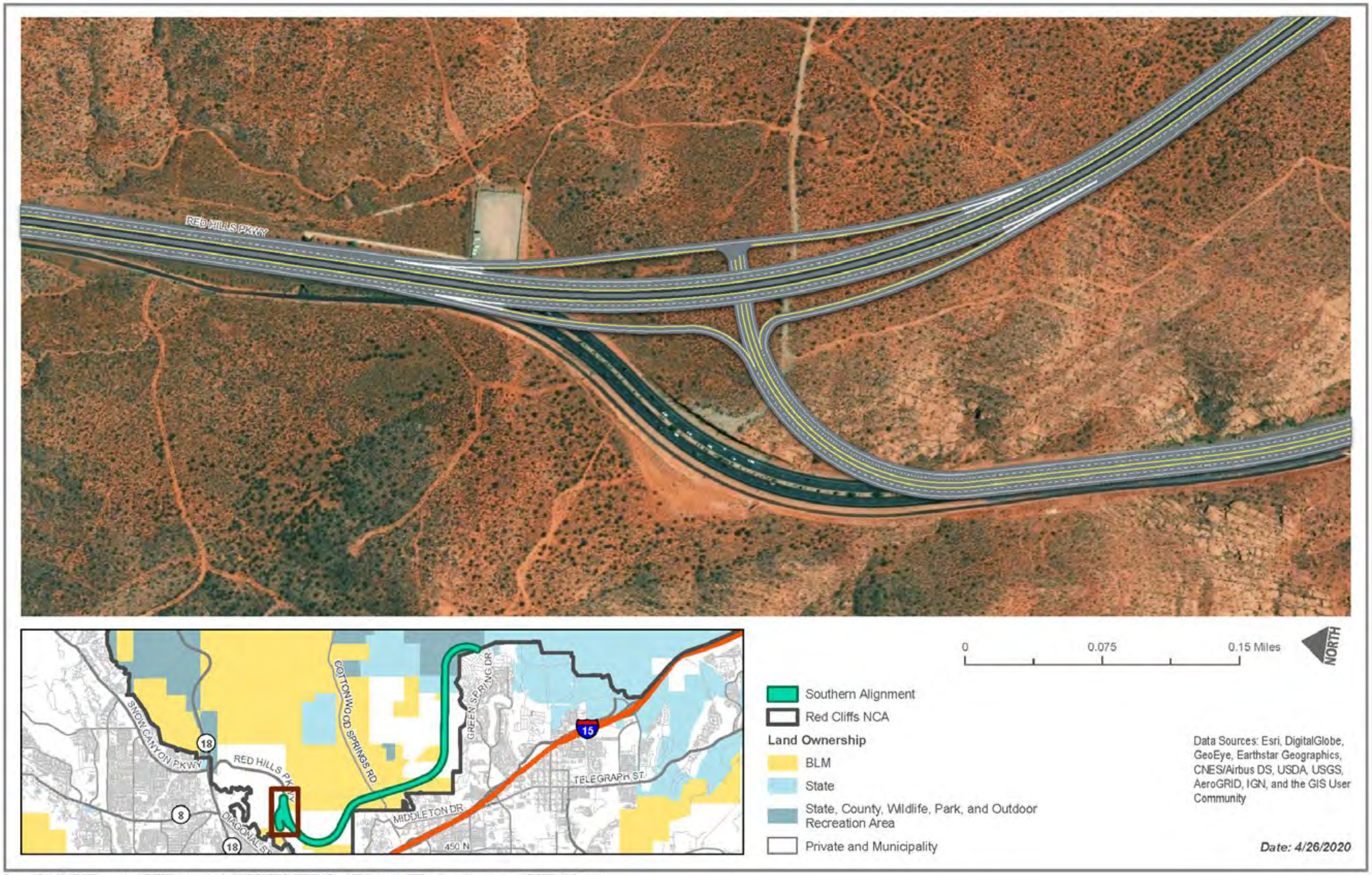



**Figure 9a.** **Southern Alignment Plan View (1 of 11)**

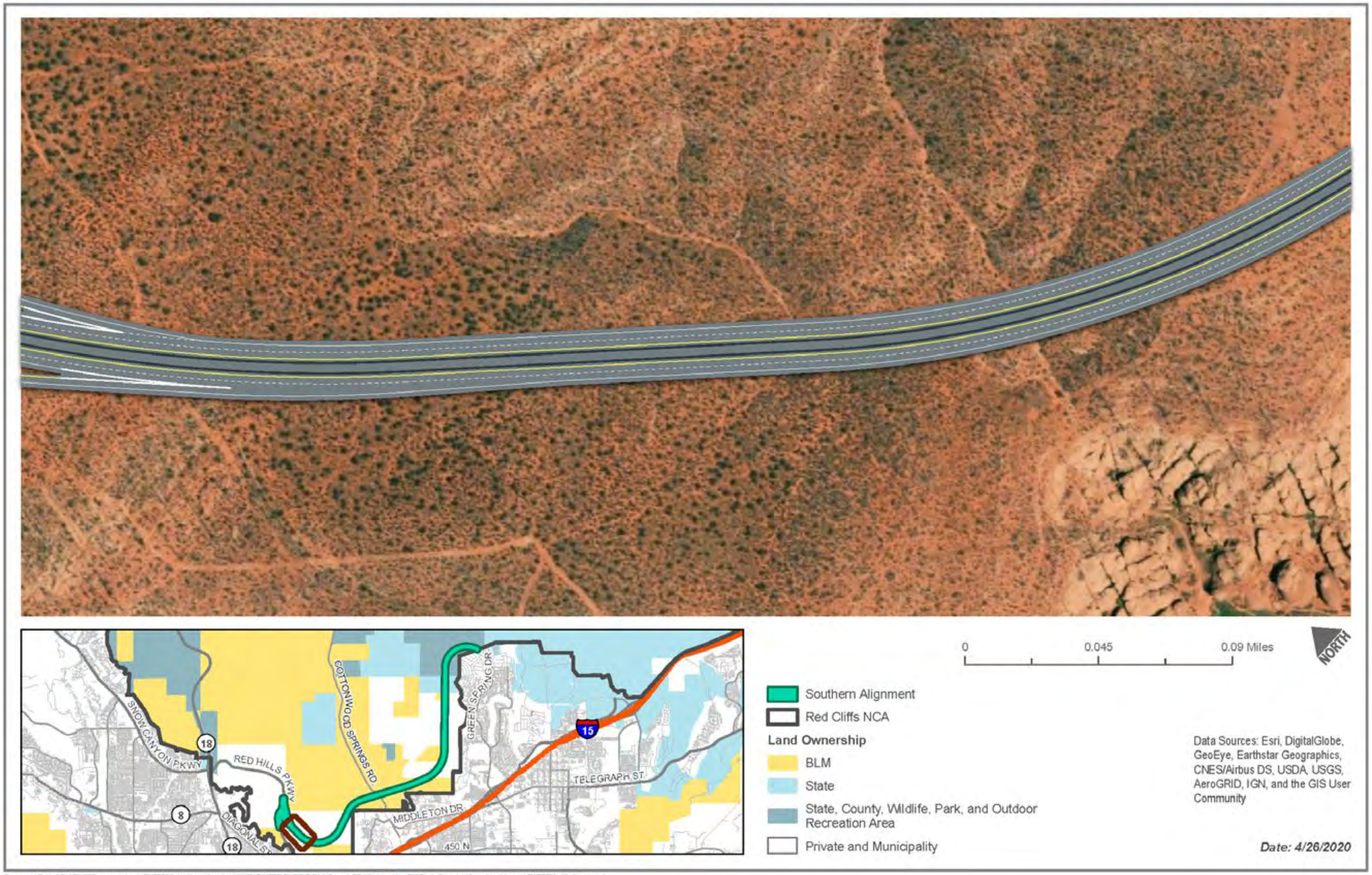



**Figure 9b. Southern Alignment Plan View (2 of 11)**

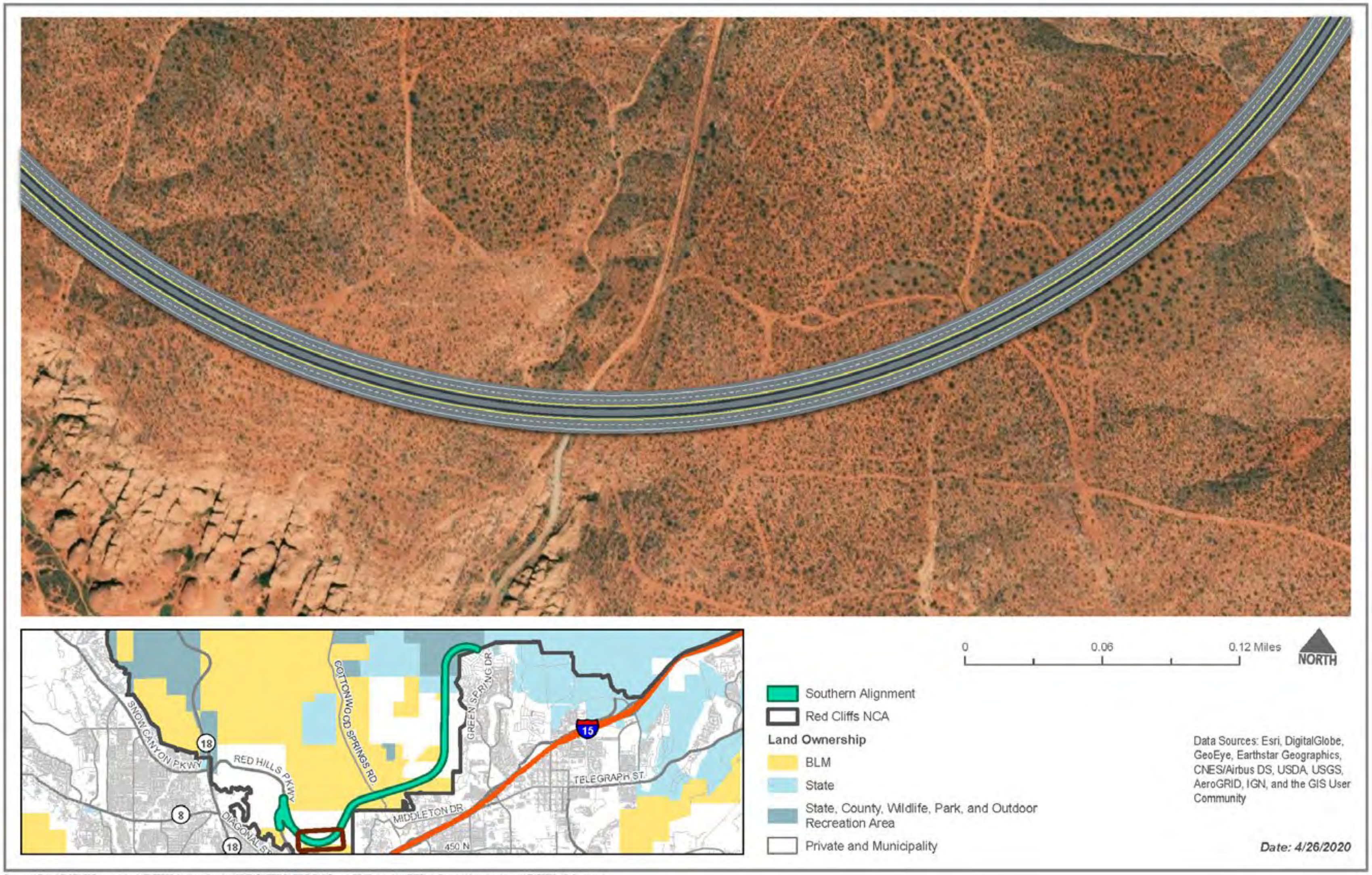



**Figure 9c. Southern Alignment Plan View (3 of 11)**

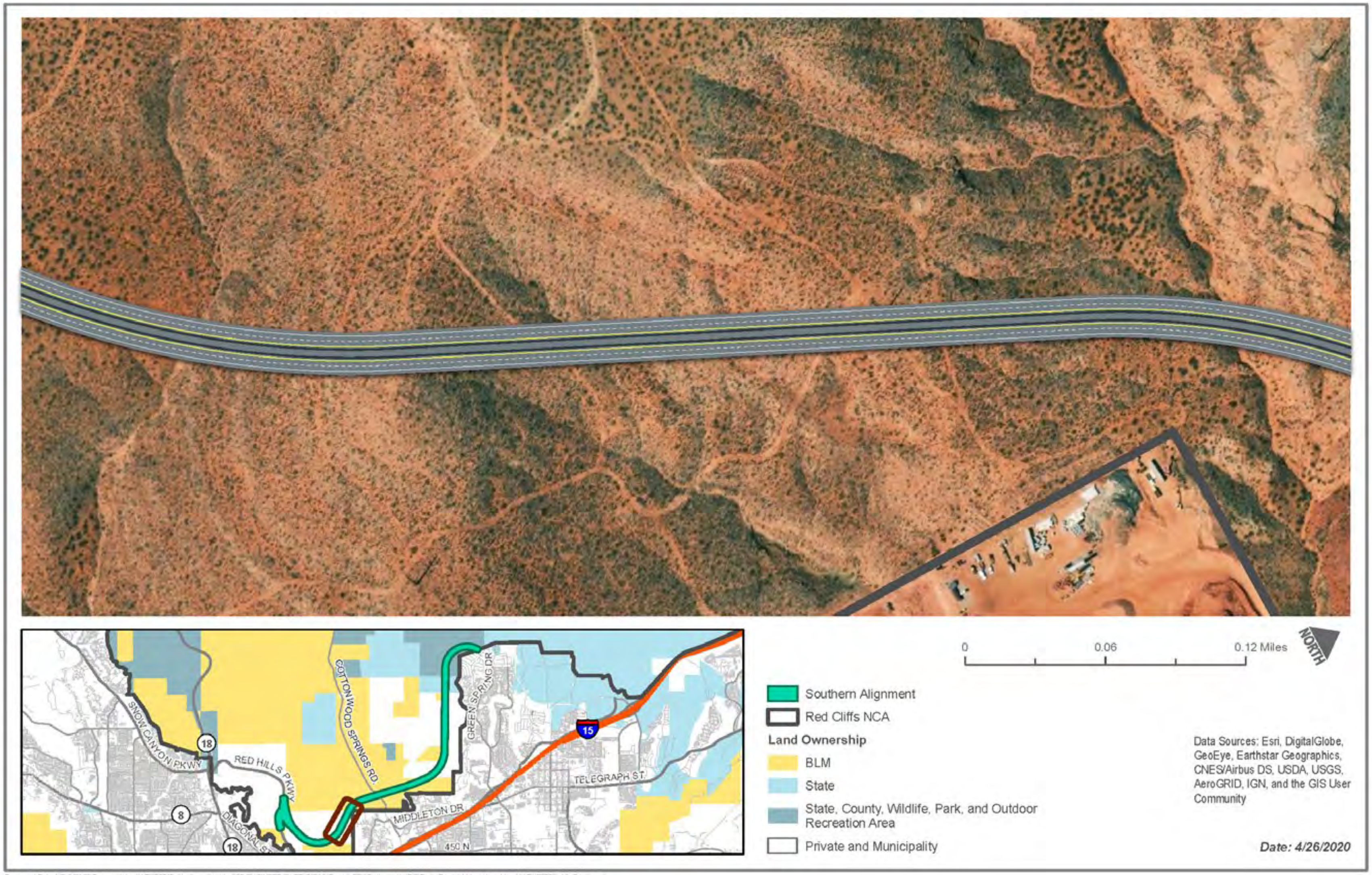



**Figure 9d.** **Southern Alignment Plan View (4 of 11)**

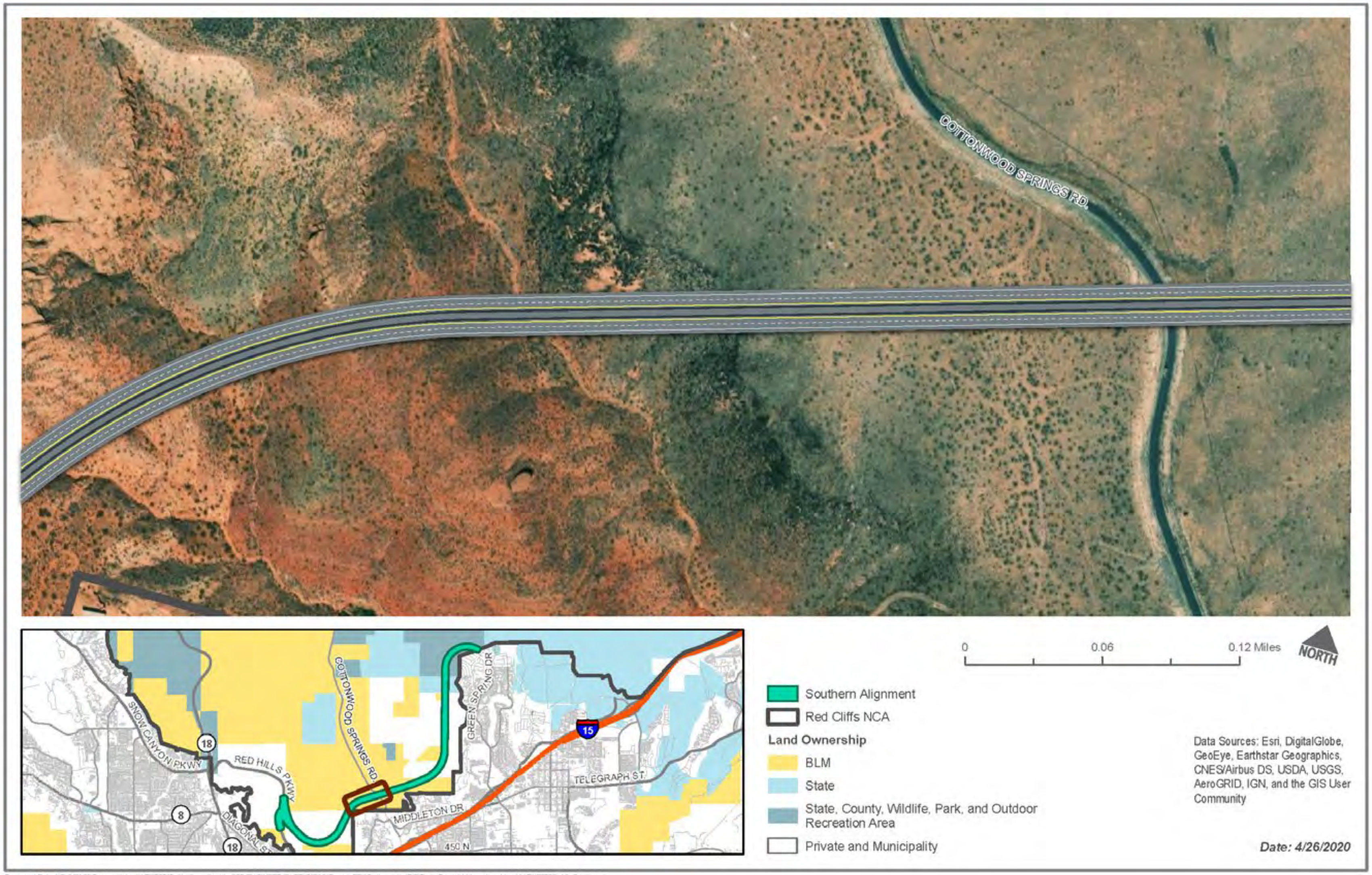



**Figure 9e. Southern Alignment Plan View (5 of 11)**

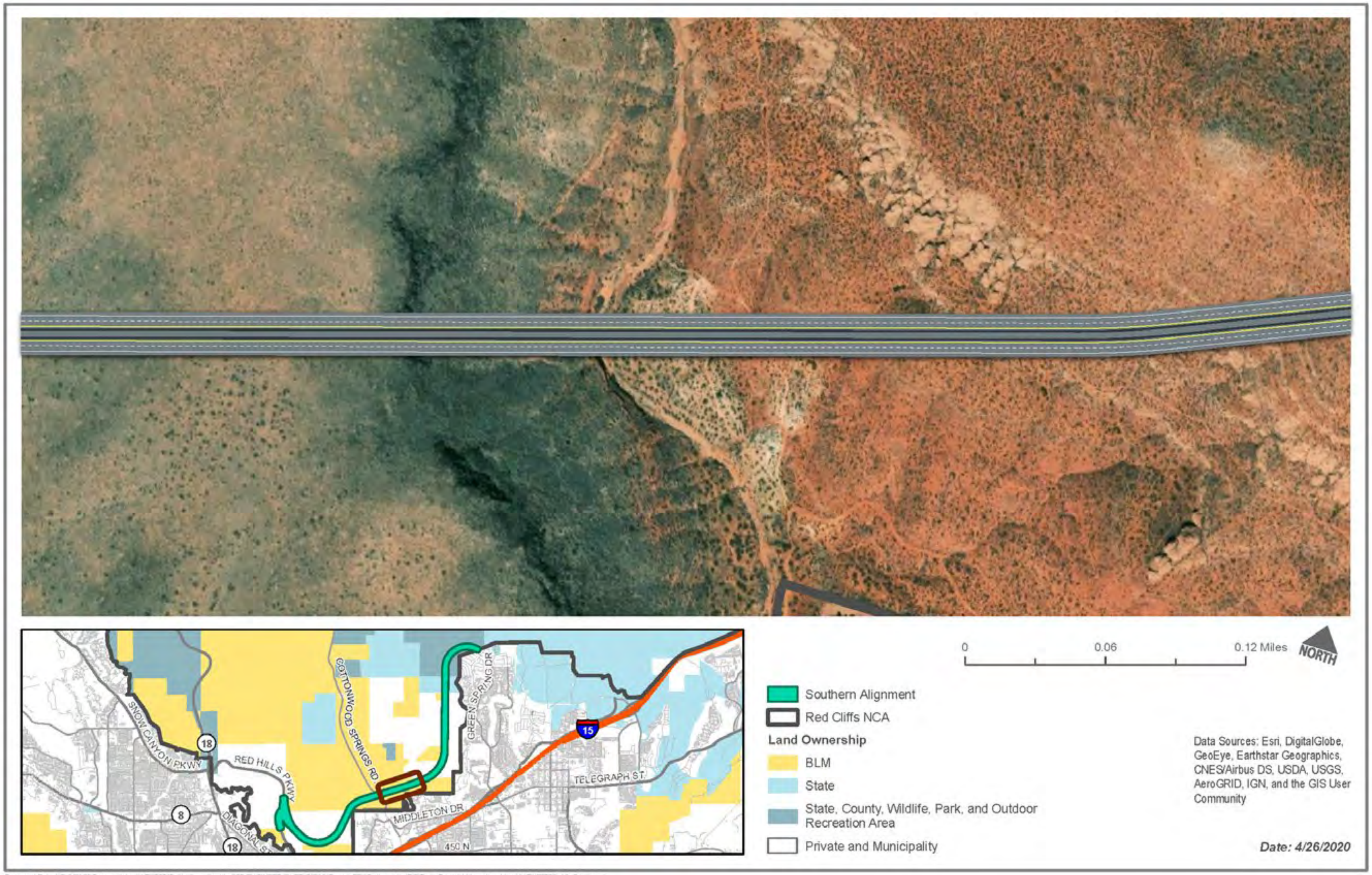



**Figure 9f. Southern Alignment Plan View (6 of 11)**

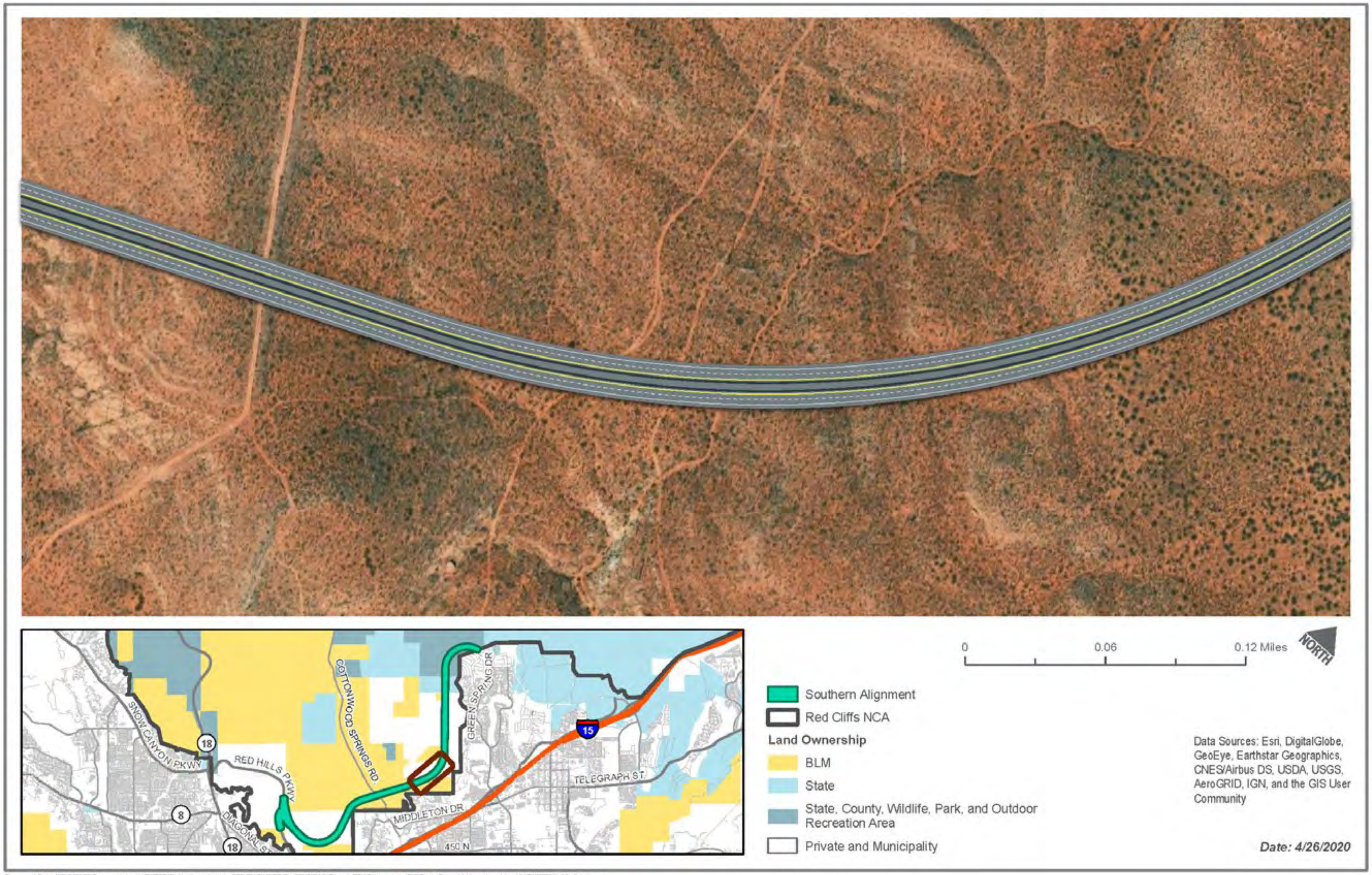



**Figure 9g.** **Southern Alignment Plan View (7 of 11)**

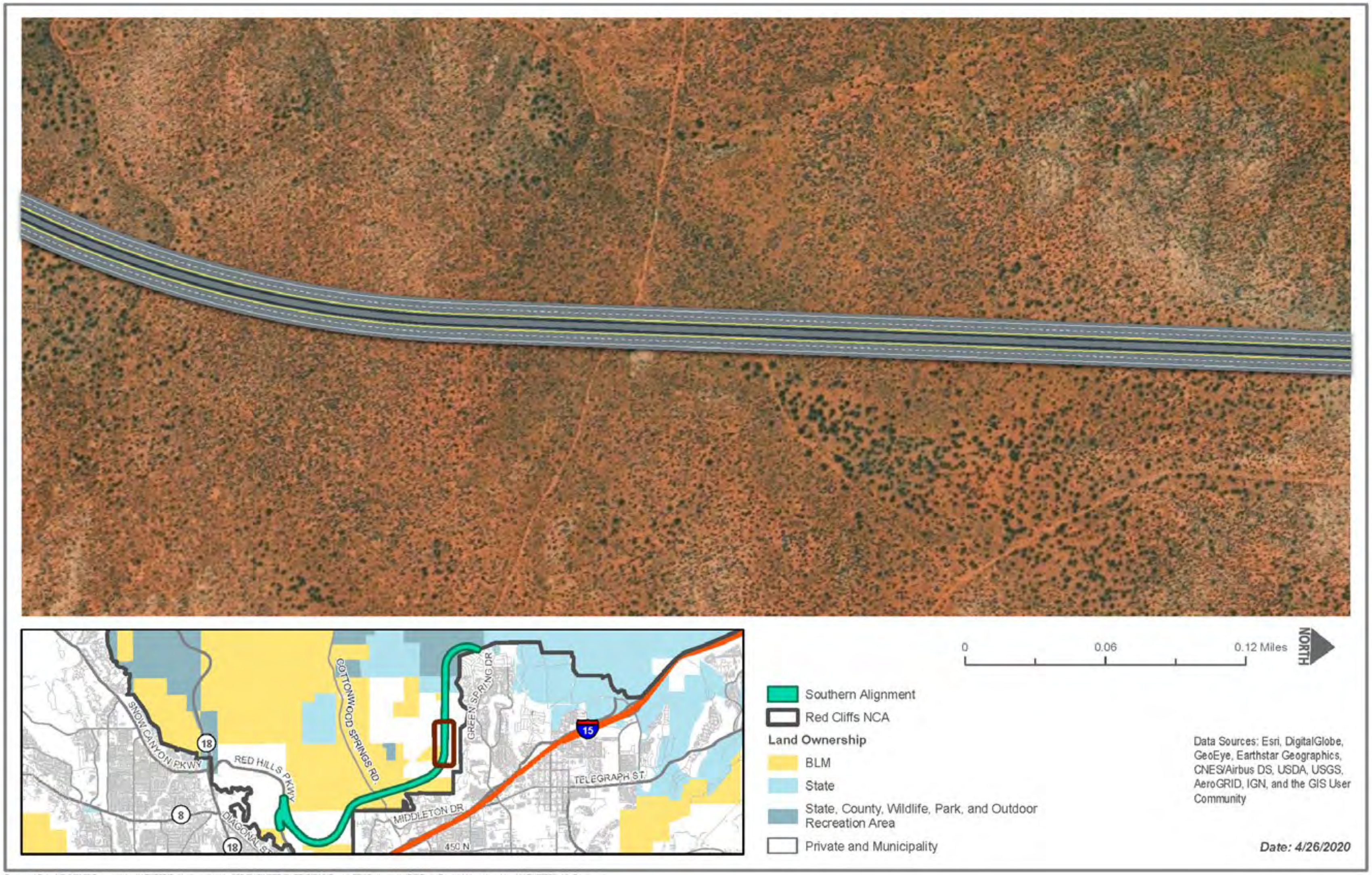



**Figure 9h. Southern Alignment Plan View (8 of 11)**

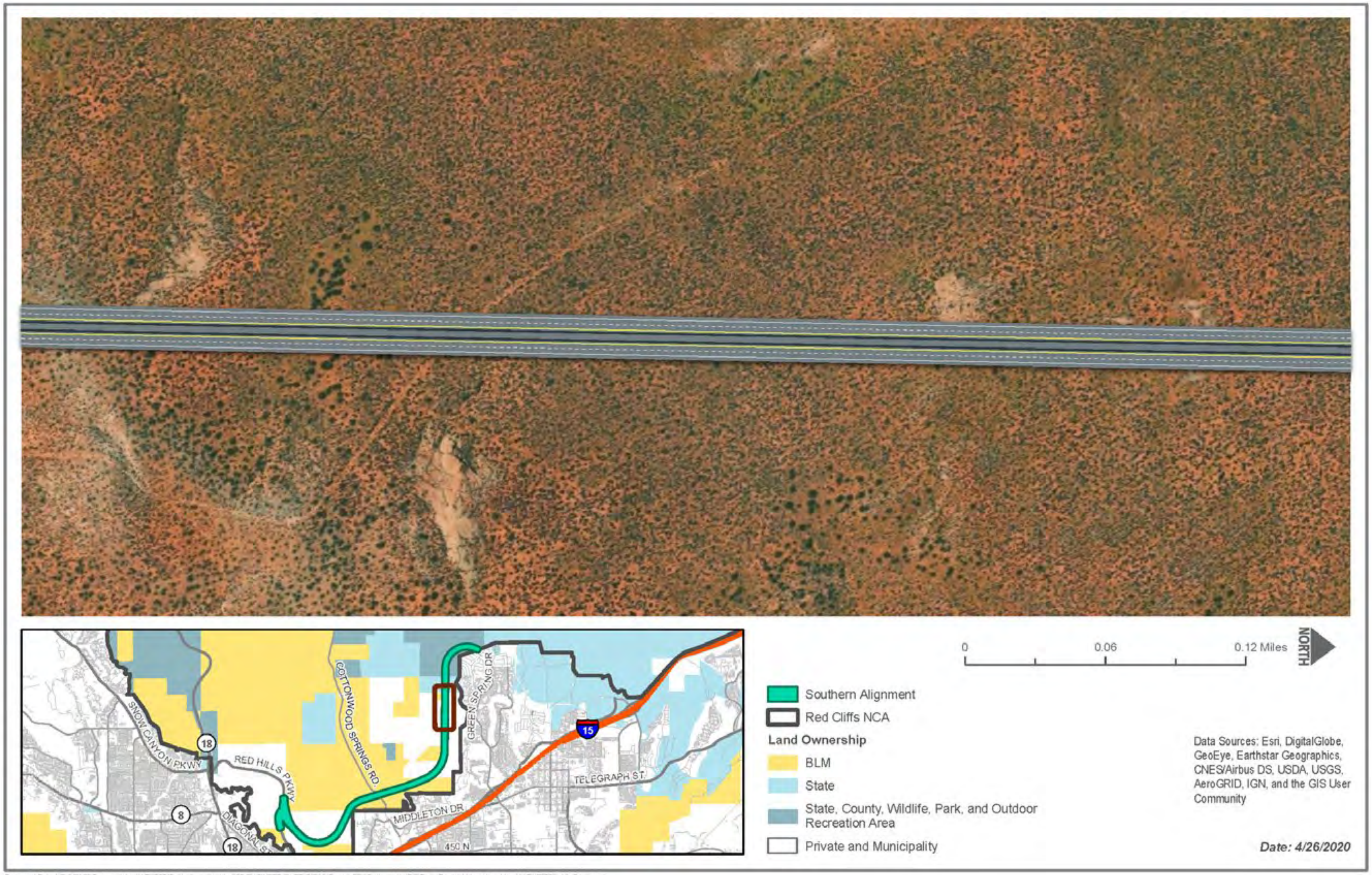



**Figure 9i. Southern Alignment Plan View (9 of 11)**

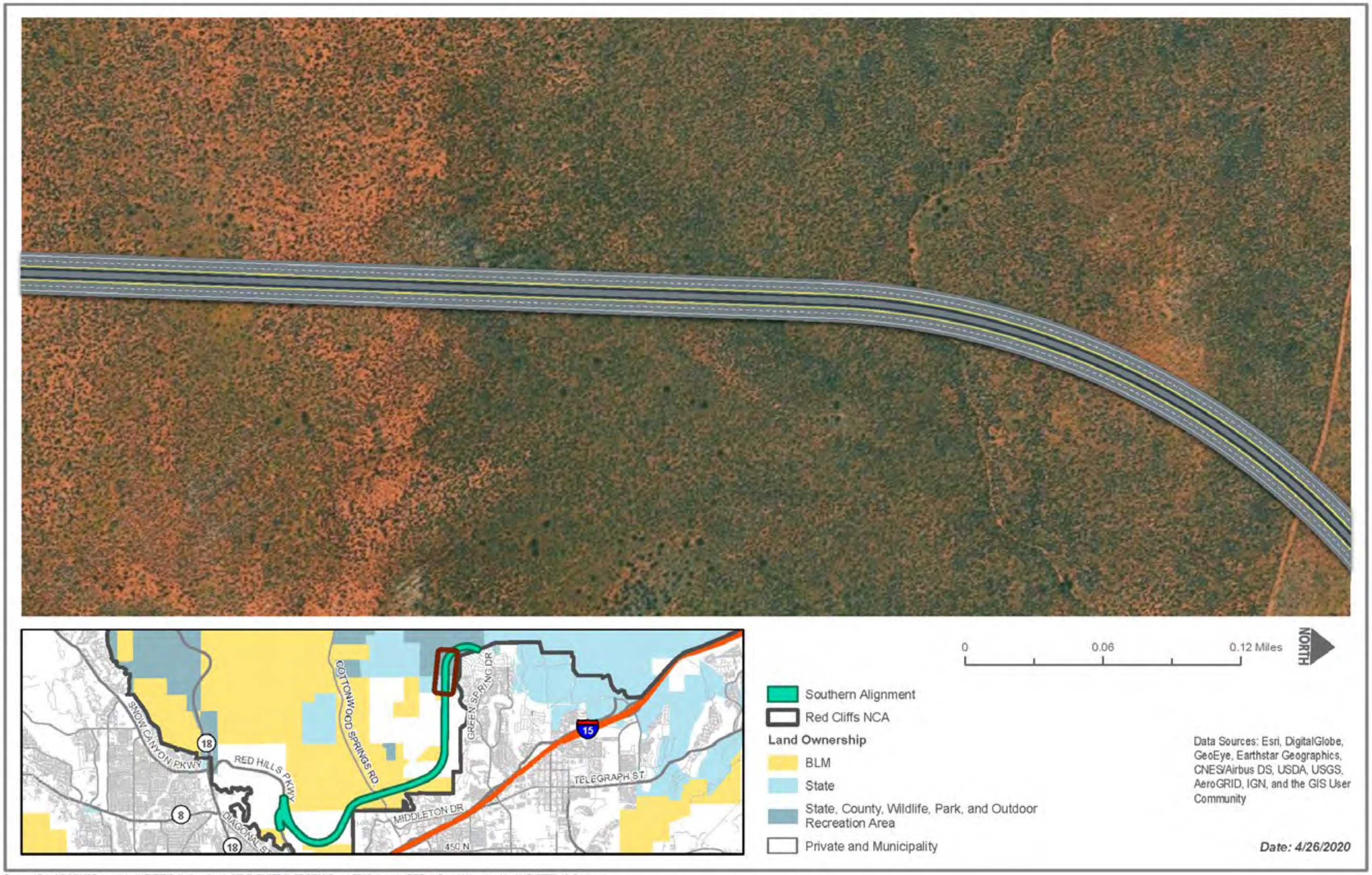



**Figure 9j. Southern Alignment Plan View (10 of 11)**

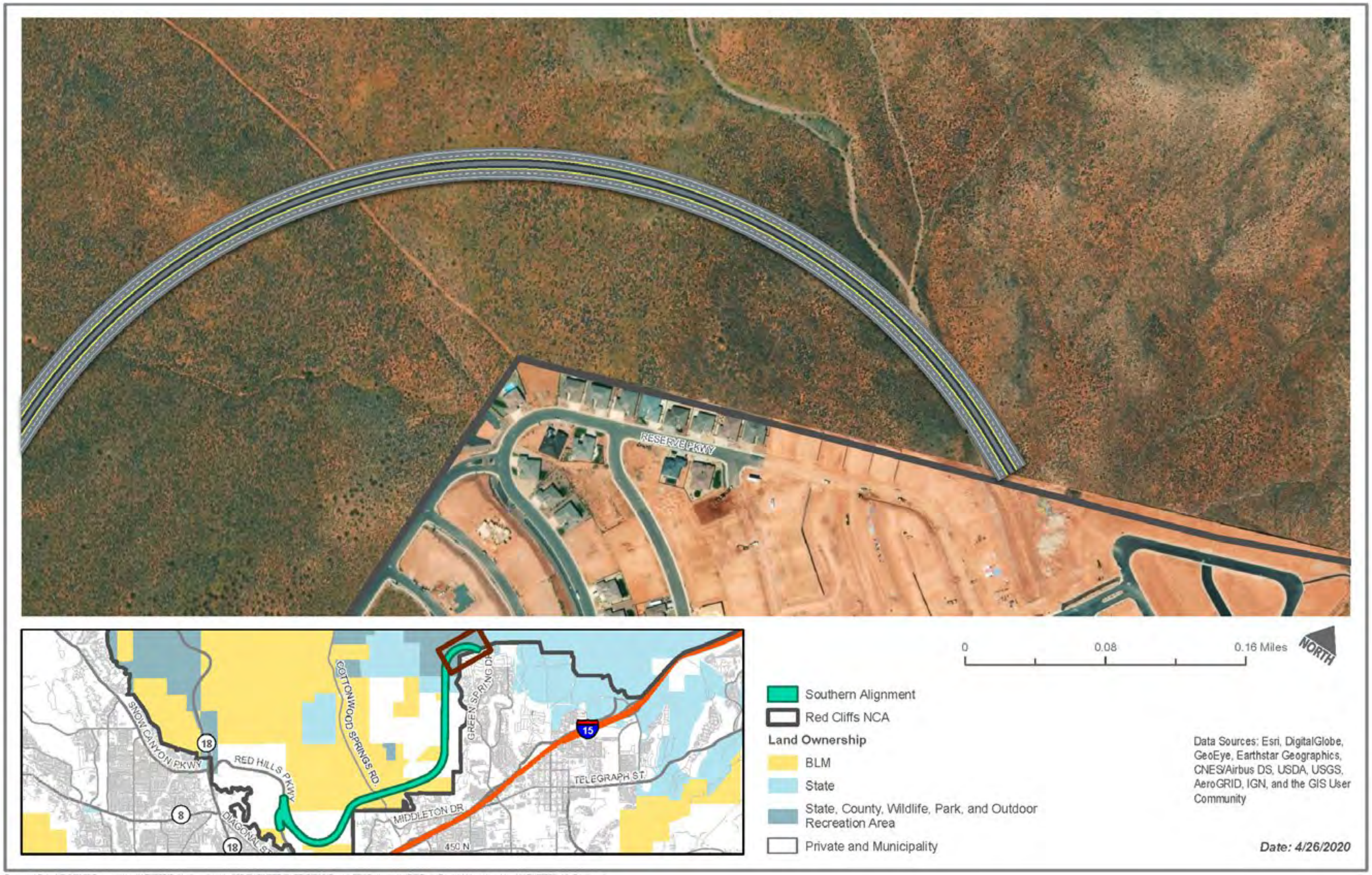



**Figure 9k.** **Southern Alignment Plan View (11 of 11)**

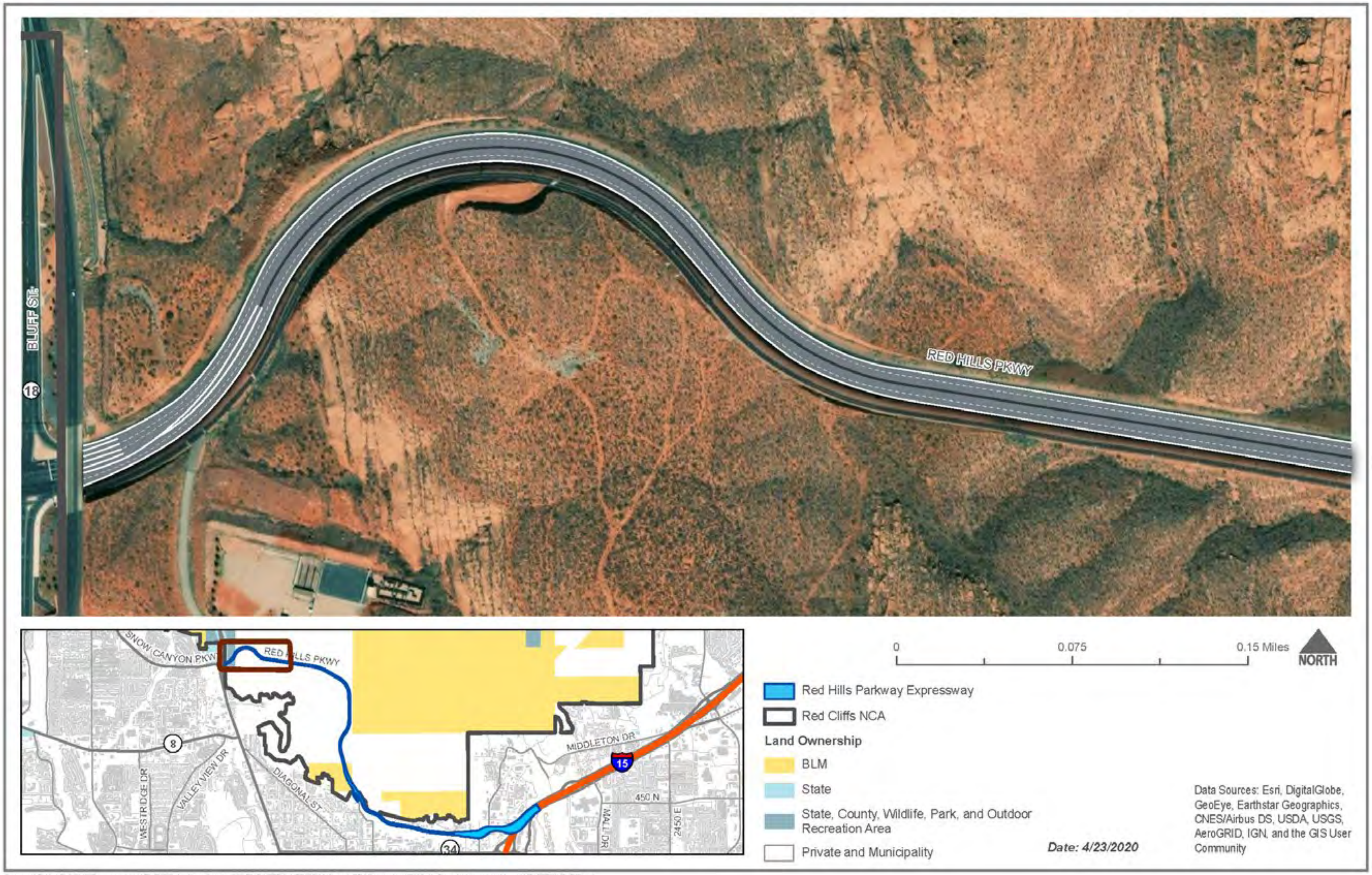



**Figure 10a. Red Hills Parkway Expressway Plan View (1 of 7)**

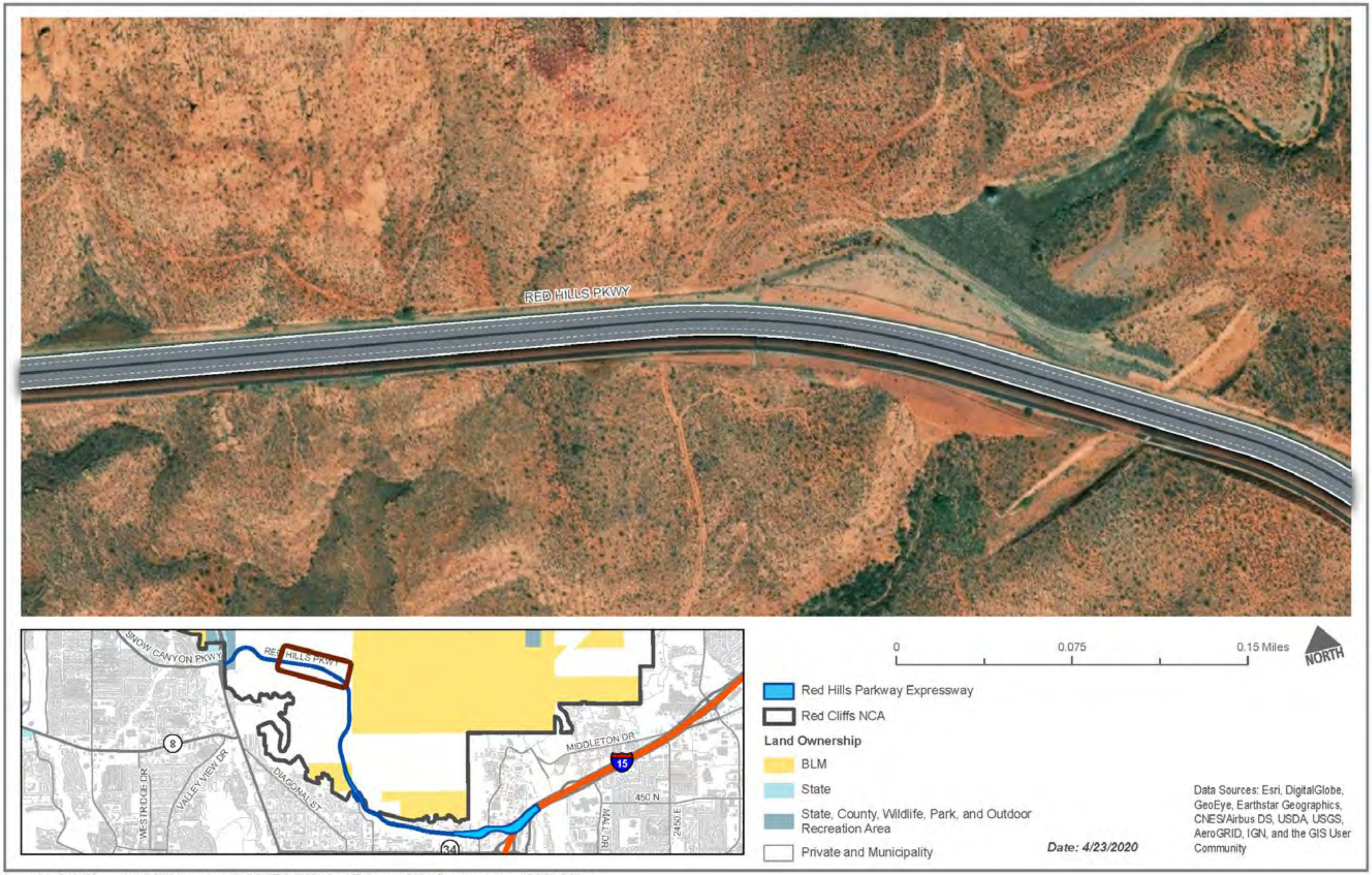



**Figure 10b. Red Hills Parkway Expressway Plan View (2 of 7)**

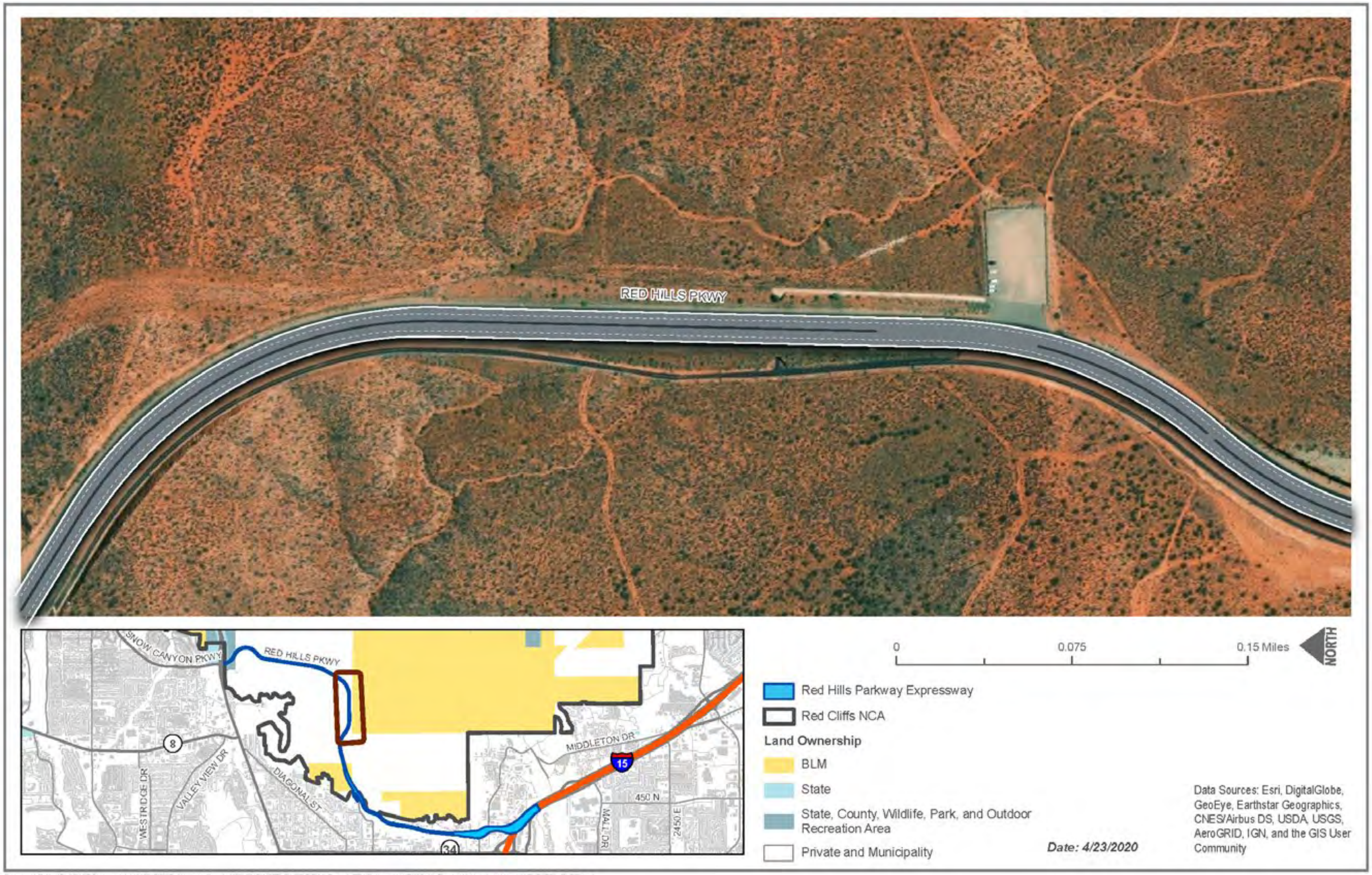



**Figure 10c.** **Red Hills Parkway Expressway Plan View (3 of 7)**

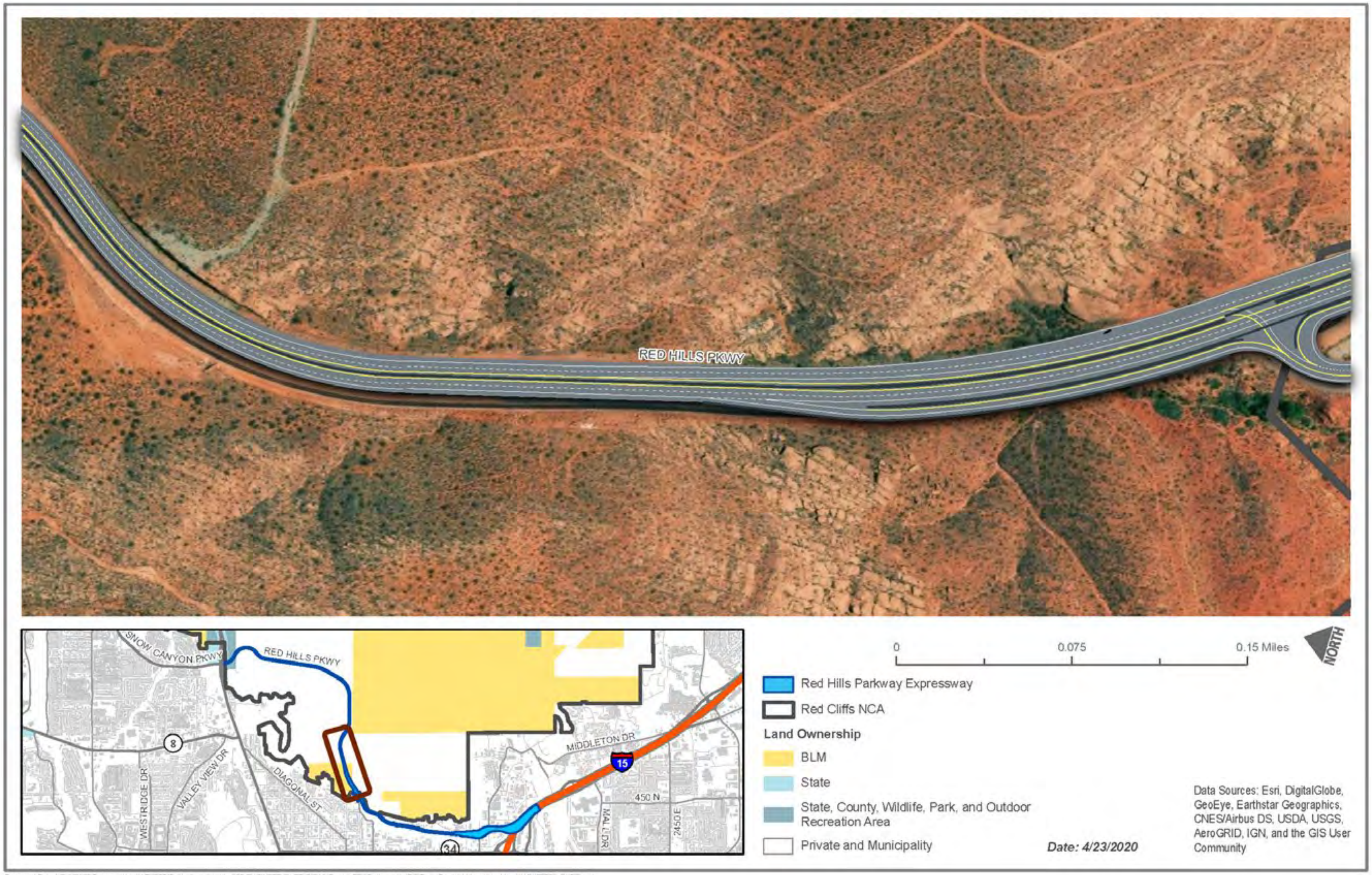



**Figure 10d. Red Hills Parkway Expressway Plan View (4 of 7)**

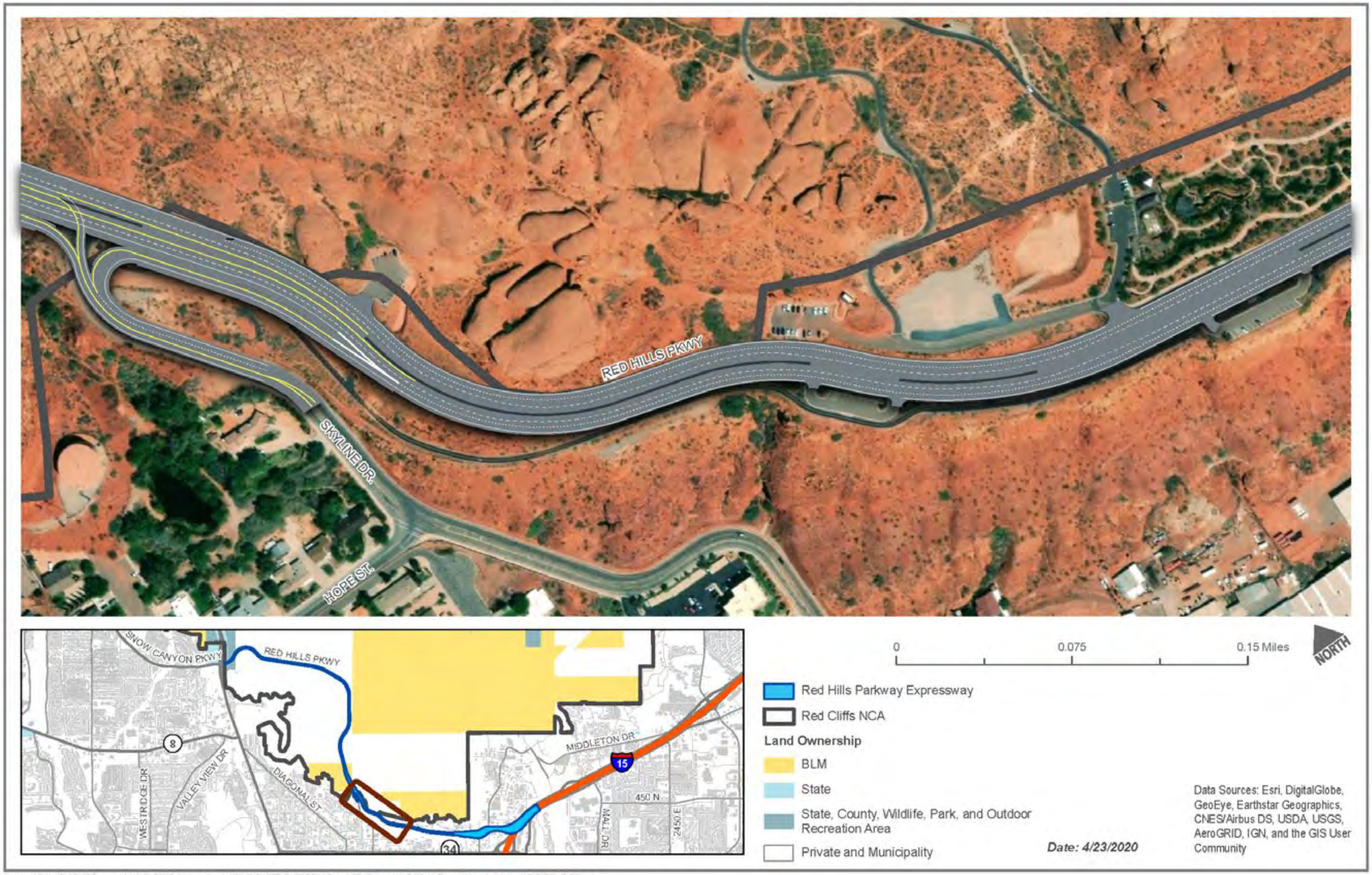



**Figure 10e. Red Hills Parkway Expressway Plan View (5 of 7)**

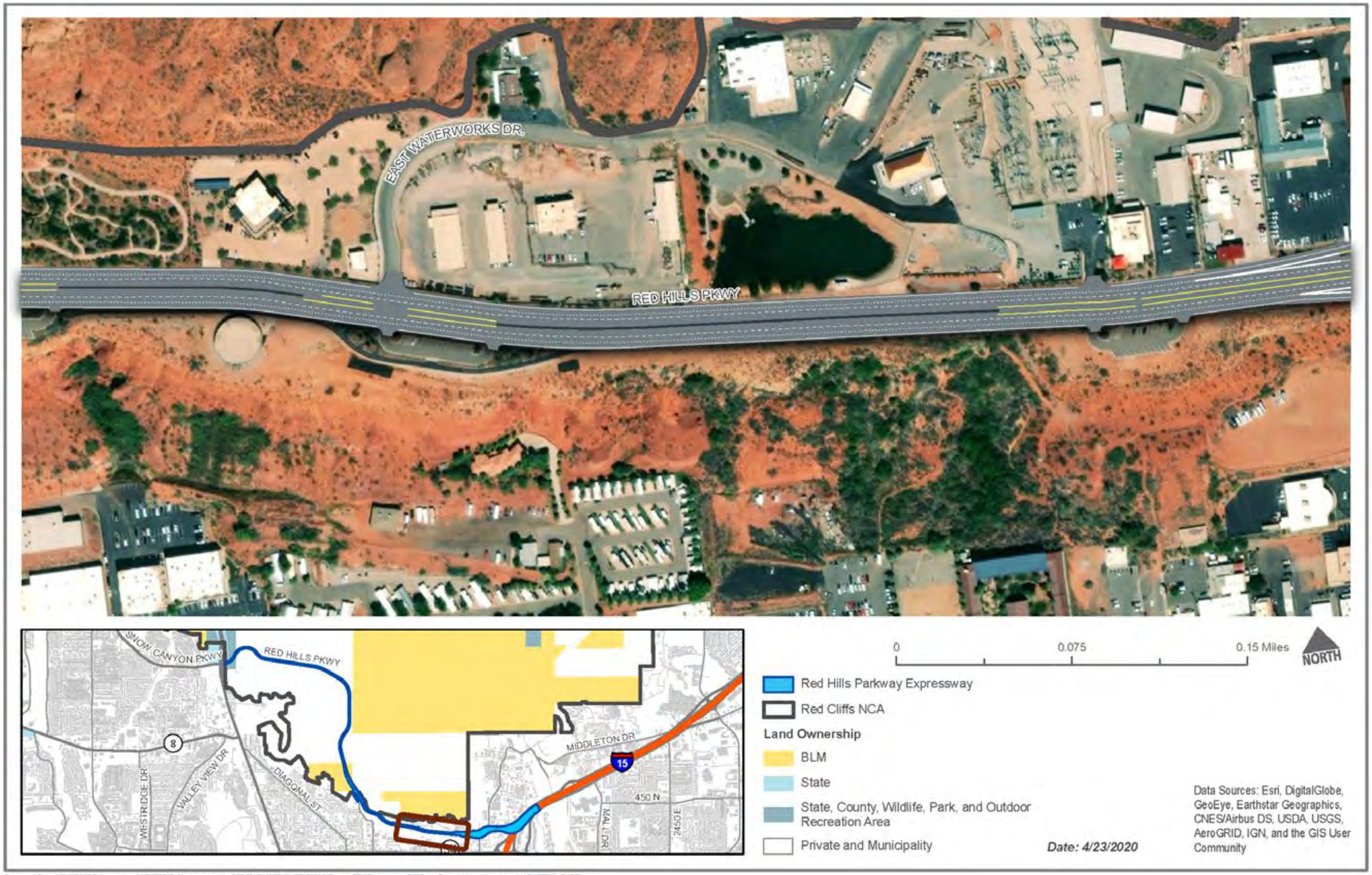



**Figure 10f. Red Hills Parkway Expressway Plan View (6 of 7)**

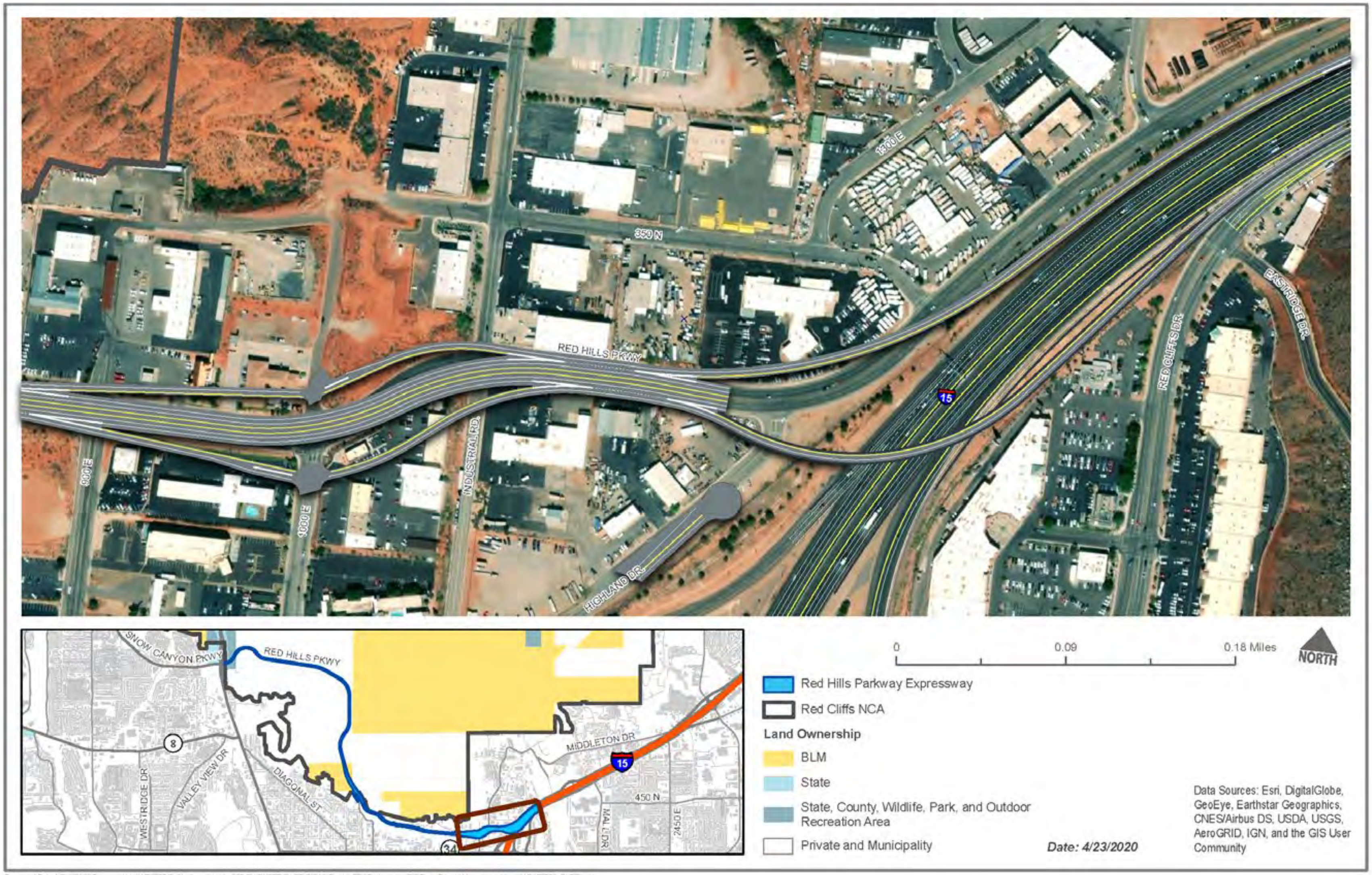



**Figure 10g. Red Hills Parkway Expressway Plan View (7 of 7)**

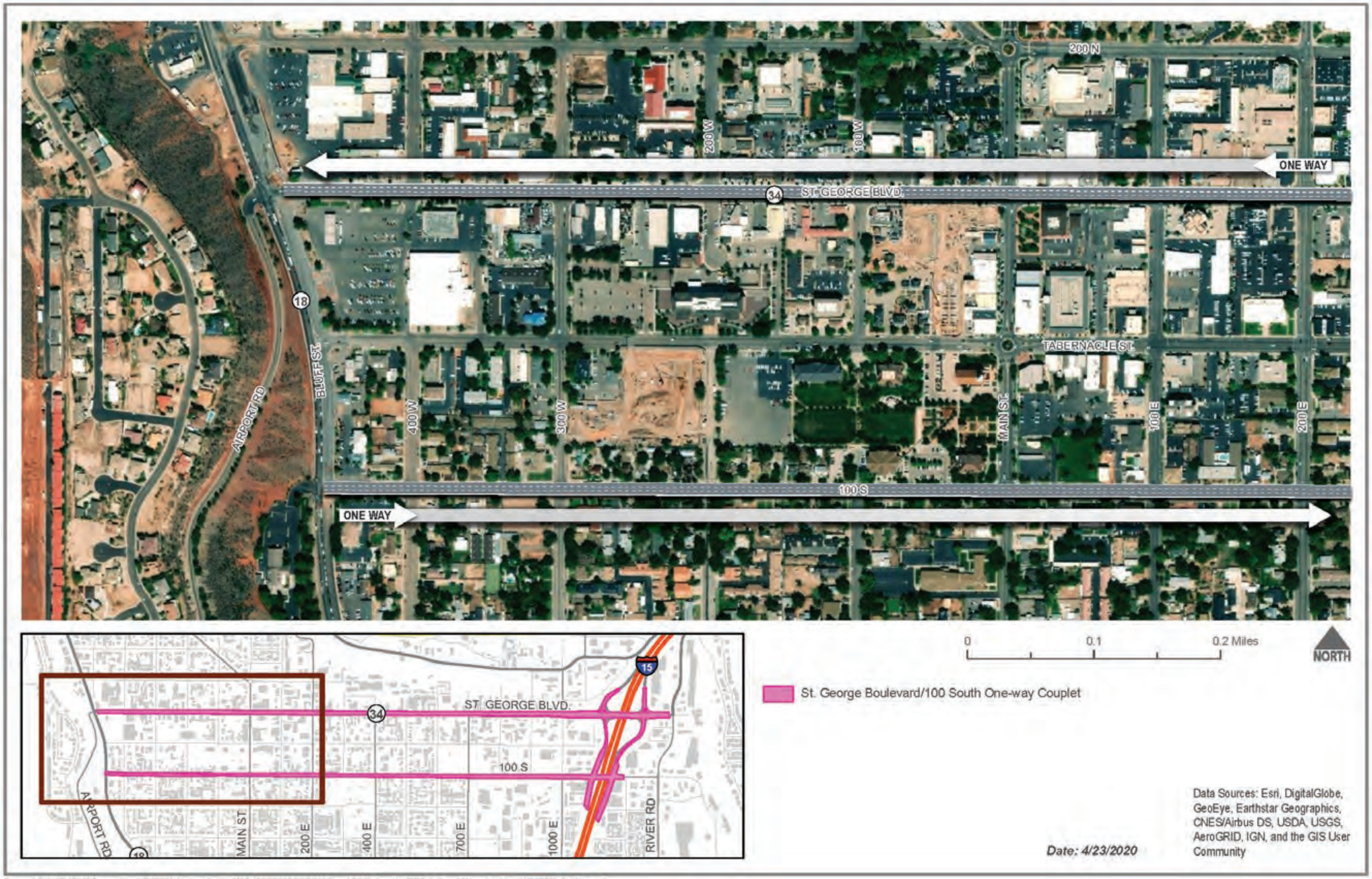



**Figure 11a. St. George Boulevard/100 South One-way Couplet Plan View (1 of 4)**

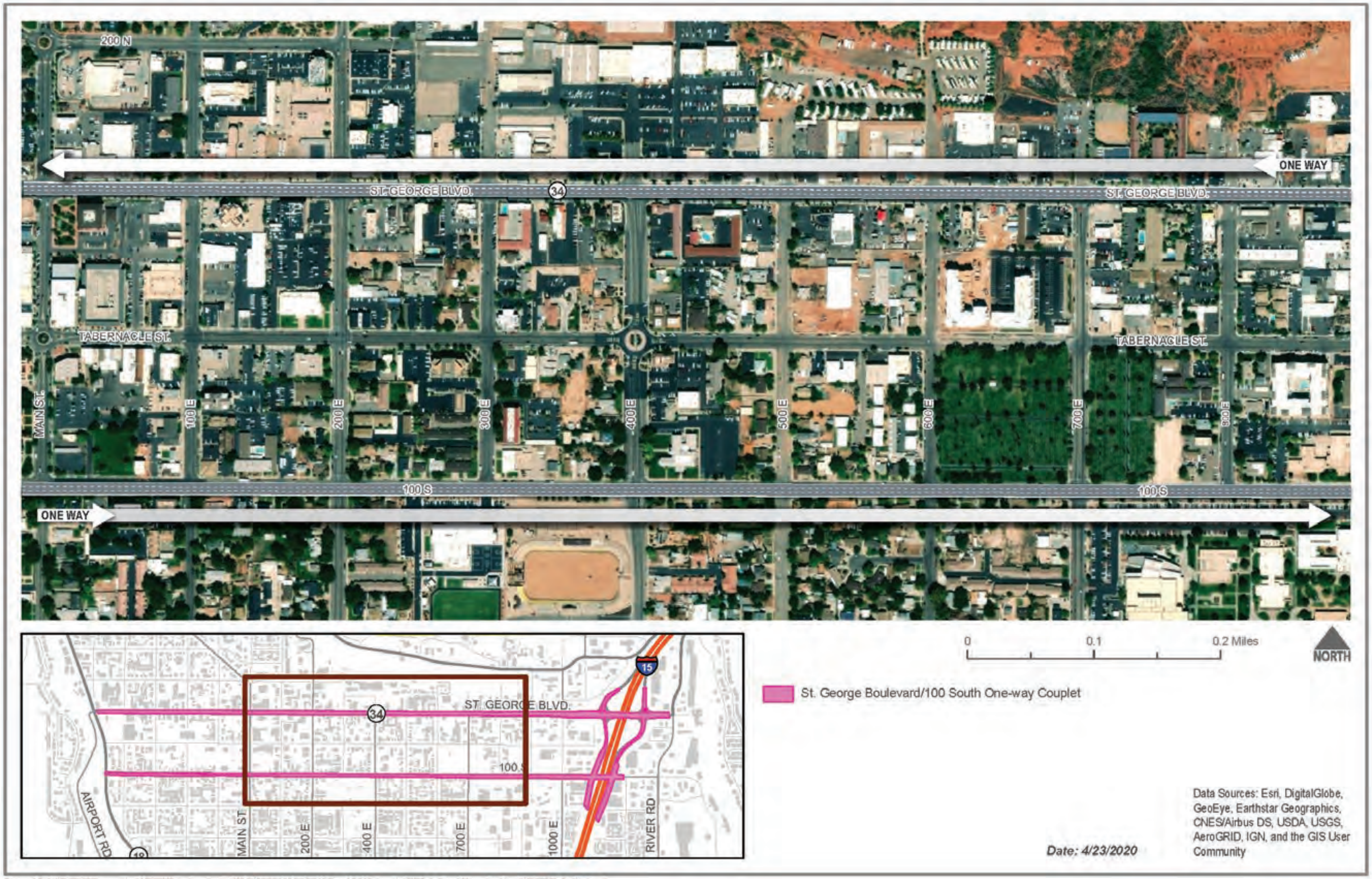



**Figure 11b. St. George Boulevard/100 South One-way Couplet Plan View (2 of 4)**

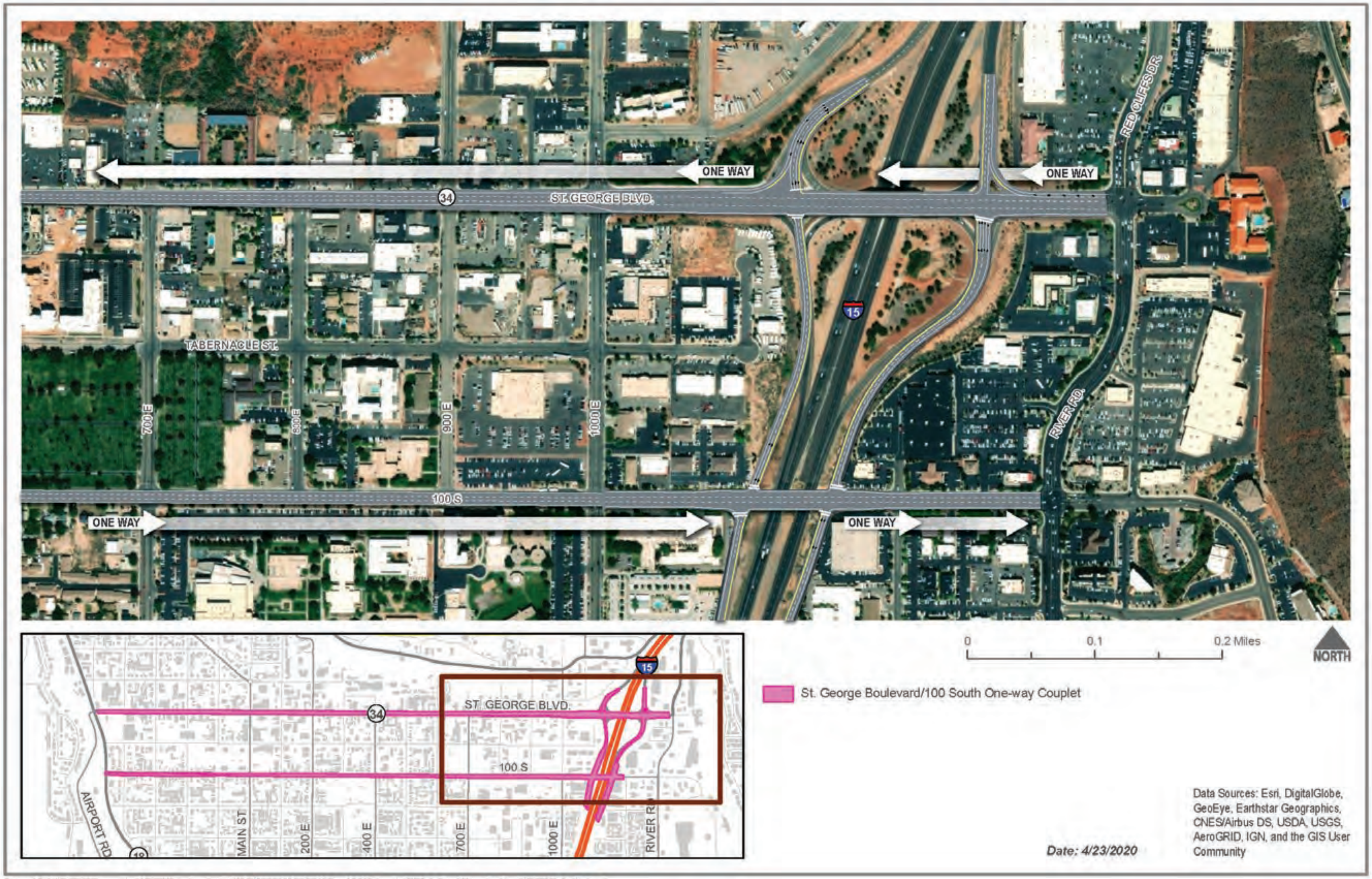



**Figure 11c. St. George Boulevard/100 South One-way Couplet Plan View (3 of 4)**

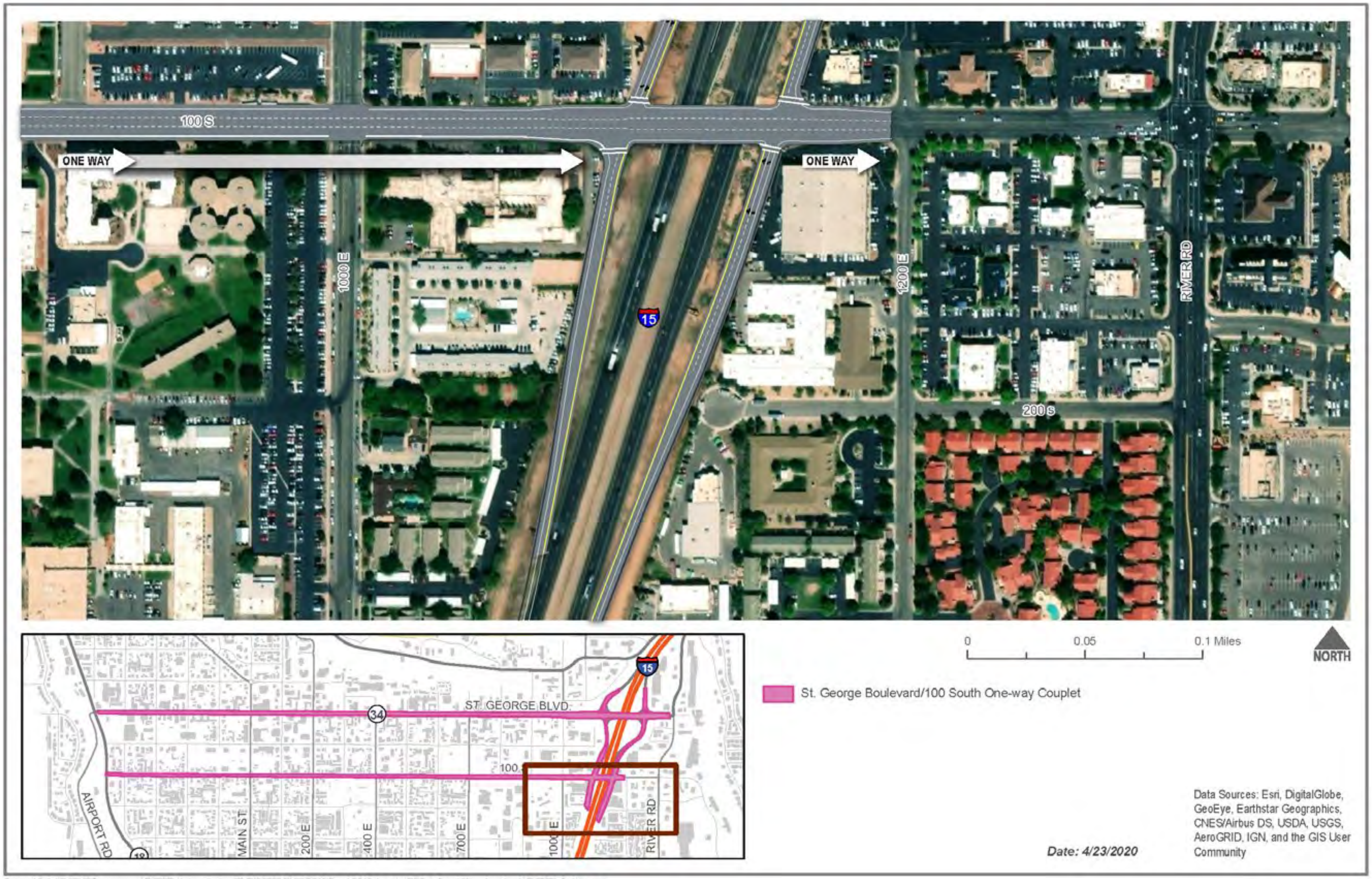



**Figure 11d. St. George Boulevard/100 South One-way Couplet Plan View (4 of 4)**

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# Appendix K: Noise Technical Report

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Jacobs

# Northern Corridor

## Noise Technical Report

Draft

May 22, 2020

Prepared for:
U.S. Department of the Interior Bureau of Land Management
Fish & Wildlife Service

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## Table of Contents



### List of Tables



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# Acronyms and Abbreviations

| | |
|---|---|
| BLM | Bureau of Land Management |
| CFR | *Code of Federal Regulations* |
| dBA | A-weighted decibel |
| EIS | Environmental Impact Statement |
| Leq(h) | level equivalent of noise over a 1-hour period |
| NAC | Noise Abatement Criteria |
| NCA | National Conservation Area |
| ROW | right-of-way |
| UDOT | Utah Department of Transportation |

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# 1. Introduction

Transportation models show the existing transportation network in Washington County does not have enough capacity for the increased demand of a growing population. In response, the Utah Department of Transportation (UDOT) filed a right-of-way (ROW) application for a proposed highway, referred to as the Northern Corridor, on the Bureau of Land Management (BLM)-administered Red Cliffs National Conservation Area (NCA). This action initiated the National Environmental Policy Act process requiring preparation of a Draft Environmental Impact Statement (EIS). This Noise Technical Report supports the Draft EIS.

# 2. Proposed Action and Alternatives

If the BLM selects an alternative that would cross BLM-administered public lands, the BLM's action would be to grant a ROW to UDOT for the construction, operation, and maintenance of the Northern Corridor across those lands. The ROW would be subject to BLM terms and conditions.

The three alternatives within the NCA (T-Bone Mesa Alignment, UDOT Application Alignment, and Southern Alignment) vary in location and tie-in locations with Red Hills Parkway, but share the following common features:

- Up to 500-foot-wide ROW.
- 4-lane highway with two 12-foot-wide travel lanes in each direction, 8-foot shoulders, and a center median.
- A combination of curb and gutter, drainage swales, and ditches.
- Bicycle and pedestrian trail(s).
- Associated signage.
- A new intersection for connection to Red Hills Parkway and a new intersection at Cottonwood Road (also known as Old Dump Road or Turkey Farm Road).

The Red Hills Parkway Expressway and St. George Boulevard/100 South One-way Couplet alternatives lie predominantly or entirely outside the NCA, and propose improvements to existing infrastructure rather than a new highway within the NCA.

Under the No Action Alternative, the BLM would deny UDOT's application for a ROW across the Red Cliffs NCA for the Northern Corridor. The alternative reflects all the roadway and transit improvements from the applicable local, regional, and statewide transportation plans that would be completed by 2050, absent the Northern Corridor. It provides a baseline against which the other Northern Corridor alternatives will be compared based on traffic performance.

Alternatives are shown on Figure 1.

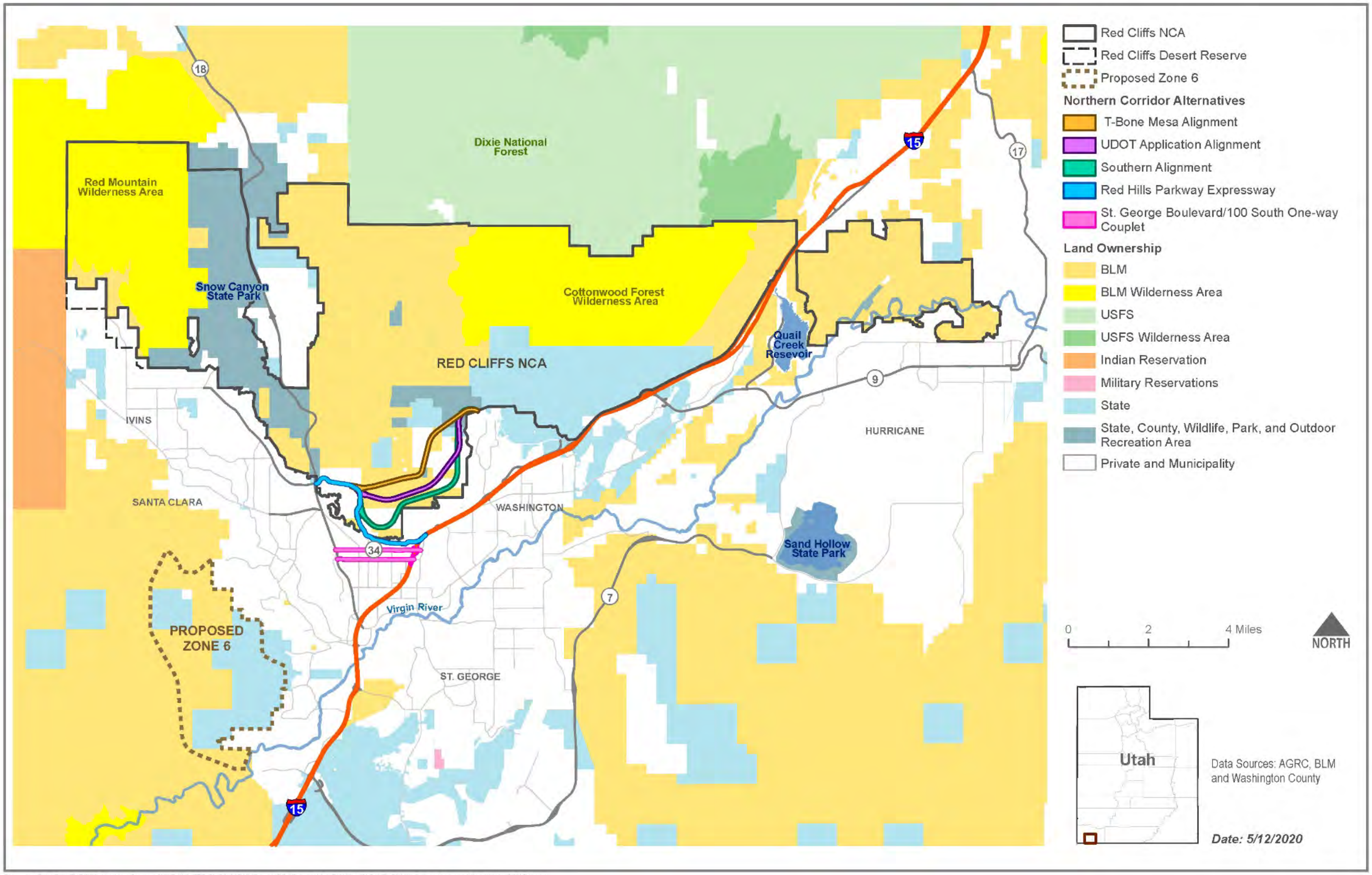



**Figure 1. Proposed Northern Corridor Alternatives**

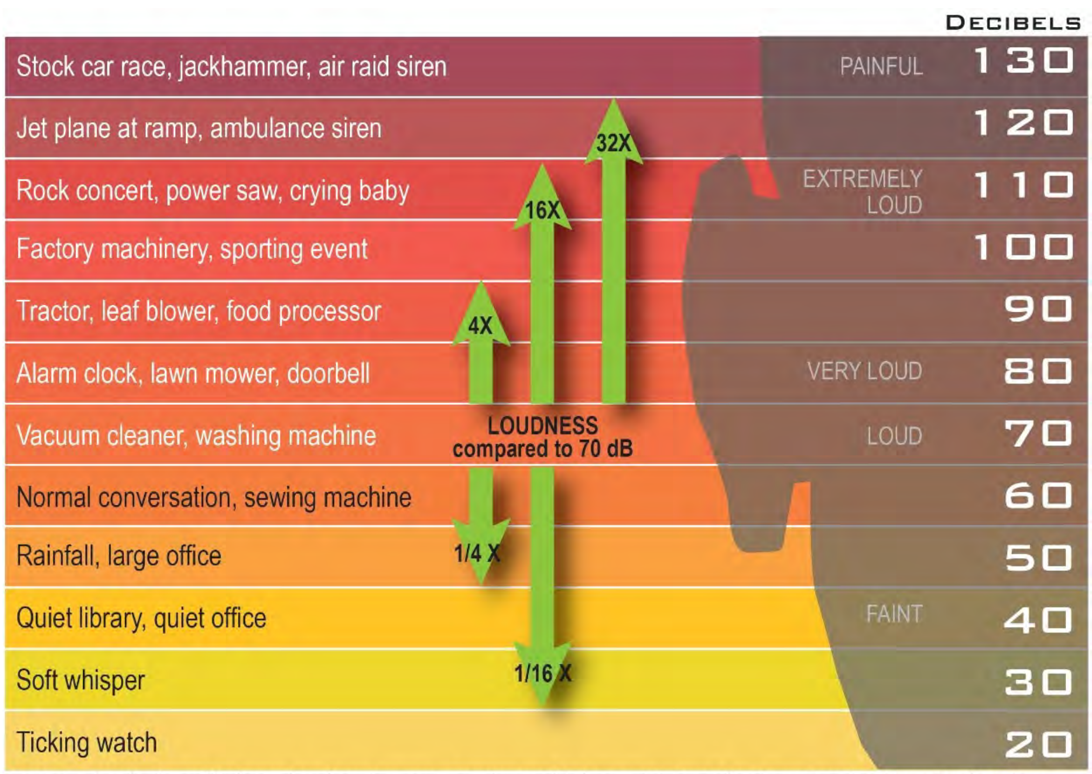
# 3. Characteristics of Sound and Noise

Noise is generally referred to as unwanted sound, while sound is defined as a form of energy transmitted by vibrations through the air that are received by the ear through the sense of hearing. The terms noise and sound are used synonymously.

Sound is described as the average sound pressure levels, and is most commonly measured in decibels. To approximate the response of the human ear, sound levels of individual frequency bands are weighted, depending on the human sensitivity to those frequencies. For the purposes of environmental studies, the A-weighted scale on a common sound level instrument is used (A-weighted decibels, or dBA), because this scale closely approximates the range of frequencies an average human ear can detect. Figure 2 shows typical A-weighted noise levels.

Changes in noise of 1 to 2 decibels are generally not perceptible, but it is widely accepted that people are able to begin to detect 3-decibel sound level increases in typically noisy environments. An increase of 3 decibels requires a doubling of existing sound energy, such as doubling the volume of traffic on a highway or halving of distance from a highway. In general, a 3-decibal increase in noise levels is considered barely perceptible, while a 5-decibel increase is generally readily perceptible, and a 10-decibel increase is perceived as being twice as loud.

Noise may be continuous or intermittent, and of high frequency or low frequency. Traffic sound levels are never constant due to the changing number, type, and speed of vehicles. Therefore, traffic noise is typically measured over a 1-hour time period, which is referred to as the level equivalent or Leq(h).




Source: American Academy of Otolaryngology (https://www.entnet.org/content/block-out-noise); Centers for Disease Control and Prevention (https://www.cdc.gov/vitalsigns/hearingloss/infographic.html#infographic); Center for Hearing and Communication (http://chchearing.org/noise/common-environmental-noise-levels/), Hearing Sense (http://hearingsense.com.au/hearing-tests-services/ear-protection/).

**Figure 2. Typical A-weighted Noise Levels**

# 4. Methodology

This section describes the methods and the established Federal and State regulations and policies that were used as the basis for the qualitative analysis.

## 4.1 Federal and State Noise Regulations and Policies

This qualitative analysis used the following regulations and policies, but is not consistent with them, as further described in this section:

- UDOT Noise Abatement Policy (08A2-01), revised June 15, 2017 (UDOT 2017a).
- 23 *Code of Federal Regulations* (CFR) 772.

There are five action alternatives for the Northern Corridor Project that would include improvements to existing roadway infrastructure and new highways on new alignments. A qualitative assessment was determined to be the appropriate level of analysis for assessing potential noise impacts due to the planning level decisions to be made under this Draft EIS. A more detailed noise analysis, including consistency with the UDOT Abatement Noise Policy for a Type 1 project, would be provided after completion of this Draft EIS in a separate project analysis. The qualitative analysis used the UDOT Noise Abatement Criteria (NAC) to categorize noise sensitive receptors, and the associated criteria that is used to determine when noise abatement should be considered. In addition, the qualitative analysis used field-collected ambient noise levels and estimated traffic data for the project to determine potential noise impacts. Changes in traffic were considered between exiting volumes and future volumes for the No Action Alternative and the action alternatives where noise sensitive locations are located adjacent to the proposed alignments.

The Federal Highway Administration has established the following NAC (Table 1) for various land use activity areas. As required by 23 CFR 772.11(e), UDOT has defined the point at which noise levels "approach" the Federal Highway Administration NAC as 1 dBA less than the NAC. As required by 23 CFR 772.11(f), UDOT defines a substantial increase in noise levels as 10 dBA over existing noise levels. Noise abatement is considered and evaluated for all permitted land use activity areas impacted by traffic noise.

**Table 1. Noise Abatement Criteria (Hourly dBA)**

| Activity Category | Federal Highway Administration Criteria Leq(h) | UDOT Criteria [a] Leq(h) | Evaluation Location | Activity Description |
|---|---|---|---|---|
| A | 57 | 56 | Exterior | Lands on which serenity and quiet are of extraordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose. |
| B | 67 | 66 | Exterior | Residential. |
| C | 67 | 66 | Exterior | Active sport areas, amphitheatres, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or non-profit institutional structures, radio studios, recording studios, recreation areas, schools, television studios, trails, and trail crossings. |
| D | 52 | 51 | Interior | Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or non-profit institutional structures, radio studios, recording studios, schools, and television studios. |
| E | 72 | 71 | Exterior | Hotels, motels, offices, restaurants and bars, and other developed lands, properties, or activities not included in Categories A through D or F. |
| F | Not applicable | Not applicable | Exterior | Agriculture, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing. |
| G | Not applicable | Not applicable | Exterior | Undeveloped lands that are not permitted. |

Source: UDOT 2017a

[a] Hourly A-weighted sound level in decibels reflecting a 1-dBA approach value below 23 CFR 772 values.

Note:

Noise impacts include the above-referenced categories only when development exists or has been permitted. A development is defined as being permitted when a formal building permit has been issued prior to the date the final environmental decision document is approved.

## 4.2 Noise Regulations for Construction Noise

Quantitative analysis of construction noise is not defined in UDOT's noise abatement policy or in the local county or city ordinances. However, St. George City Code 4-2-3 defines "enumeration of nuisances" as follows:

*It shall be unlawful for any person to make, continue, or cause to be made or continued, any loud, unnecessary or unusual noise, or any noise which annoys, disturbs, injures or endangers the comfort, repose, health, peace or safety of others, within the limits of the city. The following acts when prolonged, unusual and unnatural in their time, place and use, may be a detriment to the public health, comfort, convenience, safety, welfare and prosperity: horns, radios, stereos, loudspeakers, yelling or shouting, exhausts, motor vehicles, drums or musical instruments, construction equipment, airplanes or blasting.*

Nighttime construction is not anticipated for this proposed project. However, if construction activities are required during nighttime hours (10 p.m. to 7 a.m.), the proposed project would adhere to Senate Bill 177 (State of Utah 2016), which states:

- *A state highway construction project conducted on a road where the normal posted speed limit is 55 miles per hour (mph) or greater is exempt from any noise ordinance, regulation, or standard of a local jurisdictional authority.*
- *A state highway construction project conducted on a road where the normal posted speed limit is less than 55 mph is exempt from any noise ordinance, regulation, or standard of a local jurisdictional authority if the department:*
  - *Provides reasonable written notice at least 48 hours in advance of any required nighttime highway construction to each residential dwelling located within front row receptors of the activity.*
  - *Determines a net community benefit exists to conduct nighttime highway construction after considering other resources as defined in the senate bill.*
  - *Institutes best management noise reduction practices for front row receptors, in consultation with local government or the local jurisdictional authority for all nighttime highway construction as defined in the senate bill.*
- *Subject to subsections 2 or 3, a state highway project shall secure required noise permits from the local jurisdictional authority to conduct nighttime highway construction.*

In addition, the proposed project would be subject to UDOT 2017 Standard Specifications for Road and Bridge Construction , Section 01355, Environmental Compliance, Part 3, Execution, Sub-section 3.6, Noise Control (UDOT 2017b). Contractors would be required to conform to this specification during project implementation to reduce the impact of construction noise on the surrounding community.

## 4.3 Traffic Data and Analysis

Based on UDOT noise policy (UDOT 2017a), existing and future worst-case noise levels are modeled using the posted speed limit (or design if different from existing) and Level of Service C traffic volumes. For this project, traffic data will only be used to qualitatively assess potential noise impacts and will not be used for model inputs. A detailed quantitative analysis, including modeling, would be conducted after completion of this Draft EIS in a separate project analysis. The existing posted speed limits would remain under future conditions, except where new highways are proposed. Annual average daily traffic volumes for existing (2017) and future (2050) conditions were obtained from Horrocks (2020b). Traffic data used for this analysis are summarized in Table 2.

**Table 2. Existing and Future Annual Average Daily Traffic**

| Roadway | Segment | 2017 - Existing | No Action Alternative | T-Bone Mesa Alignment | UDOT Application Alignment | Southern Alignment | Red Hills Parkway Expressway | St. George Boulevard/100 South One-way Couplet |
|---|---|---|---|---|---|---|---|---|
| Bluff Street | Snow Canyon to Sunset | 15,000 | 31,000 | 33,000 | 32,000 | 31,000 | 32,000 | 33,000 |
| Bluff Street | Sunset to St. George | 41,000 | 65,000 | 61,000 | 61,000 | 63,000 | 55,000 | 62,000 |
| St. George Boulevard | Bluff to Main | 19,000 | 26,000 | 23,000 | 23,000 | 25,000 | 19,000 | 16,000 |
| St. George Boulevard | Main to 1000 East | 31,000 | 36,000 | 34,000 | 34,000 | 36,000 | 32,000 | 26,000 |
| St. George Boulevard | 1000 East to I-15 ramps | 44,000 | 55,000 | 50,000 | 52,000 | 55,000 | 47,000 | 47,000 |
| Red Hills Parkway | Bluff to Skyline | 12,000 | 31,000 | 39,000 | 38,000 | 32,000 | 47,000 | 32,000 |
| Red Hills Parkway | Skyline to 1000 East | 20,000 | 38,000 | 28,000 | 23,000 | 36,000 | 54,000 | 38,000 |
| Red Hills Parkway | 1000 East to I-15 crossing | 12,000 | 20,000 | 18,000 | 22,000 | 20,000 | 24,000 | 23,000 |
| 100 South | Bluff to Main | 9,000 | 12,000 | 12,000 | 13,000 | 12,000 | 11,000 | 17,000 |
| 100 South | Main to 1000 East | 16,000 | 24,000 | 22,000 | 23,000 | 24,000 | 20,000 | 29,000 |
| 100 South | 1000 East to River | 16,000 | 34,000 | 32,000 | 33,000 | 34,000 | 31,000 | 27,000 |

Source: Horrocks Engineers 2020b

# 5. Traffic Noise Impact Analysis

## 5.1 Identification of Land Use Activity Areas

A receptor is a discrete or representative location of a noise sensitive area. Noise sensitive receptors are those areas where frequent outdoor human use would occur that may be impacted by future transportation conditions. The noise study area was comprised of a 500-foot buffer around the proposed project and included all land uses that could potentially be impacted by future traffic noise. Land uses identified for this project were categorized based on the activity descriptions listed in Table 1.

General land uses in the project area include Category B residential development, Category C recreational uses (such as parks, trails and trailheads, medical facilities, places of worship, schools, day cares, libraries, and cemeteries), and Category E commercial development (such as hotels and restaurants). The majority of the land uses adjacent to the Red Hills Parkway Expressway and St. George Boulevard/100 South One-way Couplet alternatives consist of Category E and Category C land uses. The T-Bone Mesa Alignment, UDOT Application Alignment, and Southern Alignment alternatives are mostly on BLM-administered land, and adjacent land use is mostly for recreational purposes. However, there are a small number of noise sensitive receivers that include Category C uses (trailheads). Residential development is located within the surrounding area near the western termini, and ranges from approximately 500 feet to 900 feet from the center of the action alternatives depending on the alignment. Specific noise sensitive receptors will be selected for modeling and detailed analysis once the action alternatives have been refined and selected for further analysis.

## 5.2 Field Noise Monitoring

Field noise monitoring was conducted to collect ambient noise conditions in the study area. Available aerial photography was reviewed to identify the five field noise measurement locations shown in Table 3 and on Figure 3.

Noise monitoring was conducted for approximately 20 minutes per event at each location, with traffic counted simultaneously where applicable. All noise measurements were collected under meteorologically acceptable conditions; specifically, with dry pavement, calm or light winds (0 to 5 miles per hour), and free-flowing traffic conditions. Noise monitoring was conducted using a Quest 2900 Type I sound level meter that meets American National Standards Institute standards. Meters were calibrated and placed at 5 feet above ground surface, because this is the average height of the human ear.

Table 3 summarizes the field measurement noise levels.

**Table 3. Field Measurement Noise Levels**

| Meter Number | Alternative | Location | Distance to Roadway | Land Use | Field Measurement Noise Levels (Leq) | Traffic Counts Autos (hourly) | Traffic Counts Trucks (hourly) |
|---|---|---|---|---|---|---|---|
| M1 | St. George Blvd./ 100 South One-way Couplet | 500 St. George Boulevard | 25 feet | Commercial | 75.5 | 2,272 | 104 |
| M2 | St. George Blvd./ 100 South One-way Couplet | 500 East 100 South | 25 feet | Residential | 72.1 | 996 | 28 |
| M3 | Red Hills Parkway Expressway | Pioneer Park | 25 feet | Park | 72.1 | 1,328 | 108 |
| M4 | T-Bone Mesa Alignment, UDOT Application Alignment, and Southern Alignment | 1700 East 1200 North | Not applicable | Residential | 35.5 | Not applicable | Not applicable |
| M5 | T-Bone Mesa Alignment, UDOT Application Alignment, and Southern Alignment passing | 2200 North 990 West | Not applicable | Residential | 37.9 | Not applicable | Not applicable |

Note:

Not applicable = no existing roadway

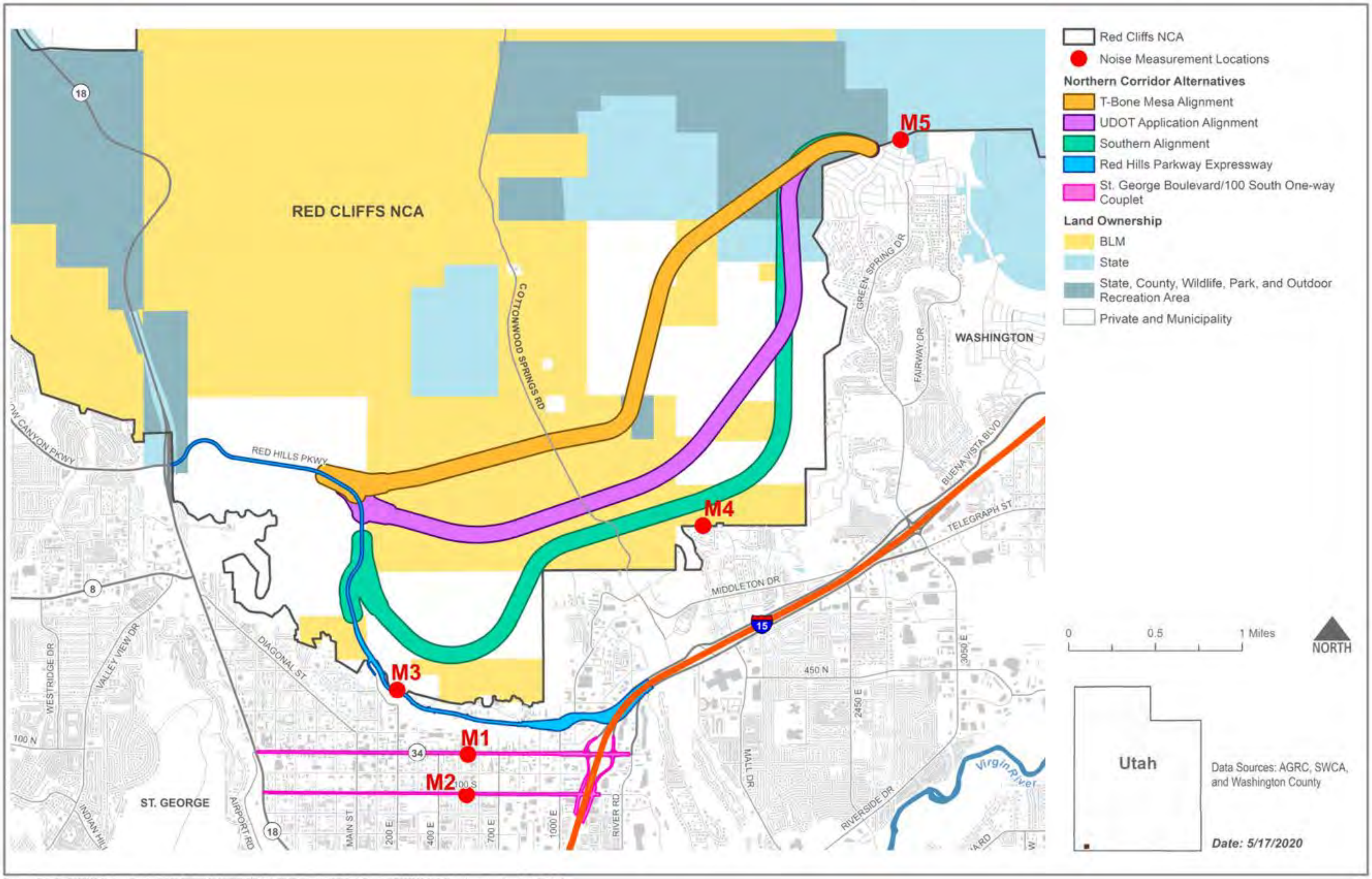



**Figure 3. Noise Measurement Locations**

## 5.3 Existing and Future Noise Levels

### 5.3.1 Overview

The highest ambient noise levels were recorded at 75.5 dBA and 72.1 dBA at approximately 25 feet from the existing roadways where improvements are proposed for the Red Hills Parkway Expressway and St. George Boulevard/100 South One-way Couplet alternatives, respectively. As shown in Table 2, estimated future traffic is anticipated to double along roadway segments on Bluff Street, Red Hills Parkway, and 100 South compared to existing conditions. A doubling of traffic generally results in a 3-dBA increase in noise levels, which would be perceptible but not substantial as defined by UDOT and Federal Highway Administration guidelines. However, the change in noise levels associated with the No Action Alternative compared to the Red Hills Parkway Expressway and St. George Boulevard/100 South One-way Couplet alternatives is not anticipated to be perceptible.

The most noticeable change in noise levels is anticipated near the T-Bone Mesa Alignment, UDOT Application Alignment, and Southern Alignment alternatives, because these alternatives propose that a new highway would be constructed in an area where no roadway exists with existing and no action conditions. The design details needed to model projected noise are not available and cannot be determined before first considering where to align the highway to best avoid sensitive resources such as Mojave desert tortoise or cultural resource sites, and other factors. If one of these alternatives is selected and design advances, noise modeling would be conducted. If noise modeling identifies future noise levels that substantially exceed existing conditions or exceed the UDOT NAC for the types of receptors near the T-Bone Mesa Alignment, UDOT Application Alignment, and Southern Alignment alternatives, noise barriers would be evaluated based on UDOT's feasible and reasonable criteria (UDOT 2017a). Feasibility factors include engineering considerations such as safety, sight distance, and utilities, and acoustics considerations such as meeting a minimum 5-dBA noise reduction. A continuous noise barrier that breaks the line of sight generally results in a noise reduction of 5 dBA or more. If warranted, noise barriers along the new Northern Corridor alignments are likely to be feasible because gaps for driveway connections and local streets would not be needed. In addition, space to construct noise barriers should be feasible since the receptors are not located adjacent to the new alignment. However, noise barriers may not be reasonable because most receptors are distant enough from the alignment that the noise barrier would only minimally reduce the noise. Reasonable criteria include a minimum of 7-dBA noise reduction for at least 35 percent of front row receptors. In addition, there needs to be enough benefited receptors to meet the cost effectiveness. A more detailed noise analysis including evaluation of noise barriers, as applicable, would be provided after completion of the Draft EIS in a separate project analysis.

Based on ambient noise levels and traffic volumes along the existing corridors of Red Hills Parkway, St. George Boulevard, and 100 South, noise levels are not likely to significantly change between the existing conditions, the No Action Alternative noise conditions in 2050, or the implementation of any of the action alternatives. Field-measured noise levels along the existing corridors of Red Hills Parkway and St. George Boulevard/100 South were 72.1 dBA and 75.5 dBA at approximately 25 feet, respectively. Therefore, future noise levels are likely to exceed the NAC for all applicable categories. Most of the noise sensitive receptors are located adjacent to the proposed improvements. However, some receptors are beyond the first row of receptors. A doubling of distance results in a 3-dBA decrease in noise levels for a line source (such as road traffic). Therefore, the distance at which noise levels would drop below the NAC (impact contour distance) is anticipated to range approximately 125 feet to 300 feet for the Red Hills Parkway Expressway and St. George Boulevard/100 South One-way Couplet alternatives, respectively. However, noise levels beyond the first row of receptors would likely be even lower when shielding from existing structures (for example, buildings) is considered. Therefore, noise impact contour distances are likely to be at shorter distances. Even if noise impacts are identified along the Red Hills Parkway Expressway and St. George Boulevard/100 South One-way Couplet alternatives, noise abatement is not likely to be feasible because of the numerous driveway connections and street intersections that would require gaps in the noise barriers, rendering them ineffective. In addition, the space between the roadway and receptors is likely to be too limited to construct and properly maintain a noise barrier within the ROW. Furthermore, constructing a noise barrier this close to the roadway would result in unsafe driving conditions for motorists because their view would be limited.

### 5.3.2 Construction

Construction activities associated with the proposed project would temporarily elevate noise levels in the study area for each action alternative. Noise generated by project-related construction activities can vary depending on the noise levels generated by individual pieces of construction equipment, the type and number of pieces of equipment operating at any given time, the timing and duration of construction activities, the proximity of nearby sensitive land uses, and the presence or lack of shielding at these sensitive land uses. The operation of heavy construction equipment and the arrival and departure of heavy-duty trucks is a primary source of noise for roadway construction projects. Table 4 summarizes general pieces of equipment likely to be used to construct one of the action alternatives, and the reference sound levels at varying distances based on the roadway construction noise model (FHWA 2006).

Construction noise associated with each action alternative would be temporary and intermittent and would be conducted during daytime hours, when occasional loud noises are more tolerable. None of the receptors are expected to be exposed to construction noise for a long duration; therefore, any extended disruption of normal activities is not expected. If noise is a concern during construction, further assessment will be required to determine use of appropriate control measures in an effort to reduce temporary noise levels.

Contractors would be required to conform to the UDOT 2017 Standard Specifications for Road and Bridge Construction (UDOT 2017b) to reduce the impact of construction noise on the surrounding community during construction. Nighttime construction is not anticipated for this proposed project. However, if construction activities are required during nighttime hours (10 p.m. to 7 a.m.), the proposed project would adhere to Senate Bill 177 (State of Utah 2016).

**Table 4. Construction Equipment Sound Levels**

| Equipment Type | Decibels at 50 feet | Decibels at 400 feet (0.08 mile) | Decibels at 800 feet (0.15 mile) | Decibels at 1,600 feet (0.30 mile) |
|---|---|---|---|---|
| Blasting | 94 | 71.5 | 64 | 56.5 |
| Chain saw | 84 | 61.5 | 54 | 46.5 |
| Compressor (air) | 78 | 55.5 | 48 | 40.5 |
| Concrete mixer truck | 79 | 56.5 | 49 | 41.5 |
| Concrete pump truck | 81 | 58.5 | 51 | 43.5 |
| Concrete saw | 90 | 67.5 | 60 | 52.5 |
| Crane | 81 | 58.5 | 51 | 43.5 |
| Excavator | 81 | 58.5 | 51 | 43.5 |
| Front end loader | 79 | 56.5 | 49 | 41.5 |
| Grader | 85 | 62.5 | 55 | 47.5 |
| Impact pile driver | 101 | 78.5 | 71 | 63.5 |
| Mounted impact hammer (hoe ram) | 90 | 67.5 | 60 | 52.5 |
| Rock drill | 81 | 58.5 | 51 | 43.5 |

Source: FHWA 2006

# 6. References


Federal Highway Administration (FHWA). 2006. *Roadway Construction Noise Model*. Accessed May 2020. https://www.fhwa.dot.gov/environment/noise/construction_noise/rcnm/.

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State of Utah. 2016. *Senate Bill 177*, *Nighttime Highway Construction Noise Amendments*. Effective May 10, 2016. Accessed December 2019. https://le.utah.gov/~2016/bills/static/SB0177.html

Utah Department of Transportation (UDOT). 2017a. *Noise Abatement Policy*. November 6, 1987; Revised June 15, 2017. UDOT 08A2-01. Accessed July 2019. https://www.udot.utah.gov/main/uconowner.gf?n=10496602977480171.

Utah Department of Transportation (UDOT). 2017b. *Standard Specifications for Road and Bridge Construction.* January 1.

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# Appendix L: Traffic Analysis Memorandum

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**Memorandum**

| | |
|---|---|
| To: | Northern Corridor EIS Project Team |
| From: | Horrocks Traffic Group |
| Date: | May 18, 2020 |
| Subject: | Preliminary Northern Corridor Traffic Analysis |

The purpose of this memo is to describe analysis performed with respect to the purpose and need and alternatives development of the Northern Corridor in support of the Northern Corridor Draft Environmental Impact Study (DEIS). The memo addresses population growth and its impact on east/west travel demand in Washington County, Utah in 2050 and evaluates potential transportation solutions in order to meet the identified future travel demands. This memorandum details data collection efforts, study methodology, and traffic operations for 2019 and 2050 under the No Action and preliminary alternatives.

# STUDY METHODOLOGY

## Data Collection

Data collected in order to perform the intersection analysis for the project included roadway geometry, signal timings, field visits to observe traffic conditions, roadway and intersection volumes, speeds, travel times, and vehicle classification information. Data was obtained from the Utah Department of Transportation (UDOT) Performance Measurement Systems (PeMS) and automatic traffic recorders, pneumatic tube counts, origin-destination information collected using Bluetooth technology, and both manual and video intersection turning movement counts. 2019 PM peak hour turning movement counts were performed at the following intersections:

- Snow Canyon Parkway and Bluff Street
- Northbound Bluff Street Flyover at Red Hills Parkway/Snow Canyon Parkway
- Southbound Bluff Street Flyover at Red Hills Parkway/Snow Canyon Parkway
- Sunset Boulevard and Bluff Street
- 500 North and Bluff Street
- 300 North and Bluff Street
- St. George Boulevard and Bluff Street
- St. George Boulevard and Main Street
- St. George Boulevard and 1000 East
- I-15 Diverging Diamond Interchange at St. George Boulevard
- St. George Boulevard and River Road/Red Cliffs Drive
- 200 East (Skyline Drive) and Red Hills Parkway
- 1000 East and Red Hills Parkway

## Traffic Analysis Software

The basic tools used for the travel demand and traffic operations analyses included the Dixie Metropolitan Planning Organization (DMPO) Regional Travel Demand Model (TDM) and Vissim traffic simulation software from the PTV Group. Vissim is a microscopic traffic simulation software program that is used to perform detailed peak hour traffic operations analysis.

The following table details the analysis type and use of each of the software packages.

**Table 1. Study Software**

| Software Package | Use/Analysis Type | Output/Performance Measure |
|---|---|---|
| Dixie Cube Travel Demand Model v3.0 | Development of future travel demand volumes | Daily and peak hour turning movement volumes, County-Wide Vehicle-Miles-Traveled (VMT) |
| VISSIM v2020.0-07 | Basic Freeway Segments, Weaving Areas | Density, Speed, Percent of Traffic Demand Served |
| | Ramp Junctions | Density, Speed, Percent of Traffic Demand Served, # of Lane Changes |
| | Intersections | LOS, Queue Length |
| | Overall Roadway Network System | Travel Time, Delay, Vehicle Miles Traveled |

## Regional Travel Demand Model Overview

Future travel demand forecasts for Washington County were developed using DMPO TDM. The TDM predicts future travel demand based on projections of land use, socioeconomic patterns, and transportation system characteristics. The model is run using the TP+/Cube software. References to “the model” in this report refer to the scripts and data maintained by DMPO, not to the Cube software. At the time of this study, the DMPO official version of the TDM is 3.0, which is calibrated to represent 2019 base year travel conditions and projects traffic out to 2050.

Specific inputs to the model include socioeconomic forecasts and transportation system data. For the DMPO TDM, the Washington County area was broken up into roughly 850 smaller geographical parts called traffic analysis zones (TAZ), which are populated with socio-economic data used for trip generation. The socioeconomic data includes population, households, employment, and average household income. Household data is further classified by household size, number of workers, and average income. Employment data is classified into twelve categories, which include two for public schools. The transportation system data includes both roadway and transit networks. The roadway network includes freeways, arterial routes and collector routes. The transit network includes local bus routes.

The DMPO TDM uses the traditional four-step modeling process consisting of trip generation, trip distribution, mode split, and trip assignment. It includes an auto ownership model to better estimate trip generation and mode split. The model provides a feedback loop during trip distribution, allowing traffic congestion to influence trip distribution patterns.

Existing socio-economic and transportation system data were used to create a base-year (2019) model. Future year forecasts are prepared by running the model using future year socioeconomic and transportation system data.

## WASHINGTON COUNTY POPULATION

Population and employment forecasts used in the DMPO TDM come from The University of Utah's Gardner Policy Institute, which provides demographic information for the Utah State Legislature and Office of the Governor. The county-level forecasts from the Gardner Policy Institute were then distributed at a city level and ultimately a TAZ level by the DMPO using land-use plans, information provided by local planners, and growth trends. It is forecasted that over the next 30 years the population in Washington County will more than double, with heavy growth expected in Hurricane, St. George's south block area, Washington City Fields area, Santa Clara, and Ivins. Table 2 shows the population of cities in Washington County between 2010 and 2050.

**Table 2. City Population Growth in Washington County**

| City Name | 2010 | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|---|
| Apple Valley | 712 | 841 | 1,152 | 1,470 | 1,805 |
| Enterprise | 1,900 | 2,206 | 2,408 | 3,165 | 3,886 |
| Hilldale | 2,812 | 3,074 | 4,546 | 5,803 | 7,124 |
| Hurricane | 12,697 | 17,820 | 26,565 | 36,990 | 51,090 |
| Ivins | 6,912 | 11,940 | 14,867 | 17,396 | 20,580 |
| La Verkin | 3,844 | 4,607 | 5,285 | 6,747 | 8,283 |
| Leeds | 854 | 1,023 | 1,381 | 1,929 | 2,551 |
| New Harmony | 261 | 313 | 422 | 538 | 661 |
| Rockville | 249 | 298 | 402 | 514 | 631 |
| Santa Clara | 6,182 | 8,204 | 11,732 | 14,975 | 18,385 |
| Springdale | 571 | 685 | 924 | 1,179 | 1,448 |
| St. George | 74,837 | 96,543 | 125,576 | 156,489 | 177,692 |
| Toquerville | 1,061 | 1,272 | 2,248 | 3,311 | 9,274 |
| Unincorporated | 5,250 | 6,294 | 8,490 | 10,837 | 13,305 |
| Virgin | 659 | 732 | 864 | 1,103 | 1,355 |
| Washington | 17,921 | 28,270 | 41,509 | 54,421 | 68,296 |
| County Total | 136,721 | 184,122 | 248,443 | 316,867 | 386,364 |

## DISTRICT-TO-DISTRICT TRAVEL DEMAND

A district is a combination of several TAZ's that are created to be able to evaluate travel characteristics of larger areas. Using the model's output for 2019 and 2050, travel demand between District 1 (Ivins, Santa Clara, west St. George, and the Ledges area) and the surrounding districts to the east (Leeds, Toquerville, Washington, Hurricane, and the southeast St. George areas) were compared in order to determine, at a higher level, the expected increase in east-west travel demand across the these areas of Washington County between 2019 and 2050 (see Figure 1). As shown in Figure 1, the travel demand between District 1 and the surrounding areas is expected to increase at a similar rate to the population increase with travel demand nearly doubling over the next 30 years.

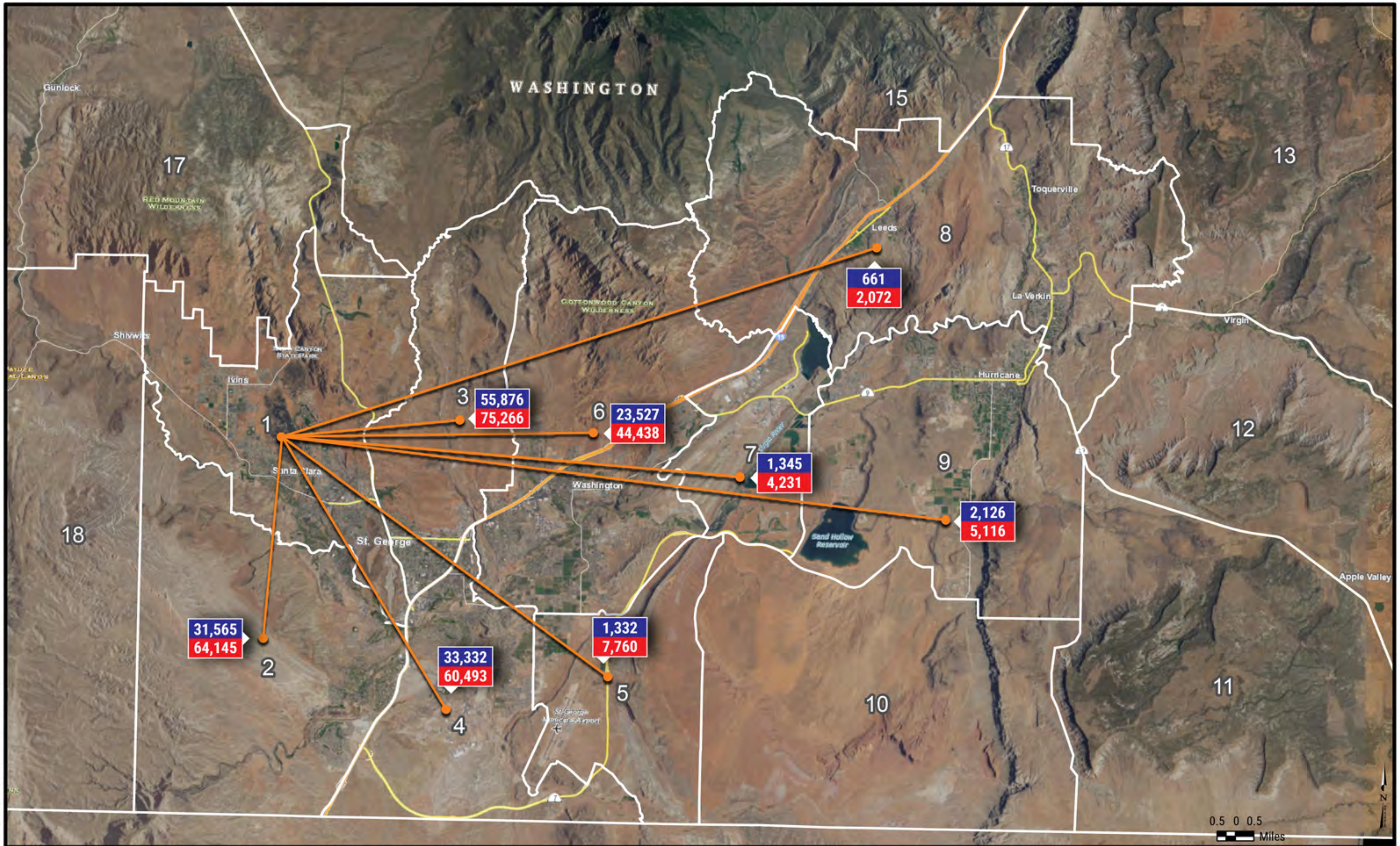
## East-West Screenline

In order to determine how the travel demand increase is expected to translate to surface street traffic, a screenline analysis was performed. A screenline analysis consists of drawing an imaginary line across a section of roadways and summing all traffic that crosses the line. Because of topographic restrictions, a large portion of travel from District 1 is concentrated north of 100 South in St. George along Bluff Street, Red Hills Parkway, and St. George Boulevard. Two screenlines were examined: Screenline A-A, which looks at total east-west travel just west of the St. George Boulevard I-15 interchange; and Screenline B-B, which looks at total north-south travel across Red Hills Parkway, Bluff Street, and Diagonal Street.

As shown in Figure 2, traffic across the screenlines is expected to increase by approximately 55% from 2019 to 2050. At a planning level, a typical travel lane can be expected to accommodate between 5,000 and 7,500 vehicles per day (vpd). In 2050, the average vpd per lane for both screenlines are expected to be around 9,000 vpd per lane.

### 2050 Volume Development

The existing 2019 traffic volumes (adjusted for weekly and seasonal variations) along with the 2019 and 2050 model output data were used for calculating the projected future 2050 volumes per the methodology described in the UDOT document "Utah Travel Demand Forecasting," which follows Chapter 8 of the National Cooperative Highway Research Program's (NCHRP) Report 255. This process involves comparing the 2019 model volumes with actual 2019 count data. The difference between the two volumes is used to make an adjustment to the 2050 volumes. This helps to correct for errors in the model where it might be over-predicting or under-predicting volumes. Existing 2019 and estimated 2050 volumes used in the analysis are included in the Appendix.

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**Regional Travel Demand**

2019

2050

Date 8/21/2019

DRAWN

Figure 1

C:\Users\sclarke\Desktop\Medium_District_Landscape.mxd, 8/22/2019 9:51:34 AM, sclarke

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# Study Screenlines

DATE 8/22/2019

DRAWN

Figure 2

## Vissim Model Overview

Model Limits - The Vissim model developed for the analysis includes the following corridors:

- Bluff Street (SR-18) from Snow Canyon Parkway to 100 South
- St. George Boulevard from Bluff Street to River Road
- Red Hills Parkway from Bluff Street to the Green Spring Drive
- Red Cliffs Drive between Street George Blvd and Green Spring Drive
- I-15 between Exit 8 (St. George Boulevard) and Exit 13 (Washington Parkway)

Geometry - Roadway geometric features such as the number of lanes, lane widths, and grades were built into the Vissim model using aerial photography, CADD files, and field visits.

Analysis Period - Traffic was modeled for two-hour periods in the PM between 4:00 PM to 6:00 PM. Daily counts collected using pneumatic tubes showed the AM peak hour traffic to be much lower than PM peak hour traffic. Therefore, only PM peak hour analysis was performed for the study.

Vehicle Composition - The vehicle composition, including truck percentages used for the model's vehicle inputs, was determined using a combination of manual traffic counts at the study intersections and PEMS data for mainline I-15. Details of the vehicle composition used for the analysis are contained in the Appendix.

Routing - Origin-Destination pairs used to route vehicles through the model's network were determined by the DMPO TDM and Bluetooth data in the study area. Turning movement ratios were used in areas that were not included in the O-D data collection area.

Signal Timing - Existing conditions were modeled with signal timings obtained from the UDOT Traffic Operations Center Signal Group. Future conditions were modeled with the same general signal timing parameters, but with optimized phasing.

## Vissim Model Calibration

For this project, version 2020-07 of the Vissim microsimulation software was used to model traffic in the study area. A model of the existing geometry and traffic volumes was prepared in order to replicate the typical traffic conditions. The Vissim software is based on two different driving behavior models, the Wiedemann-74 and Wiedemann-99 methodologies. The Wiedemann-74 model is used primarily in urban traffic conditions, and the Wiedemann-99 model is used for inter-urban motorway or freeway conditions. In the study area both types of roadway behavior are present, therefore both methodologies are used. Default Parameters for the Wiedemann-74 methodology are presented in Table 3. Default parameters for Wiedemann-99 are presented in Table 4.

**Table 3. Wiedemann-74 Model Parameters**

| Model Parameter | Value |
|---|---|
| Average standstill distance | 6.56 |
| Additive part of safety distance | 2.00 |
| Multiplicative part of safety distance | 3.00 |

**Table 4. Wiedemann-99 Model Parameters**

| Model Parameter | Value |
|---|---|
| CC-0; Standstill distance | 4.92 |
| CC-1; Headway time | 0.90 |
| CC-2; ‘Following’ variation | 13.12 |
| CC-3; Threshold for entering ‘Following’ | -8.00 |
| CC-4; Negative ‘Following’ threshold | -0.35 |
| CC-5; Positive ‘Following’ threshold | 0.35 |
| CC-6; Speed dependency for oscillation | 11.44 |
| CC-7; Oscillation acceleration | 0.82 |
| CC-8; Standstill acceleration | 11.48 |
| CC-9; Acceleration with 50 mph | 4.92 |

Criteria used in calibrating the Vissim model was taken from Federal Highway Administration’s (FHWA) Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Modeling Software (FHWA, 2004). The calibration uses the GEH statistic to compare observed vs modeled volume flow. The formula used to calculate the GEH statistic is:

$$GEH = \sqrt{\frac{(E-V)^2}{(E+V)/2}}$$

where East equals the modeled volumes and V equals the observed volume.

Based on FHWA’s document the following calibration criteria and targets shown in Table 5 were used.

**Table 5. Calibration Criteria**

| Criteria and Measure | Calibration Acceptance Targets | Condition Met? |
|---|---|---|
| **Hourly Flows, Model Versus Observed** | | |
| Within 400 veh/hr, for Flow >2700 veh/hr | > 85% of cases | Yes |
| Sum of All Link Flows | Within 5% of sum of all link counts | Yes |
| GEH Statistic < 5 for Individual Link Flows | > 85% of cases | Yes |
| GEH Statistic for Sum of All Link Flows | GEH < 4 for sum of all link counts | Yes |
| **Travel Times, Model Versus Observed** | | |
| Travel Times Within 15% | > 85% of cases | Yes |
| **Visual Audits** | | |
| Individual Link Speeds: Visually Acceptable Speed-Flow Relationship | To analyst’s satisfaction | Yes |
| Bottlenecks: Visually Acceptable Queueing | To analyst’s satisfaction | Yes |

The Vissim model was calibrated by testing various combinations of driver behavior parameter adjustments against field measurements and observations. Initial model runs with default values showed congestion levels below what was observed in the field. Queues, particularly around the Green

Spring Drive/Telegraph Street intersection were much lower than field observations. The Vissim Wiedemann-74 default parameters were adjusted up until the model generally matched observed conditions. An additional driver behavior was created for links that had a high degree of side friction from accesses. No adjustments were made to the Wiedemann-99 parameters. Table 6 shows the revised Wiedemann-74 parameters based on the calibrated adjustments:

**Table 6. Revised Wiedemann-74 model parameters**

| Model Parameter | Original Value | Adjusted Value | Side Friction |
|---|---|---|---|
| Average standstill distance | 6.56 | 6.56 | 6.56 |
| Additive part of safety distance | 2.00 | 2.25 | 2.5 |
| Multiplicative part of safety distance | 3.00 | 3.25 | 3.5 |

Based on the comparison of the Vissim model outputs to field measurements (travel times, traffic flows, and speeds) the Vissim model meets the calibration targets and accurately represents PM peak hour conditions for the existing 2019 analysis.

## Measures of Effectiveness

The primary measure of effectiveness (MOE) used for this study was Level of Service (LOS). LOS is a term used to describe the traffic operations of an intersection, based on congestion and delay, and a freeway, based on density. LOS ranges from A (almost no congestion or delay) to F (traffic demand exceeds capacity and the intersection experiences long queues and delay). LOS D is generally acceptable for urbanized intersections and was used for this analysis. LOS East is the threshold when the intersection reaches capacity. The delay criteria used to assign a letter grade to an intersection for signalized and unsignalized intersections is shown in Table 7 below.

**Table 7. Highway Capacity Manual Intersection LOS Criteria**

| LOS | Traffic Conditions | Signalized Average Control Delay (sec/veh) | Unsignalized Average Control Delay (sec/veh) |
|---|---|---|---|
| **Acceptable** | | | |
| A | Free Flow Operations / Insignificant | 0 ≤ 10 | 0 ≤ 10 |
| B | Smooth Operations / Short Delays | 10 ≤ 20 | 10 ≤ 15 |
| C | Stable Operations / Acceptable Delays | 20 ≤ 35 | 15 ≤ 25 |
| D | Approaching Unstable Operations / Tolerable Delays | 35 ≤ 55 | 25 ≤ 35 |
| **Unacceptable** | | | |
| East | Unstable Operations / Significant Delays Begin | 55 ≤ 80 | 35 ≤ 50 |
| F | Very Poor Operations / Excessive Delays Occur | > 80 | > 50 |

Table 8 details the LOS thresholds for freeway segments based on the number of passenger cars per mile per lane (pc/mi/ln):

**Table 8. Highway Capacity Manual Interstate LOS Criteria**

| LOS | Traffic Conditions | Basic Segment Freeway Density (pc/mi/ln) | Weave Segment Freeway Density (pc/mi/ln) |
|---|---|---|---|
| **Acceptable** | | | |
| A | Free Flow Operations / Insignificant | 0 ≤ 10 | 0 ≤ 10 |
| B | Smooth Operations / Short Delays | 10 ≤ 15 | 10 ≤ 20 |
| C | Stable Operations / Acceptable Delays | 15 ≤ 25 | 20 ≤ 28 |
| D | Approaching Unstable Operations / Tolerable Delays | 25 ≤ 35 | 28 ≤ 35 |
| **Unacceptable** | | | |
| East | Unstable Operations / Significant Delays Begin | 35 ≤ 50 | 35 ≤ 43 |
| F | Very Poor Operations / Excessive Delays Occur | > 50 | > 43 |

Another MOE used in the traffic analysis was queueing. The analysis identified the average and 95th percentile queue length for each movement at the study intersections. Queue length is used to identify issues such as queuing between intersections and queues that exceed their available storage.

# NO BUILD OPERATIONS

## Intersection Operations

The calibrated Vissim model was run under existing (2019), 2030, 2040, and 2050 PM peak hour no-build conditions in order to assess the current and future traffic operations and determine the impacts of not making any modifications to the study area other than those already included in local and regional long-range transportation plans. The following sections detail the operations analysis for the study intersections. Table 9 details the PM peak hour intersection delay and corresponding LOS for each of the study intersections under each of the no-build scenarios.

**Table 9. No Action PM Peak Hour Level-of-Service Alternatives**

| Intersection | 2019 Existing | 2030 No-Action | 2040 No-Action | 2050 No-Action |
|---|---|---|---|---|
| RHP/Bluff Street | B | C | C | C |
| Sunset/Bluff Street | C | D | East | F |
| SG Blvd/Bluff Street | C | D | East | F |
| SG Blvd/Main Street | C | C | C | C |
| SG Blvd/1000 East | D | D | D | D |
| I-15 Exit 8 SB Ramps | C | C | C | C |
| I-15 Exit 8 NB Ramps | C | C | C | B |
| SG Blvd/River Road | D | C | C | D |
| RHP/200 East | A | A | B | B |
| RHP/1000 East | C | D | F | F |
| I-15 Exit 10 | C | C | C | C |
| Green Spring/ Telegraph Street | East | D | D | East |
| I-15 Exit 13 SB Ramps | A | B | B | B |
| I-15 Exit 13 NB Ramps | A | A | A | A |

As shown in the table, the following intersections are expected to experience failing conditions by 2050:

- Sunset Boulevard and Bluff Street
- Bluff Street and Street George Boulevard
- Red Hills Parkway and 1000 East
- Telegraph Street and Green Spring Drive

Future congested conditions are centered around the primary corridors of Red Hills Parkway, St. George Boulevard, Bluff Street, and Green Spring Drive. The 1000 East/Red Hills Parkway intersection experienced the highest degree of congestion with queues that extended nearly a mile. It should be noted that the congested conditions at several intersections meter traffic such that other intersections that appear to be operating at an acceptable LOS may only be doing so because they do not experience the full travel demand due to the upstream congestion.

## ALTERNATIVES DEVELOPMENT AND EVALUATION

As part of the study, eight preliminary alternatives were developed. The eight concepts were evaluated based on their ability to address the study area operational problems discussed under the No-build analysis above. See Chapter 2 of the EIS for a complete description of the alternative development and evaluation process. The eight preliminary alternatives are:

1. Alternative 1: Northern Alignment (North of Cottonwood Wilderness Area)
2. Alternative 2: T-Bone Mesa Alignment
3. Alternative 3: UDOT Application Alignment
4. Alternative 4: Southern Alignment
5. Alternative 5: Red Hills Parkway Expressway

6. Alternative 6: Red Hills Parkway Widening
7. Alternative 7: Street George Boulevard/100 South One-Way Couplet
8. Alternative 8: Street George Boulevard Widening

## ALTERNATIVES EVALUATION

Each of the eight alternative concepts, in addition to the no-action alternative, were analyzed using the methodology and software discussed in the previous sections of this memo. The following measurements were calculated for each alternative:

1. Level-of-Service at each of the study intersections using Vissim microsimulation models.
2. Origin-destination travel times between I-15 north of Exit 13 and Sunset Boulevard just west of Bluff Street using three separate routes.
3. Shifts in travel patterns for the major study corridors for each of the NCA corridor alignments.

## INTERSECTION LEVEL-OF-SERVICE (LOS)

Table 10 details the LOS for each of the study intersections under each alternative under 2050 PM peak hour conditions. It should be noted that Alternative 7 would have additional impacts to many intersections throughout the downtown St. George area between St. George Boulevard, 100 South, Bluff Street, and River Road in addition to those shown in Table 10. The reconfiguration of St. George Boulevard and 100 South to one-way streets would result in increased travel on most, if not all, of the cross-streets and other parallel streets within this area as vehicles use these streets to travel back and forth between the one-way couplet system to access locations not directly available with the one-way configuration. Analysis indicates that though the volumes on these minor cross-streets would increase, they would still operate at or above the LOS D target operational threshold discussed earlier.

**Table 10. 2050 PM Peak Hour Alternative LOS Comparison**

| Intersection | No-Action | Non-NCA: Northern (Alt 1) | NCA: T-Bone Mesa (Alt 2) | NCA: UDOT (Alt 3) | NCA: Southern (Alt 4) | Non-NCA: RHP Expressway (Alt 5) | Non-NCA: RHP Widening (Alt 6) | Non-NCA: SG Blvd/100 S One-way Couplet (Alt 7) | Non-NCA: SG Blvd Widening (Alt 8) |
|---|---|---|---|---|---|---|---|---|---|
| RHP/Bluff Street | C | C | C | C | C | C | C | C | C |
| Sunset/Bluff Street | F | F | F | East | F | East | East | East | East |
| SG Blvd/Bluff Street | F | F | D | D | F | C | East | B | D |
| SG Blvd/Main Street | C | C | C | C | C | C | C | C | C |
| SG Blvd/1000 East | D | D | C | D | D | C | East | B | D |
| I-15 Exit 8 SB Ramps | C | C | C | C | C | C | F | C | C |
| I-15 Exit 8 NB Ramps | B | B | C | C | C | C | C | B | D |
| SG Blvd/River Road | D | D | D | D | D | D | D | C | D |
| RHP/200 East | B | B | A | A | B | A | A | B | A |
| RHP/1000 East | F | F | B | B | F | C | F | C | F |
| I-15 Exit 10 | C | C | C | C | C | C | C | B | C |
| Green Spring/ Buena Vista | C | C | C | C | C | C | C | D | C |
| Green Spring/ Telegraph Street | East | East | D | East | East | East | D | East | East |
| I-15 Exit 13 SB Ramps | B | B | C | B | B | B | B | B | B |
| I-15 Exit 13 NB Ramps | A | A | B | B | B | A | A | A | A |

As shown in Table 10, under each of the alternatives the Sunset Boulevard/Bluff Street intersection operates at LOS East or worse conditions. The Green Spring/Telegraph Street intersection operates at borderline D/East conditions under each of the alternatives. Outside those two intersections, the T-Bone Mesa (Alt 2), UDOT Application (Alt 3), Red Hills Pkwy Expressway (Alt 5), and St. George Boulevard/100 South One-Way Couplet (Alt 7) alternatives improved operations at each of the study intersections to LOS D or better. Associated specifically with Alternative 7 is the additional intersection of Bluff Street/100 South which would also be affected by the one-way couplet. Analysis shows this intersection would operate at LOS C in 2050 (result not shown in Table 10).

## TRAVEL TIMES

Using the Vissim traffic models, origin-destination (O-D) travel times were measured between I-15 north of Exit 13 (Washington Parkway) and Sunset Boulevard just west of Bluff Street using the routes shown in Figure 3.

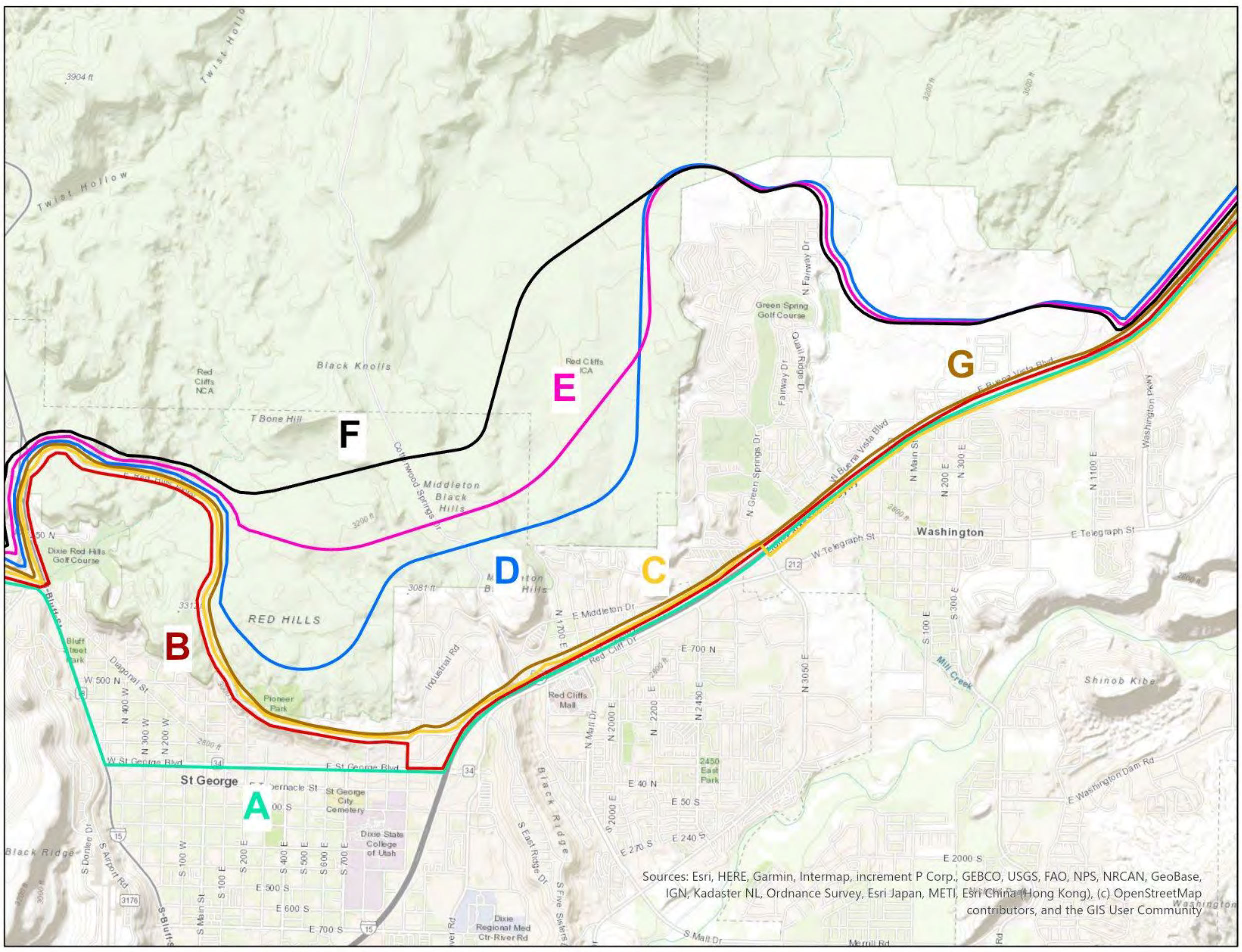



**Figure 3. 0-D Routes**

Table 11 details the results for the O-D travel times. The travel times represent the average amount of time it would take for vehicles to traverse the indicated route during a typical PM peak hour assuming implementation of each alternative.

**Table 11. 2050 PM Peak Hour Alternatives Travel Time Comparison (minutes)**

| Alternative | No-Action | Northern (Alt 1) | T-Bone Mesa (Alt 2) | UDOT (Alt 3) | Southern (Alt 4) | RHP Expressway (Alt 5) | RHP Widening (Alt 6) | SG Blvd/100 S One-way Couplet (Alt 7) | SG Blvd Widening (Alt 8) |
|---|---|---|---|---|---|---|---|---|---|
| Route A | 24 | 24 | 15 | 16 | 21 | 14 | 24 | 14 | 14 |
| Route B | 25 | 25 | 15 | 15 | 22 | 15 | 21 | 17 | 20 |
| Route C | 40 | 40 | 15 | 16 | 33 | 16 | 16 | 18 | 31 |
| Route D | N/A | N/A | N/A | N/A | 17 | N/A | N/A | N/A | N/A |
| Route East | N/A | N/A | N/A | 15 | N/A | N/A | N/A | N/A | N/A |
| Route F | N/A | N/A | 14 | N/A | N/A | N/A | N/A | N/A | N/A |
| Route G | N/A | N/A | N/A | N/A | N/A | 12 | N/A | N/A | N/A |

As shown in Table 11, Alternatives 2, 3, 5, and 7 showed the greatest reductions in travel times in 2050. It should be noted that similar to the LOS discussion earlier, Alternative 7 would have additional travel time impacts to other local streets within the downtown St. George area not reflected in Table 11. This is due to vehicles having to undertake more out-of-direction travel to access the one-way couplet system to get to their destinations.

## NORTHERN CORRIDOR ALIGNMENT COMPARISONS

Further comparisons were made between the three Northern Corridor alignments within the NCA: T-Bone Mesa, UDOT Alignment, and Southern to help understand the subtle differences each of these alternatives have on regional traffic performance. The following sections detail those comparisons.

## AREA OF INFLUENCE

Using the DMPO TDM, heat maps were created showing the area of influence of Alternatives 2, 3, and 4. These are shown in Figures 4-6. The colors represent the various TAZs that are affected by the alternative and to what relative extent they are affected. A darker area would have more trips that are using that particular alternative than a lighter area.

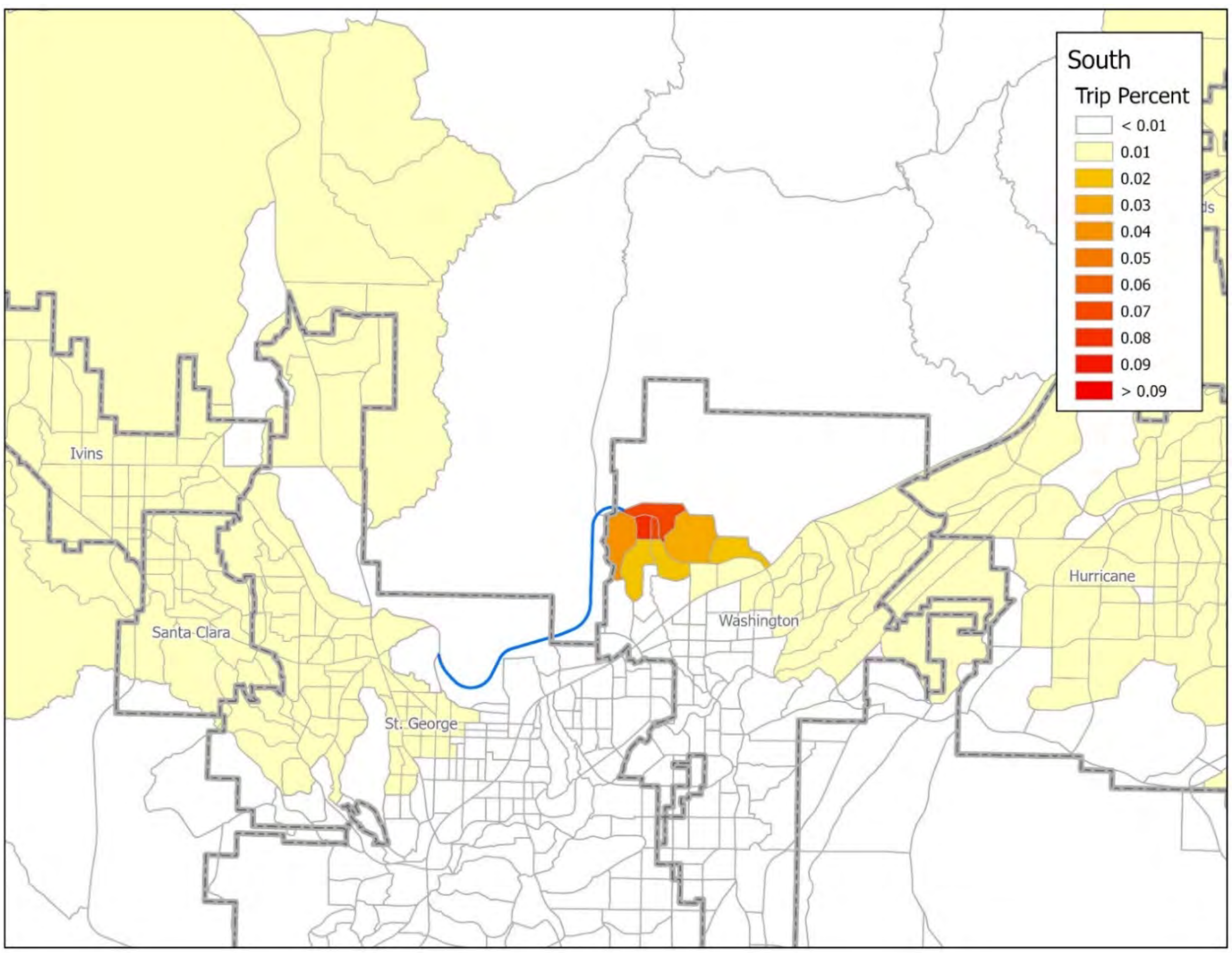
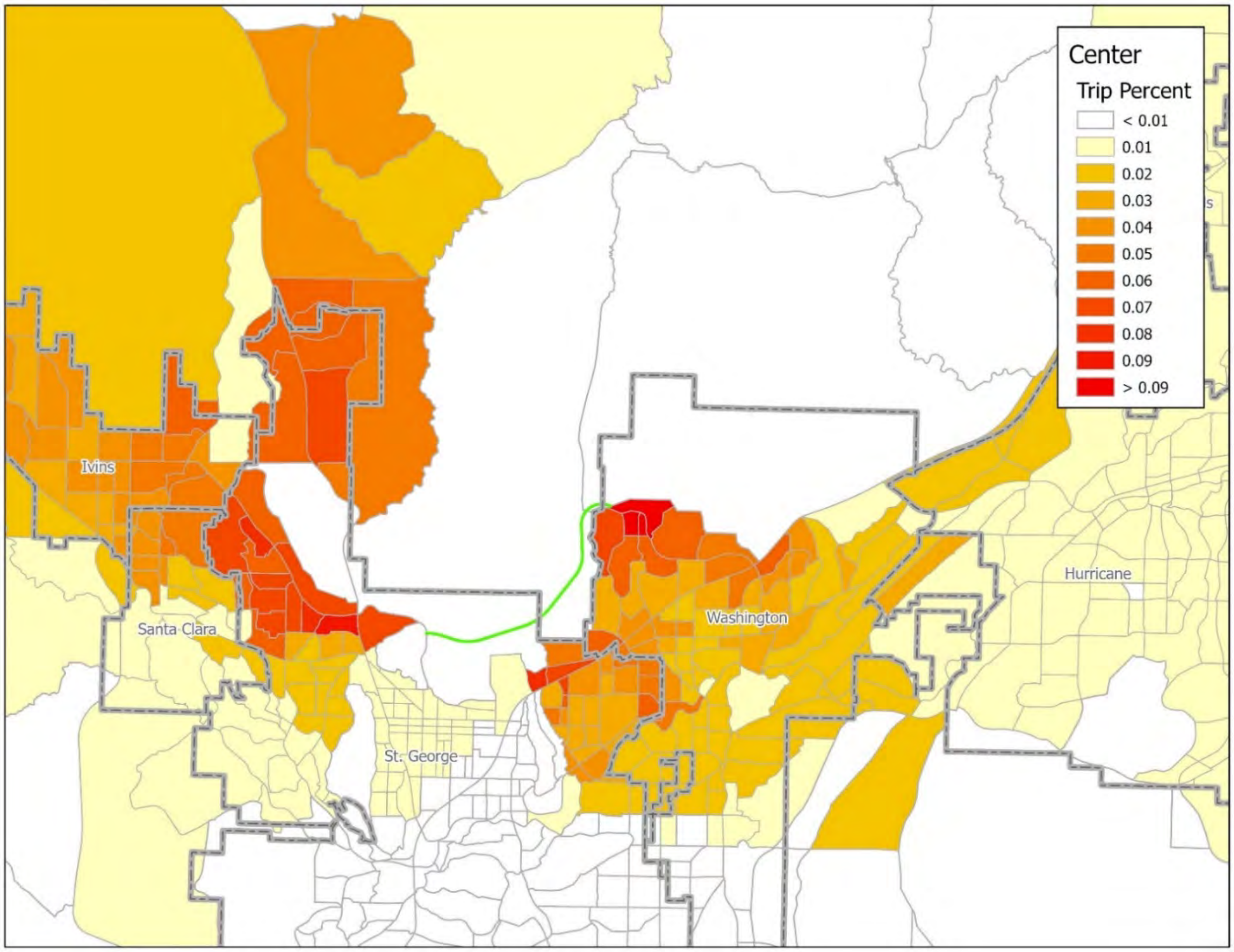



**Figure 4. Southern Alignment Area of Influence**

As shown in Figure 4, the Southern Alignment primarily serves the Green Springs north area with very little usage from Ivins, Santa Clara, northwest St. George, northeast Washington, Hurricane, and Toquerville.




## Figure 5. UDOT Application Alignment Area of Influence

The UDOT Application Alignment is 1.5 miles shorter than the Southern Alignment. The shortened distance provides more direct accesses to west Street George, Ivins, Santa Clara, and Washington as shown in Figure 5. There was a large amount of travel between the Washington area and west Street George, Ivins, and Santa Clara via Cottonwood Road and the Northern Corridor.

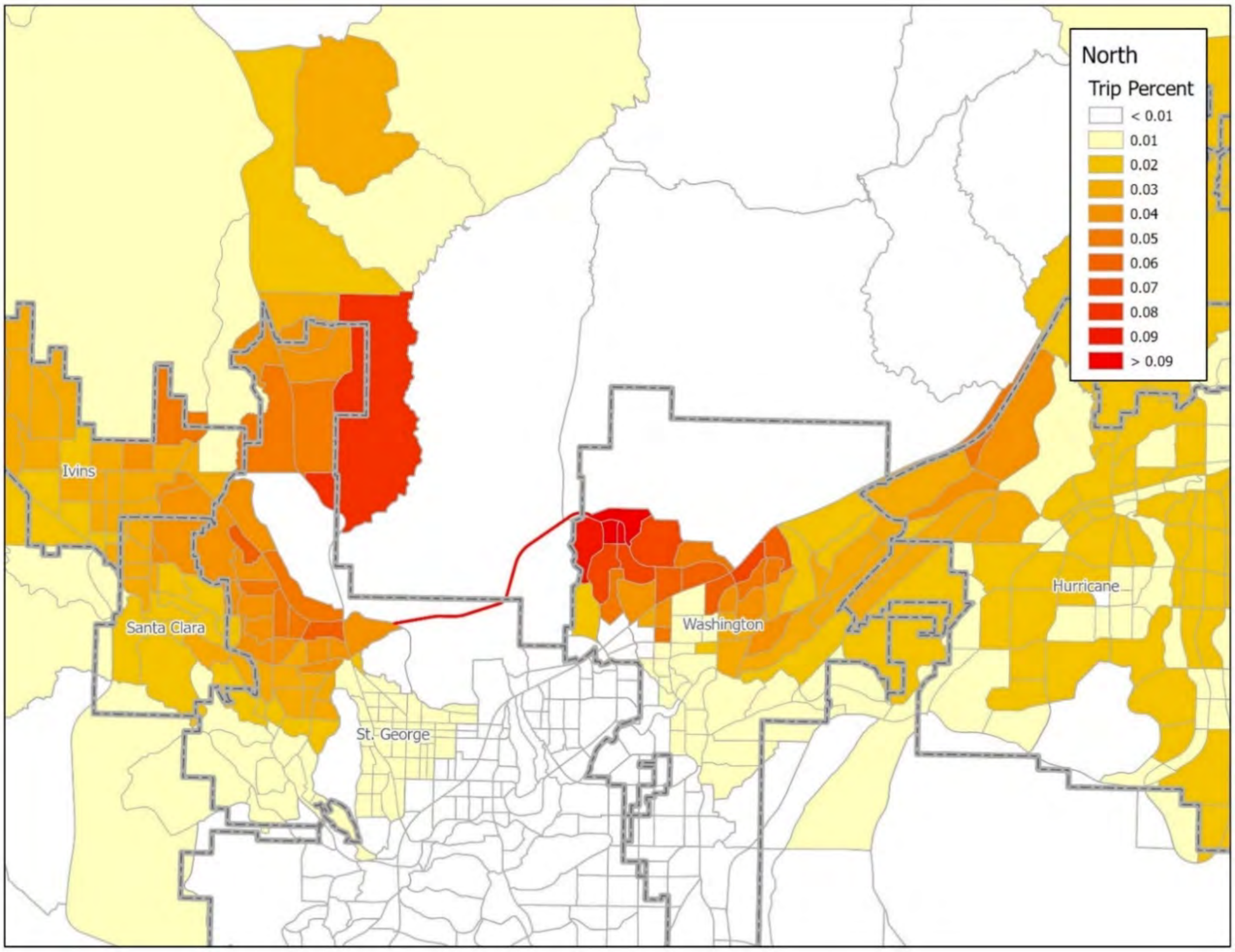



**Figure 6. T-Bone Mesa Alignment Area of Influence**

As shown in Figure 6, the T-Bone Mesa Alignment provides even more direct east/west access between west Street George, Ivins, and Santa Clara to Washington and Hurricane when compared to the other alternatives, increasing the area of influence in those areas. The T-Bone Mesa alignment, which is further north than the UDOT Alignment, decreased the amount of usage from the Washington area as the extra length of travel on Cottonwood Road caused traffic in that area to use Red Hills Parkway instead.

## DAILY VOLUME COMPARISON

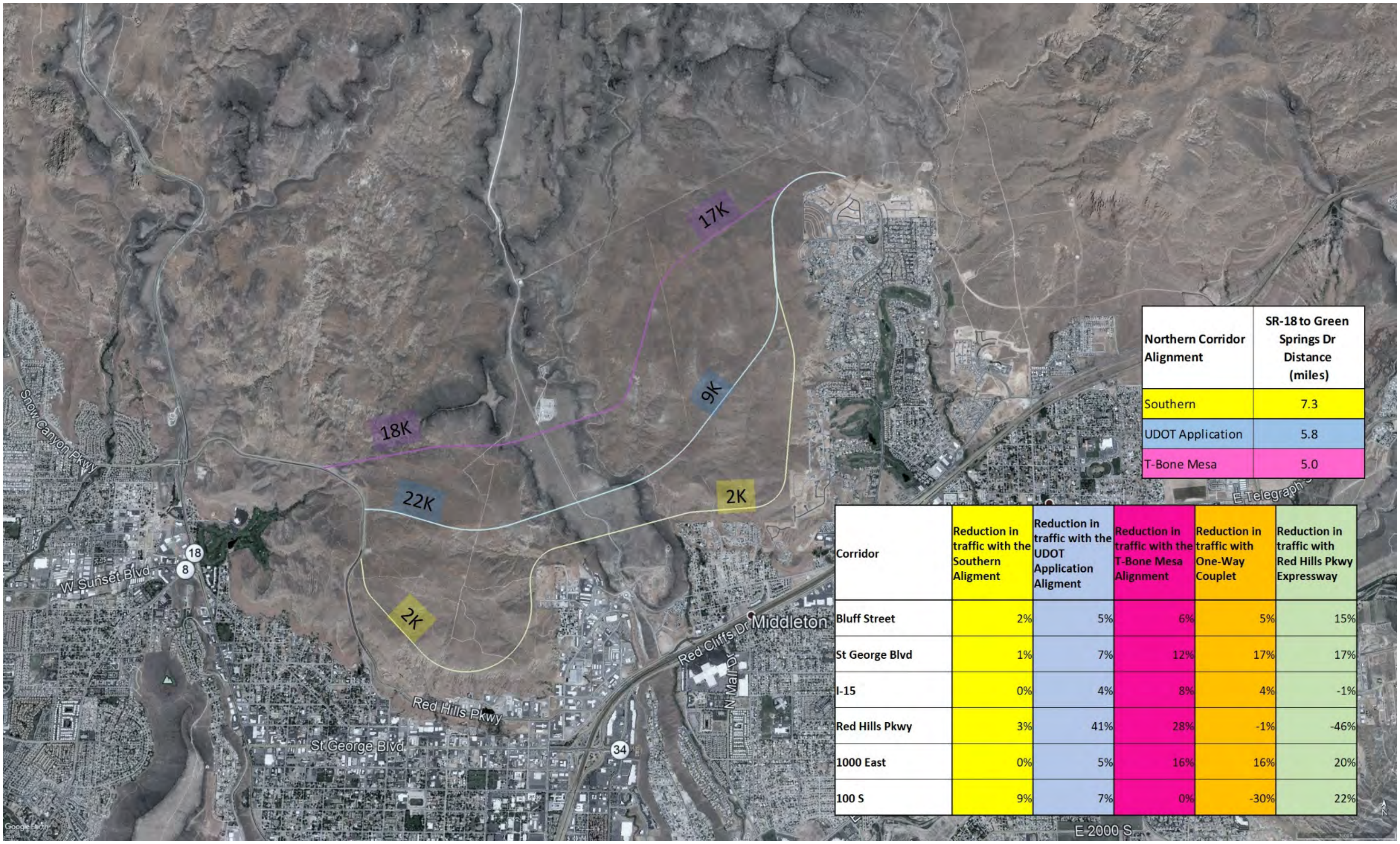
The anticipated daily volumes for Alternatives 2, 3, and 4 in 2050 are shown in Figure 7. The figure also shows the percent reduction in traffic on the major surrounding corridors associated with each alternative. It should be noted that Alternatives 1, 6, and 8 were not included in this analysis since they did not perform as well as the other alternatives in the previous LOS and travel time studies, and, thus, were eliminated from the daily volume comparisons. As shown in Figure 7, the Southern Alternative is expected to carry approximately 2,000 vehicles per day (vpd) in 2050. The UDOT Alternative carries between 9,000-22,000 vpd and the T-Bone Mesa Alternative carries between 17,000-18,000 vpd.

The Southern Alternative showed between 0%-3% reduction in travel on the major surrounding corridors. The UDOT Alternative showed a reduction ranging between 4%-33%, and the T-Bone Mesa Alternative showed a reduction between 5%-19%. The St. George Boulevard/100 South One-Way Couplet showed a -1% to 17% reduction. Th Red Hills Parkway Expressway alternative increases traffic on Red Hills Parkway by 46% and I-15 by 1% while decreasing the remaining corridors by 15% to 20%.

Table 12 provides the average annual daily traffic (AADT) volumes for each of the alternatives for various roadway segments on Bluff Street, Street George Blvd, 100 South, and Red Hills Parkway.

**Table 12. Average Annual Daily Traffic (2050 AADT) Comparison**

| Roadway | Segment | 2019 AADT | No Action | Northern Corridor (T-Bone Alignment) | Northern Corridor (UDOT Alignment) | Northern Corridor (Southern Alignment) | One-Way Couplet | Red Hills Expressway |
|---|---|---|---|---|---|---|---|---|
| Bluff Street | Snow Canyon to Sunset | 22,000 | 31,000 | 33,000 | 32,000 | 31,000 | 33,000 | 32,000 |
| Bluff Street | Sunset to Blvd | 50,000 | 65,000 | 61,000 | 61,000 | 63,000 | 62,000 | 55,000 |
| SG Blvd | Bluff Street to Main | 24,000 | 26,000 | 23,000 | 23,000 | 25,000 | 16,000 | 19,000 |
| SG Blvd | Main to 1000 East | 33,000 | 36,000 | 34,000 | 34,000 | 36,000 | 26,000 | 32,000 |
| SG Blvd | 1000 East to I-15 Ramps | 44,000 | 55,000 | 50,000 | 52,000 | 55,000 | 47,000 | 47,000 |
| Red Hills Pkwy | Bluff Street to Skyline Dr | 12,000 | 31,000 | 39,000 | 38,000 | 32,000 | 32,000 | 47,000 |
| Red Hills Pkwy | Skyline Dr to 1000 East | 22,000 | 38,000 | 28,000 | 23,000 | 36,000 | 38,000 | 54,000 |
| Red Hills Pkwy | 1000 East to I-15 Crossing | 11,000 | 20,000 | 18,000 | 22,000 | 20,000 | 23,000 | 24,000 |
| 100 S | Bluff Street to Main | 9,000 | 12,000 | 12,000 | 13,000 | 12,000 | 17,000 | 11,000 |
| 100 S | Main to 1000 East | 16,000 | 24,000 | 22,000 | 23,000 | 24,000 | 29,000 | 20,000 |
| 100 S | 1000 East to River Road | 16,000 | 34,000 | 32,000 | 33,000 | 34,000 | 27,000 | 31,000 |




| Northern Corridor Alignment | SR-18 to Green Springs Dr Distance (miles) |
|---|---|
| Southern | 7.3 |
| UDOT Application | 5.8 |
| T-Bone Mesa | 5.0 |

| Corridor | Reduction in traffic with the Southern Aligment | Reduction in traffic with the UDOT Application Aligment | Reduction in traffic with the T-Bone Mesa Alignment | Reduction in traffic with One-Way Couplet | Reduction in traffic with Red Hills Pkwy Expressway |
|---|---|---|---|---|---|
| Bluff Street | 2% | 5% | 6% | 5% | 15% |
| St George Blvd | 1% | 7% | 12% | 17% | 17% |
| I-15 | 0% | 4% | 8% | 4% | -1% |
| Red Hills Pkwy | 3% | 41% | 28% | -1% | -46% |
| 1000 East | 0% | 5% | 16% | 16% | 20% |
| 100 S | 9% | 7% | 0% | -30% | 22% |

**Figure 7. Northern Corridor Daily Volume Comparison**

## VEHICLE MILES TRAVELED

Table 13 compares the vehicle miles traveled (VMT) for all of Washington County under each of the alternatives from the DMPO TDM.

**Table 13. Washington County Vehicle Miles Traveled Comparison**

| Year | Scenario | Daily | PM Peak Period (4-6 pm) |
|---|---|---|---|
| 2019 | Base | 4,367,738 | 1,087,122 |
| 2050 | No Action | 10,287,036 | 2,557,253 |
| 2050 | T-Bone Alignment (Alt 2) | 10,296,900 | 2,560,121 |
| 2050 | UDOT Alignment (Alt 3) | 10,295,127 | 2,560,028 |
| 2050 | Southern Alignment (Alt 4) | 10,291,067 | 2,559,754 |
| 2050 | Red Hills Expressway (Alt 5) | 10,311,945 | 2,563,923 |
| 2050 | St. George Blvd/100 S One-Way Couplet (Alt 7) | 10,290,984 | 2,558,499 |

As shown in Table 13, each of the alternatives increase the overall VMT for Washington County. This is typical with roadway improvements as bottlenecks in the network are removed and people can travel longer distances in shorter amounts of time.

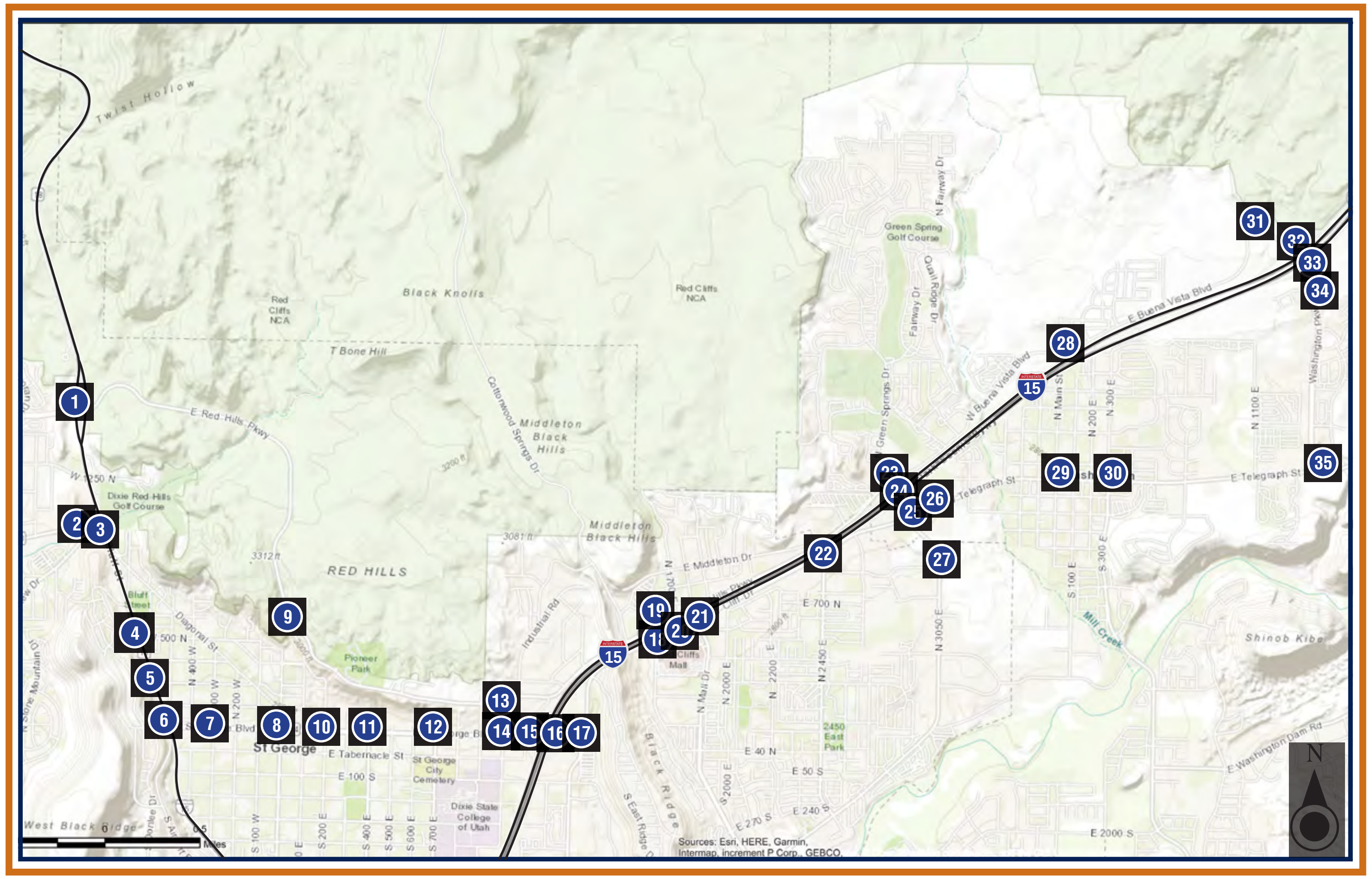
## CONCLUSION

Future growth in Washington County is expected to increase the east-west travel demand across the St. George urbanized area causing unacceptable levels of congestion along key corridors by the year 2050. Several alternatives were evaluated in order to meet the future travel demand. The following alternatives showed substantial improvements to the study corridors:

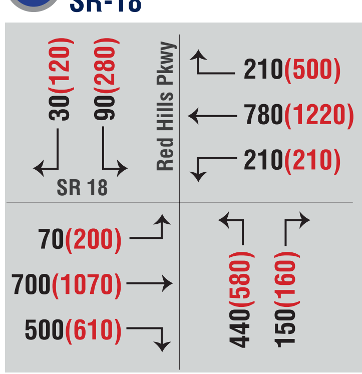
1. Alternative 2: T-Bone Mesa Alignment
2. Alternative 3: UDOT Application Alignment
3. Alternative 5: Red Hills Parkway Expressway
4. Alternative 7: Street George Blvd/100 South One-Way Couplet

# APPENDIX

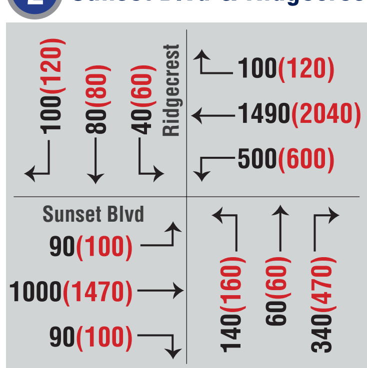
# 2017 (2050) INTERSECTION VOLUMES – PM PEAK HOUR



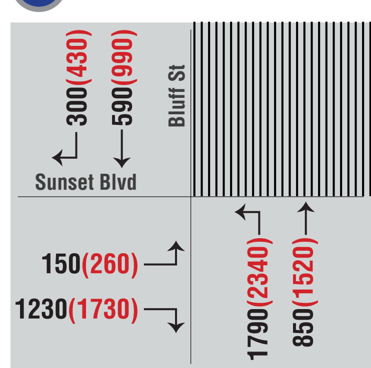

## 1 Red Hills Pkwy & SR-18



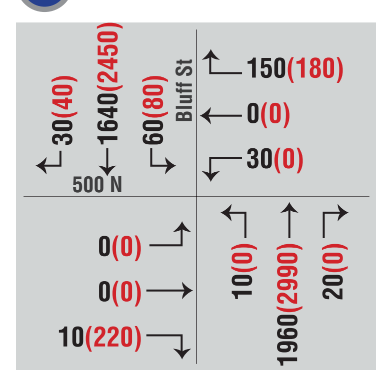

## 2 Sunset Blvd & Ridgecrest



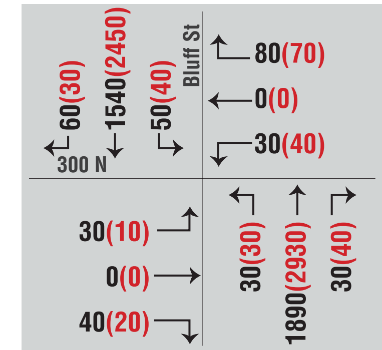

## 3 Sunset Blvd & Bluff St



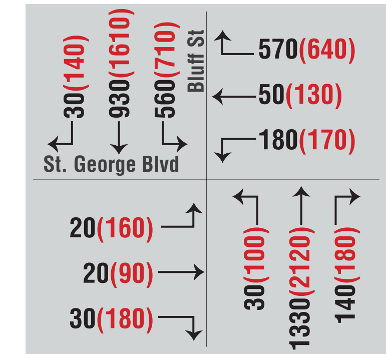

## 4 Bluff St & 500 North



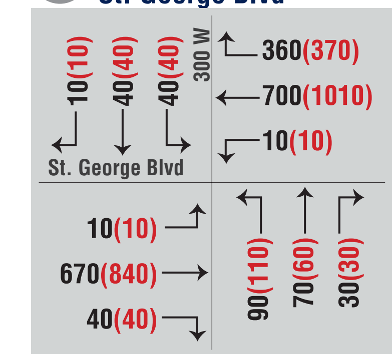

## 5 Bluff St & 300 North



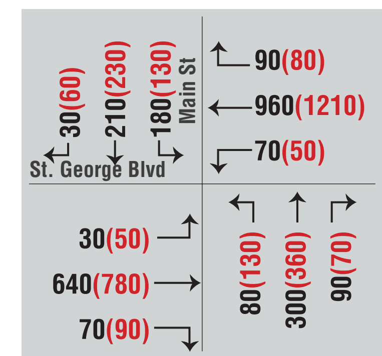

## 6 Bluff St & St. George Blvd




## 7 300 West & St. George Blvd

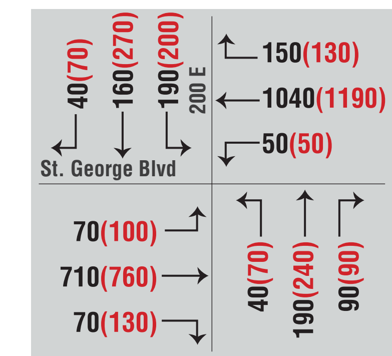



## 8 Main St & St. George Blvd

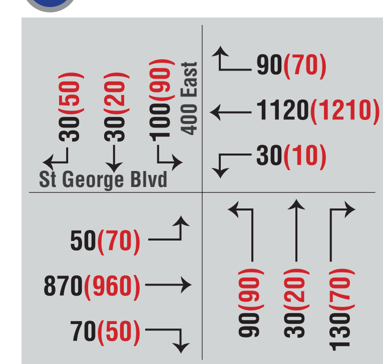



## 9

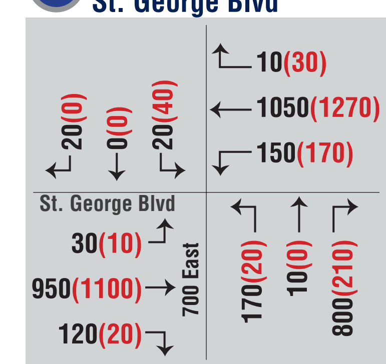

## 10 200 East & St George Blvd



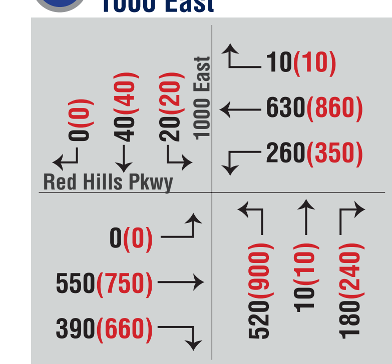

## 11 400 East & St George Blvd



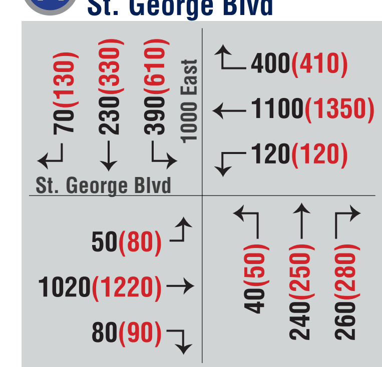

## 12 700 East & St. George Blvd



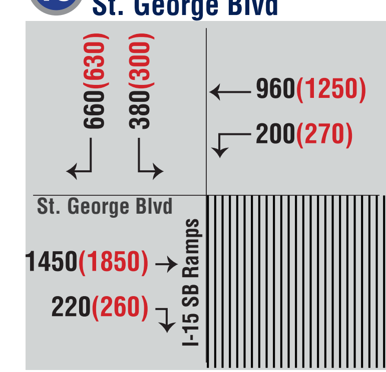

## 13 Red Hills Pkwy & 1000 East



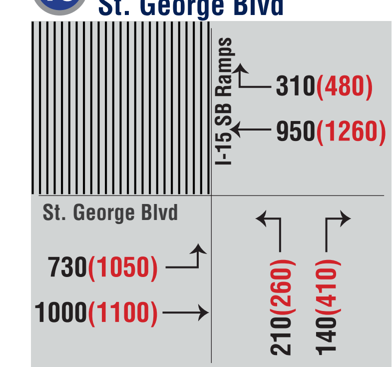

## 14 1000 East & St. George Blvd



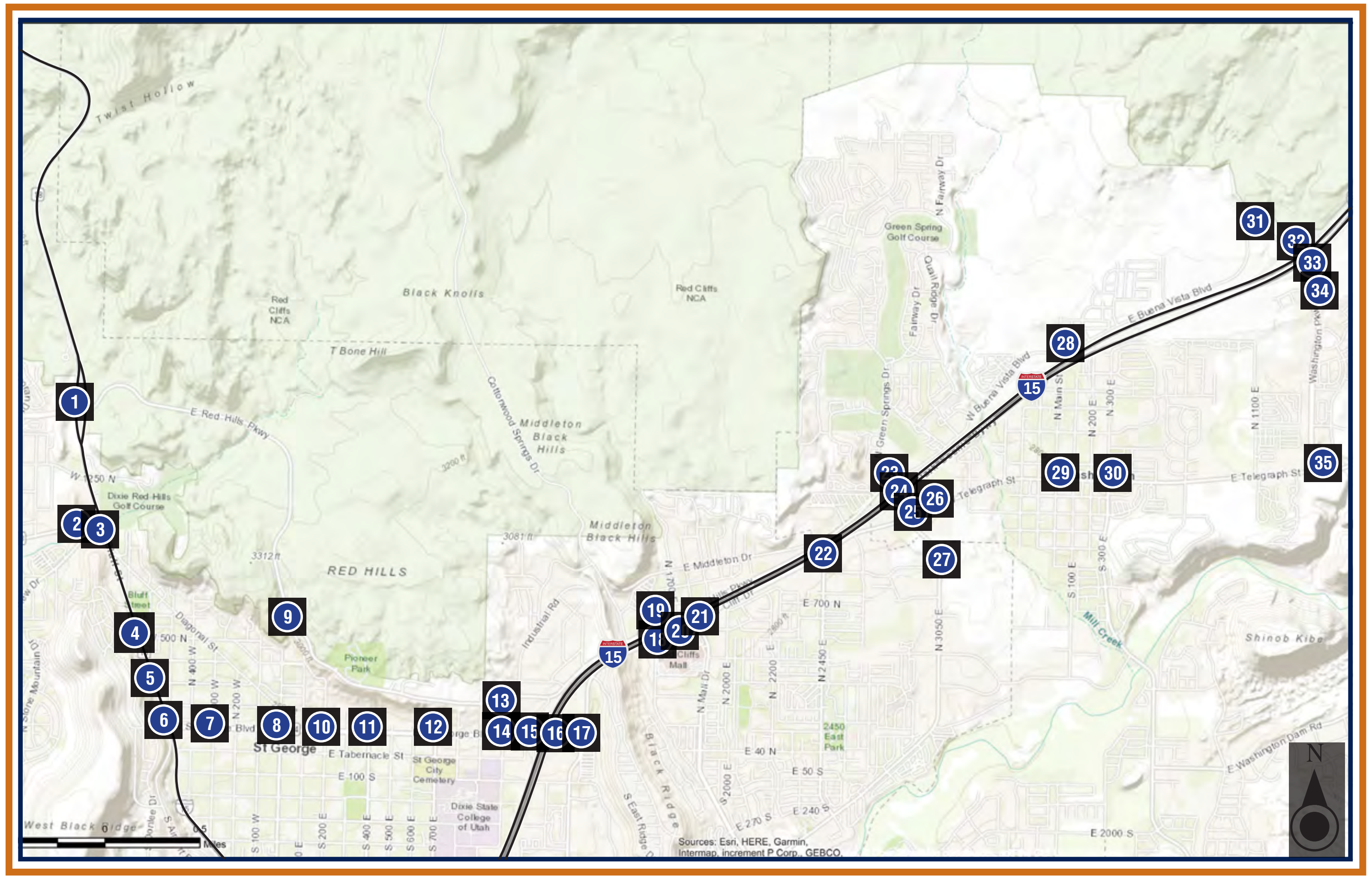

## 15 I-15 SB Ramps & St. George Blvd




## 16 I-15 NB Ramps & St. George Blvd



# 2017 (2050) INTERSECTION VOLUMES – PM PEAK HOUR




## 17 River Road & St. George Blvd

River Road: 660(1110), 370(720), 20(30)
0(0), 80(80), 70(70)
St. George Blvd: 800(990), 50(40), 520(470)
520(550), 770(1210), 60(60)

## 18 Red Cliffs Dr & 1680 East

930(1580), 60(100)
Red Cliffs Dr: 1220(1760), 130(160)
1680 East: 130(180), 100(150)

## 19 Red Hills Pkwy Underpass North

Underpass North: 600(710), 180(440)
Red Hills Pkwy: 420(500), 350(590)
300(460), 240(540)

## 20 Red Hills Pkwy Underpass South

80(310), 450(720)
Underpass North: 400(590), 910(1370)
Red Hills Pkwy: 140(420), 1180(1500)

## 21 Red Cliffs Dr & Mall Dr

Mall Dr: 840(1160), 150(170)
Red Cliffs Dr: 1260(1600), 370(620)
470(790), 120(120)

## 22 Red Cliffs Dr & 2450 East

Main St: 580(900), 180(240)
Telegraph: 1040(1420), 120(120)
250(280), 150(200)

## 23 Buena Vista Blvd & Green Springs Dr

60(120), 240(390), 10(20)
Green Springs Dr: 10(10), 170(210), 160(160)
Buena Vista Blvd: 80(160), 220(320), 380(550)
440(640), 330(520), 250(290)

## 24 Green Springs SPUI

90(120), 550(750), 140(250)
Green Springs SPUI: 130(230), 350(580)
NB Ramps
SB Ramps
200(260), 640(790)
490(640), 690(970), 430(770)

## 25 Green Springs Dr & Telegraph St

310(470), 680(1000), 550(630)
Green Springs Dr: 530(650), 540(740), 260(340)
Telegraph St: 400(610), 820(1050), 120(200)
120(220), 680(1120), 250(350)

## 26 Telegraph St & Walmart Signal

300(70), 200(190), 40(90)
Walmart Signal: 50(90), 680(1070), 150(190)
Telegraph St: 350(350), 980(1460), 290(210)
350(320), 200(210), 20(30)

## 27 850 North & 3050 East

400(350), 770(1270), 0(40)
3050 East: 0(40), 0(30), 0(50)
850 North: 460(420), 0(30), 70(90)
80(110), 710(1350), 0(70)

## 28 Buena Vista Blvd & Main St

30(20), 20(250), 10(50)
Main St: 10(50), 60(60), 10(190)
Buena Vista Blvd: 20(10), 60(50), 160(350)
140(220), 40(330), 20(320)

## 29 Telegraph St & Main St

70(120), 20(110), 60(120)
Main St: 50(90), 750(1080), 30(140)
Telegraph St: 100(160), 900(1290), 90(160)
60(180), 30(120), 20(70)

## 30 Telegraph St & 300 East

110(120), 60(120), 30(40)
300 East: 20(30), 480(700), 150(400)
Telegraph St: 140(130), 580(840), 260(530)
240(530), 60(110), 30(370)

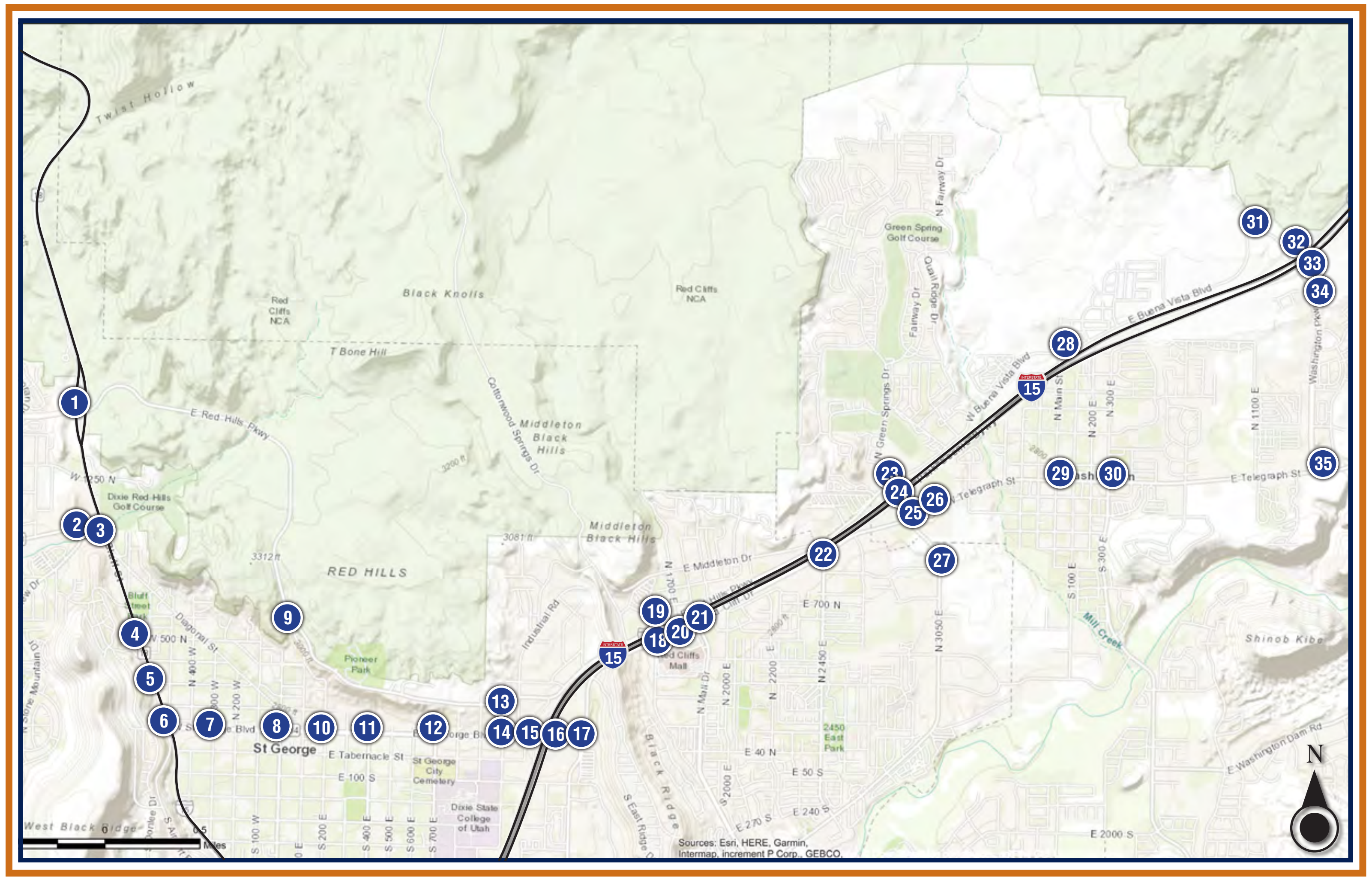
## 31 Buena Vista Blvd & Washington Pkwy

Washington Pkwy: 0(230), 80(140)
Buena Vista Blvd: 0(150), 0(0)
0(0), 90(150)

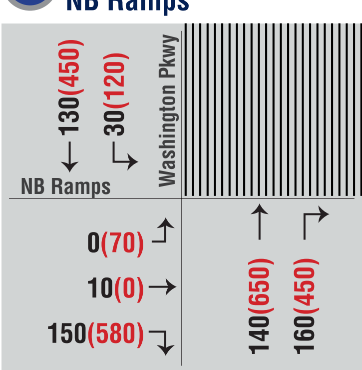
## 32 Washington Pkwy & SB Ramps

10(30), 80(350)
Washington Pkwy: 50(160), 0(0), 80(220)
SB Ramps
120(510), 30(210)

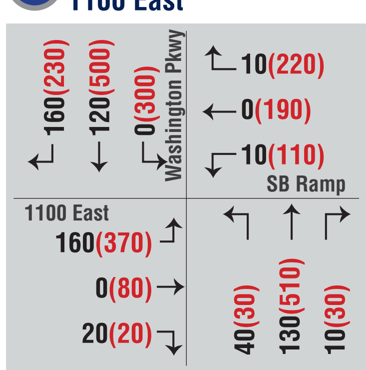
# 2017 (2050) INTERSECTION VOLUMES – PM PEAK HOUR



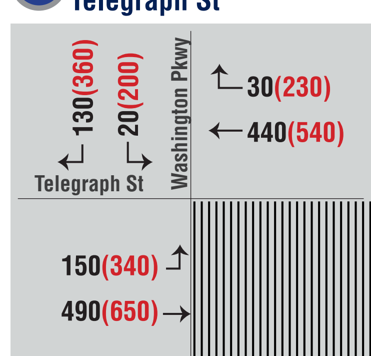

## 33 Washington Pkwy & NB Ramps




## 34 Washington Pkwy & 1100 East




## 35 Washington Pkwy & Telegraph St



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# Appendix M: Visual Impact Assessment Technical Report

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Jacobs

# Northern Corridor

Visual Impact Assessment Technical Report

Draft

May 22, 2020

Prepared for:
U.S. Department of the Interior Bureau of Land Management
Fish & Wildlife Service

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# Contents

**Attachments**



**Tables**



**Figures**

# Acronyms and Abbreviations

| | |
|---|---|
| BLM | Bureau of Land Management |
| County | Washington County |
| EIS | Environmental Impact Statement |
| FHWA | Federal Highway Administration |
| HCP | Habitat Conservation Plan |
| ITP | Incidental Take Permit |
| KOP | Key Observation Point |
| NCA | National Conservation Area |
| Reserve | Red Cliffs Desert Reserve |
| RMP | Resource Management Plan |
| ROW | right-of-way |
| SGFO | St. George Field Office |
| SITLA | School and Institutional Trust Lands Administration |
| SQRU | Scenic Quality Rating Unit |
| UDOT | Utah Department of Transportation |
| USFWS | U.S. Fish and Wildlife Service |
| VIA | Visual Impact Assessment |
| VRI | Visual Resource Inventory |
| VRM | Visual Resource Management |

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# 1. Introduction

The Utah Department of Transportation (UDOT), in association with Washington County (the County), applied to the Bureau of Land Management (BLM) for a right-of-way (ROW) grant on September 18, 2018, to construct a multi-lane, divided highway (referred to as the Northern Corridor) across the Red Cliffs National Conservation Area (Red Cliffs NCA). The Secretary of the Interior, through the BLM, was directed to manage the 45,000-acre NCA to conserve, protect, and enhance the ecological, scenic, wildlife, recreational, cultural, historical, natural, educational, and scientific resources of the Red Cliffs NCA for the benefit and enjoyment of present and future generations, and to allow only those uses of the Red Cliffs NCA that furthered its conservation purposes.

The *Red Cliffs NCA Resource Management Plan* (Red Cliffs NCA RMP), approved in 2016, provides long-term management goals, objectives, and decisions for the Red Cliffs NCA. Granting a ROW to UDOT for a highway that crosses the Red Cliffs NCA is not in conformance with current management decisions from the Red Cliffs NCA RMP. The BLM is using the National Environmental Policy Act of 1969 (NEPA) process to evaluate if the proposed ROW is consistent with the statutory purposes of the Red Cliffs NCA, and whether to amend the Red Cliffs NCA RMP to change the current Red Cliffs NCA RMP management decisions or deny UDOT's application.

The Red Cliffs NCA comprises 70 percent of the land base of a multijurisdictional, 62,000-acre mitigation reserve, known locally as the Red Cliffs Desert Reserve (the Reserve). The Reserve was established in 1995 by the U.S. Fish and Wildlife Service's (USFWS) approval of Washington County's Habitat Conservation Plan (HCP) for the threatened Mojave desert tortoise, and issuance of an Incidental Take Permit (ITP) for the take of Mojave desert tortoise associated with residential and commercial development in the county. The proposed Northern Corridor would not be consistent with the terms of the County's 1995 HCP. The USFWS is working with the County on an Amended HCP to address changed circumstances, one of which might be identifying additional mitigation measures that could address the potential impacts of the Northern Corridor being constructed through the Reserve. The County has also applied for a renewal of the ITP for a 25-year duration. A current proposal by the County would require commitments from the BLM and State of Utah School and Institutional Trust Lands Administration (SITLA) that the management of approximately 6,800 acres of BLM-administered and SITLA lands located west of the City of St. George, Utah, would be modified to emphasize the protection of the Mojave desert tortoise and its habitat. For the BLM to make this commitment, the St. George Field Office (SGFO) RMP (approved 1999) must be amended.

## 1.1 Project Location

The proposed actions would occur in Washington County in the vicinity of St. George (Attachment 1, Map 1-1). The Red Cliffs NCA is located north of St. George. Proposed Reserve Zone 6 consists of undeveloped land on the west side of Interstate 15 (I-15) and the community of Bloomington. The analysis area for the evaluation of impacts on visual resources extends 3 miles from the centerline of each proposed alignment and includes lands within the boundaries of the Red Cliffs NCA; the roadway corridors along Red Hills Parkway, St. George Boulevard, and 100 South in St. George; and the proposed Reserve Zone 6.

### 1.2 Project Description

An Environmental Impact Statement (EIS) is being prepared under NEPA requirements to evaluate the Federal actions under consideration by the BLM and USFWS. The EIS and this Visual Impact Assessment (VIA) identify potential visual impacts associated with the following four Federal actions (BLM 2020):

1) Whether the BLM will amend the Red Cliffs NCA RMP to allow for a transportation ROW or ROW corridor within the Red Cliffs NCA.
2) Whether the BLM will approve a ROW for an approximately 1.75-mile section of the approximately 4-mile-long Northern Corridor project that crosses the 45,000-acre congressionally established Red Cliffs NCA and the 62,000-acre Reserve.
3) Whether the USFWS will issue an ITP for the Mojave desert tortoise for specific land use and land development activities in Washington County.
4) Whether the BLM will amend the SGFO RMP to modify management for approximately 533,471 acres within a proposed 6,800-acre mitigation area outside the Reserve and Red Cliffs NCA.

This VIA was prepared in accordance with relevant guidance to address these four Federal actions, and proposes measures (if necessary) to mitigate any resulting adverse visual impacts. This document is formatted to do the following:

- Describe the existing conditions.
- Analyze impacts associated with each of the four actions.
- Determine compliance with BLM Visual Resource Management (VRM) Class objectives.

## 2. Guidance and Regulations Applicable to Visual Resources

The potential transportation alignments analyzed in the EIS for the project would be located on Federal and non-Federal lands. The BLM's VRM Program was used to identify and assess impacts to visual resources on BLM-administered lands in the Red Cliffs NCA and proposed Reserve Zone 6. Because no specific requirements define a visual assessment methodology for private lands, such lands within the Red Cliffs NCA congressionally designated boundary are assessed using the BLM's approach. Much of Alternative 5, which includes modifications to Red Hills Parkway, is located outside the Red Cliffs NCA, as is Alternative 6, which includes modifications to St. George Boulevard and 100 South. Therefore, the Federal Highway Administration (FHWA) visual guidance methodology was used to analyze impacts to Alternative 5 and 6.

### 2.1 BLM

The BLM's VRM system was developed to "manage public lands in a manner which will protect the quality of the scenic (visual) values of these lands" (BLM 1984). In accordance with the 2016 Red Cliffs NCA RMP, the BLM is to manage the Red Cliffs NCA to "conserve, protect, and enhance for the benefit and enjoyment of present and future generations the…scenic…resources of the Red Cliffs NCA" (BLM 2016). The RMP identifies the following overall VRM goal for the Red Cliffs NCA: "The open spaces, natural aesthetics, and scenic vistas of the Red Cliffs NCA are protected for social, economic, and environmental benefits" (BLM 2016).

The VRM system is used for "visual resource inventory, management, and impact assessment," and includes two primary components:

- Visual Resource Inventory (VRI) classes: Measurements of the quality of the visual resource based on the combination of scenic quality, visual sensitivity, and distance zones (BLM 1986a).

- VRM classes: Land use objectives that prescribe the amount of change allowed in the characteristic landscape (BLM 1984).

VRI Class I is reserved for and assigned to inventoried lands where a nondiscretionary land management decision was made by Congress, the President, or Secretary of the Interior that directs the BLM to preserve the natural landscape (e.g., Congressional designation of wilderness). VRI Class II represents the higher scenic values and VRI Class IV, the lower scenic values. The BLM assigns VRI classes for BLM-administered lands based on combining scenic quality classes, sensitivity levels, and distance zone values.

- Scenic Quality Rating Units (SQRU): Scenic quality is a measure of the aesthetic value of the landscape scenery based on analysis of seven key factors: landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications. BLM *Manual H-8410-1 – Visual Resource Inventory* identifies three scenic quality classes (Class A, Class B, and Class C) that a landscape may be rated based on the individual rating scores of the seven key factors.
- Sensitivity Level Rating Units: Sensitivity level rating units determine the level of concern the public would express toward modifications in the landscape. They are defined by the types of users, amount of use, public interest, adjacent land uses, special management areas, and other factors (BLM 1986). The BLM assigns land at either a high, medium, or low sensitivity level.
- Distance Zones: Distance zones are subdivided areas of the landscape based on the perception of scenery from viewing locations. Detail visually perceived in the landscape, or project-associated components, depends on the proximity of these features to viewers. The BLM uses three distance zones for the purposes of the VRI, which are primarily based on how landscapes are viewed. The three distance zones are foreground-middleground, background, and seldom seen. The foreground-middleground distance zone includes areas seen from highways, rivers, or other viewing locations less than 5 miles away. Areas seen beyond the foreground-middleground distance zone, but less than 15 miles away, are in the background zone. Areas not seen in the foreground-middleground or background distance zones are in the seldom seen distance zone.

VRI classes are informational only and provide the basis for considering visual values in the RMP process. They do not establish management direction.

Allowable uses and management actions must be planned in accordance with designated VRM classes (BLM no date b). VRM classes are specific land use objectives that provide the standards for planning, designing, and evaluating future management projects; they establish the desired future condition of the visual resource. VRM classes result from considering VRI classes with other resource values and land use allocations. VRM classes are ranked I, II, III, and IV, with Class I being the most protective and Class IV allowing for "major modifications of the landscape." Allowable uses and management actions must be planned in accordance with these desired future conditions (BLM 2015, no date b). Therefore, a BLM landscape can be assigned different classes (e.g., Class II VRI and Class III VRM) for the same area. The BLM VRM classes are defined in Table 1 (BLM 2016).

VRM Class I is designated to lands assigned VRI Class I and other lands where a BLM land use planning decision was made to preserve the landscape's natural character.

**Table 1. BLM VRM Class Definitions**

| VRM Class | VRM Definition |
|---|---|
| I | The existing character of the landscape is preserved. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention. |
| II | The existing character of the landscape is retained. The level of change to the characteristic landscape should be low. Changes can be seen but should not attract the attention of the casual viewer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape. |
| III | The existing character of the landscape is partially retained. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape. |
| IV | Provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements found in the predominant natural features of the characteristic landscape. |

## 2.2 FHWA

The FHWA visual assessment methodology was first published in 1988 and updated in 2015. The 1988 guidance included methods for performing a quantitative impacts analysis based on assigning numerical rankings for defined visual quality characteristics. The 2015 guidance, while generally retaining the same general concepts as the original, omitted the numerical ranking procedure. Therefore, this VIA incorporates the phases defined in the 2015 guidance but employs the 1988 methodology in the Analysis Phase to more quantitatively analyze project impacts.

The FHWA visual assessment methodology requires that visual impacts of a proposed project be determined by assessing changes to the landscape as seen both from and toward the road. The methodology also requires descriptions of visual character and visual quality. Visual character is descriptive and non-evaluative (i.e., attributes are neither “good” nor “bad”), and includes descriptive terms such as form, line, color, texture, dominance scale, diversity, and continuity). Visual quality is based on the following three components that are collectively evaluated (FHWA 1988):

- Vividness: The visual power or memorability of a landscape as the factors such as terrain, vegetation, water, human-made objects combine in distinctive visual patterns.
- Intactness: The visual integrity of the natural and human-built landscape and its freedom from encroaching elements.
- Unity: The visual coherence and compositional harmony of the landscape considered as a whole.

Visual quality can be categorized as ranging from very low to very high (FHWA 1988).

The FHWA guidance also calls for identification of landscape units or LUs on a project-by-project basis (the FHWA has not pre-defined formal landscape units). Landscape units are geographic areas on which impacts to visual character, viewers, and visual quality are assessed. Landscape units are defined by viewsheds and landscape type. A landscape unit has a particular visual identity — it is like a distinctive "outdoor room" — and is visually homogeneous with only one viewshed and one landscape type (FHWA 1988).

The FHWA guidance divides the affected population into highway neighbors (people with views toward the road) and highway users, or travelers (people with views from the road). Each category includes a variety of groups, such as urban and rural residential, recreational, commercial/institutional, and civic neighbors and commuting, touring, shipping, cycling, and walking travelers (FHWA 1988).

## 2.3 Local Plans

Appendix III of *The General Plan of Washington County, Utah, 2010,* comprises *The Washington County Resource Management Plan*; in Section Seven, County Goals and Objectives, it identifies a goal to "preserve, protect, enhance, and make available for public visitation, scenic areas" in the county, with an objective to make these sites "available for visitation and enjoyment by all residents of the county" (Washington County 2010). The General Plan also addresses visual resources under Appendix III, Section Six, Planning Guidelines and Policy Statements. This section states, "different levels of scenic values on federal lands in the county require different levels of management. While management of an area with high scenic value might be focused on preserving the existing character of the landscape, management of an area with little scenic value might allow for major modifications to the landscape. Federal land management agencies shall conduct assessments of visual impacts in determining how an area should be managed, with the goal of protecting the visual resource while not burdening authorized land uses and maintaining economic stability. It is Washington County's policy in considering VRM objectives, federal and state land management agencies shall recognize the importance of communication sites, electric transmission lines, and transportation corridors to the security, health and welfare of the county's residents" (Washington County 2010).

The *City of St. George General Plan* notes the scenic nature of the surrounding region, as exemplified by the numerous national parks, forests, monuments, and recreation areas; state parks; and wilderness areas nearby. According to the plan, "the visually striking red sandstone and black lava rock hillsides are significant natural assets to the community. The hillsides and plateaus provide a scenic backdrop to the community and provide the most defining physical characteristics for the area." The plan states that hillsides comprise an "important visual character that defines the community," development of which is regulated to protect their visual character. The plan calls for preservation of hillsides by "minimizing the amount of hillside excavation" and requiring "full reclamation to natural appearances" (City of St. George 2002a).

The *City of St. George General Plan* also identifies "scenic areas and views" as "desirable to be preserved as permanent open space." Such locations include "the steep mesas and hills that frame the city," particularly "the Red Hill north of St. George" (Washington County no date a). This hill forms a massive rise on the city's northern boundary from Skyline Drive to North 900 East, upon which Red Hill Parkway, described under Section 3.3, travels east-west.

The 2017 *Washington City General Plan* includes the directive to "analyze the visual impact of potential power-line alignments in conjunction with route selections." The plan further states, "power-lines should be located in areas that minimize their overall impact on Washington City's scenic setting" (Washington City 2017).

# 3. Existing Conditions

This section describes the existing visual landscape that would be affected by the proposed project. All maps and photographs referenced in Sections 3.1 through 3.5 are included in Attachment 1. Maps and photographs referenced in Section 3.6 are included in Attachment 2.

## 3.1 Project Setting

The proposed Federal actions are within the Mojave Basin and Range Ecosystem,[1] which is composed of alluvial fans, valleys, and scattered buttes. Vegetation includes creosote bush, Joshua tree, blackbrush, big sagebrush, and associated grasses (EPA 2019). The desert climate is characterized by low humidity, generally clear skies, relatively warm winters, and hot summers (City of St. George 2002a). Because the study area is within a designated attainment area for all criteria pollutants (EIS Section 3.12), smog is not expected to affect visibility. The roadway alignments analyzed in the EIS are within the south-central portion of the Red Cliffs NCA, abutting the City of St. George to the south. Urban and suburban development is rapidly expanding in the St. George area (EPA 2019), and this development directly abuts the Red Cliffs NCA boundaries on the north side of the city.

## 3.2 Northern Corridor and Red Cliffs NCA RMP Amendments Lands

A visibility map was completed to determine the potential visibility of the roadway alignments from points spaced 100 feet apart along each alternative center line. The farthest edge that people standing on a flat surface with their eyes about 5 feet off the ground can see is approximately 3 miles away (Roland 2019). Therefore, the mapped area (the analysis area, along with proposed Reserve Zone 6) extends 3 miles from the centerline (refer to Attachment 1, Maps 1-2a through 1-2e). The visibility map does not account for the screening properties of vegetation or small variations in topography or structures. Areas within the Red Cliffs NCA and around the Red Hills Parkway comprise the primary areas where the changes in the visual landscape would occur.

As shown in Attachment 1, Map 1-3, the BLM identified the VRI for the analysis area as VRI Class II. The Red Cliff Sandstone SQRU (Class A, the highest on a scale of A to C) comprises the majority of the analysis area except for a swath encompassing Cottonwood Springs Road in the Young Basalt Flows SQRU, which is rated Class C (Map 1-4). The VRI sensitivity level is high and the VRI distance zones are foreground-middleground throughout the analysis area (no maps were developed for these categories as they are uniform throughout the analysis area). Table 2 lists the scenic quality components that comprise the overall scenic quality rating (BLM 1986a):

**Table 2. Scenic Quality Resources**

| Scenic Resource | Description |
|---|---|
| Landform | Topography becomes more interesting as it gets steeper or more massive, or more severely or universally sculptured. Outstanding landforms may be monumental or exceedingly artistic and subtle as certain badlands, pinnacles, arches, and other extraordinary formations. |
| Vegetation | Primarily considers the variety of patterns, forms, and textures created by plant life, and short-lived displays when known to be recurring or spectacular. Considers smaller scale vegetational features that add striking and intriguing detail elements to the landscape. |
| Water | Not applicable. |
| Color | Considers the overall color(s) of the basic components of the landscape (e.g., soil, rock, vegetation) as they appear during seasons or periods of high use. Key factors for rating color are variety, contrast, and harmony. |

[1] Ecosystems are areas of general similarity in the type, quality, and quantity of environmental resources (EPA 2019).

| Scenic Resource | Description |
|---|---|
| Adjacent Scenery | Degree to which scenery outside the scenery unit being rated enhances the overall impression of the scenery within the rating unit. The distance which adjacent scenery will influence scenery within the rating unit will normally range from 0 to 5 miles, depending upon the characteristics of the topography, the vegetative cover, and other such factors. |
| Scarcity | Provides an opportunity to give added importance to scenic features that appear to be relatively unique or rare within one physiographic region. There may also be cases where a separate evaluation of each of the key factors does not give a true picture of the overall scenic quality of an area. Often it is a number of not so spectacular elements in the proper combination that produces the most pleasing and memorable scenery - the scarcity factor can be used to recognize this type of area and give it the added emphasis it needs. |
| Cultural Modifications | Cultural modifications in the landform/water, vegetation, and addition of structures may detract from the scenery in the form of a negative intrusion or complement or improve the scenic quality of a unit. |

Table 3 depicts the breakdown of the scenic quality rating for the analysis area based on the resources listed in Table 2. These components are rated on a scale of 1 to 5, with 5 being the highest quality. (Note that the cultural modifications component can also include negative scores.)

**Table 3. Scenic Quality Rating Red Cliffs NCA Analysis Area**

| Scenic Quality Unit Name | Total Acres | Scenic Quality Rating | Land-form | Vege-tation | Water | Color | Adjacent Scenery | Scarcity | Cultural Modifi-cations |
|---|---|---|---|---|---|---|---|---|---|
| Red Cliff Sandstone | 87,462 | A | 4.5 | 2.6 | 0 | 4.5 | 3.4 | 4 | -0.2 |
| Young Basalt Flows | 66,417 | C | 2.6 | 2 | 0 | 2.3 | 3.1 | 1.8 | -1.1 |

The Red Cliffs NCA RMP designates the VRM class in the analysis area as VRM Class III (Attachment 1, Map 1-5).

### 3.2.1 Red Cliffs NCA Lands

Through the Omnibus Public Land Management Act of 2009 (P.L.111- 11 at Title I, Subtitle O at sec. 1974(a)), codified at 16 U.S.C. 460www, Congress identified scenic resources as one of nine resources the Red Cliffs NCA was designated "to conserve, protect, and enhance for the benefit and enjoyment of present and future generations."

As indicated by the Class A scenic quality inventoried in the VRI, the Red Cliffs NCA is a "highly scenic area" consisting of a "colorful and diverse topography" that is "reflected in the stunning visual impact of the Red Cliffs NCA" (BLM 2015). The NCA's scenic qualities are one of the reasons that new residents choose to move to the area. "The natural character of the Red Cliffs NCA landscape contrasts sharply with the highly modified human environment just outside its boundaries; the proximity of this stunning landscape is often used as a selling point by local realtors" (BLM 2015).

The southern portions of the Red Cliffs NCA include Pioneer Park, a city park directly accessible from Red Hills Parkway (described in more detail following). Pioneer Park is a 52-acre "rock climber's paradise" that offers "spectacular views of downtown, White Dome, Zion National Park and Arizona" (City of St George

2019) (Photo 1-1 and Photo 1-2). Vivid red rocks form tall buttes, alcoves, hoodoos, and arches in layers of red sandstone creating serpentine cracks and rifts. The tops of these formations offer vast views in all directions (Photo 1-3 and Photo 1-4). This area includes attractions such as “Dixie Sugarloaf” (a prominent red sandstone butte-like rock) and Pioneer Park Arch. Several trails, including the T-Bone Trail and Pioneer Rim Trail, originate here, and some continue north into the Red Cliffs NCA, with T-Bone Trail providing views of Pioneer Arch. The 5-acre Red Hills Desert Garden (Photo 1-5) is directly east of Pioneer Park and includes a labyrinth of paths generally trending east-west between the road and a large redrock outcrop to the north, which blocks views in this direction.

Farther east, Cottonwood Springs Road travels north from Red Hills Parkway into the Red Cliffs NCA. The road and I-15 intersect on the east side of a large red cliff rock cut. Steep cliffs block views as the road gains elevation. The road passes a small industrial area and intersection, eventually flattening with the topography and narrowing. Views broaden and are punctuated by occasional buttes; the Pine Valley Mountains are visible in the distance (Photo 1-6). High sloping hills and abrupt black volcanic mounds are to the west. Vegetation consists primarily of low desert shrubs, which interject green, spiky texture onto a backdrop of red-hued soils and hills. Some locations, such as the Pioneer Hills and T-Bone trailheads, provide views to the north of the Pine Valley Mountains, which rise to heights of 10,365 feet (Photo 1-7). The T-Bone Trail ends approximately 1.8 miles north of Pioneer Park at a trailhead on Cottonwood Springs Road. The T-Bone Trail offers “views of the St. George metropolitan area to the south, a red rock fantasy land in the middle, and views of the distant Pine Valley Mountains to the north” (Washington County no date b).

Within this roadway corridor, which is rated as Class C scenic quality, several conspicuous transmission lines cross Cottonwood Springs Road approximately 1.7 miles north of Red Hills Parkway near the T-Bone Trail trailhead (Photo 1-8). These lines generally travel east to west and consist primarily of brown monopoles of varying heights and girths (Photo 1-9). An electrical substation occupying approximately 7 acres is located on the east side of Cottonwood Springs Road at this location and is directly opposite the T-Bone Trail trailhead (Photo 1-10). A smaller, approximately 1.0-acre substation is 0.15 mile north of the larger one. Transmission lines radiate out from this area in multiple directions and are prominent vertical intrusions on the broad landscape (Photo 1-11). The substations and power-lines particularly contrast against the Pine Valley Mountains to the north (Photo 1-12 and Photo 1-13). The Red Cliffs NCA notes that “these intrusions into the landscape give this area an industrial feel that seems strangely out of place in a generally natural and undeveloped landscape” (BLM 2015).

A large, white water tank is immediately adjacent to the east side of Cottonwood Springs Road approximately 0.85 mile farther north (Photo 1-14). The Middleton Powerline Trail starts just north of the water tank and travels northeast, connecting with Mill Creek Trail (Photo 1-15). A power and telephone line run parallel to the road as it continues north, and the road surface changes from paved to dirt after another 0.4 mile (Photo 1-16). The landscape becomes more varied, with black-sided volcanic mounds, red rock cliffs and buttes, and distant purple mountains. The road eventually splits into multiple dirt tracks approximately 9.0 miles north of St. George.

Because of its proximity to urban development, light pollution is visible from many locations within the Red Cliffs NCA. The municipal glow is “clearly evident” even from within the deeper canyons of distant wilderness areas, obscuring much of the night sky (BLM 2015).

### 3.2.2 Private Lands

Green Springs is a medium-density residential area in Washington City that borders the east side of the Red Cliffs NCA. Green Springs consists of large, new houses arranged into multiple residential estates. Residential development is currently ongoing in the northern end of Green Springs. At the time field studies were conducted to support the development of the EIS in February 2020, home construction was noted in the northern end of this area. Some of the newly completed houses are occupied, with many vacant and for sale (Photo 1-17 and Photo 1-18). Residential development in this area continues east, abutting the future Washington Parkway that trends south and then east, connecting to the Washington Parkway interchange, where the Grapevine Trail trailhead is located (Photo 1-19). The Grapevine Trail provides access to multiple trails and tracks to the north that travel east and west, including trails into the Red Cliffs NCA (Mill Creek Trail, Dino Cliffs Trail). The Cottontail Trail originates at the northwest side of the Green Springs development and travels west into the Red Cliffs NCA, connecting to the Middleton Powerline Trail (Photo 1-20). The Mustang Pass Trail leads north from Green Springs (Photo 1-21), connecting with the Middleton Powerline Trail and Ice House Trail, which climbs a steep hill that provides sweeping views to the south, east, and west (Photo 1-22). Although houses on the west side of Green Springs border the Red Cliffs NCA boundary, views to the west into the Red Cliffs NCA are blocked by high escarpments for many of these residences (Photo 1-23).

New home construction was also noted during the field visit along Cottonwood Springs Road off Twin Lakes Drive, which is accessed from the south end of Cottonwood Springs Road. Residences in Middleton, which is slightly east of this area, also abut the Red Cliffs NCA boundary to the north and west (Photo 1-24). New residential construction was occurring in the northern end of this area as well as farther east between North Main Street and Washington Parkway.

## 3.3 Red Hills Parkway

Located at the northern limits of the City of St. George, Red Hills Parkway is the primary east-west transportation route in the vicinity of the Red Cliffs NCA. The 4-lane road connects with Bluff Street to the west and North Green Spring Drive to the east, where the parkway parallels I-15. From this point, the route continues farther east as Buena Vista Boulevard, terminating at Washington Parkway. Travelers on Red Hills Parkway include commuters, shoppers, recreational users, commercial freight trucks, and tourists. Travelers also include pedestrians and cyclists on Red Hills Parkway Trail.

Two landscape units were defined for the area around Red Hills Parkway in order to apply the FHWA methodology to Alternative 5 (Attachment 1, Map 1-6 and Section 4): LU 1 encompasses the parkway through the undeveloped Red Cliffs NCA on the west side of the analysis area, which has a rural character, and LU 2 encompasses the parkway to the east, where the landscape is more urban. Both landscape units contain part of the Red Hills Parkway Trail, a paved multi-use path that is part of the St. George trail system, that lies entirely within or along the southern border of the Reserve. The trail offers views of the city to the south and to distant cliffs, buttes, and mountains. The trail also provides access to a large water tank owned by the city, which provides a viewing overlook to the city to the south (Washington County no date a, Caldwell 2013).

### 3.3.1 Landscape Unit 1

The viewshed for LU 1 alternates between views of rock cuts and broad desert expanses. Heading east from Bluff Street, Red Hills Parkway rapidly gains elevation as it cuts through red hillsides (Photo 1-25), after which it levels and provides expansive views of snow-capped mountains, buttes, and desert vegetation before descending southward through more rock cuts to Pioneer Park. The road offers dramatic views of Pine Valley Mountains to the north, Pioneer Park, and sweeping views of St. George to the south, which is at a lower elevation, as well as distant purple hills (Photo 1-26 through Photo 1-29). Because of this area's distinctive features, LU 1 exhibits high levels of natural harmony, landscape composition and vividness, cultural order, and coherence, resulting in high overall visual quality.

A residential area west of the intersection of Red Hills Parkway and Bluff Street is not expected to have views of Red Hills Parkway because of distance and topography. Neighbors farther east along Red Hills Parkway include recreational visitors to Pioneer Park, Red Hills Desert Garden, the water tank overlook, and the Red Hills Parkway Trail. Views of the parkway diminish, and are often blocked, for residents farther south where the topography steeply descends toward the city.

### 3.3.2 Landscape Unit 2

This landscape unit is characterized by broad views of the city to the south, which is at a lower elevation, and commercial and industrial uses to the north, beyond which a tall rock escarpment blocks further views (Photo 1-30 and Photo 1-31). Distant mountains can be seen to the east and west. Commercial uses crowd closer to the road farther east, particularly where Red Hills Parkway meets I-15. East of I-15, Cottonwood Springs Road intersects Red Hills Parkway where it runs parallel to the interstate after passing through a massive rock cut. Visual quality in LU 2 is lower than LU 1 due to the presence of commercial/industrial uses adjacent to the parkway, resulting in degraded coherence and order. Although some views to the south are intact, landscape composition, natural harmony, and vividness are diminished where the built environment blocks views of surrounding natural elements. Therefore, visual quality for LU 2 is moderate.

Neighbors include the employees and patrons of the commercial uses that line both the north and south sides of Red Hills Parkway, but are primarily concentrated to the north.

## 3.4 St. George Boulevard and 100 South Street

St. George Boulevard and 100 South Street travel east-west through central St. George between Bluff Street and I-15. St. George Boulevard is the first east-west through route south of Red Hills Parkway; 100 South Street is two blocks south of St. George Boulevard. Two landscape units were defined for these roads to apply the FHWA methodology to Alternative 6 (Attachment 1, Map 1-6): LU 3 encompasses St. George Boulevard between Bluff Street and I-15 roughly one-half block to the north and south; LU 4 similarly encompasses 100 South.

### 3.4.1 Landscape Unit 3

St. George Boulevard is a two-way, 4-lane paved road that interchanges with I-15. The road is divided by a landscaped median that is narrower at the east end. The landscaping within the median helps soften the built environment, and light fixtures both within the median and at intersections lend a historic look, especially where backdropped against the sky. The light fixtures also add a unifying element to the corridor. Topography trends slightly downhill to the west, providing views of distant hills and buildings for westbound travelers (Photo 1-32). The landscape character is commercial, consisting primarily of motels and restaurants, with gas stations, small shopping centers, and other retail establishments facing the road. Scale, mass, materials, and architectural style of the buildings and detailing vary greatly. Storefront design range from multistory brick buildings to glass-walled car dealerships, motels of various styles, and single-story utilitarian buildings, particularly at the east end of the road. Streetlights, telephone poles, a few conspicuous palm trees, and commercial signs are the dominant vertical elements. A variety of landscaped shrubs and trees (deciduous and palm) line the sidewalks. Intersections and occasional parking lots provide sporadic views of the red cliffs to the north (Photo 1-33). Traffic is busy, given the I-15 interchange, and consists of a wide range of vehicle types.

The City has implemented efforts to visually enhance this road, paying particular attention to historic aesthetics. The City has identified a “Historic Downtown” area on the west side of St. George Boulevard that includes Ancestor Square on the northwest corner of Main Street, known as “the commercial center of St. George.” All of the buildings in Ancestor Square have been renovated and share “a compatible décor to enliven the historical sense of the old city center” (Ancestor Square 2018). The buildings are visually distinctive, such as the 2-story brick Pioneer Courthouse and the 2-story residential Hardy House, with gingerbread trim, white picket fence, and white balustrades. The block between Main Street and 100 East includes a row of historic-style storefronts that create visual interest, and the newly constructed Zion Bank was designed to reflect the area’s historical architecture.

The landscape components in LU 3 outside the Historic Downtown are primarily visually unrelated due to the variety of commercial building types that are often dictated by franchises, such as gas stations, chain restaurants, and franchise supply stores and therefore exhibit low memorability. Therefore, visual quality in LU 3 is moderate when considering both this area and the Historic Downtown.

### 3.4.2 Landscape Unit 4

100 South is a two-way, 2-lane paved road with a continuous center turn lane, and wide parking lanes parallel to both sides of the road (Photo 1-34). The road does not intersect with I-15 but passes under it. Buildings related to education (primarily Dixie State University) face the eastern end of the road, occupying several blocks between I-15 and South 700 East Street, west of which the landscape character becomes residential. The topography trends slightly downhill to the west, providing views of distant hills (Photo 1-35). The St. George city cemetery occupies approximately 1.5 blocks on the north side of 100 South Street in this area. This manicured expanse includes several deciduous and evergreen trees, creating a park-like setting. The residences along this road are modest, rarely exceeding one story and occupying small footprints. Some of the larger homes display a historic design. The St. George Children's Museum at the intersection with Main Street is the southernmost building within the St. George Historic Downtown. The museum is a large, imposing 3-story stone structure. This and the similarly designed Washington County Library System building adjacent to it visually contrast with the residential buildings, displaying a different scale, mass, material, and architectural style. Deciduous trees and low shrubs are the primary natural elements in this landscape unit. Telephone poles and street lights line the road but are inconspicuous. Traffic is light and comprised primarily of cars and pickup trucks.

The majority of the landscape components (the residential buildings) in LU 4 are visually interrelated, although they do not typically form striking or distinctive visual patterns. The large stone buildings add vividness, but contrast with the overall visual intactness and unity of the residential areas within LU 4. For these reasons, memorability is moderate, as is overall visual quality.

## 3.5 Proposed Reserve Zone 6

The analysis area for visual resources around the proposed Reserve Zone 6 extends 0.5 mile outside the proposed Reserve Zone 6 boundaries to accommodate views into that area. The VRI for proposed Reserve Zone 6 is identified as VRI Class III primarily on the northern and western areas, and VRI Class IV for the southern and eastern areas (Attachment 1, Map 1-7) (Max 2019, Kiel 2019a). The VRI identified the area contained in the proposed Zone 6 as Class C scenery (primarily the Questa-Forming Shales SQRU with a small section on the east in the Urbanized Lowlands SQRU) and the distance zone as foreground-middleground. Visual sensitivity levels in the area range from low to high (Table 4, Map 1-8).

**Table 4. Scenic Quality Rating Proposed Reserve Zone 6 Analysis Area**

| Sensitivity Rating | Acres |
|---|---|
| High | 3,442 |
| Medium | 1,517 |
| Low | 1,854 |

Approximately 51 percent of proposed Reserve Zone 6 is BLM-administered land (3,471 acres); the BLM-administered land is designated as VRM Class III (Attachment 1, Map 1-9). The remaining land is owned by SITLA (47 percent [3,225 acres]), UDOT (1 percent [70 acres]), and private owners (0.6 percent [40 acres]).

Proposed Reserve Zone 6 consists of a broad, primarily undeveloped desert landscape. A large, sweeping red-hued valley drains toward the Virgin River and is flanked by high cliffs to the north and south. Large boulders and rocks litter the cliffsides and valley floor (Photo 1-36). The ridgelines provide sweeping views in all directions of redrock cliffs, the Pine Valley Mountains, Zion National Park, and St. George (Photo 1-37). Ridgelines consist of pale yellow plateaus stained with black desert varnish, and dotted with scrubby desert vegetation. Ribbons of dry washes crisscross the valley, and a handful of trails wind along the ridgelines. Residential areas abut the proposed Reserve Zone 6 boundary to the east, and a small residential area farther north has views into proposed Reserve Zone 6. No development exists on the west and south sides of proposed Reserve Zone 6.

Numerous social trails crisscross the valley within the Bearclaw Poppy Trail system (Photo 1-38). The Bearclaw Poppy Trail is accessible via two trailheads, one on Navajo Drive west of Bloomington and the other at Canyon View Drive farther north. Mountain bikers frequent this popular trail, which also connects to other trails traveling farther west and north. These trails create visual scars on the valley's soils, particularly where multiple trails are braided (Photo 1-39). As Navajo Drive leaves the residential area and travels farther west into proposed Reserve Zone 6, frequent off-road use has also created visual scars among steep hills (Photo 1-40 and Photo 1-41). Some camp trailers are parked along the road (Photo 1-42), which is crossed by tall transmission towers trending generally north-south. Shooting trash litters the ground at informal pullouts used for target shooting. Some wide, flat areas show evidence of partying and illegal dumping (Photo 1-43). However, the natural environment is visually diverse, with undulating hills in hues ranging from red to orange and gray, and views of distant purple mountains (Photo 1-44).

Moe's Valley rock climbing area is farther north and west of a rapidly developing residential area at Curly Hollow Drive. A broad dirt area serves as unofficial parking. The climbing area is visually secluded from development and is enclosed by undulating canyon walls from which large boulders have fallen. The rounded canyon walls and boulders are a pale yellow and red, and partially covered with black desert varnish. Chalk from climbing on the boulders indicates the presence of popular bouldering routes. Low, spiky pale green and silver vegetation covers the ground where rocks are absent (Photo 1-45 and Photo 1-46).

Residential development to the north off Dixie Drive abuts proposed Reserve Zone 6 and provides recreational access to the area. The Zen Trail is a very popular mountain biking trail that travels up a tilted rock slab. Riders, sometimes comprising large groups, are visible snaking along the trail. A broad, flat dirt area provides unofficial parking. The trail ascends alongside a large cleft within which climbers can be seen in the Green Valley Gap Climbing Area (Photo 1-47). The cleft offers views of the sweeping valley and distant hills to the southwest, which become more open as riders ascend. Dramatic views of the vivid red rocks of Red Cliffs NCA and purple Pine Valley Mountains are to the west, north, and east. Foreground views include rounded pale yellow sandstone punctuated with sage green scrub vegetation. On the opposite side of the cleft, a large beige water tank is partially obscured by the hill into which it was built and is clearly visible to mountain bikers on the north end of the Bearclaw Poppy Trail in this area (Photo 1-48). A water pipeline originates at the water tank and follows the Bearclaw Poppy Trail east to the Gap trailhead parking lot. An electrical substation to the south of the Zen trailhead just outside proposed Reserve Zone 6 is a visual anomaly and is visible to riders descending the Zen Trail (Photo 1-49). Tall, multistrand transmission lines are conspicuous vertical elements adjacent to the trailhead adjacent to proposed Reserve Zone 6, traveling generally north to south (Photo 1-50). An existing multiphase monopole transmission line extends south from this substation, skirting Moe's Valley to the east, and crossing the Bearclaw Poppy Trail and Navajo Drive farther south. This line is only sporadically visible from the climbing area, but is the tallest vertical element near Navajo Drive, creating an incongruous intrusion within proposed Reserve Zone 6 (Photo 1-51).

## 3.6 Key Observation Points

Key Observation Points (KOPs) are "one or a series of points on a travel route or at a use area or a potential use area, where the view of a management activity would be most revealing" (BLM 1984). KOPs should represent either a typical view from a sensitive viewing location or the range of impacts associated with the project (BLM no date c). Twelve KOPs for this project were selected in consultation with the BLM, as follows (Attachment 2):

1) T-Bone Trail looking southwest.
2) Green Springs residential area at Mustang Pass trailhead (view at dusk) looking west.
3) Red Hills Parkway multi-use path looking east.
4) Red Hills Parkway multi-use path looking north.
5) City Creek Trail looking northeast.
6) Cottontail Trail west of Green Springs residential area looking west.
7) Icehouse Trail looking southwest.
8) Pioneer Rim Trail looking east.
9) Middleton residential area, northwest end of East 1200 North Road looking northwest.
10) City Creek Trail looking east.
11) Intersection with Cottonwood Springs Road looking south.
12) Pioneer Park looking south.

Attachment 2 contains a location map and photographs of each KOP and simulations depicting expected changes resulting from the proposed alternatives as analyzed under Section 4.1.

# 4. Visual Impact Assessment

This section describes anticipated impacts resulting from each of the four proposed Federal actions described in Section 1.

## 4.1 Northern Corridor

Under this Federal action, the BLM could approve a ROW for the Northern Corridor that crosses the approximately 45,000-acre congressionally established Red Cliffs NCA and the 62,000-acre Reserve.

### 4.1.1 Proposed Alternatives

A total of six alternatives are being considered for the Northern Corridor and are described in Section 2.2 of the EIS. The alternatives are identified as follows:

1) No Action Alternative.
2) T-Bone Mesa Alignment.
3) UDOT Application Alignment.
4) Southern Alignment.
5) Red Hills Expressway.
6) St. George Boulevard/100 South One-way Couplet.

### 4.1.2 Project Design Features and Components

The T-Bone Mesa Alignment, UDOT Application Alignment, and Southern Alignment share the following common features (Chapter 2 and Appendix D of the EIS contain further details):

- Up to 500-foot-wide ROW.
- 4-lane roadway with two 12-foot-wide travel lanes in each direction, 8-foot shoulders, and a center median.
- A combination of curb and gutter, drainage swales and ditches.
- Bicycle and pedestrian trails.
- Associated signage.

- A new intersection for connection to Red Hills Parkway, as well as a new intersection at Cottonwood Spring Road (also known as Old Dump Road or Turkey Farm Road).

#### 4.1.3 Construction and Phasing

Based on funding or traffic demand, construction may be phased by building one lane in each direction, with subsequent phases adding another lane, accompanying trails, and any cross-street connections. Construction would be completed using established highway construction practices, standards, and specifications with special provisions added, as required.

Staging areas would be located within the ROW granted to UDOT. The exact locations would be determined during final design.

After construction, the site would be stabilized using erosion and sediment control measures, topsoil placed over fill material, and seeding of a BLM-approved seed mixture to establish vegetation. UDOT will manage long-term project operation and maintenance.

#### 4.1.4 Avoidance, Minimization, and Mitigation Measures

The BLM VRM Visual Contrast Rating Process states that mitigating measures should be prepared for all adverse contrasts that can be reduced (BLM 1986b). The following features were incorporated into project design to minimize visual impacts (Appendix D of the EIS contains further details):

- Grade roadway and adjacent slopes according to BLM and UDOT specifications.
- Paint all facilities a color that best allows the facility to visually blend with the background.
- Design any lighting proposed for the roadway to reduce impacts to dark night skies. These measures may include directing all light downward, using shielded lights, using only the minimum illumination necessary, using lamp types, such as sodium lamps (less prone to atmospheric scattering), using circuit timers, and using motion sensors.
- Reclaim site, including clean-up of construction materials, establishment of clear zone adjacent to the roadway that is free of trees and other ground protrusions, and placement of topsoil.
- Revegetate site according to BLM and UDOT specifications, including reseeding with BLM-approved seed mixes and planting requirements established by Washington County and City of St. George.
- Prepare a Fugitive Dust Control Plan in coordination with the Utah Department of Air Quality.
- Prepare a Blasting Plan.
- Prepare a Noxious Weed Management Plan.

The following measures identified by the BLM in Appendix 3 of *Manual 8431 – Visual Resource Contrast Rating* (BLM 1986b) as techniques to consider were also considered in development of the alignments, incorporated into project design, or both, to reduce visual impacts (Appendix D of the EIS contains further details):

**Table 5. BLM Sample List of Design Techniques for Mitigating Visual Impacts**

| Landform or Water Body | Vegetation | Structures |
|---|---|---|
| • Reduce Size of Cut and Fill Slopes:<br>– Relocate to an area with less slope.<br>– Change road width and grade.<br>– Change alignment to follow existing grades.<br>– Prohibit dumping of excess material on downhill slopes.<br>• Reduce Earthwork Contrasts:<br>– Round or warp slopes.<br>– Retain rocks, trees, and drainage.<br>– Tone down freshly broken rock faces with asphalt emulsion spray or with gray point.<br>– Add mulch, hydromulch, or topsoil.<br>– Shape cuts and fills to appear as natural forms.<br>– Cut rock areas so forms are irregular.<br>– Design to take advantage of natural screens (vegetation, land forms).<br>– Grass seed cuts and fills.<br>• Maintain Integrity of Topographic Units:<br>– Design projects to blend with topographic forms in shape and placement. | • Retain Existing Vegetation:<br>– Use retaining walls on fill slopes.<br>– Reduce surface disturbance.<br>– Protect roots from damage during excavations.<br>• Enhance Revegetation:<br>– Mulch cleared areas.<br>– Control planting times.<br>– Furrow slopes.<br>– Plant holes on cut and fill slopes.<br>– Choose native plant species.<br>– Stockpile and reuse topsoil.<br>– Fertilize, mulch, and water vegetation.<br>• Minimize Impact on Existing Vegetation:<br>– Partial cut instead of clear cut.<br>– Use irregular clearing shapes.<br>– Feather or thin edges.<br>– Dispose of all slash.<br>– Control construction access.<br>– Utilize existing roads.<br>– Limit work within construction area.<br>– Select type of equipment to be used.<br>– Minimize clearing size (strip only where necessary).<br>– Grass seed cleared areas.<br>• Maintain the Integrity of Vegetative Units:<br>– Utilize the edge effect for structure placement along natural vegetative breaks. | • Minimize Structure Contrast:<br>– Use earth-tone paints and stains.<br>– Use Corten steel (self-weathering).<br>– Treat wood for self-weathering.<br>– Use natural stone surfaces.<br>– Bury all or part of the structure.<br>– Select paint finishes with low levels of reflectivity (flat or semigloss).<br>• Redesign Structures that do not Blend/Fit:<br>– Use rustic designs and native building materials.<br>– Use natural appearing forms to complement landscape character (use special designs only as a last resort).<br>• Minimize Impact of Utility Crossings:<br>– Make crossings at right angles.<br>– Set back structures at a maximum distance from the crossing.<br>– Leave vegetation along the roadside.<br>– Minimize viewing time.<br>– Utilize natural screening.<br>• Recognize the Value and Limitations of Color:<br>– Consider that color (hue) is most effective within 1,000 feet, beyond which color becomes more difficult to distinguish and tone or value determines visibility and resulting visual contrast.<br>– Consider that using color has limited effectiveness (in the background distance zone) in reducing visual impacts on structures that are silhouetted against the sky.<br>– Paint structures somewhat darker than the adjacent landscape to compensate for the effects of shade and shadow.<br>– Select color to blend with the land and not the sky. |

### 4.1.5 Impacts Analysis

This analysis is performed as follows:

1) Applies the BLM VRM System to do the following:
   a) Identify visual impacts to landscape character and views from sensitive viewing locations.
   b) Determine consistency with BLM VRM classes identified in the Red Cliffs NCA RMP for Northern Corridor Alternatives B, C, and D.
2) Applies the FHWA VIA guidance to identify visual impacts for Northern Corridor Alternatives E and F as viewed by neighbors (views toward the road) and travelers (views from the road).

Analysis of the proposed new roadway ROW in the Red Cliffs NCA is based on BLM's VRM system, which provides a framework for managing visual resources on BLM-administered lands, and FHWA's *Guidelines for the Visual Impact Assessment of Highway Projects,* which is used to analyze visual impacts of roadway projects. The BLM's VRM system was used to evaluate the T-Bone Mesa Alignment, UDOT Application Alignment, and Southern Alignment because they would traverse lands within the Red Cliffs NCA. The FHWA guidance was used to evaluate Red Hills Expressway and St. George Boulevard/100 South One-way Couplet because they would modify existing roads outside BLM jurisdiction. Where appropriate, overlapping methods were combined into one to simplify the evaluation.

#### 4.1.5.1 BLM VRM System

The following steps in the BLM's VRM system were used to evaluate the T-Bone Mesa Alignment, UDOT Application Alignment, and Southern Alignment (Figure 1; BLM no date d):

1) Obtain project description (see Section 1.2).
2) Describe VRM objectives (see Section 2.1).
3) Select KOPs.
4) Prepare visual impact simulations.
5) Complete the BLM contrast rating form to evaluate visual impacts and determine whether the project conforms to the VRM class objectives.
6) Identify mitigation measures, if necessary.

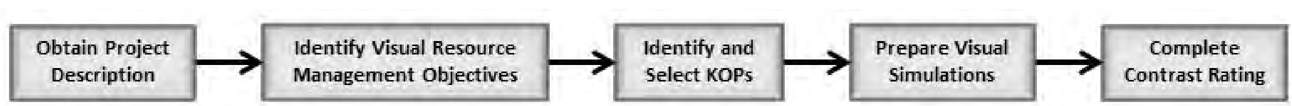


**Figure 1. BLM General Visual Contrast Rating Process**
*Source: BLM no date d*

Steps 1 and 2 were discussed in Section 1.2 and Section 2.1. Steps 3 through 6 are discussed in this section.

The BLM identifies visual impacts as "changes to the scenic attributes of the landscape brought about by the introduction of visual contrasts (e.g., development) and the associated changes in the human visual experience of the landscape" (BLM no date e). The BLM defines an adverse visual impact as "any modification in land forms, water bodies, or vegetation, or any introduction of structures, which negatively interrupts the visual character of the landscape and disrupts the harmony of the basic elements" (BLM 1984). The outcome of this analysis confirms whether the potential visual impacts will meet the BLM's VRM class objectives and allowable level of change established for the area, or if design adjustments or additional visual impact mitigation will be required.

**Impacts Analysis Methodology**

The BLM's Visual Contrast Rating process is used to analyze potential visual impact of proposed projects and activities (BLM 1986b). Per BLM *Manual 8431 – Visual Resource Contrast Rating* (BLM 1986b), "the degree to which a management activity affects the visual quality of a landscape depends on the visual contrast created between a project and the existing landscape. The contrast can be measured by comparing the project features with the major features in the existing landscape. The basic design elements of form, line, color, and texture are used to make this comparison and to describe the visual contrast created by the project."

The contrast rating is based on the most critical viewpoints, referred to as KOPs (defined in Section 3.6). KOPs are usually located along commonly traveled routes or at other likely observation points. Factors that should be considered in selecting KOPs are angle of observation, number of viewers, length of time the project is in view, relative project size, season of use, and light conditions.

Linear projects should be rated from several viewpoints representing the following (BLM 1986b):

- Most critical viewpoints; for example, views from communities and road crossings.
- Typical views encountered in representative landscapes, if not covered by critical viewpoints.
- Any special project or landscape features such as skyline crossings, river crossings, and substations.

The existing landscape and any resulting degree of change is determined for each KOP based on a photograph of the existing landscape and a photo-simulation of the proposed project. The difference is described by degrees of contrast: strong, moderate, weak, or none (BLM 1986b, no date d):

- None: The element contrast is not visible or perceived.
- Weak: The element contrast can be seen but does not attract attention.
- Moderate: The element contrast begins to attract attention and begins to dominate the characteristic landscape.
- Strong: The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

Numeric values were assigned along a continuum from 0 (none) to 7 (very strong) to determine the degree of contrast in order to apply a consistent impact analysis with the FHWA system (Section 4.1.5.2). These four levels of contrast roughly correspond with VRM Classes I, II, III, and IV, respectively. This means that a "strong" contrast rating may be acceptable in a VRM Class IV area but would not likely meet the VRM objectives for a VRM Class III area. A proposed project meets the VRM objective if all degrees of contrast are equal to or less than the highest degree of contrast or change to the existing condition allowed for the objectives of that class (BLM no date d).

**Consistency with VRM Class Objectives**

Consistency with VRM class objectives was identified for the T-Bone Mesa Alignment, UDOT Application Alignment, and Southern Alignment based on results of the impacts analysis. Although the BLM cannot assign VRM classes to lands not managed by the agency, the VRM decisions made for public lands in the Red Cliffs NCA were logically extrapolated to adjacent non-public lands for the purposes of this analysis. This was done for the purposes of continuity and allows for consistent analysis of visual resources across the entire analysis area.

In addition, general numbers and locations of residences and recreational facilities that contain sensitive viewers who would see the inconsistencies were identified.

#### 4.1.5.2 FHWA System

Steps in the FHWA's process that were used to evaluate Red Hills Expressway and St. George Boulevard/100 South One-way Couplet fall under the following phases (FHWA 2015):

1) Establishment Phase: Define the character of the project's visual features, determine the regulatory context, and define the area of visual effect (see Sections 1 through 3).
2) Inventory Phase: Describe the affected environment, affected population, and existing visual quality (Section 3.3 and Section 3.4); establish key views.
3) Analysis Phase: Assess visual impacts.
4) Mitigation Phase: Identify effective mitigation.

Steps 1 and 2 are discussed under Sections 1 through 3. Remaining steps are discussed in this section.

**Impacts Analysis Methodology**

For this VIA, Step 3 incorporates the 1988 FHWA methodology in the Analysis Phase to more quantitatively analyze impacts resulting from the Red Hills Expressway or St. George Boulevard/100 South One-way Couplet alternatives. That methodology states that visual impact equals the visual resource change (based on the compatibility of visual character and changes to visual quality) plus the viewer response to that change (based on viewer exposure and viewer sensitivity) (Figure 2) (FHWA 1988).

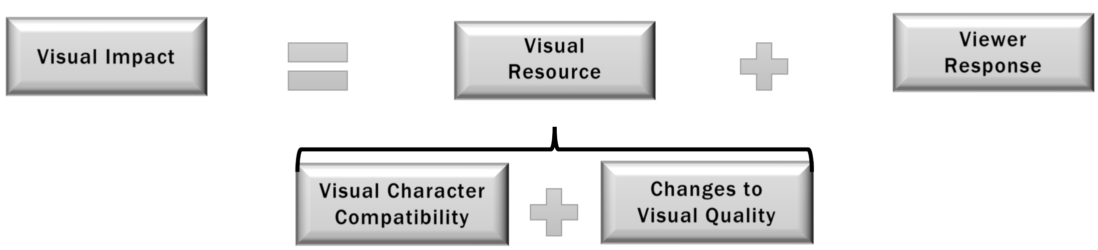


**Figure 2. FHWA Visual Impact Equation**

*Source: FHWA 1988*

Visual character is based on pattern elements (e.g., form, line, color, or texture) and pattern character (e.g., dominance, scale, diversity, or continuity). A project's compatibility with the existing setting can be low or high. Visual quality is based on vividness, intactness, and unity, and is determined by assigning numerical values to those three elements and determining their average (FHWA 1988). The 1988 FWHA Visual Quality Evaluation Worksheet was used to assess visual character compatibility and changes to visual quality as rated on a scale from 1 (very low) to 7 (very high) for Alternatives E and F (refer to Attachment 3).

#### 4.1.5.3 Jointly Assessing BLM and FHWA Methodologies

Visual impacts are identified as either beneficial, neutral, or adverse. A beneficial impact would improve the existing conditions; a neutral impact would mean no change is expected. Because of the differences in the BLM and FHWA methodologies, an approach was devised to identify adverse impacts consistently between them using the results of the BLM's Visual Contrast Rating Worksheet and the FHWA's Visual Quality Evaluation Worksheet. The worksheet contents are based on the standard worksheets provided by each agency's guidelines, but the designs were slightly modified to ease comparisons between the two. Although the worksheets appear similar, the BLM's ranks the contrast that would result from the proposed change, and the FHWA's ranks the difference in visual quality that would occur. The BLM's weak, moderate, and strong contrast rankings were assigned numeric values similar to the FHWA visual quality change rankings, as shown in Table 6.

**Table 6. Adverse Impact Ranking**

| Numerical Ranking | FHWA Visual Character Compatibility | FHWA Change to Visual Quality | BLM Visual Contrast |
|---|---|---|---|
| 1 | Very high | Very low | Very weak |
| 2 | High | Low | Weak |
| 3 | Moderately high | Moderately low | Moderately weak |
| 4 | Moderate | Average | Moderate |
| 5 | Moderately low | Moderately high | Moderately strong |
| 6 | Low | High | Strong |
| 7 | Very low | Very high | Very strong |

Using Table 6, a ranking of 2 would equal high visual compatibility and a low amount of change to visual quality, and hence a low adverse impact under the FHWA methodology, and a weak contrast, or low adverse impact under the BLM's. Rankings were assigned based on visual changes indicated in photographic simulations developed for the KOPs identified in Section 3.6. Impacts were identified as short term, which is through the first 5 years, and long term, which is through the life of the project, as defined by BLM *Manual 8431 – Visual Resource Contrast Rating* (BLM 1986b).

#### 4.1.5.4 Photographic Simulations

Photographic simulations are spatially accurate and realistic visualizations of views of a proposed action from KOPs. They are used to depict existing visual conditions and to illustrate how existing views from the KOPs would change with the proposed action. Simulations help evaluate the impact that would occur and assess if proposed actions would be consistent or inconsistent with the BLM VRM class objectives. Simulations are also used to evaluate the effectiveness of mitigation measures to address visual impact issues (BLM 1986b, no date d).

Existing visual conditions at each KOP location were photographically documented using a digital single-lens reflex camera set to take photos with a focal length equivalent to a 35-millimeter (mm) camera using a 50-millimeter lens. This type of equipment and setting best approximate what the human eye perceives (McHugh 2020).

A visual simulation was prepared for the view from each selected KOP to depict how it would appear with the completed project in place. For each view, computer modeling and rendering techniques were used to produce the simulated images. Existing topographic and site data provided the basis for developing an initial digital model. Project engineers provided data for the proposed facilities, which were used to create 3-D digital models of the alternatives. These models were combined with the digital site model to produce a complete computer model of the project changes.

For each simulation viewpoint, a viewer location was established using global positioning system (GPS) data recorded at the time the photo was taken using 5 feet as the assumed viewer eye level. Computer wire-frame perspective plots were then overlaid on the photographs of the views from the simulation viewpoints to verify scale and viewpoint location. Digital visual simulation images were produced as a next step based on computer renderings of the 3-D model, combined with high-resolution digital versions of base photographs.

Attachment 2 includes simulations prepared for this VIA, as well as existing conditions photos for comparison purposes.

#### 4.1.5.5 Noise Barriers

Noise barriers could potentially be constructed for Alternatives 1 through 3, as they were determined to be feasible but not reasonable (EIS Section 3.23). Therefore, a more detailed noise analysis evaluating noise barriers would be conducted after completion of this EIS under a separate study. For purposes of this visual impact analysis, noise barriers were not assumed.

#### 4.1.5.6 Alternative 1, No Action Alternative

**Impact Analysis**

Alternative 1 would result in no change to visual resources beyond existing conditions and trends..

**Consistency with VRM Class Objectives**

The No Action Alternative would result in no change to, and would therefore be consistent with, existing BLM VRM class objectives.

#### 4.1.5.7 Alternative 2, T-Bone Mesa Alignment

**Impact Analysis**

Long-term, primarily adverse visual impacts would result from construction and operation of Alternative 2. Sensitive viewers that would be most impacted include residents at the northern end of the Green Springs residential area and users of nearby trails (i.e., Icehouse, Mustang Pass, Cottontail, and Middleton Powerline), users of the City Creek trail system and the T-Bone Trail, drivers on Cottonwood Springs Road at the proposed intersection, and drivers on Red Hills Parkway and users of the adjacent multi-use path at the proposed interchange. KOP 1 through KOP 3 (Attachment 2) depict existing conditions and simulated changes from the Green Springs residential area, T-Bone Trail, and Red Hills Parkway interchange.

This alternative would introduce a new 4-lane, 500-foot-wide road with two 12-foot-wide travel lanes in each direction, 8-foot shoulders, and a center median into a mostly undeveloped area, creating a substantial visual impact for sensitive viewers. Additional new visual elements would further heighten the effect, including a combination of curb and gutter, drainage swales and ditches, a trail paralleling the road, and road signs. Road cuts and fills would alter the landscape's landform and vegetation, and the road would interject contrasting textures and colors into the landscape, creating a strong linear feature that would become a focal point depending on proximity of these features to viewers (distance zone) and angle of views (many viewpoints have a superior viewing angle). Revegetating disturbed areas beyond the pavement and clear zones would help reduce contrast, but due to the low size of native vegetation in the area, contrast would be minimally reduced. In addition, moving vehicles would introduce motion into a primarily static landscape, calling attention to the road. Attachment 3, KOP 1 provides an example of this change viewed from the northern end of the T-Bone Trail. These trail users would experience considerable adverse impacts, because their exposure to this view would range from 10 minutes to 1 hour or more depending on activity. The intensity of impacts for all trail users in the analysis area, including those at the north end of the Green Springs residential area, would vary based on viewing distance and angle of view, because the road may be completely or partially screened by vegetation, land formations, and view angle as sensitive viewers move through the landscape. However, the overall impact would be adverse. Attachment 3 provides more details about impacts for all KOPs.

The analysis for this alternative assumes that one bridge would be required, which would be located on the east side of Cottonwood Springs Road adjacent to the existing substation. However, the bridge would be only minimally visible from sensitive viewing locations.

Impacts to residents and visitors using trails at the north end of the Green Springs residential area would vary based on the location of their houses regarding topography, orientation, angle of view and viewing distance. Some views would be completely screened by existing houses or lower elevation. Residents on the northwestern edge of the development, where views to the west are generally unobstructed, would be most affected. In addition, the impact would be of long duration, because residences are stationary. Some residents may be further affected by the increased traffic traveling through the area, as well as any intersections that may be designed under future planning efforts.

A new stoplight-controlled interchange at Cottonwood Springs Road would introduce new lights and vertical elements. Most drivers on this road are expected to be recreationists traveling north into the Red Cliffs NCA, and as such, would be sensitive to visual change. However, visual impacts would be minor at this area, where existing substations and numerous transmission towers and lines of varying girths and heights have impeded views and diminished scenic quality. In addition, drivers would be exposed to the change for a relatively short amount of time as they continue to their destinations.

A new grade-separated interchange would be constructed at Red Hills Parkway, essentially flattening the parkway's curve where it turns to the south. The new alignment would form a mostly straight line where it joins the parkway, which would be realigned and straightened slightly to the south to create a perpendicular connection. This interchange would substantially change the visual character at that location by removing a large existing rock cut and introducing an elevated structure on large fill slopes and associated ramps (Attachment 2, KOP 3). The overpass would cast shadows at different times of the day. Although the change to landform would be considerable, the impact would be neutral (as described for KOP 3) to adverse depending on viewpoint because drivers would be exposed to the change for a relatively short amount of time. However, users of the City Creek trail system in this area would experience these impacts for a longer duration.

Associated roadway lighting and vehicle lights would draw attention to the road at night, making it a conspicuous element in an otherwise mostly undeveloped area (Attachment 2, KOP 2). This would particularly affect residents of the northern end of the Green Springs residential area, who would experience long view durations compared to drivers or recreational users, the latter of which would experience few impacts.

Short-term impacts would occur during construction and would be related to views of construction equipment, dust, possible detours at the Red Hills Parkway interchange, and temporary staging areas. Construction may be phased by building one lane in each direction, with subsequent phases adding another lane, accompanying trails, and any cross-street connections. Therefore, views of construction activity would vary as activities move along the alignment. The biggest short-term impact would result from constructing the interchange with Red Hills Parkway, which would likely require cranes and other large machinery to raise the structure. In addition, grading, adding fill, and removing the existing road cut in this area would likely create substantial dust.

Actions to minimize visual impacts (Section 4.1.4) have been incorporated into design and the simulations shown in Attachment 2, including roadway and slope grading, paint color selection, and site reclamation and revegetation. Furthermore, the size of cut and fill slopes and earthwork contrasts will be reduced by incorporating actions listed in Table 5, specifically, cuts and fills will be shaped to appear as natural and topographic forms. Revegetation activities will also adhere to Table 5 and the requirements of a Weed Control Plan, and structures such as bridges will be designed to minimize contrast as listed in Table 5. Short-term impacts will be mitigated through implementation of a Fugitive Dust Control Plan and Blasting Plan. Any lighting proposed for the roadway will be designed to reduce impacts to dark night skies, and low-reflective paint will be used to minimize glare.

The new alignment would provide views of Red Cliffs NCA for the travelers expected to use the proposed roadway itself and the adjacent trail. These travelers would have closer views of the tall, vivid red cliffs and Pine Valley Mountains north of the Green Springs residential area, as well as mountain views near the connection with Red Hills Parkway. These users would also experience close-up views of the substation and transmission lines near Cottonwood Springs Road.

Overall, the visual contrast of the proposed changes would range from moderate to strong depending on variables such as viewpoint, viewer sensitivity, angle of view, and time of day. Although impacts would be neutral in some areas where views are diminished, overall impacts would be primarily adverse due to the extent of the changes. This alternative would affect the fewest sensitive viewers of those alignments proposed through the Red Cliffs NCA, because it would be farthest from affected recreational facilities (for example, trails) and includes only one bridge. However, this alternative would adversely impact areas with high scenic quality and high sensitivity that comprise the VRI Class II through which the alignment would pass due to changes to landform, vegetation, and color, and impacts to sensitive users, including recreational visitors, nearby residents, and users of the highway. Table 7 shows the number of acres affected for each VRI unit in the analysis area for this alternative.

**Table 7. Alternative 2 – VRI Components**

| VRI Unit | Level | Number of Acres Affected |
|---|---|---|
| Scenic Quality | | |
| Red Cliff Sandstone | A | 243 |
| Young Basalt Flows | C | 23 |
| Sensitivity Level | High | 266 |
| Distance Zone | Foreground-middleground | 266 |

The new roadway and bridge would require new rock cuts and fills, vegetation removal, and interjection of new colors (particularly, pavement) and a smooth, linear form into the landscape. The roadway and bridge would also represent a new cultural modification, as a highway would exist where one currently does not, detracting from the scenery in the form of a negative intrusion. These changes to scenic quality would be most impactful in the Red Cliffs Sandstone SQRU, where landform and color are both rated 4.5 (Table 3). In addition, this alignment would cross the Young Basalt Flows SQRU in close proximity to the visually prominent substation and several substantial transmission lines near Cottonwood Springs Road, which have compromised the quality of the immediately adjacent scenery.

#### Consistency with VRM Class Objectives

Where the alignment would traverse VRM Class III, the existing character of the landscape would be partially retained in some areas, such as where the alignment would cross Cottonwood Springs Road in proximity to the substations and utility lines. Such areas are better able to absorb further visual intrusions. In addition, some sections of the alignment may not be visible from certain vantage points. However, the overall level of change to the characteristic landscape would likely exceed the moderate threshold for VRM Class III, particularly where sensitive viewers are located and recreational activities occur. This alternative would not conform to the RMP's VRM Class III objective because the highway would dominate the view of the casual observer throughout the majority of the alignment. Management activities (i.e., operation and maintenance of the road) would attract attention and would dominate the view of the casual observer, because the road would be a new and prominent feature in an otherwise undeveloped landscape. Despite incorporation of design features to help roadway components fit into the landscape, the resulting changes would not repeat the basic elements found in the predominant natural features of the characteristic landscape. Therefore, this alternative would not be consistent with VRM Class III.

### 4.1.5.8 Alternative 3, UDOT Application Alignment

#### Impact Analysis

Long-term, primarily adverse visual impacts would result from construction and operation of Alternative 3, similar to Alternative 2. Sensitive viewers that would be most impacted include residents at the northern end of the Green Springs residential area, who would have longer view durations, and users of nearby trails

(Icehouse, Mustang Pass, Cottontail, Middleton Powerline), users of the City Creek trail system and the Cottontail Trail, drivers on Cottonwood Springs Road at the proposed intersection, and drivers on Red Hills Parkway and users of the adjacent multi-use path at the proposed interchange. KOP 4 through KOP 7 (Attachment 2) depict existing conditions and simulated changes from the Red Hills Parkway interchange, City Creek Trail, Cottontail Trail, and Icehouse Trail.

This alternative would introduce the same roadway elements described for Alternative 2. As with Alternative 2, road cuts and fills would alter the landscape's topography, and the road would interject contrasting textures and colors into the landscape, creating a strong linear feature. Attachment 2, KOP 5 provides an example of this change viewed from the northern end of the City Creek Trail, where the new alignment would be raised on extensive fill. However, the new alignment is difficult to discern from this view, despite its broad panorama. The impacts of the new alignment would vary as the viewpoint and duration of view change. Attachment 2, KOP 6 depicts a simulated view from the Cottontail Trail west of the Green Springs residential area. The new alignment would be mostly obscured in this view because of the viewing angle and vegetation. Conversely, Attachment 2, KOP 7 shows extensive change from an elevated view on the Icehouse Trail. As viewers move through the landscape in the analysis area, the intensity of impacts would vary, but overall impacts would remain adverse. Attachment 3 provides more details about impacts for all KOPs.

The analysis for this alternative assumes that two bridges would be required, one on each side of Cottonwood Springs Road. However, they would be only minimally visible from sensitive viewing locations.

Impacts to residents at the north end of the Green Springs residential area would be similar to Alternative 2, although the Alternative 3 alignment would curve more sharply to the south, making this route more visible to some residents but less visible to others.

A new stoplight-controlled interchange at Cottonwood Springs Road would have similar impacts to Alternative 2. However, visual impacts to scenic quality would be slightly increased at this area, which is farther south of the existing substations and numerous transmission towers, thereby adding new vertical elements. Like Alternative 2, drivers would be exposed to the change for a relatively short amount of time as they continue to their destinations.

The new alignment would connect to Red Hills Parkway slightly south of the Alternative 2 interchange, forming a mostly diagonal line from the northwest to the southeast. The parkway would be realigned slightly from the south, curving to the northeast to create a perpendicular connection. As shown in Attachment 2, KOP 4, the elevated interchange would block some distant views, and its strong linear shape would contrast against the existing landforms. The movement of motor vehicles on the overpass would further draw attention to it and obscure distant mountains. The extent of this impact would vary based on viewing angle and location.

Night lighting impacts would be the same as described for Alternative 2.

Short-term impacts would occur as described for Alternative 2.

Actions to minimize visual impacts (Section 4.1.4) would be incorporated as described for Alternative 2.

The new alignment would provide views of Red Cliffs NCA for travelers on the proposed roadway itself and the adjacent trail, but to a lesser degree than Alternative 2. However, the substation on Cottonwood Springs Road would be farther from view, and fewer transmission lines would be visible.

Overall, the visual contrast of the proposed changes would range from moderate to strong depending on variables such as viewpoint, viewer sensitivity, angle of view, and time of day, as previously described. Although impacts would be neutral in some areas where views are diminished, overall impacts would be primarily adverse due to the extent of the changes. This alternative would affect more sensitive viewers than Alternative 2 because of its more southern alignment and closer proximity to the Green Springs residential area. In addition, this alternative is assumed to include two bridges, one on the east and one on the south side of Cottonwood Springs Road, which would increase visual impacts.

Table 8 shows the number of acres affected for each VRI unit in the analysis area for this alternative.

**Table 8. Alternative 3 – VRI Components**

| VRI Unit | Level | Number of Acres Affected |
|---|---|---|
| Scenic Quality | | |
| Red Cliff Sandstone | A | 263 |
| Young Basalt Flows | C | 24 |
| Sensitivity Level | High | 287 |
| Distance Zone | Foreground-middleground | 287 |

Impacts on scenic quality would be similar to Alternative 2 but would affect more acreage. The two proposed bridges would additionally impact scenic quality due to their mass and cut and fill requirements. The bridges would also heighten the degree of cultural modifications, representing an additional negative intrusion onto the landscape.

**Consistency with VRM Class Objectives**

This alternative would not be consistent with VRM class objectives as described for Alternative 2.

#### 4.1.5.9 Alternative 4, Southern Alignment

**Impact Analysis**

Long-term, primarily adverse visual impacts would result from construction and operation of Alternative 4, as described for Alternative 2. Sensitive viewers that would be most impacted include residents at the northern end of the Green Springs residential area and users of nearby trails (Icehouse, Mustang Pass, Cottontail, Middleton Powerline); residents at the north end of the Middleton residential area; users of the City Creek trail system, the Pioneer Rim and Pioneer Hills Trails, and the Cottontail Trail; visitors to Pioneer Park; drivers on Cottonwood Springs Road at the proposed intersection; and drivers on Red Hills Parkway and users of the adjacent multi-use path at the proposed interchange. KOP 8 through KOP 11 (Attachment 2) depict existing conditions and simulated changes from the Pioneer Rim Trail, north end of the Middleton residential area, City Creek Trail, and Cottonwood Springs Road.

This alternative would introduce the same roadway elements described for Alternative 2. As with Alternative 2, road cuts and fills would alter the landscape's topography, and the road would interject contrasting textures and colors into the landscape, creating a strong linear feature. Attachment 2, KOP 8 provides an example of this change viewed from the Pioneer Rim Trail, where the new alignment would curve into the landscape, creating a large rock cut. These trail users would experience adverse impacts because their exposure to this view would likely range from approximately 10 minutes to 1 hour depending on activity.

Similar to Alternative 3, the analysis for this alternative assumes that two bridges would be required, one on each side of Cottonwood Springs Road, but farther south. Attachment 2, KOP 9 depicts a simulated view from the north end of the Middleton residential area, where a new bridge is assumed to the north. The bridge would introduce a large transportation element that would dominate the view in an area that is primarily undeveloped, contrasting with existing landform, vegetation, and color characteristics. Residents with views in this direction would experience long view durations compared to drivers or recreational users. Attachment 3 provides more details about impacts for all KOPs.

Impacts to residents at the north end of the Green Springs residential area would be similar to Alternative 3.

A new stoplight-controlled interchange at Cottonwood Springs Road would have similar impacts as Alternative 3. As shown in Attachment 2, KOP 11, the intersection structures would call attention to the new alignment. Like Alternative 2, drivers would be exposed to the change for a relatively short amount of time as they continue to their destinations.

The new alignment would connect to Red Hills Parkway slightly south of the Pioneer Hills trailhead, curving up from the south. The parkway would be realigned to curve more sharply to the east to create a perpendicular connection. As shown in Attachment 2, KOP 10, the interchange and roadway would introduce new transportation elements where none currently exists. These features would be viewed by more sensitive viewers than Alternatives 2 and 3, because they would be visible from several trails and Pioneer Park. The introduction of moving vehicles would draw further attention to this otherwise static landscape.

Night lighting impacts would be similar to Alternative 2. However, the impacts of vehicle lights and bridge lighting would be considerable for residents in the northern end of the Middleton residential area. In addition, lighting associated with the roadway could likely be more visible to drivers and businesses along Red Hills Parkway south of the alignment.

Short-term impacts would occur as described for Alternative 2. However, these impacts would likely affect residents of the northern end of the Middleton area more as a result of the nearby bridge construction.

Actions to minimize visual impacts (Section 4.1.4) would be incorporated as described for Alternative 2.

Similar to Alternative 3, the new alignment would provide views of Red Cliffs NCA for the travelers expected to use the proposed roadway itself and the adjacent trail. This alignment may also provide views of the rock formations at Pioneer Park.

The new alignment would provide views of Red Cliffs NCA for travelers on the proposed roadway itself and the adjacent trail, similar to Alternative 3. In addition, these travelers would have more views of distant cliffs and mountains surrounding St. George from the southeast to southwest, and possible views of the rock formations at Pioneer Park

Overall, the visual contrast of the proposed changes would range from moderate to strong depending on variables such as viewpoint, viewer sensitivity, angle of view, and time of day, as described previously. Although impacts would be neutral in some areas where views are diminished, overall impacts would be primarily adverse because of the extent of the changes. This alternative would affect more sensitive viewers than Alternative 2 and 3 as a result of its southernmost alignment and proximity to the Green Springs and Middleton residential areas, as well as additional recreation areas both within and outside Red Cliffs NCA.

Table 9 shows the number of acres affected for each VRI unit in the analysis area for this alternative.

Impacts on scenic quality under this alternative would be similar to Alternative 3 but affect more acreage, particularly in the Red Cliff Sandstone Unit.

**Table 9. Alternative 4 – VRI Components**

| VRI Unit | Level | Number of Acres Affected |
|---|---|---|
| Scenic Quality | | |
| Red Cliff Sandstone | A | 337 |
| Young Basalt Flows | C | 23 |
| Sensitivity Level | High | 360 |

| VRI Unit | Level | Number of Acres Affected |
|---|---|---|
| Distance Zone | Foreground-middleground | 360 |

**Consistency with VRM Class Objectives**

This alternative would not be consistent with VRM class objectives as described for Alternative 2.

#### 4.1.5.10 Alternative 5, Red Hills Parkway Expressway

**Impact Analysis**

Long-term adverse visual impacts would result from construction and operation of Alternative 5, which would vary depending on location. The proposed structures at 200 East and 1000 East, as well as the flyovers to connect to I-15, would be visually prominent and noticeable from viewpoints throughout St. George and areas within the Red Cliffs NCA's southern boundary. The structures at 200 East and 1000 East would be approximately 25 feet above Red Hills Parkway's existing grade. Grade differentials between the parkway and new structures would likely occur along a few hundred feet. The flyovers connecting the parkway to I-15 would likely be 30 feet high and visible mostly from I-15 and the immediate surroundings. Although the flyovers would be consistent with the existing transportation elements associated with the highway, they would hinder views of commercial establishments from I-15 and surrounding streets, and would be clearly visible from residential and commercial areas on adjacent bluffs. The structures at 200 East and 1000 East would also infringe on existing views from Red Cliffs NCA into or across the valley depending on viewpoint. The 200 East structure would dominant the view from the western portions of Pioneer Park, as well as the adjacent parking area and trailhead to the west. The structures would be much less noticeable from Red Hills Desert Garden, but would be very noticeable looking toward the NCA from the water tank overlook. Users of the multi-use trail adjacent to the parkway would experience adverse impacts related to views of the new interchanges. The structures' sizes would be much more substantial than existing infrastructure, and no similar features exist at 200 East and 1000 East, thereby representing a new visual intrusion.

Sensitive viewers that would be most impacted are mostly concentrated in LU 1 and are considered people with views toward the road, including visitors to Pioneer Park and Red Hills Desert Garden, people using the water tank overlook, and people using the multi-use path adjacent to the parkway. The 200 East interchange would be visible from parts of the Owens Loop Trail within the Red Cliffs NCA. Other viewers include drivers at the proposed interchange reconstructions and drivers on Red Hills Parkway, who would have views from the road. KOP 12 in Attachment 2 depicts existing conditions and simulated changes from Pioneer Park.

Beyond interchange improvements, the majority of this alternative involves repaving and restriping the parkway, as shown in KOP 12. Sensitive viewers in LU 1 at Pioneer Park, Red Hills Desert Garden, and the water tank overlook who have views toward the road that do not include the interchanges would experience negligible, if any, adverse impacts. Because the roadway footprint would not change, the Red Hills Parkway multi-use trail would remain in place.

Night lighting impacts would be similar to existing conditions. Lights on the new interchanges would be elevated, slightly changing lighting conditions in those areas.

Short-term impacts would be similar to Alternative 2. However, the duration and intensity of these impacts would be concentrated primarily where the interchanges would be constructed and would involve no new roadway construction.

Actions to minimize visual impacts (Section 4.1.4) would be incorporated as described for Alternative 2.

The visual contrast of the proposed changes would be weak in proximity to BLM-administered lands that include no views of the interchanges, but strong where the interchanges would be seen. Overall compatibility with pattern and character elements would vary because of the presence of the interchanges. The character of LU 1 would change with the new interchange at 200 East, although visual quality would remain high overall in LU 1 and moderate in LU 2. Viewer exposure to the change would be high at the interchange locations, resulting in adverse impacts. This alternative would affect a potentially wide area of sensitive viewers who would see the proposed interchanges. Most of the roadway would follow the existing alignment, and the largest interchange would be located in a transportation setting within commercial and industrial areas.

Table 10 shows the number of acres affected for each VRI unit in the analysis area for this alternative.

**Table 10. Alternative 5 – VRI Components**

| VRI Unit | Level | Number of Acres Affected |
|---|---|---|
| Scenic Quality | | |
| Red Cliff Sandstone | A | 24 |
| Sensitivity Level | High | 24 |
| Distance Zone | Foreground-middleground | 24 |

Impacts to scenic quality are minimal because the Northern Corridor would occupy the same area as the Red Hills Parkway, an existing cultural modification in the landscape.

#### Consistency with VRM Class Objectives

Red Hills Parkway traverses BLM-administered land in LU 1 from approximately Skyline Drive north 0.2 mile. It also skirts BLM-administered land to the east from approximately the Pioneer Rim trailhead north to where the road curves west. These lands are designated VRM Class III. Although the interchanges would be visible from viewpoints within nearby BLM lands, no change to the BLM VRM Class III objectives would occur because the interchanges would be within existing transportation ROW.

### 4.1.5.11 Alternative 6, St. George Boulevard/100 South One-way Couplet

#### Impact Analysis

Long-term adverse visual impacts would result from construction and operation of Alternative F. Sensitive viewers include residences on 100 South in LU 4, who would have views toward the road and be adversely impacted. Drivers along this road and St. George Boulevard would experience changes of views from the road. Photos 1-32 through 1-35 provide representative examples of existing conditions.

The primary visual change for most viewers would be removal of the existing median and changing the direction and amount of traffic, the latter of which would be particularly noticeable at night (the view would be all taillights or headlights). Removing the median would remove existing landscaping, which currently adds natural elements to the built environment and softens the manmade features. This impact would be greater where the median is wider and includes shrubs and trees. Removing the median would also remove the historic-style light fixtures that add a unifying visual element to the roadway. Landscaping and light fixtures within and adjacent to the sidewalks would remain. Impacts would occur to sensitive viewers, such as pedestrians, residents on 100 South, and visitors to the St. George Historic Downtown. The east end of St. George Boulevard is fronted primarily by commercial uses, so few sensitive viewers would experience view toward the road at that location. Similar impacts would occur within LU 4 at 100 South, but more sensitive viewers would be affected because this is a residential area.

Creating a split interchange between these two roadways connected by one-way ramps at I-15 would reconfigure the existing transportation elements there by continuing the existing I-15 on-ramp from

St. George Boulevard to 100 South and adding a highway on-ramp south of 100 South. Land use in this area between the two roads is mostly commercial, including a large recreational vehicle parking lot, and views from these areas toward the proposed interchange currently include I-15 and an on-ramp. Therefore, extending the existing on-ramp would result in a minor visual change compared to existing conditions. Adding an on-ramp south of 100 South would introduce a new transportation element between I-15 and existing land uses. However, most of these buildings do not have windows facing the highway. The new ramps would be visible to apartment residents near the southern end of the on-ramp, where it would be merging with I-15 and farther from the buildings. This eastern end of the analysis area is characterized as a transportation setting and would remain as such. Most impacts at the new interchange would be primarily to drivers with views of the road, whose impact would be of short duration. This alternative would also increase traffic on both roads, resulting in an adverse impact to sensitive viewers, particularly residents whose views are of long duration.

This alternative would affect fewer sensitive viewers than Alternatives 2, 3, or 4 because no new roadway alignment would be constructed and no recreational facilities would be affected; residential viewers would be affected under all alternatives.

**Consistency with VRM Class Objectives**

Not applicable; this alternative is located outside the Red Cliffs NCA on non-BLM-administered lands.

## 4.2 Red Cliffs NCA RMP Amendment

Under this Federal action, the BLM would amend the Red Cliffs NCA RMP to allow for a transportation ROW within the Red Cliffs NCA.

### 4.2.1 Proposed Alternatives

Three alternatives were developed for the Red Cliffs NCA RMP amendment and are described in EIS Section 2.3.

1) **Red Cliffs NCA RMP Amendment Alternative A: No Action**: Under this alternative, the BLM would not amend the Red Cliffs NCA RMP.
2) **Red Cliffs NCA RMP Amendment Alternative B**: This alternative would allow for a one-time exception to cross a ROW avoidance area, manage the ROW for Northern Corridor as VRM Class IV, and manage an area around the selected route as part of the Rural Recreation Management Zone.
3) **Red Cliffs NCA RMP Amendment Alternative C**: This alternative would designate a new ROW corridor along the selected route for aboveground and buried utilities, manage the new ROW corridor as VRM Class IV, and manage an area around the selected route as part of the Rural Recreation Management Zone.

### 4.2.2 Impacts Analysis

#### 4.2.2.1 Impacts Analysis Methodology

This analysis is performed as follows:

1) Quantitatively describes amendments to VRM classes as defined in the RMP based on impacts from the Northern Corridor Roadway analysis (Section 4.1). Where the proposed change would be inconsistent with existing VRM classes, the length of the new ROW was calculated (in acreage) to allow for comparisons among the alternatives (Table 11).

2) Qualitatively discusses indirect effects on visual character and VRM classes from potential development of other facilities (pipelines and electrical transmission lines) within the new proposed ROW.

#### 4.2.2.2 Red Cliffs NCA RMP Amendment Alternative A: No Action

The No Action Alternative would be consistent with the existing VRM class objectives, which would continue to be managed as currently designated. Table 11 shows the change to the number of acres for each VRM Class that would result under each alternative. Although the Red Hills Parkway Alignment (Alternative 5) would travel through BLM VRM Class III lands, changes would be confined to existing ROW, resulting in no modification to the RMP.

**Table 11. Red Cliffs NCA VRM Classes by Alternative**

| VRM Class | Entire Red Cliffs NCA (acres) | Alternatives 1, 5, and 6 (acres) | Alternative 2 T-Bone (acres) | Alternative 3 UDOT (acres) | Alternative 4 Southern (acres) |
|---|---|---|---|---|---|
| VRM Class I | 19,989 | 19,989 | 19,989 | 19,989 | 19,989 |
| VRM Class II | 18,630 | 18,630 | 18,630 | 18,630 | 18,630 |
| VRM Class III | 6,205 | 6,205 | 6,106 | 6,095 | 6,138 |
| VRM Class IV | 20 | 20 | 119 | 130 | 87 |

Note: Assumes the full 500-foot ROW or corridor width would be amended to VRM Class IV.

#### 4.2.2.3 Red Cliffs NCA RMP Amendment Alternative B

Construction of any of the Northern Corridor alternatives would result in adverse visual impacts as described in Section 4.1.5, and objectives associated with existing VRM Class III lands would not be met regardless of the alignment chosen. Under Alternative B, the RMP would be amended to change the lands occupied by the ROW to VRM Class IV. Therefore, implementation of this alternative would then be in conformance with amended VRM Class IV.

#### 4.2.2.4 Red Cliffs NCA RMP Amendment Alternative C

Similar to Alternative B, construction of any of the Northern Corridor alternatives would result in adverse visual impacts as described in Section 4.1.5, and objectives associated with existing VRM Class III would not be met regardless of the alignment chosen. Under this amendment alternative, the affected VRM class areas would change to VRM Class IV as described for Alternative B. Therefore, implementation of this alternative would then be in conformance with amended VRM Class IV. In addition, a new ROW corridor would be established open to aboveground and buried utilities along the selected route. Incorporating aboveground utilities, specifically transmission and telephone lines, would introduce vertical components into the landscape that would not be included under Alternative B. The extent of visual impacts would depend on the height and girth of the towers and the number of lines. Such utilities would increase the indirect adverse impacts beyond those described in Section 4.1.5, because the vertical structures would draw attention to the roadway where it may otherwise not be readily apparent. The towers would cast shadows and the lines would reflect sunlight, introducing glare during certain times of the day and year. In addition, the lines would be conspicuous when skylined against a clear sky (Photos 1-8 through 1-15, 1-50, and 1-52 provide examples). The landscape's desert setting lacks tall, dense forests or other natural vertical components that could help visually absorb aboveground utilities.

Visual impacts related to belowground utilities would be primarily short term and occur during construction and occasional maintenance as needed. The disturbed ground would be revegetated, and would appear similar to existing conditions within the ROW before design year 2050. If revegetation is not successful for those future projects, linear forms associated with ROW vegetation clearing for construction would continue to contrast with the existing landscape character.

The acreage affected would be the same as shown in Table 11 for Alternative 2, as the ROW width would be the same for both alternatives.

## 4.3 Habitat Conservation Plan

As identified in EIS Table 3.1-1, visual impacts associated with issuance of the ITP and Washington County's Amended HCP were not specifically assessed because decisions to be made by the USFWS related to the issuance of an ITP would not affect visual resources outside of proposed Reserve Zone 6. However, the amendment to the SGFO RMP would establish proposed Reserve Zone 6 and is tied to the Amended HCP and the USFWS' decision to issue an ITP. Therefore, visual impacts related to the SGFO RMP are discussed in Section 4.4.

## 4.4 St. George Field Office Resource Management Plan Amendments

If Alternatives 2, 3, or 4 are approved by the BLM, proposed Reserve Zone 6 would be established. The BLM would amend the existing SGFO RMP to align management of BLM-administered lands within proposed Reserve Zone 6 with the management described in the Washington County HCP.

### 4.4.1 Proposed Alternatives

The BLM developed three alternatives to complete this task, as described in EIS Section 2.5:

1) **SGFO RMP Amendment Alternative A: No Action:** No change in current management.
2) **SGFO RMP Amendment Alternative B:** Place limitations on surface disturbing activities, including managing proposed Reserve Zone 6 as an exclusion area for new ROWs, place new restrictions on minerals management and mining, restrict some recreation uses, make all lands unavailable for livestock grazing, and identify all non-Federal lands for acquisition.
3) **SGFO RMP Amendment Alternative C:** Similar to Alternative B except less restrictive management, including managing Federally managed lands in proposed Reserve Zone 6 as a ROW avoidance area, placing fewer restrictions on minerals management and mining, placing fewer restrictions on recreation activities, and making more areas available for livestock grazing.

### 4.4.2 Impacts Analysis

#### 4.4.2.1 Impacts Analysis Methodology

This analysis is performed as follows:

1) Qualitatively describes the potential proposed Reserve Zone 6 land use changes that would alter the visual character and quality of lands seen by sensitive viewers (residents and recreational users).
2) Qualitatively describes areas containing sensitive viewers where existing BLM VRM objectives might change within proposed Reserve Zone 6.

#### 4.4.2.2 SGFO RMP Amendment Alternative A: No Action

Alternative A would allow continuation of certain activities in varying degrees that would result in visual impacts in proposed Reserve Zone 6. Managing some proposed Reserve Zone 6 lands for ROW use, and mining and mineral use would potentially introduce additional utilities – particularly extractive equipment (such as drilling rigs) and power poles, which would be allowed in 96.5 percent of the BLM-administered land within proposed Reserve Zone 6. Power poles, other utilities, and drilling or other extractive equipment typically consist of manmade vertical elements, and the area's uninterrupted desert setting lacks tall, dense forests or other natural vertical components that can help absorb such additions, making mitigation of these elements difficult. Sensitive viewers, such as recreational users, would be adversely impacted. Allowing livestock grazing, dispersed camping, off-highway vehicle use, and mountain biking, even if restricted, would likely continue to create scars on the landscape because of soil disturbance. Continuing to manage lands under different agencies within proposed Reserve Zone 6 could result in inconsistent uses, potentially resulting in impacts to visual resources occurring in some areas but not others. For example, one land manager may allow land development activities and another may restrict or prohibit such use, with different visual effects from vehicle operation and resultant landscape scarring. Sensitive viewers would be affected based on their perception of particular recreation activities.

The lands in proposed Reserve Zone 6 were identified as Class C. The No Action Alternative would potentially allow additional cultural modifications to be introduced and further reduce scenic quality. No change to the VRM Class III designation for BLM-administered lands within proposed Reserve Zone 6 would occur.

#### 4.4.2.3 SGFO RMP Amendment Alternative B

Compared to the No Action Alternative, Alternative B would greatly restrict, if not completely prohibit, ROW use and mining and mineral activities. Therefore, no or few new manmade vertical components would be introduced to the landscape. Landscape scarring would be minimized by closing or recommending withdrawing all proposed Reserve Zone 6 lands from mineral uses; making the area unavailable to livestock grazing; closing the area to camping, competitive equestrian and off-highway vehicle events; limiting special events to existing public roads; and restricting mountain biking and off-highway vehicle use to existing routes. In addition, applying sustainable actions to travel routes would further help minimize creation of new unauthorized routes and their resulting scars. Alternative B would have a beneficial effect on sensitive viewers.

Restricting activities as described under this alternative could potentially increase scenic quality by not allowing visually incongruent actions to be permitted (cultural modifications). Under Alternative B, non-Federal lands would be identified for Federal (BLM) acquisition. As the non-Federal lands are acquired, the BLM would assign VRM classes to these lands.

#### 4.4.2.4 SGFO RMP Amendment Alternative C

Overall, Alternative C would be more restrictive than Alternative A but less restrictive than Alternative B. Specifically, ROW use and mining and mineral activities would be permitted only in certain circumstances or locations. Similarly, livestock grazing would be allowed in specific areas and some restrictions would be placed on camping and recreational events, such as concentrating camping to designated areas, and requiring permits for events. Visual impacts could result from limited vertical intrusions due to fluid mineral leasing in unincorporated areas and the effects of scarring from grazing and recreational use. However, visual scarring related to off-highway vehicle and mountain bike use would be minimized as described for Alternative B. Alternative C would have a beneficial effect on sensitive viewers, but to a lesser extent than Alternative B.

Limiting certain activities as described under this alternative could potentially increase scenic quality as described for Alternative B. Under Alternative C, non-Federal lands would be identified for Federal (BLM) acquisition. As the non-Federal lands are acquired, the BLM would assign VRM classes to these lands.

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# Attachment 1
# Existing Conditions

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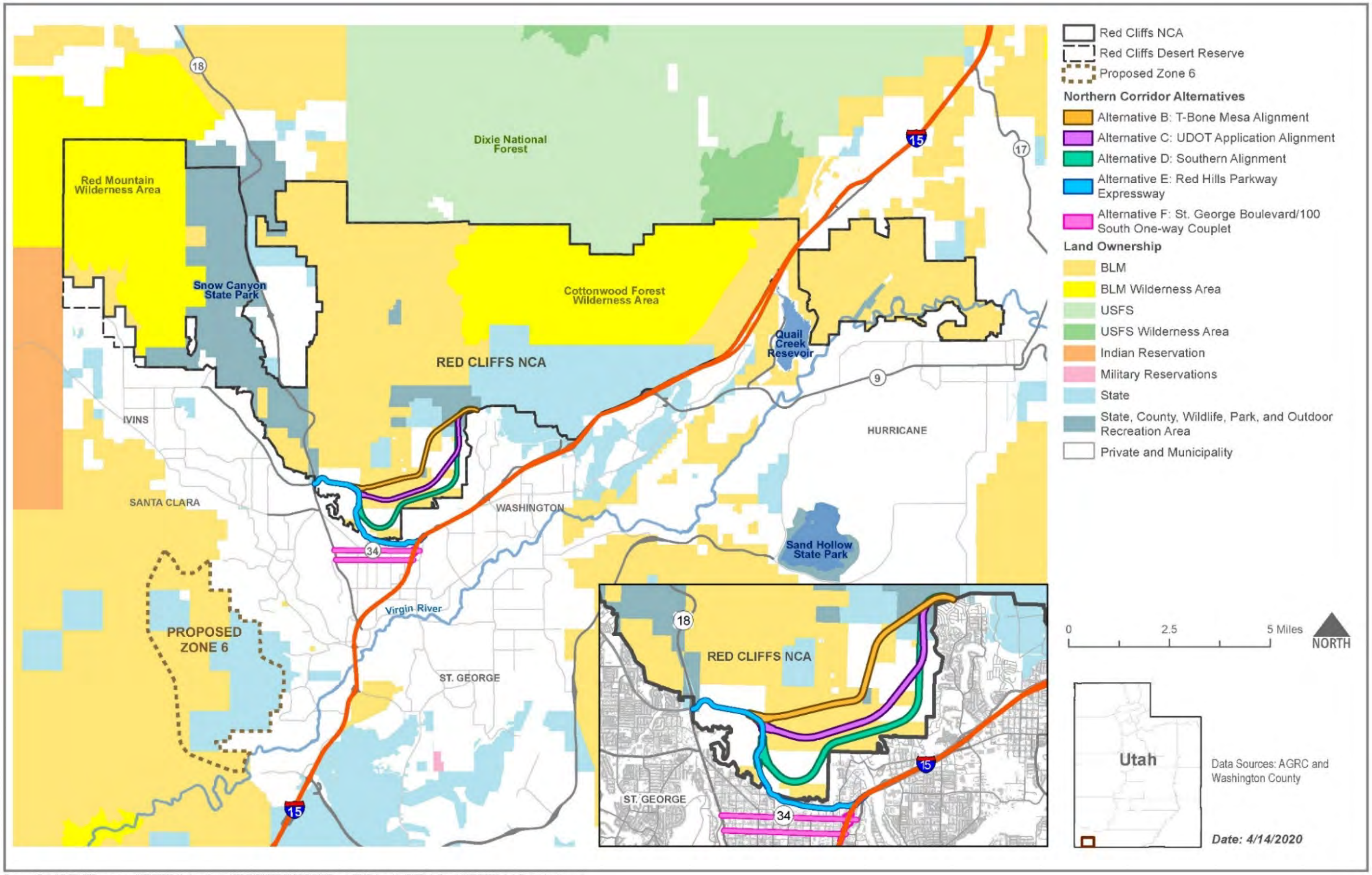
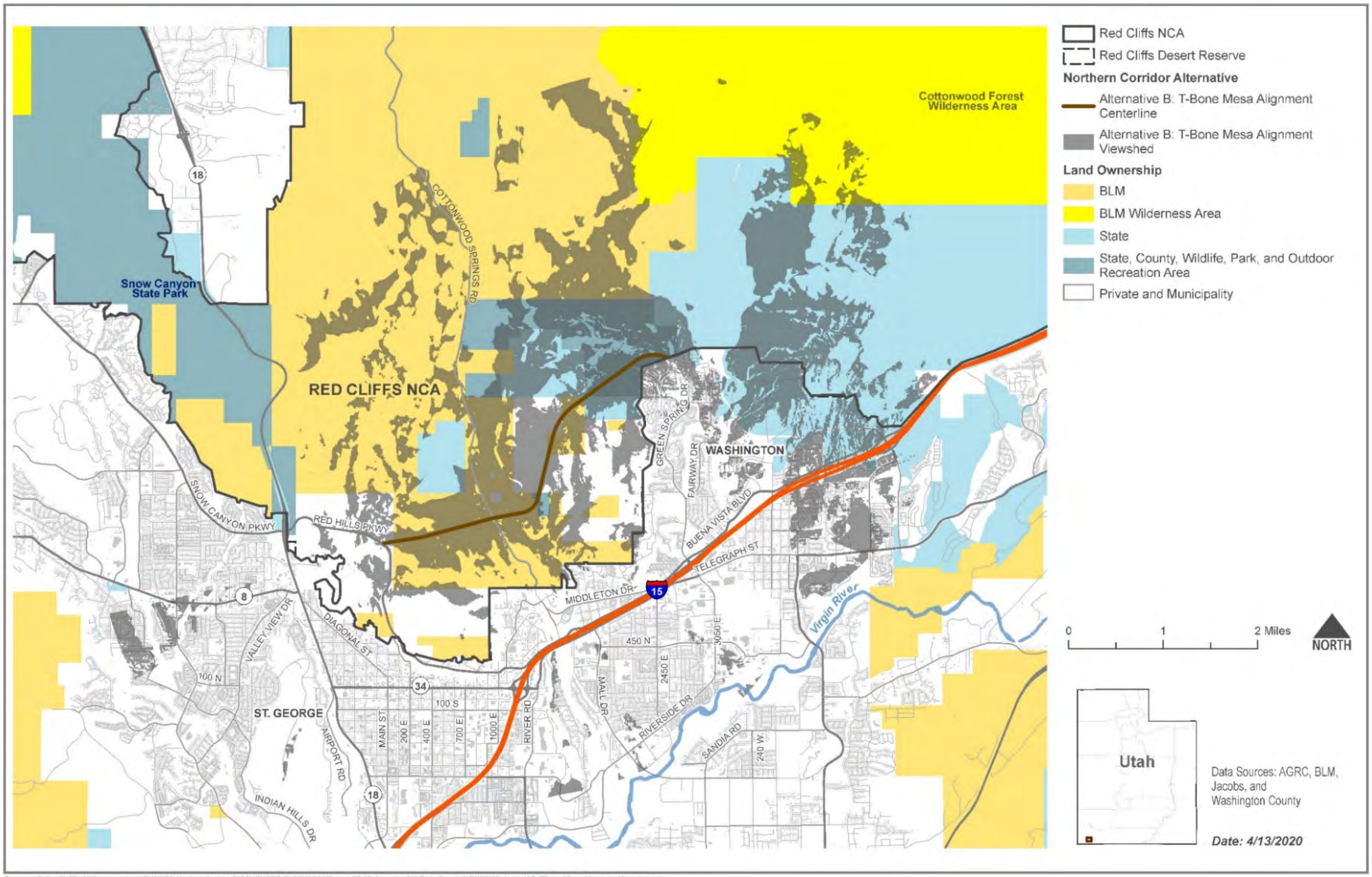
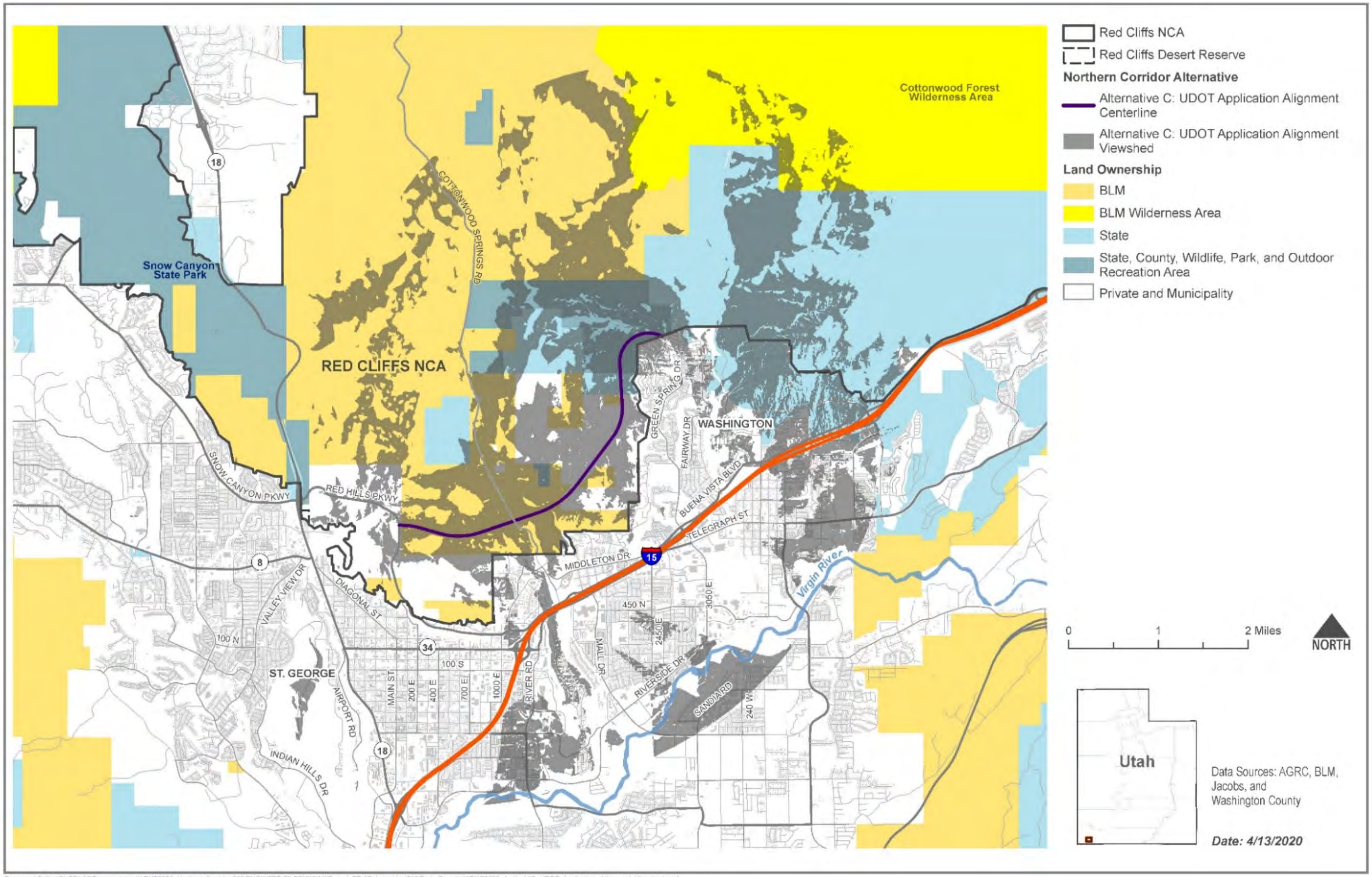
**Map 1-1. Project Location**



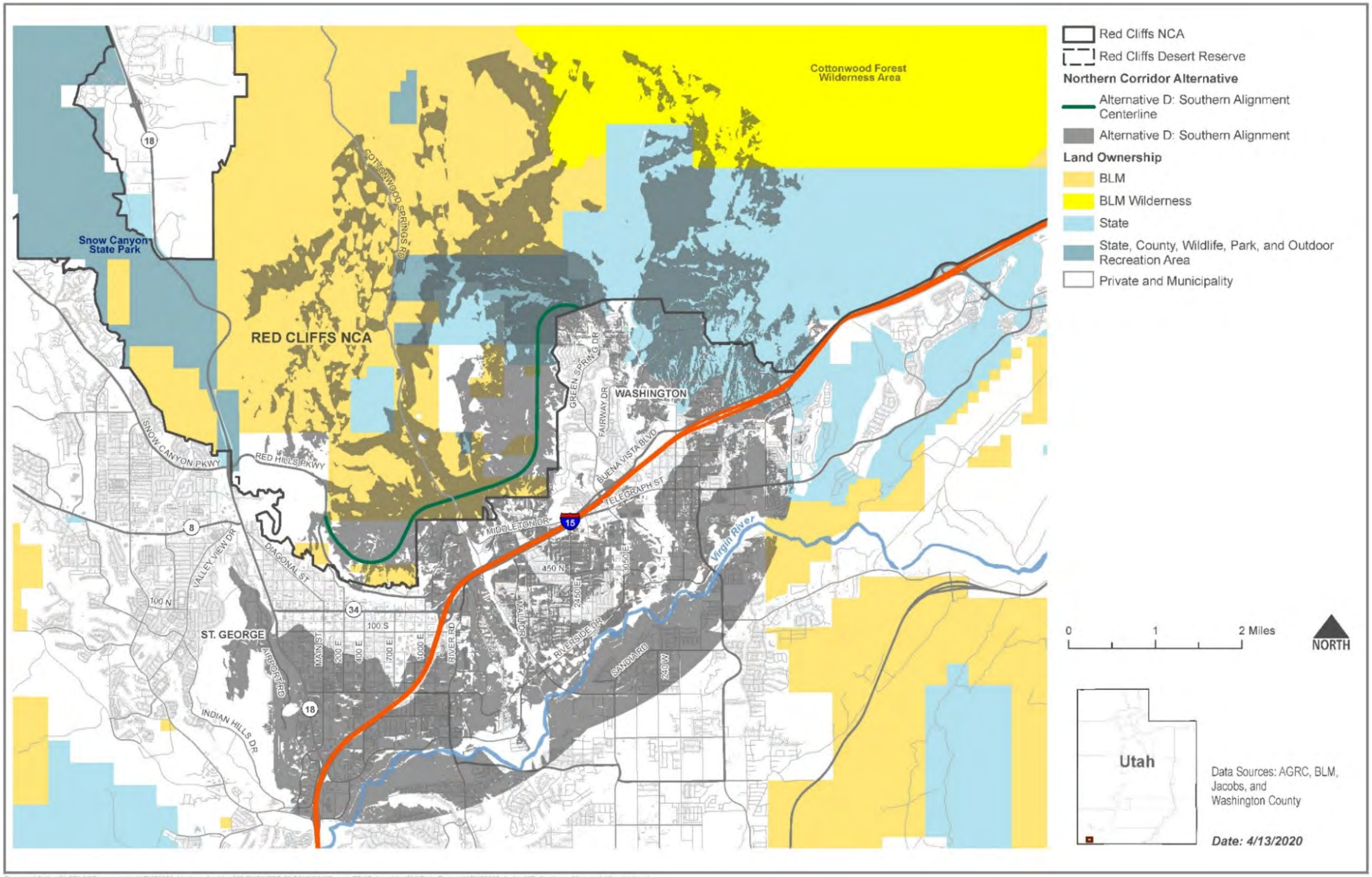
**Map 1-2a. Visibility Map, T-Bone Mesa Alignment**



**Map 1-2b. Visibility Map, UDOT Application Alignment**



**Map 1-2c. Visibility Map, Southern Alignment**

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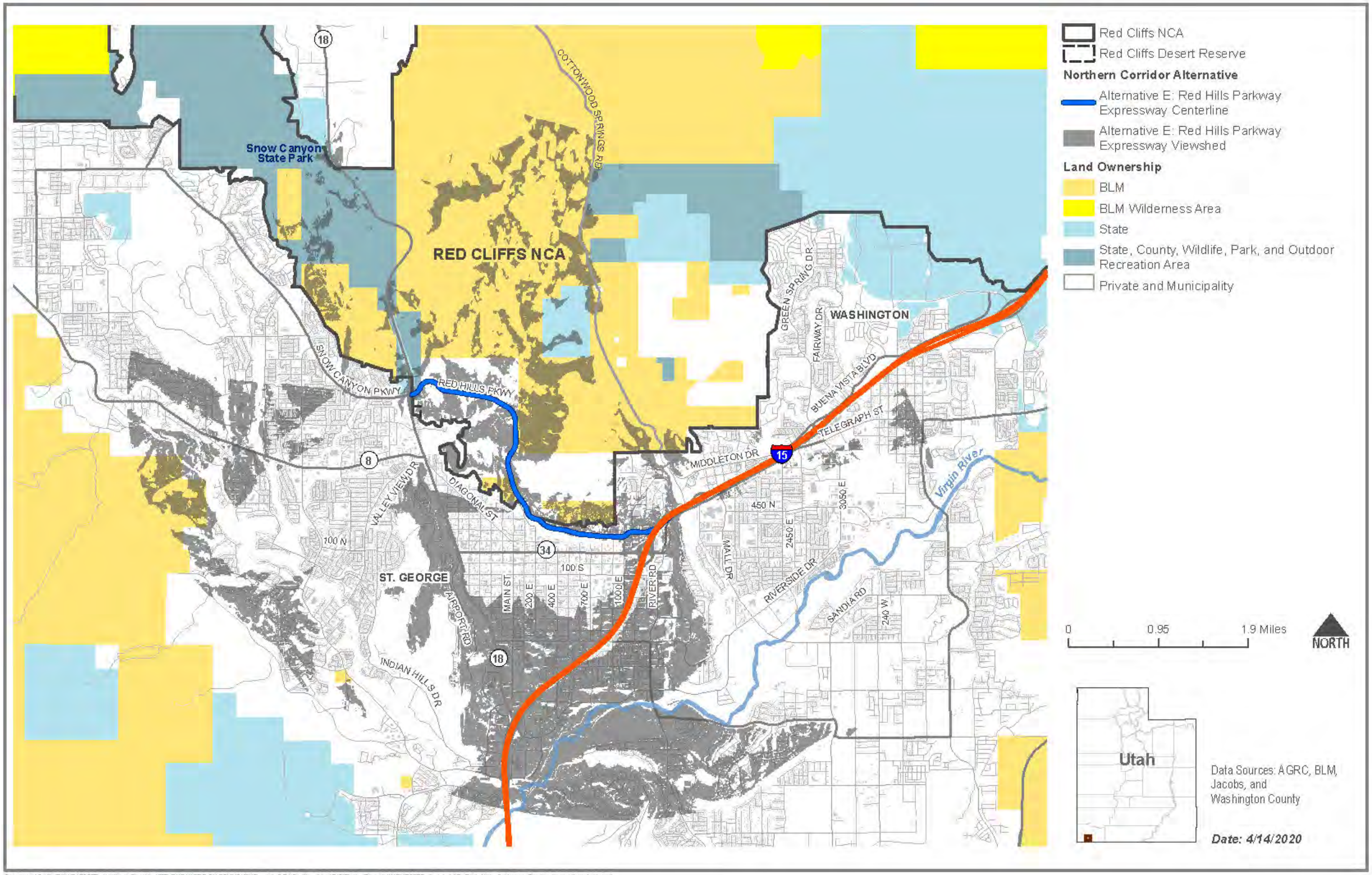
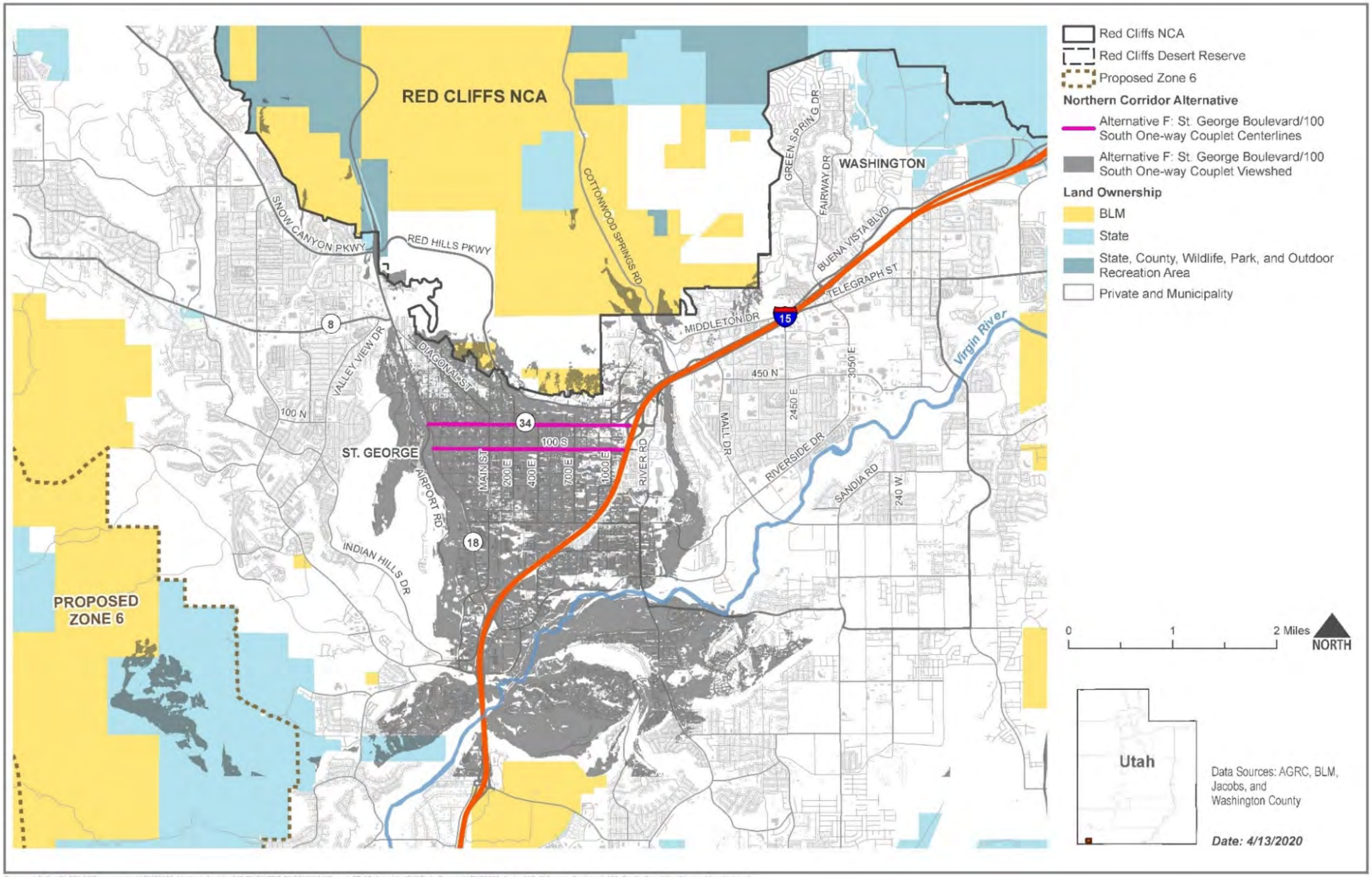
Jacobs

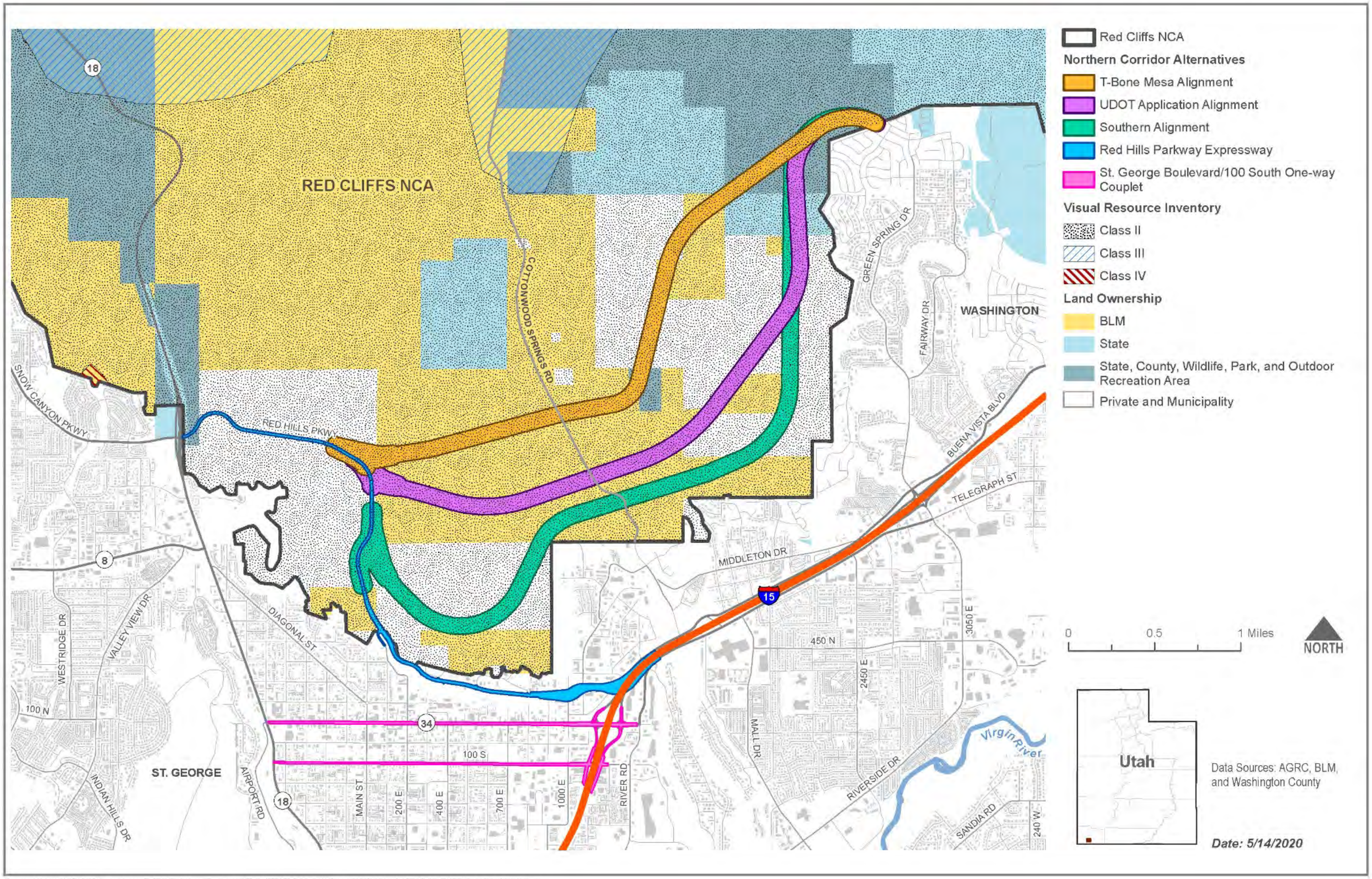
## Map 1-2d. Visibility Map, Red Hills Expressway Alignment



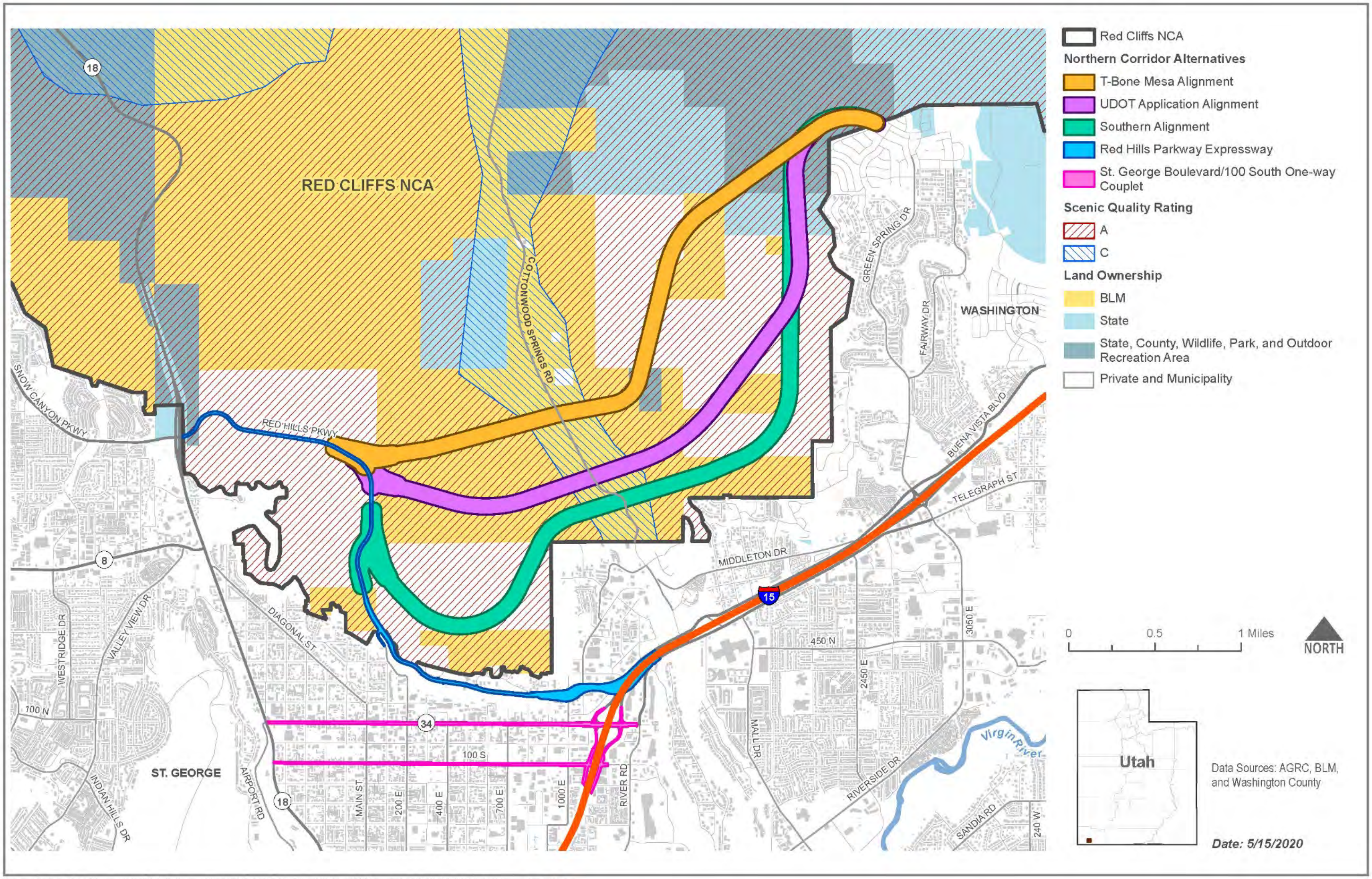
**Map 1-2e. Visibility Map, St. George Boulevard/100 South One-way Couplet**



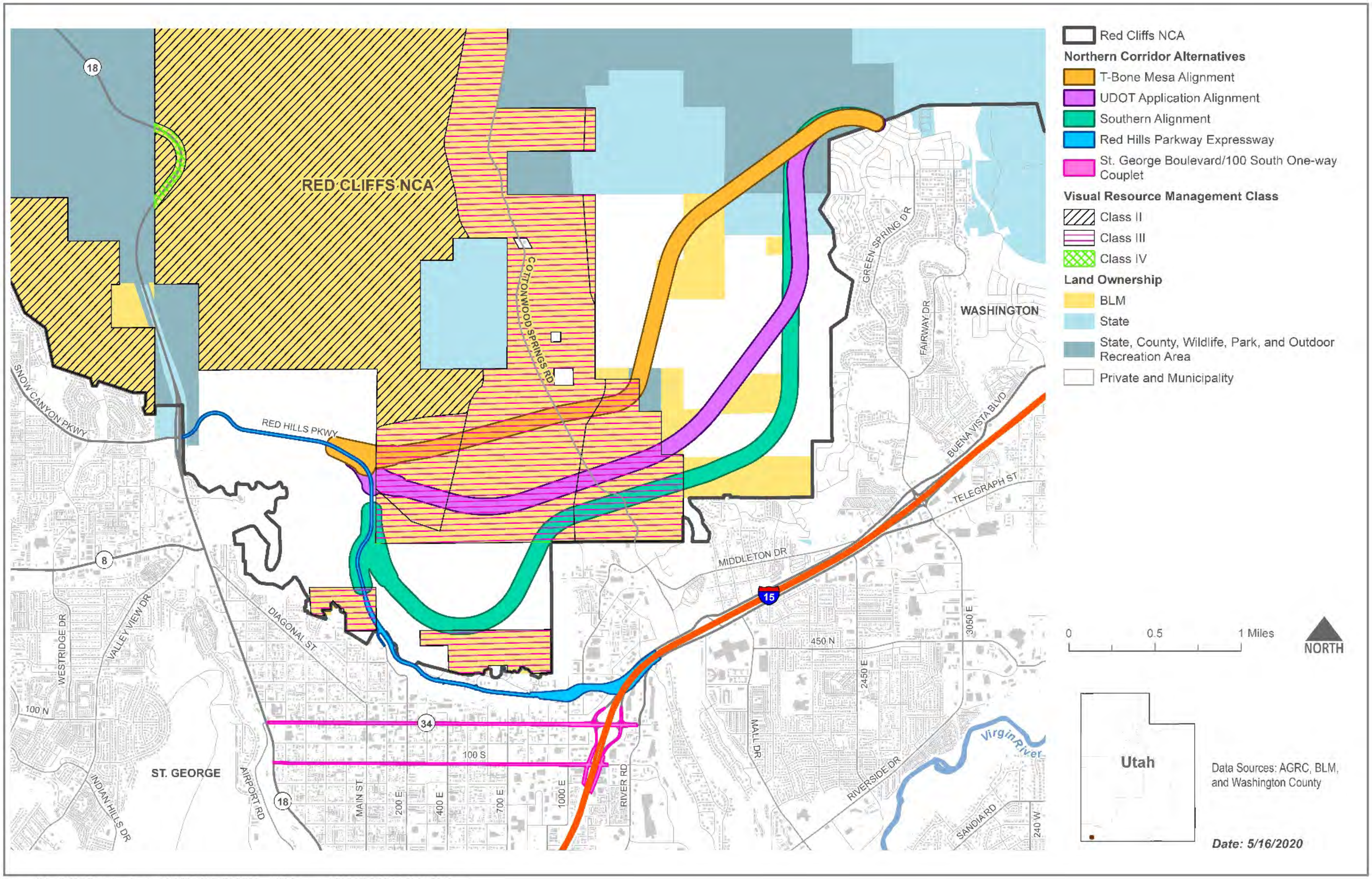
**Map 1-3. Red Cliffs National Conservation Area VRI Classes**



**Map 1-4. VRI Scenic Quality Rating Red Cliffs NCA**



**Map 1-5. Red Cliffs National Conservation Area VRM Classes**

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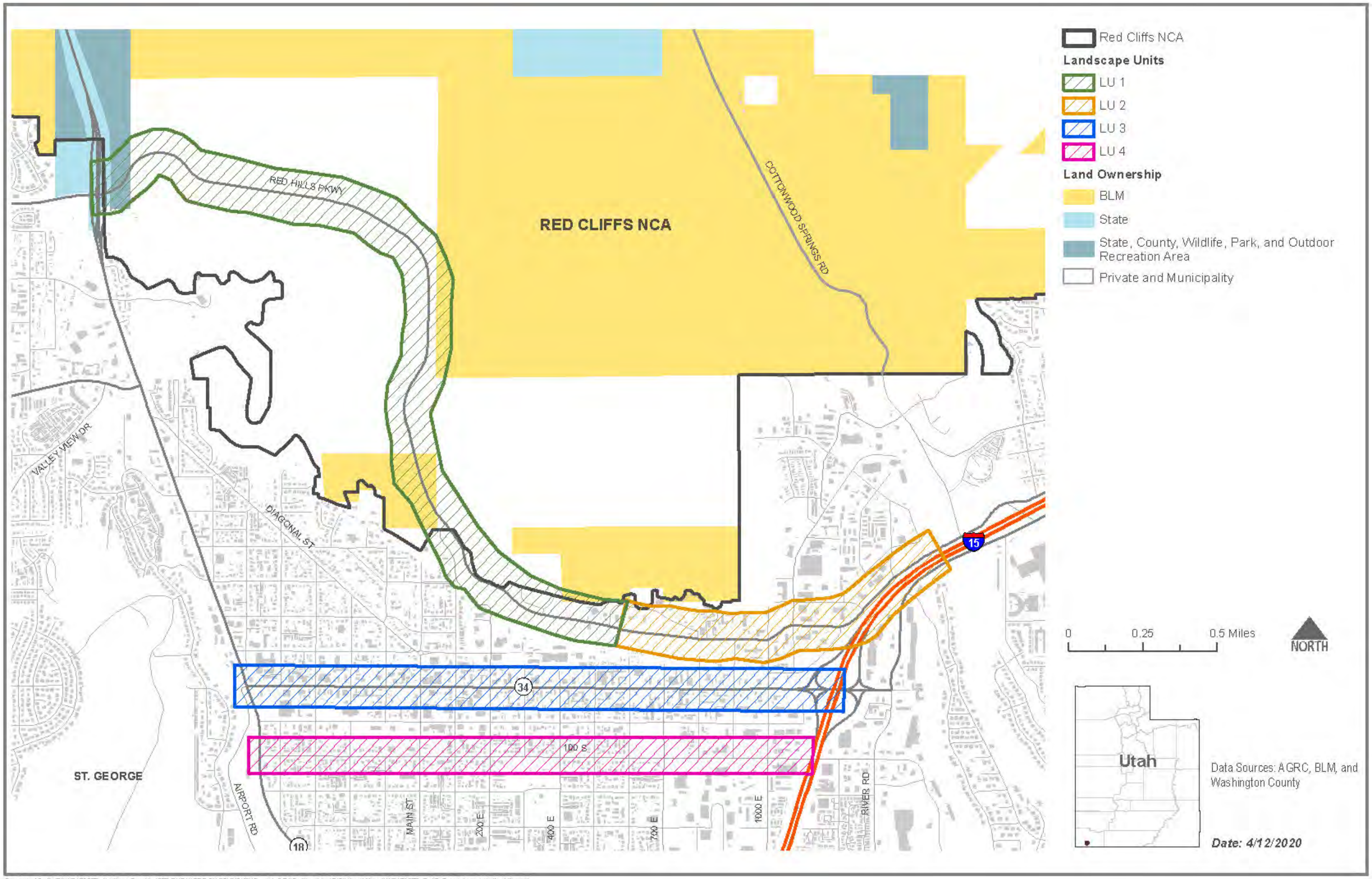
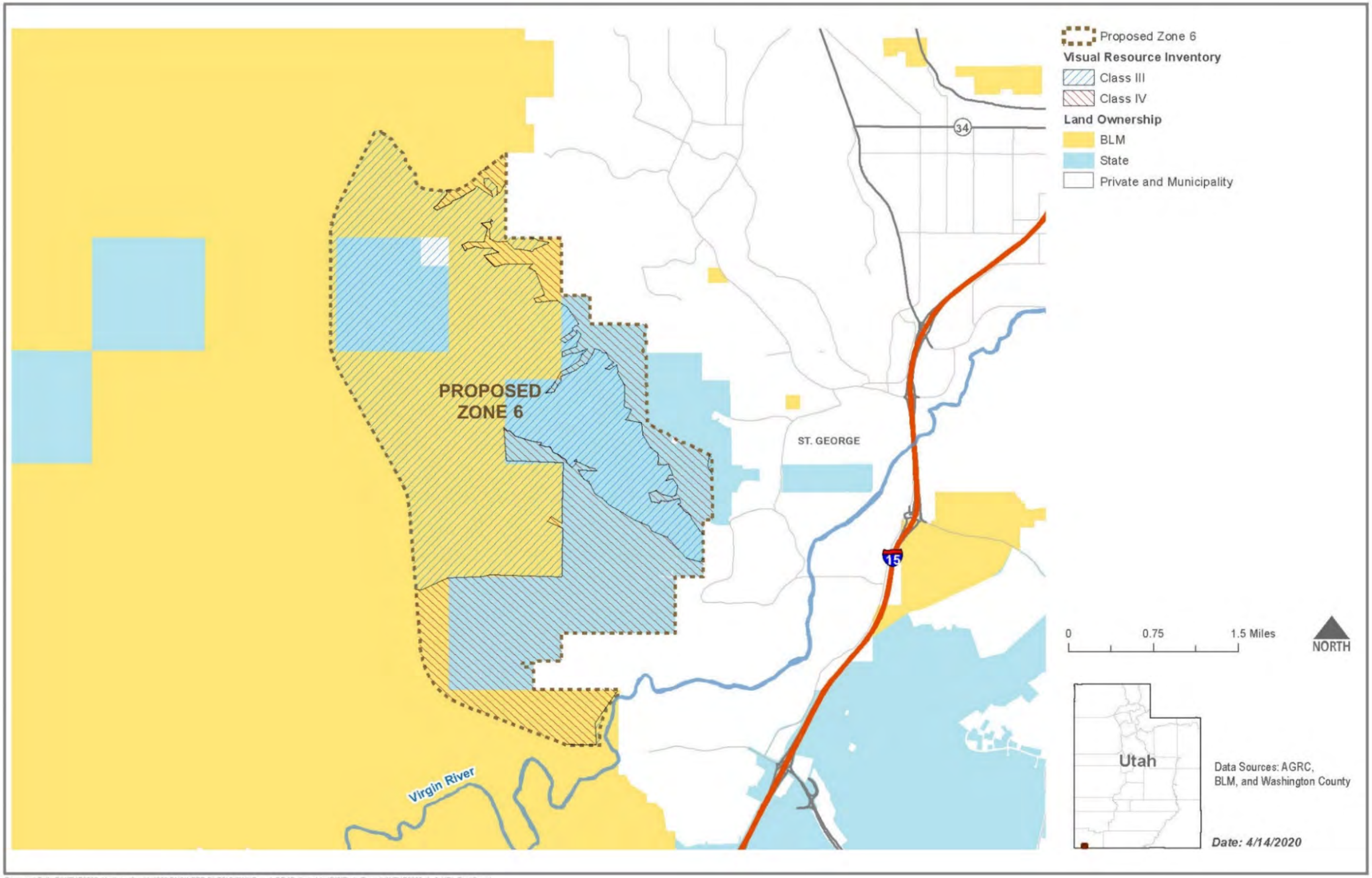
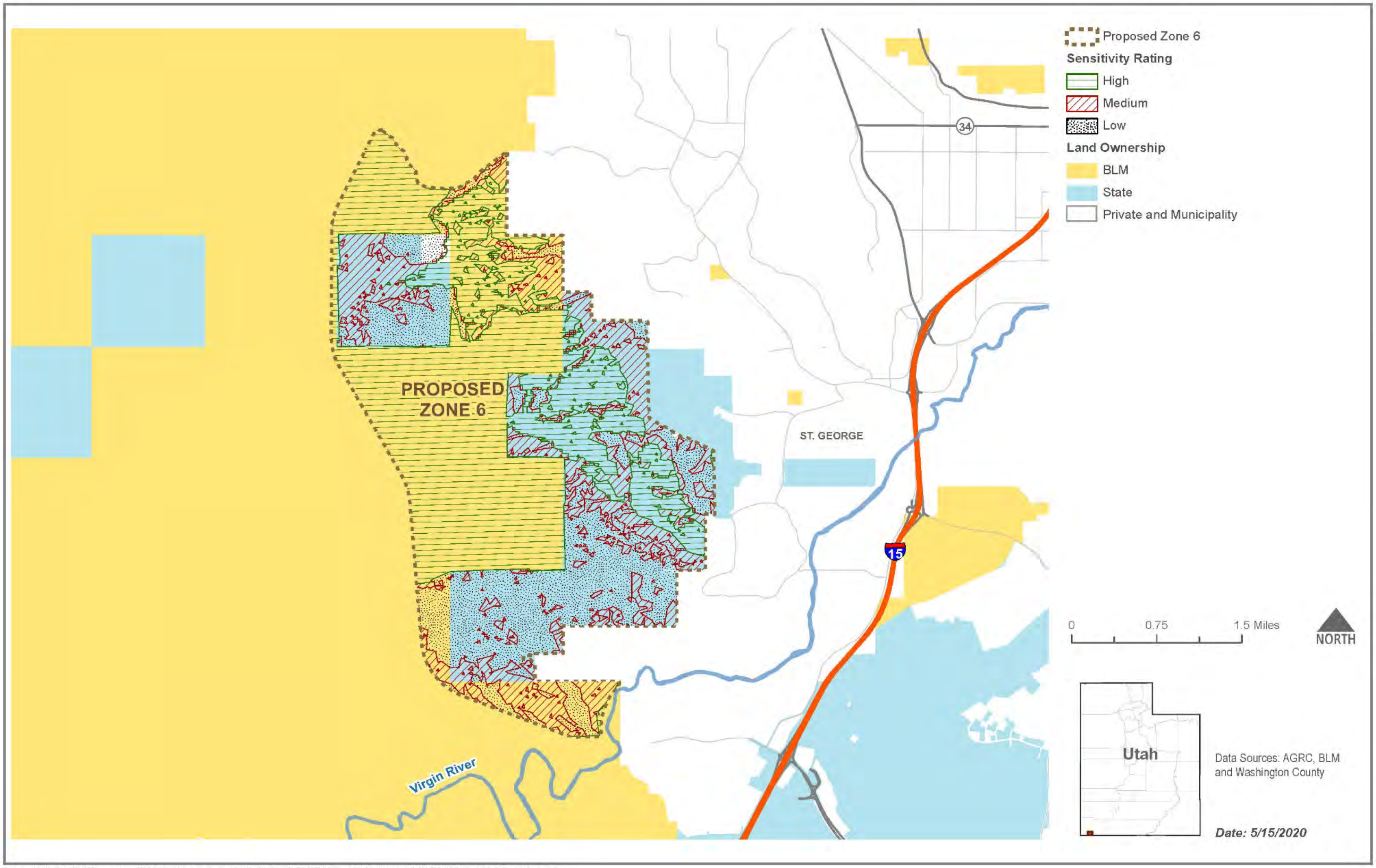
**Map 1-6. Landscape Units**



**Map 1-7. Proposed Reserve Zone 6 VRI Classes**



**Map 1-8. Proposed Reserve Zone 6 VRI Sensitivity Ratings**



**Map 1-9. Proposed Reserve Zone 6 VRM Classes**

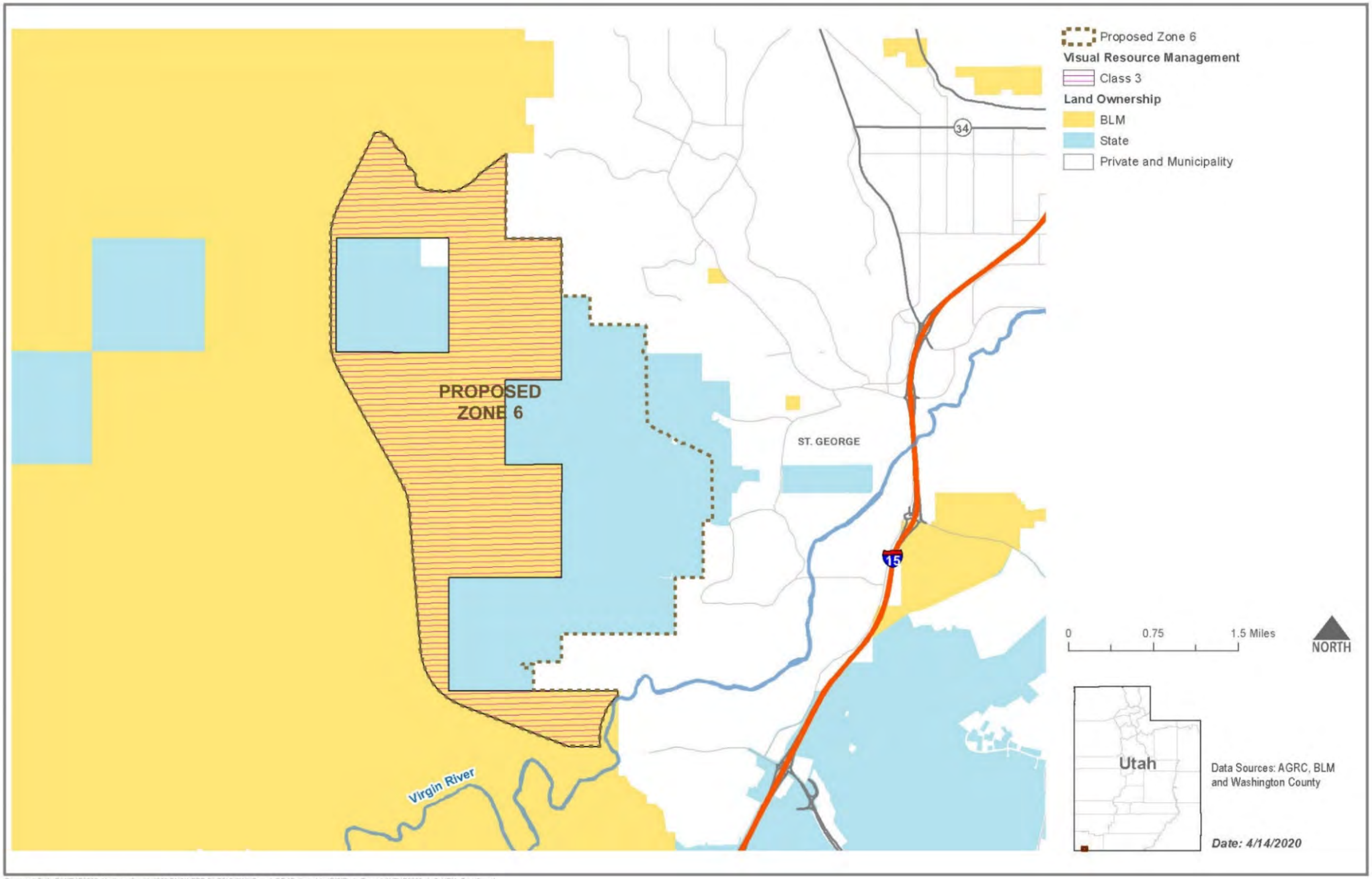


**Photo 1-1. Pioneer Park**

**Photo 1-2. Pioneer Park**

**Photo 1-3. Pine Valley Mountains from Pioneer Park**

**Photo 1-4. City of St. George from Pioneer Park**

**Photo 1-5. Red Hills Desert Garden**

**Photo 1-6. Pine Valley Mountains from Cottonwood Springs Road**

**Photo 1-7. Pine Valley Mountains from Pioneer Hills Trail**

**Photo 1-8. Transmission Lines at T-Bone Trailhead**

**Photo 1-9. Transmission Lines at T-Bone Trailhead**

**Photo 1-11. Transmission Lines at Cottonwood Springs Road**

**Photo 1-10. Substation at Cottonwood Springs Road**

**Photo 1-12. Transmission Lines and Pine Valley Mountains**

**Photo 1-13. Substation and Pine Valley Mountains**

**Photo 1-14. Water Tank at Cottonwood Springs Road**

**Photo 1-15. Middleton Powerline Trail**

**Photo 1-16. Cottonwood Springs Road**

**Photo 1-17. North End of Green Springs Residential Area**

**Photo 1-19. Grapevine Trail**

**Photo 1-18. North End of Green Springs Residential Area**

**Photo 1-20. Cottontail Trail**

**Photo 1-21. Mustang Pass Trailhead**

**Photo 1-22. Green Springs Residential Area from Icehouse Trail**

**Photo 1-23. Hill on West Side of Green Springs Residential Area**

**Photo 1-24. North End of Middleton Residential Area**

Photo 1-25. LU 1 — Red Hills Parkway Rock Cut near Bluff Street

Photo 1-26. LU 1 — Pine Valley Mountains

Photo 1-27. LU 1 — Pioneer Park

Photo 1-28. LU 1 — St. George

**Photo 1-29. LU 1 — Red Hills Parkway**

**Photo 1-31. LU 2 — Commercial and Industrial Uses**

**Photo 1-30. LU 2 — St. George**

**Photo 1-32. LU 3 — St. George Boulevard Looking West**

**Photo 1-33. LU 3 — St. George Boulevard Looking East**


**Photo 1-34. LU 3 — 100 S Street Looking East**

**Photo 1-35. LU 3 — 100 S Street Looking West**

**Photo 1-36. Zone 6 Cliffs and Valley Floor**

**Photo 1-37. Zone 6 Views**

**Photo 1-38. Zine 6 Bearclaw Poppy Trail System**

**Photo 1-39. Zone 6 Mountain Biking Scars**

**Photo 1-40. Zone 6 Off-Road Vehicle Scars**

**Photo 1-41. Zone 6 Off-Road Vehicle Scars**

**Photo 1-42. Zone 6 Camp Trailers**

**Photo 1-43. Zone 6 Trash**

**Photo 1-44. Zone 6 Landscape**

**Photo 1-45. Zone 6 Moe's Valley Rock Climbing Area**

**Photo 1-46. Zone 6 Moe's Valley Rock Climbing Area**

**Photo 1-47. Zone 6 Green Valley Gap Climbing Area**

**Photo 1-48. Zone 6 Water Tank**

**Photo 1-49. Substation outside Zone 6 near Zen Trailhead**

**Photo 1-50. Transmission Lines outside Zone 6 near Zen Trailhead**

**Photo 1-51. Transmission Lines within Zone 6 near Navajo Drive**

**Photo 1-52. Example of Transmission Line Glare and Skylighting**

# Attachment 2
# Key Observation Points

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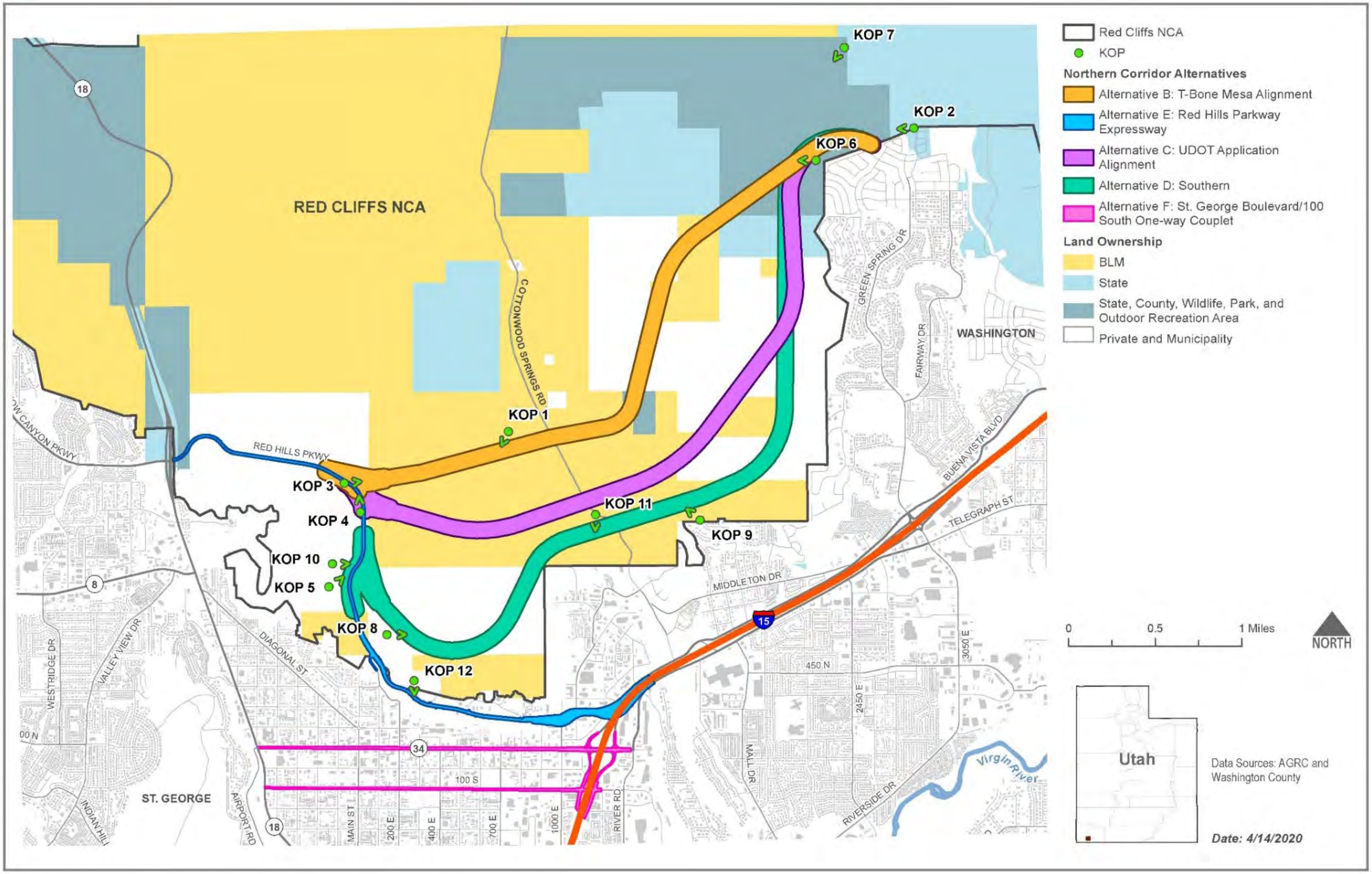
**Map 2-1. KOP Locations**



**KOP1. T-Bone Trail West of Cottonwood Springs Drive Looking West, Existing Conditions**

**KOP1. T-Bone Trail West of Cottonwood Springs Drive Looking West, T-Bone Mesa Alignment Simulation**

**KOP2. Green Springs Residential Area at Mustang Pass Trailhead Looking West, Existing Conditions [a]**

[a] simulated dusk view

**KOP2. Green Springs Residential Area at Mustang Pass Trailhead Looking West [a], T-Bone Mesa Alignment Simulation**

[a] simulated dusk view

**KOP3. Red Hills Parkway East of Bluff Street Looking Northeast, Existing Conditions**

**KOP3. Red Hills Parkway East of Bluff Street Looking Northeast, T-Bone Mesa Alignment Simulation**

**KOP4. Red Hills Parkway North of Pioneer Hills Trailhead, Existing Conditions**

**KOP4. Red Hills Parkway North of Pioneer Hills Trailhead, UDOT Application Alignment Simulation**

**KOP5. City Creek Trail Looking Northeast, Existing Conditions**

**KOP5. City Creek Trail Looking Northeast, UDOT Application Alignment Simulation**

**KOP6. Cottontail Trail Looking West, Existing Conditions**

**KOP6. Cottontail Trail Looking West, UDOT Application Alignment Simulation**

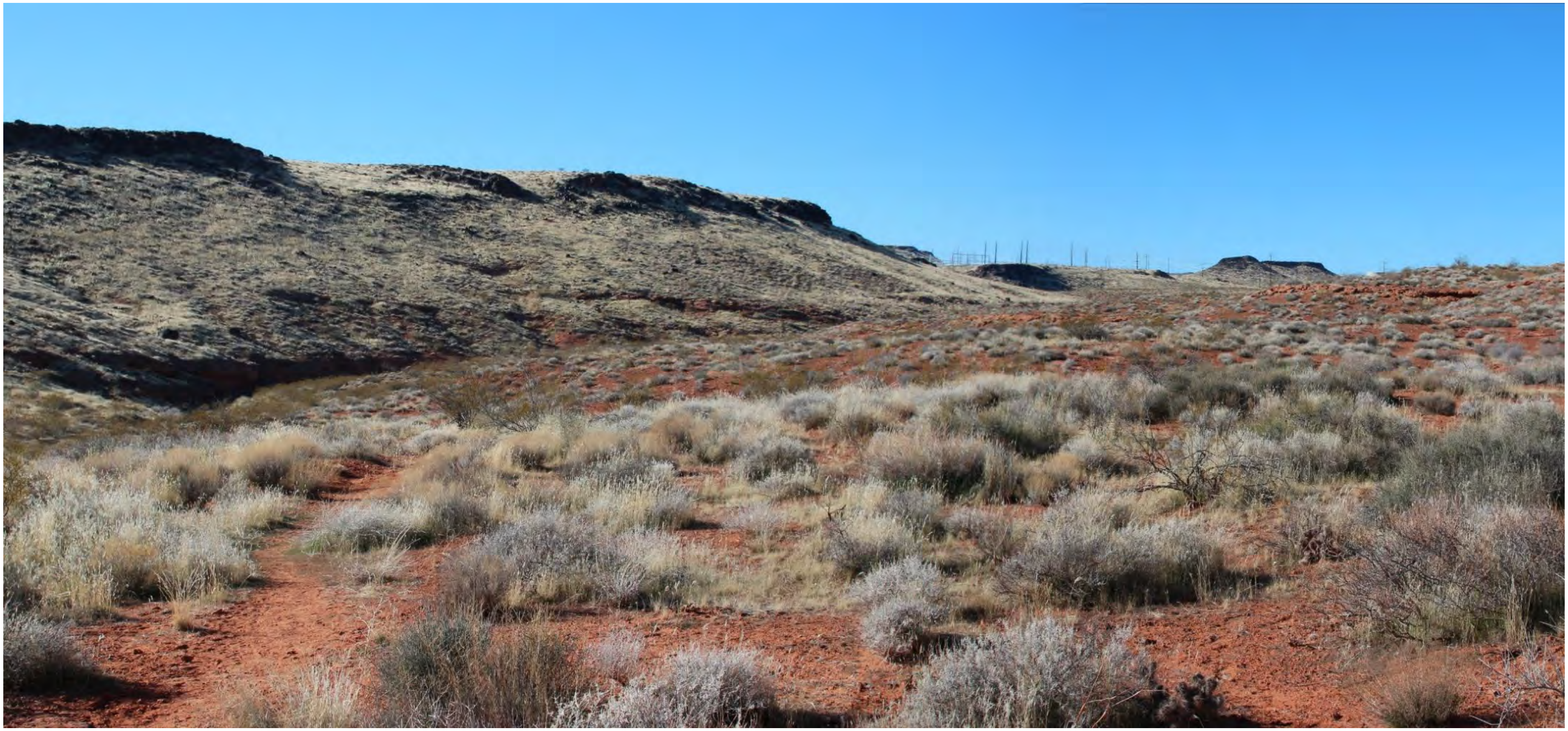
**KOP7. Icehouse Trail Looking Southwest, Existing Conditions**

**KOP7. Icehouse Trail Looking Southwest, UDOT Application Alignment Simulation**

**KOP8. Pioneer Rim Trail Looking East, Existing Conditions**

**KOP8. Pioneer Rim Trail Looking East, Southern Alignment Simulation**

**KOP9. Middleton Residential Area Looking Northwest, Existing Conditions**



**KOP9. Middleton Residential Area Looking Northwest, Southern Alignment Simulation**

**KOP10. City Creek Trail Looking East**

**KOP10. City Creek Trail Looking East, Southern Alignment Simulation**

**KOP11. Cottonwood Springs Drive Looking South, Existing Conditions**

**KOP11. Cottonwood Springs Drive Looking South, Southern Alignment Simulation**

**KOP12. Pioneer Park Looking South, Existing Conditions**

**KOP12. Pioneer Park Looking South, Red Hills Expressway Simulation**

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# Attachment 3
# Impact Evaluation Worksheets

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**Bureau of Land Management**
**Visual Contrast Rating Worksheet**

| Section A. Project Information | | | | |
|---|---|---|---|---|
| Project Name: | Northern Corridor | | | |
| Key Observation Point: | 1 | | | |
| Location: (lat/long) | 37.13637580 / -113.56768825: T-Bone Trail just west of Trailhead on Cottonwood Springs Road | | | |
| Photograph Orientation: | Southwest | | | |
| Existing VRM Class: | Partially retained (Class III) | | | |
| Date: | 2/11/20 4:49 PM | | | |
| Viewers: | Activity: | ☑ Recreational | ☐ Residential | ☐ Business/Commuter |
| | Number: | Medium (4-6) | Duration of View: | Medium-Term (10 mins-1 hr) |
| ALTERNATIVE: | T-Bone Mesa Alignment | | | |

| Component | Section B. Characteristic Landscape Description (form, line, color, and texture) | Section C. Proposed Activity Description (form, line, color, and texture) | Section D: Contrast Rating |
|---|---|---|---|
| Land/Water Body | The landscape consists of a mostly undeveloped hillside that dominates the view. The topography trends downhill in the immediate foreground; an old dirt road scar in the middleground indicates a rise to a hilltop that forms a fairly horizontal line, beyond which low, pale purple mountains are visible in the background. No waterbodies are present. | The landscape includes a new road, drainage swales, and trail, with areas of fill in the foreground (to the right of the utility pole) that raise the road above the topographic depression. The road cuts through a hill in the far middleground, which changes the contours of the landscape by flattening the slopes in this view. The landscape character is no longer mostly undeveloped. | 6.80 |
| Vegetation | Low scrub vegetation of uniform height covers the entire hillside, creating a coarse, mostly unbroken homogenous texture and pattern of dark olive greens in the late afternoon light. A short row of pale yellow grasses are visible in the immediate foreground. | A wide swath of vegetation has been removed to accommodate the new roadway, diminishing the uniform covering provided by the vegetation and intactness of the view. | 4.80 |
| Structures | A slim, brown utility pole in the foreground slightly left of center is the sole vertical element in the view. A series of horizontal utility lines reflect glare from the sun on the south (left) side of the view, heightening their visibility in the foreground. These elements are primarily absorbed by the background landscape but are partially skylined against the horizon, interjecting humanmade components into a mostly undisturbed scene. | The new road cuts an obvious swath through the landscape, creating a strong linear element that is a focal point in the view. Moving vehicles further call attention to the road. Although the road's long linear form somewhat echoes the horizon lines, leading the eye toward a vanishing point below a tall mountain in the distance, the road's smooth texture and colors contrast with the surrounding vegetation. | 6.70 |
| | | Total | 6.10 |

The VRI contrast rating is: **Strong**
The VRM change is: **Major modification (Class IV)**

| Section D. Contrast Rating Continued | |
|---|---|
| Does project design meet visual resources management objective? | **No** |
| Explain: This viewpoint is in an area designated as VRM Class III and would view the Northern Corridor from a superior viewing angle. The description of VRM Class III states that the existing character of the landscape is partially retained, which is true in this view. However, the level of change to the characteristic landscape should be moderate, which this change exceeds, as the overall change is strong. The description for VRM Class III states that changes may attract attention but should not dominate the view. For KOP1, the change dominates the view. Furthermore, changes in VRM Class III lands should repeat the basic elements of form, line, color, and texture in the landscape. While the smooth road echoes the view's linear horizon line, it contrasts with the landscape's form (filled hill) and the color and texture of the surrounding vegetation, as well as introducing motion into the landscape. For these reasons, the revised character of the landscape would not meet VRM Class III objectives. | |

| | |
|---|---|
| Additional mitigation measures recommended? | **No** |
| Explain: The design elements identified for this project have been considered in this KOP, specifically: use irregular clearing shapes, feather/thin edges, minimize clearing size, utilize the edge effect for structure placement along natural vegetative breaks, round and/or warp slopes, tone down freshly broken rock faces, shape cuts and fills to appear as natural forms, and use earth-tone paints and stains. No further mitigation measures have been identified that could reduce impacts. | |

Scores/Rating is based on the following scale:
7 = Very Strong, 6 = Strong, 5 = Moderately Strong, 4 = Moderate, 3 = Moderately Weak, 2 = Weak, 1 = Very Weak, 0 = None

Foreground-middleground: less than 5 miles away. Background: between beyond foreground-middleground and 15 miles away.

**Bureau of Land Management**
**Visual Contrast Rating Worksheet**

| Section A. Project Information | | | | |
|---|---|---|---|---|
| Project Name: | Northern Corridor | | | |
| Key Observation Point: | 2 | | | |
| Location: (lat/long) | 37.16176128 / -113.52537774: North end of Green Springs residential area at Mustang Pass Trailhead | | | |
| Photograph Orientation: | West | | | |
| Existing VRM Class: | N/A | | | |
| Date: | 2/12/2020 11:39:00 AM (lighting conditions modified to depict dusk) | | | |
| Viewers: | Activity: | ☑ Recreational | ☑ Residential | ☐ Business/Commuter |
| | Number: | Several (>6) | Duration of View: | Long-Term (>1 hr) |
| ALTERNATIVE: | T-Bone Mesa Alignment | | | |

| Component | Section B. Characteristic Landscape Description (form, line, color, and texture) | Section C. Proposed Activity Description (form, line, color, and texture) | Section D: Contrast Rating |
|---|---|---|---|
| Land/Water Body | The north (right) side of the view is an expansive undeveloped desert landscape that slopes downhill in the immediate foreground and then gradually uphill to a primarily horizontal horizon line in the middleground capped with dark volcanic rocks that are slightly visible. Pale purple mountains rise slightly in the background in the center of the view; darker shadows indicate steep gullies. No waterbodies are present. | The expansive north (right) side of the view is occupied by a large, curving roadway that rises with the distant hill and generally follows the existing landforms, with the exception of filled areas at the curve. Given the horizontal nature of the roadway, these landform changes are indistinct in this dusk setting. However, they would be a prominent feature during daylight hours. | 5.00 |
| Vegetation | Low scrub vegetation of uniform height covers most of the landscape, creating a coarse, homogenous texture and pattern of dark olive greens against pale colored grasses. Tumbleweeds are caught in a fence in the immediate foreground. | A swath of vegetation has been removed, which is most obvious where the road curves. This change is indistinct in this dusk setting, but would be more prominent during daytime. | 3.90 |
| Structures | The Green Springs residential area butts directly against the RCNCA boundary, forming a straight dividing line and obvious edge in the center of the view traveling west that acts as a focal point. Houses are in various stages of development. Graded red dirt is visible between the buildings, which are distinguished primarily by their gray roofs. The immediate foreground includes a paved path, wire fence, and filled area enclosed by a stone wall. The developed area is a stark contrast against the expansive undisturbed landscape. | The roadway interjects a new transportation element that curves into the north (right) side of this elevated view. Although the road contrasts with the landscape to the north, it is somewhat absorbed by the developed, residential setting to the south (left). Lights on vehicles are mostly imperceptible from this location, but would be more prominent at a lower, closer viewpoint. During the daytime, the roadway would be more visually prominent. | 5.40 |
| | | Total | 4.77 |

The VRI contrast rating is: **Moderately Strong**
The VRM change is: **N/A**

| Section D. Contrast Rating Continued | |
|---|---|
| Does project design meet visual resources management objective? | |
| Explain: Views of the Northern Corridor would occur from a superior viewing angle and introduce motion into the landscape.This viewpoint is in an area that is not within BLM-managed lands; therefore, VRM does not apply. | |

| Additional mitigation measures recommended? | **No** |
|---|---|
| Explain: The design elements identified for this project have been considered in this KOP, specifically: use irregular clearing shapes, feather/thin edges, minimize clearing size, utilize the edge effect for structure placement along natural vegetative breaks, and use earth-tone paints and stains. No further mitigation measures have been identified that could reduce impacts. | |

Scores/Rating is based on the following scale:
7 = Very Strong, 6 = Strong, 5 = Moderately Strong, 4 = Moderate, 3 = Moderately Weak, 2 = Weak, 1 = Very Weak, 0 = None

Foreground-middleground: less than 5 miles away. Background: between beyond foreground-middleground and 15 miles away.

# Bureau of Land Management
# Visual Contrast Rating Worksheet

| Section A. Project Information | | | | |
|---|---|---|---|---|
| Project Name: | Northern Corridor | | | |
| Key Observation Point: | 3 | | | |
| Location: (lat/long) | 37.13205208 / -113.58482027: Red Hills Parkway approximately 1.13 miles east of Bluff Street | | | |
| Photograph Orientation: | East | | | |
| Existing VRM Class: | Partially retained (Class III) | | | |
| Date: | 2/10/20 1:56 PM | | | |
| Viewers: | Activity: | ☑ Recreational | ☑ Residential | ☑ Business/Commuter |
| | Number: | Several (>6) | Duration of View: | Short-term (<10 mins) |
| ALTERNATIVE: | T-Bone Mesa | | | |

| Component | Section B. Characteristic Landscape Description (form, line, color, and texture) | Section C. Proposed Activity Description (form, line, color, and texture) | Section D: Contrast Rating |
|---|---|---|---|
| Land/Water Body | This scene approximates views from Red Hills Parkway for eastbound drivers and users on the adjacent multi-use path. A large red rock cut created for the road is an imposing mass that dominates this view, disrupting the landform continuity. The rock cut displays a coarse, broken texture of varying shades of red, interjected with occasional white minerals. Middleground and background views are hidden by the cut. No waterbodies are present. The dramatic cut lends a slight degree of vividness by mimicking a natural red cliff. | The landform is completely modified, as the existing road cut has been removed and fill has been added to raise the elevated interchange. The new fill approximates the mass and height of the existing road cut, but is slightly farther away and the steep, angular face of the existing cut has been replaced with more sloping, vegetated hills. The realignment also opens the view, making it more expansive but still obscuring any background views. The color remains the same, but the texture has changed from that of broken cut rocks to vegetated soil. | 6.70 |
| Vegetation | Vegetation is sparse and consists of low spiky scrubs of uniform height and dark olive color is sporadically visible along the top of the cut, as well as within the road median and shoulders. | Substantially more vegetation is visible due to the revegetation on the filled slopes. Realigning Red Hills Parkway also adds more vegetation to the immediate foreground. The rounded clumps of vegetation create a repeating nubby texture that becomes more fine-grained in the distance. | 5.20 |
| Structures | Red Hills Parkway forms a gray plane of asphalt that forms a straight, slightly diagonal line in the immediate foreground within a prominent rock cut. Two cars are visible. This view is predominantly a transportation scene. | The elevated interchange introduces a new transportation element, which dominates the view. However, the view remains that of a transportation scene. The curved line of the overpass echoes the curved line of the realigned road and ramp below, which it mostly parallels. The overpass color is compatible with the setting. | 6.20 |
| | | Total | 6.03 |

The VRI contrast rating is: **Strong**
The VRM change is: **Major Modification (Class IV)**

| Section D. Contrast Rating Continued | |
|---|---|
| Does project design meet visual resources management objective? | **No** |
| Explain: This viewpoint includes views of VRM Class III. Views of the Northern Corridor from this location would be level. The description of VRM Class III states that the existing character of the landscape is partially retained, which is true in this view in that the character remains a transportation setting. However, the level of change to the characteristic landscape should be moderate, which this change exceeds, as the overall contrast is strong primarily due to the new overpass structure. In addition, the view is broader. The description for VRM Class III states that changes may attract attention but should not dominate the view. For KOP3, the overpass dominates the view. Furthermore, changes in VRM Class III lands should repeat the basic elements of form, line, color, and texture in the landscape. While the new structures share similar lines, the form (overpass) is different and the texture has changed from a cut rock surface to a vegetated expanse. For these reasons, the revised character of the landscape would not meet VRM Class III objectives. | |

| Additional mitigation measures recommended? | **No** |
|---|---|
| Explain: The design elements identified for this project have been considered in this KOP, specifically: use irregular clearing shapes, feather/thin edges, minimize clearing size, utilize the edge effect for structure placement along natural vegetative breaks, round and/or warp slopes, shape fills to appear as natural forms, blend with topographic forms in shape and placement, choose native plant species, use natural appearing forms to complement landscape character, and use earth-tone paints and stains. No further mitigation measures have been identified that could reduce impacts. | |

Scores/Rating is based on the following scale:
7 = Very Strong, 6 = Strong, 5 = Moderately Strong, 4 = Moderate, 3 = Moderately Weak, 2 = Weak, 1 = Very Weak, 0 = None

Foreground-middleground: less than 5 miles away. Background: between beyond foreground-middleground and 15 miles away.

## Bureau of Land Management
## Visual Contrast Rating Worksheet

| Section A. Project Information | | | | |
|---|---|---|---|---|
| Project Name: | Northern Corridor | | | |
| Key Observation Point: | 4 | | | |
| Location: (lat/long) | 37.12963663 / -113.58313794: Red Hills Parkway approximately 0.2 mile north of Pioneer Hills Trailhead | | | |
| Photograph Orientation: | Northeast | | | |
| Existing VRM Class: | Partially retained (Class III) | | | |
| Date: | 2/10/20 1:32 PM | | | |
| Viewers: | Activity: | ☑ Recreational | ☑ Residential | ☑ Business/Commuter |
| | Number: | Several (>6) | Duration of View: | Short-term (<10 mins) |
| ALTERNATIVE: | UDOT Application Alignment | | | |

| Component | Section B. Characteristic Landscape Description (form, line, color, and texture) | Section C. Proposed Activity Description (form, line, color, and texture) | Section D: Contrast Rating |
|---|---|---|---|
| Land/Water Body | Similar to KOP5, this view encompasses a low, flat-topped hill, beyond which is a black lava-capped mesa in the center middleground. Distant purple-hued Pine Valley mountains can be seen to the west (left). The buttes and mountains create an undulating horizon line of various hues and color intensity depending on distance. Black and red soil is intermittently visible among the vegetation, and a red road cut is visible to the west. | A large, imposing red-dirt fill occupies the foreground to the east (right), and a slightly lower fill is visible to the west (left), blocking the existing rock cut. The eastern fill dominates the scene and blocks farther views, particularly of the black buttes in the middleground. | 6.90 |
| Vegetation | Low scrub vegetation covers the hill in the foreground, creating an olive green dot pattern that becomes a more fine-grained texture on the black buttes. Similar types of plants sporadically occupy the roadway median, creating rounded, spiky shapes. | Vegetation is sporadically visible on the fill slope, its dark olive color creating a contrast against the red soil. This vegetative coverage is somewhat thinner than the hill beyond the fill, which is mostly obscured. | 4.30 |
| Structures | Red Hills Parkway and part of the adjacent multi-use path are visible in the immediate foreground. The road creates a straight, slightly diagonal line that somewhat parallels the hillside between the road and the buttes. Two motor vehicles are visible. | An elevated overpass creates a strong visual line that cuts diagonally across the view from east to west. This straight line is in contrast to the undulating shapes of the horizon line, and the movement of tall vehicles calls attention to it. The overpass support structures add hefty vertical elements to a scene that has none. Red Hills Parkway has been realigned, creating a curving line that echoes that of the new ramp to the east (right). The overpass casts strong shadows on the road, fill, and support structures. | 6.90 |
| | | Total | 6.03 |

The VRI contrast rating is: **Strong**
The VRM change is: **Major Modification (Class IV)**

| Section D. Contrast Rating Continued | |
|---|---|
| Does project design meet visual resources management objective? | **No** |
| Explain: This viewpoint includes views of VRM Class III. Views of the Northern Corridor would be inferior as the proposed bridge is constructed across an existing road. The description of VRM Class III states that the existing character of the landscape is partially retained, which is true in this view in that the character remains a transportation setting. However, the level of change to the characteristic landscape should be moderate, which this change exceeds, as the overall contrast is strong primarily due to the new overpass structure, which also blocks farther views. The description for VRM Class III states that changes may attract attention but should not dominate the view. For KOP4, the overpass dominates the view. Furthermore, changes in VRM Class III lands should repeat the basic elements of form, line, color, and texture in the landscape. The new overpass interjects a new form that creates a hard, linear line, as well as vertical support structures, that are not in the original setting. For these reasons, the revised character of the landscape would not meet VRM Class III objectives. | |

| Additional mitigation measures recommended? | **No** |
|---|---|
| Explain: The design elements identified for this project have been considered in this KOP, specifically: use irregular clearing shapes, feather/thin edges, minimize clearing size, utilize the edge effect for structure placement along natural vegetative breaks, round and/or warp slopes, shape fills to appear as natural forms, blend with topographic forms in shape and placement, choose native plant species, use natural appearing forms to complement landscape character, and use earth-tone paints and stains. No further mitigation measures have been identified that could reduce impacts. | |

Scores/Rating is based on the following scale:
7 = Very Strong, 6 = Strong, 5 = Moderately Strong, 4 = Moderate, 3 = Moderately Weak, 2 = Weak, 1 = Very Weak, 0 = None

Foreground-middleground: less than 5 miles away. Background: between beyond foreground-middleground and 15 miles away.

# Bureau of Land Management
## Visual Contrast Rating Worksheet

| Section A. Project Information | | | | |
|---|---|---|---|---|
| Project Name: | Northern Corridor | | | |
| Key Observation Point: | 5 | | | |
| Location: (lat/long) | 37.12343818 / -113.58644197: City Creek Trail | | | |
| Photograph Orientation: | Northeast | | | |
| Existing VRM Class: | Partially retained (Class III) | | | |
| Date: | 2/11/20 3:04 PM | | | |
| Viewers: | Activity: | ☑ Recreational | ☐ Residential | ☐ Business/Commuter |
| | Number: | Several (>6) | Duration of View: | Medium-Term (10 mins-1 hr) |
| ALTERNATIVE: | UDOT Application Alignment | | | |

| Component | Section B. Characteristic Landscape Description (form, line, color, and texture) | Section C. Proposed Activity Description (form, line, color, and texture) | Section D: Contrast Rating |
|---|---|---|---|
| Land/Water Body | This expansive panorama encompasses a variety of landforms due to its elevation, and is particularly vivid due to the black lava-capped mesa in the middleground, beyond which the Red Cliff NCA's namesake red cliffs and distant purple-hued Pine Valley mountains can be seen. Red soil is visible among the vegetation, particularly in the immediate foreground, adding to the scene's colorful palette. The mass of the various landforms and their contrasting colors, textures, and shapes create diversity and visual interest. Few humanmade intrusions are visible, and the view is mostly intact and undisturbed. | An extensive amount of fill elevating the roadway cuts diagonally across the middleground and background. The straight line created by the fill is mostly consistent with the horizontal line indicating the top of the black buttes, but inconsistent with the irregular horizon line and curve of the existing road. However, the fill blends into the existing landscape and the new landform is barely detectable. | 2.40 |
| Vegetation | Low scrub vegetation forms small clumps in the immediate foreground of medium grain and density. Colors vary in value from pale sage to dark olive and are fairly regularly spaced; the density distribution becomes more gradated with distance and becomes indistinct. The varying color and texture of the foreground vegetation adds diversity and visual interest. | The fill has been revegetated with the same plant species in the existing landscape, helping the new roadway fit into the landscape. | 1.20 |
| Structures | A utility line traverses the center of the view traveling east to west (right to left) in the middleground. Three slim brown poles are obvious vertical elements but are partially absorbed by the landscape as they not skylined above the horizon line. Several transmission lines are visible in the glare of the sun, but are also subordinate. The horizontal lines generally parallel the more distant horizon line, minimizing the intrusion. Red Hills Parkway is partially visible to the east (right) as a partially hidden dark gray curve that follows the landscape contours. | The new road surface is barely detectable due to the view angle and distance. However, the movement of vehicles would draw attention to the road, but to a slight degree given the distance. The interchange with Red Hills Parkway is somewhat visible to the west (left) side of the view. However, this overpass structure is also inconspicuous. | 3.00 |
| | | Total | 2.20 |

The VRI contrast rating is: **Weak**

The VRM change is: **Partially retained (Class III)**

| Section D. Contrast Rating Continued | |
|---|---|
| Does project design meet visual resources management objective? | **Yes** |
| Explain: This viewpoint is in an area designated as VRM Class III with superior views of the Northern Corridor beyond an existing roadway. The description of VRM Class III states that the existing character of the landscape is partially retained, which is true in this view because the raised roadway is mostly undetectable, resulting in a weak overall contrast compared to existing conditions. The description for VRM Class III states that changes may attract attention but should not dominate the view, which this simulation demonstrates, as the distant landforms (the black mesa and distant cliffs and mountains) remain the dominant visual elements. Furthermore, changes in VRM Class III lands should repeat the basic elements of form, line, color, and texture in the landscape. The straight line created by the new roadway, while indistinct, echoes the mostly straight line of the black buttes, and the color and texture of the filled slopes are consistent with surrounding soil and vegetation. For these reasons, the revised character of the landscape in this particular view meets VRM Class III objectives. | |

| Additional mitigation measures recommended? | **No** |
|---|---|
| Explain: The design elements identified for this project have been considered in this KOP, specifically: use irregular clearing shapes, feather/thin edges, minimize clearing size, utilize the edge effect for structure placement along natural vegetative breaks, round and/or warp slopes, shape fills to appear as natural forms, and use earth-tone paints and stains. No further mitigation measures have been identified that could reduce impacts. | |

Scores/Rating is based on the following scale:
7 = Very Strong, 6 = Strong, 5 = Moderately Strong, 4 = Moderate, 3 = Moderately Weak, 2 = Weak, 1 = Very Weak, 0 = None

Foreground-middleground: less than 5 miles away. Background: between beyond foreground-middleground and 15 miles away.

# Bureau of Land Management
# Visual Contrast Rating Worksheet

| Section A. Project Information | | | | |
|---|---|---|---|---|
| Project Name: | Northern Corridor | | | |
| Key Observation Point: | 6 | | | |
| Location: (lat/long) | 37.15909067 / -113.53559530: Cottontail Trail adjacent to Green Springs residential area | | | |
| Photograph Orientation: | West | | | |
| Existing VRM Class: | N/A | | | |
| Date: | 2/13/20 12:04 PM | | | |
| Viewers: | Activity: | ☑ Recreational | ☑ Residential | ☐ Business/Commuter |
| | Number: | Several (>6) | Duration of View: | Medium-Term (10 mins-1 hr) |
| ALTERNATIVE: | UDOT Application Alignment | | | |

| Component | Section B. Characteristic Landscape Description (form, line, color, and texture) | Section C. Proposed Activity Description (form, line, color, and texture) | Section D: Contrast Rating |
|---|---|---|---|
| Land/Water Body | Foreground elements comprise the majority of this broad view, consisting of a wide red dirt double-track trail that curves slightly into the center of the scene, where it vanishes. The more distant middle- and background consists of low hills and some black-topped mesas to the east (right) that add variety to this mostly uniform view. However, due to their low height, the horizon line remains primarily horizontal. | A new road cut is visible as a horizontal line in the center of the view to the left of center. The cut is widest to the west (left). The red color of the cut is consistent with the foreground double-track. The slightly curved shape of the cut is similar to the subtle undulations in the farther hills. Although the line created by the road is roughly parallel with the horizon line, its smooth, level form is inconsistent with the shapes of the distant buttes. | 3.20 |
| Vegetation | Desert scrub vegetation forms low, rounded clumps in the immediate foreground in a pale sage and ochre color. A handful of taller, darker, and spikier plants interrupt the vegetation's overall homogeneity, but remain primarily indistinct. Vegetation appears as coarse. pale texture on the distant hills. | Foreground vegetation obscures the new road to the east (right) side of the view. The sparse vegetation on the new road cuts calls attention to them, but the cuts are partially hidden by the taller, spiker plants, which remain intact. | 2.20 |
| Structures | The red dirt track is an obvious humanmade element. A utility line is barely visible in the distance, primarily where the poles are skylined against the clear blue sky. | The new road is sporadically visible among the vegetation as two gray lines. The low viewing angle flattens the foreground, reducing the apparent size of the road from this view. Although mostly hidden, the strong, smooth line created by the road contrasts with the highly textural vegetation. In addition, moving vehicles would call attention to the road. | 3.00 |
| | | Total | 2.80 |

The VRI contrast rating is: **Moderately Weak**

The VRM change is: **N/A**

| Section D. Contrast Rating Continued | |
|---|---|
| Does project design meet visual resources management objective? | |
| Explain: Views of the Northern Corridor from this location would be level and mostly screened by vegetation. This viewpoint is in an area that is not within BLM-managed lands; therefore, VRM does not apply. | |

| Additional mitigation measures recommended? | **No** |
|---|---|
| Explain: The design elements identified for this project have been considered in this KOP, specifically: use irregular clearing shapes, feather/thin edges, minimize clearing size, utilize the edge effect for structure placement along natural vegetative breaks, shape cuts to appear as natural forms, and use earth-tone paints and stains. No further mitigation measures have been identified that could reduce impacts. | |

Scores/Rating is based on the following scale:
7 = Very Strong, 6 = Strong, 5 = Moderately Strong, 4 = Moderate, 3 = Moderately Weak, 2 = Weak, 1 = Very Weak, 0 = None

Foreground-middleground: less than 5 miles away. Background: between beyond foreground-middleground and 15 miles away.

## Bureau of Land Management
## Visual Contrast Rating Worksheet

| Section A. Project Information | | | | |
|---|---|---|---|---|
| Project Name: | Northern Corridor | | | |
| Key Observation Point: | 7 | | | |
| Location: (lat/long) | 37.16848687 / -113.53263857: Icehouse Trail north of Green Springs residential area | | | |
| Photograph Orientation: | Southwest | | | |
| Existing VRM Class: | N/A | | | |
| Date: | 2/13/20 1:03 PM | | | |
| Viewers: | Activity: | ☑ Recreational | ☐ Residential | ☐ Business/Commuter |
| | Number: | Medium (4-6) | Duration of View: | Medium-Term (10 mins-1 hr) |
| ALTERNATIVE: | UDOT Application Alignment | | | |

| Component | Section B. Characteristic Landscape Description (form, line, color, and texture) | Section C. Proposed Activity Description (form, line, color, and texture) | Section D: Contrast Rating |
|---|---|---|---|
| Land/Water Body | This view is primarily an expansive undeveloped desert landscape that slopes downhill in the foreground and middleground, and then gradually rises uphill to a fairly horizontal horizon line. Slight undulations in the landform are visible, as indicated by the Middleton Powerline Trail in the foreground. Pale purple mountains rise in the background. Otherwise, colors are limited to muted olive greens and tans. No waterbodies are present. Although the landscape is not visually distinctive or diverse, its broad, sweeping view from a high vantage point is remarkable. | The new road has been cut into the hillside on the south (left) side of the view, as well as farther into the distance, which flattens the slight undulations in the landscape. The cut depresses the road into the topography, partially obscuring the road just west of the residential area before the large curve, as well as beyond the farther hill cut. The road's color and smooth texture contrast with that of the surrounding landscape. | 5.00 |
| Vegetation | Vegetation is visible in the form of a nubby carpet of olive green and tan, creating a primarily uninterrupted but slightly uneven dot pattern and texture that becomes more fine-grained in the distance. | Vegetation has been removed to accommodate the new road, but remains intact throughout the majority of this view. | 3.30 |
| Structures | The Middleton Powerline Trail forms a subtle undulating line in the foreground. The utility line paralleling the trail is barely visible, as it is mostly absorbed by the background. The northern end of the Green Springs residential area is an incongruous intrusion on the southeast (left) side of the view. A road encircling the development creates a hard butt edge, within which a dense grouping of houses exist, indicated primarily by roofs of varying shades of gray. The road and roofs are somewhat reflective in the bright sunlight. The contrast between developed and undeveloped land is stark and degrades the otherwise natural character of the view. | The new road creates a strong, curving linear form whose lines are visible for a long distance. Its location to the east (left) side of the view is somewhat compatible with the adjacent residential development. However, this compatibility is diminished as the road travels farther south into the undeveloped area of the landscape. In addition, moving vehicles would draw further attention to the change. | 6.60 |
| | | Total | 4.97 |

The VRI contrast rating is: **Moderately Strong**
The VRM change is: **N/A**

| Section D. Contrast Rating Continued | |
|---|---|
| Does project design meet visual resources management objective? | **No** |
| Explain: Distant views of the Northern Corridor from this location would be from a superior vieiwng angle. This viewpoint is in an area that is not within BLM-managed lands; therefore, VRM does not apply. | |

| Additional mitigation measures recommended? | **No** |
|---|---|
| Explain: The design elements identified for this project have been considered in this KOP, specifically: use irregular clearing shapes, feather/thin edges, minimize clearing size, utilize the edge effect for structure placement along natural vegetative breaks, round and/or warp slopes, tone down freshly broken rock faces, shape cuts and fills to appear as natural forms, and use earth-tone paints and stains. No further mitigation measures have been identified that could reduce impacts. | |

Scores/Rating is based on the following scale:
7 = Very Strong, 6 = Strong, 5 = Moderately Strong, 4 = Moderate, 3 = Moderately Weak, 2 = Weak, 1 = Very Weak, 0 = None

Foreground-middleground: less than 5 miles away. Background: between beyond foreground-middleground and 15 miles away.

## Bureau of Land Management
## Visual Contrast Rating Worksheet

| Section A. Project Information | | | | |
|---|---|---|---|---|
| Project Name: | Northern Corridor | | | |
| Key Observation Point: | 8 | | | |
| Location: (lat/long) | 37.11940118 / -113.58035738: Pioneer Rim Trail northwest of Pioneer Park | | | |
| Photograph Orientation: | East | | | |
| Existing VRM Class: | N/A | | | |
| Date: | 2/10/20 3:22 PM | | | |
| Viewers: | Activity: | ☑ Recreational | ☐ Residential | ☐ Business/Commuter |
| | Number: | Several (>6) | Duration of View: | Medium-Term (10 mins-1 hr) |
| ALTERNATIVE: | Southern Alignment | | | |

| Component | Section B. Characteristic Landscape Description (form, line, color, and texture) | Section C. Proposed Activity Description (form, line, color, and texture) | Section D: Contrast Rating |
|---|---|---|---|
| Land/Water Body | The foreground, middleground, and background of this panoramic view are readily distinguishable by specific visual characteristics. The foreground is characterized by pale-hued vegetation that forms a horizontal line, beyond which the topography descends. The landscape rises beyond that as red-colored soil overlain with clumpy vegetation that forms a broad hillside, also creating a primarily horizontal line. Red and purple cliffs occupy the background and form a slightly undulating horizon line; vertical shadows indicate steep gullies. No waterbodies are present. The distinct Project-Level Distance Zone and varying colors add visual interest to this primarily intact landscape. | The hill in the middleground has been extensively cut to accommodate the new road. The largest cut, which is on the south (right) side of the view, is a dominant visual element where the road makes a substantial curve. The cuts on both sides of the curve slope fairly steeply down to the roadbed, disrupting the natural rise of the hillside. | 6.80 |
| Vegetation | Bright pale yellow grasses intersperse rounded clumps of sage-hued vegetation in the foreground, adding texture and color that contrasts against the middleground. Vegetation is more indistinct but detectable as contrasting texture and pattern on the red soil of the hill in the middleground. | Removing a substantial portion of the hillside has also removed vegetation. Some vegetation has regrown on the rock cuts, helping them blend into the hillside, particularly to the north (left) of the center of the view. | 4.40 |
| Structures | Humanmade structures are visible only in the distance and are therefore indistinct. A utility line roughly parallels, but is below, the horizon line, and is therefore visually absorbed by the landforms. The City of St. George is partially visible in the background to the south (right) below, and backdropped against, the distant cliffs. | The road is a new and obvious humanmade element in a view that was predominantly undisturbed. Although the road is less evident to the north (left) due to the viewing angle, it becomes prominent as the topography rises at the curve. At this point, the view of the road also widens, making it more conspicuous. The moving vehicles would make the change more obvious. | 6.90 |
| | | Total | 6.03 |

The VRI contrast rating is: **Strong**
The VRM change is: **N/A**

| Section D. Contrast Rating Continued | |
|---|---|
| Does project design meet visual resources management objective? | |
| Explain: Views of the Northern Corridor from this location would be from a superior viewing angle level and introduce motion into the landscape. This viewpoint is in an area that is not within BLM-managed lands; therefore, VRM does not apply. | |

| Additional mitigation measures recommended? | **No** |
|---|---|
| Explain: The design elements identified for this project have been considered in this KOP, specifically: use irregular clearing shapes, feather/thin edges, minimize clearing size, utilize the edge effect for structure placement along natural vegetative breaks, round and/or warp slopes, tone down freshly broken rock faces, shape cuts and fills to appear as natural forms, and use earth-tone paints and stains. No further mitigation measures have been identified that could reduce impacts. | |

Scores/Rating is based on the following scale:
7 = Very Strong, 6 = Strong, 5 = Moderately Strong, 4 = Moderate, 3 = Moderately Weak, 2 = Weak, 1 = Very Weak, 0 = None

Foreground-middleground: less than 5 miles away. Background: between beyond foreground-middleground and 15 miles away.

## Bureau of Land Management
## Visual Contrast Rating Worksheet

| Section A. Project Information | | | | |
|---|---|---|---|---|
| Project Name: | Northern Corridor | | | |
| Key Observation Point: | 9 | | | |
| Location: (lat/long) | 37.12897592 / -113.54768476: Middleton residential area, northwest end of E 1200 N Road | | | |
| Photograph Orientation: | Northwest | | | |
| Existing VRM Class: | Partially retained (Class III) | | | |
| Date: | 2/12/20 3:15 PM | | | |
| Viewers: | Activity: | ☑ Recreational | ☑ Residential | ☐ Business/Commuter |
| | Number: | Several (>6) | Duration of View: | Long-Term (>1 hr) |
| ALTERNATIVE: | Southern Alignment | | | |

| Component | Section B. Characteristic Landscape Description (form, line, color, and texture) | Section C. Proposed Activity Description (form, line, color, and texture) | Section D: Contrast Rating |
|---|---|---|---|
| Land/Water Body | This mostly undeveloped view is framed on the west (left) by tall, prominent buttes in the foreground and middleground capped with black volcanic rock outcrops; the black rocks and soil are somewhat visible along the hillside through sparse vegetation. The row of buttes form an undulating vanishing line toward smaller, more distant formations in the background. These buttes block views farther west (left). A red dirt trail in the immediate foreground leads the eye toward these buttes before disappearing into a broad ravine. No waterbodies are present. The landscape broadens and rises slightly to the east (right), where the horizon line mostly flattens and red soil is visible through the vegetation. The imposing mass of the buttes dominate the view, and the black and red soil and rocks add color contrast. | The closest butte (left side of view) has been cut to accommodate a bridge, removing the black rock outcrop and smoothing the downslope, which is in shadow from the bridge deck. The farther buttes are no longer visible. A substantial amount of fill has been placed on the east (right) side of the view to support the bridge, greatly increasing the height of the low hill in that area. | 6.90 |
| Vegetation | Vegetation consists of low, spiky scrubs that appear as rounded mounds of light gray and pale yellow in the immediate foreground. Vegetation is intermittently spaced in the foreground and to the east (right), showing patches of red soil against sage green plants. These plants create a medium-grained, medium-density yellow-hued surface pattern on the buttes, through which black soil and rocks are visible. | Vegetation has been removed from the butte on the west (left) side of the view, but has partially regrown. Vegetation has also grown on the fill, matching the form and pattern of the existing vegetation. | 4.30 |
| Structures | Transmission towers associated with the substation on Cottonwood Springs Road are visible in the distance at a low point in the row of buttes. Although slim due to distance, they are prominent vertical elements against the sky. However, their small number and size are a minimal visual intrusion. | The bridge's length and close proximity to the viewer makes it an obvious new structure dominating a mostly undeveloped view, particularly where skylined against the bright blue sky. The bridge span occupies most of the view, creating a strong horizontal line that contrasts with the undulating landforms. Tall moving vehicles would call further attention to the bridge. The bridge supports introduce several new, prominent vertical elements in a landscape that has few; however, the bridge partially obscures the utility towers in the distance. The bridge colors are similar to those in the landscape. | 7.00 |
| | | Total | 6.07 |

The VRI contrast rating is: **Strong**
The VRM change is: **Major modification (Class IV)**

| Section D. Contrast Rating Continued | |
|---|---|
| Does project design meet visual resources management objective? | **No** |
| Explain: This viewpoint is in an area designated as VRM Class III and would view the Northern Corridor from an inferior viewing angle. The description of VRM Class III states that the existing character of the landscape is partially retained, which is not true in this view as the new bridge changes it from a predominantly natural character to a transportation character. In addition, the level of change to the characteristic landscape should be moderate, which this change exceeds as the contrast is strong. The description for VRM Class III also states that changes should attract attention but not dominate the view. For KOP9, the change dominates the view. Furthermore, changes in VRM Class III lands should repeat the basic elements of form, line, color, and texture in the landscape. The strong linear and vertical components of the bridge deck and supports, as well as their smooth forms, contrast with the landscape's undulating forms and texture. For these reasons, the revised character of the landscape would not meet VRM Class III objectives. | |

| | |
|---|---|
| Additional mitigation measures recommended? | **Yes** |
| Explain: The design elements identified for this project have been considered in this KOP, specifically: round and/or warp slopes, tone down freshly broken rock faces, shape cuts and fills to appear as natural forms, blend with topographic forms in shape and placement, choose native plant species, use natural appearing forms to complement landscape character, and use earth-tone paints and stains. No further mitigation measures have been identified that could reduce impacts. | |

Scores/Rating is based on the following scale:
7 = Very Strong, 6 = Strong, 5 = Moderately Strong, 4 = Moderate, 3 = Moderately Weak, 2 = Weak, 1 = Very Weak, 0 = None

Foreground-middleground: less than 5 miles away. Background: between beyond foreground-middleground and 15 miles away.

# Bureau of Land Management
# Visual Contrast Rating Worksheet

| Section A. Project Information | | | | |
|---|---|---|---|---|
| Project Name: | Northern Corridor | | | |
| Key Observation Point: | 10 | | | |
| Location: (lat/long) | 37.12529635 / -113.58604730: City Creek Trail | | | |
| Photograph Orientation: | East | | | |
| Existing VRM Class: | Partially retained (Class III) | | | |
| Date: | 2/11/20 2:53 PM | | | |
| Viewers: | Activity: | ☑ Recreational | ☐ Residential | ☐ Business/Commuter |
| | Number: | Medium (4-6) | Duration of View: | Medium-Term (10 mins-1 hr) |
| ALTERNATIVE: | Southern Alignment | | | |

| Component | Section B. Characteristic Landscape Description (form, line, color, and texture) | Section C. Proposed Activity Description (form, line, color, and texture) | Section D: Contrast Rating |
|---|---|---|---|
| Land/Water Body | This elevated, mostly undeveloped panorama is primarily occupied by an expansive low hill in the middleground, the top of which forms a slightly curving line. Red and purple cliffs are visible in the background, also forming a slightly undulating but fairly horizontal horizon line; vertical shadows indicate steep gullies. A road cut to accommodate Red Hills Parkway is distinctly visible as a red horizontal swath in the foreground traveling north to south (left to right). The lack of vegetation, shadows formed by the cut rocks, and white minerals call further attention to the rock cut. This cut interrupts the continuity of the landform. No waterbodies are present. | Filled slopes have been added to the middleground hill to accommodate an overpass. The effect is that of another hill in the middleground. A new rock cut is visible to the south (right), where Red Hills Parkway is realigned. The old rock cut, no longer required for the road, remains visible. | 5.00 |
| Vegetation | Dark gray-green low, spikey shrubs sporadically occupy the immediate foreground, through which flat, red rock slabs are visible. Similar dark olive and gray vegetation blankets the foreground hill, creating a dot pattern that becomes more fine-grained with distance. | The new fill slopes have been vegetated with plant species similar to the surroundings, but vegetation has been removed where the new roadway elements have been added. In addition, the overpass and road somewhat block views of the vegetated hill beyond them. | 3.90 |
| Structures | Red Hills Parkway is not visible, only the rock cut created for it. Utility poles form a diagonal row mostly on the north (left) side of the view, becoming smaller with distance. These poles are set against the hillside and distant cliffs, helping absorb their visual impact, as they are the only vertical elements in the view. | The overpass carrying the new alignment creates a strong, slightly curved horizontal line in the center of the view. Red Hills Parkway has been substantially realigned to curve away from its existing route to meet the overpass. The rerouted road appear as another line extending from the overpass to the south (right). The mostly horizontal lines formed by two connecting ramps are slightly visible. All of these new horizontal lines disrupt the landscape's continuity, but somewhat repeat the horizon line and existing rock cut. However, moving vehicles would call further attention to these new transportation elements introduced to a primarily natural setting. | 6.60 |
| | | Total | 5.17 |

The VRI contrast rating is: **Moderately Strong**
The VRM change is: **Major Modification (Class IV)**

| Section D. Contrast Rating Continued | |
|---|---|
| Does project design meet visual resources management objective? | **No** |
| Explain: This viewpoint includes views of VRM Class III. Views of the Northern Corridor from this location would be from a superior viewing angle level and introduce motion into the landscape. The description of VRM Class III states that the existing character of the landscape is partially retained, which is not true of this view, because it changed from a primarily undeveloped character to a transportation character. In addition, the level of change to the characteristic landscape should be moderate, which this change exceeds for the same reason; the level of contrast is moderately strong. The description for VRM Class III also states that changes should attract attention but not dominate the view. For KOP10, the change dominates the view, as it traverses the entire middleground. Furthermore, changes in VRM Class III lands should repeat the basic elements of form, line, color, and texture in the landscape. The road and overpass contrast with the form, color, and texture of the hill through which the interchange is built. For these reasons, the revised character of the landscape would not meet VRM Class III objectives. | |

| Additional mitigation measures recommended? | **No** |
|---|---|
| Explain: The design elements identified for this project have been considered in this KOP, specifically: use irregular clearing shapes, feather/thin edges, minimize clearing size, utilize the edge effect for structure placement along natural vegetative breaks, round and/or warp slopes, shape fills to appear as natural forms, blend with topographic forms in shape and placement, choose native plant species, use natural appearing forms to complement landscape character, and use earth-tone paints and stains. No further mitigation measures have been identified that could reduce impacts. | |

Scores/Rating is based on the following scale:
7 = Very Strong, 6 = Strong, 5 = Moderately Strong, 4 = Moderate, 3 = Moderately Weak, 2 = Weak, 1 = Very Weak, 0 = None

Foreground-middleground: less than 5 miles away. Background: between beyond foreground-middleground and 15 miles away.

# Bureau of Land Management
# Visual Contrast Rating Worksheet

| Section A. Project Information | | | | |
|---|---|---|---|---|
| Project Name: | Northern Corridor | | | |
| Key Observation Point: | 11 | | | |
| Location: (lat/long) | 37.12942202 / -113.55858975: Cottonwood Springs Road | | | |
| Photograph Orientation: | South | | | |
| Existing VRM Class: | Partially retained (Class III) | | | |
| Date: | 2/13/20 4:25 PM | | | |
| Viewers: | Activity: | ☑ Recreational | ☐ Residential | ☐ Business/Commuter |
| | Number: | Several (>6) | Duration of View: | Short-term (<10 mins) |
| ALTERNATIVE: | Southern Alignment | | | |

| Component | Section B. Characteristic Landscape Description (form, line, color, and texture) | Section C. Proposed Activity Description (form, line, color, and texture) | Section D: Contrast Rating |
|---|---|---|---|
| Land/Water Body | This mostly undeveloped view includes a hillside that slopes downward in the immediate foreground that then trends uphill, creating a slight undulation. Vegetation tints the hill a pale yellow hue, beyond which is a series of low cliffs. The closest cliffs are a vivid red, striated with darker lines indicating shadows formed by steep gullies. Farther cliffs in the background to the east (left) display a lighter hue due to distance. These cliffs add vivid, contrasting color and texture to an otherwise unremarkable view. | A new, red-hued rock cut is visible beyond the BLM sign to the east (left) side of the view. Although this cut is a new visual element, it echoes the color and shape of the background cliffs, helping it fit into the view. | 3.10 |
| Vegetation | Dry pale yellow grasses carpet the foreground, interspersed with clumps of olive green shrubs that form a random dot pattern that is denser to the west (right). Vegetation is more sparse in the immediate foreground where the road slopes slightly down and to the west (right). | A swath of yellow vegetation has been replaced with the new road in the foreground, changing the color on the cut. Overall, most vegetation remains intact. Small clumps of vegetation has sporadically regrown on the rock cut. | 2.70 |
| Structures | Cottonwood Springs Road forms a dark gray curving ribbon that leads the eye into the foreground and vanishes into a bend. The curve of the road echoes the subtle curves of the landscape. The matte grey background of a BLM entrance sign is to the east (left) but is unobtrusive. A short metal post-and-wire fence is barely discernable to the west (right), as its slim lines are mostly absorbed by the landscape behind it. | The new road appears as a thin horizontal line on the east (left) side of the view. The straight line it creates contrasts with the curve of Cottonwood Springs Road in the foreground, and the slight curves of the surrounding landforms. Tall traffic lights are conspicuous vertical elements that call attention to the intersection, and moving vehicles would call further attention to the new road. | 4.90 |
| | | Total | 3.57 |

The VRI contrast rating is: **Moderate**
The VRM change is: **Partially retained (Class III)**

| Section D. Contrast Rating Continued | |
|---|---|
| Does project design meet visual resources management objective? | **Yes** |
| Explain: The viewpoint is in an area designated as VRM Class III with level to slighly superior views of the Northern Corridor. These views would be partially screened by topography. The description of VRM Class III states that the existing character of the landscape is partially retained, which is primarily true in this view. The level of change to the characteristic landscape should be moderate, which this change exhibits. The description for VRM Class III also states that changes should attract attention but not dominate the view, which is true in this view that includes an existing road in the foreground. Furthermore, changes in VRM Class III lands should repeat the basic elements of form, line, color, and texture in the landscape. The new road repeats the same elements of the existing road to a large degree. For these reasons, the revised character of the landscape in this particular view remains VRM Class III. | |

| Additional mitigation measures recommended? | **No** |
|---|---|
| Explain: The design elements identified for this project have been considered in this KOP, specifically: use irregular clearing shapes, feather/thin edges, minimize clearing size, utilize the edge effect for structure placement along natural vegetative breaks, round and/or warp slopes, tone down freshly broken rock faces, shape cuts to appear as natural forms, blend with topographic forms in shape and placement, choose native plant species, use natural appearing forms to complement landscape character, and use earth-tone paints and stains. No further mitigation measures have been identified that could reduce impacts. | |

Scores/Rating is based on the following scale:
7 = Very Strong, 6 = Strong, 5 = Moderately Strong, 4 = Moderate, 3 = Moderately Weak, 2 = Weak, 1 = Very Weak, 0 = None

Foreground-middleground: less than 5 miles away. Background: between beyond foreground-middleground and 15 miles away.

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# FHWA
# Visual Quality Evaluation

| Project Information | | | | |
|---|---|---|---|---|
| Project Name: | Northern Corridor | | | |
| Key Observation Point: | 12 | | | |
| Location: | 37.11554493 / -113.57750595: Pioneer Park | | | |
| Photograph Orientation: | South | | | |
| Date: | 2/12/20 9:46 AM | | | |
| Viewers: | Activity: | ☑ Recreational ☐ Residential ☐ Business/Commuter | | |
| | Number: | Several (>6) | Duration of View: | Long-Term (>1 hr) |
| ALTERNATIVE: | Red Hills Expressway Alignment | | | |

**Visual Quality**

**Vividness** (degree of drama, memorability or distinctiveness of features from a regional perspective)

| **Component** | **Existing Description (form, line, color, and texture)** | Existing Score* | **Description with Alternative (form, line, color, and texture)** | Score with Alternative* |
|---|---|---|---|---|
| Landform | This view toward Red Hills Expressway from a rock outcrop at Pioneer Park shows the bright red soil of the park in the foreground covering a hill that slopes downward to Red Hills Expressway. The City of St. George occupies the valley beyond the road. Distant hills, buttes, and mountains are visible in the background in varying shades of olive green and purple. The contrasting colors and the dramatic vista have a high degree of vividness. | 6.30 | No change to the landform is visible as the changes remain within the same footprint and follow the same route as the existing road, without change to elevation (e.g., no cut or fill). | 6.30 |
| Vegetation | Small intermittent rounded clumps of desert scrubs are in the immediate foreground. Landscaped trees are visible in the city in the distance but appear more like a carpet due to distance. The far hillsides are covered in olive green indicative of vegetation cover. Vegetation does not meaningfully contribute to the view's vividness. | 3.20 | Minimal, if any, vegetation is removed for the reasons listed above. | 3.20 |
| Water Feature | None | n/a | None | n/a |
| Human-Made | Red Hills Parkway and a parking lot for Pioneer Park, including a small restroom, are visible in the foreground. A tall telephone pole is a conspicuous vertical element. Beyond the road, several buildings occupy a broad valley that comprise the City of St. George. Buildings to the west (right) are closer and appear larger. | 4.80 | The roadway striping is slightly different and pavement is new, which is barely detectable. No other noticeable visual change is visible for the reasons listed above. | 4.90 |
| Total/Summary | The sweeping view and variety of landforms and colors add drama and make the scene memorable. | 4.77 | The slight changes to landform, vegetation, and human-made elements is barely noticeable. Fresh pavement improves the view very slightly. | 4.80 |

| Intactness (fit with natural and human-built landscape and degree of attention given to aesthetics of human-made objects; degree of encroachment from out of place elements) | | | | |
|---|---|---|---|---|
| **Component** | **Existing Description (form, line, color, and texture)** | Existing Score* | **Description with Alternative (form, line, color, and texture)** | Score with Alternative* |
| Development | The buildings are mostly of uniform height and bulk, particularly those most discernable to the west (right). Their colors, primarily tans and brick reds, echo those of the surrounding landscape. A large, white church to the east (left) is a prominent landmark. | 4.80 | No change to the buildings has occurred. | 4.80 |
| Encroachment | Although some buildings encroach onto the tops of buttes to the west (right), the City of St. George fits within the confines of the valley and forms an orderly appearance. The road and parking lot follow the curved line of the cliff on which it is built. The telephone pole is out of place, but is a minor element. | 4.90 | The new road does not further encroach onto the view. | 4.90 |
| Total/Summary | The City of St. George fits fairly well within the landscape; the view is interrupted by the foreground telephone pole, but is a minor distraction. | 4.85 | The scene remains intact, as no changes to intactness are visible. | 4.85 |

| Unity (degree to which visual resources combine to form a coherent, harmonious visual pattern in the landscape) | | | | |
|---|---|---|---|---|
| **Component** | **Existing Description (form, line, color, and texture)** | Existing Score* | **Description with Alternative (form, line, color, and texture)** | Score with Alternative* |
| Unity | The foreground, middleground, and background are comprised of distinctly different landscape features, creating specific horizontal bands of landscape character. However, each distance zone displays a coherent internal visual pattern typically uninterrupted by conflicting components. | 5.20 | No change to unity has occurred. | 5.20 |
| Total/Summary | Overall unity is close to high due to cohesion within each distance zone. | 5.20 | Unity remains the same, as no changes to unity are visible. | 5.20 |

**Overall Visual Quality Score**

| | |
|---|---|
| **Overall Existing Visual Quality Score** | 4.94 |

| | |
|---|---|
| **Overall Visual Quality Score with Alternative** | 4.95 |
| **Compatibility with Pattern Elements (form line, color, texture)** | High |

Rationale: Modifications to form, line, color, and texture are barely discernable as the changes to the roadway share these same elements.

| | |
|---|---|
| **Pattern Character Elements (Dominance, Scale, Diversity, Continuity)** | High |

Rationale: No change to dominance, scale, diversity, and continuity is present as the roadway remains within the existing footprint and follows the same route.

***Scores/Rating is based on the following scale:**

7 = Very High, 6 = Moderately High, 5 = High , 4 = Medium, 3 = Moderately Low, 2 = Low, 1 =Very Low, 0 = None

****Distance Zones are described as:** Foreground (0 to 0.25 mile), Middleground (0.25 mile to 0.75), and Background (0.75 mile and beyond)

# Appendix N: Special Status Wildlife Species Habitat Types

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# Appendix N. Special Status Wildlife Species Habitat Types

GIS data identifying suitable habitat for each species were not available for the analysis of impacts to special status wildlife species. Therefore, GIS data of existing vegetation types (EVT, from the LANDFIRE dataset) were used to identify habitat types for each species. EVTs were combined into groups identified as habitat types. Table N-1 identifies the habitat types that were used to identify the number of acres of suitable habitat for each special status wildlife species in the analysis area. Table N-2 identifies the EVTs in the analysis area and which EVTs were attributed to each habitat type.

**Table N-1. Habitats Used to Calculate Acres Impacted for Each Special Status Wildlife Species**

| Species | Habitat Types |
|---|---|
| Arizona toad | Open water, washes, riparian, croplands, sandy areas |
| Common chuckwalla | Cliffs, canyons, and rocky outcrops; desert scrub |
| Desert night lizard | Cliffs, canyons, and rocky outcrops; desert scrub; chaparral; pinyon-juniper woodland; other woodlands |
| Gila monster | Washes; cliffs, canyons, and rocky outcrops; desert scrub; sagebrush; sandy areas |
| Sidewinder | Washes; desert scrub; sagebrush; sandy areas |
| Western banded gecko | Washes; cliffs, canyons, and rocky outcrops; desert scrub; desert pavement; sagebrush; sandy areas; open plateaus; grassland |
| Western threadsnake | Desert scrub; desert pavement; chaparral; grassland; pinyon-juniper woodland; other woodlands |
| Zebra-tailed lizard | Washes; desert scrub; desert pavement; sagebrush; sandy areas |
| Bald eagle | Open water, riparian, conifer forest |
| Burrowing owl | Washes, croplands, pastures, desert scrub, sagebrush, sandy areas, grassland, shrub steppe, weedy fields |
| Ferruginous hawk | Croplands, pastures, sagebrush, grassland, shrub steppe, weedy fields |
| Golden eagle | Riparian; cliffs, canyons, and rocky outcrops; desert scrub; grassland; shrub steppe; shrublands; weedy fields |
| Short-eared owl | Croplands, pastures, grassland, shrub steppe, shrublands, meadows, weedy fields |
| Allen’s big-eared bat | Riparian; cliffs, canyons, and rocky outcrops; desert scrub; shrublands; pinyon-juniper woodland; other woodlands; conifer forest |
| Big free-tailed bat | Cliffs, canyons, and rocky outcrops; desert scrub; grassland; shrub steppe; shrublands; pinyon-juniper woodland; other woodlands |
| Fringed myotis | Desert scrub, sagebrush, chaparral, grassland, shrubland, pinyon-juniper woodland, other woodlands, conifer forest |
| Kit fox | Washes; cliffs, canyons, and rocky outcrops; desert scrub; desert pavement; sagebrush; sandy areas; chaparral; grassland; shrubland |
| Spotted bat | Riparian; cliffs, canyons, and rocky outcrops; desert scrub; chaparral; grassland; pinyon-juniper woodland; other woodlands; conifer forest; meadows |
| Townsend’s big-eared bat | Riparian; cliffs, canyons, and rocky outcrops; desert scrub; sagebrush; grassland; shrubland; pinyon-juniper woodland; other woodlands; conifer forest |
| Western red bat | Riparian, croplands, grassland, shrubland |
| Mojave poppy bee | Bear poppy habitat (suitable habitat mapped—includes desert scrub), prickly poppy habitat (disturbed roadsides, overgrazed pastures, sandy areas, washes, sagebrush, pinyon-juniper woodland, conifer forest) |
| Monarch butterfly | Riparian; cliffs, canyons, and rocky outcrops; conifer forest; meadows |
| Western bumble bee | Riparian, grassland, pinyon-juniper woodland, other woodlands, conifer forest, meadows |

**Table N-2. Existing Vegetation Types That Comprise Special Status Wildlife Habitats**

| Habitat Types | Existing Vegetation Types |
|---|---|
| Chaparral | Great Basin Semi-Desert Chaparral |
| | Mogollon Chaparral |
| | Sonora-Mojave Semi-Desert Chaparral |
| Cliffs, Canyons, and Rocky Outcrops | Inter-Mountain Basins Cliff and Canyon |
| | Inter-Mountain Basins Volcanic Rock and Cinder Land |
| | North American Warm Desert Bedrock Cliff and Outcrop |
| | Rocky Mountain Cliff Canyon and Massive Bedrock |
| Conifer | Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland |
| | Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland |
| Cropland | Western Cool Temperate Close Grown Crop |
| | Western Cool Temperate Row Crop |
| | Western Warm Temperate Close Grown Crop |
| | Western Warm Temperate Fallow/Idle Cropland |
| | Western Warm Temperate Row Crop |
| Desert Pavement | North American Warm Desert Pavement |
| Desert Scrub | Inter-Mountain Basins Mixed Salt Desert Scrub |
| | Mojave Mid-Elevation Mixed Desert Scrub |
| | Sonora-Mojave Creosotebush-White Bursage Desert Scrub |
| | Sonora-Mojave Mixed Salt Desert Scrub |
| Disturbed Roadsides | Developed-Roads |
| Grassland | Inter-Mountain Basins Semi-Desert Grassland |
| | Inter-Mountain Basins Juniper Savanna |
| | Recently Disturbed Other-Herb and Grass Cover |
| Meadows | Rocky Mountain Subalpine-Montane Mesic Meadow |
| | Western North American Ruderal Wet Meadow & Marsh |
| Open Plateaus | Colorado Plateau Mixed Bedrock Canyon and Tableland |
| Other Woodland | Inter-Mountain Basins Curl-leaf Mountain Mahogany Woodland |
| Pasture | Western Cool Temperate Pasture and Hayland |
| | Western Warm Temperate Pasture and Hayland |
| Pinyon-Juniper Woodland | Colorado Plateau Pinyon-Juniper Shrubland |
| | Colorado Plateau Pinyon-Juniper Woodland |
| | Great Basin Pinyon-Juniper Woodland |
| Riparian | Great Basin Foothill and Lower Montane Riparian Herbaceous |
| | Great Basin Foothill and Lower Montane Riparian Shrubland |
| | Great Basin Foothill and Lower Montane Riparian Woodland |
| | Interior West Ruderal Riparian Scrub |
| | North American Warm Desert Lower Montane Riparian Shrubland |
| | North American Warm Desert Lower Montane Riparian Woodland |
| | North American Warm Desert Riparian Herbaceous |
| | North American Warm Desert Riparian Mesquite Bosque Shrubland |
| | North American Warm Desert Riparian Mesquite Bosque Woodland |
| | North American Warm Desert Riparian Shrubland |
| | North American Warm Desert Riparian Woodland |
| | Rocky Mountain Lower Montane-Foothill Riparian Woodland |

| Habitat Types | Existing Vegetation Types |
|---|---|
| Sagebrush | Colorado Plateau Mixed Low Sagebrush Shrubland |
| | Great Basin Xeric Mixed Sagebrush Shrubland |
| | Inter-Mountain Basins Big Sagebrush Shrubland |
| | Inter-Mountain Basins Montane Sagebrush Steppe |
| Sandy Areas | Inter-Mountain Basins Active and Stabilized Dune |
| | Southern Colorado Plateau Sand Shrubland |
| Shrub Steppe | Inter-Mountain Basins Semi-Desert Shrub-Steppe |
| Shrubland | Colorado Plateau Blackbrush-Mormon-tea Shrubland |
| | Inter-Mountain Basins Greasewood Flat |
| | Rocky Mountain Gambel Oak-Mixed Montane Shrubland |
| | Rocky Mountain Lower Montane-Foothill Shrubland |
| Streams/Open Water | Open Water |
| Wash | North American Warm Desert Wash Shrubland |
| | North American Warm Desert Wash Woodland |
| Weedy Fields | Great Basin & Intermountain Introduced Annual and Biennial Forbland |
| | Great Basin & Intermountain Introduced Annual Grassland |
| | Great Basin & Intermountain Introduced Perennial Grassland and Forbland |
| | Great Basin & Intermountain Ruderal Shrubland |
| | Interior Western North American Temperate Ruderal Grassland |
| | Interior Western North American Temperate Ruderal Shrubland |
| | North American Warm Desert Ruderal & Planted Scrub |

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