Final Climate Change Analysis for the Proposed Holden Canyon Connector Road Project on the Nogales Ranger District, Coronado National Forest

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Acronyms and Abbreviations

CBP	Customs and Border Protection
CEQ	Council on Environmental Quality
CH_4	Methane
CO_2	carbon dioxide
GHG	greenhouse gas
GWP	global warming potential
ICLEI	International Council for Local Environmental Initiative
IPCC	Intergovernmental Panel on Climate Change
LULUCF	Land Use, Land Use Change, and Forestry
LWC	low-water crossing
MMT CO_2E	million metric tons carbon dioxide equivalent
MT CO_2E	metric tons of carbon dioxide equivalent
N_2O	nitrous oxide
NEPA	National Environmental Protection Act
SC-GHG	social cost of GHG
USBP	U.S. Border Patrol
USDA	U.S. Department of Agriculture
U.S. EPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service

1.0 Introduction

The U.S. Customs and Border Protection (CBP) Tucson Sector, in cooperation with the U.S. Forest Service (USFS), Coronado National Forest (Nogales Ranger District), under the U.S. Department of Agriculture (USDA), are proposing to improve, repair, and construct approximately 12.43 miles of unpaved road within the Coronado National Forest Nogales Ranger District located in Santa Cruz and Pima counties, Arizona (Proposed Action; Figures 1.1, 1.2, and 1.3, Appendix A). The purpose of this study is to address potential climate change/greenhouse gas (GHG) emissions impacts associated with the Proposed Action consistent with the National Environmental Policy Act (NEPA), NEPA Guidance on Consideration of Greenhouse Gas Emissions and Climate Change (Council on Environmental Quality [CEQ] 2023), and USFS guidance.

1.1 Understanding Climate Change

1.1.1 Global Climate Change

To evaluate the incremental effect of the Proposed Action on statewide GHG emissions and global climate change, it is important to have a basic understanding of the nature of the global climate change problem. Global climate change is a change in the average weather of the earth, which can be measured by wind patterns, storms, precipitation, and temperature. The earth's climate is in a state of constant flux with periodic warming and cooling cycles. Extreme periods of cooling are termed "ice ages," which may then be followed by extended periods of warmth. For most of the earth's geologic history, these periods of warming and cooling have been the result of many complicated interacting natural factors that include volcanic eruptions that spew gases and particles (dust) into the atmosphere; the amount of water, vegetation, and ice covering the earth's surface; subtle changes in the earth's orbit; and the amount of energy released by the sun (sun cycles). However, since the beginning of the Industrial Revolution around 1750, the average temperature of the earth has been increasing at a rate that is faster than can be explained by natural climate cycles alone.

With the Industrial Revolution came an increase in the combustion of carbon-based fuels such as wood, coal, oil, natural gas, and biomass. Industrial processes have also created emissions of substances not found in nature. This in turn has led to a marked increase in the emissions of gases shown to influence the world's climate. These gases, termed "greenhouse" gases, influence the amount of heat trapped in the earth's atmosphere. Recently observed increased concentrations of GHGs in the atmosphere appear to be related to increases in human activity. Therefore, the current cycle of "global warming" is believed to be largely due to human activity. Of late, the issue of global warming, or global climate change, has arguably become the most important and widely debated environmental issue in the United States and the world. Because it is believed that the increased GHG concentrations around the world are related to human activity and the collective of human actions taking place throughout the world, it is quintessentially a global or cumulative issue.

1.1.2 Climate Change Impacts in Arizona

The primary issues related to climate change in Arizona are rising temperatures, drought, and changes in rainfall amounts. In the last 100 years of weather records, Arizona has become about two degrees warmer (Fahrenheit) (U.S. Environmental Protection Agency [U.S. EPA] 2016). Within Arizona, and throughout the southwestern United States, heat waves are becoming more common. Based on weather predictions, the upward trends in average temperature and extreme heat will continue. Modeling under a higher emissions scenario indicates that annual average temperatures would continue to rise in the southwest, including Arizona, over the next century (Frankson et al. 2022).

With rising temperatures, typically less precipitation falls as snow and more snow melts during the winter, which decreases the snowpack. Over the last 50 years, snowpack has been decreasing within Arizona, leading to decreased water supplies for communities throughout Arizona. Rising temperatures also increase the rate at which water evaporates into the air from soils, plants, and surface waters (U.S. EPA 2016).

Arizona is also in a long-term drought that has lasted approximately 20 years. Due to the drought as well as reduced snowpack, water levels within critical lakes and reservoirs that supply communities throughout Arizona have been at historic lows. Long-term drought also increases the risk of wildfires, increases the spread of invasive plants, reduces agricultural output, and causes negative impacts to natural resources (vegetation and wildlife communities).

Within Arizona and the southwest, projections indicate there is a risk that annual precipitation may decrease in the spring. Overall annual precipitation may be more variable and more extreme precipitation events may occur (Frankson et al. 2022).

1.2 Greenhouse Gases of Primary Concern

There are numerous GHGs, both naturally occurring, and man-made. Each GHG has variable atmospheric lifetime and global warming potential (GWP). The atmospheric lifetime of the gas is the average time a molecule stays stable in the atmosphere. Most GHGs have long atmospheric lifetimes, staying in the atmosphere hundreds or thousands of years. GWP is a measure of the potential for a gas to trap heat and warm the atmosphere. Although GWP is related to its atmospheric lifetime, many other factors including chemical reactivity of the gas also influence GWP. GWP is reported as a unitless factor representing the potential for the gas to affect global climate relative to the potential of carbon dioxide (CO_2). Because CO_2 is the reference gas for establishing GWP, by definition its GWP is 1. Although methane (CH_4) has a shorter atmospheric lifetime than CO_2, it has a 100-year GWP of 28; this means that CH_4 has 28 times more effect on global warming than CO_2.

The GWP is officially defined as (U.S. EPA 2010):

> The cumulative radiative forcing—both direct and indirect effects—integrated over a period of time from the emission of a unit mass of gas relative to some reference gas.

GHG emissions estimates are typically represented in terms of equivalent metric tons of CO_2 (MT CO_2E). CO_2E emissions are the product of the amount of each gas by its GWP. The effects

of several GHGs may be discussed in terms of MT CO_2E and can be summed to represent the total potential of these gases to warm the global climate. Table 1 summarizes some of the most common GHGs.

It should be noted that the U.S. EPA and other organizations update the GWP values they use occasionally. This change can be due to updated scientific estimates of the energy absorption or lifetime of the gases or to changing atmospheric concentrations of GHGs that result in a change in the energy absorption of one additional ton of a gas relative to another. The GWPs shown in Table 1 are the most current.

All of the gases in Table 1 are produced by either biogenic (natural) sources, anthropogenic (human) sources, or both. CO_2 would be emitted by the Proposed Action due to the combustion of fossil fuels in vehicles (including construction) and is the primary GHG of concern for this analysis.

Table 1
Global Warming Potentials and Atmospheric Lifetimes
(years)

Gas	Atmospheric Lifetime (years)	100-year GWP	20-year GWP
Carbon dioxide (CO_2)	50–200	1	1
Methane (CH_4)	12.4	25	84
Nitrous oxide (N_2O)	121	298	264
HFC-23	222	12,400	10,800
HFC-32	5.2	677	2,430
HFC-125	28.2	3,170	6,090
HFC-134a	13.4	1,300	3,710
HFC-143a	47.1	4,800	6,940
HFC-152a	1.5	138	506
HFC-227ea	38.9	3,350	5,360
HFC-236fa	242	8,060	6,940
HFC-43-10mee	16.1	1,650	4,310
CF_4	50,000	6,630	4,880
C_2F_6	10,000	11,100	8,210
C_3F_8	2,600	8,900	6,640
C_4F_{10}	2,600	9,200	6,870
c-C_4F_8	3,200	9,540	7,110
C_5F_{12}	4,100	8,550	6,350
C_6F_{14}	3,100	7,910	5,890
SF_6	3,200	23,500	17,500

SOURCE: Intergovernmental Panel on Climate Change (IPCC) 2007, 2014.

2.0 Proposed Action Description

Under the Proposed Action, the CBP Tucson Sector, in cooperation with USFS Coronado National Forest, proposes to improve, repair, and construct approximately 12.43 miles of road to provide enhanced access for U.S. Border Patrol (USBP) activities in the Holden Canyon area (see Figures 1.2 and 1.3, Appendix A). The Proposed Action also includes decommissioning of approximately

3.94 miles of road segments no longer needed for patrol and access in the vicinity of the Holden Canyon area and the international border. The Proposed Action is detailed below.

2.1 Holden Canyon Connector Road

The 12.43-mile road would consist of the following:

- Improvement and repair of approximately 8.68 miles of Mojonera Canyon Road (FR 216A), Saucito Tank Road (FR4169), Sentinel Peak Road (FR4167), and currently decommissioned road and trail segments (closed road and trail segments would require significant improvement) (Figures 2.1 through 2.9 and Figures 2.13 and 2.14, Appendix A).

- New construction of a Maintenance Level 2 road of approximately 3.75 miles within an undeveloped area (Figures 2.9 through 2.13, Appendix A.

Equipment staging areas would be located within the existing road or disturbed areas. Equipment needed to improve, repair, and construct the proposed road would include trackhoes, bulldozers, dump trucks, graders, compactors, loaders, and similar heavy equipment. A water tender would also be used for compaction of the road surface and dust abatement during construction. Approximately three to five heavy equipment operators would be working at any given time.

Access to the area would be via existing roads and no temporary roads would be necessary for project implementation. Once the improvement, repair, and construction phase is completed, maintenance of the proposed road would be on an "as-needed" basis or in the event of emergency situations that require repair. CBP would fund road improvements, repairs, construction, and maintenance. The USFS would be responsible for final design, improvements, repairs, construction, and maintenance.

The proposed Holden Canyon Connector Road would be designated as open to public motor vehicle access (Maintenance Level 2 road for high-clearance vehicles). The proposed road would generally have low patrol traffic volume (averaging about two to three patrols per day) with low speed use and low public use volume consisting primarily of hunters and all-terrain vehicles.

The timeline for proposed Holden Canyon Connector Road improvement, repair, and construction, as well as road decommissioning, would be approximately five months over the fall/winter season (October 1 through March 30).

2.1.1 Existing Road Segments

The existing road segments (8.68 miles) would be improved and repaired to USFS Road Maintenance Level 2 standards. Maintenance Level 2 roads are intended for travel of high-clearance vehicles and not passenger vehicles. Based on the road engineering design, the approximate potential ground disturbance area for the proposed road improvement and repair segments (within existing or closed roads) would be approximately 14.60 acres, predominantly within the existing road use and disturbed area.

The guidelines for Maintenance Level 2 roads are as follows:

- **Traveled way:** Log out and brush away only as necessary to provide for high-clearance vehicles. Maintain road prism for drainage and to provide for passage of high-clearance vehicles. Traveled way should only be bladed (with bulldozer) to maintain drainage functionality and not to provide a smooth surface for passenger cars.
- **Shoulder:** Shoulder is usually not defined and maintenance is not required unless necessary to maintain structural integrity of the roadway, drainage functionality, or access by high-clearance vehicles.
- **Drainage:** Drain as necessary to keep drainage facilities functional and prevent unacceptable environmental damage while maintaining passage for high-clearance vehicles.
- **Roadway:** Remove or ramp-over slides and repair slumps as needed to provide access for high-clearance vehicles and to control resource damage.
- **Roadside:** Generally, no work is required unless necessary to provide clearance for existing traffic. Fallen trees may be left in place if not an obstacle to safe passage of intended traffic.
- **Structure:** Maintain all structures to provide for the passage of high-clearance vehicles and to protect natural resources.
- **Traffic Service:** Install and maintain route markers. Maintain warning, regulatory, and guide signs, and other traffic control devices as warranted in the sign plan to provide for existing traffic and the appropriate traffic management strategy. Generally, few, if any, signs or other traffic control devices are required.

Within existing road segments with sensitive biological and cultural resources, minimal road improvement or repair would occur to avoid potential impacts to these resources (avoidance areas).

Road dips would continue to be used within the existing road segments as the preferred drainage treatment. Currently there are no low-water crossings (LWC) with concrete mats or reinforced concrete or rock within existing road segments.

2.1.2 Proposed New Road Segment

The proposed new road (3.75 miles) would be engineered to conform to the USFS Maintenance Level 2 guidelines, native surfaced (constructed of on-site soil materials), and be suitable for high-clearance vehicles. The road would be approximately 14 feet wide in most areas (12-foot travel way with 1-foot shoulders). In areas requiring road switchbacks and cuts along slopes, a wider road area would be needed, and slopes may require reinforcement.

A cattle guard would be needed along FR4169 to keep livestock from moving between allotments. The cattle guard would be a metal structure. Metal cattle guards are constructed over a pit, with treated timbers or concrete for the foundation, concrete or rock on either side, and open for drainage.

The USFS developed a road disturbance area based on slopes and other topography along the proposed road alignment. Ground disturbance for the proposed new road segment construction

area would be approximately 14.92 acres based on preliminary design. Calculations assumed a generally 14-foot-wide road plus fill and cut slopes as needed. Fills constructed with a 2:1 or flatter slope typically promote growth of vegetation and provide slope stability (Keller and Sherar 2003). Final design of the road would determine road widths and shoulder reinforcements needed but would stay within the preliminary design disturbance area. Ground disturbance would be limited to the approximately 14-foot-wide road area.

One LWC would be needed where the proposed new road segment crosses the Holden Canyon ephemeral wash area. The crossing would ideally be made of reinforced concrete, downstream sill, native cobble reinforcement, and possible excavation of approximately 3 feet down may be needed (approximate design). The LWC should be designed for flooding between the 25- to 100-year events which, based on preliminary modeling, would require a LWC length of approximately 140 feet. The LWC width would be approximately 14 feet wide to match the proposed road. Ground disturbance for construction of the low-water crossing would consist of approximately 0.08 acre of temporary disturbance surrounding the site (disturbance during construction activities) and 0.05 acre of permanent disturbance (low-water crossing).

Within existing road segments with sensitive resources, such as cultural sites, riparian areas, and special status plant locations, no improvement or repair activities would occur to avoid potential impacts to these resources (avoidance areas).

2.2 Proposed Road Decommissioning

CBP and USFS propose to decommission 20 existing unimproved road segments within the Nogales Ranger District totaling 3.94 miles to offset the proposed approximately 3.75 miles of new road construction for access to Holden Canyon (Table 2, Figures 2.13 through 2.20, Appendix A). The USFS requirement for the proposed road decommissioning would include barricading the roadway to prevent motorized vehicle travel onto the roadway. Barricades would include either fencing or boulders across the roadway and several feet beyond the road edge to prevent access around the barrier.

Table 2 Proposed Roads for Decommissioning within the Nogales Ranger District	
USFS Road Number/Name	Length (miles)
Road 509. Part of the road is the proposed Holden Connector Road. Overlap between 509 and Holden Connector is not calculated.	0.10
Road 253	0.17
Road 421	0.11
Road 467	0.19
Road 197	0.70
Cantina Connection	0.27
Road 364	0.20
Road 149	0.24
Road 440	0.31
Roads 516, 238 (also includes a small segment of Road 4167)	0.37
Road 505	0.26
Road 438	0.05
Road 505	0.31
Road 564	0.21
Portion of Road 531	0.06
Road 602	0.21
Road 565	0.03
Road 412	0.06
Road 328	0.09
TOTAL	3.94

The roadway surface would be tilled (using hand tools or machines to physically break up shallow, compacted soils) and seeded along areas visible from decommissioned road end points except within areas with sensitive biological and cultural resources (avoidance areas). Approximately 5.82 acres would potentially be temporarily disturbed for long-term restoration of decommissioned road areas (calculations assumed a 14-foot-wide road and entire road length). Selected methods for a given road segment would depend on site-specific needs, according to the judgments of the road engineer and other staff.

Within decommissioned road segments with sensitive resources, such as cultural sites, riparian areas, and special status plant locations, no decommissioning activities would occur to avoid potential impacts to these resources (avoidance areas).

Decommissioning of these roads would contribute to the reduction of vehicle noise and increase the opportunities for quiet recreation, as emphasized in the Forest Plan. These road segments are duplicative of nearby roads that would continue to provide patrol, grazing allotment, and recreational access, no access opportunities would be lost.

3.0 Regulatory Setting

In response to rising concern associated with increasing GHG emissions and global climate change impacts, several plans and regulations have been adopted at the international, national, and state levels with the aim of reducing GHG emissions. The following is a discussion of the federal, state, and local plans and regulations most applicable to the Proposed Action.

3.1 Federal

3.1.1 U.S. Environmental Protection Agency

In 2009, the U.S. EPA issued its science-based finding that the buildup of heat-trapping GHGs in the atmosphere endangers public health and welfare (U.S. EPA 2009). The "Endangerment Finding" reflects the overwhelming scientific evidence on the causes and impacts of climate change. It was made after a thorough rulemaking process considering thousands of public comments and was upheld by the federal courts. The U.S. EPA has many federal level programs and projects to reduce GHG emissions. The U.S. EPA provides technical expertise and encourages voluntary reductions from the private sector. The U.S. EPA also collaborates with the public sector, including states, tribes, localities, and resource managers, to encourage smart growth, sustainability preparation, and renewable energy and climate change preparation. These initiatives include the Clean Energy – Environment State Partnership Program, the Climate Ready Water Utilities Initiative, the Climate Ready Estuaries Program, and the Sustainable Communities Partnership.

To date, no national standards have been established for nationwide mobile-source GHG reduction targets, nor have any regulations or legislation been enacted specifically to address climate change and GHG emissions reduction at the project level.

3.1.2 U.S. Forest Service

In 2009, the USFS issued guidance for climate change considerations for NEPA analysis "Climate Change Consideration in Project Level NEPA Analysis" (USFS 2009). The basic concepts outlined in the guidance are:

1. Climate change effects include the effects of agency action on global climate change and the effects of climate change on a proposed project.
2. The Agency may propose projects to increase the adaptive capacity of ecosystems it manages, mitigate climate change effects on those ecosystems, or to sequester carbon.
3. It is not currently feasible to quantify the indirect effects of individual or multiple projects on global climate change and therefore determining significant effects of those projects or project alternatives on global climate change cannot be made at any scale.
4. Some project proposals may present choices based on quantifiable differences in carbon storage and GHG emissions between alternatives.

In 2023, the Deputy Chief of the National Forest System released updated guidance on how to consider GHG emissions and climate change in project-level NEPA analysis and documentation in response to the 2023 Council of Environmental Quality guidance (see Section 3.1.3 below). The

guidance was developed to ensure the USFS addresses climate change in NEPA analyses by considering the following (USFS 2023a):

1. A proposed project's effects on climate change through the estimation of GHG emissions.
2. Quantification of GHG emissions for a proposed action and all alternatives, including the no action alternative.
3. Contextualization of GHG emissions through social cost, equivalences, and climate action goals.
4. Climate change effects on a proposed project and how proposed actions, project objectives, project design, etc. can help ecosystems and human communities adapt to a changing climate.

Also in 2023, Region 3 (Arizona and New Mexico, Southwestern Region) released a Regional Climate Adaption Strategy. The adaptation strategy was developed to provide guidance and a workflow to help land managers incorporate climate adaptation and set priorities in planning, and to narrow adaptation options for the consideration of project-level tactics (USFS 2023b).

3.1.3 Council on Environmental Quality

In 2023, the CEQ issued interim guidance to assist federal agencies in their consideration of the effects of GHG emissions and climate change when evaluating proposed major federal actions in accordance with NEPA and the CEQ Regulations Implementing the Procedural Provisions of NEPA (CEQ 2023). This guidance was developed to help facilitate compliance with existing NEPA requirements, improving the efficiency and consistency of reviews of proposed federal actions for agencies, decision makers, project proponents, and the public. The guidance provides federal agencies a common approach for assessing their proposed actions, while recognizing each agency's unique circumstances and authorities.

This guidance explains how agencies should apply NEPA principles and existing best practices to their climate change analyses by:

- Recommending that agencies leverage early planning processes to integrate GHG emissions and climate change considerations into the identification of proposed actions, reasonable alternatives (as well as the no-action alternative), and potential mitigation and resilience measures;
- Recommending that agencies quantify a proposed action's projected GHG emissions or reductions for the expected lifetime of the action, considering available data and GHG quantification tools that are suitable for the proposed action;
- Recommending that agencies use projected GHG emissions associated with proposed actions and their reasonable alternatives to help assess potential climate change effects;
- Recommending that agencies provide additional context for GHG emissions, including through the use of the best available social cost of GHG (SC-GHG) estimates, to translate climate impacts into the more accessible metric of dollars, allow decision makers and the public to make comparisons, help evaluate the significance of an action's climate change effects, and better understand the tradeoffs associated with an action and its alternatives;

- Discussing methods to appropriately analyze reasonably foreseeable direct, indirect, and cumulative GHG emissions;
- Guiding agencies in considering reasonable alternatives and mitigation measures, as well as addressing short- and long-term climate change effects;
- Advising agencies to use the best available information and science when assessing the potential future state of the affected environment in NEPA analyses and providing up to date examples of existing sources of scientific information;
- Recommending agencies use the information developed during the NEPA review to consider reasonable alternatives that would make the actions and affected communities more resilient to the effects of a changing climate;
- Outlining unique considerations for agencies analyzing biogenic carbon dioxide sources and carbon stocks associated with land and resource management actions under NEPA;
- Advising agencies that the "rule of reason" and "concept of proportionality" inherent in NEPA and the CEQ Regulations should guide agencies in determining, based on their expertise and experience, how to consider an environmental effect and prepare an analysis based on the available information; and
- Reminding agencies to incorporate environmental justice considerations into their analyses of climate-related effects, consistent with Executive Orders 12898 and 14008.

3.2 State

The state of Arizona has not adopted a statewide climate action plan and no regulations aimed at identifying statewide and regional GHG emissions caps or GHG emissions reduction targets.

4.0 GHG Inventories

4.1 National GHG Inventory

The U.S. EPA develops an annual report, called the Inventory of U.S. Greenhouse Gas Emissions and Sinks, that tracks U.S. GHG emissions and sinks by source, economic sector, and GHG going back to 1990. A summary of the 1990 and 2021 (most current) national GHG emissions by economic sector is provided in Table 3.

Table 3 National GHG Emissions by Sector		
Sector	1990 Emissions in MMT CO_2E[a]	2021 Emissions in MMT CO_2E[a]
Transportation	1,521.4	1,804.3
Electric Power Industry	1,879.7	1,584.1
Industrial	1,677.3	1,487.3
Agriculture	592.9	635.8
Commercial	447.0	439.2
Residential	345.6	365.6
U.S. Territories	23.4	24.1
Total Gross Emissions (Sources)	**6,487.3**	**6,340.2**
Land Use, Land Use Change, and Forestry (LULUCF) Sector Net Total[b]	*(881.0)*	*(754.2)*
Net Emissions (Sources and Sinks)	**5,606.4**	**5,586.0**

SOURCE: U.S. EPA 2023.
[a]MMT CO^2E = million metric tons carbon dioxide equivalent.
[b]The LULUCF Sector Net Total is the net sum of all LULUCH CH_4 and N_2O emissions to the atmosphere plus LULUCF net carbon stock changes.
Notes: Total (gross) emissions are presented without LULUCF. Total net emissions are presented with LULUCF. Totals may not sum due to independent rounding. Parentheses indicate negative values or sequestration.

4.3 Local GHG Inventory

The Pima Association of Governments completed a GHG inventory in 2019 using the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions v.1.2 (International Council for Local Environmental Initiative [ICLEI] 2019) and the Local Government Operations Protocol for the Quantification and Reporting of Greenhouse Gas Emissions Inventories v.1.1 (ICLEI 2010).

A County emissions inventory was prepared for 2019, which was the baseline year for the County's Climate Action Plan. Table 4 summarizes the sources and quantities of community emissions. The largest source of emissions is stationary energy.

Table 4 Pima Association of Governments County Community GHG Emissions in 2019	
Sector	2019 GHG Emissions (MT CO_2E)
Stationary Energy (Residential, Commercial and Industrial)	7,017,332 (54%)
On-Road Transportation	3,176,675 (25%)
Waste (Solid and Wastewater Reclamation)	151,958 (1%)
Transportation - Non-Road	532,403 (4%)
Transportation - Locomotive	100,752 (1%)
Transportation - Aircraft	653,078 (5%)
Industrial Processes	893,556 (7%)
Central Arizona Project - Water	412,352 (3%)
TOTAL	12,938,106 (100%)
SOURCE: Pima Association of Governments 2021. MT CO_2E = metric tons of carbon dioxide equivalent	

5.0 Proposed Action Analysis

The potential GHG emissions for the Proposed Action only address climate change impacts and non-biogenic carbon emissions from the proposed activities. Non-biogenic emissions include CO_2 emissions from the combustion of fossil fuels, CO_2 emissions from other non-combustion processes, and the portion of CO_2 from fuels with a fossil and biomass component that is considered fossil in origin.

A forest-unit (the entirety of the Coronado National Forest) level carbon white paper has been prepared by USFS staff that fulfills the biogenic carbon emission requirement (see Coronado Carbon Assessment in the Project Record). The unit-level carbon whitepaper covers baseline carbon stocks, pools, trends, and disturbance impacts. Biogenic emission sources are emissions that come from organic sources, such as wood, vegetation, and soil that were originally removed from the atmosphere by photosynthesis and, under natural conditions, eventually cycles through living organisms and the atmosphere.

5.1 Construction Emissions

The proposed Holden Canyon Connector Road project would result in short-term emissions associated with construction. Construction emissions associated with the Proposed Action were estimated using the USFS Greenhouse Gas Calculator for Mining, Construction, Hauling, and Commuting calculator (USFS 2023c). This calculator can be used to assist in developing GHG emission estimates for typical equipment and vehicles encountered in mining, construction, and other USFS projects.

The calculator relies on emission factors from the latest version of the U.S. EPA's Motor Vehicle Emissions Simulator, the 2022 EPA Automotive Trends Report, and AP-42 Compilation of Air Pollutant Emissions Factors. Emission factors are based on national-level data. The "Large

Equipment" calculator contains all emission sources described in the U.S. EPA NONROAD model including those that may not be encountered in USFS projects. Examples include bore/drill rigs, cement mixers, excavators, trenchers, etc. Inputs needed include operating hours, fuel type (diesel or gasoline), and horsepower. If these inputs are not available, an alternative option to estimate emissions is provided using fuel consumption data. Inputs needed for this alternative option include the fuel type (diesel or gasoline) and the volume of fuel consumed (in gallons). "Hauling and Commuting" refers to emission sources such as motor vehicles and short-haul/long-haul trucks. Inputs needed include the anticipated miles traveled. An alternative option is provided as well and requires the fuel type and the amount of fuel consumed. If fuel consumption data are available, either through expert opinion or historical fuel purchase receipts, it should be used for both "Large Equipment" and "Hauling and Commuting" tabs. Non-CO_2 GHG emissions from the sources in the tool are not considered significant and are not included.

5.1.1 Construction Equipment

Construction equipment needed to improve, repair, and construct the proposed road would include trackhoes, bulldozers, dump trucks, graders, compactors, loaders, and similar heavy equipment. A water tender would also be used for compaction of the road surface and dust abatement during construction (considered under Dump/Haul Truck). Table 5 summarizes the modeled construction equipment for each phase. It should be noted that this equipment list is preliminary because the road engineering is currently not considered the final of design; however, it is representative of what would be required.

Table 5
Construction Parameters

Phase	Phase Duration (Days/Miles)	Equipment
Road Improvement and Repair	40 Days	Excavator
	18 Days	Crawler Tractor/Dozer with Straight Blade
	18 Days	Crawler Tractor/Dozer with Six-way Blade
	8 Days	Grader
	20 Days	Dump/Haul Truck
	16,000 miles	4 Workers/Commuting Vehicles/Light Truck
Road Construction	12 Days	Dump/Haul Truck
	12 Days	Dump/Haul Truck
	24 Days	Crawler Tractor/Dozer
	24 Days	Crawler Tractor/Dozer
	12 Days	Grader
	12 Days	Soil Compactor
	12 Days	Excavator
	16,800 miles	7 Workers/Commuting Vehicles/Light Truck
Road Decommissioning	9 Days	Excavator
	9 Days	Crawler Tractor/Dozer
	9 Days	Crawler Tractor/Dozer
	4,800 miles	3 Workers/Commuting Vehicles/Light Truck

SOURCE: USFS 2023c.

5.1.2 Calculation Results

Using the methodology discussed in Section 5.1, total construction emissions were calculated using the USFS Region 8 Greenhouse Gas Calculator for Mining, Construction, Hauling, and Commuting calculator and are summarized in Table 6.

Table 6
Proposed Action Construction-Related GHG Emissions
(MT CO_2E per Year)

Phase	Source	Total CO_2 (pounds)	Total CO_2 (metric tons)	GHG Emissions (MT CO_2E)
Road Improvement and Repair	Large Equipment	474,574.30	215.32	215.32
	Hauling and Commuting	15,988.60	7.24	7.24
Road Construction	Large Equipment	485,497.76	220.28	220.28
	Hauling and Commuting	16,788.03	7.62	7.62
Road Decommissioning	Large Equipment	190,724.05	86.54	86.54
	Hauling and Commuting	4,796.58	2.18	2.18
TOTAL		**1,188,369.32**	**539.18**	**539.18**

MT CO_2E = metric tons of carbon dioxide equivalent
Calculation for CO_2E: Multiply GHG (CO_2) by Global Warming Potential (GWP) (CO_2 GWP = 1)

As indicated in Table 6, construction of the Proposed Action would generate 539 MT CO_2E. As compared to the Pima County inventory (see Table 4), 530 MT CO_2E would be 0.00004 percent of GHG emissions in the county. This is the equivalent of adding approximately 116 typical passenger cars (at 4.63 MT CO_2E/year per vehicle) to the road over a short period of time (U.S. EPA 2020). The construction emissions are primarily the result of diesel-powered construction equipment exhaust and would be temporary and cease when construction activities are completed.

While the Proposed Action would result in GHG emissions during construction, it is anticipated that the project would not result in an increase in operational GHG emissions. The construction of a new road segment is proposed to reduce vehicle/patrol miles traveled in the Holden Canyon area. Currently, patrol vehicles must travel approximately 24 miles in order to access the eastern or western portions of the Holden Canyon area, there is currently no existing vehicle access. The proposed new road segment would reduce vehicle miles traveled by providing direct access to the Holden Canyon area.

Patrol and access of the existing road segments would likely stay at current levels; there is no anticipated change. Vehicle use of the proposed new road segment would likely be similar to existing use as the road segment connects existing road segments. Vehicle miles traveled would decrease due to the proposed new road segment and decreased use of the longer route currently used to reach the Holden Canyon area. Therefore, the Proposed Action is not anticipated to generate new vehicle trips and would not substantially increase operational emissions relative to existing conditions. Additionally, the Proposed Action does not conflict with any applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs. Overall, the Proposed Action is not anticipated to result in an operational GHG impact.

5.2 Project-Level GHG Reduction Strategies

The following measures would also be implemented as avoidance and minimization measures to reduce GHG emissions and potential climate change impacts from the Proposed Action.

- Construction activities shall comply with all appropriate regulations, including Arizona Administrative Code R18-2-604 through 607, and R18-2-804; and Pima County Code 17.1 and 17.16, which require mitigation measures for the control of dust from open areas, roadways, and material handling; control of emissions from the operation of mobile equipment; fugitive dust permits for activities such as building roads; and limits on visible emissions.
- All surface disturbances, including road construction and associated travel, would be kept to the minimum necessary to accomplish construction of the road.
- The perimeter of all new areas to be disturbed would be clearly demarcated using flagging or temporary construction fencing. No disturbance would be allowed outside that perimeter.
- Disturbed areas would be revegetated with native species.
- Suitable species and establishment techniques would be used to cover or revegetate disturbed areas in compliance with local direction and requirements in accordance with USFS Manual (FSM) 2070 and FSM 2080 for vegetation ecology and prevention and control of invasive species.
- If vegetation must be removed, allow natural regeneration of native plants by cutting vegetation with hand tools, mowing, trimming, or other removal methods that allow root systems to remain intact.
- Vegetation targeted for retention would be flagged to reduce the likelihood of being disturbed.
- Preparation and implementation of a Storm Water Pollution Prevention Plan would address erosion control necessary to comply with the Arizona Pollutant Discharge Elimination System Construction General Permit conditions and apply mitigation measures where necessary.
- Construction would adhere to mitigation measures for erosion control and sediment runoff to surface waters (USFS 2012).

5.3 Council on Environmental GHG Guidance

The CEQ has issued interim guidance to assist agencies in analyzing GHGs and climate change effects of their proposed actions under NEPA (CEQ 2023). The guidance states "NEPA reviews should quantify proposed actions' GHG emissions, place GHG emissions in appropriate context and disclose relevant GHG emissions and relevant climate impacts, and identify alternatives and mitigation measures to avoid or reduce GHG emissions. CEQ encourages agencies to mitigate GHG emissions associated with their proposed actions to the greatest extent possible, consistent with national, science-based GHG reduction policies established to avoid the worst impacts of climate change." The guidance goes on to say that "when conducting climate change analyses in NEPA reviews, agencies should consider: (1) the potential effects of a proposed action on climate change, including

by assessing both GHG emissions and reductions from the proposed action; and (2) the effects of climate change on a proposed action and its environmental impacts."

5.3.1 Potential Effects of the Proposed Action on Climate Change

GHG emissions associated with temporary construction activities have been calculated and are summarized in Table 6. Additionally, the Proposed Action would implement GHG reduction strategies outlined in Section 5.3. These strategies were not factored into the GHG emission calculations. Therefore, implementation of these measures would reduce GHG emissions beyond those summarized in Table 6. Furthermore, Proposed Action GHG emissions would be temporary and would cease after construction activities are complete. The Proposed Action would not result in an increase in long-term operational emissions because no increase in vehicle travel would likely occur. Rather, the Proposed Action would improve connectivity to the Holden Canyon area, thereby resulting in a decrease in vehicle miles traveled and GHG emissions when compared to the existing condition. Therefore, the Proposed Action would not have a significant effect on climate change.

5.3.2 Potential Effects of Climate Change on the Proposed Action

The construction period (road segment improvement, repair, construction, and decommissioning) would occur over an approximately six-month period (October through March). Based on current trends, average air temperatures at the start and finish of construction should not be noticeably different. Rising temperatures in the region and further destabilization from extreme weather conditions in the Global South may impact CBP's operations and ability to operate in the future within the southwest region of the United States, including the Tucson Sector. With the increase in extreme and unpredictable weather, CBP and USFS may need to extend construction activities to offset the impact of delayed work, resulting from high winds or other unsafe working conditions.

Many natural systems are expected to be affected by climate change; therefore, a proposed project should consider the likely impacts of climate change on the project's short- and long-term suitability and resilience. The frequency and severity of natural hazards may be affected by climate change, including:

- Flooding
- Extreme storms
- Drought
- Extreme heat
- Wildfires

Similarly, climate change may alter site suitability factors, such as:

- Air quality
- Soil stability
- Water resources, such as: excessive stormwater runoff and site flooding

It is USFS policy to incorporate climate considerations into decision-making and build resilience against the impacts of climate change. Climate change is creating warmer temperatures, deeper droughts, and drier vegetation. These conditions will likely persist in the coming decades and lead to an increase in the extent, intensity, and frequency of wildfires. The potential increase in wildfires within the Nogales Ranger District may result in road access limitations or road closures. Wildfires also lead to health and safety risks from fire and smoke exposure.

With average temperatures rising due to climate change, historically dry areas across the U.S., including southern Arizona, are likely to experience less precipitation and increased risk of longer, more intense droughts. Droughts cause dry forest conditions which lead to higher wildfire potential. Increased wildfires, as mentioned above, can lead to road closures.

Drought, extreme heat, and extreme weather that could lead to flooding all impact road soils. Within drought areas, the effects of runoff and wind exacerbate the rate of soil erosion. The drying of soils due to drought and extreme heat creates cracks which reduce the moisture and volume of soils. Heavy rain events can then result in higher erosion potential of dried, cracked soils, which in turn leave damaged roads that may require higher levels of maintenance and repair, and may require road closures or a pause in Proposed Action construction activities.

6.0 Social Cost Analysis

SC-GHG values are calculated using models that translate changes in emissions into economic values, which allows decision-makers and the public to make comparisons, help evaluate the significance of an action's climate change effects, and better understand the tradeoffs associated with an action and its alternatives. The SC-GHG is the monetary value of the net harm to society associated with adding GHGs to the atmosphere in a given year. In principle, it includes the value of all climate change impacts, including (but not limited to) changes in net agricultural productivity, human health effects, property damage from increased flood risk natural disasters, disruption of energy systems, risk of conflict, environmental migration, and the value of ecosystem services (Interagency Working Group on Social Cost of Greenhouse Gases 2021).

The SC-GHG estimates are certainty-equivalent values that account for the uncertainty in future consumption per capita, and the certainty-equivalent discount factor incorporates this uncertainty. For most analyses, constant discount using the near-term target rate provides a close approximation of the present value from a policy action.

The metric of social cost is a range of estimates, in dollars, of the long-term damage done by one ton of GHG emissions. The model captures the pathway through which an extra ton of emissions leads to a change in atmospheric concentrations, which in turn leads to changes in average global surface temperature and precipitation. This then leads to biophysical impacts on changes in agricultural productivity, changes in health outcomes, sea level rise and coastal property damage, changes in energy consumption and declines in labor productivity.

Based on the Proposed Action's estimated GHG emissions (539.18 $MTCO_2E$; see Table 6), the net social costs using the estimates of social cost of carbon ($SC\text{-}CO_2$) are shown in Table 7 below. Social costs are shown for the base year, which is the year construction activities may begin. There are no

social costs beyond the base year as construction activities would last no more than six months (March through October) and occur only once (no construction activities beyond the base year).

Table 7
Proposed Action Construction-Related Social Costs of CO_2
(Base Year 2025)

Emission	Average 5%	Average 3%	Average 2.5%	95th Percentile 3%
CO_2	$9,000	$30,000	$44,000	$89,000

SOURCE: USFS 2023d.

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2023d Social Cost-Greenhouse Gas Calculator. 4 pp.

Appendix A

Figures

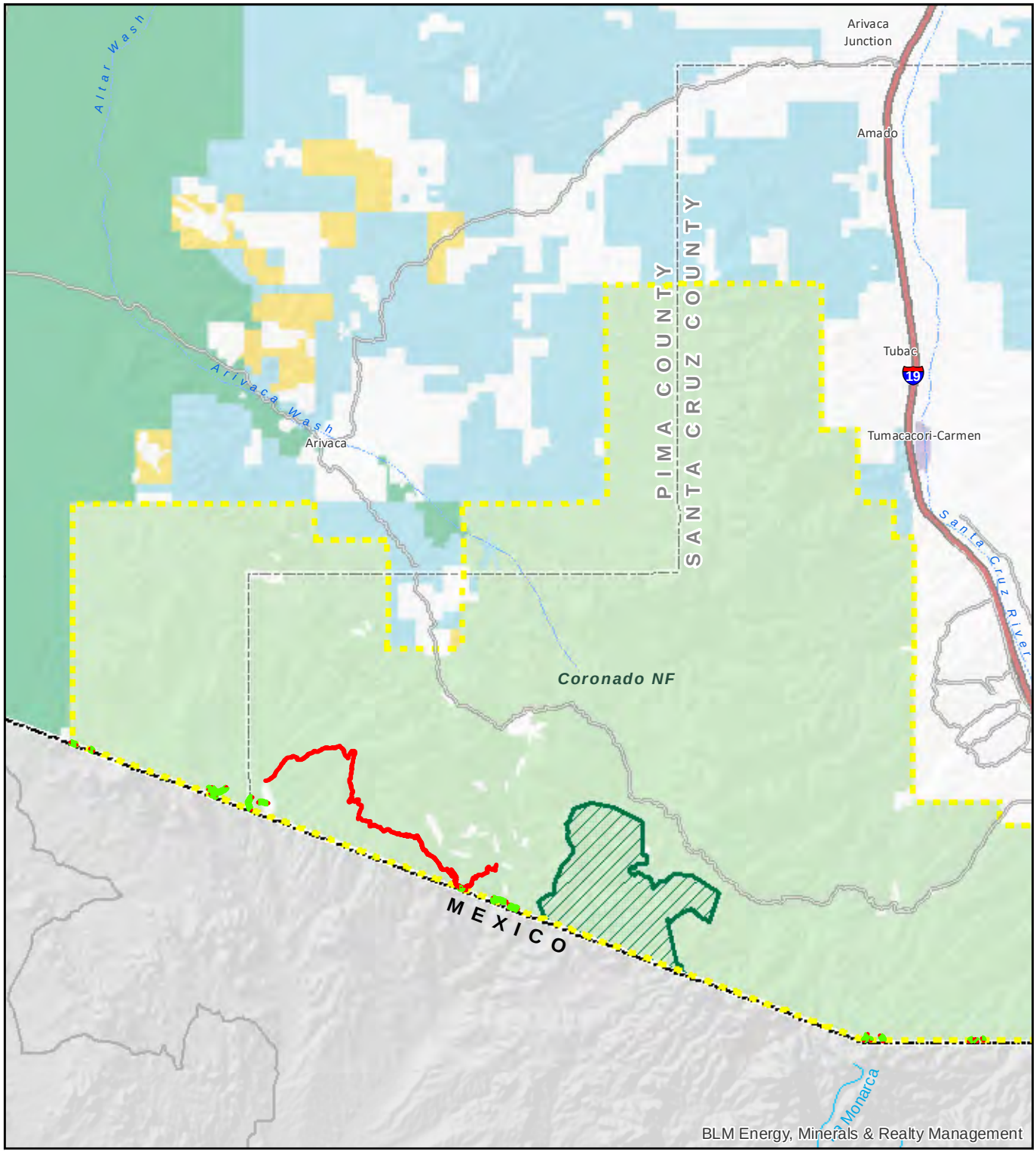


FIGURE 1.1
Regional Location

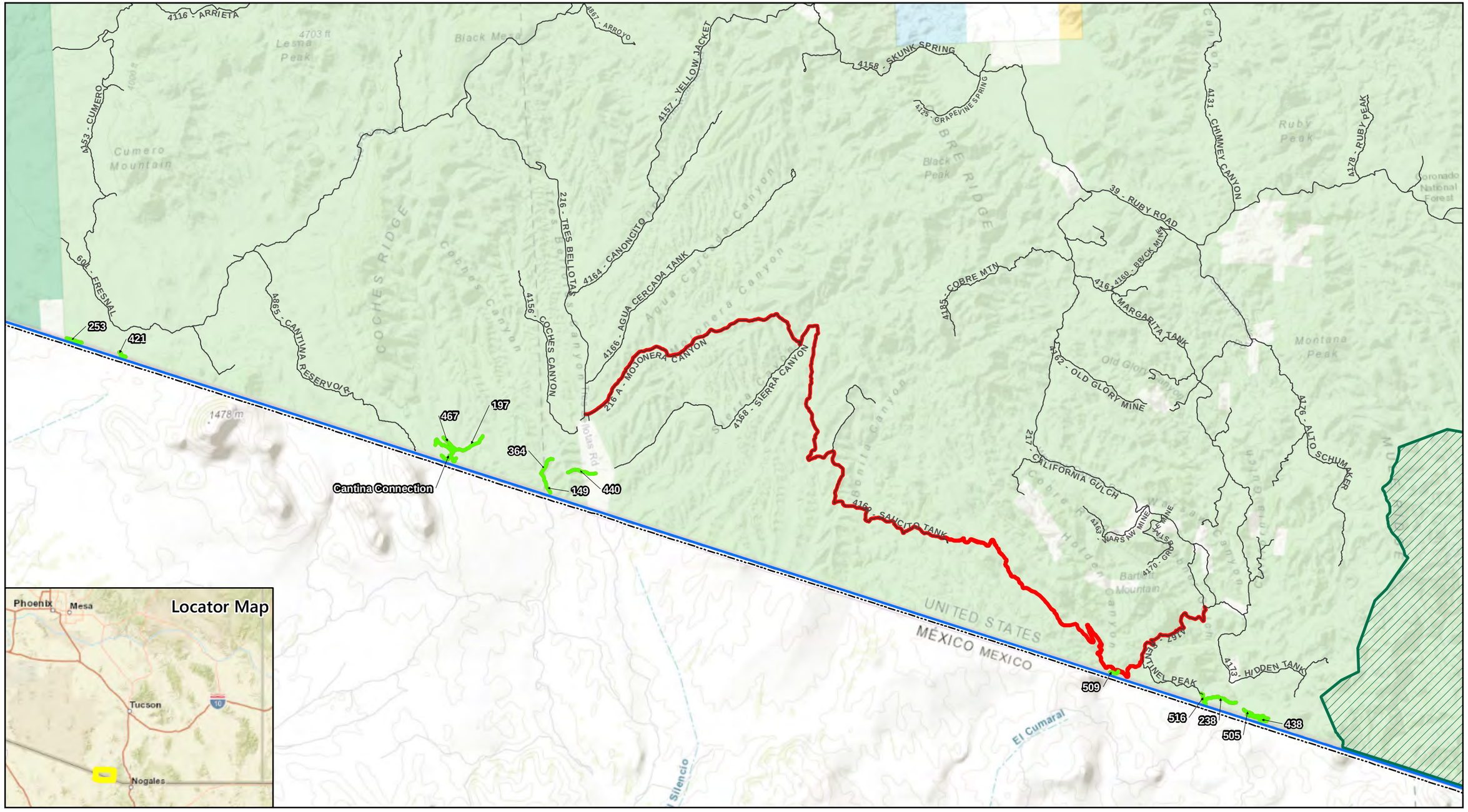
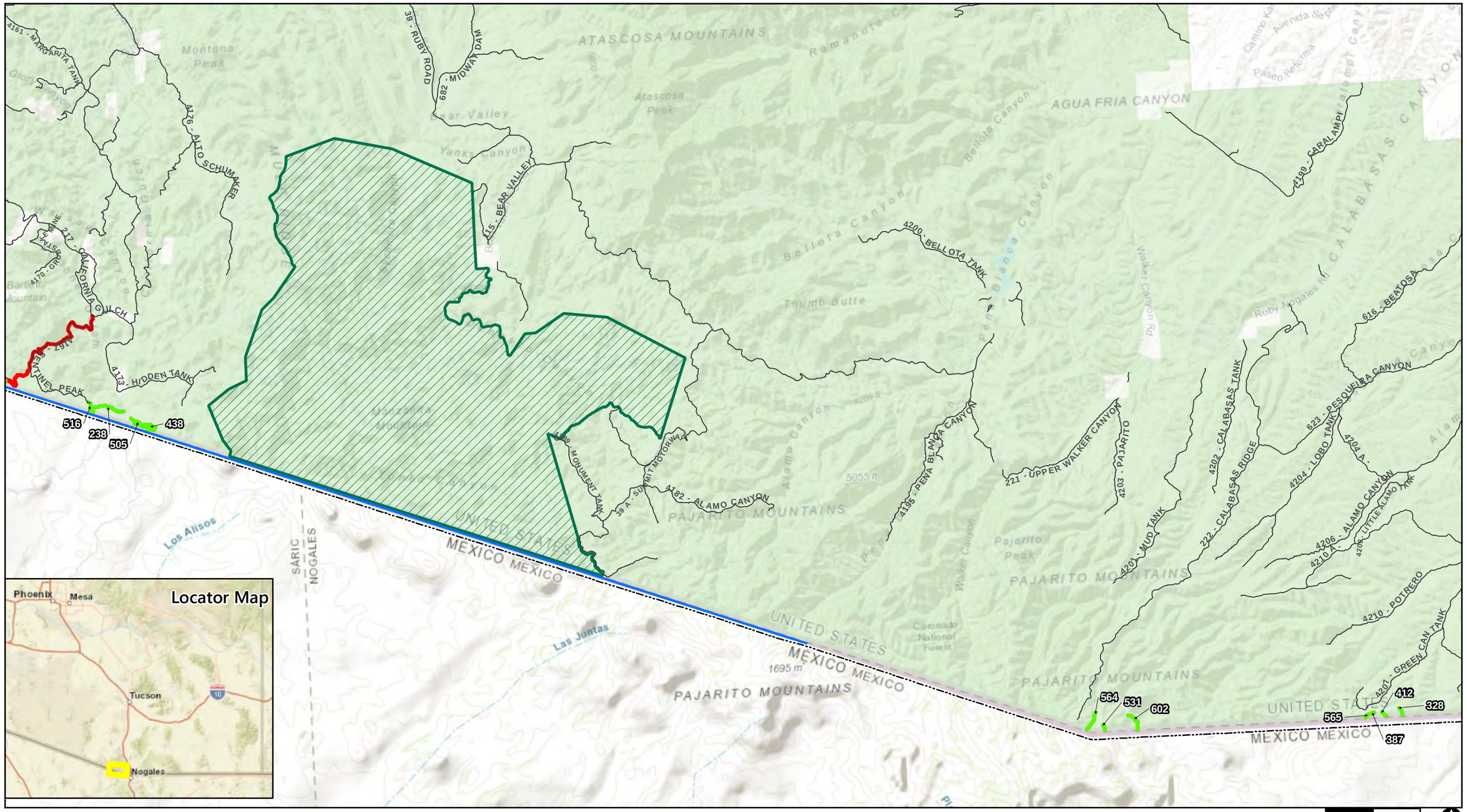


FIGURE 1.2
Proposed Holden Canyon Connector Road Project Area – Western Extent



Proposed Holden Canyon Connector Road Project Area

Proposed Decommissioned Roads

Existing Forest Service Roads

Border Road

U.S./Mexico International Border

US Forest Service Tumacacori EMA

Private or Unknown

Pajarita Wilderness Area

FIGURE 1.3

Proposed Holden Canyon Connector Road Project Area – Eastern Extent

Image Source: Maxar (flown January 2022)

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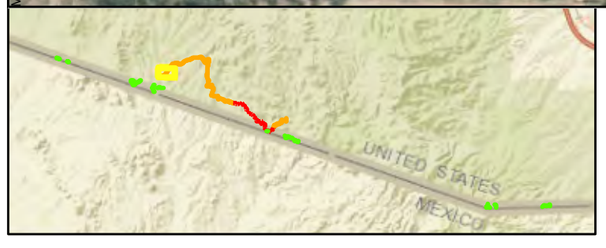

Existing Road Segments

New Road Segment

Proposed Decommissioned Roads

14-foot Road Width Disturbance Area

0 Feet 300

FIGURE 2.1
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

FIGURE 2.2
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

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- Existing Road Segments
- New Road Segment
- Proposed Decommissioned Roads
- 14-foot Road Width Disturbance Area

0 Feet 300

FIGURE 2.3
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

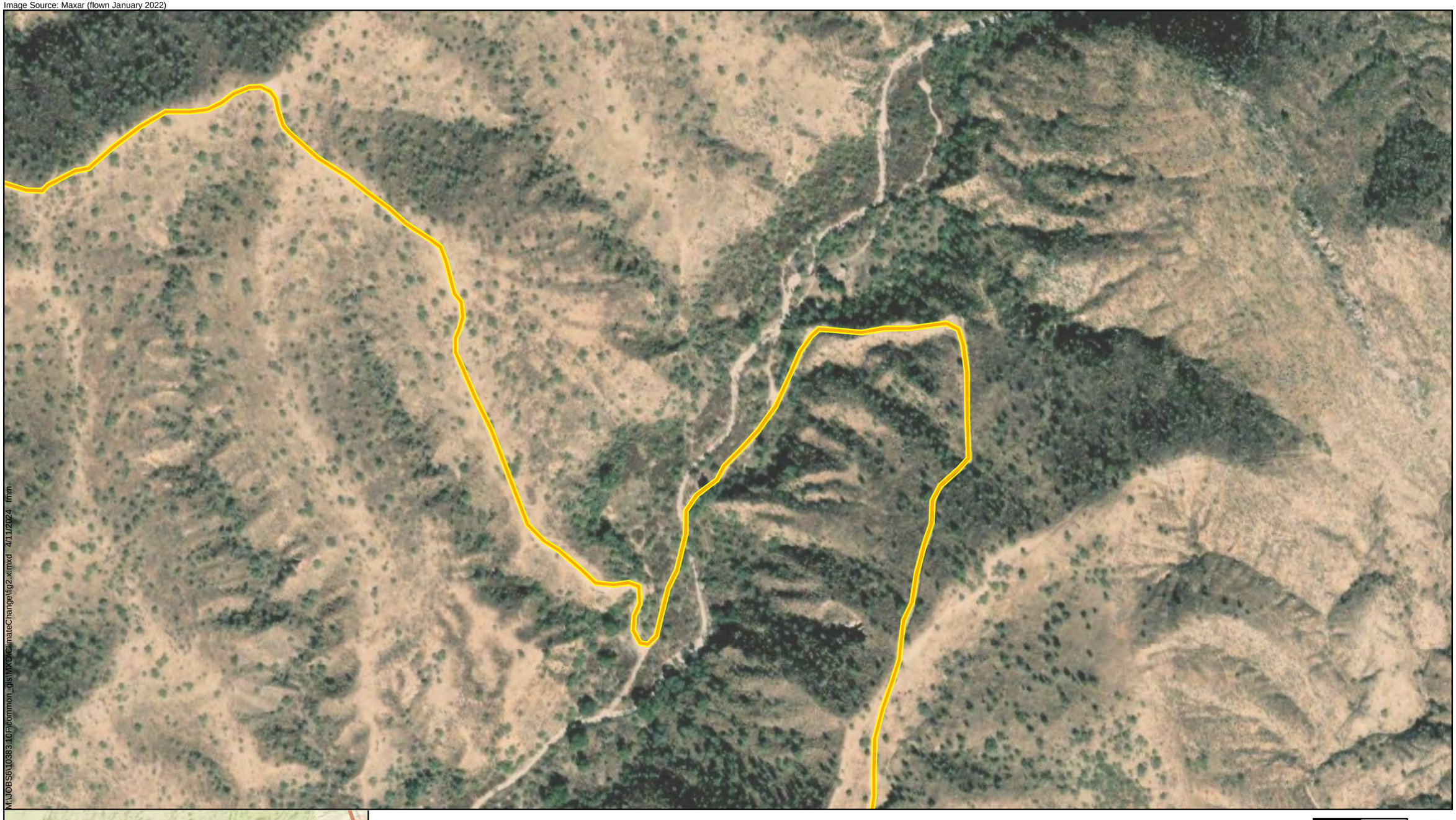

FIGURE 2.4
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

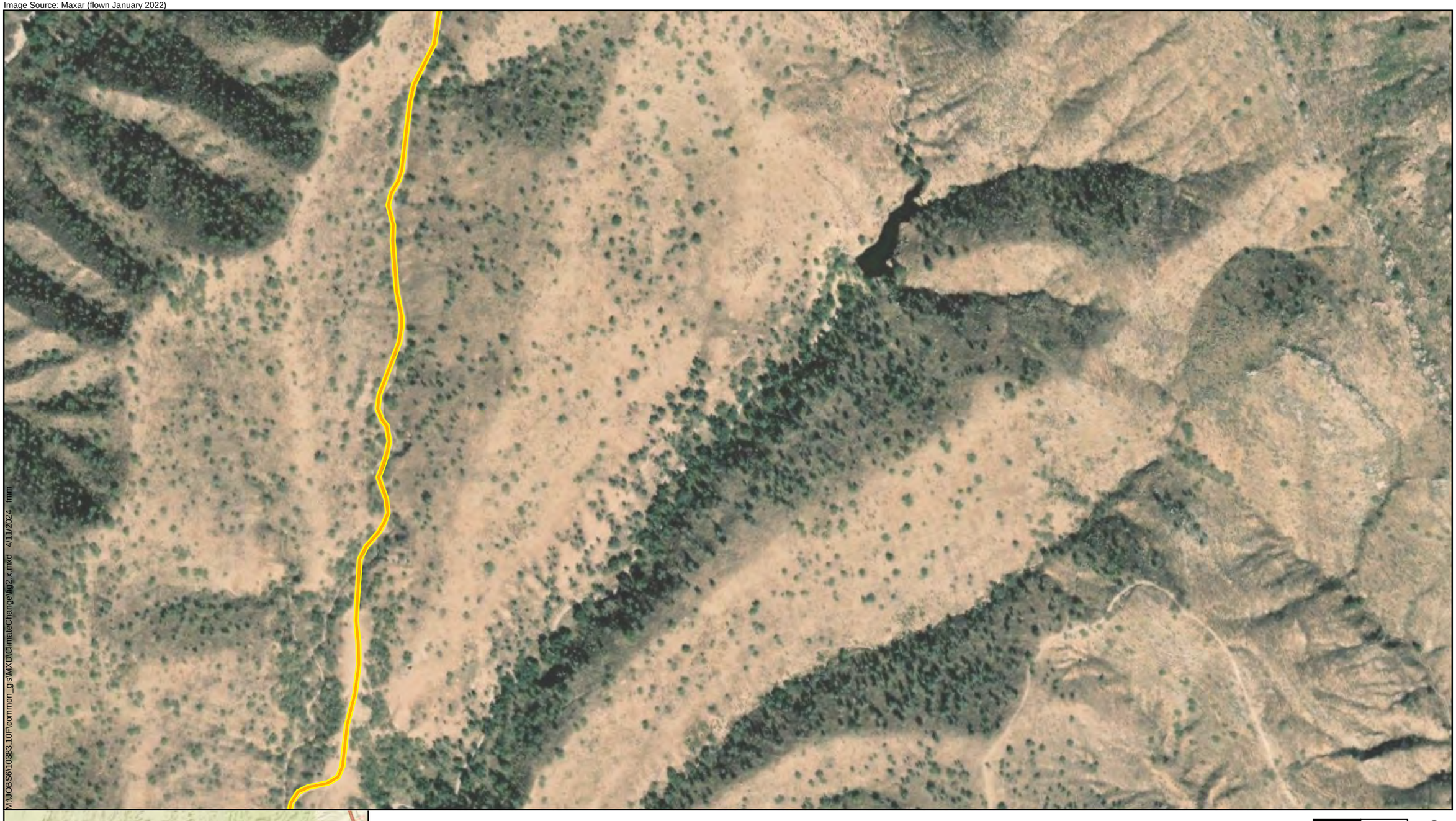

FIGURE 2.5
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

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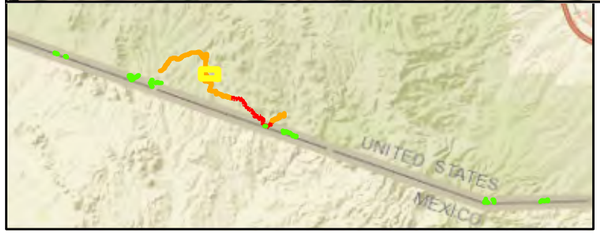


Existing Road Segments

New Road Segment

Proposed Decommissioned Roads

14-foot Road Width Disturbance Area

0 Feet 300

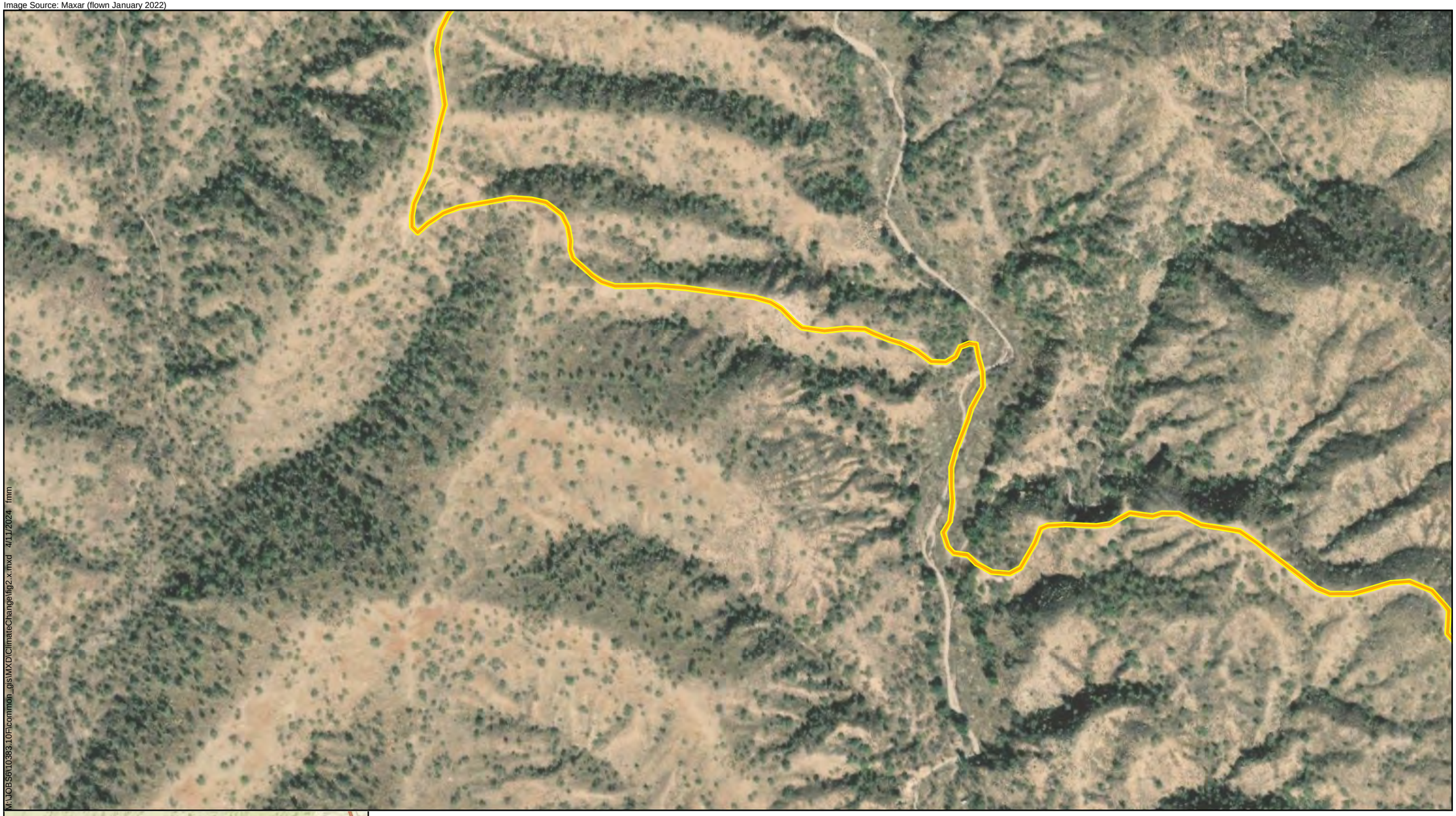
FIGURE 2.6

Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

FIGURE 2.7
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)



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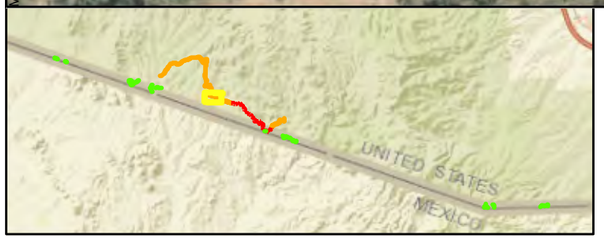
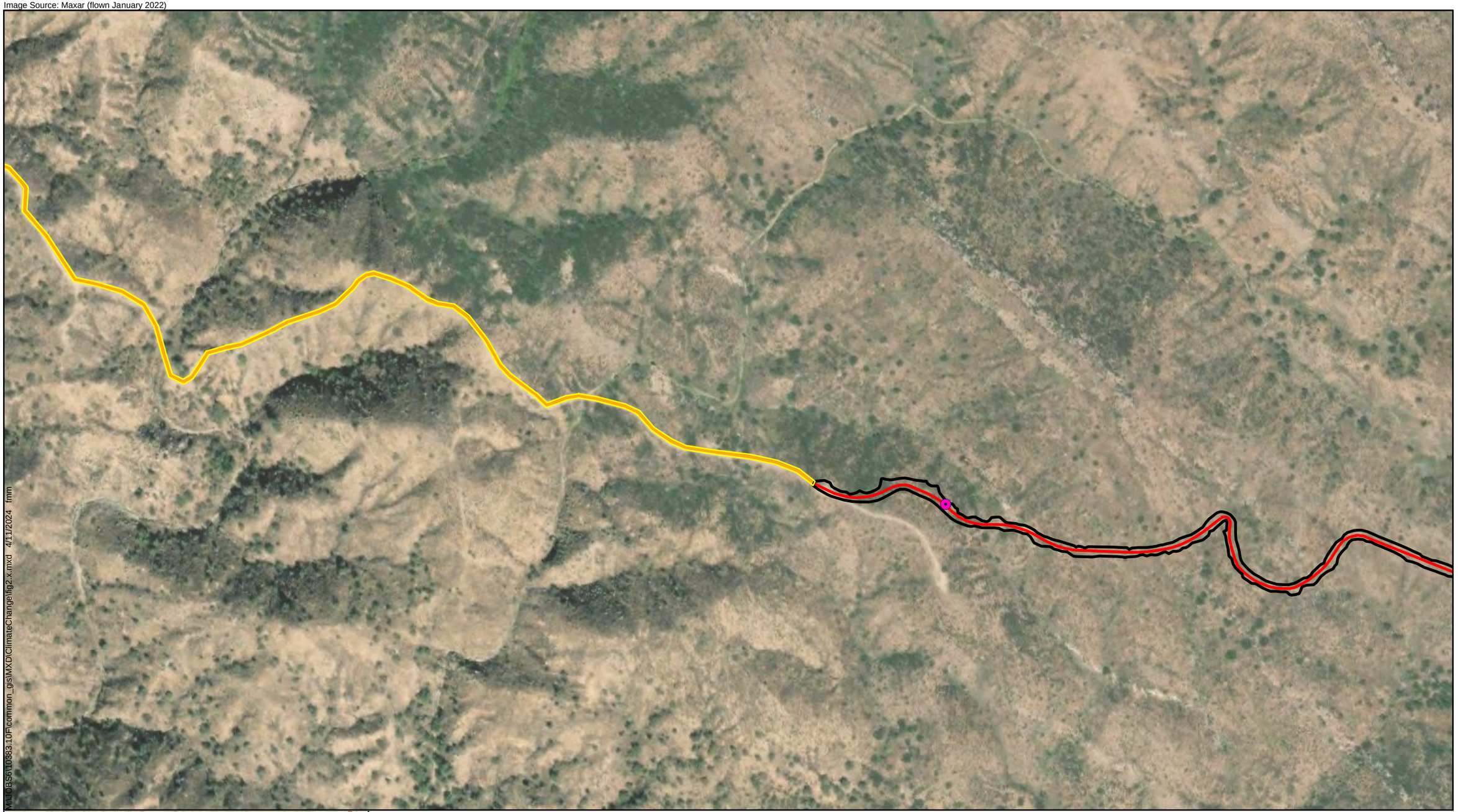


Existing Road Segments
New Road Segment
Proposed Decommissioned Roads
14-foot Road Width Disturbance Area

0 Feet 300

FIGURE 2.8
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)



- Existing Road Segments
- New Road Segment
- Proposed Decommissioned Roads
- 14-foot Road Width Disturbance Area
- USFS Alignment Disturbance Area
- Proposed Cattle Guard

0 Feet 300

FIGURE 2.9
Proposed Holden Canyon Connector Road Project Area Detail

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Image Source: Maxar (flown January 2022)

FIGURE 2.10
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

FIGURE 2.11
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

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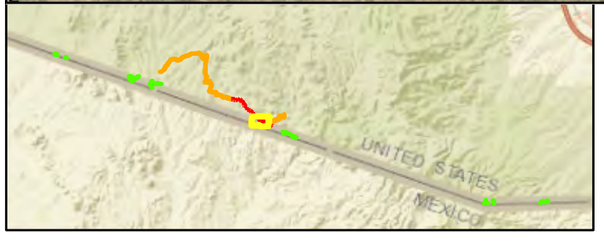

Existing Road Segments
New Road Segment
Proposed Decommissioned Roads
USFS Alignment Disturbance Area

Low-Water Crossing
Permanent Impacts
Temporary Impacts

0 Feet 300

FIGURE 2.12
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

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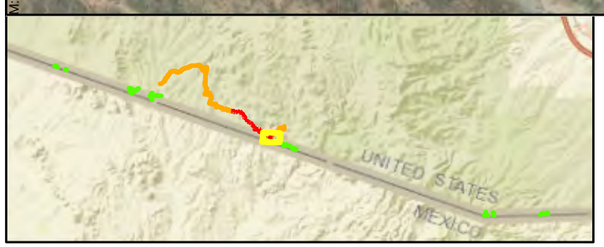

Existing Road Segments
New Road Segment
Proposed Decommissioned Roads
14-foot Road Width Disturbance Area
USFS Alignment Disturbance Area

Low-Water Crossing
Permanent Impacts
Temporary Impacts

0 Feet 300

FIGURE 2.13
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

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Existing Road Segments

New Road Segment

Proposed Decommissioned Roads

Avoidance Areas

14-foot Road Width Disturbance Area

0 Feet 300

FIGURE 2.14
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

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Existing Road Segments
New Road Segment
Proposed Decommissioned Roads

0 Feet 300

FIGURE 2.15
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

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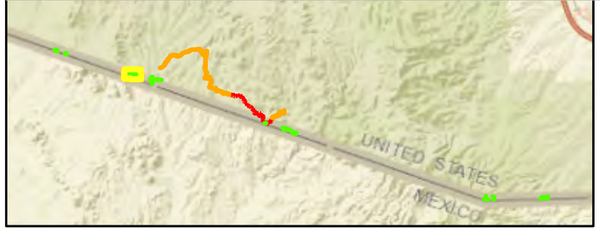

Existing Road Segments
New Road Segment
Proposed Decommissioned Roads

0 Feet 300

FIGURE 2.16
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

FIGURE 2.17
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

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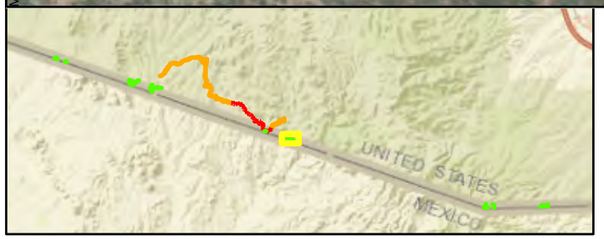

Existing Road Segments
New Road Segment
Proposed Decommissioned Roads
Avoidance Areas

0 Feet 300

FIGURE 2.18
Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

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Existing Road Segments

New Road Segment

Proposed Decommissioned Roads

Avoidance Areas

0 Feet 300

FIGURE 2.19

Proposed Holden Canyon Connector Road Project Area Detail

Image Source: Maxar (flown January 2022)

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Existing Road Segments
New Road Segment
Proposed Decommissioned Roads
Avoidance Areas

0 Feet 300

FIGURE 2.20
Proposed Holden Canyon Connector Road Project Area Detail