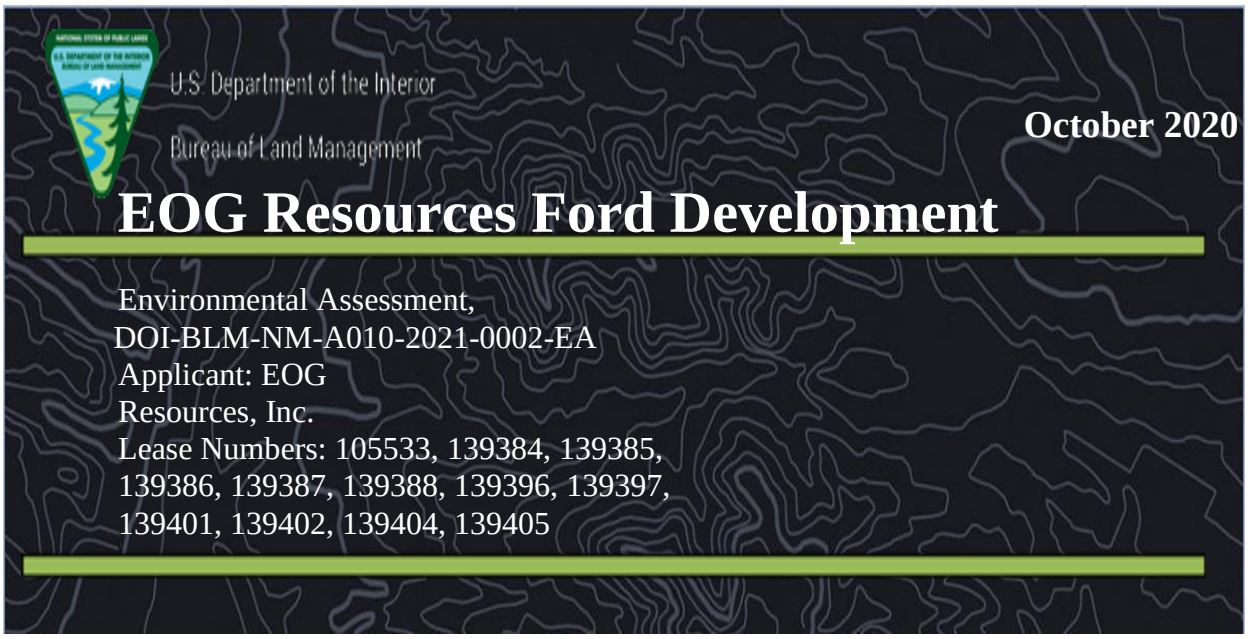

EOG Resources Ford Development

Bullitt 1 Pilot, Bullitt 06 Fed 601H-612H, Capri 04 Fed 601H-612H , Del Rio 12 Fed 601H-612H, Durango 14 Fed 601H-612H, Fairlane 22 Fed 601H-610H, Falcon 05 Fed 601H-612H, Galaxie 12 Fed 601H-612H, Interceptor 02 Fed 601H-612H, Pinto 03 Fed 601H-612H, Starliner 23 Fed 601H-612H, Talladega 14 Fed 601H-612H, Thunderbird 05 Fed 601H-612H, and Torino 02 Fed 601H-612H

Well pads, Production Facilities, Access Roads, Pipelines, Borrow Sources, and Staging Areas

Rio Puerco Field Office

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Albuquerque, NM 87109

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1.0 Introduction

1.1 Summary of Proposed Project

This Environmental Assessment (EA) has been prepared to analyze and disclose the environmental consequences of the Bullitt 1, Bullitt 06 Fed 601H-612H, Starliner 23 Fed 601H-612H, Talladega 14 Fed 601H-612H, Durango 14 Fed 601H-612H, Galaxie 12 Fed 601H-612H, Del Rio 12 Fed 601H-612H, Thunderbird 05 Fed 601H-612H, Falcon 05 Fed 601H-612H, Capri 04 Fed 601H-612H, Interceptor 02 Fed 601H-612H, and Fairlane 22 Fed 601H-610H (Fairlane) Oil and Gas Projects in addition this EA analyzes and discloses the environmental consequences of issuing a Right-of-Way (ROW) and a Mineral Materials Sales contract(s), in support of the development of the Oil and Gas Projects cited above (collectively referred to as the Proposed Action) as proposed by EOG Resources, Incorporated (EOG).

An application for permit to drill (APD) and right-of-way (ROW) grant submittal for Fairlane well pad was previously submitted to the Bureau of Land Management (BLM) Rio Puerco Field Office (RPFO) as a standalone project in July 2020 and filed as DOI-BLM-NM-A010-2020-0090-EA. These projects are now being analyzed under a single EA due to their connectivity, shared resources, and proximity to one another. The Proposed Action includes the construction, operation, maintenance, and reclamation of fourteen well pads and their associated facilities, fourteen access roads, sixteen borrow sources, three staging areas, and fourteen well-connect subsurface pipeline systems for transporting natural gas, oil, and produced water to the proposed EOG Continental Divide (CD) Trunk Line pipeline system. The Proposed Action would also extend the CD Trunk Line by 22,598.64 feet to intercept the new well-connect pipelines.

The complete development of the Proposed Action will be spread out over 20 years. Only one well would be drilled in winter 2020, with well construction increasing to two to six wells per year after that.

The well development and associated infrastructure is necessary to access federal subsurface fluid minerals within active oil and gas leases NMNM 105533, NMNM 139384, NMNM 139385, NMNM 139386, NMNM 139387, NMNM 139388, NMNN 139396, NMNM 139397, NMNM 139401, NMNM 139402, NMNM 139404, and NMNM 139405. The BLM-RPFO is the administrator of the federally allotted minerals within leases referred to in this EA. The Proposed Project Area (PPA) is located within the BLM-RPFO management area approximately 20 miles west of Cuba, New Mexico and entirely within Sandoval County. Specifically, the legal locations of the proposed well pads are as follows:

- Bullitt 1 Pilot: Section 1, Township 21 North, Range 5 West, New Mexico Principal Meridian (NMPM)
- Bullitt 06 Fed 601H (Bullitt 06): Section 6, Township 21 North, Range 4 West, NMPM
- Capri 04 Fed 601H-612H (Capri): Section 4, Township 21 North, Range 4 West, NMPM
- Del Rio 12 Fed 601H-612H (Del Rio): Section 12, Township 21 North, Range 5 West, NMPM
- Durango14 Fed 601H-612H (Durango): Sections 13 & 14, Township 21 North, Range 5 West, NMPM

- Fairlane: Section 22, Township 21 North, Range 5 West, NMPM
- Falcon 05 Fed 601H-612H(Falcon): Sections 5 and 6, Township 21 North, Range 4 West, NMPM
- Galaxie 12 Fed 601H-612H (Galaxie): Section 12**,** Township 21 North, Range 5 West, NMPM
- Interceptor 02 Fed 601H-612H (Interceptor): Section 2, Township 21 North, Range 4 West, NMPM
- Pinto 03 Fed 601H-612H (Pinto): Section 3, Township 21 North, Range 4 West, NMPM
- Starliner 23 Fed 601H-612H (Starliner): Section 23, Township 21 North, Range 5 West, NMPM
- Talladega 14 Fed 601H-612H (Talladega): Section 14, Township 21 North, Range 5 West, NMPM
- Thunderbird 05 Fed 601H-612H (Thunderbird): Sections 5 and 6, Township 21 North, Range 4 West, NMPM
- Torino 02 Fed 601H-612H (Torino): Section 2, Township 21 North, Range 4 West, NMPM

Project maps showing the proposed project area on USGS 7.5-minute topographic quadrangle and digital aerial orthophotography are provided in Appendix E.

1.2 Purpose and Need

The purpose of the Proposed Action is to facilitate reasonable access to EOG upon public lands to develop Federal minerals administered by the BLM and New Mexico Oil Conservation Division (NMOCD) for EOG valid mineral leases (NMNM 105533, NMNM 139384, NMNM 139385, NMNM 139386, NMNM 139387, NMNM 139388, NMNN 139396, NMNM 139397, NMNM 139401, NMNM 139402, NMNM 139404, and NMNM 139405) within the PPA.

The need for the Proposed Action is BLM's requirement to respond to application for permit to drill (APD) and ROW grant submittals, as well as provide a local source of borrow/fill material materials necessary for properly developing the access route, as per 43 CFR 3160 (Onshore Oil and Gas Operations); the Mineral Leasing Act (MLA) of 1920, as amended (30 United States Code [USC] 181 et seq.); the Act of March 3, 1909 (1909 Act); and the Federal Land Policy and Management Act of 1976 (FLPMA; 43 USC 1701 et seq.).

1.3 Decision to be Made

The BLM-RPFO will decide whether or not to approve the Proposed Action and issue the APDs, ROW Grants and Mineral Material sales Contracts associated with the Proposed Action, and if so, under what terms and conditions.

1.4 Land Use Plan Conformance

This EA is prepared in compliance with the National Environmental Policy Act of 1969 (NEPA) and with all applicable guidelines, regulations, and laws passed subsequent to NEPA, including the Council on Environmental Quality (CEQ) regulations (40 CFR 1500-1508); United States Department of the Interior (USDI) requirements (Department Manual 516, Environmental

Quality [USDI 2004]); and the Bureau of Indian affairs (BIA), Indian Affairs Manual (IAM); National Environmental Policy Act Guidebook 59 IAM 3-H (USDI BIA 2013), and BLM guidelines in Handbook H-1790-1 (USDI BLM 2008).

The BLM would handle post-approval operational activities in accordance with operations regulations contained in 43 CFR 3160. All operational regulations, orders, and Notice to Lessees (NTL) apply to development of Indian trust minerals. The BIA may issue notices of noncompliance for violation of terms and conditions of the Minerals Agreement, other than those enforced by BLM and impose its own penalty provisions.

The Proposed Action is in conformance with the October 1992 BLM-RPFO Resource Management Plan (RMP), with Record of Decision (ROD; BLM 1992b) as updated in October of 1992. Pursuant to 40 CFR 1508.28 and 1502.21, this site-specific Environmental Assessment (EA) tiers into and incorporates by reference the information and analysis contained in the BLM-RPFO Resource Management Plan/Final Environmental Impact Statement (RMP/FEIS; BLM 1992a). The RMP was approved by the October 1985, ROD (BLM 1992b), and updated in October 1992 when the boundary of the Rio Puerco Resource Area RPRA was changed.

Also pursuant to 40 CFR 1508.28 and 1502.21, this EA tiers into and incorporates by reference the information and analysis contained in the RPFO December 2018 Competitive Oil and Gas Lease Sale EA (Lease Sale EA; BLM, 2018b) and subsequent addendum (BLM, 2018c).

Specifically, the proposed action supports the following BLM policy:

- It is the policy of the BLM to make mineral resources available for disposal and to encourage development of mineral resources to meet national, regional, and local needs, consistent with national objectives of an adequate supply of minerals at reasonable market prices. At the same time, the BLM strives to ensure that mineral development is carried out in a manner that minimizes environmental damage and provides for the rehabilitation of affected lands (BLM, 2003).

1.5 Scoping and Issues

A Notice of Staking (NOS), used in conjunction with an APD, is submitted to the BLM by an operator to indicate their intent to develop a lease. EOG submitted 14 NOSs to the BLM-RPFO, one for each well pad in the Ford Development, indicating necessary information such as operator contact information, location of access roads and pads, and the number and depth of wells to be drilled. The NOSs were posted to the BLM national website, https://reports.blm.gov/report/AFMSS/34/30-Day-Federal-Public-Posting.. The BLM sent out notification of the NOSs soliciting participation in the On-site inspections. Table 1-1 lists the dates NOSs were submitted to the BLM-RPFO and dates the on-site well pad inspections occurred.

Table 1-1. Dates of NOSs and On-Site Inspections.

Well Pad	NOS Date	On-Site Inspection Date
Bullitt 01	11/21/2019	6/17/2020
Bullitt 06	11/7/2019	6/17/2020

Capri 04	7/24/2020	8/10/2020
Del Rio 12	7/24/2020	8/10/2020
Durango 14	7/24/2020	8/10/2020
Fairlane 22	9/19/2019	8/10/2020
Falcon 05	7/24/2020	8/10/2020
Galaxie 12	7/24/2020	8/10/2020
Interceptor 02	7/24/2020	8/10/2020
Pinto 03	7/24/2020	8/10/2020
Starliner 23	2/3/2020	6/17/2020
Talladega 14	11/7/2020	6/17/2020
Thunderbird 05	7/24/2020	8/10/2020
Torino 02	7/24/2020	8/10/2020

1.6 Relationship to Statutes, Regulations, Other NEPA Documents

Necessary permits and approvals for the Proposed Action would be obtained prior to project implementation and are mandated by the following laws, regulations, orders, and memoranda:

- Clean Water Act (CWA) ([33 USC 1251-1376; Chapter 758; PL 845; 62 Stat. 1155]; reauthorized 1991)
- The Clean Air Act of 1972, as amended (CAA) [42 USC 7401 et seq.]
- The Endangered Species Act of 1973 (ESA) [16 USC. 1531 et. seq.]
- The Migratory Bird Treaty Act (MBTA)
- Executive Order 13186, Responsibilities of Federal Agencies to Protect Migratory Birds
- The Bald and Golden Eagle Protection Act, as amended (PL 86-70, PL 87-884, PL 92-535, PL 95-616; USC 668-668d)
- Federal Noxious Weed Act
- Executive Order 13112, Invasive Species
- New Mexico Executive Order 00-22
- Antiquities Act of 1906 (PL 52-209)
- Section 106 of the National Historic Preservation Act of 1966 (PL 89-665; 80 Stat. 915; 16 USC 470 et seq.), as amended (implemented under regulations of the Advisory Council on Historic Preservation, 36 CFR Part 800)
- The Archaeological and Historical Conservation Act of 1974 (PL 93-291)

- The Archaeological Resources Protection Act of 1979 (PL 96-95; 93 Stat. 721; 16 USC § 470aa et seq.), as amended (PL 100-555; PL 100-588) and its regulations (36 CFR 296)
- Paleontological Resources Preservation Act of 2009 (Sections 6301-6312 of the Omnibus Public Lands Act of 2009, 16 USC 470aaa)

Oil and gas regulations administered by the NMOCD are contained in NMAC 19.15. These regulations include the following, with which EOG would comply:

- The EMNRD requires operators to follow "pit rule" guidelines (NMAC 19.15.17) to reduce groundwater contamination from industry-related activities.
- NMAC 19.15.15 establishes requirements for well acreage spacing, obtaining approval of unorthodox well locations, and pooling or communitizing small acreage oil lots.
- NMAC 19.15.16.19 requires the disclosure of hydraulic fracture constituents.

1.7 Issues Identified for Analysis

The BLM-RPFO developed a list of issues to analyze in detail in this EA in accordance with guidelines set forth in the BLM NEPA Handbook (2008). Key issues identified during internal agency scoping are summarized in Table 1-2.

Table 1--2 Issues to be Analyzed

Issue 1	What would be the impacts of the Proposed Action on air quality?
Issue 2	What would be the impacts of the Proposed Action on Greenhouse gas emissions and climate?
Issue 3	What would be the impacts of the Proposed Action on drinking water, surface water, and useable groundwater resources? What would be the impacts on surface and ground water quality?
Issue 4	What would be the impacts of the Proposed Action on induced seismicity?
Issue 5	What would be the impacts of the Proposed Action on erosion? What would be the potential for reclamation success (revegetation) on certain soils if disturbed?
Issue 6	What would be the impacts of the Proposed Action on existing native vegetation?
Issue 7	Both cattle and horses are known to graze within/near the Proposed Action area. What are the potential impacts on grazing livestock and associated facilities?
Issue 8	What would be the impacts of the Proposed Action on big game, other game species, and non-game wildlife? What would be the impacts of the Proposed Action on USFWS listed Threatened, Endangered, or Candidate Species or their designated habitat? What would be the impacts on BLM Sensitive Wildlife Species? What would be the impacts on migratory birds?
Issue 9	Socio-economics and Environmental Justice: The regional population includes minority and low-income groups. If the wells are productive, what would be the impacts of the Proposed Action on these groups? Would there be a potentially disproportionate impact on minority or low-income populations?
Issue 10	What would be the impacts of the Proposed Action on Paleontological Resources?

Issue 11 What would be the impacts of the Proposed Action on Cultural Resources and Native American Religious Concerns?

Issue 12 What would be the impacts of the Proposed Action on Recreation? Specifically, the Oh-My-God 100 (A-C) course?

Issue 13 What would be the impact of the Proposed Action on Indian Trust Assets?

1.8 Issues Identified but Eliminated from Further Analysis

The following issues were identified during a scoping meeting held on August 28, 2020, as issues of potential concern that would not be impacted by the Proposed Action or that have been covered by prior environmental review. Table 1-3 summarizes issues will not be analyzed in this EA.

Table 1-3. Resources Identified, but Eliminated from Further Analysis

Resource	Issue Statement	Rationale for not further discussing in detail in EA
Areas of Critical Environmental Concern (ACEC)	What would be the potential to adversely affect the Torreon Fossil ACEC?	The access road for the Fairlane Well Pad boarders the northern edge of the Torreon Fossil ACEC (BLM, 2019d) Development of the Proposed Action does not occur within the boundary of the ACEC for paleontological resources and no effects are anticipated to occur.
Fuel Wood Resources	What would be the effect of the Proposed Action and any alternatives on existing public lands fuel wood resources?	Approximately 225-250 pinyon/juniper trees would be cut down within the PPA. Prior to cutting, EOG would estimate the volume of wood in cords and provide this estimate to BLM-RPFO forester. EOG would obtain a vegetation removal permit (BLM Form 5450-5).
Wetlands/ Riparian Zones	What would be the Potential to affect watershed stability and associated resources such as riparian areas, wetlands, and floodplains?	No wetlands (as defined by 40 CFR 230.3 [t]) or riparian zones are present within or near the PPA (USFWS 2011 and site survey).
Visual Resources	What would be the effect of the Proposed Action and any alternatives on visual resources?	None – VRI Class IV; C II or less total score for Scenic Quality except for Starliner area of Torreon Fossil is Class II Mitigate with best practice – (location to reduce visibility; BLM paint color to blend in with surrounding environment, keep area free of trash) (BLM, 2019d).
Floodplains	What would be the potential to adversely affect floodplains?	There are no floodplains (as defined by Executive Order No. 11988) present within or near the PPA (site survey).

Resource	Issue Statement	Rationale for not further discussing in detail in EA
Farmlands (Prime and Unique)	Would the Proposed Action adversely affect farmland?	There are no prime or unique farmlands (as defined by 7 CFR 657.5) present within or near the PPA (site survey).
Wild and Scenic Rivers	Would the Proposed Action adversely affect Wild and Scenic Rivers?	There are no Wild and Scenic Rivers (as defined by 16 U.S. Code 1271-1287) within or adjacent to the PPA (National Wild and Scenic Rivers Coordinating Council, 2009).
Wild Horses and Burros	Would the Proposed Action adversely affect populations of wild horses and burros?	No wild horses or burros are known to occur within or near the PPA. Following passage of the Wild Horse Act, the BLM inventoried all public lands in New Mexico for wild horses and the BLM identified herd areas. The BLM determined that there were no wild horses or herd areas within the Rio Puerco Planning Area. (BLM, 2019d).
Wilderness/Wilderness Study Areas	Would the Proposed Action adversely affect Wilderness/Wilderness study areas?	No Designated Wilderness Areas (as defined in 16 U.S. Code 1131-1136) or Wilderness Study Areas are present within or immediately near the PPA.
Lands/Access	What would be the effect of the Proposed Action on other land actions and/or access to the project areas?	The Proposed Action is on federal lands and would therefore be approved under EOG's mineral rights and subject to on-lease regulations under 43 CFR 3160. Access to federal lands will not be impacted by the Proposed Action other than an increase in traffic.
Public Health & Safety	What would be the effect of the Proposed Action on local residential safety, including traffic?	The Proposed Action is in a remote area. Design features in Appendix D requiring safe driving practices and following posted speed limits and other traffic laws would minimize impacts to the residents.
Waste (Hazardous and/or Solid) and Waste Disposal	Would there be impacts to public health and safety from hazardous or solid wastes generated by the Proposed Action?	Adequate measures for hazardous and solid was management are presented in Design Features (Appendix D).
Invasive Species/Noxious Weeds	What would be the effect of the Proposed Action on area noise levels during the different stages of the project?	Design Features (Appendix D) would fully mitigate impacts to the PPA, including the potential spread and establishment of invasive species and noxious weeds. No listed noxious weeds were observed during surveys.
Solid Mineral Resources	What would be the effects of the Proposed Action on solid mineral resources?	Solid mineral resources would not be used for development of the well pads. However , Material from existing stock ponds (Borrow Sources) will be utilized in the construction of the main road:

Resource	Issue Statement	Rationale for not further discussing in detail in EA
		creating beneficial effects to hydrology, soils, wildlife and range resources.

2.0 Alternatives

2.1 Alternative 1 - No Action Alternative

Under this alternative, the BLM-RPFO would deny the proposed APDs, applications for ROWs.and would not dispose of Mineral Materials associated with the Proposed Action. EOG would retain the lease rights and may continue submit future APDs and applications for ROWs. Oil and natural gas would not be extracted from the proposed wells, and production from NMNM 105533, NMNM 139384, NMNM 139385, NMNM 139386, NMNM 139387, NMNM 139388, NMNN 139396, NMNM 139397, NMNM 139401, NMNM 139402, NMNM 139404, and NMNM 139405 leases would continue at the current rate. Surface disturbance would not occur and current uses in the area would continue.

2.2 Alternative 2 - Proposed Action Alternative

Under the Proposed Action the BLM-RPFO would approve the APDs associated ROW applications as submitted, with design features and issue Mineral Material Sales Contracts, with applicable mitigation measures that are developed as a result of this analysis. Upon approval EOG would drill, complete, operate, maintain, reclaim, and eventually plug up to 155 oil and natural gas wells. The Proposed Action includes the construction, use, and reclamation of fourteen well pads (including construction zones and facility pads), fourteen access roads, sixteen borrow sources, three staging areas, and fourteen well-connect oil, natural gas, and produced water pipeline corridors. Section 1.7 in the BLM-RPFO Lease Sale EA provides a detailed narrative of well pad and road construction, well drilling and completion, hydraulic fracturing, production operations, and plugging and abandonment.

A Surface Use Plan of Operations (SUPO) is developed for each aspect of the Proposed Action that provides more detail of the surface construction operations. Pursuant to 40 CFR 1508.28 and 1502.21, this EA tiers into and incorporates by reference the information and analysis contained in the Proposed Action SUPOs developed by EOG.

If approved, it is anticipated that construction of the Proposed Action and drilling of the wells would commence in Winter 2020. The lifetime of the Proposed Action is estimated to be up to 30 to 50 years. EOG-committed design features are outlined in Appendix D. Maps in Appendix E provide location details of the Proposed Action.

Additional details associated with the surface features are outlined in further detail in Appendix B and have been totaled for all proposed project disturbances. Further details regarding the Proposed Action’s surface features, including access, road maintenance, and traffic; and construction, drilling, and completion are provided in the section below.

Access Roads: A total of approximately 41,473.55 linear feet or 7.86 miles of new access roads would be constructed within a 30-foot-wide corridor. The northern 2.95 miles of access road would use a 24-foot-wide running surface while the southern 4.91 miles would use a 16-foot-wide running surface. Approximately 33,842.35 linear feet or 6.41 miles of access roads would be developed utilizing existing two-track roads in order to minimize new disturbance (13.25 acres existing disturbance, 10.06 acres new disturbance). Approximately 759.2 linear feet (0.14 mile) of the access roads would overlap with the 50-foot well pad construction buffers (0.52 acres). The remaining 6,872 linear feet (1.30 miles) of access roads would be newly constructed and considered new disturbance (4.73 acres).

The running surface of the roads would be constructed of compacted road base with an approximate footprint of 18.1 acres and would remain disturbed for the lifetime of the project. The remainder of the disturbed ROW that is not hard surfaced, approximately 5.71 acres, would be re-seeded with a BLM-approved seed mix after construction is complete.

8,656.65 feet of access road would be located on private surface ownership. Of that, 5,652.33 feet would pass through tribal surface ownership.

Borrow Sources and Associated Access Roads: Material from 16 existing stock ponds (29.91 acres) would be utilized in the construction of the main road. These stock ponds are considered previously disturbed and cleanout of material from them is considered to provide a beneficial effect to hydrology, soils, wildlife and rangeland resources, . Removing material results in deeper stock ponds, which in turn reduces the amount of water evaporation from the surface. Reduced evaporation would result in an increased amount of stored water available for grazing cattle as well as local wildlife; furthermore, clearing the stock ponds prevents overflow and breaching of the retention berm.

Twelve of the borrow sources would require additional access roads in order to utilize them. Approximately 4,863.7 linear feet of access roads would be constructed within a 14-foot-wide working area (1.56 acres). Two borrow sources are adjacent to the main road and would not require additional access. The remaining two borrow sources would utilize existing two-track roads to minimize the need for new disturbance.

Well Pads, Facility Pads, and Construction Zones: The rectangular-shaped well pads vary in size for each location (134.93 acres total). Each well pad would have a 50-foot-wide construction zone buffer surrounding the well pad and would be used for slope development and topsoil storage (38.7 acres total). The construction zones would be entirely reclaimed during interim reclamation.

Each location would contain a production facilities area within the proposed well pad that would be used for production facility equipment. A teardrop driving surface would be used for working access to the well heads and production facilities. The facilities area and teardrop driving surface would remain disturbed throughout the duration of the project (27.44 acres total). The remaining well pad acreage would be reclaimed during interim reclamation (107.49 acres total). During interim reclamation, approximately 89.05 acres would be reseeded and recontoured and the remaining 18.39 acres would be reseeded only. See plans for Surface Reclamation contained in each site-specific APD for more information.

Well-connect Pipelines: If the wells prove viable, EOG proposes to construct, operate, and maintain 39,186.44 linear feet of subsurface well-tie pipelines within a single 40-foot-wide ROW

corridor. EOG would excavate up to three trenches within the ROW off-set from one another by 5 feet. Each trench would consist of up to three steel and/or poly gas/liquids pipelines not to exceed 12 inches in diameter. In addition, one 6-inch or less poly or steel water pipeline, one fiber-optic cable and one electric power line would be placed in one of the three trenches.

Approximately 37,305.67 feet (17.13 acres) of the pipelines would be adjacent to the proposed access roads, offset by 20 feet, for a 50-foot-wide total ROW, and the remaining 1,880.13 feet (1.73 acres) would overlap the proposed well pads and construction buffers. The pipelines would transport produced water and hydrocarbons from the Proposed Action to the proposed EOG Continental Divide Trunk Line pipeline gathering system, operated by EOG. All pipeline disturbance would be reclaimed during interim reclamation.

Staging Areas: Three staging areas would be needed to stage equipment during completion and production activities. Pinto Staging Area 1 would measure 485 feet by 440 feet (4.9 acres) and the Pinto Staging Area 2 would measure 385 feet by 25 feet (0.21 acres). The Torino Staging Area would measure 220 feet by 440 feet (2.2 acres). Existing and proposed access roads would be used to access the TUA locations.

Well Pad Equipment and Facilities

Equipment and facilities that would be placed on each well pad include, but are not limited to: two oil and two produced water tanks, compressors, generators, separators, vapor recovery units, meter runs, methanol tanks, and one flare. Tanks would be 15.5 feet by 24 feet with a storage capacity of 750 barrels. Berms or containment walls would be constructed around all storage tanks sufficient in size to contain the volume of the single largest storage vessel plus 1-foot freeboard of precipitation; or 110% of the fluids in the largest tank. Equipment and facilities for the Proposed Action would be painted covert green to reduce visual impacts to the surrounding environment.

Access, Road Maintenance, and Traffic

EOG has applied for ROW easements to upgrade and construct approximately 47,745.46 linear feet or 9.04 miles of existing resource road located on BLM-RPFO managed surface, referred to as the Continental Divide Arterial Road. All vehicles would stay within the existing and proposed road ROWs.

All proposed access roads would be built to standards established by The Gold Book: Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development (BLM and U.S. Forest Service 2007) and BLM Manual 9113, Sections 1 and 2 (BLM 2011a, BLM 2011b). Maintenance activities would continue until final abandonment and reclamation are completed.

Traffic volume generated by the Proposed Action would vary depending on the phase of implementation. Table 2-1 outlines estimated traffic volumes on area roads for the construction and drilling, completion, production, and reclamation phases of implementation for each individual location of the Proposed Action.

Table 2-1. Estimated traffic volumes on area roads for each phase of the Proposed Action.

Phase	Duration of Phase (days)	Anticipated Traffic Volume (round trips)	Anticipated Vehicle Type (Truck/Passenger Vehicle/Other)
Construction and Drilling	~ 30 Total (30 days expected for drilling)	Daily	Cars, Pickups, Water Trucks, Tractor-Trailers
Completion	~ 30 days	Daily	Cars, Pickups, Water Trucks, Tractor-Trailer
Production	Life of wells	Daily	Pickups (Heavy equipment – Tractor-Trailer, Water Truck etc. as needed on a monthly basis)
Reclamation	2-3 weeks	Daily	Cars, Pickups, Water Trucks, Tractor-Trailer

Construction Equipment

Construction is anticipated to last approximately 30 days per project location for the Proposed Action. A summary of key construction-related information is provided in Table 2-2.

Table 2-2. Summary of key construction related information.

Component of Proposed Action	Construction Duration (weeks)	Expected Equipment Needs
Access Road	3-4	Grader (1), Compact Track Loader w/ brush attachment (1), Excavator (1), Bulldozers (2), Backhoe (1), Scrapers (2), Off-road Water Truck (1), Compactor (1)
Pipeline	6-8	Trencher or Backhoe (1), Side booms (2)
Well Pad/Facilities Area	3-4	Grader (1), Roadroller (1), Excavator (1), Bulldozer (1)

2.3 Alternatives Considered but Eliminated from Detailed Study

EOG examined many alternative locations for the 14 well pads before ultimately deciding on their current locations. Table 2-3 summarizes the different placement options examined for each well and the reasons those options were eliminated from further discussion.

Table 2-3. Alternative Well Placement Options.

Well Pad	Location (NMPM)	Issue with Placement
Bullitt 1	Initial access road route changed	An archaeological resource site was found on the initial access road route.
Bullitt 06	Initial staking was 1,500 feet south of current location	High potential for erosion and off-site sedimentation based on surface water drainage patterns.
	Second staking was 1,800 feet north of current location	Topographic relief may require excessive cut-and fill construction and/or lead to high risk of erosion and off-site sedimentation.
Capri 04	200’ FNL, 1050’ FEL - Section 5, T21N, R4W	High potential for erosion and off-site sedimentation based on surface water drainage patterns.
Del Rio 12	1300’ FNL, 1500’ FEL - Section 12, T21N, R5W	Topographic relief may require excessive cut-and fill construction and/or lead to high risk of erosion and off-site sedimentation.
	1125’ FNL, 1250’ FEL - Section 12, T21N, R5W	High potential for erosion and off-site sedimentation based on surface water drainage patterns.
	726’ FNL, 2141’ FEL - Section 12, T21N, R5W	Would impact existing fence improvements
Durango 14	350’ FNL, 450’ FEL - Section 14, T21N, R5W	High potential for erosion and off-site sedimentation based on surface water drainage patterns.
	100’ FSL, 600’ FEL - Section 11, T21N, R5W	Topographic relief may require excessive cut-and fill construction and/or lead to high risk of erosion and off-site sedimentation.
	250’ FSL, 350’ FWL - Section 12, T21N, R5W	High potential for erosion and off-site sedimentation based on surface water drainage patterns.
Fairlane 22	None	
Falcon 05	None	
Galaxie 12	1550’ FSL, 1450’ FWL - Section 14, T21N, R5W	High potential for erosion and off-site sedimentation based on surface water drainage patterns.
	1950’ FSL, 1700’ FWL - Section 12, T21N, R5W	High potential for erosion and off-site sedimentation based on surface water drainage patterns.

Table 2-3. Alternative Well Placement Options.

Well Pad	Location (NMPM)	Issue with Placement
Interceptor 02	2350’ FSL, 2450’ FEL – Section 2, T21N, R4W	Laterals too short to the north
	600’ FNL, 1200’ FWL – Section 12, T21N, R4W	High potential for erosion and off-site sedimentation based on surface water drainage patterns.
	650’ FSL, 1400’ FEL – Section 2, T21N, R4W	Topographic relief may require excessive cut-and fill construction and/or lead to high risk of erosion and off-site sedimentation.
Pinto 03	850’ FSL, 900’ FWL - Section 3, T21N, R4W	High potential for erosion and off-site sedimentation based on surface water drainage patterns.
	1345’ FSL, 624’ FWL - Section 3, T21N, R4W	May cause damage to a historically significant dam.
Starliner 23	None	
Talladega 14	None	
Thunderbird 05	250’ FNL, 100’ FEL - Section 6, T21N, R4W	Topographic relief may require excessive cut-and fill construction and/or lead to high risk of erosion and off-site sedimentation.
	200’ FNL, 195’ FWL - Section 5, T21N, R4W	Causes impact to fence.
Torino 02	600’ FSL, 400’ FWL – Section 2, T21N, R4W	High potential for erosion and off-site sedimentation based on surface water drainage patterns.

3.0 Affected Environment and Environmental Consequences

In this section, the potential impacts of the Proposed Action on the environment are sometimes generally described as short-term or long-term. As a general rule of thumb, short-term impacts last five years or less and long-term impacts last for greater than five years.

3.1 Issue 1: Air Quality

The Proposed Action is located in Sandoval County, New Mexico. Much of the information referenced in this section is incorporated from the Air Resources Technical Report for BLM Oil and Gas Development in New Mexico, Kansas, Oklahoma, and Texas (herein referred to as Air Resources Technical Report) (USDI BLM, 2019). This document summarizes the technical information related to air resources associated with oil and gas development and the methodology and assumptions used for analysis. The analysis area for impacts on air quality

consists of San Juan, Sandoval, Rio Arriba, and McKinley Counties. This spatial scope of analysis was identified based on the regional nature of air pollution and to facilitate analysis using the best available air quality data, which are generally provided at the county level.

3.1.1 Affected Environment

Air quality is determined by the quantity and chemistry of atmospheric pollutants in consideration of meteorological factors (i.e., weather patterns) and topography, both of which influence the dispersion and concentration of those pollutants. The presence of air pollutants is due to a number of different and widespread sources of emissions.

National Ambient Air Quality Standards

The Clean Air Act (CAA) requires the U.S. Environmental Protection Agency (EPA) to set National Ambien Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. Primary standards provide public health protection, and secondary standards provide for public welfare, including protection against degraded visibility and damage to animals, crops, vegetation, and buildings (EPA, 2019a). The primary NAAQS are set at a level to protect public health, including the health of at-risk populations, with an adequate margin of safety (EPA, 2018a).

The EPA has set NAAQS for seven principal pollutants ("criteria" air pollutants): carbon monoxide (CO); nitrogen dioxide (NO_2); ozone (O_3); particulate matter equal to or less than 10 microns in diameter (PM_{10}); particulate matter equal to or less than 2.5 microns in diameter ($PM_{2.5}$); sulfur dioxide (SO_2); and lead (Pb). The EPA has delegated the responsibility of regulation and enforcement of the NAAQS to the state level and has approved the New Mexico State Implementation Plan (SIP), which allows the state to enforce both the New Mexico Ambient Air Quality Standards (NMAAQS) and the NAAQS on all public and private lands with the exception of tribal lands and lands within Bernalillo County. The New Mexico Environment Department (NMED) Air Quality Bureau is responsible for implementation of the SIP and enforcement of air quality standards.

Areas that are in attainment of the NAAQS are categorized as either Class I, Class II, or Class III, which determines the increment of air quality deterioration allowed. All areas that attain the NAAQS and are not specifically designated as Class I areas under the CAA are considered to be Class II for air quality, where a moderate amount of degradation is permitted. The analysis area is in attainment for the NAAQS and the NMAAQS and is categorized as a Class II area (EPA, 2018b; NMED, 2018a).

Design values are statistics that describe the air quality in a certain area relative to the NAAQS; they are to be consistent with NAAQS as defined in 40 CFR 50. Design values are generally used to classify and designate non-attainment areas (EPA, 2019b). The measurement parameters for each air monitor vary depending on the criteria pollutant being monitored, the scale at which that pollutant is being measured, the duration and frequency of the monitoring sample, and the monitor objective. CAA regulations establish design criteria for ambient air quality monitoring networks (also known as state and local air monitoring stations [SLAMS]), including "scales of representativeness of most interest" for monitoring sites, ranging from national and global scales down to the local level (EPA, 2012).

Table 3-1 summarizes the Design Value concentrations of criteria pollutants within the analysis area, compared with the NAAQS and NMAAQS. The counties in the analysis area do not currently monitor for CO, Pb, or PM2.5; however, because the counties are relatively rural in character, it is likely that these pollutants are not elevated and are considered to be in attainment for the lease sale sites.

Table 3-1. Design Values for Counties within the Analysis Area

Pollutant	2018 Design Concentrations	Averaging Time	NAAQS	NMAAQS# **††
O_3	Rio Arriba County: 0.067 ppm Sandoval County: 0.068 ppm San Juan County: 0.070 ppm, 3 stations; Bloomfield at 0.069 ppm, Navajo Dam at 0.070 ppm, Shiprock at 0.069 ppm	8-hour	0.070 ppm*	–
NO_2	San Juan County: 3 stations; Bloomfield at 10 ppb, Navajo Dam at 6 ppb, Shiprock at 3 ppb	1 year	53 ppb†	50 ppb
NO_2	San Juan County: Bloomfield at 34 ppb	1-hour	100 ppb‡	–
SO_2	San Juan County: 2 ppb	1-hour	75 ppb¶	–
$PM_{2.5}$	San Juan County: Invalid monitor data#	1 year	12 µg/m3 §	–
PM_{10}	San Juan County: Invalid monitor data#	24-hour	150µg/m3 ††	–

Source: EPA (2019a)

ppm = parts per million; ppb = parts per billion

* Annual fourth highest daily maximum 8-hour concentration, averaged over 3 years.

† Primary and Secondary, Annual Mean

‡ . Primary - 98th percentile of 1-hour daily maximum concentrations, averaged over 3 years.

¶ 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years.

§ Annual mean, averaged over 3 years.

†† Not to be exceeded more than once per year on average over 3 years

$PM_{2.5}$ monitor stations currently show installed locations in the planning area (San Juan County); however the monitor status of these stations show invalid data and cannot be used to represent design values.

** The NMAAQS standard for total suspended particulates, which was used as a comparison with PM_{10} and $PM_{2.5}$, was repealed as of November 30, 2018.

Ozone (O_3), Nitrogen Oxides (NO_x), and Volatile Organic Compounds (VOCs)

O3 is a criteria pollutant that is of most concern for the analysis area. Breathing ground-level ozone, or tropospheric O3, can have human health effects particularly for sensitive groups (children, the elderly, and those with chronic lung conditions like bronchitis, emphysema, and asthma) as well as sensitive vegetation (NMED, 2018b). O3 is most likely to reach unhealthy levels on hot, sunny days in urban environments and can be transported long distances by wind into rural areas (EPA, 2018c). As a secondary pollutant, O3 is not a direct emission pollutant (that is, it is not emitted directly into the air), but it is the result of chemical reactions between a group of highly reactive gases called nitrogen oxide(s) (NOx) and volatile organic compounds (VOCs), which are organic compounds that vaporize (i.e., become a gas) at room temperature when exposed to sunlight (EPA, 2018c). O3 and NO2 are criteria air pollutants and therefore are regulated under the NAAQS and NMAAQS; VOCs are not regulated, however, because O3 is not a direct emission; emissions of NOx (particularly NO2, which is used as an indicator for the larger group of gases) and VOCs are used as a proxy for determining potential levels of

secondary formation of O3. NOx can also react with other chemicals in the air to form particulate matter, contributing to haze (EPA, 2016b).

Major sources of emission for both NOx and VOCs include industrial facilities like power plants and motor vehicle exhaust (including off-road equipment). NOx is primarily emitted through fossil fuel combustion in electric utilities, high-temperature operations at other industrial sources, and the operation of motor vehicles (EPA, 2016b). VOCs are emitted from burning fuels (gasoline, wood, coal, or natural gas) and are associated with refineries, oil and gas production equipment, and other industrial processes. VOCs are also released from chemicals like solvents, paints and thinners, adhesives, air fresheners, copy machines and printers, cleaners and disinfectants, and other consumer products (National Institute of Health, U.S. National Library of Medicine, 2017). Biogenic sources, such as trees and plants, can also represent a substantial portion of NOx and VOC emissions in an area, including New Mexico (BLM, 2018a).

The upstream sources of VOCs that are produced during the production of oil and gas are emitted during the separation of gases from liquids and the storage process. Such emissions are generally controlled with the use of enclosed combustion devices, such as flares. Leaks and ineffective control systems are also a source of VOC emissions. In the event that VOCs are produced from incomplete combustion, they become more highly reactive ozone precursors (Matichuk et al., 2016). NOx are primarily emitted through fossil fuel combustion in electric utilities, high-temperature operations at other industrial sources, and the operation of motor vehicle (EPA 2014).

Monitoring conducted by the NMED (under the EPA) in the analysis area indicates that levels of O3 have not yet exceeded, the NAAQS in San Juan County/Sandoval County (see Table 3-1). If such exceedances were to occur, the area would be designated "nonattainment," which could impact industrial development for the area (NMED, 2018c). The NMED Air Quality Bureau has begun developing an Ozone Attainment Initiative, which, if implemented on schedule, will have a plan in place by summer 2020. The Ozone Attainment Initiative plan will set standards for emission sources that contribute to the exceedance of design values of 95% or more, in particular to control NOx and VOCs to achieve maintenance or attainment of the standards pursuant to New Mexico Statutes 74-2-5.3 (NMED, 2018d).

Particulate Matter (PM)

Particulate matter (also known as particle pollution) is a mixture of solid particles and liquid droplets in the air. Particulate matter varies in size: PM_{10} refers to particulate matter 10 micrometers or less in diameter (commonly considered "dust"). $PM_{2.5}$ refers to particulate matter that measures 2.5 micrometers or less (i.e., fine particles), which are the main cause of reduced visibility (haze) in the United States (EPA, 2018d). The EPA regulates inhalable particulate matter 10 micrometers in diameter or smaller (PM_{10} and $PM_{2.5}$) because they are inhalable into the lungs (NMED, 2018b) but does not regulate particles larger than 10 micrometers in diameter (such as sand and larger dust particles).

$PM_{2.5}$ is not currently monitored in the analysis area, and there are no areas of high concentrations that would warrant monitoring by the NMED. Recent monitoring for PM_{10} (dust) in the analysis area began in 2017 at a San Juan County monitoring site. Like O_3, most particulate matter is formed by reactions between other chemicals, specifically between SO_2 and

NOx, which are emitted from vehicles, power plants, and other industrial processes (EPA, 2018d). Particulate matter emissions often result from activities like construction, traffic on unpaved roads, fields, and wildfires (EPA, 2018d). Particulate matter is of heightened concern when emissions are near sensitive receptors, such as residences, because particulate matter can be present in higher concentrations in a localized area prior to settling or dispersion.

Human-Caused Criteria Pollutant Emissions

Along with criteria pollutant concentrations as measured by air monitors, the EPA provides data on human-caused criteria pollutant emissions, expressed in tons per year or total volume of pollutant released into the atmosphere. Human-caused emissions data point to which industries and/or practices are contributing the most to the general level of pollution (BLM, 2018a). Total human-caused emissions within the analysis area are reported in Table 3-2, based on 2014 National Emissions Inventory (NEI) in tons per year (EPA, 2018e).

These emissions are primarily the result of electrical power generation, oil and gas development, vehicles (highway and off-highway traffic), and other industrial activities (EPA, 2018e). The primary sources of several criteria air pollutants in the analysis area are two coal-fired electrical generation units: the San Juan Generating Station 15 miles west of Farmington, New Mexico, and the Four Corners Power Plant on the Navajo Nation near Fruitland, New Mexico. These electrical generation units are the primary source of SO_2 (85%), NOx (41%), and $PM_{2.5}$ (3%) in the analysis area (BLM, 2018a; EPA, 2018e).

The Western States Air Resources Council–Western Regional Air Partnership (WESTAR-WRAP) conducted an oil and gas emissions inventory report for base year 2014 to further clarify the contributions of oil and gas activities to human-caused emissions within the Permian and San Juan Basins. The results indicate there are non-point sources, including fugitive components, pneumatic devices, pumps, and well blowdown events, that may not be reported through the state and federal inventories. These nonpoint sources could represent greater criteria, hazardous air pollutants (HAPs), and Greenhouse Gas (GHG) emissions within these basins, in particular VOC and NOx emissions that contribute to ozone formation. It is therefore believed that the 2014 NEI data in Table 3-2 related to petroleum and related industries are underreported in terms of VOC and NOx emissions. Table 3-2 provides a comparison of NEI and WESTAR-WRAP data sets.

As shown in the Table 3-2, a comparison of data sets indicates that oil and gas development–related NOx and VOC emissions may be underreported by approximately 58% and 49%, respectively.

Table 3-2. Human-Caused Emissions in the New Mexico Portion of the San Juan Basin, in Tons per Year

County (San Juan, Sandoval, Rio Arriba, and McKinley)	NO_X	CO	VOC	PM_{10}	$PM_{2.5}$	SO_2
2014 NEI—all sources	70,255	166,934	93,763	118,725	18,899	6,602
2014 NEI—petroleum and related industries	25,011	–	66,385	–	–	–
WESTAR-WRAP 2014 oil and gas sources	59,989	–	90,064	–	–	–

Sources: EPA (2014) and Ramboll Environ (2017).

Notes: Values include Tier 1 summaries for each county, including combustion, industrial, on-road/non-road, and miscellaneous sectors. Biogenic sources are not included.

Only precursor pollutants to ozone formation compared in this analysis (NOx and VOC).

Air Quality Index

The level of emission for a pollutant, in consideration of weather and geographical influences, is a key factor affecting the concentration of that pollutant in an area. Emissions, which contribute to concentrations, can be understood through the Air Quality Index (AQI). The AQI is used to report daily air quality information in an easy-to-understand way by explaining how local air quality relates to human health. Calculated by the EPA, the AQI considers the following: O_3, particulate matter ($PM_{2.5}$ and PM_{10}), NO_2, SO_2, and CO (all except Pb). According to the EPA, O_3 and particulate matter, both calculated daily for the AQI, are the two air pollutants that pose the greatest threat to human health (AirNow, 2016).
The higher the AQI value, the greater the level of air pollution and the greater the concern for public health. An AQI value of 100 typically corresponds to the NAAQS set for that pollutant, and values below 100 are considered satisfactory for public health. The AirData AQI interactive map and summary report (EPA, 2018f, 2018g) provides annual summary information, including maximum AQI values and the count of days in each AQI category. Table 3-3 provides a summary of the number of days classified above 100 (unhealthy for sensitive groups or worse) for the counties in the analysis area for the period from 2006 through 2019.

Table 3-3. AQI Summary Data for Number of Days Classified above 100 for the Analysis Area (2006–2019)

County	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
San Juan	24*	45	3	0	20†	18	12	6	0	2	2	6	16	0
Sandoval	17	6	0	0	0	0	0	0	0	0	0	1	12	0
Rio Arriba	0	0	0	0	0	0	0	2	0	0	0	3	3	0
McKinley	–	–	0	0	0	0	0	0	–	–	–	–	-	-

Source: EPA (https://www.epa.gov/outdoor-air-quality-data/air-quality-index-report)

Note: All AQI values presented are classified as unhealthy for sensitive groups (101–150), unless otherwise indicated. Annual summary data for McKinley County are only available for 2008–2013.

* Including one (1) unhealthy day (above 150).

† Including five (5) unhealthy days (above 150) and two (2) very unhealthy days (above 200).

‡ Including one (1) unhealthy day (above 150).

For the reporting period, Sandoval County had few years with incidences of the number of days classified above 100 annually, with 2018 reporting 12 days reaching unhealthy for sensitive groups and a max AQI of 119. In 2019 there were 0 days with an AQI above 100, the prior exceedances do not represent a trend of degrading AQI values over time (BLM 2018a).

Hazardous Air Pollutants

The CAA requires control measures for HAPs, which are a class of 187 toxic air pollutants that are known or suspected to cause cancer or other serious health effects and/or adverse environmental effects. National Emission Standards for Hazardous Air Pollutants (NESHAPs), established by the EPA, limit the release of specified HAPs from specific industries (BLM, 2018a). NESHAPs for oil and gas development include control of benzene, toluene, ethyl benzene, mixed xylenes, and n-hexane from major sources, and benzene emissions from

triethylene glycol dehydration units as area sources (BLM, 2018a). The CAA defines a major source for HAPs as being one that emits 10 tons per year of any single HAP or 25 tons per year of any combination of HAPs. Under state regulations, a construction or operating permit may be required for a major source and, for New Mexico, determining a major source requires consideration of each oil and gas exploration and production well individually (BLM, 2018a). In New Mexico, regulations for major sources are found under 20.2.70 and 20.2.71 NMAC.

The National Air Toxics Assessment (NATA), published by the EPA, provides a tool by which to help focus emissions reductions strategies. The most recent NATA was completed for 2014 and was released in August 2018 (EPA, 2018h). The 2014 NATA models ambient concentrations and estimates exposures and risk of cancer and/or other health impacts from HAPs, represented as risk hazard indices for cancer, neurological problems, and respiratory problems for each county and census tract (BLM, 2018; EPA, 2018h, 2018i).

A review of the results of the 2014 NATA shows that cancer, neurological risks, and respiratory risks in the analysis area (San Juan, Sandoval, Rio Arriba, and McKinley Counties) are generally lower than statewide and national levels, as well as those for Bernalillo County, where urban sources are concentrated in the Albuquerque area (EPA, 2018i).

3.1.2 Environmental Impacts—No Action Alternative

The No Action Alternative would result in the continuation of the existing land and resource uses in the analysis area and their subsequent and current impacts to air quality; therefore, additional impacts would not be expected.

3.1.3 Environmental Impacts—Proposed Action

Methodology

A BLM oil well emission calculator was used as the baseline of emission calculations to predict VOCs, criteria, hazardous and greenhouse gas pollutants (GHGs) (Issue 2) for construction and operational (production phase) activities. Emissions calculators were developed by air quality specialists at the BLM National Operations Center in Denver, Colorado, and account for a number of variables, including access and construction requirements, equipment, and other infrastructure needs, as well as expected production volumes. Because these calculators quantify emissions based on averages and several assumptions (e.g., construction methods, all wells would be hydraulically fractured), these estimates provide approximations of emissions of criteria pollutants, VOCs, HAPs, and GHGs relative to regional and national levels. Additionally, the BLM in New Mexico has modified the calculators and assumptions for use in analyzing a single well to more closely represent oil and gas wells in the state and to address emissions from development and production for one horizontal well (BLM 2019).

Adjustments to the baseline assumptions were allowed to be made by EOG Resources with project specific details such as the capacity of equipment, acres of disturbed land, construction equipment details, time of activities, as well as the number of days for drilling and completion activities, etc. Where project specific details were not made available, default BLM assumptions and inputs were maintained. Inputs, assumptions, and methodologies include baseline values from AP-42 (surface material silt content, surface material moisture content and number of days of precipitation, etc.) (EPA, AP-42 Volume I, Section 13.2.2 Unpaved Roads, Table 13.2.2-2, Nov. 2006). To facilitate organization of air quality and GHG (Issue 2), activities have been

categorized by phases; construction phase (activities lasting 30-60 days), operational phase (activities occurring throughout the year), and reclamation phase however emissions for the reclamation phase are negligible and not carried forward in this analysis. Each phase is further categorized by subcomponent activities of the phase. Emissions were also divided into fugitive dust emissions (PM_{10} and $PM_{2.5}$), VOC and criteria pollutant emissions and Issue 2 provides GHG emissions by phase.

Fugitive Dust (PM_{10} and $PM_{2.5}$) Emissions

Construction Phase

Fugitive dust (PM_{10} and $PM_{2.5}$) activities during the construction phase include land disturbance (acres), drilling & completion vehicle and equipment traffic and wind erosion. Total acres disturbed for access roads is estimated at 14.85 acres/well pad. Time of construction for the access road/wellpad is estimated to take a maximum of 5 days. Total acres disturbed for the wellpad and associated facilities (production facility, storage tanks, pipeline) is estimated at 22.68 acres/well pad and maximum number of days for development is estimated at 30 days.

A 50% control efficiency was applied to vehicle and equipment traffic calculations. Vehicle types, average vehicle weights, distances and miles traveled during this phase is provided in the BLM oil well calculator. Total fugitive dust (PM_{10} and $PM_{2.5}$) emissions for the construction phase are estimated at 8.10 and 0.85 tons per year/well respectively (Table 3.4). Development of a maximum of 155 wells would result in 1,255.5 and 131.75 tons of PM_{10} and $PM_{2.5}$ respectively, over the life of the project, if all wells were developed. PM_{10} and $PM_{2.5}$ emissions from a maximum annual development scenario (8 wells per year) would result in 64.8 and 6.8 tons/year of PM_{10} and $PM_{2.5}$ emissions during this stage. Further control efficiencies can be applied to reduce fugitive dust emissions (See Section 3.1.5).

Operations (Production) Phase

Fugitive dust (PM_{10} and $PM_{2.5}$) activities during the operations phase include well worker traffic on unpaved roads, well site inspection traffic, road maintenance traffic, produced water and oil hauling traffic. Well workover emission estimates for road traffic include a rig and haul and pickup trucks. Well site inspection visits include a single pickup truck. Road maintenance traffic includes a motor grader and pickup truck. Produced water pickups includes a haul truck with up to 108,000 bbls/year/well. Produced oil pickups includes a haul truck with up to 78,840 bbls/year/well.

A 50% control efficiency was applied to vehicle and equipment traffic calculations. Vehicle types, average vehicle weights, distances and miles traveled during this phase is provided in the BLM oil well calculator. Total fugitive dust (PM_{10} and $PM_{2.5}$) emissions for the operations phase are estimated at 3.39 and 0.34 tons per year/well respectively (Table 3-4). Development of a maximum of 155 wells would result in 525.45 and 52.7 tons of PM_{10} and $PM_{2.5}$ respectively, over the life of the project, if all wells were developed. PM_{10} and $PM_{2.5}$ emissions from a maximum annual development scenario (8 wells per year) would result in 27.12 and 2.72 tons/year of PM_{10} and $PM_{2.5}$ emissions during this stage. Further control efficiencies can be applied to reduce fugitive dust emissions (See Section 3.1.5).

Table 3-4 PM_{10} & $PM_{2.5}$ Fugitive Dust Emissions from Proposed Action

Phase and Activity	PM_{10} (tons/year/well)	$PM_{2.5}$ (tons/year/well)
Construction Phase		
Land Disturbance	5.28	0.53
Drilling and Completion Vehicle and Equipment Traffic	1.99	0.20
Wind Erosion	0.83	0.12
Total Construction Phase Emissions	**8.10**	**0.85**
Operations (Production) Phase		
Well Workover Traffic Unpaved Roads	0.04	0.0038
Well Site Inspection Traffic	0.04	0.0044
Road Maintenance Traffic	0.00227	0.00021
Produced Water Hauling	2.56	0.26
Produced Oil Hauling	0.17	0.02
Recompletion Traffic	0.66	0.07
Total Operations (Production) Phase Emissions	**3.39**	**0.34**

VOC and Criteria Pollutant Emissions

Construction Phase

Activities during the construction phase generating VOC and criteria pollutant emissions include construction equipment, drilling & completion equipment and drilling & completion support vehicles and equipment. For construction of one well, the calculation assumes operation of up to five pieces of construction equipment which would result in engine exhaust emissions from equipment such as graders, road rollers, excavators and a bulldozers. The calculation assumes equipment will operate 20-30 hours total for up to 3 days per well. Maximum engine horsepower is at 175 hp and is assumed to operate at a maximum of 80% load factor.

Drilling related equipment includes three 1,000 horsepower (HP) diesel drill rig engines, an auxiliary pump and two generators. Operating hours of each piece of drilling equipment varies between 8-24 hours per day and operating days range from 8 days for the running of the generators to up to 16 days of drill rig operation. Load factors for the engines range between 50% to 80%.

Well completion and testing related equipment includes one 600 HP diesel drill engine, an auxiliary pump (225 HP) and a power swivel engine (150 HP). The calculation assumes operating hours, for the well completion and testing equipment, ranging between 8-11 hours per day and days of operation of 2-5 days. Load factors for the engines range between 50% to 80%. Other auxiliary equipment includes field generators for pumps and lights operating at 12

hours/day for 3 days.

Vehicle types, average vehicle weights, distances and miles traveled during this phase is provided in the BLM oil well calculator. Total VOC and criteria pollutant emissions during the construction phase range from 0.11 tons per year/well of SO_2 emissions to 5.21 tons per year/well of NOx emissions (Table 3.5). Development of a maximum of 155 wells would result in 17.05 tons of SO_2 and 807.55 tons of NOx, over the life of the project, if all wells were developed. Emissions of SO_2 and NOx from a maximum annual development scenario (8 wells per year) would result in 0.88 and 41.68 tons/year respectively during this stage.

Well completion and testing during the construction phase are expected to be short-lived (30-60 days) and spread out over time and space. Emission reductions can be obtained through use of higher EPA tiered engines (See Section 3.1.5).

Operations (Production) Phase

VOC and criteria pollutant emission activities during the operations phase include well worker support vehicles and equipment, well site inspection vehicle exhaust, road maintenance exhaust, produced water and oil hauling exhaust and recompletion support vehicles and equipment exhaust.

Well workover emission sources include a workover rig and haul and pickup trucks.
Well site inspection visits include a single pickup truck. Road maintenance traffic includes a motor grader and pickup truck. Produced water pickups includes a haul truck with up to 108,000 bbls/year/well. Produced oil pickups includes a haul truck with up to 78,840 bbls/year/well.

Vehicle types, average vehicle weights, distances and miles traveled during this phase is provided in the BLM oil well calculator. Total VOC and criteria pollutant emissions during the operations phase range from 0.003 tons per year/well of SO_2 emissions to 0.38 tons per year/well of NOx emissions (Table 3-5). Development of a maximum of 155 wells would result in 0.465 and 58.9 tons of SO_2 and NOx respectively, over the life of the project, if all wells were developed. SO_2 and NOx emissions from a maximum annual development scenario (8 wells per year) would result in 0.024 and 3.04 tons/year of SO_2 and NOx emissions during this stage. Emission reductions can be obtained through use of higher EPA tiered engines (See Section 3.1.5).

Table 3-5 VOC and Criteria Pollutant Emissions from Proposed Action

Phase and Activity	PM10 (tons/year/ well)	PM2.5 (tons/year/well)	VOCs (tons/year/well)	NOx (tons/year/well)	CO (tons/year/well)	SO2 (tons/year/well)
Construction Phase						
Construction Equipment	0.01	0.01	0.01	0.05	0.03	0.00
Drilling and Completion Equipment	0.26	0.26	0.37	5.05	1.29	0.10
Drilling and Completion Support Vehicles and Equipment	0.01	0.01	0.04	0.10	0.12	0.00
Total Construction Phase Emissions	**0.28**	**0.27**	**0.42**	**5.21**	**1.44**	**0.11**
Operations (Production) Phase						
Well Workover Support Vehicles and Equipment	0.008	0.007	0.010	0.134	0.047	0.002
Well Site Inspections	0.000	0.000	0.000	0.000	0.008	0.000
Road Maintenance	0.000	0.000	0.000	0.001	0.000	0.000
Produced Water Hauling	0.013	0.011	0.016	0.124	0.079	0.001
Produced Oil Hauling	0.008	0.007	0.011	0.083	0.052	0.000
Recompletion Support Vehicles and Equipment	0.003	0.003	0.026	0.042	0.067	0.000
Total Operations Phase Emissions	**0.032**	**0.028**	**0.064**	**0.384**	**0.253**	**0.003**

Emissions where "0.000" appear may indicate significant figure differences where numbers are very small.

Construction and operations emissions from Tables 3-4 and 3-5 have been summed. Table 3-6 shows the emissions of the proposed action resulting from 155 wells and the percent increase in VOCs and criteria pollutants over existing conditions.

Table 3-6. Emissions and Percent Increase from Development of Proposed Action

	Emissions (tons per year)					
	NOx	**SO_2**	**CO**	**VOC**	**PM_{10}**	**$PM_{2.5}$**
Human-caused emissions (San Juan, Sandoval, Rio Arriba, and McKinley Counties)	70,255	6,602	166,934	93,763	118,725	18,899

	Emissions (tons per year)					
	NOx	**SO_2**	**CO**	**VOC**	**PM_{10}**	**$PM_{2.5}$**
One-well emissions (horizontal)	5.59	0.11	1.70	0.48	11.81	1.49
Emissions from development of the 8 wells (Maximum Annual Development Scenario)	44.75	0.88	13.56	3.84	94.46	11.89
Percent increase (Calculated based on above #)	0.06	0.01	0.01	0.00	0.08	0.06

It should be noted that VOC and criteria pollutant emissions presented in Table 3.6 are lower because emissions from production facilities, oil and produced water storage tanks, venting, compressors, dehydrators and heaters and compressor station fugitives are authorized separately by the New Mexico Environment Department (NMED).

Because the increase in overall emission levels would be low (≤0.08 percent), development of the Proposed Action (maximum annual development scenario) would not be expected to increase the number of days classified above 100 (unhealthy for sensitive groups, or worse). Therefore, it is not anticipated that the Proposed Action would result in a change in the AQI for the analysis area. This incremental increase would not be expected to result in exceeding the NAAQS or state air quality standards for any criteria pollutants in the analysis area.

3.1.4 Cumulative Effects

Past and Present Actions

Current estimated emissions across the analysis area are reported above and air quality across the analysis area is generally good based on AQI ratings over the last decade. See Table 3-3. Current estimated emissions and AQI ratings are reflective of the effects of past and present actions. Power generation is a major source of regional air emissions, as the two major sources of criteria pollutant and VOC emissions are the San Juan Generating Station and the Four Corners Power Plant (Oil and gas development is also a prominent source of emissions. There are approximately 23,034 active oil and gas wells in the New Mexico portion of the San Juan Basin. About 16,139 of the wells in these counties are federal wells, with the remainder falling in other jurisdictions (BLM, 2018).

As of July 2019, there are a total of 919 well completions within the RPFO (IHS Energy Group, 2019). The total figure includes 772 abandoned wells (84%), 46 oil wells (5%), 43 non-producing wells (including water injection wells, pilot holes, service wells, observation wells, and saltwater disposal wells), 23 suspended or temporarily abandoned wells, 17 geothermal wells, eight gas storage wells, six CO2 wells, and four gas wells (Crocker and Glover, 2019).

Within the RPFO in the past ten years (2008-2018), a total of eight wells were drilled within the field office in this timeframe, including six vertical wells and two horizontal wells. Three wells produced or are producing oil, two were dry holes, and three are otherwise non-producing (two service wells and one well with suspended drilling operations) (Crocker and Glover, 2019).

Reasonable and Foreseeable Future Actions

The analysis area for the cumulative impacts scenario (examined by Crocker and Glover 2019 for the RPFO) focused on the portion of the San Juan Basin and other potential oil and gas producing areas under the jurisdiction of the RPFO. The RFD scenario projects 200 new oil and gas wells (160 vertical and 40 horizontal) for 2020-2039, or an average of 10 wells a year, mostly vertically drilled.

Emissions associated with the 2019 Reasonably Foreseeable Development (RFD) scenario and development of the Proposed Action would be offset by substantial decreases in emissions - including a 67 percent reduction in sulfur dioxide, 62 percent reduction in nitrogen oxides, 50 percent reduction in particulate matter, 44 percent reduction in carbon monoxide, and 51 percent reduction in VOCs resulting from power generation due to the recent shutdown of two of the units at the San Juan Generating Station. Additionally, selective catalytic reduction technology installed on the two remaining coal-fired generators at the Four Corners Power Plant would result in additional reductions in emissions from the facility, including a 36 percent reduction in nitrogen oxides, 43 percent reduction in particulate matter, and 24 percent reduction in sulfur dioxide (BLM, 2018a). The San Juan Generating Station is also proposed for full closure by 2022, which would result in even further drops in future pollutant emissions for the analysis area. Additional measures taken to comply with recent revisions to the Regional Haze Rule in January 2017 would further reduce pollutant emissions. The State of New Mexico will have to comply with these revisions as it develops its SIP for the second planning period (USEPA, 2018h).

Cumulative Impacts Analysis

Cumulatively, it is expected that future levels of criteria pollutant, VOC, and HAP emissions would be lower than current levels due to the aforementioned factors, despite the increases in emissions associated with reasonably foreseeable oil and gas development and development of the Proposed Action. Table 3-7 quantifies annual emissions from the 2019 RFD Mancos Gallup in conjunction with the operation of the proposed wells.

Table 3-7. Cumulative Air Emissions from Oil and Gas Development

	Emissions (tons per year)					
	NOX	**SO2**	**CO**	**VOC**	**PM10**	**PM2.5**
Human-caused emissions (San Juan, Sandoval, Rio Arriba, and McKinley Counties)	70,255	6,602	166,934	93,763	118,725	18,899
Oil Well Emissions from RFD (160 wells annually)	990.4	17.6	420.8	187.2	849.6	129.6
Percent RFD increase to Human-caused Emissions	1.41	0.27	0.25	0.20	0.72	0.69
Emissions from Proposed Action (Maximum annual of 8 wells)	44.75	0.88	13.56	3.84	94.46	11.89
Percent Proposed Action (8 wells annually) increase to Human-caused Emissions	0.064	0.013	0.008	0.004	0.080	0.063

Percent Proposed Action (8 wells annually) increase to RFD (160 wells annually)	0.006	0.076	0.002	0.002	0.009	0.049
Total Emissions from Proposed Action (155 wells)	866.95	17.06	262.74	74.36	1830.25	230.37
Percent Proposed Action (155 wells) increase to annual Human-caused Emissions*	1.23	0.26	0.16	0.08	1.54	1.22
Percent of Proposed Action (155 wells) to total RFD (3,200 wells)	4.38	4.85	3.12	1.99	10.77	8.89

*Additional regulated emissions during the Operations Phase are authorized by NMED.

This total cumulative proposed action scenario (155 wells) in Table 3-6 assumes that all wells would be developed concurrently within the same year and sums construction and operations phase emissions. The development of the total cumulative proposed action (155 wells annually) would result in an incremental increase in overall emission levels between 0.08 percent and 1.54 percent of existing emissions. This assumption facilitates quantification in the analysis and provides a conservative estimate of maximum concurrent emissions as a result of the Proposed Action. It is more reasonable to assume that development would be spaced throughout the year (average maximum development of 8 wells per year). The development of the proposed action (8 wells annually) would result in an incremental increase in overall emission levels between 0.002 percent and 0.08 percent of existing emissions.

Emissions are anticipated to be at the most acute level during well construction and completion phases; because not all wells would be constructed at the same time, it is anticipated that the incremental addition of criteria pollutants and VOCs may be lower than reported above. Accordingly, the cumulative impacts disclosed above are not be expected to result in any exceedances of the NAAQS or NMAAQS for any criteria pollutants in the analysis area. Because the increase in overall emission levels would be low (1.54 percent or less), development of the Proposed Action in conjunction with other reasonably foreseeable future actions would not be expected to increase the number of days classified above 100 (unhealthy for sensitive groups, or worse).

Ninety seven percent of HAPs during the development of an oil well are projected to be emitted during the operations (production) phase from oil tank storage, venting and flaring, compressors, heaters and dehydrators as well as compressor station fugitives. These HAPs are authorized and accounted for in the NMED permit (Appendix X). Other emissions (three percent) of HAPS during the construction phase are estimated at 0.04 tons/year/well. The emissions are a combination of HAP constituents existing in natural gas and released during vehicle and equipment combustion as well as during the completion process. Most gas vented during the completion process is flared, which substantially reduces the quantity of HAPs released.

Emissions from any given well development are anticipated to be at the most acute level during the construction and completion phases of implementation; however, because the timing of well development varies (i.e., permit approval, well pad construction, spudding, and completion), the phases of development may not occur in succession but may be spread out in development over time. As such, the incremental addition of criteria pollutants and VOCs would not be expected to result in any exceedances of the NAAQS or NMAAQS for any criteria pollutants in the analysis area. Because the incremental increase in overall emission levels from proposed action would be low (1.54% or less), development of the proposed action would not be expected to

increase the number of days classified above 100 (unhealthy for sensitive groups, or worse). The Proposed Action would comprise no more than 0.49% of the cumulative annual emissions for all criteria pollutants and VOCs (Table 3.5).

Cumulatively, it is expected that future levels of criteria pollutant, VOC, and HAP emissions would be lower than current levels due to the aforementioned factors (discussed in Reasonable and Foreseeable Future Actions) despite the increases in emissions associated with reasonably foreseeable oil and gas development and future potential development of the proposed action.

3.1.5 Mitigation and Residual Impacts

Design features have been established to minimize dust by limiting surface disturbance, requiring interim reclamation, and requiring dust control on dirt roads. Construction impacts would be temporary and would rapidly dispersed. Residual operations impact would be generally limited to the wells, which would be considered a minor source unit permitted under a General Construction Permit per 20.2.72 NMAC.

The EPA has promulgated air quality regulations for completion of hydraulically fractured gas wells. These rules require air pollution mitigation measures that reduce the emissions of VOCs during gas well completions. Based on its authority under the standard terms and conditions attached to leases, the BLM also requires industry to incorporate and implement BMPs designed to reduce impacts to air quality by reducing emissions, surface disturbances, and dust from field production and operations. Typical measures include: adhere to BLM's Notice to Lessees' (NTL) 4(a) concerning venting and flaring of gas on Federal leases for natural gas emissions that cannot be economically recovered, flare hydrocarbon gases at high temperatures in order to reduce emissions of incomplete combustion, water dirt roads during periods of high use to reduce fugitive dust emissions, collocate wells and production facilities to reduce new surface disturbance, implement directional and horizontal drilling and completion technologies whereby one well provides access to petroleum resources that would normally require the drilling of several vertical wellbores, maintain vapor recovery systems in areas where petroleum liquids are stored, and perform interim reclamation to revegetate areas not required for production facilities and reduce the amount of fugitive dust.

In addition, the BLM encourages industry to participate in the Natural Gas STAR program that is administered by the EPA. The Natural Gas STAR program is a flexible, voluntary partnership that encourages oil and natural gas companies to adopt proven, cost-effective technologies and practices that improve operational efficiency and reduce natural gas emissions (USEPA, 2019c). Additionally, as noted above, The NMED Air Quality Bureau has begun developing an Ozone Attainment Initiative to set standards for emission sources that contribute to the exceedance of design values (See Appendix D).

3.2 Issue 2: Greenhouse Gases and Climate Change

The analysis areas associated with this issue are the New Mexico portion of the San Juan Basin, the state of New Mexico, the United States, and the globe. The different geographic scales are used in this analysis to provide a basis of comparison at multiple geographic scales to disclose the relative magnitude of GHG emissions as a result of oil and gas development of the lease parcels, which occur in the New Mexico portion of the San Juan Basin. Comparison of the

relative magnitude of impacts at various geographic scales is appropriate because, although the effects of GHG emissions are global in nature, each region experiences the impacts of climate change in different ways. Therefore, the analysis presents the relative magnitude of the Proposed Action to quantify and discuss the environmental effects in terms of GHG emissions.

The cumulative impacts section is presented in two parts. Firstly, oil and gas activities within the jurisdiction of the BLM New Mexico State Office (NMSO) that contribute cumulatively to overall GHG emissions. Therefore, oil and gas activities within the states of New Mexico, Texas, Kansas, and Oklahoma, which are controlled by the BLM NMSO, are discussed and the magnitude of emissions are presented. The potential energy resource development within this area is disclosed to provide context and a summary of the degree of contribution from BLM NMSO leasing activities to global and national GHG emissions are presented to disclose the relative magnitude of emissions.

Secondly, because the impacts of GHG emissions are not localized to the area where they originate and the impact of GHG emissions are inherently cumulative, the impacts of climate change are presented in the cumulative impacts section. The contribution of the Proposed Action, as well as the cumulative actions of the BLM NMSO, are inherently included in the cumulative GHG emissions that contribute to global climate change impacts, and for completeness, the projected BLM energy leasing activities from 13 states that contribute most of the federal energy production and consumption are discussed within the context of global cumulative emissions. The anticipated cumulative impacts of climate change are discussed in terms of global impacts and impacts to the New Mexico portion of the San Juan Basin. This not only gives insight into the global nature of climate change impacts, but also provides more specific projections of impacts at the scale of the Proposed Action. Particularly, presenting the impacts in the New Mexico portion of the San Juan Basin allows more intuitive and concrete assessment of the impacts of climate change in concert with other resource impacts of the Proposed Action to assist with a reasoned choice between alternatives based on a more comparable geographic scale. The methodology for analyzing and calculating VOCs and criteria pollutants from Issue 1 is brought forward to this Issue which includes use of the BLM calculator for estimating GHG emission resulting from the proposed action.

3.2.1 Affected Environment

Climate change is a statistically significant and long-term change in climate patterns. The terms climate change and “global warming,” though often used interchangeably, are not the same. Climate change is any deviation from the average climate via warming or cooling and can result from both natural and human (anthropogenic) sources. Natural contributors to climate change include fluctuations in solar radiation, volcanic eruptions, and plate tectonics. Global warming refers to the apparent warming of climate observed since the early twentieth century and is primarily attributed to human activities such as fossil fuel combustion, industrial processes, and land use changes.

Climate change is a global process that is affected by the sum total of GHGs in the Earth’s atmosphere. The incremental contribution to global GHGs from a proposed land management action cannot be accurately translated into effects on climate change globally or in the area of any site-specific action. Currently, global climate models are unable to forecast local or regional effects on resources (Intergovernmental Panel on Climate Change [IPCC] 2013). However, there are general projections regarding potential impacts on natural resources and plant and animal

species that may be attributed to climate change from GHG emissions over time; these effects are likely to be varied, including those in the southwestern United States (Karl 2009). Climate change projections are based on a hierarchy of climate models that range from simple to complex, coupled with comprehensive earth system models. Additional near-term warming is inevitable due to the thermal inertia of the oceans and ongoing GHG emissions.

The natural greenhouse effect is critical to the discussion of climate change. The greenhouse effect refers to the process by which GHGs in the atmosphere absorb heat energy radiated by Earth's surface. Water vapor is the most abundant GHG, followed by carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and several other trace gases. Each of these GHGs exhibit a particular "heat trapping" effect which causes additional heat retention in the atmosphere that would otherwise be radiated into space. The greenhouse effect is responsible for Earth's warm atmosphere and temperatures suitable for life on Earth. Different GHGs can have different effects on the Earth's warming due to their ability to absorb energy ("radiative efficiency"), and how long they stay in the atmosphere ("lifetime"). The Global Warming Potential (GWP) was developed to allow comparisons of the global warming impacts of different gases (EPA 2019h). Because some GHGs have a GWP greater than that of CO_2, the EPA uses measures of CO_2 equivalencies (CO_2e) to account for the difference in each GHG's GWP (BLM 2019). Water vapor is often excluded from the discussion of GHGs and climate change since its atmospheric concentration is largely dependent upon temperature rather than human-related activities.

The three primary GHGs associated with the oil and gas industry are CO_2, CH_4 and N_2O. CH_4 has a GWP that is 21 to 28 times greater than the warming potential of CO_2 over a 100-year timescale while N2O has a warming potential that is 298-310 times warming potential over the same timescale (BLM 2019). Oil and gas field production activities do not substantially contribute to N_2O levels however when quantifiable, they are presented. Several different time horizons can express GWPs to fully account for the gases' ability to absorb infrared radiation (heat) over their atmospheric lifetime. The BLM uses the 100-year time horizon since most of the climate change impacts derived from climate models are expressed toward the end of the century. Also, in accordance with international GHG reporting standards under the United Nations Framework Convention on Climate Change and in order to maintain consistent comparisons over the years, official GHG emission estimates for the United States are reported based on the GWP values given in the Fourth Assessment Report (AR4) of the IPCC.

A more detailed discussion of climate change and the relationship of GHGs to climate change, as well as the intensity and effects at different geographic contexts (i.e., basin-specific [San Juan], New Mexico, national, and global climate), is presented in the Air Resources Technical Report (BLM 2019).

To summarize, findings indicate that warming of the climate system is unequivocal and many of the observed changes and unprecedented over decades to millennia. It is certain that global mean surface temperature has increased since the late nineteenth century, and virtually certain that maximum and minimum temperatures over land have increased on a global scale since 1950. Human influence has been detected in warming of the atmosphere and the ocean, in changes in the global water cycle, in reductions in snow and ice, in global mean sea level rise, and in changes in some climate extremes. It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-twentieth century. Additional near-term warming is inevitable due to the thermal inertia of the oceans and ongoing GHG emissions. Worldwide, 2016 total global GHG emissions were 49,358 million metric tons (MMT) of CO_2e,

including land-use change and forestry (see **Error! Reference source not found.**8). Energy consumption (electricity generation, manufacturing/construction, and transportation) account for roughly 30%, 12%, and 16% of total global GHG emissions, respectively (World Resources Institute 2019).

In the United States, 2018 national emissions totaled 6,677 MMT of CO_2e (see **Error! Reference source not found.**8). Energy consumption (electricity production, commercial and residential, transportation, and industry) account for 27%, 12.3%, 28%, and 22% of total national GHG emissions, respectively, or 5,971 MMT (89.41%) of CO_2e. Other GHG contributions are from agriculture (9.9%) and land use and forestry (11.6%) (EPA 2020b). On a national scale, it is estimated that extraction and end-use combustion of fossil fuels produced on federal lands comprise less than 3% of global emissions and less than 20% of national emissions. In 2014, the U.S. federal lands provided 283.2 MMT of carbon storage on a national basis. U.S. federal lands sequestered an average of 195 MMT of CO_2e between 2005 and 2014, offsetting approximately 15% of the CO_2 emissions resulting from the extraction of fossil fuels on federal lands and their end use combustion (BLM 2019).

Climate change will impact regions of the United States differently, and warming would not be equally distributed. The general trend for New Mexico over the past two decades has been increasing GHG emissions, due largely to increase in coal-based electricity generation and oil and natural gas production activities. In 2014, New Mexico federal lands provided 12 MMT of carbon storage. Federal lands in New Mexico sequestered an average of 9.5 MMT of CO_2e between 2005 and 2014 (BLM 2019).

Data indicate that in the region encompassing southern Colorado and New Mexico, which includes the New Mexico Portion of the San Juan Basin where the Proposed Action will occur, average temperatures rose just under 0.7 degrees Fahrenheit per decade between 1971 and 2011, which is approximately double the global rate of temperature increase. **Error! Reference source not found.**8 shows estimated global emissions as well as GHG emissions for the United States, New Mexico, and the major oil and gas basins of New Mexico. Emissions are expressed in MMT CO_2e.

Table 3-8. Estimated Annual GHG Emissions

Annual GHG Emissions	Million Metric Tons per Year (MMT CO_2e)	% Global Emissions	% U.S. Emissions	% New Mexico Emissions
Global emissions, all sources [1]	49,358	100%	N/A	N/A
U.S. emissions from all sources [2]	6,677	13.53%	100%	N/A
New Mexico emissions [3]	46.6	0.09%	0.70%	100%
San Juan Basin emissions [4]	23.7	0.05%	0.35%	50.84%

Note: N/A = not applicable

Sources:

[1] As cited from World Resources Institute 2019. Based on 2016 global emissions data.

[2] As cited from EPA 2020b. Based on 2016 global emissions data.

[3] EPA 2017a. State-level emission data in the table above include mobile source emission and prescribed burning emission data from EPA's 2017 National Emissions Inventory (NEI) data, which are the most recent available national emission inventory data for these area sources of GHG emissions. These area source GHG emission values are added to the most recently available

data from EPA's Facility Level Information on Greenhouse Gases Tool (FLIGHT) for the 2018 reporting period. EPA's FLIGHT data include GHG emissions from large stationary sources which are required by 40 CFR 98 to report their emissions. Note that the reporting requirements of 40 CFR 98 applies only to large suppliers of GHG emitting products or facilities in certain sectors that emit more than 25,000 metric tons of CO_2e per year. Note that agricultural and land use sectors are not required to report, and the data exclude smaller stationary sources of GHG emissions. The EPA estimates that the GHG emissions reported to the EPA through the mandatory reporting program for large stationary sources encompass approximately 85% to 90% of total U.S. GHG emissions from stationary sources.

NMED 2006

It is important to note that various sources of GHG emission data have various limitations and uncertainties. The data shown in **Error! Reference source not found.**8 include data that have been collected and verified by the EPA and the World Resources Institute, a nongovernmental organization that compiles dozens of different data sets to estimate historical GHG emission data, including from the U.S. Census Bureau, the U.S. Department of Commerce, and the EPA. However, other sources of GHG data may result in different estimates.

Recent studies have identified anomalously large methane (CH_4) concentrations (a "hotspot") in the Four Corners region including the northern portion of the FFO. A subsequent study also indicated larger anomalies over other oil and gas basins in the United States. While space-borne studies can determine the pollutant concentration in a column of air, these studies cannot pinpoint the specific sources of air pollution. Further study is required to determine the sources responsible for methane concentrations in the Four Corners region; however, it is known that a significant amount of methane is emitted during oil and gas well completion. Methane is also emitted from process equipment, such as pneumatic controllers and liquid unloadings at oil and gas production sites (BLM 2019). A 2015 study identified more than 250 individual sources of methane; observed sources from included gas processing facilities, storage tanks, pipeline leaks, and well pads, as well as a coal mine venting shaft (Frankenberg et al. 2016). Information on methane may also be found in a new interactive mapping tool launched by NMED in 2019. The mapping tool shows elevated methane levels along the northern border of San Juan County and western border of Rio Arriba County, New Mexico. It also provides locations of NMED-permitted oil and gas wells and tank batteries for permits greater than 10 tons of methane emissions per year. These sources are concentrated along State Route 550 in San Juan, Rio Arriba, and Sandoval Counties, northeast of CCNHP (NMED 2019c). Quantifiable sources of methane emissions contributing to the Four Corners region methane hotspot include large, stationary sources (such as gas processing facilities) subject to the EPA's Mandatory Greenhouse Gas reporting requirements codified in 40 CFR Part 98. Emissions from these sources are included in the EPA's Facility Level Information on GreenHouse Gas Tool (FLIGHT) data (EPA 2019i) which is summarized in **Error! Reference source not found.**. However, it is important to note that emissions of other potential contributors to this hotspot, such as unplanned methane releases (leaks and seepages) or smaller sources not subject to mandatory reporting thresholds are not included in these data.

3.2.2 Environmental Impacts—No Action Alternative

The No Action Alternative would result in the continuation of the existing land and resource uses in the analysis area and their subsequent and current impacts to GHG emissions and climate change, therefore there would be no expected, additional impacts.

3.2.3 Environmental Impacts—Proposed Action

The following analyses quantifies emissions associated with construction and operation of a horizontal well and discloses the contribution of these emissions in relation to basin, state, national, and global emissions. The analysis also discloses production (downstream or end use) emissions, which are based on projected oil and gas production volumes. Note that the BLM does not direct or regulate the end use of produced oil and/or gas.

An analysis of the social cost of carbon is not included because 1) it is not engaged in a rulemaking for which the protocol was originally developed; 2) the Interagency Working Group (IWG), technical supporting documents (IWG 2010), and associated guidance have been withdrawn; 3) NEPA does not require cost-benefit analysis; and 4) the full social benefits of fossil fuel-fired energy production have not been monetized, and quantifying only the costs of GHG emissions but not the benefits would yield information that is both potentially inaccurate and not useful. See Appendix H for further explanation. The Proposed Action's GHG emissions contribute to GHG concentrations in the atmosphere, which cumulatively result in climate change impacts. The impacts of climate change on the analysis area are inherently cumulative and are discussed in the cumulative climate change impacts section.

Construction Phase

The same sub-activities, equipment and assumptions used for the VOC and criteria pollutant emissions during the construction phase were also used to estimate GHG emissions (See Issue 1). Total GHG pollutant emissions during the construction phase range from 0.01 tons per year/well of N_2O emissions to 576.79 tons per year/well of CO_2 emissions (Table 3.9). Development of a maximum of 155 wells would result in 1.55 tons of N_2O and 89,402.45 tons of CO_2, over the life of the project, if all wells were developed. Emissions of N_2O and CO_2 from maximum annual development scenario (8 wells per year) would result in 0.08 and 4,614 tons/year respectively during this stage. Emissions during the construction phase are expected to be short-lived (30-60 days) and spread out over time and space. Emission reductions can be obtained through use of higher EPA tiered engines (See Section 3.2.5).

Operations (Production) Phase

The same sub-activities, equipment and assumptions used for the VOC and criteria pollutant emissions during the operations phase were also used to estimate GHG emissions (See Issue 1). Total GHG pollutant emissions during the operations phase range from 0.0002 tons per year/well of N_2O emissions to 81.60 tons per year/well of CO_2 emissions (Table 3.9). Development of a maximum of 145 wells would result in 0.029 tons of N2O and 11,832 tons of CO_2, over the life of the project, if all wells were developed. Emissions of N_2O and CO_2 from maximum annual development scenario (8 wells per year) would result in 0.0016 and 652.8 tons/year respectively during this stage. Emissions during the construction phase are expected to be short-lived (30-60 days) and spread out over time and space. Emission reductions can be obtained through use of higher EPA tiered engines (See Section 3.2.5).

It should be noted that GHG Pollutant emissions presented in Table 3-9 are lower because emissions from production facilities, oil and produced water storage tanks, venting, compressors, dehydrators and heaters and compressor station fugitives are authorized separately by the New

Mexico Environment Department (NMED).

Table 3-9 GHG Emissions from Proposed Action

Phase and Activity	CO_2 (tons/year/well)	CH_4 (tons/year/well)	N_2O (tons/year/well)	CO_2e* (tons/year/well)
Construction Phase				
Construction Equipment	6.81	0.0001	0.0001	6.83
Drilling and Completion Equipment	543.29	0.0056	0.0059	545.19
Drilling and Completion Support Vehicles and Equipment	26.69	0.0010	0.0004	26.85
Total Construction Phase Emissions	**576.79**	**0.01**	**0.01**	**578.87**
Operations (Production) Phase				
Well Workover Support Vehicles and Equipment	10.76	0.0002	0.000120	10.79
Well Site Inspections	0.15771	0.00002	0.00001	0.16
Road Maintenance	0.09	0.000001	0.000001	0.09
Produced Water Hauling	36.26464947	1.6924	0.000264268	78.65
Produced Oil Hauling	24.2729	0.404	0.000175504	34.43
Recompletion Support Vehicles and Equipment	10.06380	0.00033	0.00018	10.13
Total Operations Phase Emissions	**81.60**	**2.0971**	**0.0002**	**134.08**

*GWP emission factors of 25 and 298 applied to methane and nitrogen dioxide emissions respectively to obtain the total CO2e emissions.

Production (Downstream/End Use)

Estimates of production (or downstream/end use) GHG emissions are dependent on projected oil and gas production volumes. The BLM does not direct or regulate the end use of produced oil and/or gas. The challenge for estimating downstream emissions comes with understanding when and how oil and gas would be distributed and used for energy. It can be reasonably assumed that the oil and gas produced on BLM lands would be combusted primarily for electricity generation, transportation, industry, agriculture, commercial, and residential uses. From this assumption, the BLM provides potential GHG emissions estimates using currently available GHG emissions data. End-use/downstream GHG emissions estimates were derived from EOG Resources projected production volumes. Oil and gas production volumes were converted to metric tons of CO_2 and CH_4. A GWP factor was applied to estimated metric tons of CH_4 emissions to determine metric tons of CO_2e. GHG combustion emission factors for natural gas and petroleum were obtained from 40 CFR Part 98, Subparts A and C. The GWP used in the analysis aligns with the IPCC and EPA 100-year GWPs.

Estimated downstream/end use GHG emissions from future development of the proposed action uses the total oil and gas production values as summarized in Table 3-10 (615,516 bbls of oil and 1,759,818 mcf of natural gas) and the EPA's GHG equivalencies calculator (EPA 2019j). As noted previously, the BLM does not direct or regulate the end use of produced oil and/or gas. The downstream/end-use GHG emissions in Table 011 cannot be reasonably compared to an annual metric or value because the amount of production expected from each well would vary on an annual basis; however, Table 012 provides historical production values at different scales of end-use. As another point of comparison, in 2014, end-use combustion emissions from fossil fuels produced on U.S. federal lands was 1,201 MMT and end-use combustion emissions of fossil fuels produced on New Mexico federal lands was 73 MMT (BLM 2019).

Table 3-10. Estimated oil and gas production per well.

Year	Average of OIL BOPD	Average of GAS MCFD
1	465.6187633	669.1910106
2	227.1349567	532.2649882
3	150.9399294	468.6359363
4	114.2043557	401.8157414
5	92.33834771	328.4342243
6	77.75440752	279.5477227
7	67.29977022	244.5433999
8	59.42062141	218.1927461
9	53.25964247	197.6119831
10	48.30394535	181.0765281
11	44.22737131	167.4900717
12	40.81233975	156.1215294
13	37.90799517	146.4642003
14	35.40636808	138.1555611
15	33.22219075	130.9058905
16	31.22780747	124.2436044
17	29.35413902	117.9134121
18	27.59289068	111.8955658
19	25.93731724	106.1753729
20	24.3810782	100.738779
Total (20 year-total) *	615515.65 bbls	1759817.67 MCF

***Multiplies each year by 365 days and sums all years to obtain a cumulative total of production volumes.**

Table 0-11 Estimated Production (Downstream/End-Use) GHG Emissions for the Proposed Action

Product Category	Emission Factors	Estimated Product Quantity	Estimated Emissions (MMT CO_2e of GHG)
Crude oil (bbl)	0.43 MT CO2/bbl	615,516	0.26
Natural gas (mcf)	0.055 MT CO2/mcf	1,759,818	0.097
Total			**0.36**

Source: EPA 2019j

Table 0-12. Historical Oil and Gas Production and GHG Emissions

Oil and Gas Production	2014	2015	2016	2017
U.S. oil production (Mbbl)	3,196,889	3,442,188	3,232,025	3,413,376
New Mexico oil production (Mbbl)	125,021	147,663	146,389	171,440
BLM Mancos-Gallup planning area oil production (Mbbl)	5,755	8,457	6,889	5,980
U.S. gas production (MMcf)	25,889,605	27,065,460	26,592,115	27,291,222
New Mexico gas production (MMcf)	1,140,626	1,151,493	1,139,826	1,196,514
Mancos-Gallup planning area gas production (MMcf)	664,211	642,211	596,747	464,709
GHG Emissions				
Total U.S. oil and gas GHG emissions (MMT CO_2e)	2,791.29	2,961.11	2,844.84	2,961.08
Total New Mexico oil and gas GHG emissions (MMT CO_2e)	116.17	126.50	125.32	139.19
Total BLM Mancos-Gallup planning area oil and gas GHG emissions (MMT CO_2e)	38.82	38.78	35.62	28.00

Note: Mbbl = thousand barrels; MMcf = million cubic feet

Source: BLM 2019

3.2.4 Cumulative Effects

Cumulative GHG Emissions from BLM NMSO Lease Sales

The 2019 Air Resources Technical Report, Section 10.6, details recent trends of GHG emissions by sector. Within the fossil fuel combustion sector, the contribution by fuel type shows that petroleum represents 44.7% of the fuel type, natural gas 29.5%, and coal 25.8% (BLM 2019).

In 2017, BLM commissioned a climate change report with an energy focus. The report calculates GHG emissions associated with production and consumption activities related to coal, oil, natural gas, and natural gas liquids. The baseline year is 2014 and forecasts production/consumption GHG emissions for 2020 and 2030 for federal and non-federal lands on a national level and for 13 energy-producing states, not limited to New Mexico, Oklahoma, Texas, and Kansas. Inputs for the report were developed using publicly available online information from such sources as the U.S. Energy Information Administration, EPA's Greenhouse Gas Inventory Report: 1990–2014 (EPA 2016), U.S. Department of the Interior

Office of Natural Resources Revenue, U.S. Extractive Industries Transparency Initiative, BLM oil and gas statistics, and others as applicable to each state. More information on the methodology and assumptions, as well as other data sources for all 13 states, is in the Greenhouse Gas and Climate Change Report, 2017 (Golder Associates 2017), which is herein incorporated by reference.

In November of 2018, the USGS published a scientific investigation report, Federal Lands Greenhouse Gas Emissions and Sequestration in the United States: Estimates 2005-2014 (Merrill et al. 2018). The 2019 Air Resources Technical Report summarizes this information and separates emissions by mineral and discloses relative percentages relative to national and worldwide GHG emissions. In 2014, end-use combustion and extraction of fossil fuels produced on New Mexico federal lands was 91.63 MMT of CO2e. This value is comparable with the 2014 baseline reported value of 93.72 MMT of CO_2e as reported by Golder Associates (2017). The 2014 baseline for the 13 states evaluated in the Golder Associates report is 1,275.53 MMT of CO_2e, compared with an estimated 1,332 MMT CO_2e in the USGS report (Merrill et al. 2018). The values from USGS and Golder Associates include emissions from the combustion of coal, oil, and natural gas from fossil fuels produced on federal lands as well as extraction emissions from activities occurring on federal lands.

For the purposes of this analysis, BLM uses projections of the total federal and non-federal oil and gas emissions from Golder Associates (2017) to estimate expected annual future GHG emissions from energy production and consumption activity within a subnational region, New Mexico, Oklahoma, Kansas, and Texas, which the BLM NMSO has jurisdiction over. Assumptions of the analysis are discussed in Golder Associates 2017. The following are key assumptions:

- State-specific oil consumption is equal to state total production minus export and reserves for the state based on national averages.
- National averages for sector breakdown percentages (power, industrial, etc.) for oil, natural gas, and natural gas liquids consumptions were applied to state-specific data.
- The value of production and consumption on non-federal lands is equal to the difference of the total state or nation value minus the federal lands value.

At the state level, production does not necessarily translate to 100% consumption of the fossil fuel but is representative of future energy consumption and production to show GHG emissions. The development projected in the RFDs for each BLM field office under NMSO jurisdiction (such as the 2018 RFD for the Mancos-Gallup planning area; see Crocker and Glover 2018) are considered in these data. Current and future lease sales are part of each RFD. Because the BLM NMSO has control over lease sales in this area, for NEPA disclosure purposes, this section provides a discussion of reasonably foreseeable cumulative production and consumption within these states and discloses the magnitude of GHG emissions likely to result from BLM NMSO lease sale activities on an annual basis. This information is further contextualized by comparing the relative magnitude of these emission with projected national and global annual GHG emission rates.

New Mexico Coal, Oil, and Gas GHG Emissions

BLM's New Mexico reasonably foreseeable coal, oil, and gas production and consumption GHG emissions from federal activities are 95.09 MMT of CO_2e/year for the 2020 high scenario and

99.35 MMT of CO_2e/year for the 2030 high scenario (Table 0-13). These represent increases of 2.5% and 7.2%, respectively, from the 2014 baseline coal, oil, and gas GHG emissions (92.75 MMT of CO_2e). New Mexico federal coal, oil, and gas GHG emissions of 95.09 (2020 High scenario) and 99.35 (2030 High scenario) MMT CO_2e/year would represent 49% and 52% of state 2020 and 2030 high reasonably foreseeable coal, oil, and gas GHG emissions (see Table 0-113).

Oklahoma Coal, Oil, and Gas GHG Emissions

BLM's Oklahoma reasonably foreseeable coal, oil, and gas production and consumption GHG emissions from federal activities are 2.63 MMT of CO_2e for the 2020 high scenario and 2.44 MMT of CO_2e for the 2030 high scenario (see Table 0-13). This is a decrease of 1.9% and an increase of 8.9%, respectively, from the 2014 baseline coal, oil, and gas GHG emissions (2.68 MMT of CO_2e). Oklahoma federal coal, oil, and gas GHG emissions of 2.63 MMT (2020 high scenario) and 2.44 (2030 high scenario) MMT CO_2e/year would represent 1.14% and 0.96%, respectively, of state 2020 and 2030 high reasonably foreseeable GHG emissions from coal, oil, and gas activities (see Table 0-13).

Kansas Coal, Oil, and Gas GHG Emissions

BLM's Kansas reasonably foreseeable coal, oil, and gas production and consumption GHG emissions from federal activities are 0.42 MMT CO_2e for the 2020 high scenario and 0.47 MMT CO_2e for the 2030 high scenario (see Table 0-13). These values represent increases of 5.0% and 17.5%, respectively, compared with the 2014 baseline coal, oil, and gas GHG emissions (0.40 MMT of CO_2e). Kansas federal coal, oil, and gas GHG emissions of 0.42 (2020 High scenario) and 0.47 (2030 High scenario) MMT CO_2e/year would represent 0.97% and 1.01%, respectively, of state 2020 and 2030 high reasonably foreseeable GHG emissions from coal, oil and gas activities (see Table 0-113).

Texas Coal, Oil, and Gas GHG Emissions

BLM's Texas reasonably foreseeable coal, oil, and gas production and consumption GHG emissions from federal activities are 2.50 MMT of CO_2e for the 2020 high scenario and 2.88 MMT of CO_2e for the 2030 high scenario (see Table 0-113). These are an increase of 4.2% and 20.7%, respectively, compared with the 2014 baseline coal, oil, and gas GHG emissions (2.40 MMT of CO_2e). Texas federal coal, oil, and gas GHG emissions of 2.50 (2020 high scenario) and 2.88 (2030 high scenario) MMT CO_2e/year would represent 0.18% and 0.19%, respectively, of state 2020 and 2030 high reasonably foreseeable GHG emissions from coal, oil, and gas activities (see Table 0-13).

Table 0-13. Reasonably Foreseeable Coal, Oil and Gas Production and Consumption Annual GHG Emissions for BLM New Mexico, Oklahoma, Kansas and Texas

GHG Emissions (MMT CO_2e/year)					
Category	**New Mexico**	**Oklahoma**	**Kansas**	**Texas**	**NM, OK, KS, TX**
2020 High Scenario					
Federal coal	13.89	1.25	0	0	15.14

GHG Emissions (MMT CO_2e/year)					
Category	**New Mexico**	**Oklahoma**	**Kansas**	**Texas**	**NM, OK, KS, TX**
Federal oil	25.49	0.33	0.08	0.06	25.95
Federal gas	49.60	0.96	0.29	2.40	53.25
Federal natural gas liquids	6.11	0.09	0.05	0.04	6.29
Total Federal	**95.09**	**2.63**	**0.42**	**2.50**	**100.64**
Federal + non-federal coal	43.12	1.87	0.13	97.46	142.58
Federal + non-federal oil	55.28	56.72	22.10	518.06	652.16
Federal + non-federal gas	83.28	152.16	18.14	694.29	947.87
Federal + non-federal natural gas liquids	12.14	20.09	3.14	84.14	119.51
Total federal and non-federal	**193.82**	**230.84**	**43.51**	**1,393.95**	**1,862.12**
2030 High Scenario					
Federal coal	10.14	0.91	0	0	11.05
Federal oil	25.60	0.33	0.08	0.06	26.07
Federal gas	57.44	1.11	0.34	2.78	61.67
Federal natural gas liquids	6.17	0.09	0.05	0.04	6.35
Total Federal	**99.35**	**2.44**	**0.47**	**2.88**	**105.14**
Federal + non-federal coal	31.52	1.37	0.1	71.12	104.11
Federal + non-federal oil	55.51	56.95	22.19	520.20	654.85
Federal + non-federal gas	96.45	176.21	21.02	804.05	1097.72
Federal + non-federal natural gas liquids	12.25	20.27	3.17	84.88	120.57
Total federal and non-federal	**195.73**	**254.8**	**46.47**	**1,480.25**	**1,977.25**

Note: Sum of individual values may not equal total due to independent rounding.

Source: Golder Associates 2017

Although a NEPA document may present quantified estimates of potential GHG emissions associated with reasonably foreseeable energy development, there is significant uncertainty in GHG emission estimates due to uncertainties with regard to eventual production volumes and variability, flaring, construction, transportation, etc. A rough estimate was possible using publicly available information and estimates from future production for the RFD scenario. Also, there is uncertainty with regard to the net effects of reasonably foreseeable energy development on climate; that is, while BLM actions may contribute to the climate change phenomenon, the specific effects of those actions on global climate are speculative given the current state of the science. Inconsistencies in the results of scientific models designed to predict climate change on regional or local scales limits the ability to quantify potential future impacts of decisions made at this level and to determine the significance of any discrete amount of GHG emissions beyond the limits of existing science at the present time.

Cumulative Climate Change Impacts

Changes in climate are generally measured over long time periods to avoid the influence of meteorological or climatic cycles occurring on shorter time scales (e.g., inter-annual variability). While climate change projections are available for different regions, the climate impacts from GHGs are a global issue.

Golder Associates (2017: Section 4.0) discusses future climate projections, including four representative concentration pathways (RCPs) as identified by IPCC: RCP 2.6, 4.5, 6.0, and 8.5. The RCP scenarios were developed based on representative GHG emission scenarios including varying assumptions regarding levels of cumulative global GHG emissions over time. RCP 8.5 assumes increasing GHG emissions over time, with no stabilization, and is meant to be representative of scenarios leading to high GHG concentration levels. RCP 4.5 and RCP 6.0 represent scenarios where GHG emissions are reduced over time through climate policy. RCP 2.6 represents a scenario where drastic action is taken through stringent climate policy and substantial GHG emission reductions are achieved over time. The pathways are named after the radiative forcing (defined as the difference between insolation [sunlight] absorbed by the Earth and energy radiated back to space) projected to occur by 2100 (e.g., RCP 8.5 would be projected to result in 8.5 watts per square meter radiative forcing by 2100). The radiative forcing of the atmosphere in each pathway is driven by the concentration of GHGs accumulated in the atmosphere. The RCP characterizations and regions are further described by Golder Associates (2017: Section 4.1) Climate Change report.

Climate change is driven by radiative forcing, which is influenced by cumulative GHG emissions, not annual emission rates from any given sub-national project. Figure 0-1 shows a comparison of global cumulative emissions in relation to RCPs 2.6, 4.5, and 8.5, representing low, medium, and high global cumulative emissions scenarios.

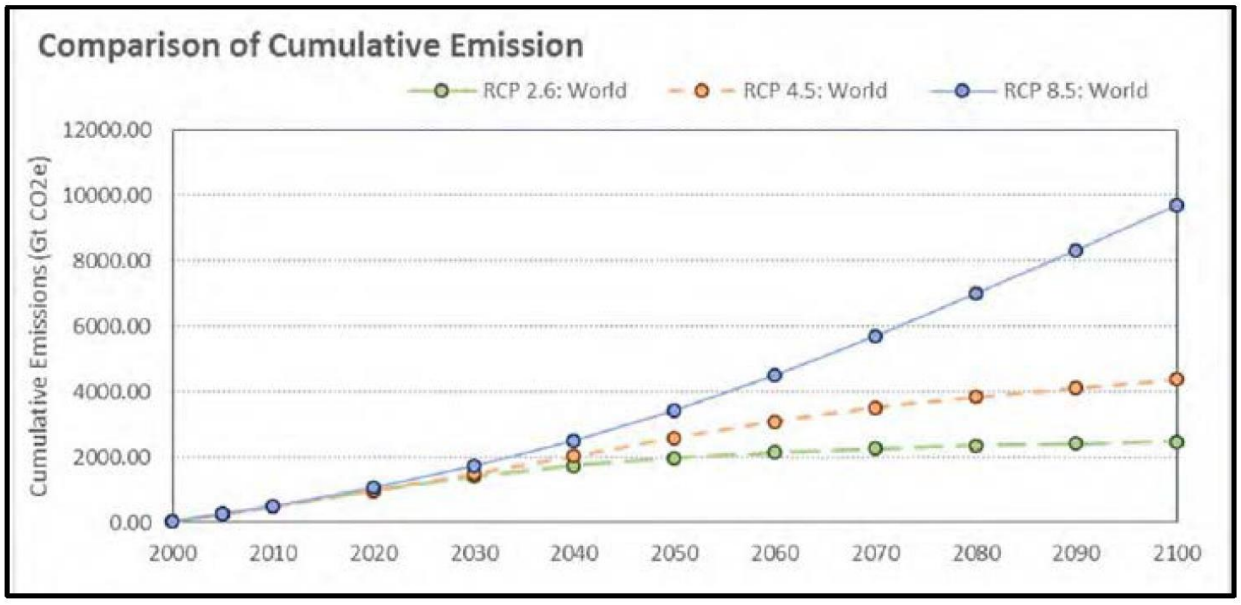

Figure 0-1. Comparison of RCP 2.6, RCP 4.5, and RCP 8.5 cumulative emission estimates over the twenty-first century

When considering the cumulative emissions on a global scale, the annual emission rates of various sub-national projects are one of many emission contributions. Any single contribution on a sub-national scale is dwarfed by the large number of comparable national and sub-national contributors on a global scale.

However, the best surrogate for understanding the potential impact of BLM's sub-national scale emissions on climate is estimating projected annual emission rate due to BLM energy lease sale projects. Golder Associates (2017) provides projections of GHG emissions from the 13 western states that regulate most of the federal fossil fuel leasing and compares these emissions with GHG emissions from other contributors. To accomplish this comparison, the Golder Associates demonstrates a comparison of the projected BLM annual emission rates derived from federal lease sale and production information from the 13 western states and compares them against the RCP scenario emissions profile (a derived value estimating the annual GHG emission rate for each scenario). This comparison is provided in Figure 0-2. For additional context, 2014 baseline year federal resource production and consumption estimates for these 13 states can be compared with the 2014 baseline national energy consumption and total GHG emissions. BLM subnational emissions in these 13 states were approximately 25.97% of the total national energy consumption and 19.75% of national GHG emission totals at 2014 levels. In 2014, federal mineral production and consumption in these 13 states represented approximately 2.64% of the global totals from all emission sources. With the relative magnitude of these emissions in mind, climate change trends and impacts are discussed below.

The contribution of GHG emissions from coal, oil, natural gas, and liquefied natural gas for the 13 BLM subject states in 2020 and 2030 under both normal and high production scenarios were evaluated and compared with the GHG emissions profile (the derived annual emission rate for the three RCP scenarios shown in Figure 3 2). By comparing the relative emission rates of the derived ranges of BLM emissions profiles (low and high estimates) with the RCP scenarios, the BLM emissions most closely track with RCP 8.5 in 2020 and between RCP 2.6 and RCP 4.5 in 2030 (Golder Associates 2017). The reduction in BLM's emissions profile in 2030 compared with 2020 is a result of a projected change to the federal energy resource mixture. Less coal development is projected, while a slight increase in oil, gas, and natural gas liquids are projected into 2030 relative to 2020. Because coal is the most GHG-intensive fossil fuel, the reduction in this resource development is anticipated to reduce BLM's lease sale emissions profile (annual GHG emission rate) overall (see Figure 3.2).

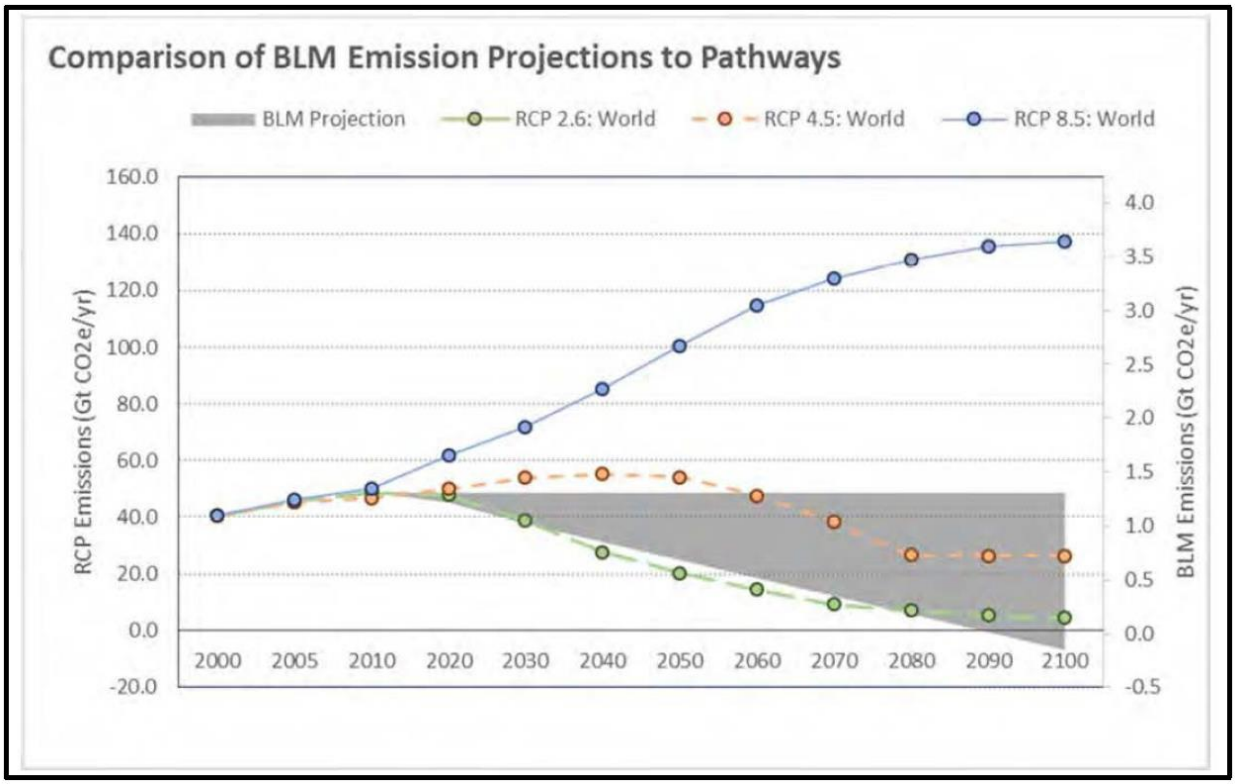

Figure 0-2. Comparison of BLM Emission Projections with RCP 2.6, RCP 4.5, and RCP 8.5

Based on the analysis in Golder Associates (2017), BLM activities are estimated to be conducted at a level that would be in line with the level of emissions anticipated in the RCP 2.6 and RCP 4.5 through 2060. Estimates of BLM activities in future years are more uncertain and have a wider range of variability. The projections presented above are based on best available data and assumptions used to provide context to BLM's cumulative impact. However, due to the levels of uncertainty, some additional information is provided below regarding BLM's relative contribution to global emissions and, by proxy, climate change. If BLM operates under the business-as-usual scenario while all other contributors are reducing their emissions in line with RCP 2.6, the relative contribution of BLM increases as the emissions more closely resemble RCP 4.5. If BLM operates under the decreased emissions scenario, keeping their reductions in line with RCP 2.6 like all the other contributors, the relative contribution of BLM remains similar to current contributions. If BLM operates under the decreased emissions scenario while all other contributors are maintaining constant emissions (business-as-usual) or increasing emissions, the relative contribution of BLM greatly reduces. It is very unlikely that the global cumulative emissions will be strongly influenced by a single contributor at a national or sub-national scale. However, the individual behavior of each contributor, through their relative contribution, has the ability to influence which RCP global emissions scenario is most closely resembled and, therefore, which climate change projections are most likely manifested toward the end of the century (Golder Associates 2017).

To understand the impacts of climate change, the various RCP scenario projections of global temperature and precipitation changes under three RCPs in both the near term (representing the period from 2021 through 2040) and far term (representing the period of 2081 through 2100) are

presented below in Table 0-14. These estimates are derived from the average of over 30 different climate change models using the inputs of each RCP scenario.

Table 0-14. Projected Changes in Climate under Representative Concentration Pathways

RCP Pathway	Near Term		Far Term	
	Temperature (°C)	Precipitation (%)	Temperature (°C)	Precipitation (%)
RCP 2.6	0.78	1.44	0.97	2.27
RCP 4.5	0.85	1.49	1.81	3.51
RCP 8.5	0.96	1.62	3.68	5.89

Under each RCP scenario, projected temperatures are expected to increase and changes in precipitation are anticipated. However, generally, the impacts of climate change are least severe under the RCP 2.6 scenario and most severe under the RCP 8.5 scenario. Regardless of the specific magnitude of the impacts, the impacts to global climate are anticipated to include

- long-term global temperature change;
- intensified droughts impacting agricultural, rural, and urban communities and resulting in changes in land cover and land use;
- intensified and more frequent wildfires;
- sea level rise, ocean warming, and reduced ocean oxygen, impacting global weather patterns and flora and fauna;
- intensified flooding impacting infrastructure, natural resource–based livelihoods, and cultural resources; and
- human health, such as heat-associated deaths and illnesses, chronic diseases, and other health issues associated with poor air quality (Gonzalez et al. 2018).

To understand climate change impacts in the area of the Proposed Action, impacts anticipated in the region encompassing southern Colorado and New Mexico are discussed. Climate modeling suggests that annual average temperatures in this region may rise by 4 to 6 degrees Fahrenheit by the end of the twenty-first century, with warming increasing from south to north. By 2080–2090, the southwestern United States would see a 10% to 20% decline in precipitation, primarily in winter and spring, with more precipitation falling as rain. A recent Bureau of Reclamation report (2013, as cited in BLM 2019) made the following projections through the end of the twenty-first century for the Upper Rio Grande Basin (southern Colorado to central-southern New Mexico) based on the current and predicted future warming:

- There would be decreases in overall water availability by one-quarter to one-third.
- The seasonality of stream and river flows would change, with summertime flows decreasing.
- Stream and river flow variability would increase. The frequency, intensity, and duration of both droughts and floods would increase (BLM 2019).

3.2.5 Mitigation and Residual Impacts

The BLM best management practices are designed to reduce impacts on air quality (see Issue 1) and reduce methane and GHG emissions. In addition, the BLM encourages industry to participate in the Natural Gas STAR program that is administered by the EPA. The Natural Gas STAR program is a flexible, voluntary partnership that encourages oil and natural gas companies to adopt proven, cost-effective technologies and practices that improve operational efficiency and reduce natural gas emissions (EPA 2006). Adoption of the Natural Gas STAR program would likely significantly reduce CO2e emissions since the program is particularly focused on reducing methane, which has a high GWP. However, adoption of Natural Gas STAR Program best practices would reduce but not eliminate GHG emissions.

The EPA has NSPS (codified in 40 CFR 60) in place to reduce methane emissions from oil and gas sources. NSPS OOOOa requires reduction of VOCs and methane from well completion operations from new or re-fractured hydraulically fractured wells and a requires reduction of storage tank emissions by 95% for tanks constructed after September 18, 2015, with emissions greater than 6 tons per year of VOC (this has the co-benefit of reducing methane emissions as well). NSPS OOOOa imposes stringent semiannual leak detection and repair requirements for the collection of fugitive emission components at well sites constructed after September 18, 2015. NSPS OOOOa also requires scheduled maintenance and/or emission control devices for reciprocating and centrifugal compressor venting at compressor stations, including provisions to limit emissions from natural gas pneumatic devices and pumps. These provisions aim to reduce fugitive emissions at oil and gas facilities.

The NMED and New Mexico Energy, Minerals, and Natural Resources Department are each in the process of developing rules that will regulate methane emissions. The departments were charged with this task under the Executive Order on Addressing Climate Change and Energy Waste Prevention of Gov. Michelle Lujan Grisham. The ordwer instructs NMED and New Mexico Energy, Minerals, and Natural Resources Department to “jointly develop a statewide, enforceable regulatory framework to secure reductions in oil and gas sector methane emissions and to prevent waste from new and existing sources and enact such rules as soon as practicable” (NMED 2019d).

3.3 Issue 3: Water

Impacts to groundwater from the proposed alternatives could occur through groundwater depletion or contamination. Potential impacts to surface water and shallow groundwater resources could occur from stormwater runoff and sedimentation associated with soil erosion. There would also be potential for accidental spills and leaks. The impact indicator for groundwater resources is the number of wells drilled and the impact indicator for surface water resources is acres of new disturbance. The analysis area is the San Juan Basin and the state of New Mexico.

3.3.1 Affected Environment

Groundwater

The geologic setting of the San Juan Basin is highly stratified and complex. There are 10 major confined aquifers in the San Juan Basin: Morrison Formation, Ojo Alamo Sandstone, Pictured

Cliffs Sandstone, Cliff House Sandstone, Menefee Formation, Kirtland Shale/Fruitland Formation, Point Lookout Sandstone, Gallup Sandstone, Dakota Sandstone, and Entrada Sandstone. Water yields in these formations vary, with Cenozoic (younger) aquifers in the San Juan Basin, such as the Ojo Alamo Sandstone, the Nacimiento Formation, and the San Juan Formation, having potential to produce water at a rate of 100 gallons per minute (gpm), but in general, most aquifers yield less than 20 gpm (BLM, 2019c). In the southern portion of the San Juan Basin, water for hydraulic fracturing of oil wells comes from sources that tap the Nacimiento Formation and the Ojo Alamo Sandstone.

Groundwater quality in the San Juan Basin is variable (ranging from fresh to brackish) due to the complex stratigraphy and varying rock formations within the Basin. Brackish and saline water is typically found in the center of the Basin, and fresh groundwater is typically found along the Basin margins. Total dissolved solids (TDS) concentration is the primary indicator of groundwater quality. Higher TDS concentrations typically make water less suitable for drinking or for agricultural purposes like irrigation. In groundwater, TDS is influenced by the dissolution of natural materials such as rock, soil, and organic material.

Anthropogenic activities also contribute to TDS concentrations in shallow unconfined aquifers. TDS concentration in the San Juan Basin is dependent on the stratigraphic location and the geologic formation where the water resides. Fresh water (TDS less than 1,000 milligrams per liter [mg/l]) is typically found at depths less than 2,500 feet below the ground surface, although exceptions to this generalization occur in deeper layers like the Gallup Sandstone and Morrison Formation. Saline and brackish water is dominant in the center of the Basin at deeper depths (BLM, 2019c).

Surface Water

Surface water occurrence within the PPA is in the form of ephemeral and intermittent streams, with some impoundments of varying sizes for livestock and wildlife watering and for erosion control. These streams flow for brief periods only in response to rainfall and snowmelt. Runoff and stream flow may result from summertime thunderstorms, melting snow in higher terrain, and frontal system rainfall. The Rio Puerco River, located approximately 20 miles west of the PPA, is the nearest perennial water source. There are no known or observed seeps, springs, or riparian areas within the PPA.

The PPA was evaluated for potential jurisdictional Waters of the U.S, including wetlands. Jurisdictional Waters of the U.S. are regulated by the U.S. Army Corps of Engineers (USACE) under the Clean Water Act. The northern portion of the project area is in the Blanco Canyon Watershed (HUC14080103) and the southern portion is in the Arroyo Chico Watershed (HUC 13020205).

After conducting an onsite inspection of the PPA, referencing the USGS 7.5-minute topographic map of the project area (Deer Mesa), and researching the USFWS online National Wetlands Inventory (NWI), it appears the PPA would cross multiple intermittent/ephemeral USGS watercourses. The washes have a defined stream channel (i.e., Ordinary High Water Mark) and would thereby likely be subject to regulatory jurisdiction under the USACE. Assuming the watercourses are jurisdictional, crossings would be covered under Nationwide Permit No. 12 (Utility Line Activities) or Nationwide Permit No. 14 (Linear Transportation Projects). Numerous smaller, non-jurisdictional washes occur within the PPA and generally

run northeasterly and drain into larger, ephemeral drainages that eventually connect to Torreon Wash, but only in response to large storm events.

Water Disposal

The New Mexico Oil Conservation Division (NMOCD) regulates and monitors underground injection wells. NMOCD permits saltwater disposal wells into formations that will allow water infiltration and has total dissolved solids greater than 10,000 mg/l.

The majority of current saltwater disposal wells are permitted in the Entrada Formation; however, some older saltwater disposal wells were permitted in the Mesaverde Formation. Using data from the New Mexico State Land Office, over 600 saltwater disposal wells are currently located throughout the San Juan Basin with an average depth of around 6,000 feet (BLM, 2018c).

3.3.2 Environmental Impacts – No Action Alternative

The No Action Alternative would result in the continuation of the existing land and resource uses in the analysis area and their subsequent and current impacts to water; therefore, impacts would not be expected.

3.3.3 Environmental Impacts – Proposed Action

Ground Water

During construction, fresh water sources will be used to dampen the native soils as fill slopes are constructed in lifts. Fresh water is also used on an as needed basis for dust suppression along dirt roadways during drilling, completion, and any other operations where heavy traffic will be anticipated. The total amount applied during these activities is all dependent upon, but not limited to, length of dirt road, weather conditions, relative humidity, density of traffic, and duration of traffic. EOG would also use fresh water during initial drilling and post completion drill out operations. During completion operations, EOG would use a combination of fresh and non-potable water with primary usage being non-potable.

The Proposed Action anticipates the use of slick water stimulation for the hydraulic fracturing of the proposed wells during completion operations. Slick water stimulation is a relatively new technology that uses greater quantities of water for fracturing but the sources of water can be produced water, flowback water, or otherwise brackish water as opposed to using freshwater. Slick water stimulation allows for a significant reduction of freshwater used during completion, instead relying on recycled or reused water that's either temporarily stored in on-site tanks communally collected in large above ground storage tanks by neighboring operators.

To date, 20 wells have been drilled using long laterals (approximately 1.5-mile laterals) with slick water stimulation within the FFO. Based on water use information for these wells obtained from Frac Focus and lateral length information obtained from the well APDs, the BLM has calculated a water use average of 27 acre-feet (AF) per lateral mile. Additional information on estimated water use for slick water stimulation is contained in the Water Support Document (USDI BLM, 2020). EOG provides all stimulation fluid properties and

additives through the Frac Focus site established for reporting to State and Federal agencies. See Frac Focus for stimulation fluid components.

Under the Proposed Action, the following estimates are for water use for each well that will be drilled and produced. Based on the depth of the Nacimiento Formation, it is estimated that development of each well would require approximately 180,000-200,000 barrels (23.3-25.8 AF of water for drilling and completion. Development of the 155 wells proposed in the Ford Development would require up to approximately 31,000,000 barrels or 3,995.67 AF of water for drilling and completion.

Fresh water would be obtained from the following locations:

- Blanco Trading Post (POD No. SJ02105), SW ¼, NE ¼, Section 32, Township 25 North, Range 9 West, NMPM. This source is located on State of New Mexico lands managed by NMSLO. Transportation from source will be via truck.

- Smelser Water Hole (POD. No. RG82771), NE ¼, NE ¼, Section 9, Township 21 North, Range 2 West, NMPM. This source is located on private land. Transportation from source will be via truck.

Produced, recycled, non-potable, brine water will be obtained from the following location:

- Basin Disposal Produced Water Central Delivery AST, SE ¼, NE ¼, Section 13, Township 23 North, Range 7 West, NMPM.

The Proposed Action would include up to thirteen storage tanks with containment. Oil and gas along with produced water will be extracted from the well and separated at the facility sites. Oil and produced water will be stored in tanks until transport. Produced water would be hauled by trunk and/or transported through subsurface pipeline infrastructure and disposed of at the following facilities:

- Bois d Arc SWD 001, API 30-043-20981, operated by EOG Resources, Inc., located in the NW ¼ of the SE ¼, Section 22, Township 21 North, Range 5 West (Sandoval County)

- Disposal 001, API 30-045-26862, operated by Basin Disposal Inc., located in the SE ¼ of the NW ¼, Section 3, Township 29 North, Range 11 West (San Juan County)

- Sunco Disposal 001, API 30-045-28653, operated by Agua Moss, LLC, located in the SW ¼ of the NW ¼, Section 2, Township 29 North, Range 12 West (San Juan County)

- Pretty Lady 30 11 24 001, API 30-045-30922, operated by Agua Moss, LLC, located in the NW ¼ of the SE ¼, Section 34, Township 30 North, Range 11 West (San Juan County)

Storage of the oil and liquids at the Proposed Action would increase potential for oil or produced water spills that could affect groundwater quality. As noted in Appendix D, design features and BMPs include containment areas surrounding all tanks. Containment areas would be capable of containing the volume of the single largest storage vessel plus 1-foot freeboard of precipitation; or 110% of the fluids in the largest tank.

If proper cementing and casing programs are not followed, there may be a loss of well integrity, surface spills, or loss of fluids in the drilling and completion process that could result in large volumes of high concentrations of chemicals reaching groundwater resources. If contamination of usable water aquifers (total dissolved solids <10,000 parts per million [ppm]) from any source occurs, changes in groundwater quality could impact springs and water wells that are sourced from the affected aquifers.

The BLM and State of New Mexico Oil Conservation Division (NMOCD) have casing, cementing, and inspection requirements in place to limit the potential for groundwater reservoirs and shallow aquifers to be impacted by fracking or the migration of hydrocarbons during oil and gas drilling and production activities. The BLM requires operators to comply with the regulations at 43 Code of Federal Regulations (CFR) 3160. These regulations require oil and gas development to comply with directives in the Onshore Orders and the orders of the Authorized Officer. Onshore Order No. 2 and the regulations at 43 CFR 3162.3-3 provide regulatory requirements for hydraulic fracturing, including casing specifications, monitoring and recording, and management of recovered fluids. The State of New Mexico also has regulations for drilling, casing and cementing, completion, and plugging to protect freshwater zones (19.15.16 New Mexico Administrative Code). Complying with the aforementioned regulations requires producers and regulators to verify the integrity of casing and cement jobs. Casing specifications are designed and submitted to the BLM together with an APD. The BLM petroleum engineer independently reviews the drilling plan, and based on site-specific geologic and hydrologic information, ensures that proper drilling, casing and cementing procedures are incorporated in the plan to protect usable groundwater. This isolates usable water zones from drilling, completion/hydraulic fracturing fluids, and fluids from other mineral bearing zones, including hydrocarbon bearing zones. Conditions of Approval (COAs) are attached to the APD to ensure groundwater protection. Casing and cementing operations are witnessed by certified BLM Petroleum Engineering Technicians. At the end of the well's economic life, the operator must submit a plugging plan, which is reviewed by the BLM petroleum engineer prior to well plugging. This review ensures permanent isolation of usable groundwater from hydrocarbon bearing zones. BLM inspectors ensure planned procedures are properly followed in the field.

The requirements listed above are in place so that drilling fluids, hydraulic fracturing fluids, and produced water and hydrocarbons remain within the well bore and do not enter groundwater or any other formations. Should a spill occur, the BLM would work with the NMOCD to immediately remediate spills on BLM lands in accordance with federal and state standards, including 19.15.29.11 NMAC. See the Water Support Document (USDI BLM, 2020) for more information on spills.

Surface Water

Water use for development will primarily come from groundwater sources; therefore, surface water quantities would not be affected except in cases of exceptionally large groundwater withdrawals that may result in lowering shallow groundwater tables that support surface waters. Such withdrawals are not expected for the Proposed Action.

Potential impacts to surface water and shallow groundwater resources could occur from stormwater runoff and sedimentation associated with soil erosion. There would also be potential

for accidental spill of chemicals, produced water, or flowback fluids. During the construction of the Proposed Action, approximately 224.1 acres of soil would be temporarily exposed and serve as a sediment source in the short-term. Following drilling and completion, 162 acres of disturbance would be reclaimed in the interim, reducing potential stormwater runoff. If the wells are productive, 62.1 acres would remain barren and compacted on the well pads, production facility pads, storage tank pads, and access roads for the long-term and could be a long-term source of increased runoff and sediment transport into local drainages. When the wells are plugged, all disturbed acreage would be reclaimed, lowering potential sediment transport.

Vegetation cover is generally moderate to high within the Proposed Action and surrounding areas. Removal of vegetation, particularly on slopes, would lead to an increase in an undetermined amount of sediment transport, especially during storm events. Surrounding vegetative coverage will provide filtration of stormwater run-off from the Proposed Action. Slight alteration in the project area drainage patterns may also lead to an increase in sediment transport. These increases in sediment transport may persist for several years until the disturbed soils are stabilized. The potential for sediment transport into the drainages would be minimized through the implementation of the design features outlined in Appendix D and the project's Plans for Surface Reclamation.

Minimal amounts of chemicals (i.e., gas, diesel, etc.) would be used and stored in the PPA during construction and drilling. All chemicals stored on site would be properly contained. Containment structures such as containment dikes, drip pans, or equivalent protective structures would be installed and maintained to prevent discharge onto the adjacent land and arroyos. Any spills of non-freshwater fluids would be immediately cleaned up and removed to an approved disposal site in accordance with federal and state regulations. Any accidental chemical spills or releases could impact the immediate land and arroyos but are not likely to impact local water quality and would be minimized through the implementation of the design features outlined in Appendix D.

3.3.4 Cumulative Effects

The San Juan Basin presents the highest potential for oil and gas development in the RPFO and therefore the greatest demand on water resources. In addition to the projected use in the RPFO jurisdiction noted above, it is important to also consider other development of the San Juan Basin that will impact water use.

Past and Present Actions

Ground Water

Within the San Juan Basin (which encompasses San Juan, McKinley, Rio Arriba, and Sandoval Counties), total water use in 2015 was estimated at 486,660 AF, 15 percent of total state withdrawals (BLM, 2019c). About 10 percent of this total (or 50,008 AF) came from groundwater. The largest water use categories in the San Juan Basin are irrigation (79 percent), followed by public water supply (8 percent). Two percent (11,658 AF per year) of total water use in the San Juan Basin is attributable to mining (the category under which oil and gas operations are reported), all of which comes from groundwater. Most mining water use was saline. In 2015, San Juan Basin mining water use comprised about 7 percent of statewide mining water use (163,901 AF). Total state water use associated with oil and gas development

(4,032 AF) comprises approximately 2.5 percent of the statewide mining water use (163,901 AF). The largest water use categories in the San Juan Basin are irrigation (79%), followed by public water supply (85). Water use for 2015 in the state of New Mexico is summarized in Table 3-15.

Table 3-15. 2015 Statewide Water Use in New Mexico

	Surface Water				Groundwater					Total Water		
Category	Fresh	Saline	Total Surface Water	% of Total Water	Fresh	Saline	Total Ground Water	% of Total Water	Total Fresh Water	Total Saline Water	Total Water	% of Total Water
Public Water Supply	87,751.90	0	87,751.90	3	205,714.70	0	205,714.70	6	293,466.60	0	293,466.60	9
Industrial	0	0	0	0	3,811.40	0	3,811.40	0	3,811.40	0	3,811.40	0
Irrigation	1,485,112.0	0	1,485,112	46	1,175,312.5	0	1,175,312.5	36	2,660,424.50	0	2,660,424.50	82
Livestock	2,522.30	0	2,522.30	0	33,372.20	0	33,372.20	1	35,894.40	0	35,894.40	1
Aquaculture	6,109.50	0	6,109.50	0	20,929.10	0	20,929.10	1	27,038.50	0	27,038.50	1
Mining	19,550.20*	0	19,550.20	1	44,111.40	100,239.8	144,351.20	4	63,661.60	100,239.80	163,901.40	5
Thermoelectric power	30,636.90	0	30,636.90	1	6,871.70	0	6,871.70	0	37,508.70	0	37,508.70	1
Domestic	0.00	0	0.00	0	27,621.40	0	27,621.40	1	27,621.40	0	27,621.40	1
Totals	1,631,385.8	0	1,631,682.8	50.2	1,517,744.3	100,239.8	1,617,984.1	49.80	3,149,427.10	100,239.80	3,249,666.90	100.00

Source: Dieter et al. (2018); updated with additional information provided to the BLM from the New Mexico Office of the State Engineer (NMOSE) regarding water use of the Navajo Power Plant (BLM, 2019c)

*Approximately 19,550 AF of the freshwater use within the mining industry is from surface water; the remainder of all other water use is from groundwater. The mining category includes the following self-supplied enterprises that extract minerals occurring naturally in the Earth's crust: solids, such as potash, coal, and smelting ores; liquids, such as crude petroleum; and gases, such as natural gas. This category includes water used for oil and gas production (well drilling and secondary recovery of oil_, quarrying, milling (crushing, screening, washing, flotation, etc.), and other processing done at the mine site or as part of a mining activity, as well as water removed from underground excavations (mine dewatering) and stored in – and evaporated from – tailings ponds. The mining category also includes water used to irrigate new vegetation covers at former mine sites that have been reclaimed. It does not include the processing of raw materials, such as smelting ores, unless this activity occurs as an integral part of a mining operation and is included in an NMOSE permit.

Table 3-16. 2015 San Juan Basin Water Use

	Surface Water				Groundwater					Total Water		
Category	Fresh	Saline	Total Surface Water	% of Total Water	Fresh	Saline	Total Ground Water	% of Total Water	Total Fresh Water	Total Saline Water	Total Water	% of Total Water
Public Water Supply	21,612.90	0	21,612.90	4	17,958.40	0	17,958.40	4	39,571.30	0	39,571.30	8
Industrial	0	0	0	0	2,634.40	0	2,634.40	1	2,634.40	0	2,634.40	1
Irrigation	381,240.90	0	381,240.90	78	3,576.00	0	3,576.00	1	384,816.90	0	384,816.9	79
Livestock	437.20	0	437.20	0	9,865.00	0	986.50	0	1,423.70	0	1,423.70	0
Aquaculture	0.00	0	0.00	0	4,640.90	0	4,640.90	1	4,640.90	0	4,640.90	1
Mining	2,724.00	0	2,724.00	0.6	3,676.90	5,257.50	8,934.40	2	6,400.90	5,257.50	11,658.40	2

	Surface Water				Groundwater					Total Water		
Thermoelectric power	30,636.90	0	30,636.90	6	2,298.10	0	2,298.10	0	32,935.00	0	32,935.00	7
Domestic	0.00	0	0.00	0	8,979.20	0	8,979.20	2	8,979.20	0	8,979.20	2
Totals	436,651.90	0	436,651.90	89.7	44,750.30	5,257.50	50,007.80	10.30	481,402.20	5,257.50	486,659.70	100.00

Source: Dieter et al. (2018).

As part of oil and gas development, water is used for drilling fluid preparation, completion fluids, well stimulation (of which the most common method is hydraulic fracturing), washing rigs, internal combustion engine coolant, dust suppression on roads or well/facility pads, and equipment testing. Water use associated with hydraulic fracturing of wells, which comprises the majority of water use, is dependent on many factors, including the geologic formation. On average, the water use associated with hydraulic fracturing for vertical wells in the New Mexico portion of the San Juan Basin is 0.537 AF/well (Crocker and Glover, 2018). Horizontal wells require more water than vertical wells for well completion. The 2018 RFD (Crocker and Glover, 2018) reported that horizontal wells in the New Mexico portion of the San Juan Basin require on average approximately 3.13 AF/well.

Surface Water

According to the RPFO RFD (BLM, 2019) as of 2019, existing wells in the RPFO were associated with an estimated 590 acres of surface disturbance. Additional past and present actions that have impacted surface water quality within the RPFO resulting from surface disturbance include livestock grazing, vegetation management, fuel wood cutting, recreation, land management and natural events. Estimated existing disturbances associated with non-oil/gas related development is not available at this time.

Reasonable Foreseeable Future Actions

Ground Water

The 2019 RPFO RFD (Crocker and Glover, 2018) predicts that hydraulically fracturing the projected wells with currently-used methods will require an estimated 8.34 to 14.47 AF of water per year over the next twenty years and 307.39 AF of water over the twenty-year period (Given 200 wells, 160 anticipated to be drilled vertically and 40 horizontally).

The Proposed Action could contribute to the cumulative impacts to groundwater quantity as EOG estimates that approximately up to 200,000 barrels (25.8 AF) of water would be used to drill and complete each well using slick water stimulation. Over a twenty-year period, it is estimated that completion and drilling for each of EOG's proposed 155 wells would require a total of 31,000,000 barrels (3,995.66 AF). Water usage could increase if laterals longer than one mile are drilled, or if operators shift to more water-intensive well completion methods. Water usage could decrease if fewer wells are drilled or fractured, if rates of water re-use and recycling increase over the twenty-year period, or if technological improvements reduce the water volumes required for well completion (Crocker and Glover, 2019).

The Proposed Action could contribute to the cumulative impacts to groundwater quality, including potential contamination of freshwater aquifers from well integrity failures, spills, or loss of fluids during the drilling and completion processes. The regulatory program discussed in the Water Support Document (USDI BLM, 2020) and standard terms and conditions would greatly reduce cumulative impacts to groundwater from the future well development.

Surface Water

Surface disturbances associated with reasonable and foreseeable future actions include the past and present actions outlined above and are expected to continue at their current rate. Within the RPFO, the RFD baseline scenario projects 200 new oil and gas wells (160 vertical wells and 40 horizontal wells) for 2020-2039. Over the life of the plan, the maximum potential disturbance (including existing and projected well pads, roads, and rights-of- way) is 2,750 acres. Accounting for reclamation, it is estimated that 1,190 acres of long-term surface disturbance would remain at the end of the plan in 2039 (Crocker and Glover, 2019).

Development of the Proposed Action would result in new surface disturbance of approximately 224.1 acres. Approximately 162 acres would be reclaimed during interim reclamation and 62.1 acres would remain disturbed for the life of the wells. The Proposed Action would account for 31.95% of existing surface disturbance and 6.9% of total estimated surface disturbance predicted in the RPFO RFD. After reclamation, the Proposed Action would account for 5.2% of the remaining estimated surface disturbance.

The surface disturbances from the construction of roads, pipelines, and well pads associated with the Proposed Action could contribute to the cumulative impacts to surface water resources Specific impacts could include increased soil movement due to vegetation removal. Soil compaction caused by construction could reduce soil infiltration rates, in turn increasing runoff during precipitation events. Downstream effects of the increase runoff may include sedimentation and changes in downstream channel morphology such as bed and bank erosion or accretion. Impacts would be greatest shortly after the start of the Proposed Action and would decrease over time. Implementation of the design features and timely reclamation would minimize impacts to surface waters from the Proposed Action.

3.3.5 Mitigation and Residual Impacts

Ground Water

The producing geologic formation targeted for oil and gas extraction, Nacimiento Formation, is isolated from and at a depth below any underground sources of drinking water. Additionally, BLM Onshore Order #2 requires protection of usable groundwater through proper drilling, cementing and casing procedures. When an operator submits an APD, the operator must submit a site-specific drilling plan. The BLM petroleum engineer reviews the drilling plan, and based on site-specific geologic and hydrologic information, ensures that proper drilling, casing and

cementing procedures are incorporated in the plan in order to protect usable groundwater. This isolates usable water zones from drilling, completion/fracturing fluids, and fluids from other mineral bearing zones, including hydrocarbon bearing zones. Conditions of approval are attached to the APD, if necessary, to ensure groundwater protection. At the end of the well's economic life, the operator must submit a plugging plan which undergoes review by the BLM petroleum engineer prior to well plugging, which ensures permanent isolation of usable groundwater from hydrocarbon bearing zones. BLM inspectors ensure planned procedures are properly followed in the field. The State of New Mexico also has regulations for drilling, casing and cementing, completion and plugging to protect freshwater zones.

Surface Water

Potential impacts to surface water quality are expected to be mitigated by the implementation of design features (Appendix D) and conditions of approval (COA) including stormwater control measures that would slow runoff and capture sediment, and require proper revegetation at the interim and final reclamation phases. Pad-specific SUPOs detail the locations and types of BMPs used to manage stormwater. Construction and reclamation activities would be in accordance with BLM Gold Book standards where applicable. These measures would be applied at the APD stage to address site specific conditions based on submitted surface use plans of operations as required by the BLM. In addition, the State of New Mexico requires stormwater protection plans for disturbances greater than one acre.

Any existing culverts along the Continental Divide Arterial Road, if applicable, may be replaced and upsized to accommodate the reconstructed road width. EOG will install no smaller than a 24-inch culvert with a minimum cover of one half the culvert diameter. Culverts will be installed within existing natural channels and topographic low spots where water may converge, and transverse grade encourages flow across the road. Additional culverts may be installed during construction and interim reclamation beyond those identified if found to be necessary for maintaining a safe and stabile roadway. Bell holes will be constructed on the upstream side of all culverts (Exception: some sandy wide bottom drainages/washes that are culverted in their natural flow direction do not need upstream bell hole. It is best on these drainages to set the culvert at native grade with the wash bottom and build roadway up and over. These drainage types will silt in bell holes immediately in inclement weather and silt in culverts if not installed at wash grade.). Rip-rap Armor will be installed on outlet side of culverts only if found to be necessary per soil type and slope at outlet

Potential impacts to USACE jurisdictional waters of the U.S. would be covered under Nationwide Permit No. 12 or 14. No impacts to wetlands are anticipated. The proposed project would be designed to avoid discharge into other watercourses that are potentially USACE jurisdictional and would not result in the loss of greater than ½ acre of waters of the U.S. and is in conformance with the CWA (33 USC 1251 et seq.). No unaccounted-for water depletions within USFWS-listed fish habitat would occur. There do not appear to be wetlands present in the PPA or within 200 feet of the project area edge of disturbance.

3.4 Issue 4: Induced Seismicity

Impacts to seismicity from the Proposed Action could occur through disposal of produced water. The impact indicator for this issue is the amount of produced water injected as a result of the Proposed Action. The analysis area is the San Juan Basin.

3.4.1 Affected Environment

The area containing the Proposed Action has a highly varied physiography as a result of its position at the intersection of several formally defined physiographic provinces. Generally, the Proposed Action is situated at the western margin of the Rio Grande rift, between the Colorado Plateau, to the west, and the Great Plains, to the east.

The majority of the faulting and folding in New Mexico is distributed within the Rio Grande rift (Machette et al., 2000), which is part of a large region of western North America affected by Cenozoic extension and includes the Basin and Range Province to the west (Keller et al., 1991). Rift zones are associated with high heat flow, vertical movements, and seismic activity (Keller et al., 1991).

Earthquakes in New Mexico mainly occur within three identified earthquake clusters or swarms: the Socorro Seismic Anomaly near Socorro (a naturally occurring phenomena predating oil and gas development), the Dagger Draw (approximately 15 miles northwest of Carlsbad) and Raton Basin (near Raton). The latter two may be linked to specific, nearby wastewater injection wells (Pursley et al., 2013; Sanford et al., 2006).

Recently, there has been concern with induced seismicity (induced earthquakes) from waste water injection. The first earthquakes induced by wastewater injection were in the 1960s. The two largest induced earthquakes are a 5.3 magnitude in Trinidad, Colorado and a 5.6 magnitude in Prague, Oklahoma. From 2010 through 2019, there were 12 earthquakes with a magnitude of 2.5 or greater in areas around the San Juan Basin (USGS, 2020). The Proposed Action is in the San Juan Basin and is further than 150 miles from these areas (see Table 3-17).

The San Juan Basin has not been associated with induced seismicity (Weingarten et al. 2015). In 2018, the San Juan Basin was situated in an area forecast to have less than a 1% annual chance of potentially minor-damage ground shaking (Petersen et al., 2018; USGS, 2018). The Gallina and Nacimiento faults, which are situated on the eastern boundary of the San Juan Basin, are predominantly normal faults that experience vertical displacement of less than 0.2 millimeters per year (USGS, 2019b).

Disposal of wastewater (fluids that are a byproduct of oil production) is the primary cause of anthropogenic felt earthquakes in New Mexico. Hydraulic fracturing is a very minor contributor toward inducing felt earthquakes. Even relatively extreme seismic incidents associated with hydraulic fracturing are well below the damage threshold for modern building codes (USGS, 2019a; Ellsworth, 2013).

Table 2-17. San Juan Basin Earthquakes 2010-2018

2010 - 2018 Earthquakes around the San Juan Basin						
Time	**Lat**	**Long**	**depth (km)**	**Magnitude**	**Felt Report**	**Location**
2018-06-26_03:55	36.1699	-106.9229	2.80	3.00	felt by 4	16km N of Cuba, New Mexico
2018-06-14_22:09	36.1901	-106.9626	5.00	3.00	felt by 4	18km N of Cuba, New Mexico
2016-10-20_13:28	35.2346	-107.4048	5.00	3.50	felt by 1	22km N of Laguna, New Mexico
2013-08-21_09:37	36.5321	-106.2797	5.08	2.60	Not felt	30km SE of Tierra Amarilla, New Mexico
2013-03-31_19:42	35.558	-105.91	5.00	3.00	Not felt	1 km N of El Dorado at Santa Fe, New Mexico
2011-10-17_16:38	35.853	-105.975	5.00	3.50	felt by 10	3.2km SE of Cuyamungue, New Mexico
2011-07-19_12:59	36.223	-106.076	5.00	2.70	Not felt	5.5km SW of Duranes, New Mexico
2011-02-07_13:50	35.693	-106.288	5.00	2.70	Not felt	6.7km NE of Cochiti Lake, New Mexico
2010-12-18_06:55	36.383	-106.638	5.00	3.20	felt by 4	11.6km SW of Alire, New Mexico
2010-12-17_01:31	36.375	-106.722	5.00	3.00	Not felt	13km E of Llaves, New Mexico
2010-12-17_01:31	36.408	-106.707	5.00	3.00	Not felt	10km SW of Wright Place, New Mexico
2010-12-14_16:47	36.399	-106.682	5.00	2.90	Not felt	11.4 km N of Wright Place, New Mexico

The risk of induced seismicity increases with long-term and high-volume injections into deep wells carried out through wastewater (which is water and chemicals added during drilling and fracking process) or produced water injections (Ellsworth, 2013). A combination of many factors is necessary to induce felt earthquakes; the injection rate and total volume injected, the presence of faults that are large enough to produce felt earthquakes, stresses that are large enough to produce earthquakes, and the presence of pathways for the fluid pressure to travel from the injection point to faults (USGS, 2019; Machette et al., 2000). High injection rates of >300,000 barrels per month are much more likely to be associated with earthquakes and any earthquake within 15 kilometers (km) of an active injection well could be associated with that well (Weingarten et al., 2015). From 2010 through 2018, 12 earthquakes with a magnitude of 2.5 or greater were measured at seismographs in areas around the San Juan Basin (USGS, 2020). Depending on the specific circumstances, earthquakes of magnitude 2.5 or greater are often felt, whereas earthquakes of lesser magnitude are often not.

Currently for the San Juan Basin area, none of the active injection wells are within 15 km of recent seismic activity nor does their monthly injection exceed 300,000 barrels (NMOCD, 2019a). The well with the highest average monthly injection rate (82,265 barrels) is 87.5 km from the nearest earthquake. At this time, there is no research that shows a particular formation is more prone to cause induced seismicity. Recent research on how stress and pore pressure affect faults was also unavailable.

3.4.2 Environmental Impacts – No Action Alternative

The No Action Alternative would result in the continuation of the existing land and resource uses in the analysis area and their subsequent and current impacts to induced seismicity; therefore, additional impacts are not expected.

3.4.3 Environmental Impacts – Proposed Action

The Proposed Action would result in approximately 218,220.3 barrels of produced water per well over the life of the wells. Development of the entire Ford Development could result in up to 33,824,146.5 barrels of produced water over the life of the Proposed Action. This is assuming that all of the produced water would be injected and does not account for any water that will be recycled. During the first year of production, it is estimated that one well would produce up to

10,116 barrels of water. The amount of produced water per day is estimated to decrease over time. Table 3-18 shows the estimated volume (in barrels, bbls) of produced water per well and for the entire Proposed Action per day.

Table 3-18. Produced Water Estimates

Year	Average Amount of Water For a Single Well Per Day (bbls)	Average Amount of Water For a Single Well Per Month (bbls)
1	337.2087867	10,116.2636
2	68.12567707	2,043.770312
3	38.39800492	1,151.940148
4	26.46474453	793.9423359
5	20.0566494	601.699482
6	16.07480694	482.2442082
7	13.36940218	401.0820654
8	11.4162639	342.487917
9	9.942739952	298.2821986
10	8.793229018	263.7968705
11	7.872577621	236.1773286
12	7.119391551	213.5817465
13	6.49232176	194.7696528
14	5.960071427	178.8021428
15	5.483166719	164.4950016
16	5.044513382	151.3354015
17	4.640952311	139.2285693
18	4.269676126	128.0902838
19	1.130890078	33.92670234
20	0	0

The Proposed Action would contribute to existing and future produced water quantities within the San Juan Basin. Injection amounts greater than 300,000 barrels of water per month could contribute to increased rates of induced seismicity. EOG would utilize four separate salt water disposal wells (SWD) for the disposal of produced water. One SWD is within Sandoval County and three of the SWDs are within San Juan County.

3.4.4 Cumulative Effects

The BLM-FFO and BLM-RPFO make up the majority of the San Juan Basin and the RFD scenarios created for both planning areas will be used to represent the San Juan Basin as a whole. New Mexico's Underground Injection Control (UIC) Program (NMOCD, 2004) would apply to future well development and injection wells to minimize the cumulative potential for induced seismicity.

Past and Present Actions

Approximately 991,197 barrels of produced water were injected in Sandoval County during 2019 and 423,865 barrels of produced water have been injected from January to August in 2020. Approximately 19,449,196 barrels of water were injected in San Juan County in 2019 and 9,196,819 barrels of water were in injected in 2020. Approximately 944,956,570 barrels of produced water were injected in 2019 from all oil and gas operations in New Mexico as a whole (NMOCD, 2020b).

Reasonable and Foreseeable Future Actions

The 2018 BLM-FFO RFD estimates 279,561,000 barrels of oil, 5,083,680,000 thousand cubic feet of gas (Mcf), and 187,223,000 barrels of water will be produced over the twenty-year period. The 2019 BLM-RPFO RFD estimates 8,479,400 bbls of oil, 3,776,000 Mcf of gas, and 200,633,000 bbls of water (Crocker and Glover, 2019) would be produced over the twenty-year period. It is noteworthy that the Proposed Action was not considered in the analysis performed by Crocker and Glover for the RPFO RFD.

Future potential development of the Proposed Action would result in approximately 218,220.3 barrels of water per well over the life of the wells. During the first year of production, it is estimated that one well would produce up to 10,116 barrels of produced water, as compared to a total number of 944,956,570 barrels of injected produced water in 2019 from all oil and gas operations in New Mexico as a whole (NMOCD 2020b). Development of the entire Ford Development could result in up to 33,824,146.5 barrels of produced water over the life of the Proposed Action. The amount of anticipated produced water from future potential development of the Proposed Action would be approximately 8.32% of the total estimated amount of produced water within the BLM-FFO and BLM-RPFO over a twenty-year period. Development of the Proposed Action would be spread out over 20 years with an estimated 3-6 wells drilled and developed per year. Spreading out development over 20 years would reduce the annual amount of produced water from the Proposed Action.

With consideration of how New Mexico regulates its injection wells and the current risk of earthquakes in the San Juan Basin, development of the Proposed Action is not expected to result in induced seismicity.

3.4.5 Mitigation and Residual Impacts

The BLM's regulations state, "for an injection well proposed on Federal or Indian leases, the operator shall obtain an UIC permit pursuant to 40 CFR parts 144 and 146 from the Environmental Protection Agency or the State/Tribe where the State/Tribe has achieved primacy" (BLM, 1993). The operator shall also comply with procedural and information requirements for Application for Permit to Drill or Sundry Notice as set forth in Onshore Oil and Gas Order No. 1 (BLM, 2017b). The injection well shall be designed and drilled or conditioned in accordance with the requirements and standards described in Order No. 7 (BLM 1993) and pertinent NTLs, as well as the UIC permit.

The EPA classifies these wells as Class II injection wells, which are wells used for disposal of fluids associated with the production of oil and natural gas (hydrocarbons); to inject fluids for

enhanced oil recovery; or for the storage of liquid hydrocarbons. New Mexico's UIC Program monitors and regulates the injection of fluids into the subsurface. New Mexico regulations set limits on maximum allowable injection pressures and require mechanical integrity testing of the boreholes, pressure monitoring, and reporting. All injection wells permitted by New Mexico Oil Conservation Division (NMOCD) are subject to limitations on surface-injection pressure. Wells are required to be equipped with a pressure-limiting device which ensures that the maximum surface injection pressure is not exceeded (NMOCD, 2004). Compliance officers from the NMOCD periodically inspect wells and surface facilities to ensure wells and related surface equipment are in good repair and meet regulations.

3.5 Issue 5: Soils

Impacts to soils from the Proposed Action could occur through ground disturbance activities during construction. The impact indicator for this issue is acres of new disturbance. The analysis area is the RPFO.

3.5.1 Affected Environment

The Natural Resource Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database indicates the soil map units underlying the Proposed Action are Orlie-Sparham association, Blancot-Councelor-Tsosie association and Vessilla-Menefee-Orlie association. None of the primary components are listed as prime farmland soils. Table 3-19 summarizes the soil types at the Proposed Action. Complete information on each soil can be found at the Web Soil Survey, websoilsurvey.nrcs.usda.gov and the project-specific Biologic Survey Reports for the Proposed Action.

Table 3-19. Soils and General Soil Characteristics of the Proposed Action

Proposed Action Component	Soil Name	Classification	General Soil Location	Erosion Potential	Run-Off	Available Water Holding Capacity	Limiting Factor(s)	Reclamation Potential
Bullitt 1 Bullitt 06 Thunderbird Falcon Capri Pinto Torino Interceptor Roads Borrow Sources	Orlie-Sparham association, 0 to 5 percent slopes	Medium to fine sandy loam/silty clay	Valley sides, floors and terraces	Moderately high wind erosion	Medium	Well drained, high	Low organic content and wind erosion	Fair
Talledaga Durango Galaxie Roads Borrow Sources	Blancot-Councelor-Tsosie association	Fine-loamy, mixed, mesic Ustalfic Haplargids	Valley sides, ridges, sideslopes, stream terraces	Moderately high wind erosion	Low	Well drained, very low	Low organic content and wind erosion	Fair

Proposed Action Component	Soil Name	Classification	General Soil Location	Erosion Potential	Run-Off	Available Water Holding Capacity	Limiting Factor(s)	Reclamation Potential
Starliner Del Rio Thunderbird Fairlane	Vessilla-Menefee-Orlie association	Loamy, mixed, calcareous, mesic Lithic Ustorthents	Mesas, mountainside, hillslopes	Moderately high wind erosion	Very High	Well drained, very low	Low organic content and wind erosion	Poor

3.5.2 Environmental Impacts – No Action Alternative

The No Action Alternative would result in the continuation of the existing land and resource uses in the analysis area and their subsequent and current impacts to soil, therefore there would be no expected, additional impacts.

3.5.3 Environmental Impacts – Proposed Action

Under the Proposed Action, a maximum of 224.1 acres of soil/vegetation would be cleared, topsoil would be stripped, and surface would be altered. Approximately 162 acres would be reclaimed during interim reclamation and approximately 62.1 acres would remain as bare, relatively flat, compacted surface for the life of the Proposed Action. The soils found in the analysis area have been classified as having low to very high surface runoff, are well drained, and are susceptible to wind erosion.

The primary impacts to area soils from the Proposed Action include the potential for erosion. The level of erosion susceptibility may vary over the life of the project, depending on the project phases. Proposed Action phases are detailed in Table 2-2. The hazard of erosion would be the highest during the construction and completion phases as the clearing of vegetation would result in the exposure of soils to water erosion, wind erosion, and direct human disturbances. During the reclamation phase there would be a potential for erosion until vegetation has been reestablished (three to five growing seasons). The overall potential impacts to soils would be dependent, in part, on seasonal variation in rainfall and snowmelt run-off, terrain, soil type, prevailing winds, and vegetative cover. There is a potential for soil contamination due to spills or leaks. Soil contamination from spills or leaks can result in decreased soil fertility, less vegetative cover, and increased soil erosion.

3.5.4 Cumulative Effects

Cumulative impacts to soils in the RPFO include the total amount of short-term and long-term surface disturbance due to past, present and future surface disturbances.

Past and Present Actions

According to the RPFO RFD (BLM, 2019) as of 2019, existing wells in the RPFO were associated with an estimated 590 acres of surface disturbance. Additional past and present actions that have impacted soils within the RPFO resulting from surface disturbance include livestock grazing, vegetation management, fuel wood cutting, recreation, land management and natural events. Estimated existing disturbances associated with non-oil/gas related development is not available at this time.

Reasonable and Foreseeable Future Actions

Surface disturbances associated with reasonable and foreseeable future actions include the past and present actions outlined above and are expected to continue at their current rate. Within the RPFO, the RFD baseline scenario projects 200 new oil and gas wells (160 vertical wells and 40 horizontal wells) for 2020-2039. Over the life of the plan, the maximum potential disturbance (including existing and projected well pads, roads, and rights-of- way) is 2,750 acres. Accounting for reclamation, it is estimated that 1,190 acres of long-term surface disturbance would remain at the end of the plan in 2039 (Crocker and Glover, 2019).

Development of the Proposed Action would result in new surface disturbance of approximately 224.1 acres. Approximately 162 acres would be reclaimed during interim reclamation and 62.1 acres would remain disturbed for the life of the wells. The Proposed Action would account for 32.22% of existing surface disturbance and 6.9% of total estimated surface disturbance predicted in the RPFO RFD. After reclamation, the Proposed Action would account for 5.2% of the remaining estimated surface disturbance.

Natural and human induced soil erosion has and continues to result in increased sedimentation of surface waters, with resulting impacts to the watersheds. The Proposed Action may contribute to localized erosion, but impacts would be short-term and minor. With proper mitigation as outlined below and when added to past, present, and reasonably foreseeable activities that may also impact soils in the area, the Proposed Action is not expected to result in substantial cumulative impacts to soil resources.

3.5.5 Mitigation and Residual Impacts

The implementation of erosion control measures in accordance with the Design Features outlined in Appendix D and the project Surface Reclamation Plans (included as part of the project's Surface Use Plan of Operation) would limit soil damage and erosion. Additionally, Design Features implemented to mitigate impacts to upland vegetation (as discussed in Section 3.6) would limit soil damage and erosion.

3.6 Issue 6: Vegetation

Impacts to vegetation from the Proposed Action could occur through ground disturbance activities, vehicle traffic, and fugitive dust. The impact indicator for this issue is acres of new disturbance. The analysis area is the RPFO.

3.6.1 Affected Environment

The following two distinctive vegetative communities are located within the PPA: sagebrush grassland and open pinyon-juniper woodland. Grasses noted within the PPA include blue grama (*Bouteloua gracilis*), Indian ricegrass (*Achnatherum hymenoides*), galleta (*Pleuraphis jamesii*), sand dropseed (*Sporobolus cryptandrus*), and needle-and-thread grass (*Hesperostipa comate*), Forbs and shrubs common within the sagebrush grassland community include rabbitbrush (*Ericameria nauseosa*), sand sagebrush (*Artemisia filifolia*), broom snakeweed (*Gutierrezia sarothrae*), plains blackfoot (*Melopodium leucanthum*), big sagebrush (*Artemisia tridentata*), New Mexican prickly pear cactus (*Opuntia phaeacantha*), narrow leaf yucca (*Yucca angustissima*), and banana yucca (*Yucca baccata*). The pinyon-juniper woodland contains many

of the species described above but also contains a distribution of one-seed juniper (*Juniperus monosperma*) and pinyon pine (*Pinus edulis*).

During the biological surveys, no USDA-listed noxious weeds (NRCS 2010) or NMDA-listed invasive or poisonous weed species were identified within the PPA. Russian thistle (*Salsola australis*) and cheat grass (*Bromus tectorum*) were noted in sporadic patches throughout the PPA, particularly in areas of existing disturbance. Although Russian thistle and cheatgrass are not included on the USDA, NMDA, or BLM invasive, non-native plant species lists, they are known to out-compete desirable, native vegetation (Whitson et al., 1992).

3.6.2 Environmental Impacts – No Action Alternative

The No Action Alternative would result in the continuation of the existing land and resource uses in the analysis area and their subsequent and current impacts to vegetation, therefore there would be no expected, additional impacts.

3.6.3 Environmental Impacts – Proposed Action

Information regarding the individual plant species for each project location can be found in the project-specific Biological Survey Reports. Under the Proposed Action, a maximum of 224.1 acres of soil/vegetation would be cleared, topsoil would be stripped, and surface would be altered. Approximately 162 acres would be reclaimed during interim reclamation and approximately 62.1 acres would remain as bare, relatively flat, compacted surface for the life of the Proposed Action. Approximately 350-400 pinyon/juniper trees would be removed as part of the Proposed Action. Details of individual project disturbances can be found in Appendix B.

The accumulation of fugitive dust on neighboring native vegetation and the potential introduction of invasive species caused by vehicle traffic servicing the Proposed Action may impede native vegetative growth and vigor within the PPA and surrounding areas. The introduction of invasive species and the success of area reclamation could cause a change in species and cover within the PPA and these impacts could continue throughout the life of the producing wells.

3.6.4 Cumulative Effects

Cumulative impacts to vegetation in the RPFO include the total amount of temporary and permanent surface disturbance due to past, present and future surface disturbances.

Past and Present Actions

According to the RPFO RFD (BLM, 2019), as of 2019 oil and gas wells in the RPFO were associated with an estimated 590 acres of surface disturbance. Additional past and present actions that have impacted vegetative cover, growth, and change in species within the RPFO resulting from surface disturbance include livestock grazing, vegetation management, fuel wood cutting, recreation, land management and natural events. Estimated existing disturbances associated with non-oil/gas related development are not available at this time.

Reasonable and Foreseeable Future Actions

Surface disturbances associated with reasonable and foreseeable future actions include the past and present actions outlined above and expected to continue at their current rate. Within the

RPFO, the RFD baseline scenario projects 200 new oil and gas wells (160 vertical wells and 40 horizontal wells) for 2020-2039. Over the life of the plan, the maximum potential disturbance (including existing and projected well pads, roads, and rights-of- way) is 2,750 acres. Accounting for reclamation, it is estimated that 1,190 acres of long-term surface disturbance would remain at the end of the plan in 2039 (Crocker and Glover, 2019).

Cumulative Impacts Analysis

The Proposed Action would contribute 224.5 acres of disturbances (162 acres short-term, reclaimed disturbance and 62.1 acres long-term disturbance) to the cumulative amount of disturbance from oil and gas development in the RPFO (approximately 6.7 percent of the total acres of past, present and potential surface disturbances).

With proper mitigation as outlined below and when added to past, present, and reasonably foreseeable activities that may also impact vegetative cover, growth, and change in species in the area, the Proposed Action is expected to have moderate short-term and minor long-term cumulative impacts to area vegetation resources.

3.6.5 Mitigation and Residual Impacts

The implementation of vegetation/fuel wood/reclamation measures in accordance with the Design Features outlined in Appendix D and the project Surface Reclamation Plans (included as part of the project's Surface Use Plan of Operation) would limit impacts to vegetation and provide direction for successful reestablishment of vegetation within the project areas. Additionally, Design Features implemented to mitigate impacts to soil resources (as discussed in Section 3.5) would also limit the impact to vegetative cover, growth, and change in species in the area.

Re-established vegetation would consist of native grass, forb, and shrub species included in the seed mixture. The interim and final reclaimed vegetation would result in a vegetation community different from, but comparable to, the original native plant community of the PPA. The establishment of seeded vegetation is expected to take three to five growing seasons, depending on precipitation, the successful deferment or exclusion of livestock grazing, and the prevention of the establishment of weedy annuals from the site during this time (Monsen et al., 2004). Revegetation is especially difficult in desert shrub habitat, because soils are shallow and highly saline, and moisture availability is relatively low (Monsen et al., 2004).. Within reclaimed areas, regeneration of the one-seed juniper and pinyon pine trees are not expected for over 50 years. The native vegetation communities, excluding the trees species, are expected to return within 5 years.

3.7 Issue 7: Grazing

Impacts to grazing from the Proposed Action could occur through ground disturbance activities, removal of vegetation, and vehicle traffic. The impact indicator for this issue is acres of new disturbance. The analysis area is the Pelon Community allotment, Continental Divide Community allotment, Starr Community allotment and a limited section of the Counselor Community allotment, which are all located within the PPA.

3.7.1 Affected Environment

The San Juan Basin has been producing oil and natural gas since the early to middle 1900s and is characterized by overlapping uses for grazing and dispersed recreation. Cattle comprise the majority of grazing livestock within the vicinity of the Proposed Action. Grazing of horses is not authorized. Livestock grazing is yearlong.

The metric the BLM uses to evaluate impacts from grazing are "Animal Unit Months" (AUM). An AUM is the amount of forage required by one animal unit for one month. The Natural Resources Conservation Service (NRCS) uses 30 pounds of air-dry forage per day as the standard forage demand for a 1,000- pound cow and her calf (one animal unit).
The BLM establishes a limit for AUMs in each grazing allotment based on existing conditions. This defines the total maximum number of AUMs. This is due to factors such as drought, financial limitations, market conditions, and implementation of grazing practices to improve range conditions. Grazing occurs year- round. The four grazing allotments and their respective permits allow for a total of 6,817 AUMs throughout the year. The number of cattle and AUMs permitted varies by season and is highlighted in Table 3-20.

Table 3-20. Grazing Allotments

GRAZING ALLOTMENT	PERMITTEE	PERMIT #	TOTALS	
			Cattle	AUM
Pelon	Casaus Brothers	3000529	38	132
Pelon	Sisto Sandoval & Sons	3000642	42	309
Pelon	H&J Sanchez Cattle LLC	3000943	156	527
Starr	Lee Johnson	3024825	55	433
Starr	Craig & Casey Spradley	3027272	109	1073
Continental Divide	Eugene Johnson & Sons LLC	3026767	140	980
Counselor Community	28 active permittees	-	112	3363
		Total:	652	6,817

3.7.2 Environmental Impacts –No Action Alternative

The No Action Alternative would result in the continuation of the existing land and resource uses in the analysis area and their subsequent and current impacts to grazing, therefore there would be no expected, additional impacts.

3.7.3 Environmental Impacts –Proposed Action

The Proposed Action would impact a total of approximately 224.1 acres of livestock forage and shelter. This impact would be for the short-term, until interim reclamation replaces approximately 162 acres of livestock forage. In the long-term, if the wells are economically productive, approximately 62.1 acres would be removed from livestock grazing for the long term. Table 3-21 identifies the total number of acres in each of the four grazing communities, and the associated impacted acreage by the Proposed Action broken down by previously disturbed, newly disturbed, interim reclamation, and final reclamation as a percent of total grazing community.

Table 3-21. Grazing Acres Affected by Proposed Action

Grazing Lease	Total Acres	EOG Location	Previously Disturbed Acres	Newly Disturbed Acres	Reclamation	Final Reclamation/Long-Term Disturbance	% of Total Acres Long Term Disturbance
Continental Divide (NM00001)	8,542.68	Bullitt 06	11.88	10.56	20.01	2.42	0.028
		Thunderbird		11.79	8.07	3.73	0.044
		Falcon		11.42	9.2	2.21	0.026
		Capri		11.78	9.38	2.4	0.028
		Pinto	5.56	17.8	15.89	7.5	0.088
		Torino	0.94	15.13	10.58	5.48	0.064
		Interceptor	3.36	14.6	12.32	5.64	0.066
Total Long-term Disturbance:						29.38	0.344
Counselor Community (NM006015)	100,559	Bullitt 1 Pilot	1.85	5.59	6.24	1.21	0.001
		Del Rio		11.15	9.07	2.08	0.002
Total Long-term Disturbance:						3.29	0.003
Starr Community (NM00004)	16,160	Galaxie		11.79	9.48	2.3	0.014
		Durango		11.38	9.18	2.2	0.014
Total Long-term Disturbance:						4.5	0.028
Pelon Community (NM00003)	7,689	Talladega	8.79	10.5	16.88	2.4	0.031
		Starliner	1.72	10.93	10.01	2.64	0.034
		Fairlane	0.41	3.86	1.31	2.14	0.027
Total Long-term Disturbance:						7.18	0.093

Additional direct short-term impacts of the Proposed Action could include displacement of permitted livestock during construction and drilling activities, or exposure of livestock to hazards. Vehicle traffic associated with the wells could also pose a direct threat to livestock, considering that the areas are within open range and livestock may be found on roads in the project area. Direct impacts to livestock could occur if pits are not excluded properly; however, the Proposed Action will be drilled utilizing a closed-loop system, and will not require a reserve pit.

After construction and drilling, livestock should become acclimated to the Proposed Action and associated traffic. As discussed in Appendix D, Design Features, during the drilling and productive phases of the well, all potential hazards would be properly fenced to prohibit livestock access.

3.7.4 Cumulative Effects

Past and Present Actions

According to the RPFO RMP as of 2019, it was estimated that there are approximately 590 acres of existing disturbance associated with oil and gas development within the RPFO. Additional past and present actions that have impacted livestock within the RPFO resulting from surface disturbance include vegetation management, recreation, land management and natural events. Estimated existing disturbances associated with non-oil/gas related development are not available at this time. The four grazing allotments and their respective permits allow for a total of 6,817 AUMs throughout the year.

Reasonable Foreseeable Future Actions

The 2019 RPFO RFD anticipates the maximum potential disturbance (including existing and projected well pads, ROWs) to be 2,750 acres over the lifespan of the RFD. Accounting for reclamation, 1,190 acres of surface disturbance is projected to remain at the end of the plan in 2039 (Crocker and Glover, 2019).

Development of the Proposed Action would result in new surface disturbance of approximately 224.1 acres. Approximately 162 acres would be reclaimed during interim reclamation and 62.1 acres would remain disturbed for the life of the wells. The Proposed Action would account for 6.9% of total estimated surface disturbance predicted in the RPFO RFD. After reclamation, the Proposed Action would account for 5.2% of the remaining estimated surface disturbance.

Within the Continental Divide grazing allotment, the Proposed Action would result in long-term disturbance of 29.38 acres or 0.34% of the acreage available within the grazing allotment. Within the Counselor Community grazing allotment, the Proposed Action would result in long-term disturbance of 3.29 acres of 0.003% of the available acreage within the grazing allotment. Long-term disturbances within the Starr Community grazing allotment and the Pelon Community grazing allotment would result in the disturbance of 4.5 acres and 7.18 acres, respectively. This would account for 0.028% of available acreage within the Starr Community allotment and 0.093% of the available acreage within the Pelon Community allotment.

Livestock grazing is expected to continue unaltered within the Proposed Action. The Proposed Action would result in a slight decrease in livestock forage with majority of impact the Pelon Community and Continental Divide Community. Development of oil and gas including associated roads would add new elements of livestock hazards due to equipment hazards, substance hazards, and the potential for vehicle collisions.

3.7.5 Mitigation and Residual Impacts

The implementation of Livestock Grazing measures in accordance with the Design Features outlines in Appendix D and the project Surface Reclamation Plans (included as part of the Project's Surface Use Plan of Operation) would limit impacts to livestock and provide direction for successful continuation of grazing within the PPA. Additionally, Design Features implemented to mitigate impacts to vegetation (as discussed in Section 3.6) would also limit the impact to area grazing. The residual impact outlined in section 3.6 are applicable to grazing as

well. Pad-specific SUPOs address specific fence lines crossed by access roads and discuss placements of gates and cattle guards.

3.8 Issue 8: Wildlife

Impacts to area wildlife from the Proposed Action could occur through ground disturbance activities and noise created during construction, operation, removal of vegetation, and vehicle traffic. The impact indicator for this issue is acres of new disturbance. The analysis area is the RPFO.

3.8.1 Affected Environment

Biological surveys were conducted for the Proposed Action on February 26th, March 30th, April 29th, June 30th, July 11th, and July 21st, 2020. The objective of the biological surveys was to determine the potential for listed endangered, threatened, candidate, and other designated sensitive flora and fauna species to occur within the proposed action area, including migratory birds. Prior to the surveys, a list was developed of high priority migratory bird species with potential to occur in the area of the proposed action. See the site-specific biological survey reports, on file with BLM-RPFO, for more information.

Wildlife commonly encountered in the area includes coyote (*Canis latrans*), common raven (*Corvus corax*), red-tailed hawk (*Buteo jamaicensis*), Nuttall's cottontail (*Sylvilagus nuttallii*), black-tailed jackrabbit (*Lepus californicus*), mule deer (*Odocoileus hemionus*), and various rodents, migratory birds, and reptiles. Wildlife observed during the biological surveys, or evidence of their presence, include:

Common Raven	*Corvus corax*
Western Meadowlark	*Sturnella neglecta*
Mountain Bluebird	*Sialia currucoides*
Spotted Towhee	*Pipilo maculatus*
Red-Tailed Hawk	*Buteo jamaicensis*
Burrowing Owl	*Athene cunicularia*
Pinyon Jay	*Gymnorhinus cyanocephalus*
Mule Deer	*Odocoileus hemionus*
Cottontail rabbit	*Sylvilagus* sp.
Black-tailed prairie dog	*Cynomys ludovivianus*
New Mexico Whiptail lizard	*Aspidoscelis neomexicanus*

Vegetation communities found within the PPA are discussed in Section 3.6 and were found to provide suitable foraging and/or nesting habitat for serval wildlife species, including migratory birds. The Proposed Action occurs within GMU unit 7 but does not contain any known critical migration routes or habitat for big game.

Table 3-22 lists federally listed Endangered, Threatened, or Candidate species that have potential to occur within Sandoval County, NM, their conservation status, habitat requirements, and potential to occur in the proposed project or action area. Species are considered to have a "low" potential to occur within an area if some suitable habitat characteristics are present but other core habitat characteristics are lacking.

Table 3-22. USFWS IPaC Species List for Sandoval County, NM and the Action Area

Species	Status	Occurrence Within Region	Habitat	Potential to Occur within Action Area
BIRDS				
Mexican Spotted Owl (*Strix occidentalis lucida*)	Threatened	Year-round range.[2]	Mixed conifer forests. Typically where unlogged, uneven-aged, closed-canopy forests occur in steep canyons.[1]	**No potential.** PPA does not provide suitable habitat for species to occur. Lack of mixed conifer forests and steep canyons a limiting factor.
Southwestern Willow Flycatcher (*Empidonax traillii extimus*)	Endangered with Designated Critical Habitat	Summer/breeding range.[2]	Breeds in dense riparian habitat.[2]	**No potential.** PPA does not provide suitable habitat for species to occur. Lack of riparian habitat limiting factor.
Western yellow-billed cuckoo (*Coccyzus americanus*)	Threatened	Possible rare summer/breeding occurrences.[2]	In the southwestern U.S., associated with riparian woodlands dominated by cottonwood or willow trees. In New Mexico, native or exotic species may be used.[2]	**No potential.** PPA does not provide suitable habitat for species to occur. Lack of riparian habitat limiting factor.
AMPHIBIANS				
Jemez Mountains Salamander (*Plethodon neomexicanus*)	Endangered	Range restricted to Jemez Mountains.[2]	Mixed conifer habitat with abundant rotted logs and surface rocks. Vegetation is dominated by fir, spruce, and ponderosa pine (7,185-11,256 feet AMSL).[2]	**No potential.** PPA does not provide suitable habitat for species to occur. Lack of mixed conifer habitat a limiting factor.
MAMMALS				
New Mexico meadow jumping mouse (*Zapus hudsonius luteus*)	Endangered	New Mexico range includes portions of San Juan Mountains, Sangre de Cristo Mountains, Jemez Mountains, Sacramento Mountains, Rio Grande Valley, and lower Rio Chama Valley.[1]	Nests in dry soils, but requires moist, streamside, dense riparian/wetland vegetation up to an elevation of about 8,000 feet; utilizes two riparian community types: 1) persistent emergent herbaceous wetlands (i.e., beaked sedge and reed canary grass alliances); and 2) scrub-shrub wetlands (i.e., riparian areas along perennial streams that are composed of willows and alders). It especially uses microhabitats of patches or stringers of tall dense sedges on moist soil along the edge of permanent water.[1]	**No potential.** PPA does not provide appropriate dense riparian habitat for species to occur.

Table 3-22. USFWS IPaC Species List for Sandoval County, NM and the Action Area

Species	Status	Occurrence Within Region	Habitat	Potential to Occur within Action Area
[1]USFWS; [2]NatureServe Explorer				

Species in Table 3-23 are listed by the BLM New Mexico State Office as Sensitive (SEN) and/or as Endangered, Threatened, Species of Greatest Conservation Need (SGCN) or Species of Concern by the State of New Mexico. Species addressed previously will not be reiterated here.

Table 3-23. Bureau of Land Management and State of New Mexico Sensitive Species

Species Name	Conservation Status		Habitat Associations	Potential to Occur in Action Area
	BLM	State of NM		
BIRDS				
Bendire's thrasher (*Toxostoma bendirei*)	SEN	SGCN	Typically inhabits sparse desert shrubland and open woodland with scattered shrubs. Breeds in scattered locations in central and western portions of NM; most common in southwest NM. [2,3]	Areas of open shrubland within the PPA may provide potential, suitable habitat for species to occur.
Burrowing owl (*Athene cunicularia*)	SEN	SGCN	Dry, open, short-grass, treeless plains. Nests in abandoned burrows and is typically associated with prairie dog colonies. [2,3]	PPA provides suitable habitat for species to occur. Active prairie dog colonies were observed near the Talladega 1409 Fed 601H location. No active nests were identified and no individuals were observed during survey.
Pinyon jay (*Gymnorhinus cyanocephalus*)	SEN	SGCN	Foothills throughout NM wherever large blocks of pinyon-juniper woodland habitat occurs. [2,3]	Areas of open woodland within the PPA may provide potential, suitable habitat for species to occur. Lack of large blocks of pinyon-juniper woodland may be a limiting factor.
Mexican Whip-poor-will (*Antrostomus arizonae*)	SEN	SGCN	Pine-oak woods in mountains. Breeds in woodland in mountains and canyons, mostly in the pine-oak zone at middle elevations.	**No potential.** PPA does not provide suitable habitat for species to occur. Lack of pine-oak woodlands likely a limiting factor.

Species Name	Conservation Status		Habitat Associations	Potential to Occur in Action Area
	BLM	State of NM		
Virginia's Warbler (*Vermivora virginiae*)	SEN	SGCN	Breeding during the summer and commonly transient in areas of pinon/juniper woodlands, ponderosa/oak forests, and mixed conifer forests near terrestrial regions. Breeds in areas with steep draw, drainages, or slopes with oak or other shrubby vegetation. [2]	**No potential.** PPA does not provide suitable habitat for species to occur. Lack of woodlands likely a limiting factor.
PLANTS				
Brack's hardwall cactus (*Sclerocactus cloveriae* ssp. *brackii*)	SEN	-	Sandy clay slopes of the Nacimiento Formation in sparse semi desert, piñon-juniper grasslands and open arid areas of badland habitat (5,000-6,400 feet AMSL). [2,4]	**No potential.** PPA does not provide suitable habitat for species of occur. Lack of Nacimiento formations likely a limiting factor.
Clover's Cactus (*Sclerocactus cloverae*)	SEN	-	Gravelly or rocky ground, found in the San Jose, Nacimiento, and possibly Animas formations. [2]	**No potential.** PPA does not provide suitable habitat in the form of gravelly or rocky ground.
Acoma Fleabane (*Erigeron acomanus*)	SEN	Species of Concern	Sandy slopes and benches beneath sandstone cliffs of the Entrada Sandstone Formation in pinyon-juniper woodland. (6,900-7,100 feet AMSL). In New Mexico, populations have been found in McKinley and Cibola counties. [2,4]	**No potential.** PPA does not provide suitable habitat in the form of Entrada Sandstone.
Parish's alkali grass (*Puccinellia parishii*)	SEN	Endangered	Alkaline springs, seeps, and seasonally wet areas that occur at the heads of drainages or on gentle slopes (2,600-7,200 feet AMSL). In New Mexico, populations have been found in Catron, Cibola, Grant, Hidalgo, McKinley, Sandoval, and San Juan counties. [2,4]	**No potential.** PPA does not provide suitable habitat for species to occur. Lack of alkaline springs, seeps, and seasonally wet areas likely limiting factor. PPA located northeast of known populations.
Sand Verbena, Galisteo (*Abronia bigelovii*)	SEN	Species of Concern	Restricted to the hills and ridges of calcareous Toldilto gypsum and clay soils derived from this formation. Elevations between 5,700 to 7,400'. [2]	**No potential.** PPA does not provide suitable habitat for species to occur. Lack of gypsum and clay soils likely a limiting factor.
Knight's Milkvetch (*Astragalus knightii*)	SEN	Species of Concern	Rimrock ledges and sand pockets in cliff terraces, rooting in the orangey decayed sandstone of the Dakota Series. [2]	**No potential.** PPA does not provide suitable habitat for species to occur. Lack of Dakota series formations likely a limiting factor.

Species Name	Conservation Status		Habitat Associations	Potential to Occur in Action Area
	BLM	State of NM		
Ripley Milkvetch (*Astragalus ripleyi*)	SEN	Species of Concern	Open savannahs and shrublands, open canopy ponderosa pine forest, and along edges of closed canopy forest and woodlands. [2]	**No potential.** PPA does not provide suitable habitat for species to occur. Lack of open savannahs and canopy forests likely a limiting factor.
Clipped Wildbuckwheat (*Eriogonum lachnogynum var. colobum*)	SEN	Species of Concern	Rocky limestone flats and slopes, pinon-juniper woodlands. [2]	**No potential.** PPA does not provide suitable habitat for species to occur. Lack of limestone flats and slopes likely a limiting factor.
Todilito Stickleaf (*Mentzelia todiltoensis*)	SEN	Species of Concern	Outcrops of gypsum. [2]	**No potential.** PPA does not provide suitable habitat for species to occur. Lack of gypsum formations likely a limiting factor.
Yeso Twinpod (*Physaria newberryi var. yesicola*)	SEN	Species of Concern	Nearly barren badlands and canyon sides of various slopes and exposures. Occurs on sandy gypsum and other silty strata of the Permian age Yeso Formation. [2]	**No potential.** PPA does not provide suitable habitat for species to occur. Lack of sandy gypsum and silty strata likely a limiting factor.
Townsend Daisy (*Townsendia gypsophila*)	SEN	Species of Concern	Weathered gypsum outcrops of the Todildto Formation and the lower Morrison Formation. Pinon-Juniper woodland, Great Basin desert scrub.[2]	**No potential.** PPA does not provide suitable habitat for species to occur. Lack of gypsum outcrops like a limiting factor.
MAMMALS				
Spotted bat (*Euderma maculatum*)	SEN	Threatened	A wide variety of habitats including in or near pine forests, pinyon-juniper woodland near sandstone cliffs areas and often near bodies of water in ponderosa or mixed-coniferous forest.[2]	**Low potential.** Areas adjacent to the PPA may provide marginal habitat for species to occur. Lack of sandstone cliffs and woodland habitat likely limiting factors.
Townsend's big-eared bat (*Corynorhinus townsendii*)	SEN	-	In New Mexico, most commonly found in evergreen forests. Roosts and nursery colonies in caves and mine tunnels.[2]	**No potential.** PPA does not provide suitable habitat for species of occur. Lack of evergreen forest habitat and roosting locations likely limiting factor.

Species Name	Conservation Status		Habitat Associations	Potential to Occur in Action Area
	BLM	State of NM		
Gunnison's prairie dog (*Cynomys gunnisoni*)	SEN	-	Grasslands from low valleys to montane meadows. High mountain valleys and plateaus with open or slightly brushy country with scattered junipers and pines (6,000-12,000 feet AMSL).[2]	**No potential.** PPA does not provide suitable habitat for species of occur. Lack of grasslands and open ground likely a limiting factor. No active or abandoned burrows observed.
Black-tailed prairie dog (*Cynomys ludovicianus*)	SEN	-	Shortgrass plains, sacaton grassland, sycamore, cottonwood, and rabbitbrush vegetation communities. Avoid areas with tall grass and heavy sagebrush. [2]	PPA may provide suitable habitat for species of occur. Active populations were observed near the Talladega 1409 Fed 601H location.
Cebolleta pocket gopher (*Thomomys umbrinus*)	Watch	Threatened	Perennial riparian habitat with willows, cottonwood, alder and maple. Uplands include large sandstone cliffs with juniper, pinyon, and sage. In New Mexico populations have been found in a small area in Cibola County.[2]	**No potential.** PPA does not provide suitable habitat for species of occur. Lack of perennial riparian habitat likely limiting factor.
REPTILES				
Desert massasauga (*Sistrurus tergeminus*)	SEN	-	Desert grasslands, dry shortgrass plains. [2]	**Low potential.** PPA may provide marginal habitat for species of occur. Lack of grasslands and open ground likely a limiting factor.
AMPHIBIANS				
Southwestern toad (*Anaxyrus microscaphus*)	SEN	SGCN	Rocky stream courses in the pine-oak zone, streams bordered by willows and cottonwoods, irrigation ditches, flooded/irrigated fields, and reservoirs. [2]	**No potential.** PPA does not provide suitable habitat for species of occur. Lack of water sources likely a limiting factor.
Northern Leopard Frog (*Lithobates pipiens*)	SEN	SGCN	Near springs, slow streams, marshes, bogs, ponds, canals, flood plains, reservoirs, and lakes. [2]	**No potential.** PPA does not provide suitable habitat for species of occur. Lack of water sources likely a limiting factor.
ARTHROPODS				

Species Name	Conservation Status		Habitat Associations	Potential to Occur in Action Area
	BLM	State of NM		
Monarch Butterfly (*Danaus plexippus plexippus)*	SEN	-	Breed in milkweed patches. Require nighttime roosting sites, generally in deciduous and evergreen trees. Use wide variety of flowering plants as a nectar source. [1]	**Low potential.** PPA does not provide suitable habitat for species of occur. Lack of roosting sites and flowering plants likely a limiting factor.
FISH				
Rio Grande Sucker (*Catostomus plebeius)*	SEN	SGCN	Habitat includes rocky pools, runs, and riffles of small to medium rivers usually over gravel and/or cobble, also in backwaters and pools below riffles. [2]	**No potential.** PPA does not provide suitable habitat for species of occur. Lack of perennial water sources likely a limiting factor.
Rio Grande Chub (*Gila Pandora*)	SEN	SGCN	Most commonly found in flowing pools of headwaters, creeks, and small rivers, often near inflow of riffles and in association with cover such as undercut banks, aquatic vegetation, and plant debris. [2]	**No potential.** PPA does not provide suitable habitat for species of occur. Lack of perennial water sources likely a limiting factor.
Roundtail Chub (*Gila robusta*)	SEN	Endangered SGCN	Occupies deep pools and eddies in mid- to large sized rivers and streams throughout the Colorado River basin. [2]	**No potential.** PPA does not provide suitable habitat for species of occur. Lack of perennial water sources likely a limiting factor.
[1]USFWS, 2016; [2]Nature Serve, 2012; [3]NMPIF, 2007; [4]NMRPTC, 1999				

The Migratory Bird Treaty Act (MBTA) implements various treaties and conventions between the U.S. and Canada, Japan, Mexico and the former Soviet Union for the protection of migratory birds. Under the Act, taking, killing or possessing migratory birds is unlawful.

The bald eagle was delisted under the ESA on August 9, 2007. Both the bald eagle and golden eagle are still protected under the MBTA and Bald and Golden Eagle Protection Act (BGEPA). The BGEPA affords both eagles protection in addition to that provided by the MBTA, in particular, by making it unlawful to "disturb" eagles.

The 1988 amendment to the Fish and Wildlife Conservation Act mandates the USFWS to “identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973.” *Birds of Conservation Concern 2008* (USFWS 2008) is the most recent effort to carry out this mandate. The PPA is located in Bird Conservation Region (BCR) 16, Southern Rockies/Colorado Plateau.

Table 3-24 lists migratory birds with the potential to occur within the PPA as well as priority birds of conservation concern included in BCR 16. Species addressed previously will not be reiterated here.

Table 3-24. Priority Birds of Conservation Concern

Species Name	Habitat Associations	Potential to Occur in the Action Area
Black-throated sparrow (*Amphispiza bilineata*)	Xeric habitats dominated by open shrubs with areas of bare ground. In New Mexico, breeds primarily in desert scrub in the southern part of the state, less commonly in other scrub habitats in the north. [1, 2]	**Low potential.** PPA may provide marginal habitat for species of occur. Lack of areas of bare ground likely a limiting factor.
Brewer's sparrow (*Spizella breweri*)	Closely associated with sagebrush, preferring dense stands broken up with grassy areas. [1]	Areas of sagebrush within the PPA may provide marginal habitat for species to occur.
Gray Vireo (*Vireo vicinior*)	In northern NM, stands of pinyon pine and Utah juniper (5,800 – 7,200 feet AMSL), open with a shrub component and mostly bare ground; antelope bitterbrush, mountain mahogany, Utah serviceberry and big sagebrush often present. Broad, flat or gently sloped canyons, in areas with rock outcroppings, or near ridge-tops. [1, 2]	Areas of open woodland within the PPA may provide potential, suitable habitat for species to occur.
Loggerhead shrike (*Lanius ludovicianus*)	Open country interspersed with improved pastures, grasslands, and hayfields. Nests in sagebrush areas, desert scrub, and woodland edges. [1, 2]	**Low potential.** Areas of sagebrush and woodland edges within the PPA could provide suitable habitat for the species, although significant improved pastures and hayfields are lacking.
Mountain bluebird (*Sialia currucoides*)	Open pinyon-juniper woodlands, mountain meadows, and sagebrush shrublands; requires larger trees and snags for cavity nesting. [1, 2]	Areas of open pinyon-juniper woodland and sagebrush shrublands within the PPA may provide suitable foraging habitat for species to occur.
Mourning dove (*Zenaida macroura*)	Open country, scattered trees, and woodland edges. Feeds on ground in grasslands and agricultural fields. Roost in woodlands in the winter. Nests in trees or on ground. [1]	Areas of open pinyon-juniper woodland and woodland edges within the PPA may provide suitable foraging and nesting habitat for the species.
Sage sparrow (*Amphispiza belli*)	Large and contiguous areas of tall and dense sagebrush. Negatively associated with seral mosaics and patchy shrublands and abundance of greasewood. [1]	Areas of sagebrush within the PPA may provide marginal habitat for species to occur.
Sage thrasher (*Oreoscoptes montanus*)	Shrub-steppe dominated by big sagebrush. [1, 2]	Areas of sagebrush within the PPA may provide marginal habitat for species to occur. Lack of large and contiguous areas of tall and dense sagebrush likely a limiting factor.
Scaled quail (*Callipepla squamata*)	Brushy arroyos, cactus flats, sagebrush or mesquite plains, desert grasslands, Plains grasslands, and agricultural areas. Good breeding habitat has a diverse grass composition, with varied forbs and scattered shrubs. [2]	**Low potential.** Sagebrush within the PPA may provide marginal habitat for species of occur. Lack of bushy arroyos, mesquite plains, desert grassland, and agricultural areas may be a limiting factor.

Species Name	Habitat Associations	Potential to Occur in the Action Area
Swainson's hawk (*Buteo swainsoni*)	A mixture of grassland, cropland, and shrub vegetation; nests on utility poles and in isolated trees in rangeland. Nest densities higher in agricultural areas. [2]	**Low potential.** Shrub vegetation within the PPA may provide marginal habitat for species of occur. However, lack of grassland and cropland for foraging and lack of tall perching/nesting structures likely a limiting factor.
Vesper sparrow (*Pooecetes gramineus*)	Dry montane meadows, grasslands, prairie, and sagebrush steppe with grass component; nests on ground at base of grass clumps. [1, 2]	**Low potential.** Sagebrush within the PPA may provide marginal habitat for species of occur. However, lack of dry montane meadows, grasslands, and prairies likely a limiting factor.
American peregrine falcon (*Falco peregrinus anatum*)	Open country near lakes or rivers with rocky cliffs and canyons. Tall city bridges and buildings also inhabited. [2]	**No potential.** PPA does not provide suitable habitat for species to occur. Lack of large water features, canyons and/or buildings a limiting factor.
Bald eagle (*Haliaeetus leucocephalus*)	Near lakes, rivers and cottonwood galleries. Nests near surface water in large trees. May forage terrestrially in winter. [1, 2]	**No potential**. PPA does not provide suitable habitat for species to occur. Lack of large water features, canyons and/or buildings a limiting factor.
Ferruginous hawk (*Buteo regalis*)	Open areas containing broad expanses of prairie grassland or shrub-steppe vegetation. Landscapes with low to moderate agricultural coverage may be used for nesting and foraging, and agricultural fields may serve as important foraging areas. Within northwest NM, nesting often occurs on rock spires. May occasionally use transitional and edge areas between grassland and juniper savannah or pinyon-juniper woodland. [2]	**Low potential.** PPA area may contain habitat for foraging, but not for nesting. Lack of broad open grasslands, and agricultural areas likely limiting factor.
Golden Eagle (*Aquila chrysaetos*)	In the West, mostly open habitats in mountainous, canyon terrain. Nests primarily on cliffs and in large trees. [1, 2]	PPA contains habitat for foraging, but not for nesting. Areas adjacent to the PPA contain habitat suitable for nesting. One inactive nest was observed west of Thunderbird and whitewash was observed SE of Capri.
Mountain plover (*Charadrius montanus*)	Typically nests in flat (<2% slope) to slightly rolling expanses of grassland, semi-desert, or badland, in an area with short, sparse vegetation, large bare areas (often >1/3 of total area), and that is typically disturbed (e.g. grazed); may also nest in plowed or fallow cultivation fields. [1, 2]	PPA area may contain marginal habitat. Lack of rolling expanses of grassland or badlands and large bare areas within project area a limiting factor.
Snowy plover (*Charadrius nivosus*)	Beaches, dry mud or salt flats, and sandy shores of river, lakes and ponds. [1]	PPA may contain marginal habitat, especially near borrow sources and stock ponds. Lack of salt flats within project area a limiting factor.

Species Name	Habitat Associations	Potential to Occur in the Action Area
Prairie falcon (*Falco mexicanus*)	Arid, open country, grasslands or desert scrub, rangeland; nests on cliff ledges, trees, power structures. [1, 2]	PPA may contain habitat for foraging, but not for nesting. Areas adjacent to the PPA contain habitat suitable for nesting.
Gunnison Sage Grouse (*Centrocercus minimus*)	A variety of habitat throughout the year, but the primary component necessary is sagebrush, especially big sagebrush (*Artemisia tridentata*) [1]	PPA may contain suitable habitat for species to occur.
American Bittern (*Botaurus lentiginosus*)	Breeds primarily in wetlands with tall emergent vegetation. Nests primarily in inland freshwater wetlands, sometimes in tidal marshes or sparsely vegetated wetlands or dry grassy uplands. [1]	**Low potential**. PPA may provide marginal habitat for nesting, however lack of wetlands likely a limiting factor.
Long-billed curlew (*Numenius americanus*)	Breeds in prairies and grassy meadows, generally near water. Nests in dry prairies and moist meadows, usually on ground in a flat area with short grass. [1]	PPA may contain suitable habitat for species to occur.
Flammulated owl (*Psiloscops flammeolus*)	Montane forest, usually open conifer forests with a preference for ponderosa pine. [1]	**No potential**. PPA does not provide suitable habitat for species to occur. Lack of large water montane forests a limiting factor.
Lewis' Woodpecker (*Melanerpes lewis*)	Open forest and woodland, often logged or burned, including oak, coniferous forest, riparian woodland, and less commonly pinyon/juniper. [1]	**Low potential**. PPA may provide marginal habitat for foraging but not nesting. Lack of appropriate open forest and woodlands likely a limiting factor.
Juniper titmouse (*Baeolophus ridgwayi*)	Pinyon/juniper woodlands. [1]	PPA may contain suitable habitat for species to occur.
Veery (*Catharus fuscescens*)	Nest in swampy forest, especially in more open areas with shrubby understory as well as second growth, willow or alder shrubber near water; large tracts of forest are most suitable. [1]	**No potential**. PPA does not provide suitable habitat for species to occur. Lack of swampy forests a limiting factor.
Grace's Warbler (*Setophaga graciae*)	Montane pine and pine-oak forest. Breeds in ponderosa pine. [1]	**No potential**. PPA does not provide suitable habitat for species to occur. Lack of coniferous forests a limiting factor.
Grasshopper Sparrow (*Ammodramus savannarum*)	Prefer grasslands of intermediate height andoften associated with clumped vegetation interspersed with patches of bare ground. [1]	PPA may contain suitable habitat for species to occur.
Chestnut-collared Longspur (*Calcarius ornatus*)	Mixed-grass and shortgrass uploads. Prefer open prairie and avoids excessively shrubby areas. [1]	PPA may contain suitable habitat for species to occur.
Black rosy finch (*Leucosticte atrata*)	Barren, rocky, or grassy areas and cliffs among glaciers or beyond timberline; in migration and winter also in open fields, cultivated lands, brushy areas, and around human habitation. Nests usually in rock crevices or holes in cliffs above snow fields. [1]	**Low potential**. PPA may provide marginal habitat for foraging but not nesting. Lack of snow and high alpine conditions likely a limiting factor.

Species Name	Habitat Associations	Potential to Occur in the Action Area
Brown-capped Rosy-Finch (*Leucosticte australis*)	Barren, rocky, or grassy areas and cliffs among glaciers or beyond timberline; in migration and winter also in open fields, cultivated lands, brushy areas, and around human habitation. Nests usually in rock crevices or holes. [1]	**Low potential**. PPA may provide marginal habitat for foraging but not nesting. Lack of snow and high alpine conditions likely a limiting factor.
Cassin's Finch (*Haemorhous cassinii*)	Open coniferous forest; in migration and winter also in deciduous woodland, second growth, scrub, brushy areas, and sometimes suburbs near mountains. Usually nests in conifer. [1]	**Low potential**. PPA may provide marginal habitat for foraging but not nesting. Lack of appropriate forests likely a limiting factor.
[1]Nature Serve, 2012; [2]NMPIF		

3.8.2 Environmental Impacts – No Proposed Action

The No Action Alternative would result in the continuation of the existing land and resource uses in the analysis area and their subsequent and current impacts to wildlife, therefore there would be no expected, additional impacts.

3.8.3 Environmental Impacts – Proposed Action

New surface disturbances associated with the Proposed Action would result in the removal of 224.1 acres of potential wildlife habitat in the form of scrubland sagebrush and pinyon-juniper woodland communities. If reclamation is successful, approximately 162 acres would be reclaimed during interim reclamation and the remaining 62.1 acres would be disturbed for the life of the Proposed Action. The PPA would be converted to a reseed community following interim reclamation. If interim reclamation is successful, a sagebrush vegetation community would become re-established within the PPA. However, as addressed previously in Section 3.6 the typically-slow vegetation regrowth could cause surface disturbance to have long-term, indirect, adverse impacts to vegetation resources (BLM 2012, pg 4-246). Revegetation is especially difficult in desert shrub habitat due to shallow, highly saline soils and relatively low moisture availability and is estimated to take three to five years for the initial establishment of native species (BLM 2012, 4-246). Additionally, the transformation of the proposed project area to a reseed community could remove potential habitat for numerous wildlife species.

There is available, similar habitat in the surrounding areas that wildlife could utilize. However, the clearing of vegetation would remove potential habitat. It is assumed that habitat loss and fragmentation likely adversely impact wildlife (BLM, 2012, 4-261). Such impacts include but are not limited to population isolation, increased nest predation and parasitism, encroachment of noxious and invasive weeds, and disruption of migration patterns (BLM, 2012). Roads are considered a greater contributor to the fragmentation of habitat, particularly for small species of wildlife, such as amphibians, reptiles and small mammals. Construction within areas that are not adjacent to existing surface disturbance increase fragmentation. In order to minimize the impacts of fragmentation on local plant and wildlife populations the proposed access road/pipeline routes have been placed along existing disturbed two-track roads when possible and all well-connect pipeline disturbance has been placed adjacent to proposed disturbances and will be fully reclaimed. There would be a long-term loss of 62.1 acres of foraging and nesting habitat. The

remaining 162 acres of the disturbance would be reclaimed during interim reclamation and would not result in long-term fragmentation.

It is possible that burrowing animals could be killed or injured during the construction phase of the proposed project, as equipment digs into the earth and rolls over the surface of the ground. During the construction phase of the proposed project, terrestrial wildlife could fall into an open pipeline trench and be injured, stressed, or killed. The presence of an open trench could also disrupt normal wildlife movements to and from water and/or food sources. However, design features outlined in Appendix D and Best Management Practices (BMPs) would be implemented during the construction phase of the proposed project to assist in the prevention of injury, stress, or death of wildlife.

In addition to habitat loss and fragmentation, the extent and duration of noise levels would increase in the analysis area due to construction, operation, and maintenance activities associated with the Proposed Action. Current traffic within the analysis area consists of recreational vehicles and vehicles servicing the grazing allotments. Additional traffic volume generated by the Proposed Action would vary depending on the phase of implementation. Table 2-2 outlines estimated traffic volumes on area roads for the construction and drilling, completion, production, and reclamation phases of implementation of the Proposed Action.

Audial and visual disturbances associated with the Proposed Action could temporarily deter migratory birds from utilizing the proposed project area and immediately adjacent lands. However, due to the mobility of adult birds, they would be unlikely to be directly harmed by the proposed project.

It is possible that avian species, particularly burrowing species, may be killed during initial ground-disturbing construction. If the vegetation-clearing phase of construction is scheduled to occur during the migratory bird breeding season (March 1st through August 31st),**a pre-construction nest survey would be conducted no more than one week prior to the start of construction activities**. Therefore, it is unlikely that nests, eggs, or young birds within the analysis area would be directly harmed.

No USFWS-listed Threatened, Endangered or Candidate Species or their Designated Habitat are present within or near the Proposed Action areas.

The Proposed Action is not expected to permanently alter big game wildlife populations, presence, or other hunting-related activities in the area.

3.8.4 Cumulative Effects

Cumulative impacts to wildlife in the RPFO include the total amount of short-term and long-term surface disturbance due to past, present and future surface disturbances.

Past and Present Actions

According to the RPFO RFD (BLM, 2019) as of 2019 oil and gas wells in the RPFO were associated with an estimated 590 acres of surface disturbance. Additional past and present actions that have impacted wildlife within the RPFO resulting from surface disturbance include livestock grazing, vegetation management, fuel wood cutting, recreation, land management, and

natural events. Estimated existing disturbances associated with non-oil/gas related development is not available at this time.

Reasonable and Foreseeable Future Actions

Surface disturbances associated with reasonable and foreseeable future actions include the past and present actions outlined above, which are expected to continue at their current rate. Within the RPFO, the RFD baseline scenario projects 200 new oil and gas wells (160 vertical wells and 40 horizontal wells) for 2020-2039. Over the life of the plan, the maximum potential disturbance (including existing and projected well pads, roads, and rights-of- way) is 2,750 acres. Accounting for reclamation, it is estimated that 1,190 acres of long-term surface disturbance would remain at the end of the plan in 2039 (Crocker and Glover, 2019).

Cumulative Impacts Analysis

Development of the Proposed Action would result in new surface disturbance of approximately 224.1 acres. Approximately 162 acres would be reclaimed during interim reclamation and 62.1 acres would remain disturbed for the life of the wells. The Proposed Action would account for 6.9% of total estimated surface disturbance predicted in the RPFO RFD. After reclamation, the Proposed Action would account for 5.2% of the remaining estimated long-term surface disturbance.

With proper mitigation as outlined below and when added to past, present, and reasonably foreseeable activities that may also impact area wildlife, the Proposed Action is expected to have moderate short-term and nonsignificant long-term cumulative impacts to area wildlife including migratory birds.

3.8.5 Mitigation and Residual Impacts

The implementation of wildlife measures in accordance with the Design Features outlined in Appendix D and the project Surface Reclamation Plans (included as part of the project's Surface Use Plan of Operation) would limit impacts to wildlife, their habitat, and food and shelter resources.

3.9 Issue 9: Socio-Economics and Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires federal agencies to determine if proposed actions have disproportionate and adverse environmental impacts on minority, low income, and American Indian populations of concern. Before determining if an environmental justice (EJ) population of concern is present, the BLM must first determine the area of analysis for the issue. The analysis area includes the nearest communities to the Proposed Action. See Table 3-25.

For this analysis, "quality of life" is defined as "a feeling of well-being, fulfillment, or satisfaction resulting from factors in the external environment" (Greenwood 2001). The quality of life definition was chosen for the focus on external environmental factors and due to a lack of data on existing quality of life issues for the analysis area.

3.9.1 Affected Environment

The purpose of Executive Order 12898 is to identify and address, as appropriate, disproportionally high and adverse human health or environmental effects on low-income populations, minority populations, or Indian Tribes (Chapter Houses in this instance) that may experience common conditions of environmental exposure or effects associated with a plan or project. Environmental justice refers to the fair treatment and meaningful involvement of people of all races, cultures, and incomes with respect to the development, implementation, and enforcement of environmental laws, regulations, programs, and policies.

The RPFO is home to a wide variety of cultural, ethnic, and tribal communities. Multiple indigenous Native American populations inhabit the study area, and many Hispanic residents can trace their family's history of settlement of northern New Mexico back hundreds of years. These traditional and indigenous communities are intermingled with more recent Euro-American groups and immigrants. Ranchers, miners, farmers, oil and gas workers, and service industry providers are all part of the socioeconomic mix of people in the RPFO.

The nearest communities to the Proposed Action are residents of the Ojo Encino and Counselor Chapters of the Navajo Nation, and rural residents of northern Sandoval County and southern San Juan County. Data on population, percent minority, percent Native American, income level, and poverty rates in the Ojo Encino and Counselor Chapters of the Navajo Nation, San Juan County, Sandoval County, and the state of New Mexico (as a comparative population) are provided in Table 3-25 (USCB, 2018).

Table 3-25. Population, Percent Minority, Percent Native American, Income Levels, and Poverty Data for Areas near the Proposed Lease Parcels

Location	Population (n)	Minority (%)	Native American	Per Capita Income($)	Median Household	Poverty Rate (%)
Ojo Encino Chapter-Navajo	537	99	97	$7,335	$20,000	55
Counselor Chapter	762	100	92	$7,480	$14,375	68
Cuba	756	74	41	$14,685	$32,228	32.5
San Juan County	126,926	61	38	$20,719	$45,942	21
Sandoval County*	142,025	56	12	$27,038	$57,158	16
New Mexico	2,081,015	62	9	$22,146	$46,748	20

* Northern Sandoval County is primarily rural, with dispersed ranching and tribal communities scattered widely throughout the northeastern quarter of the county. Southeastern Sandoval County contains the rapidly growing communities of Rio Rancho and Bernalillo, and associated suburban expansion. The presence of these communities in the southern part of the county account for the large difference in population and income relative to the other units of analysis.

Data source: https://censusreporter.org/profiles, data collection dates range from 2016 to 2018, specifically https://censusreporter.org/profiles/25100US2430560-ojo-encino-chapter/

Based on BLM experience with the area of the Proposed Action and the residents within, it is assumed that data on percent minority, percent Native American, income, and poverty for the Navajo Nation Chapters is more representative of residences and communities near the Proposed Action than those of local counties or larger towns in the region.

The following EJ terminology developed by the CEQ is used in this analysis (CEQ 1997).

- Low-income population: A low-income population is determined based on annual statistical poverty thresholds developed by the Census Bureau. In 2017, poverty level was based on a total income of $12,752 for an individual and $25,283 for a family of four (Census Bureau 2017).

- Minority: Minorities are individuals who are members of the following population groups: American Indian, Alaskan Native, Asian, Pacific Islander, Black, or Hispanic.

- Minority population area: A minority population area is so defined if either the aggregate population of all minority groups combined exceeds 50% of the total population in the area or if the percentage of the population in the area comprising all minority groups is meaningfully greater than the minority population percentage in the broader region.

- Comparison population: For the purpose of identifying a minority population or a low-income population concentration, the comparison populations used in this study are the surrounding counties and the state of New Mexico.

As seen in the above table, nearby Navajo Nation Chapters range from 99 to 100% minority and 92% to 97% Native American. Poverty rates for these Chapters ranges from 55% to 68%. Per capita income for these Chapters is below the poverty threshold, and median household income is below the poverty threshold for these Chapters, except the Huerfano Chapter, which is just above the poverty threshold. In general, income is lower, poverty is higher, and the percentage of minority and Native American populations is higher near the Proposed Action than in surrounding cities, counties, and the State of New Mexico.

Given the above data and BLM experience with the residents and communities surrounding the Proposed Action, the BLM concludes that there are low-income, minority, and Native American populations of concern (or "Environmental Justice Populations"), defined under Executive Order 12898, that may be disproportionately and adversely impacted by activities resulting from development of the proposed actionAll identified environmental justice populations should be provided opportunities to identify any perceived adverse environmental impacts. The determination of potential adverse and disproportionate impacts from specific actions may initially be the assessment of the BLM. This assessment should not be assumed to be the position of specific, potentially impacted, EJ populations. The BLM realizes that additional impacts may be identified by local EJ populations as specific development locations and types are proposed. As a result, this discussion assesses only the impacts for the issues identified by the BLM. The BLM should continue to work with potentially impacted EJ populations to identify and address additional EJ issues as they arise.

3.9.2 Environmental Impacts – No Action Alternative

The No Action Alternative would result in the continuation of the existing land and resource uses in the analysis area and their subsequent and current impacts to socio economics and/or environmental justice, therefore there would be no expected, additional impacts.

3.9.3 Environmental Impacts – Proposed Action

Indirect effects of the Proposed Action could include increased employment opportunities related to the oil and gas and service support industry in the region as well as the economic contributions to federal, state, and county governments related to lease payments, royalty payments, severance taxes, and property taxes. However, there is no evidence indicating that the jobs generated would be offered to the local communities of Cuba and the Tri-Navajo Chapters. Other effects could include the potential for an increase in transportation, roads, and noise disturbance associated with development, and potential for change in property values due to development. These effects would apply to all public land users in the study area, and surface owners above and adjacent to the proposed lease parcels.

Economic activity associated with tourism and recreation can be an important contribution to local communities and their economies. Potential impacts resulting from oil and gas development can be concerns for communities that promote recreation and tourism. Oil and gas drilling and production would potentially inconvenience visitors through increased traffic and traffic delays, noise, and visual impacts. The level of inconvenience would depend on the activity affected, traffic patterns within the area, noise levels, and the length of time and season in which these activities occurred. Increased truck traffic hauling heavy equipment, fracking fluids, and water as well as increased traffic associated with oil workers could cause more traffic congestion, increase commuting times, and affect public safety. Additionally, impacts to visitors could include reduction of current view sheds, dark night skies, and soundscapes.

During proposed construction, reclamation, and maintenance activities, proposed and existing facilities (such as oil and gas wells, pipelines, and production facilities) could be damaged or ruptured, which could pose a risk to human safety, including minority and low-income populations within the analysis area. Potential adverse environmental impacts to air and water quality and flora and fauna, which could also pose a risk to human safety and/or traditional lifestyles, have been addressed previously in this EA. Design Features outlined in Appendix D have been proposed by EOG to address these issues and ensure the protection of the public and environment.

Continued expansion of the oil and gas industry may be perceived as having a negative impact on quality-of-life considerations for people who value undeveloped landscapes, opportunities for isolation, and activities such as wildlife viewing and cattle ranching. The construction of new access roads as part of the Proposed Action could allow increased public access potentially exposing private properties to increases in traffic, dust, and noise impacts. Based on ongoing consultation with the Ojo Encino and Counselor Chapters and several Pueblos the BLM has developed stipulations, COAs, design features, and other methods to address EJ concerns.

3.9.4 Cumulative Effects

<u>Past and Present Actions</u>

The direct effect of leasing and development of the RPFO 2018 Lease Sale parcels would be the payments received from leasing all or a subset of the acres of federal mineral estate.

According to the RPFO RFD (BLM, 2019) as of 2019 oil and gas wells in the RPFO were associated with an estimated 590 acres of surface disturbance.

Reasonable Foreseeable Future Actions

Surface disturbances associated with reasonable and foreseeable future actions include the past and present actions outlined above and are expected to continue at their current rate. Within the RPFO, the RFD baseline scenario projects 200 new oil and gas wells (160 vertical wells and 40 horizontal wells) for 2020-2039. Over the life of the plan, the maximum potential disturbance (including existing and projected well pads, roads, and rights-of- way) is 2,750 acres. Accounting for reclamation, 1,190 acres of surface disturbance are expected to remain at the end of the plan in 2039 (Crocker and Glover, 2019).

Development of the Proposed Action would result in new surface disturbances totaling 224.1 acres. Approximately 162 acres would be reclaimed during interim reclamation and 62.1 acres would remain disturbed for the life of the wells. The Proposed Action would account for 6.9% of total estimated surface disturbance predicted in the RPFO RFD. After reclamation, the Proposed Action would account for 5.2% of the remaining estimated surface disturbance.

In general, socioeconomic impacts and environmental justice are of a cumulative nature. Most of the past and predicted future disturbance related to oil and gas development in the RPFO jurisdictional area is in the southeastern edge of the San Juan Basin, thus affecting the persons living in this area more significantly than other areas of the RPFO.

Additional cumulative impacts to socioeconomic conditions and EJ populations associated with the Proposed Action could be additional employment opportunities in the oil and gas industry and/or increases in demand for local service industries due to the presence of work crews. Oil and gas development in the area of analysis would also continue to contribute to taxes, royalties, and interest to the State for oil and gas development.

3.9.5 Mitigation and Residual Impacts

The surrounding communities do not have additional policies or ordinances in place, beyond what the BLM stipulates, that would regulate the proposed impacts. Based on ongoing consultation with the Ojo Encino, Counselor Chapters, and several Pueblos, the BLM has developed stipulations, COAs, design features, and other methods similar to the Design Features outlined in Appendix D to address EJ concerns and help minimize potential adverse and disproportionate impacts.

3.10 Issue 10: Paleontological Resources

Impacts to paleontological resources from the Proposed Action could occur through ground disturbance activities during construction. The impact indicator for this issue is acres of new disturbance. The analysis area is the RPFO.

3.10.1 Affected Environment

All locations relating to the Proposed Action are within areas identified as Potential Fossil Yield Classification (PFYC) 5. The PFYC is a tool that allows the BLM to predict the likelihood of a geologic unit to contain paleontological resources (BLM, 2016). The PFYC is based on a numeric system of 1-5. An area identified as PFYC 1 has little likelihood of containing paleontological resources, whereas an area identified as PFYC 5 is a geologic unit that is known to contain abundant scientifically important paleontological resources. Within areas identified as PFYC 5, paleontological resource management concern is elevated because the likelihood of encountering scientifically important fossils is very high. The two formations of concern within the PPA are the Nacimiento and San Jose Formations.

All Proposed Actions that are planned to occur through geologic units that are assigned a PFYC 5 require a pre-disturbance paleontological survey and monitoring during ground disturbing activities. A written report of the initial survey will include recommendations stating the findings of the pre-disturbance survey. Once this report is reviewed and accepted by the Authorized Officer, construction may be allowed to proceed. During any surface-disturbance actions in PFYC 5 areas, monitoring shall take place by a BLM- permitted paleontologist for any paleontological resources.

3.10.2 Environmental Impacts – No Action Alternative

The No Action Alternative would result in the continuation of the existing land and resource uses in the analysis area and their subsequent and current impacts to paleontological resources, therefore additional impacts are not expected.

3.10.3 Environmental Impacts – Proposed Action

Direct impacts would result in the immediate physical loss of fossils and their contextual data. Impacts indirectly associated with ground disturbance could subject fossils to damage or destruction from erosion, as well as creating improved access to the public and increased visibility, potentially resulting in unauthorized collection or vandalism. Ground disturbance can also reveal scientifically important fossils that would otherwise remain buried and unavailable for scientific study. Such fossils can be collected properly and curated into the museum collections of a qualified repository making them available for scientific study and education.

Surveys for paleontological resources were conducted on May 19th, 20th, 21st, 22nd, 23rd, 26th, 27th, June 26th, July 2nd and 8th, and August 5th, 2020 by Woods Canyon Archaeological. Paleontological resource surveys for the Fairlane well pad and associated facilities were conducted by Goshawk Consulting on October 6, 2019 and April 11, 2020. Results from these surveys for each location are listed below. See the site-specific reports on file with the BLM-RPFO for more information.

- The Bullitt 06 Fed 601H-612H survey area is entirely within the San Jose Formation which the paleontologist assigned a PFYC of 3 for high fossil potential. No significant resources were identified within the Proposed Action footprint or buffer that was surveyed. Based on the results of the survey, a paleontological monitor is recommended during construction in areas where there is bedrock at or near the surface. No further mitigation work is recommended.

- The Bullitt 1 survey area is situated in the San Jose Formation and has been assigned a PFYC 5. No Significant resources were identified within the Proposed Action footprint of buffer. A paleontological monitor is recommended during construction in areas where there is bedrock at or near the surface. No further mitigation work is recommended.
- The Capri survey area is situated in the San Jose Formation and has been assigned a PFYC 5. No Significant resources were identified within the Proposed Action footprint of buffer. Areas that have no exposed outcrop should be spot-checked to determine if bedrock is being encountered and if there is bedrock, this should be monitored during construction. No further mitigation work is recommended.
- The Del Rio survey area is entirely within the San Jose Formation which the paleontologist assigned a PFYC of 5 for high fossil potential. No significant resources were identified within the Proposed Action footprint or buffer that was surveyed. Based on the results of the survey, a paleontological monitor is recommended during construction in areas where there is bedrock at or near the surface. No further mitigation work is recommended.
- The Falcon survey area is situated in the San Jose Formation and has been assigned a PFYC 5. No Significant resources were identified within the Proposed Action footprint of buffer. A paleontological monitor is recommended during construction in areas where there is bedrock at or near the surface. No further mitigation work is recommended.
- The Galaxie survey area is situated in the San Jose Formation and has been assigned a PFYC 5. The entire survey area is in an area of thick sandy valley fill with no exposed bedrock. No significant resources were identified within the Proposed Action footprint or buffer. Based on the results of the survey, no paleontological monitor is recommended during construction. No further mitigation work is recommended.
- The Starliner survey area is situated in the San Jose Formation and has been assigned a PFYC 5. No Significant resources were identified within the Proposed Action footprint of buffer. A paleontological monitor is recommended during construction in areas where there is bedrock at or near the surface. No further mitigation work is recommended.
- The Talladega survey area is situated in the San Jose Formation and has been assigned a PFYC 5. No Significant resources were identified within the Proposed Action footprint of buffer. A paleontological monitor is recommended during construction in areas where there is bedrock at or near the surface. No further mitigation work is recommended.
- The Thunderbird survey area is situated in the San Jose Formation and has been assigned a PFYC 5. No Significant resources were identified within the Proposed Action footprint of buffer. A paleontological monitor is recommended during construction in areas where there is bedrock at or near the surface. No further mitigation work is recommended.

- The Torino survey area is situated in the San Jose Formation and has been assigned a PFYC 5. No Significant resources were identified within the Proposed Action footprint of buffer. A paleontological is recommended during construction within and through 100 feet of fossil scatters 1 and 2, as well as spot checking construction to see if bedrock is being exposed in areas that are covered by deep soils
- The Durango survey area is situated in the San Jose Formation and has been assigned a PFYC 5. No Significant resources were identified within the Proposed Action footprint of buffer. A paleontological monitor is recommended during construction in areas where there is bedrock at or near the surface. No further mitigation work is recommended.
- The Pinto survey area is situated in the San Jose Formation and has been assigned a PFYC 5. No Significant resources were identified within the Proposed Action footprint of buffer. Areas that have no exposed outcrop should be spot-checked to determine if bedrock is being encountered and if there is bedrock, this should be monitored during construction. No further mitigation work is recommended.
- The Interceptor survey area is situated in the San Jose Formation and has been assigned a PFYC 5. No Significant resources were identified within the Proposed Action footprint of buffer. Areas that have no exposed outcrop should be spot-checked to determine if bedrock is being encountered and if there is bedrock, this should be monitored during construction. No further mitigation work is recommended.
- The Fairlane survey area is situated in the San Jose Formation and has been assigned a PFYC 5. No Significant resources were identified within the Proposed Action footprint of buffer. Areas that have no exposed outcrop should be spot-checked to determine if bedrock is being encountered and if there is bedrock, this should be monitored during construction. No further mitigation work is recommended.

3.10.4 Cumulative Effects

Past and Present Actions

According to the RPFO RFD (BLM, 2019) as of 2019 oil and gas wells in the RPFO were associated with an estimated 590 acres of surface disturbance. Additional past and present actions near the Proposed Action area that have resulted in impacts to paleontological resources include livestock grazing, vegetation management, fuel wood cutting, recreation, hunting, land management, and natural events.

Reasonable and Foreseeable Future Actions

Surface disturbances associated with reasonable and foreseeable future actions include the past and present actions outlined above and are expected to continue at their current rate. Within the RPFO, the RFD baseline scenario projects 200 new oil and gas wells (160 vertical wells and 40 horizontal wells) for 2020-2039. As of 2019, existing wells in the field office were associated with an estimated 590 acres of surface disturbance. Over the life of the plan, the maximum potential disturbance (including existing and projected well pads, roads, and rights-of- way) is 2,750 acres. Accounting for reclamation, it is expected that 1,190 acres of surface disturbance to remain at the end of the plan in 2039. It is considered that the lands in the northern portion of the

field office in western Sandoval County (the southeastern edge of the San Juan Basin) to have high to very high potential for the occurrence of oil and gas (Crocker and Glover, 2019), much of which is in an area with PFYC 3- 5 Classification.

Development of the Proposed Action would result in new surface disturbance of approximately 224.1 acres. Approximately 162 acres would be reclaimed during interim reclamation and 62.1 acres would remain disturbed for the life of the wells. The Proposed Action would account for 6.9% of total estimated surface disturbance predicted in the RPFO RFD. After reclamation, the Proposed Action would account for 5.2% of the remaining estimated surface disturbance.

Additional impact may also occur from any activity that cause surface disturbance, including grazing, community development, vegetation management, recreation, land management such as prescribed fires, firewood gathering, recreation, lands and realty.

No significant paleontological resources were observed within the PPA. There would be no negative cumulative impacts on paleontological resources as significant paleontological resources would be avoided. A positive cumulative effect is the additional scientific information yielded by the paleontological surveys.

3.10.5 Mitigation and Residual Impacts

Impacts to paleontological resources would be minimized by standard lease terms, which require a lessee to avoid, conduct inventories or special studies, and/or monitoring at the discretion of the BLM. A paleontological monitor will be onsite during all ground disturbing activities. If in the conduct of operations paleontological resources are discovered, the lessee must cease any operations that would result in the destruction of such specimens and contact the BLM Authorized Officer.

Although few fossils were found on the surface during the survey, there is potential to find fossils in the subsurface ground disturbance during project construction. It is recommended that monitoring of all areas of outcrops is recommended during construction. Any potential fossils seen during construction would be reported to the BLM-RPFO and/or Woods Canyon so they can be examined, documented, and a determination or significance established. All scientifically important fossils and associated data from BLM lands will be housed and made available for education purposed and scientific research in an accredited and federally-approved museum.

Unlawful removal, damage, or vandalism of paleontological resources from Federal lands will be prosecuted by Federal law enforcement. All employees, contractors, and sub-contractors of the project will be informed by the project proponent that paleontological sites are to be avoided by all personnel, personal vehicles, and company equipment, and that it is illegal to collect, damage, or disturb the resources. Such activities are punishable by criminal and/or administrative penalties under the provisions of the Paleontological Resources Preservation Act of 2009 (Sections 6301-6312 of the Omnibus Public Lands Act of 2009, 16 USC 470aaa).

Paleontological mitigation results in a beneficial impact since scientifically important fossils and associated data are housed and made available for educational purposes and scientific research in an accredited and federal approved museum.

3.11 Issue 11: Cultural Resources

Impacts to cultural resources from the Proposed Action could occur through ground disturbance activities during construction. The impact indicator for this issue is acres of new disturbance. The analysis area is the RPFO.

3.11.1 Affected Environment

The Proposed Action is located within the archaeologically rich San Juan Basin of northwestern New Mexico. Cultural resources within Sandoval County range from Paleoindian residential and special activity sites; through many kinds of Archaic residential and special activity sites; the full range of Ancestral Puebloan sites; colonial Spanish sites; Navajo, Apache, and Ute sites; and Hispanic and Anglo sites, including homesteads. More complete information can be found in *A Class II Cultural Resources Inventory of the Southern portion of the Chaco Planning Unit, McKinley and Sandoval Counties, New Mexico* by Alan R. Dulaney and Steven G. Dosh, published in 1981 by the Bureau of Land Management; *A Class I and Class II Survey of the Rio Puerco Grazing Area* by Cheryl L. Wase, prepared in 1982 and on file at the Rio Puerco Field Office; and *Prehistory of the Middle Rio Puerco Valley, Sandoval County, New Mexico* edited by Larry L. Baker and Stephen R. Durand, published in 2003 by the Archaeological Society of New Mexico.

Cultural sites vary considerably, and can include but are not limited to simple artifact scatters, domiciles of various types with a myriad of associated features, rock art and inscriptions, ceremonial/religious features, and roads and trails.

3.11.2 Environmental Impacts – No Action Alternative

The No Action Alternative would result in the continuation of the existing land and resource uses in the analysis area and their subsequent and current impacts to archaeological resources, therefore there would be no expected, additional impacts.

3.11.3 Environmental Impacts – Proposed Action

Impacts normally include alterations to the integrity of a cultural site. If a cultural site is significant for other than its scientific information, impacts may also include the introduction of audible, atmospheric, or visual elements that are out of character for the cultural site.

A potential impact from the Proposed Action is the increase in human activity or access to the area with the increased potential of unauthorized removal of or other alteration to cultural sites in the area. Other potential direct effects include physical disturbance of a site from the construction of a well pad, associated access roads, or associated infrastructure like pipelines. Potential indirect effects include changes to the landscape which result in impacts to a site's setting, feeling, or association. Given the types of cultural resources known and expected in the area, such indirect effects would likely apply only to traditional cultural properties, sacred sites, and/or traditional use area.

Significant cultural sites (e.g., sites eligible for the National Register of Historic Places) would be avoided with the implementation of design features such as, but not limited to, reduction of construction areas, installation of temporary barriers, and site monitoring.

Archaeological surveys were conducted by Dinétahdóó Cultural Resources Management, LLC (DCRM) between March 3rd and September 15th, 2020. Cultural resource surveys for the

Fairlane well pad and associated facilities were conducted by Goshawk Consulting on October 6, 2019 and April 11, 2020. Results from these survey efforts are detailed in Table 3-26 below.

Table 3-26. Archaeological Survey Results

SITE	NMCRIS #	FINDINGS	RECOMMENDATIONS
Torino	#145903	One (1) new archaeological site and six (6) Isolated Occurrences/Isolated Manifestations (IOs/IMs) were identified and documented. The site has been determined unevaluated by the BLM for listing in the National Register of Historic Properties (NHRP).	Following review the BLM finds a determination of No Effect to cultural properties. Avoidance of site impacts will be achieved through avoidance measures and monitoring during construction activities.
Pinto	#145921	One (1) archaeological site and nineteen (19) Isolated Occurrences/Isolated Manifestations (IOs/IMs) were identified and documented. The newly discovered site is historic in nature and the BLM has determined the site eligible for listing in the National Register of Historic Places (NRHP).	Following review the BLM finds a determination of No Effect to cultural properties. Avoidance of site impacts will be achieved through avoidance measures and monitoring during construction activities.
Bullitt 1	#146982	Two (2) new archaeological sites and twenty-four (24) Isolated Occurrences/Isolated Manifestations (IOs/IMs) were identified and documented. Sites are prehistoric in nature and the BLM has determined the sites eligible for listing in the National Register of Historic Place (NRHP)	Following review the BLM finds a determination of No Effect to cultural properties. Avoidance of site impacts will be achieved through avoidance measures and monitoring during construction activities.
Bullitt 1 Fed 601H	#145989	Identification efforts resulted in no archaeological sites being discovered and 13 Isolated Occurrences/Isolated Manifestations (IOs/IMs) documented. None of the IOs/IM's meet eligibility requirements for listing in the NRHP due to lack of context and integrity.	BLM finds a determination of no effect as no historic properties were identified.
Capri	#146474	Identification efforts resulted in no archaeological sites being discovered and 2 Isolated Occurrences/Isolated Manifestations (IOs/IMs) documented. None of the IOs/IM's meet eligibility requirements for listing in the NRHP due to lack of context and integrity.	BLM finds a determination of no effect as no historic properties were identified.
Del Rio	#146356	Identification efforts resulted in no archaeological sites being discovered and 5 Isolated Occurrences/Isolated Manifestations (IOs/IMs) documented. None of the	BLM finds a determination of no effect as no historic properties were identified.

SITE	NMCRIS #	FINDINGS	RECOMMENDATIONS
		IOs/IM's meet eligibility requirements for listing in the NRHP due to lack of context and integrity.	
Durango	#146340	Identification efforts resulted in no archaeological sites being discovered and no Isolated Occurrences/Isolated Manifestations (IOs/IMs) documented.	BLM finds a determination of no effect as no historic properties were identified.
Falcon	#146381	Identification efforts resulted in no archaeological sites being discovered and 2 Isolated Occurrences/Isolated Manifestations (IOs/IMs) documented. None of the IOs/IM's meet eligibility requirements for listing in the NRHP due to lack of context and integrity.	BLM finds a determination of no effect as no historic properties were identified.
Galaxie	#146354	Identification efforts resulted in no archaeological sites being discovered and 4 Isolated Occurrences/Isolated Manifestations (IOs/IMs) documented. None of the IOs/IM's meet eligibility requirements for listing in the NRHP due to lack of context and integrity.	BLM finds a determination of no effect as no historic properties were identified.
Interceptor	#146471	Two (2) new archaeological sites and 2 Isolated Occurrences/Isolated Manifestations (IOs/IMs) were identified and documented. One Sites is prehistoric in nature and one historic. The BLM has determined both sites eligible for listing in the National Register of Historic Place (NRHP)	Following review, the BLM finds a determination of No Effect to cultural properties. Avoidance of site impacts will be achieved through avoidance measures and monitoring during construction activities.
Starliner	#146109	Identification efforts resulted in no archaeological sites being discovered and 7 Isolated Occurrences/Isolated Manifestations (IOs/IMs) documented. None of the IOs/IM's meet eligibility requirements for listing in the NRHP due to lack of context and integrity.	BLM finds a determination of no effect as no historic properties were identified.
Talladega	#145107	Identification efforts resulted in no archaeological sites being discovered and 14 Isolated Occurrences/Isolated Manifestations (IOs/IMs) documented. None of the IOs/IM's meet eligibility requirements for listing in the NRHP due to lack of context and integrity.	BLM finds a determination of no effect as no historic properties were identified.

SITE	NMCRIS #	FINDINGS	RECOMMENDATIONS
Thunderbird	#146435	Identification efforts resulted in no archaeological sites being discovered and 7 Isolated Occurrences/Isolated Manifestations (IOs/IMs) documented. None of the IOs/IM's meet eligibility requirements for listing in the NRHP due to lack of context and integrity.	BLM finds a determination of no effect as no historic properties were identified.
Fairlane	#144328	Five (5) new archaeological sites and 18 Isolated Occurrences/Isolated Manifestations (IOs/IMs) were identified and documented. Sites consisted of one historic site the BLM has determined not Eligible for listing on the NRHP. Four prehistoric sites, of those sites the BLM has determined two are not eligible for listing on the NRHP and two are Eligible for listing on the NRHP. None of the IOs/IM's meet eligibility requirements for listing in the NRHP due to lack of context and integrity.	Following review, the BLM finds a determination of No Effect to cultural properties within the authority of the BLM. Avoidance of site impacts will be achieved through avoidance measures and monitoring during construction activities

3.11.4 Cumulative Effects

Past and Present Actions

As of 2019, existing wells in the field office were associated with an estimated 590 acres of surface disturbance. Additional past and present actions near the Proposed Action area that have resulted in impacts to cultural resources include livestock grazing, vegetation management, fuel wood cutting, recreation, hunting, land management, and natural events.

Sites have been relatively scarce within the PPA. BLM conducted a review of records in the RPFO, as well as records available in the database maintained by the Archaeological Resource Management Section of the New Mexico Historic Preservation Division. The existing records indicated that out of the approximately 41,000 acres that were involved in the December 2018 Competitive Oil and Gas Lease sale for the Rio Puerco Field Office, approximately 20% of the surface had been inventoried for cultural resources. Ninety-seven sites with 107 components have been recorded within the Lease Sale area (BLM, 2018c). The existing records review is on file at the RPFO as NM-11-2018(IV)A.

Reasonably Foreseeable Future Actions

Surface disturbances associated with reasonable and foreseeable future actions include the past and present actions outlined above and are expected to continue at their current rate. Within the RPFO, the RFD baseline scenario projects 200 new oil and gas wells (160 vertical wells and 40

horizontal wells) for 2020-2039. Over the life of the plan, the maximum potential disturbance (including existing and projected well pads, roads, and rights-of- way) is 2,750 acres. Accounting for reclamation, it is expected that 1,190 acres of surface disturbance to remain at the end of the plan in 2039.

The Proposed Action would result in 224.1 acres of disturbance, of which 44.78 are considered previously disturbed or previously permitted. Approximately 162 acres would be reclaimed during interim reclamation and the remaining 62.1 acres would be disturbed for the life of the project. The Proposed Action would account for 6.9% of total estimated surface disturbance predicted in the RPFO RFD. After reclamation, the Proposed Action would account for 5.2% of the remaining estimated surface disturbance.

The results of the Class III inventory of the PPA indicate that the Proposed Action could adversely affect one NRHP-eligible archaeological site, located on privately-owned land, during topsoil removal for access road reconstruction. A cultural monitor will be onsite during all ground disturbing activities.

A positive cumulative effect of the Proposed Action is the additional scientific information yielded by the archaeological surveys.

3.11.5 Mitigation and Residual Impacts

All actions authorized by the BLM-RPFO, including APDs and ROW Grants, have stipulations, under penalty of law, that require the reporting of and avoidance of further disturbing cultural discoveries during implementation of the Proposed Action. Adherence to cultural resources design features in Appendix D and conditions of approval and stipulations attached to the Proposed Action's APD and ROW Grants would allow the Proposed Action to have no effect on historic properties identified through field inventory.

3.12 Issue 12: Recreation

Impacts to recreation from the Proposed Action could occur through ground disturbance activities during construction and the presence of production facilities through the life of the Proposed Action. The impact indicators for this issue are acres of new disturbance and quantity and location of production facilities. The analysis area is the RPFO.

3.12.1 Affected Environment

Recreational activities within the area of the Proposed Action include ranching, hunting, camping, and fuel wood gathering. Camping is usually associated with hunting, especially big game hunting during the fall and early winter months. Small game (generally black-tailed jackrabbit and desert cottontail) is hunted year-round in the area. Large game, such as mule deer, elk, and black bear are hunted during the fall and early winter months.

Three separate and unique loop trails were designed and implemented for the Oh-My-God competitive motorcycle race. The Oh-My-God race consists of three courses, race course A, B, and C, which are created solely for event use once every three years. Courses A and B are not within the PPA. Course C lies within the PPA and is approximately 36 miles long in total.

Approximately 2.9 miles of the Oh-My-God Course C overlaps with the main two-track road that is proposed for upgrade by EOG. Specifically, the course would run adjacent to the Starliner, Talladega, Durango, and Falcon locations.

3.12.2 Environmental Impacts – No Action Alternative

The No Action Alternative would result in the continuation of the existing land and resource uses in the analysis area and their subsequent and current impacts to recreation resources, therefore there would be no expected, additional impacts.

3.12.3 Environmental Impacts – Proposed Action

Temporary impacts to camping and hunting may result from the drilling and completion of the Proposed Action. Increased activity within the PPA may minimize camping during drilling and completion of the well. The clearing of vegetation and fragmentation of habitat could reduce overall production of large game species but is not likely to impact small game species.

The upgraded access road would alter the natural trail substrate that racers are accustomed to along the Oh-My-God courses. Additionally, the presence of oil and gas facilities would degrade the natural ambience of racing in the wilderness. Approximately 15,031.5 linear feet or 2.85 miles of the Oh-My-God Course C would overlap with the main road proposed for upgrade by EOG. The course would not overlap with any other proposed infrastructure such as well pads or facility pads.

3.12.4 Cumulative Effects

Past and Present Actions

As of 2019, existing wells in the field office were associated with an estimated 590 acres of surface disturbance. Additional past and present actions near the Proposed Action area that have resulted in impacts to recreational resources include livestock grazing, vegetation management, fuel wood cutting, land management, and natural events.

Reasonably Foreseeable Future Actions

Surface disturbances associated with reasonable and foreseeable future actions include the past and present actions outlined above and are expected to continue at their current rate. Within the RPFO, the RFD baseline scenario projects 200 new oil and gas wells (160 vertical wells and 40 horizontal wells) for 2020-2039. Over the life of the plan, the maximum potential disturbance (including existing and projected well pads, roads, and rights-of- way) is 2,750 acres. Accounting for reclamation, it is estimated that 1,190 acres of surface disturbance would remain at the end of the plan in 2039 (Crocker and Glover, 2019).

Development of the Proposed Action would result in approximately 224.1 acres of surface disturbance, of which 179.3 acres are considered new disturbance. Approximately 162 acres would be reclaimed during interim reclamation and 62.1 acres would remain disturbed throughout the lifetime of the Proposed Action. The Proposed Action would account for 6.9% of total estimated surface disturbance predicted in the RPFO RFD. After reclamation, the Proposed Action would account for 5.2% of the remaining estimated surface disturbance.

Future oil and gas exploration is expected to occur in the vicinity of the Proposed Action, which may cause a disproportionate level of direct and indirect impacts to recreation in the area. Some of these would be temporary impacts, such as the addition of project lighting or flaring to the landscape. Other impacts, such as the addition of roads and oil/gas facilities to the region, would be relatively longer term and would be in use for the lifetime of the projects.

The construction of new access roads within the PPA could allow increased public access and traffic. Based on ongoing consultation with the Ojo Encino and Counselor Chapters and several Pueblos, the BLM has developed stipulations, COAs, design features, and other methods to address these concerns.

The Oh-My-God race is currently held every 3 years. Impacts would be highest during the construction phase of the Proposed Action but would decrease as construction is completed. Development of the area could improve access to remote portions of the race course.

3.12.5 Mitigation and Residual Impacts

Most production facilities associated with the well pads are temporary; they would be removed once drilling and completion phases are complete. BMPs would be incorporated into Conditions of Approval. Potential noise impacts as a direct result of development would be temporary. Long-term noise impacts will be as a result of hydrocarbon development and transportation by truck compressors, and pump jacks.

Mitigation of the effects of noise would be achieved by requiring all facilities using internal combustion engines to have exhaust mufflers, sound barrier walls, or earthen mounds to quite noise or direction of impacts.

Coordination between race officials and RPFO is recommended to avoid potential conflicts with racers during all construction, drilling, and operation phases.

3.13 Issue 13: Indian Trust Assets

Indian Trust Assets (ITA) are a legal interest in assets held in trust by the United States Government for Indian tribes or individuals. Some examples of ITAs are lands, minerals, water rights, hunting and fishing rights, titles and money.

3.13.1 Affected Environment

The Proposed Action would involve reconstructing 5,652.33 feet of existing county-maintained access road across tribal lands. Additionally, 5,609.01 feet of pipeline is proposed to be constructed adjacent to the access road on tribal land. See Map 5, Appendix E for tribal land locations relative to the Proposed Action.

3.13.2 Environmental Impacts – No Action Alternative

The No Action Alternative would result in the continuation of the existing land and resource uses in the analysis area and their subsequent and current impacts to ITAs; therefore, additional impacts are not expected.

3.13.3 Environmental Impacts – Proposed Action

The reconstructed access road ROW width would be 30 feet and the pipeline and utility system ROW width would be 40 feet. The two ROWs would overlap by 20 feet to create one 50-foot wide ROW corridor. The edges of the corridor would be utilized as temporary use areas during both road and pipeline construction phases to provide additional workspace.

The total surface disturbance caused to ITAs by road and pipeline construction on tribal lands would be approximately 6.46 acres. 3.36 acres would be reclaimed during interim reclamation, leaving 3.1 acres of long-term disturbance associated with the reconstructed access road.

3.13.4 Cumulative Effects

Past and Present Actions

ITAs are identified primarily during the Section 106 process and through consultation with federally recognized Indian Tribes on a government-to-government basis. The BLM-RPFO has a long history of consultation with local tribes on projects and issues that might affect their people or interests due to the varied land status of BLM-managed lands. In general, key ITAs in the RPFO have included rights for water, fluid minerals, and grazing.

Reasonably Foreseeable Future Actions

Within the RPFO, the RFD baseline scenario projects 200 new oil and gas wells will be drilled between 2020 and 2039. As of 2019, existing wells in the field office were associated with an estimated 590 acres of surface disturbance. Over the life of the plan, the maximum potential disturbance (including existing and projected well pads, roads, and rights-of- way) is 2,750 acres.

Development of the Proposed Action would result in new surface disturbance of approximately 224.1 acres. Approximately 162 acres would be reclaimed during interim reclamation and 62.1 acres would remain disturbed for the life of the wells. The Proposed Action would account for 6.9% of total estimated surface disturbance predicted in the RPFO RFD. After reclamation, the Proposed Action would account for 5.2% of the remaining estimated surface disturbance.

Further energy development within the RPFO would correlate with the identification of more ITAs and increased need for tribal consultation.

3.13.5 Mitigation and Residual Impacts

The United States has an Indian Trust Responsibility (ITR) to protect and maintain rights reserved by or granted to Indian tribes or individuals by treaties, statutes, executive orders, and rights further interpreted by the courts. The ITR requires that all federal agencies take all actions reasonably necessary to protect such trust assets. If any ITAs are identified and are to be impacted, further consultation on measures to avoid or minimize potential adverse effects will take place. If the project results in adverse impacts, consultation regarding mitigation and/or compensation will take place.

4.0 Consultation and Coordination

4.1 Summary of Consultation and Coordination

The following persons, groups, agencies, or other parties were consulted or coordinated with during the preparation of this analysis.

SHPO Consultation:

Pursuant to 36 CFR Part 800 the BLM will consult with the New Mexico SHPO as to the results of historic properties identification efforts to determine cultural significance of historic properties identified, effects to properties, avoidance measures and resolution of effects to properties if historic properties are determined to be impacted by the proposed undertaking.

Tribal Consultation:

Letters were sent on October 8, 2020 to listed Tribal Entities in table 4-1 to notify of the opportunity and invitation to consult with the BLM Rio Puerco Field Office pursuant to the BLM responsibility, detailed in the BLM Tribal Relations Manual H-1780-1 and under Section 106 following 36 CFR 800 concerning the results of cultural inventories, mitigation efforts and monitoring plans for this undertaking.

Table 4-1 Agency and Organizations

Name	Agency/Organization
Governor Brian D. Vallo	Pueblo of Acoma
Todd Scissons	Acoma Historic Preservation Office
Governor Anthony Ortiz	Pueblo of San Felipe
Ricardo Ortiz	Tribal Historic Preservation Officer, Pueblo of San Felipe
Pinu'u Stout	Natural Resources Director, Pueblo of San Felipe
Governor J. Michael Chavarria	Pueblo of Santa Clara
Ben Chavarria	Tribal Historic Preservation Officer, Pueblo of Santa Clara
Governor Robert Mora Sr.	Pueblo of Tesuque
Mark Mitchell	Tribal Historic Preservation Officer, Pueblo of Tesuque
Chairman Timothy Nuvangyaoma	Hopi Tribal Council
Stewart Koyiyumptewa	The Hopi Tribe, Cultural Preservation Office
President Jonathon Nez	Navajo Nation
Richard M. Begay	Navajo Nation Historic Preservation Department
President Edward Velarde	Jicarilla Apache Nation
Dr. Jeffrey Blythe, THPO	Jicarilla Apache Nation
President George Werito, Jr.	Ojo Encino Chapter
President Harry Domingo Sr.	Counselor Chapter
Chapter President David Rico	Torreon/Star Lake Chapter

Name	Agency/Organization
Governor Val Panteah Sr.	Pueblo of Zuni
Kurt Dongoske	Pueblo of Zuni Tribal Historic Preservation Officer
Governor Maz A. Zuni	Pueblo of Isleta
Dr. Henry Walt	Pueblo of Isleta Tribal Historic Preservation Officer
Chairman Christine Baker-Sage	Southern Ute Tribe

4.2 Summary of Public Participation (If Applicable)

This summary will be updated based upon public comment period to include, dates, methods and other pertinent information.

5.0 List of Appendices

Appendix A—List of Preparers

Appendix B—Project Disturbances

Appendix C— List of References

Appendix D—Design Features

Appendix E—map

Appendix F—Figures

Appendix A: List of Preparers[1]

Name	Agency/Organization	Responsibility
Dawn Chavez	BLM Rio Puerco Field Office	NEPA/Planning
Calvin Parson	BLM Rio Puerco Field Office	Geologist
Lucas Vargo	BLM Rio Puerco Field Office	Minerals/Oil and Gas
Michael Papirtus	BLM Rio Puerco Field Office	Cultural Resources/Paleontology
Jennifer Merino	BLM Rio Puerco Field Office	Visual Resource Management (Rec)
Alec Bryan	BLM Rio Puerco Field Office	Range and Livestock
Dave Mattern	BLM Rio Puerco Field Office	Soil, Water, Air
Joshua Freeman	BLM Rio Puerco Field Office	Wildlife
Joseph Pruitt	BLM Rio Puerco Field Office	Invasive Weeds
Zane Homesley	Goshawk Consulting	Resource Surveys
Heather Ireland	Adkins Environmental Consulting	EA Preparation
Sarah McClosky	Adkins Environmental Consulting	EA Preparation
David Jaffe	Adkins Environmental Consulting	EA Preparation
Alex Simon	Adkins Environmental Consulting	EA Preparation

[1] This list should include all individuals involved in the preparation of the EA document, including BLM, Cooperating Agency staff and contractors (as applicable).

Appendix B: Project Disturbances

Associated Project	Surface Management	Surface Disturbance Description	Existing/Previously Permitted Surface Disturbance	New Surface Disturbance
BULLITT 1				
Well Pad				
Bullitt 1	BLM	Well Pad (340’ x 385’ Max.)	-	3.01 acres
		Construction Buffer (50’ beyond the edge of the well pad)	-	1.89 acre
	Access Road			
	BLM	Existing 14’ wide two-track road	815.5’ long x 14’ ROW (0.26 acre)	815.5’ long x 16’ ROW (0.30 acre)
		Overlaps Proposed Construction Buffer	50.2’ long x 30’ ROW (-[a])	-
	Well-tie Pipelines			
	BLM	Parallels Proposed Access (~ 15’ off-set)	780.8’ long x 20’ ROW (-[b])	780.8’ long x 20’ ROW (0.36 acre)
		Overlaps Proposed Well Pad	321.6’ long x 40’ ROW (-[b])	-
	Borrow Sources			
	BLM	Borrow Source 10A	1.59 acres	-
		Borrow Source 10A - Access	-	113.4’ long x 14’ Wide (0.04 acre)
BULLITT 06 FED 601H-612H				
	Well Pad			
Bullitt 06 Fed 601H-612H	BLM	Well Pad (600’ x 500’ Max.)	-	6.89 acres
		Construction Buffer (50’ beyond the edge of the well and facility pads)	-	2.75 acres
	Access Road			
	BLM	Cross-country	677.1’ long x 14’ ROW (0.22 acre)	677.1’ long x 16’ ROW (0.25 acre)
		Overlaps Proposed Construction Buffer	50.4’ long x 30’ ROW (-[a])	-
	Well-tie Pipelines			
	BLM	Parallels Proposed Access (~ 15’ off-set)	518.7’ long x 20’ ROW (-[b])	518.7’ long x 20’ ROW (0.24 acre)
		Overlaps Proposed Well Pad	210.3’ long x 40’ ROW (-[b])	-
	Borrow Sources			
	BLM	Borrow Source 10	9.38 acres	-

Associated Project	Surface Management	Surface Disturbance Description	Existing/Previously Permitted Surface Disturbance	New Surface Disturbance
		Borrow Source 10 - Access	-	93.4’ long x 14’ Wide (0.03 acre)
		Borrow Source 11	1.04 acre	-
		Borrow Source 11 - Access		1244.4’ long x 14’ Wide (0.4 acre)
		Borrow Source 12	0.85 acre	-
		Borrow Source 12 - Access	1214.8’ long x 14’ Wide (0.39 acre)	-
CAPRI 04 FED 601H-612H				
	Well Pad			
Capri 04 Fed 601H-612H	BLM	Well Pad (570’ x 620’ Max.)	-	8.11 acres
	BLM	Construction Buffer (50’ beyond the edge of the well pad and facility area)	-	2.96 acres
	Access Road			
	BLM	Cross-country	-	630.4’ long x 30’ ROW (0.43 acre)
	BLM	Overlaps Proposed Construction Buffer	70.7’ long x 30’ ROW (-[a])	-
	Well-tie Pipelines			
	BLM	Parallels Proposed Access (~ 15’ off-set)	601.3’ long x 20’ ROW (-[b])	601.3’ long x 20’ ROW (0.28 acre)
	BLM	Overlaps Proposed Well Pad and Construction Buffer	70.7’ long x 40’ ROW (-[b])	-
DEL RIO 12 FED 601H-612H				
	Well Pad			
Del Rio 12 Fed 601H-612H	BLM	Well Pad (575’ x 620’ Max.)	-	8.11 acres
	BLM	Construction Buffer (50’ beyond the edge of the well pad and facility area)	-	2.96 acres
	Access Road			
	BLM	Cross-country	-	51.1’ long x 30’ ROW (0.04 acre)
	BLM	Overlaps Proposed Construction Buffer	50.1’ long x 30’ ROW (-[a])	-
	Well-tie Pipelines			
	BLM	Parallels Proposed Access (~ 15’ off-set)	77.6’ long x 20’ ROW (-[b])	77.6’ long x 20’ ROW (0.04 acre)

Associated Project	Surface Management	Surface Disturbance Description	Existing/Previously Permitted Surface Disturbance	New Surface Disturbance
		Overlaps Proposed Well Pad and Construction Buffer	50.1’ long x 40’ ROW (-[b])	-
DURANGO 14 FED 601H-612H				
	Well Pad			
Durango 14 Fed 601H-612H	BLM	Well Pad (570’ x 620’ Max.)	-	8.11 acres
		Construction Buffer (50’ beyond the edge of the well pad and facility area)	-	2.96 acres
	Access Road			
	BLM	Cross-country	-	269.7’ long x 30’ ROW (0.19 acre)
		Overlaps Proposed Construction Buffer	57.2’ long x 30’ ROW (-[a])	-
	Well-tie Pipelines			
	BLM	Parallels Proposed Access (~ 15’ off-set)	267.1’ long x 20’ ROW (-[b])	267.1’ long x 20’ ROW (0.12 acre)
		Overlaps Proposed Well Pad and Construction Buffer	57.2’ long x 40’ ROW (-[b])	-
FAIRLANE 22 FED 601H-610H				
	Well Pad			
Fairlane 22 Fed 601H-610H	BLM	Well Pad (420’ x 400’ Max.)	0.41 acres	3.45 acres
		Construction Buffer (50’ beyond the edge of the well pad and facility area)	-	2.07 acres
	Access Road			
	BLM	Overlaps Proposed Construction Buffer	17,219.4’ long x 18’ ROW (7.12 ac) (-[a])	17,219.4’ long x 12’ ROW (4.74 ac)
	Tribal	Overlaps Proposed Construction Buffer	5,652.3’ long x 18’ ROW (2.34 acres)	5,652.3’ long x 12’ ROW (1.56 acres)
	Other Private	Overlaps Proposed Construction Buffer	3,004.3’ long x 18’ ROW (1.24 acres)	3,004.3’ long x 12’ ROW (0.83 acres)
	Well-tie Pipelines			
	BLM	Parallels Access Road (20’ off-set)	13,985.6’ long x 20’ ROW (6.42 ac) (-[b])	13,985.6’ long x 20’ ROW (6.42 ac)
	Tribal	Parallels Access Road (20’ off-set)	5,609’ long x 20’ ROW (2.58 acres)	5,609’ long x 20’ ROW (2.58 acres)
	Other Private	Parallels Access Road (20’ off-set)	3,004’ long x 20’ ROW (1.40 acres)	3,004’ long x 20’ ROW (1.40 acres)
FALCON 05 FED 601H-612H				
	Well Pad			
Falcon 05 Fed 601H-612H	BLM	Well Pad (570’ x 620’ Max.)	-	8.11 acres

Associated Project	Surface Management	Surface Disturbance Description	Existing/Previously Permitted Surface Disturbance	New Surface Disturbance
		Construction Buffer (50’ beyond the edge of the well pad and facility area)	-	2.96 acres
	Access Road			
	BLM	Cross-country	-	296.8’ long x 30’ ROW (0.2 acre)
		Overlaps Proposed Construction Buffer	62.1’ long x 30’ ROW (-[a])	-
	Well-tie Pipelines			
	BLM	Parallels Proposed Access (~ 15’ off-set)	297.5’ long x 20’ ROW (-[b])	297.5’ long x 20’ ROW (0.14 acre)
		Overlaps Proposed Well Pad and Construction Buffer	62.1’ long x 40’ ROW (-[b])	-
GALAXIE				
	Well Pad			
Galaxie 12 Fed 601H-612H	BLM	Well Pad (570’ x 620’ Max.)	-	8.11 acres
		Construction Buffer (50’ beyond the edge of the well pad and facility area plus 150’ x 50’ additional area)	-	3.13 acres
	Access Road			
	BLM	Cross-country	-	446.5’ long x 30’ ROW (0.31 acre)
		Overlaps Proposed Construction Buffer	63.9’ long x 30’ ROW (-[a])	-
	Well-tie Pipelines			
	BLM	Parallels Proposed Access (~ 15’ off-set)	503.7’ long x 20’ ROW (-[b])	503.7’ long x 20’ ROW (0.23 acre)
		Overlaps Proposed Well Pad and Construction Buffer	63.9’ long x 40’ ROW (-[b])	-
INTERCEPTOR 02 FED 601H-612H				
	Well Pad			
Interceptor 02 Fed 601H-612H	BLM	Well Pad (570’ x 620’ Max.)	-	8.11 acres
		Construction Buffer (50’ beyond the edge of the well pad and facility area)	-	2.96 acres
	Access Road			
	BLM	Cross-country	4285.6’ long x 14’ ROW (1.38 acres)	4285.6’ long x 16’ ROW (1.57 acres)

Associated Project	Surface Management	Surface Disturbance Description	Existing/Previously Permitted Surface Disturbance	New Surface Disturbance
		Overlaps Proposed Construction Buffer	58.9’ long x 30’ ROW (-[a])	-
	Well-tie Pipelines			
	BLM	Parallels Proposed Access (~ 15’ off-set)	4258.8’ long x 20’ ROW (-[b])	4258.8’ long x 20’ ROW (1.96 acres)
		Overlaps Proposed Well Pad and Construction Buffer	58.9’ long x 40’ ROW (-[b])	-
	Borrow Source			
	BLM	Borrow Source 18	(0.313 acre) [c]	-
		Borrow Source 19	(0.44 acre) [c]	
		Borrow Source 19 Access	3822.2’ long x 14’ ROW (1.23 acres)	-
PINTO 03 FED 601H-612H				
	Well Pad			
Pinto 03 Fed 601H-612	BLM	Well Pad (570’ x 620’ Max.)	-	8.11 acres
		Construction Buffer (50’ beyond the edge of the well pad and facility area)	-	2.96 acres
	Access Road			
	BLM	Cross-country	-	644.9’ long x 30’ ROW (0.44 acre)
		Overlaps Proposed Construction Buffer	56.2’ long x 30’ ROW (-[a])	-
	Well-tie Pipelines			
	BLM	Parallels Proposed Access (~ 15’ off-set)	615.8’ long x 20’ ROW (-[b])	615.8’ long x 20’ ROW (0.28 acres)
		Overlaps Proposed Well Pad and Construction Buffer	56.2’ long x 40’ ROW (-[b])	-
	Borrow Source			
	BLM	Borrow Source 13	(1.12 acres) [c]	-
		Borrow Source 13 Access		301.1’ long x 14’ ROW (0.10 acre)
		Borrow Source 14	(0.59 acre) [c]	-
		Borrow Source 14 Access	-	788.3’ long x 14’ ROW (0.25 acre)
		Borrow Source 15	(1.84 acres) [c]	-
		Borrow Source 15 Access	-	1149.4’ long x 14’ ROW

Associated Project	Surface Management	Surface Disturbance Description	Existing/Previously Permitted Surface Disturbance	New Surface Disturbance
				(0.37 acre)
		Borrow Source 16	(2.01 acres) [c]	-
		Borrow Source 16 Access	-	579’ long x 14’ ROW (0.19 acre)
	TUA Staging/AST			
	BLM	Pinto Staging Area 1		0.21
		Pinto Staging Area 2		4.9
STARLINER 23 FED 601H-612H				
	Well Pad			
Starliner 23 Fed 601H-612H	BLM	Well Pad (600’ x 500’ Max.)	-	6.89 acres
		Construction Buffer (50’ beyond the edge of the well and facility pads)	-	2.75 acres
	Access Road			
	BLM	Cross-country	-	1071’ long x 30’ ROW (0.74 acre)
		Overlaps Proposed Construction Buffer	56.7’ long x 30’ ROW (-[a])	-
	Well-tie Pipelines			
	BLM	Parallels Proposed Access (~ 15’ off-set)	1109.47’ long x 20’ ROW (-[b])	1109.47’ long x 20’ ROW (0.51 acre)
		Overlaps Proposed Well Pad	443.73’ long x 40’ ROW (-[b])	-
	Borrow Source			
	BLM	Borrow Source 1	1.72 acres [c]	-
		Borrow Source 1 - Access	121.6’ x 14’ Wide (0.04 acre)	-
TALLADEGA 1409 FED 601H-612H				
	Well Pad			
Talladega 14 Fed 601H-612H	BLM	Well Pad (600’ x 500’ Max.)	-	6.29 acres
		Construction Buffer (50’ beyond the edge of the well and facility pads)	-	2.75 acres
	Access Road			
	BLM	Cross-country	-	635.9’ long x 30’ ROW (0.44 acre)
		Overlaps Proposed Construction Buffer	59.9’ long x 30’ ROW (-[a])	-
	Well-tie Pipelines			

Associated Project	Surface Management	Surface Disturbance Description	Existing/Previously Permitted Surface Disturbance	New Surface Disturbance
	BLM	Parallels Proposed Access (~ 15' off-set)	638.7' long x 20' ROW (-[b])	638.7' long x 20' ROW (0.29 acre)
		Overlaps Proposed Well Pad	362.5' long x 40' ROW (-[b])	-
	Borrow Sources			
	BLM	Borrow Source 2	(1.92 acres) [c]	-
		Borrow Source 3	(0.83 acre) [c]	-
		Borrow Source 3 - Access	-	68.4' long x 14' wide (0.02 acre)
		Borrow Source 4	(0.48 acre) [c]	-
		Borrow Source 4 - Access	-	176.8' long x 14' wide (0.06 acre)
		Borrow Source 5	(5.56 acres) [c]	-
		Borrow Source 5 - Access	-	159.2' long x 14' wide (0.05 acre)
THUNDERBIRD				
	Well Pad			
Thunderbird 05 Fed 601H-612H	BLM	Well Pad (500' x 520' Max.)	-	5.97 acres
		Construction Buffer (50' beyond the edge of the well pad and facility area)	-	2.57 acres
	Access Road			
	BLM	Cross-country	-	2825.7' long x 30' ROW (1.95 acres)
		Overlaps Proposed Construction Buffer	67.3' long x 30' ROW (-[a])	-
	Well-tie Pipelines			
	BLM	Parallels Proposed Access (~ 15' off-set)	2849.4' long x 20' ROW (-[b])	2849.4' long x 20' ROW (1.31 acres)
		Overlaps Proposed Well Pad and Construction Buffer	67.3' long x 40' ROW (-[b])	-
TORINO 02 FED 601H-612H				
	Well Pad			
Torino 02 Fed 601H-612H	BLM	Well Pad (570' x 620' Max.)	-	8.11 acres
		Construction Buffer (50' beyond the edge of the well pad and facility area)	-	2.96 acres
	Access Road			

Associated Project	Surface Management	Surface Disturbance Description	Existing/Previously Permitted Surface Disturbance	New Surface Disturbance
	BLM	Cross-country	2188.1’ long x 14’ ROW (0.70 acres)	2188.1’ long x 16’ ROW (0.80 acres)
		Overlaps Proposed Construction Buffer	55.6’ long x 30’ ROW (-[a])	-
	Well-tie Pipelines			
	BLM	Parallels Proposed Access (~ 15’ off-set)	2188.8’ long x 20’ ROW (-[b])	2188.8’ long x 20’ ROW (1.00 acre)
		Overlaps Proposed Well Pad and Construction Buffer	55.6’ long x 40’ ROW (-[b])	-
	Borrow Sources			
	BLM	Borrow Source 17	(0.23 acre) [c]	-
		Borrow Source 17 Access	-	68.7’ long x 14’ ROW (0.02 acres)
	TUA Staging/AST			
	BLM	Torino Staging Area	-	220’ x 440’ (2.22 acres)
	Total Project Surface Disturbance[d]		**64.19 acres**	**171.93 acres**

[a] Approximately 0.52 acre of the access disturbance accounted for in the well pad buffer disturbance.
[b] Approximately 8.48 acres of the pipeline disturbance accounted for in the proposed access and well pad and buffer disturbance.
[c] Approximately 29.91 acres of the borrow sources will not be re-seeded and re-contoured.
[d] May vary from other Total Project Surface Disturbance estimates due to different calculations of prior disturbed and overlapping surface areas.

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Appendix D: Design Features

Design features address concerns raised by internal scoping and potentially affected elements of the human environment. Design features are incorporated into the Proposed Action to ensure potential impacts to natural and human resources would be minimized. Detailed description of the design features specific to the well under the Proposed Action can also be found in the individual well APD on file at the BLM-RPFO, Albuquerque, New Mexico. Plats located in Appendix B and the Plan for Surface Reclamation in Appendix C also detail design features for the well. EOG would adhere to the following design features, as APD Conditions of Approval (COAs):

Air Resources

- Compressor engines 300 horsepower or less used during well production must be rated by the manufacturer as emitting NOx at 2 grams per horsepower hour or less to comply with the New Mexico Environmental Department, Air Quality Bureau's guidance.
- Revegetation would occur in areas not required for production facilities in order to reduce dust.
- Dirt roads would be watered during periods of high use in order to reduce fugitive dust emissions. Magnesium chloride, organic-based compounds, or polymer compounds could also be applied to roads or other surfaces to reduce fugitive dust. Petroleum-based products or produced water would not be used for dust reduction.
- BMPs provided in The Gold Book for proposed and existing roads would be implemented (USDI BLM and USDA Forest Service 2007).

Geology/Mineral Resources/ Energy Production

- Fluids, additives, and other materials used for drilling and completion operations must be protective of public health and the environment
- If acidizing processes are used, no deleterious substances would be permitted to pollute subsurface water.

Soils

- The well specific Plan for Surface Reclamation would be followed.
- Clearing, removal of topsoil, and grading would be limited to the permitted area and the minimum area required for safe and efficient construction.
- Topsoil would be segregated and stockpiled at the edge of the workspace. Topsoil is defined as the top four to six inches of soil.
- Vehicle/equipment traffic would be prevented from crossing topsoil stockpiles.
- EOG would take appropriate measures to prevent topsoil loss, if the location becomes prone to wind or water erosion. Such measures may include using tackifiers, blankets, straw bales, straw wattles, or water to wet the topsoil stockpile to create a crust across the exposed soil to prevent soil loss.
- Waterbars may be installed on disturbed slopes, at spacing and cross sections specified by the BLM Authorized Officer.
- No construction or routine maintenance activities would be performed during periods when the soil is too wet to adequately support construction equipment. If equipment would create ruts deeper than six inches, the soil would be deemed too wet for construction or maintenance.
- If the wells are economically productive, permanent erosion control measures would be installed after the well pad has been re-contoured.

Water Resources

- To prevent erosion, the areas surrounding the proposed pads would be recontoured during interim reclamation.
- Liquid containment mitigation would surround all tanks. Containment areas would be capable of containing the volume of the single largest storage vessel plus 1-foot freeboard of precipitation; or 110% of the fluids in the largest tank.
- Culvert and silt traps would be installed as appropriate

Vegetation/ Fuel Wood/Reclamation

- All vehicle and pedestrian traffic associated with the Proposed Action would be restricted to disturbance areas and existing roads.
- Interim and final reclamation would follow the Plan for Surface Reclamation individualized for the well (Appendix C).
- Trees larger than three inches in diameter would be cut at ground level and de-limbed. Trees would be cut as close to the ground as possible. Stumps and root balls would be hauled to an approved disposal site. Wood not suitable for fence posts would be cut into 16-inch lengths or smaller and stacked at a specified location to be utilized by the public. Wood suitable for fence posts would be left whole and placed in a designated area for public use.
- Trees smaller than three inches in diameter, slash, and brush would be chipped, shredded, or mulched and would be incorporated into the topsoil for later use in interim reclamation. Remaining brush would be brush-hogged or scalped at ground level prior to ground disturbance.
- At interim reclamation, rocks and limbs removed during clearing would be scattered across the workspace in a random arrangement using rubber-tired equipment.
- If wells are economical, productive equipment would be placed on location in such a manner to minimize long-term disturbance and maximize interim reclamation. As practical, access would be provided by a tear-drop shaped road through the production area so that the center may be re-vegetated.
- All disturbed areas would be seeded with a seed mixture specified by the BLM-RPFO. Seeding would be accomplished within 90 days of completion of the well.
- For both interim and final reclamation, the reclaimed areas would be fenced to facilitate planting establishment.

Invasive and Noxious Weeds

- A pre-disturbance noxious weed inventory would be conducted to determine the presence of noxious weeds prior to any well pad or access road construction. Noxious weeds are those species listed on the New Mexico Department of Agriculture's A and B List (2009).
- If noxious weeds are found, the following would be documented:
    - A Global Positioning System (GPS) location recorded in North American Datum 1983
    - Species
    - Canopy cover or number of plants
    - Size of infestation (estimate of square feet or acres)
- Control and management of noxious weeds and invasive species infestations would use the principles of integrated weed management, including chemical, mechanical, and biological control methods. An approved Pesticide Use Proposal is required for all planned herbicide applications. Herbicides would be applied by a certified applicator.

- It would be EOG's responsibility to monitor, control, and eradicate all invasive, non-native plant species within the Proposed Action throughout the life of the well. EOG would contact the BLM regarding acceptable weed-control methods. If EOG does not hold a current Pesticide Use Permit, a Pesticide Use Permit would be submitted prior to pesticide application. Only pesticides authorized for use on federal lands would be used. The use of pesticides would comply with federal laws. Pesticides would be used only in accordance with their registered use and limitations. EOG would contact the BLM prior to using these chemicals.

Livestock Grazing

- Individuals with grazing animals would be notified at least 5 business days prior to construction.
- If livestock, including horses are present, barriers would be used to ensure animals do not come in contact with hazards. This would include but is not limited to fencing and/or covering of exposed holes, fencing or containment of all chemicals and fencing or containment of all hazards.
- Containment of any contaminants, fluid leaks, or hazards that could cause injury to domestic grazing animals (i.e. antifreeze for compressors, drilling pits, equipment, pump jacks) will be utilized.
- Safety meetings or briefs to employees would include information to increase awareness about grazing animals (driving speeds to avoid collisions).
- Immediately upon well completion, all materials not needed for production will be removed from the well pad.

Protection of Flora and Fauna, including Migratory Birds and Special Status Species

- The Proposed Action does not contain or is near any known critical periods or habitat for big game. If critical habitat and/or time period is recognized, EOG would work with the BLM to mitigate any conflicts.
- If the wells are productive, open pits would be netted and vent caps placed on all open pipes to prevent bird entry and nesting. However, the wells would be drilled utilizing a closed-loop system, and will not have a reserve pit or open pits.
- A migratory bird and raptor nest survey would be conducted if any vegetation-disturbing activities occur from March 1 to August 31. If active nests are located within the Proposed Action, project activities would not be permitted without written approval of the BLM-RPFO.
- All hazards to wildlife would be fenced, covered, and/or contained in storage tanks, as necessary.
- Prior to any clearing or construction in or near the Proposed Action, a seasonally appropriate walkthrough would be conducted to identify any sensitive ecological resources, sensitive species, or culturally important objects.
- All personnel would be made aware of wildlife in the area to reduce vehicle/wildlife collision potential.

Cultural Resources/Native American Religious Concerns

- All BLM/RPFO cultural resource stipulations will be followed as indicated in the Cultural Resource Record of Review that is attached to the COA's in the APD's and/or ROW Grants as the case may be.

- All employees, contractors, and sub-contractors on the project would be informed by EOG that cultural sites are to be avoided by all personnel, personal vehicles, and company equipment. All employees, contractors, and sub-contractors on the project would also be informed that it is illegal to collect, damage, or disturb cultural resources and that such activities are punishable by criminal and/or administrative penalties under the provisions of the Archaeological Resources Protection Act.
- A cultural monitor will be onsite during all ground disturbing activities.
- In the event of a discovery during construction, EOG would immediately stop all construction activities and notify the BLM Archaeologist. The BLM would then evaluate or cause the site to be evaluated. Should a discovery be evaluated as significant (e.g., National Register, Native American Graves Protection and Repatriation Act, Archaeological Resources Protection Act), it would be protected in place until mitigating measures can be developed and implemented according to guidelines set by the BLM.
- All land-altering activities would be confined to the culturally surveyed areas.
- EOG would control the actions of its agents at the job site to ensure no archaeological sites are disturbed or damaged. Any work outside the culturally surveyed boundaries would be a violation and subject to work stoppage.

Traditional Cultural Properties

- Cultural ceremonies and rituals would be respected by EOG, observing the experience of visual and auditory solitude and nature.
- In the event of a discovery of cultural resources or human remains, EOG would immediately stop all construction activities within 50 feet of the discovery and immediately notify the BLM Archaeologist. The BLM Archaeologist would evaluate the site and determine treatment for the discovery.

Visual Resources

- Production facilities would be painted Covert Green within six months of well completion, except for equipment subject to safety requirements, to blend with the natural color of the landscape.
- Production facilities would be located, to the extent practical, to reasonably minimize visual impacts.
- All vehicle and pedestrian traffic associated with the Proposed Action would be restricted to proposed disturbance areas and roads.
- Dust emissions would be controlled on the road and location, as necessary, with the application of dust suppressants (e.g., magnesium chloride) and/or water.
- All disturbed areas, including areas that would be re-disturbed, would then be seeded with the BLM-specified seed mixture. Seeding would be accomplished within 90 days of completion or plugging and abandonment of the well.
- Lights would be limited to those needed for safety during construction and operations.
- Lighting would be downward-facing or shielded where possible.

Lands/Access

- Existing roads utilized to access the Proposed Action would be maintained for the life of the producing well in a condition as good as or better than the existing condition, prior to the commencement of operations.

- Water along the access road would be diverted at frequent intervals by cutouts.
- Mud holes would be filled and detours around mud holes would not be permitted.
- The access roads would be upgraded to BLM Gold Book Standards (USDI BLM and USDA Forest Service 2007). Road maintenance would continue until final abandonment and reclamation of the well and well pad.
- If the wells are productive, gates and/or cattleguards would be installed as directed by the BLM-RPFO.

Noise

- If the wells are productive, a pumping unit or compressor may be needed. Engines for pumping units or compressor will be equipped with mufflers or barriers. In the situations where these engines are in close proximity to housing or special designated wildlife areas, the BLM would stipulate the need for hospital grade mufflers.

Waste (Hazardous and/or Solid) and Waste Disposal

- EOG would comply with the use and disposal of hazardous materials as regulated primarily under the Resource Conservation and Recovery Act (RCRA) of 1976 (42 U.S. Code 6901, et seq.), the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, as amended (42 U.S. Code 9601, et seq.), and the Toxic Substances Control Act (TSCA) of 1976, as amended (15 U.S. Code 2601, et seq.).
- No chemicals subject to reporting under the Superfund Amendments and Reauthorization Act of 1986 as amended (SARA) in an amount equal to or greater than 10,000 pounds would be used, produced, stored, transported, or disposed of annually in association with the drilling, testing, or completing of the well.
- No extremely hazardous substances, as defined in 40 CFR 355, in threshold planning quantities, would be used, produced, stored, transported, or disposed of in association with the drilling, testing, or completing of the well.
- No chemicals subject to reporting under the Emergency Planning and Right-to-Know Act of 1968, would be used, produced, stored, transported, or disposed of in association with the Proposed Action.
- All wastes and products brought to the well site would be handled as specified by law and label directions.
- All chemicals stored on site would have appropriate containment, pursuant to federal, state, and local rules, regulations, and guidelines. This would include storing chemicals in containers that discourage volatility, storage with appropriate wind abating devices such as tarps or wind blocks. If needed, a 20 mil. impermeable liner would be placed underneath when on the ground to prevent soil contamination. A containment dike/berm of at least 110% would surround all non-freshwater tanks.
- Current Material Safety Data Sheets (MSDS) for all chemicals, compounds and/or substances which would be used during any phase of the Proposed Action would be available on location and/or at the nearest field office.
- Self-contained, chemical toilets would be provided for human waste disposal. The toilet holding tanks would be pumped, as needed, and the contents thereof disposed of in an approved sewage disposal facility. Toilets would be on site during all construction and operations.
- Garbage, trash, and other waste materials would be collected in a portable, self-contained, and fully-enclosed trash container during drilling and completion operations. Accumulated trash

would be removed, as needed, and disposed of at an authorized sanitary landfill. No trash would be buried or burned on Proposed Action.

- Immediately after removal of the drilling rig and completion rig, all debris and other waste materials not contained in the trash container would be cleaned up and removed from the well location.
- All structures, facilities, improvements, and equipment would be maintained in a safe and orderly manner.
- All appropriate and reasonable measures to protect the public, wildlife, and livestock from hazardous materials, equipment, structures, or conditions resulting from project operations would be taken.
- Any spills of non-freshwater fluids will be reported to the BLM and the New Mexico Oil Conservation District office within 48-hours and immediately cleaned up and removed to an approved disposal site such as Industrial Ecosystems Oil and Gas Waste Management. The notification of releases such as natural gas, natural gas liquids, produced water and petroleum, outside the facility site is required under the CERCLA and under BLM NTL-3A.
- If the wells are economically productive, storage tanks would be fenced and contained within a containment dike of sufficient capacity, at a minimum, to contain the entire contents of the largest tank.

Public Health and Safety, and Traffic

- EOG employees and contractors would be prohibited from bringing dogs or carrying firearms on site.
- EOG would conduct periodic employee and contractor wildlife awareness programs that cover seasonal wildlife requirements and sensitivities, how disturbances affect wildlife, and ways personnel can reduce disturbances.
- The hauling of equipment and materials on public roads would comply with New Mexico Department of Transportation regulations.
- During drilling and completion operations, garbage, trash and other waste material would immediately be put in a portable, self-contained, and fully enclosed metal cage or equivalent for removal to the nearest approved disposal facility. No trash would be buried or burned on location. Immediately following the rig release, all debris, and other waste materials not contained in the trash container would be cleaned up and removed from the well location.
- During the production phase, keeping trash on site would be discouraged, and attempts would be made to gather and remove trash as and when it is generated.
- No toxic substances would be stored or used within the Proposed Action.
- EOG would have inspectors present during construction. Any accidents involving persons or property would immediately be reported to the BLM-RPFO.
- EOG would notify the public of potential hazards by posting signage, as necessary.
- All aspects of the Proposed Action including construction, drilling, operations, maintenance, and abandonment would be done in accordance with applicable federal laws and regulations.
- All Occupational Safety and Health Administration regulations and Department of Transportation regulations would be followed.
- Vehicles would be confined to designated access roads and parking areas.
- Non-trained public would be excluded from the Proposed Action at all times.

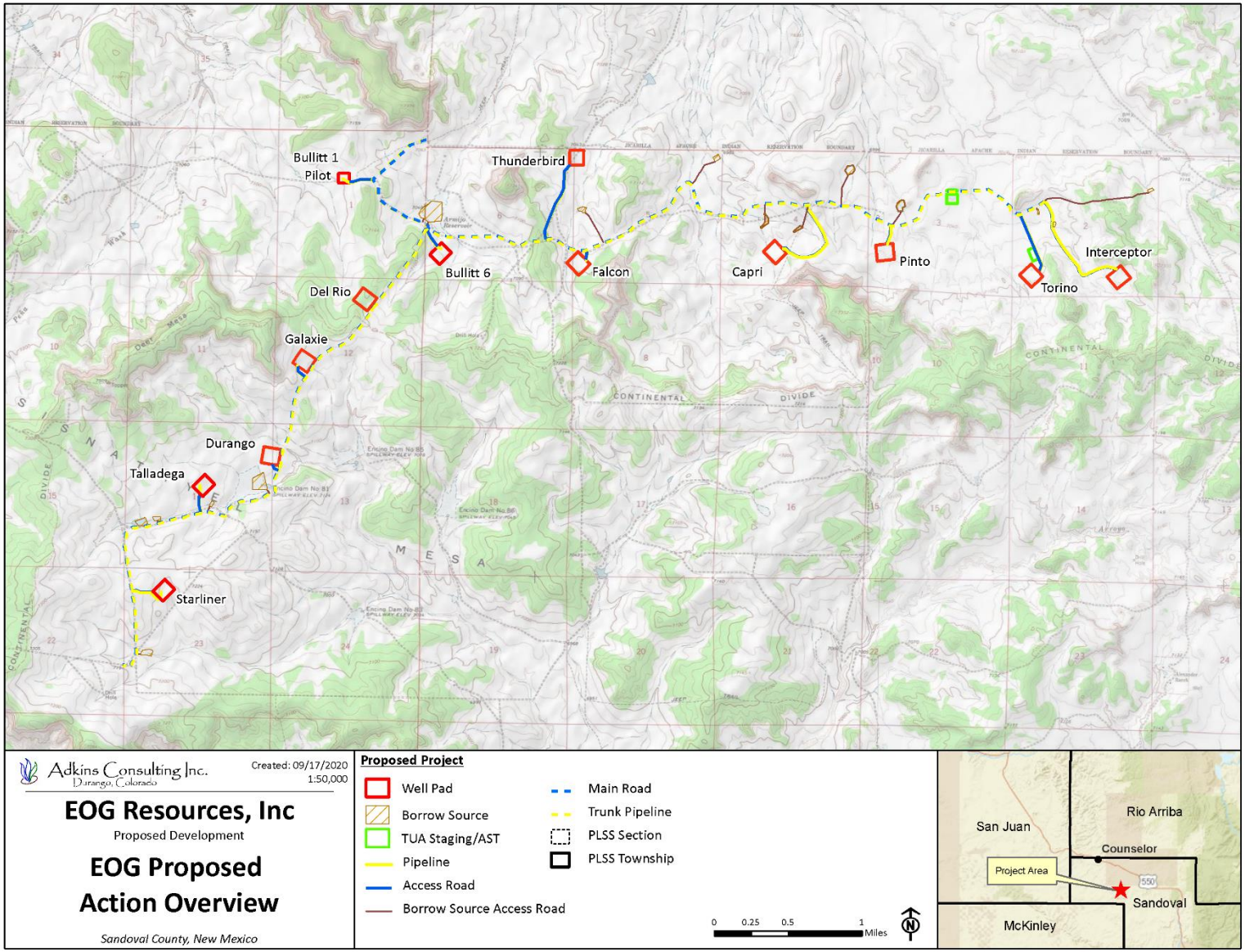
Other Regulatory Requirements

- Notification requirements:
    - Forty-eight hours prior to well pad and/or access road construction
    - Notification prior to moving on the drilling rig
    - At least twenty-four hours prior to spudding the well
    - Twenty-four hours prior to running casing and cementing strings
    - First Production Notice: within five business days after new well begins or production resumes after well has been off production for more than ninety days.

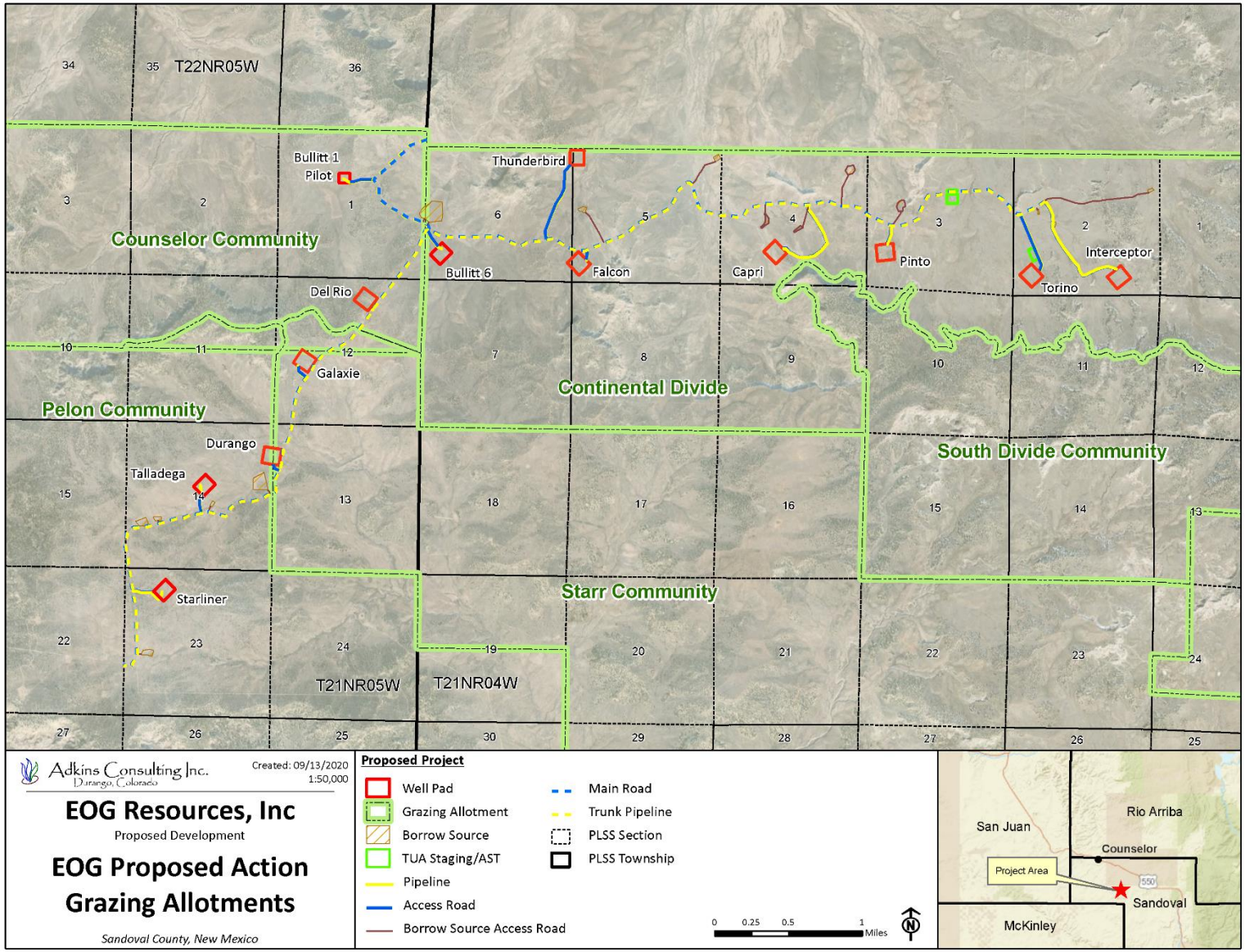
Appendix E: Maps

Map 1: Proposed Action Overview

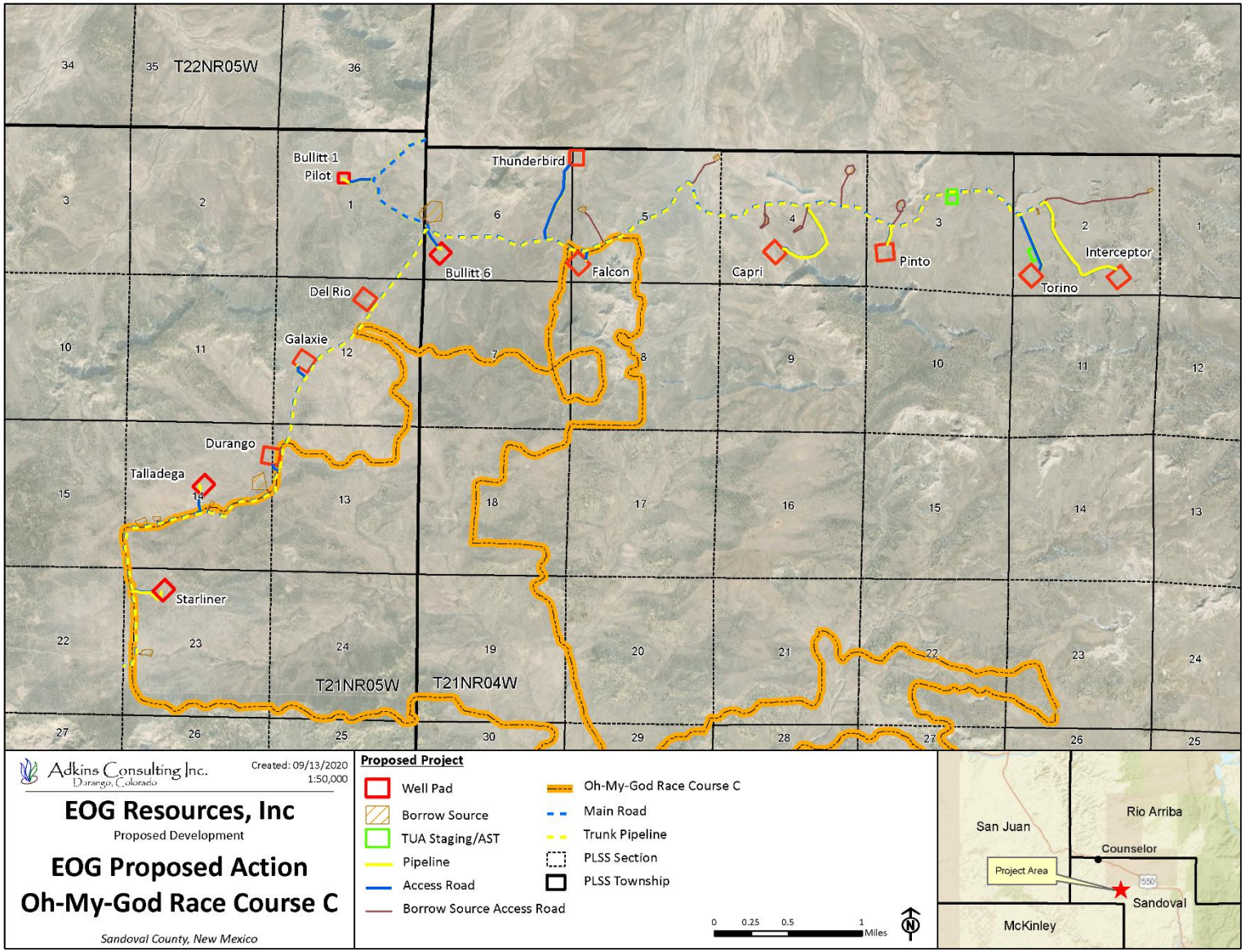
Map 2: Topo Overview



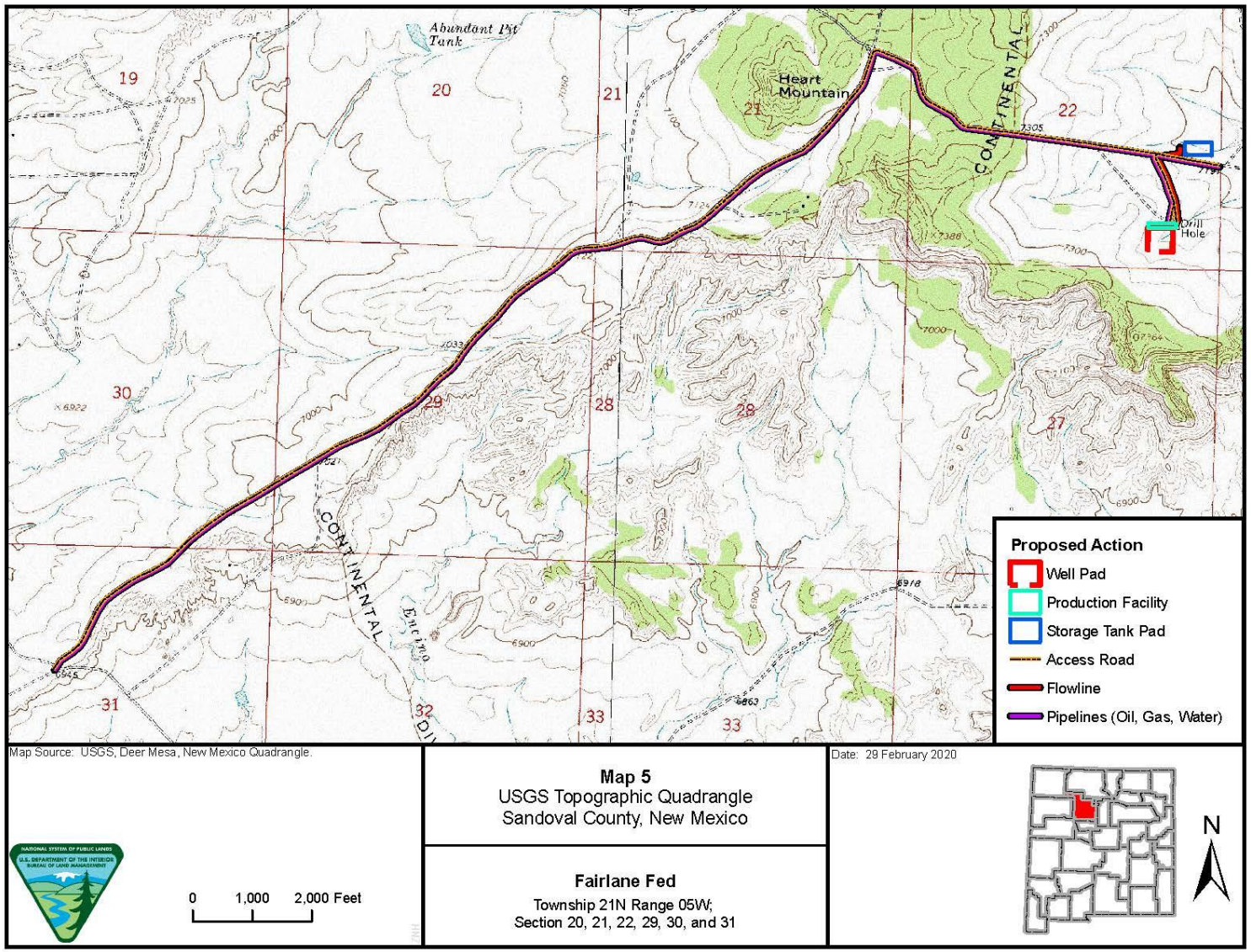
Map 3: Grazing Allotments



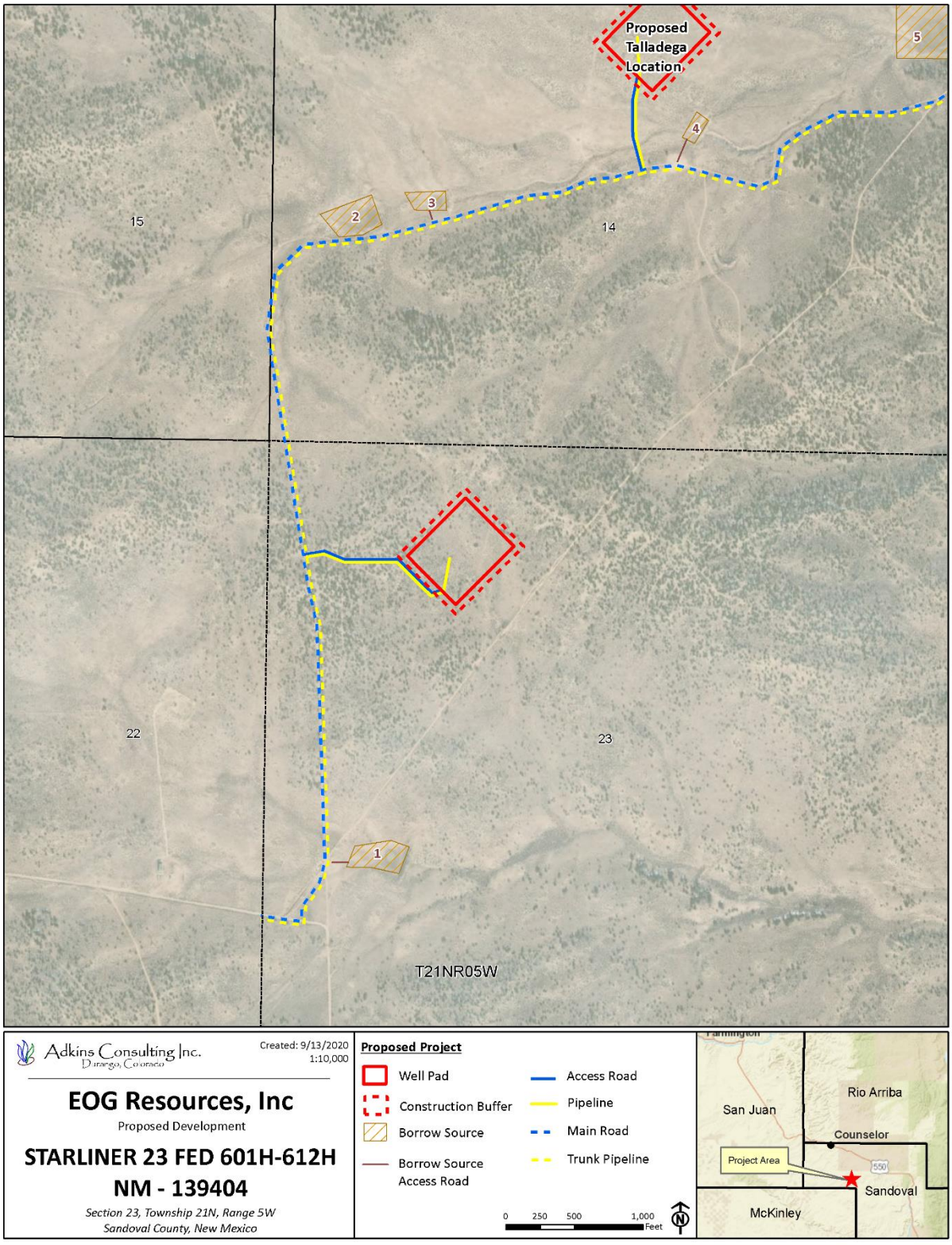
Map 4: Oh-My-God Course C



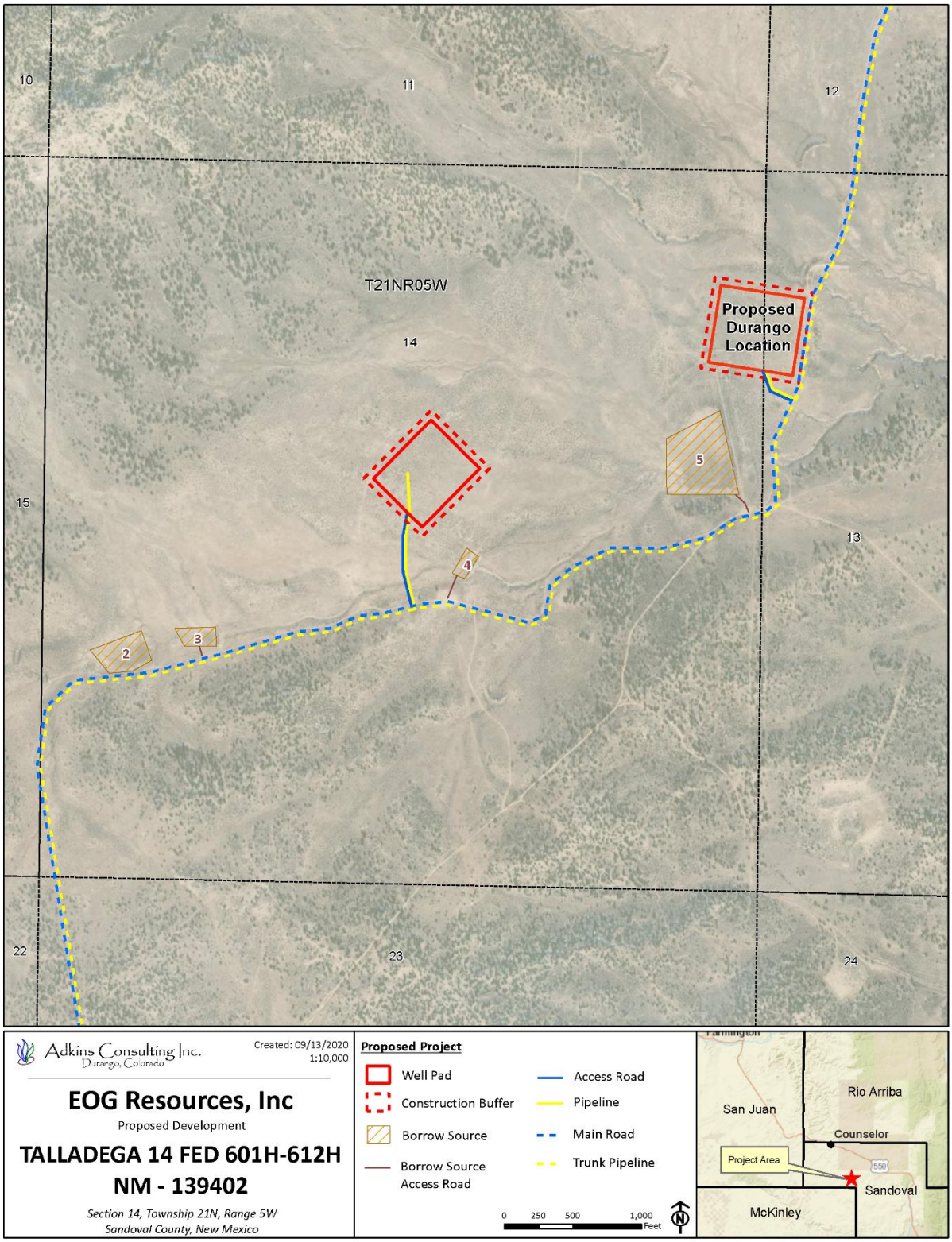
Map 5. Fairlane 22 Fed 601H-610H



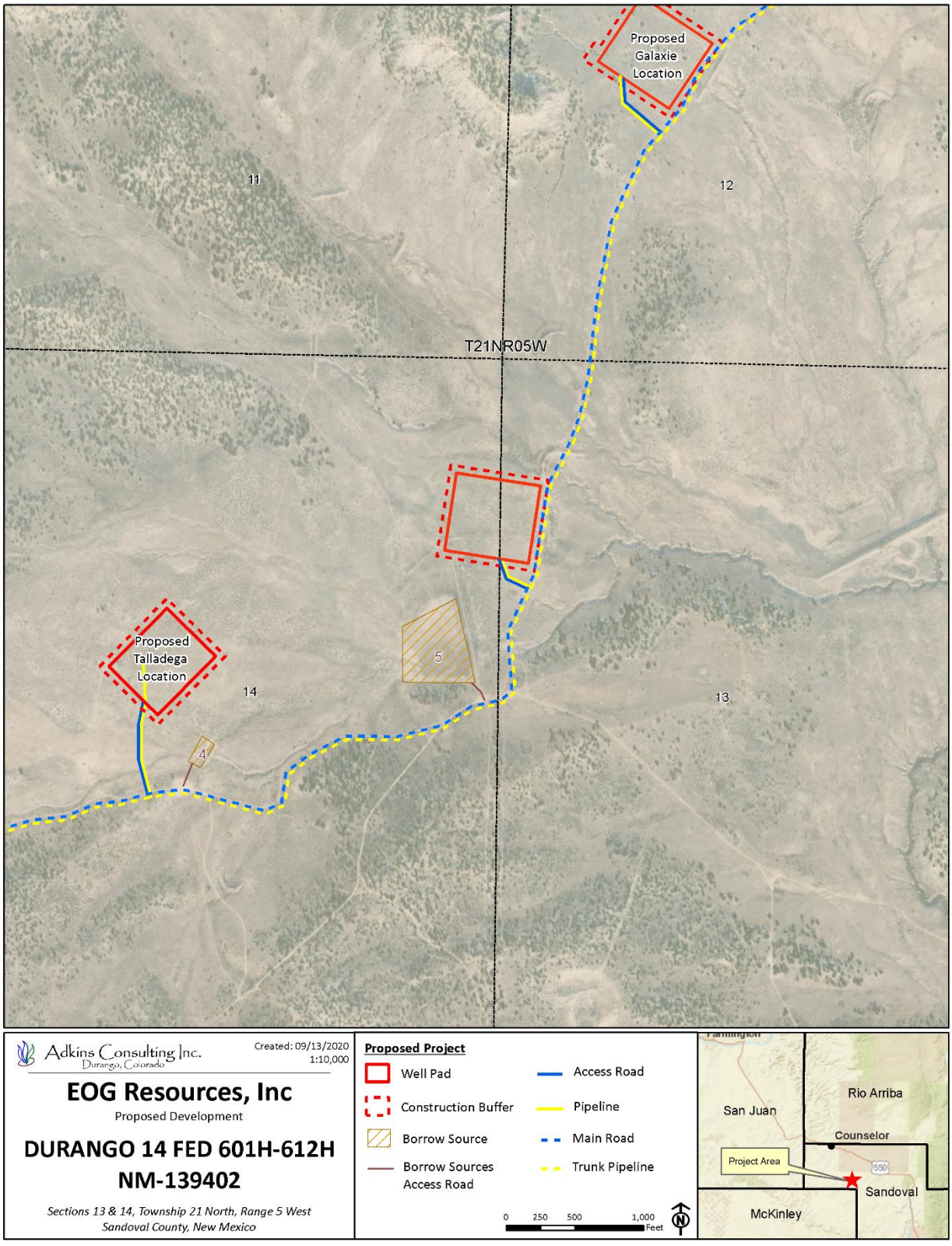
Map 6: Starliner



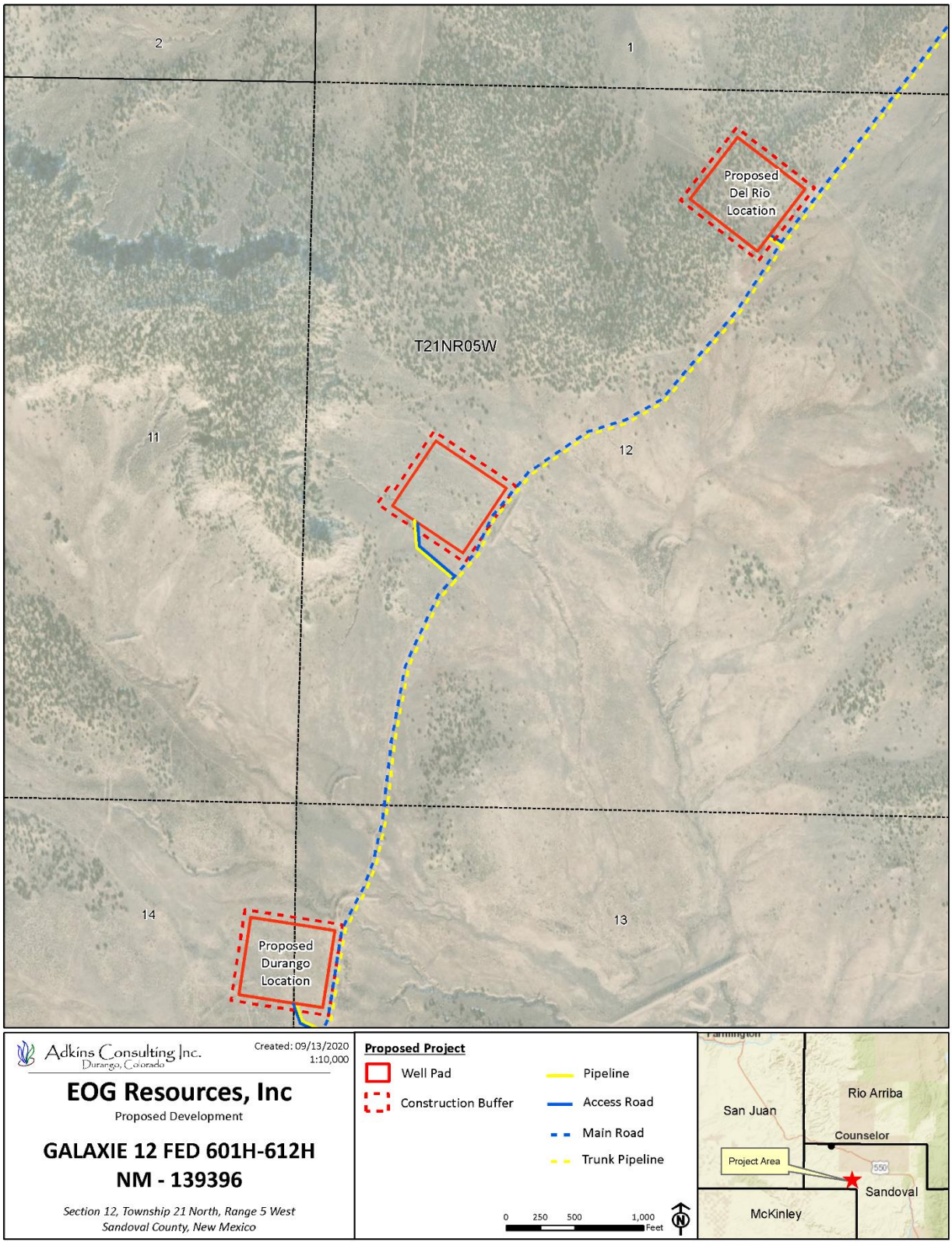
Map 7: Talladega



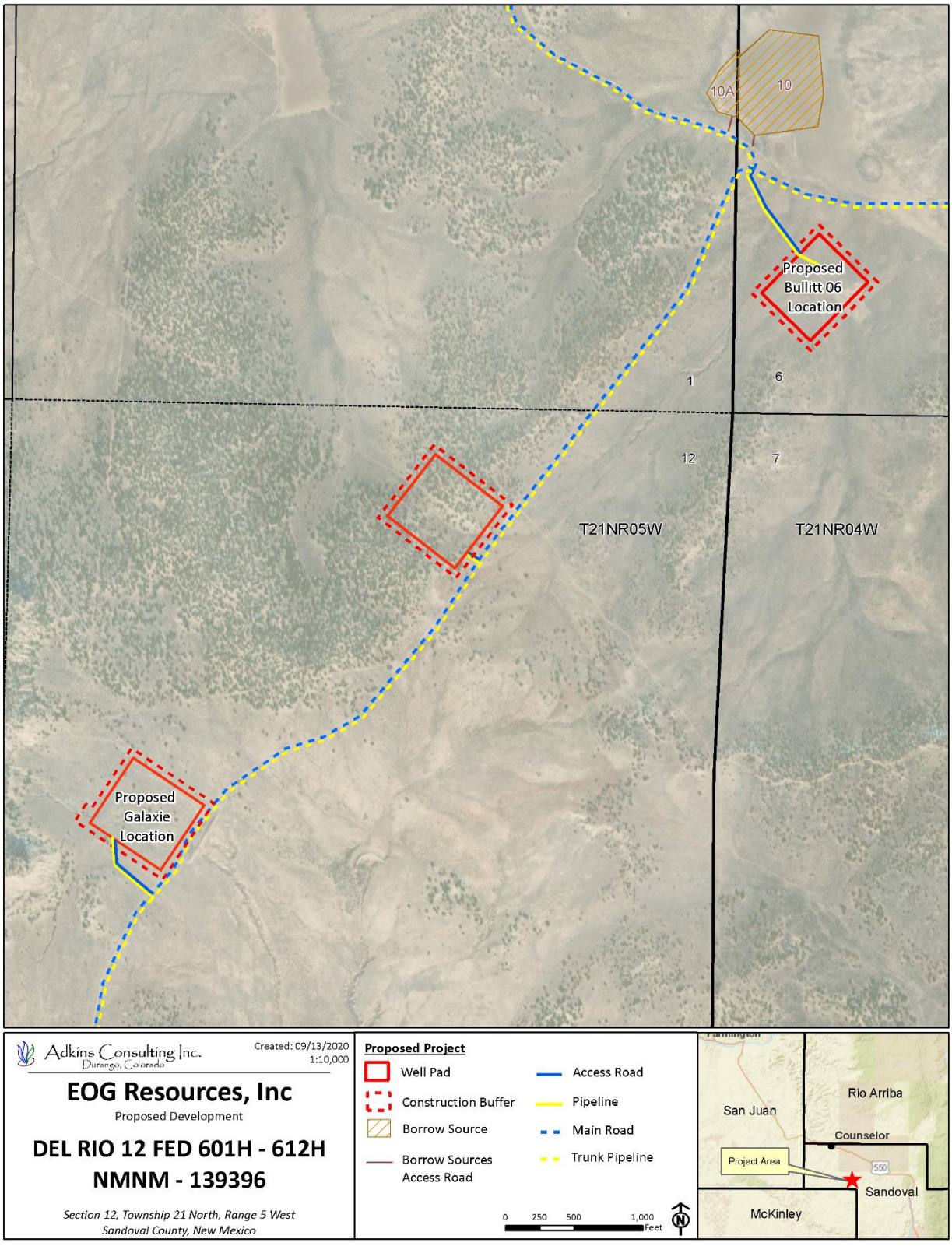
Map 8: Durango



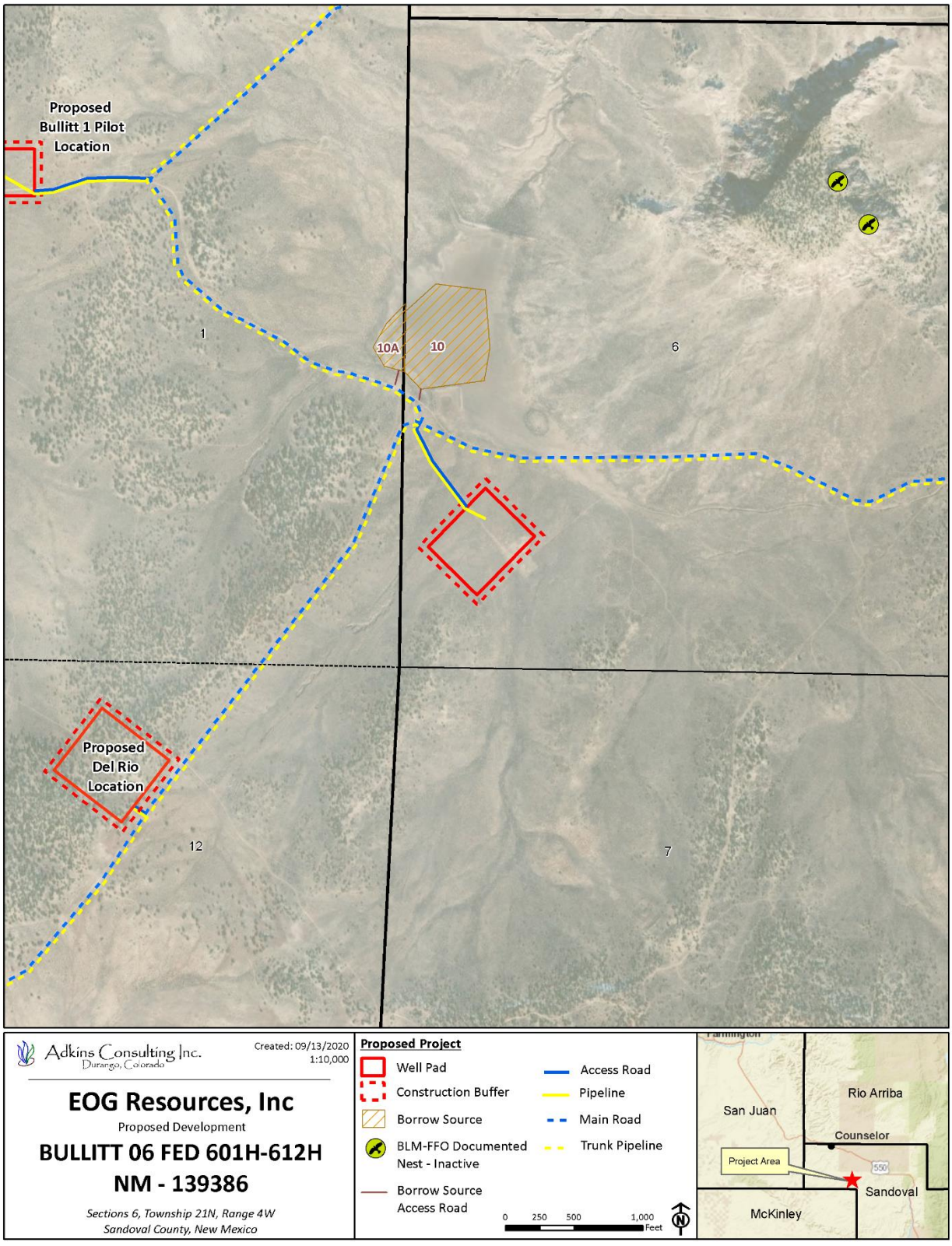
Map 9: Galaxie



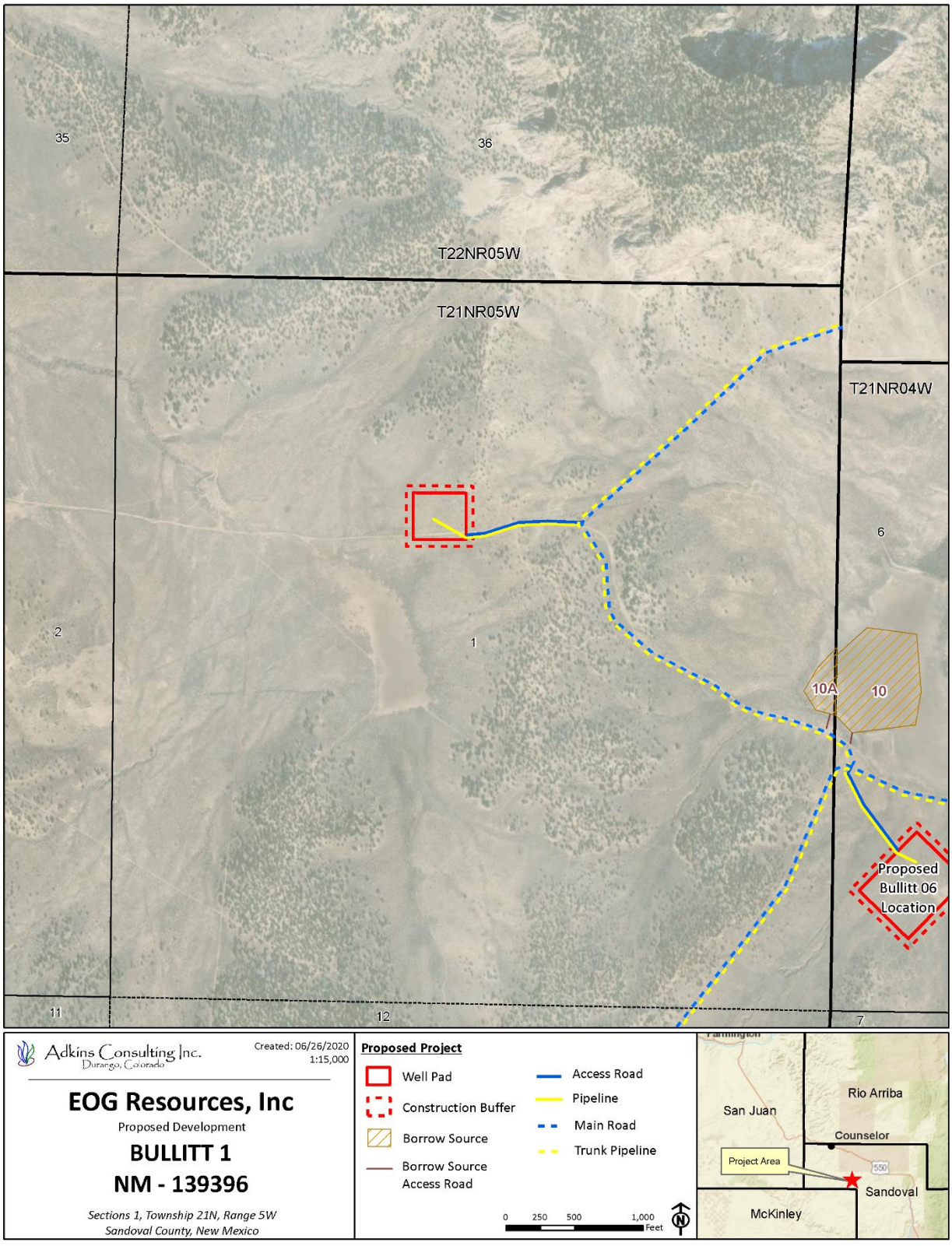
Map 10: Del Rio



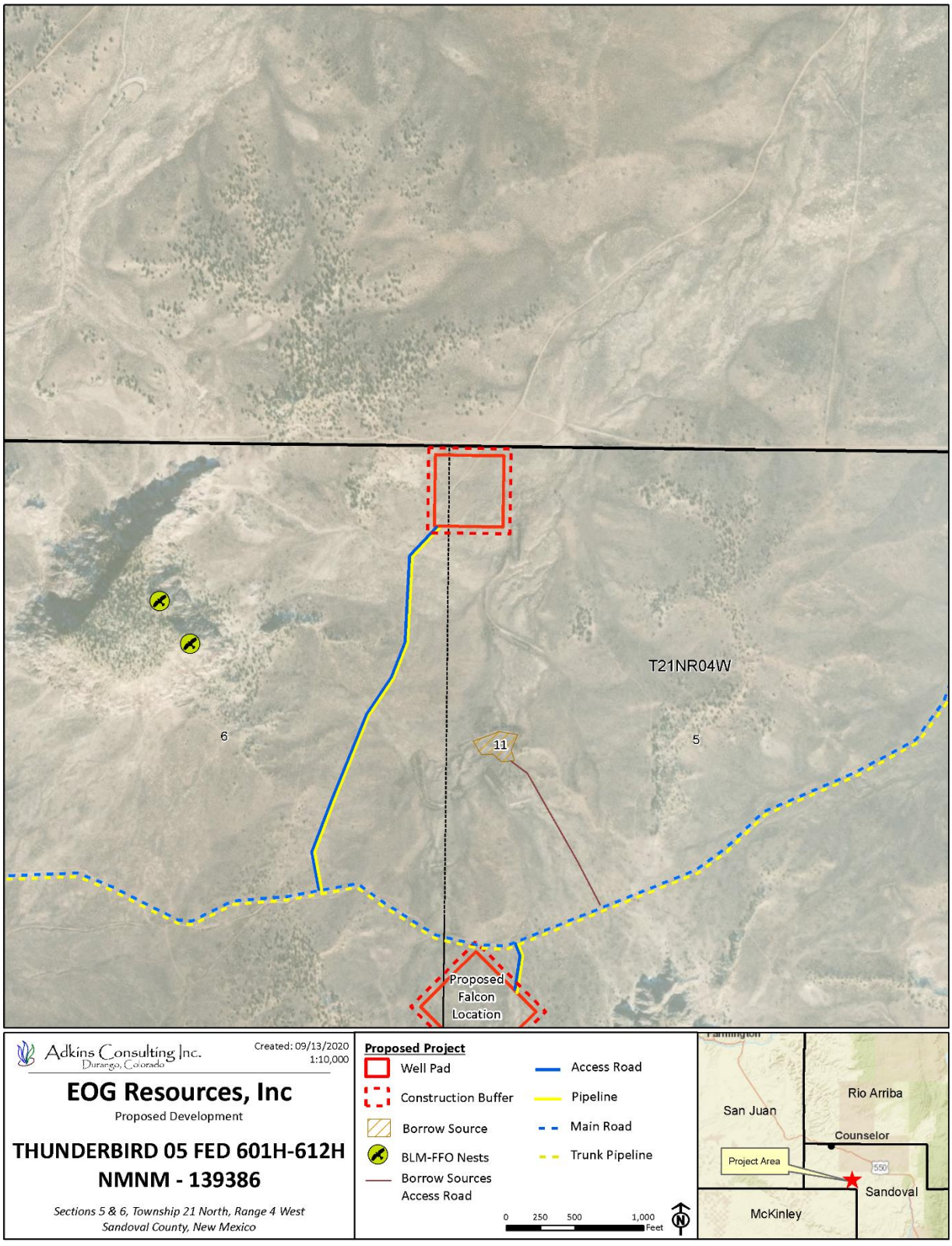
Map 11: Bullitt 06



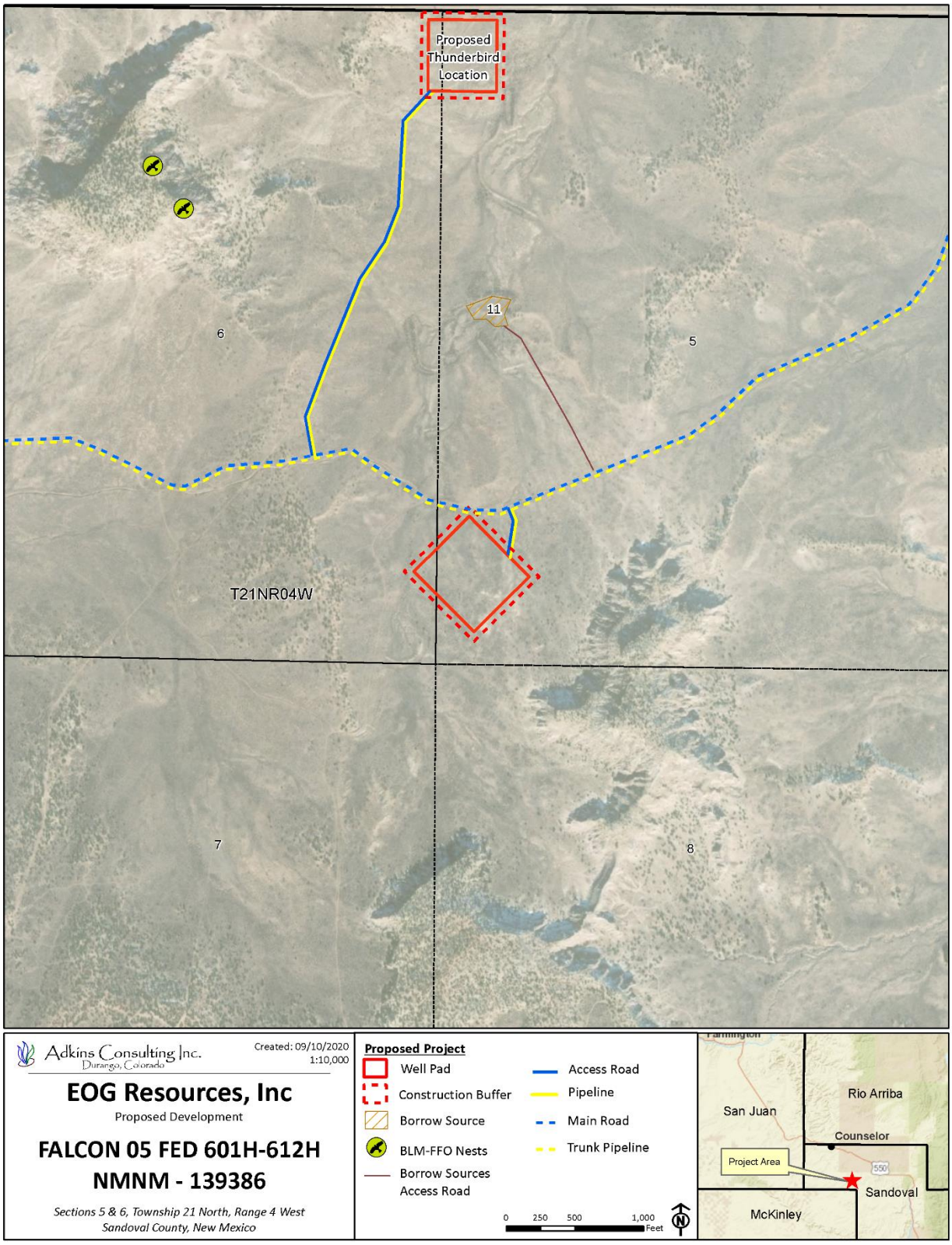
Map 12: Bullitt 1 Pilot



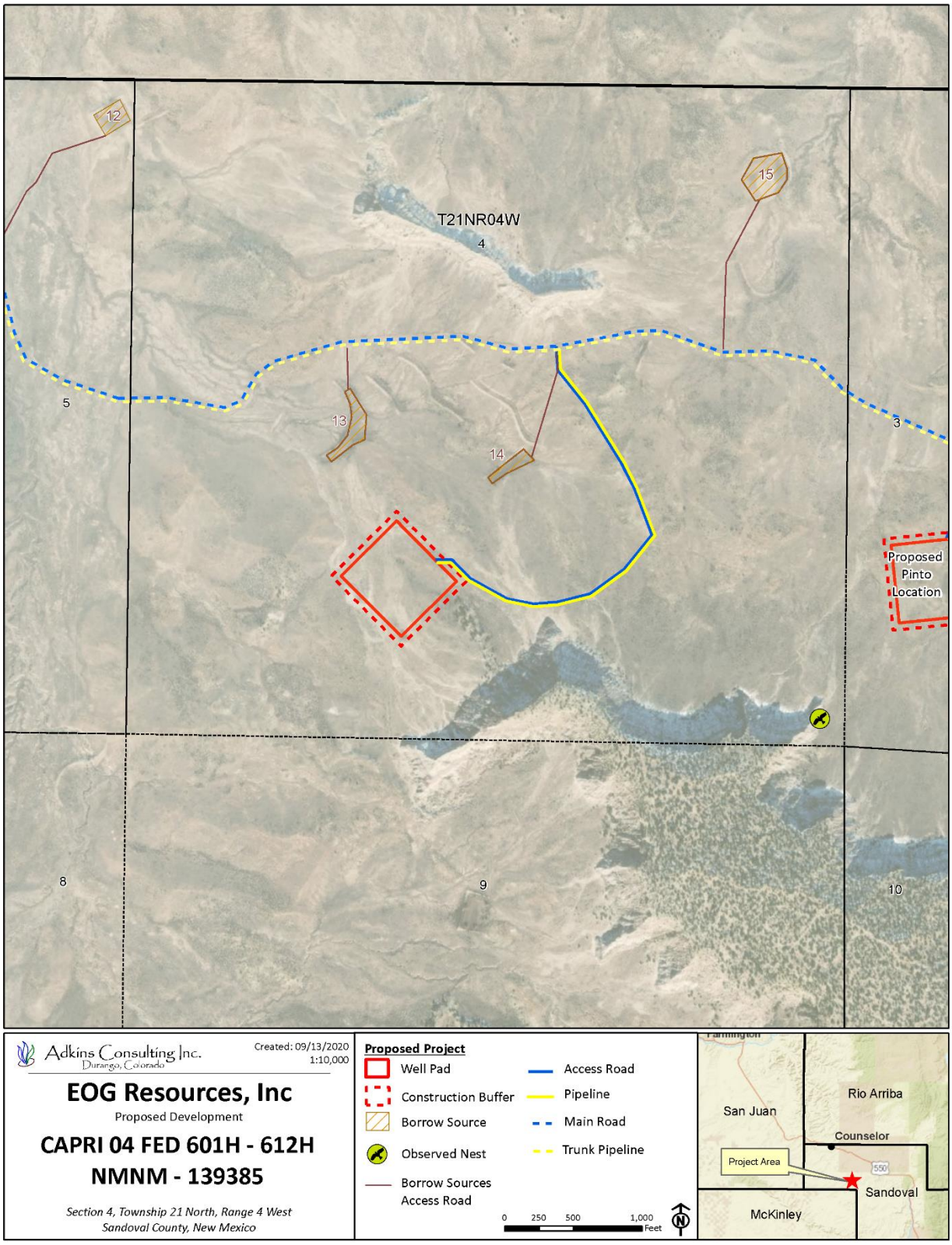
Map 13: Thunderbird



Map 14: Falcon



Map 15: Capri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T21NR04W
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14
3
Proposed
Pinto
Location
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9
10
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Durango, Colorado
Created: 09/13/2020
1:10,000
EOG Resources, Inc
Proposed Development
CAPRI 04 FED 601H - 612H
NMNM - 139385
Section 4, Township 21 North, Range 4 West
Sandoval County, New Mexico
Proposed Project
Well Pad
Construction Buffer
Borrow Source
Observed Nest
Borrow Sources Access Road
Access Road
Pipeline
Main Road
Trunk Pipeline
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San Juan
Rio Arriba
Counselor
Project Area
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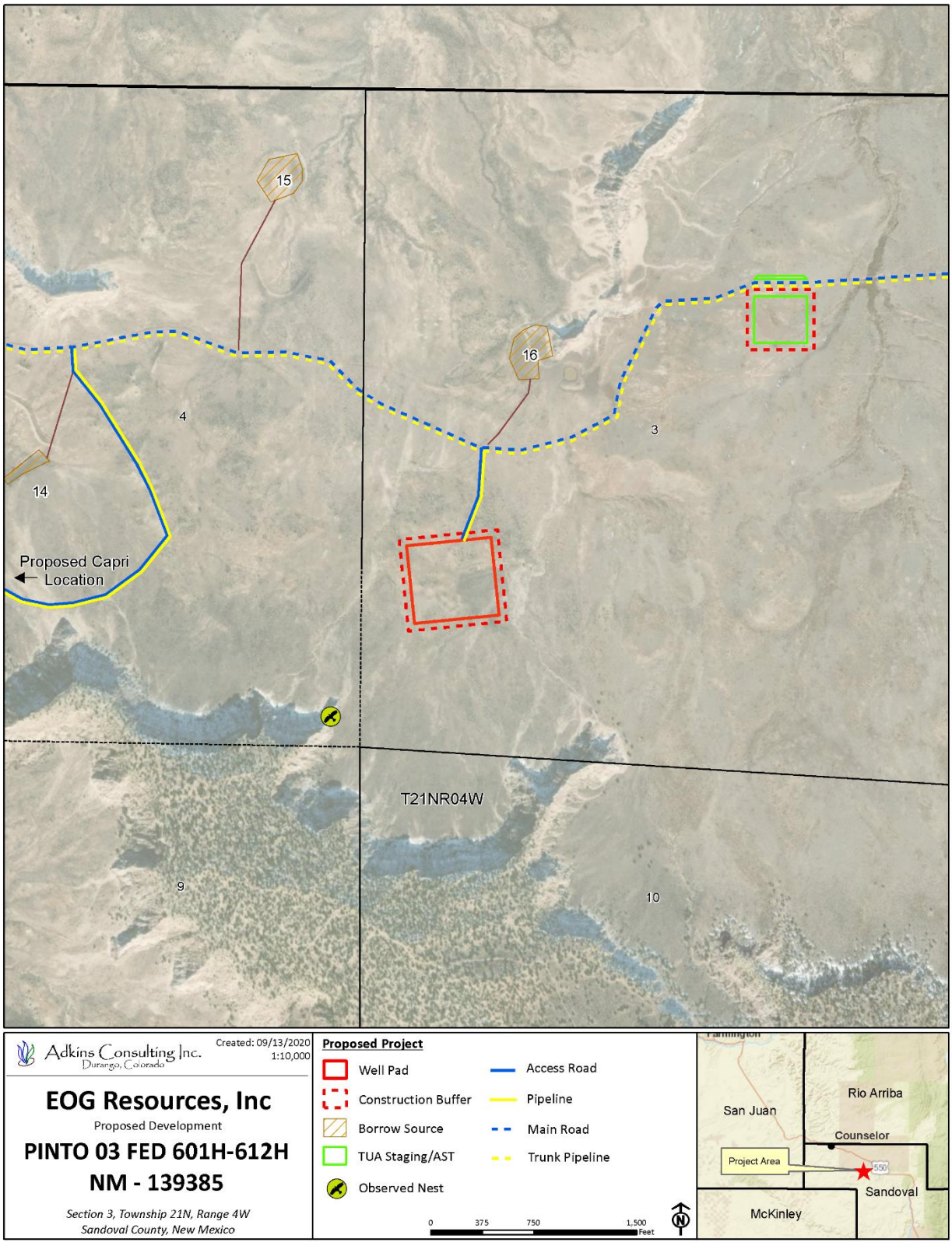
Sandoval
McKinley

Map 16: Pinto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Durango, Colorado
Created: 09/13/2020
1:10,000
EOG Resources, Inc
Proposed Development
PINTO 03 FED 601H-612H
NM - 139385
Section 3, Township 21N, Range 4W
Sandoval County, New Mexico
Proposed Project
Well Pad
Construction Buffer
Borrow Source
TUA Staging/AST
Observed Nest
Access Road
Pipeline
Main Road
Trunk Pipeline
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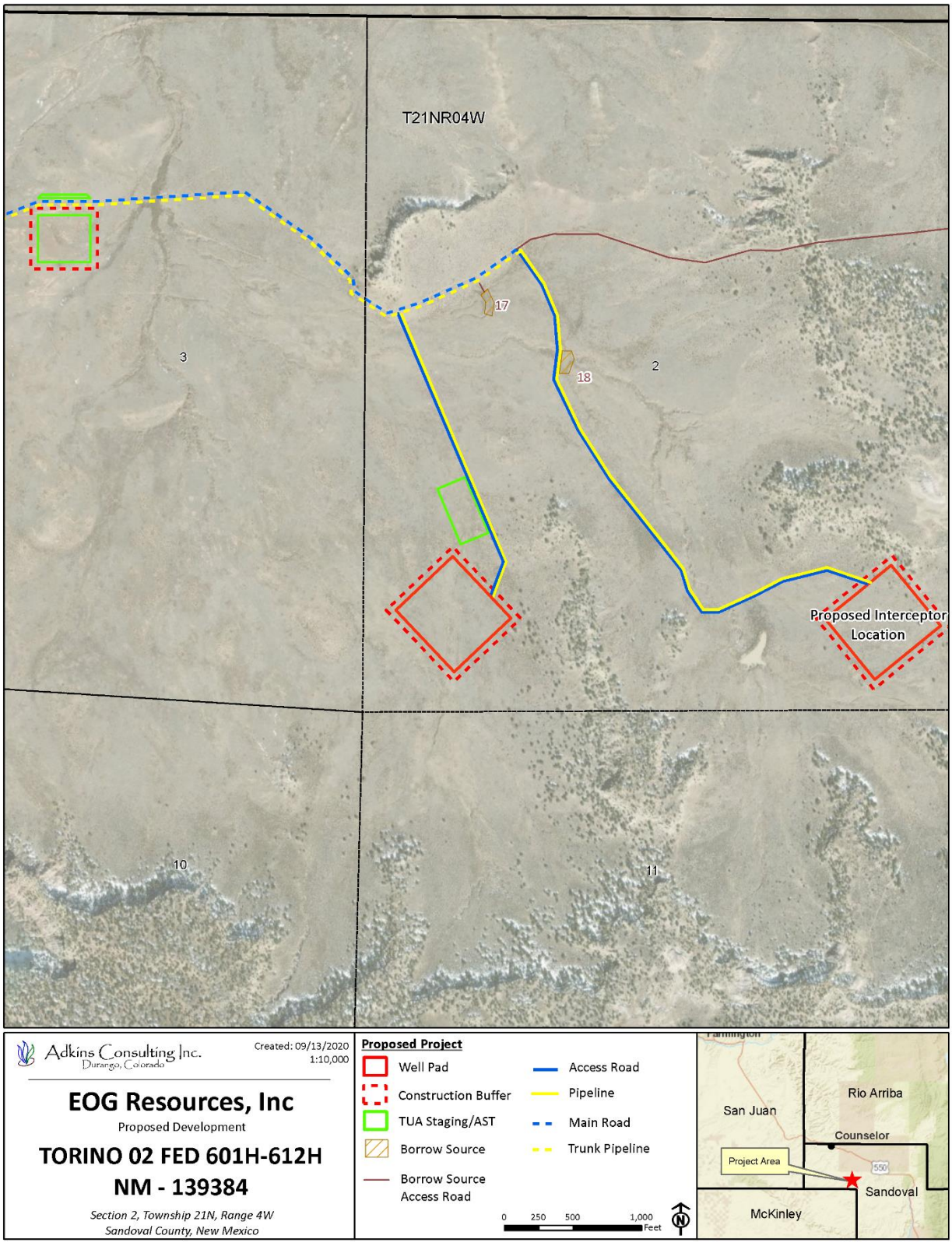
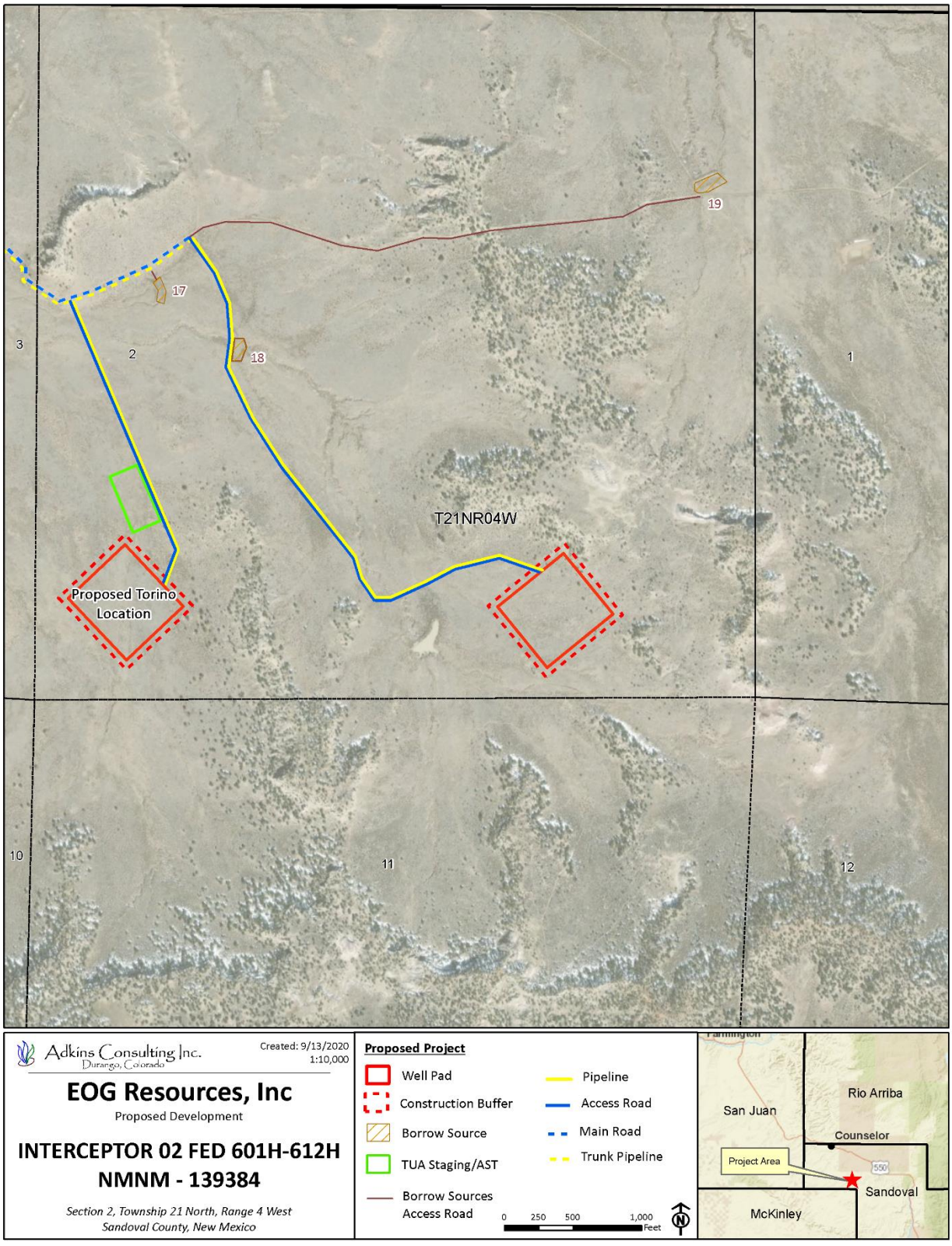
Feet
San Juan
Rio Arriba
Counselor
Project Area
Sandoval
McKinley

Map 17: Torino



Map 18: Interceptor



Appendix F: Figures

Figure 1: Starliner SE pad corner

Figure 2: Starliner SW pad corner

Figure 3: Starliner NE pad corner

Figure 4: Starliner NW pad corner

Figure 5: Proposed Starliner Access Road

Figure 6: Proposed Starliner wellheads (facing north)

Figure 7: Talladega SE pad corner

Figure 8: Talladega SW pad corner

Figure 9: Talladega NE pad corner

Figure 10: Talladega NW pad corner

Figure 11: Proposed Talladega wellheads (facing west)

Figure 12: Proposed Talladega Access Road

Figure 13: Durango SE pad corner

Figure 14: Durango SW pad corner

Figure 15: Durango NE pad corner

Figure 16: Durango NW pad corner

Figure 17: Proposed Durango wellheads (facing north)

Figure 18: Active burrows within Talladega proposed well pad

Figure 19: Galaxie SE pad corner

Figure 20: Galaxie SW pad corner

Figure 21: Galaxie NE pad corner

Figure 22: Galaxie NW pad corner

Figure 23: Wash within Galaxie proposed well pad

Figure 24: Active burrows within Galaxie proposed well pad

Figure 25: Del Rio SE pad corner

Figure 26: Del Rio SW pad corner

Figure 27: Del Rio NE pad corner

Figure 28: Del Rio NW pad corner

Figure 29: Proposed Del Rio wellhead (facing north)

Figure 30: Proposed Del Rio wellhead (facing west)

Figure 31: Bullitt 1 SE pad corner

Figure 32: Bullitt 1 SW pad corner

Figure 33: Bullitt 1 NE pad corner

Figure 34: Bullitt 1 NW pad corner

Figure 35: Proposed Bullitt 1 wellhead (facing north)

Figure 36: Proposed Bullitt 1 wellhead (facing north)

Figure 37: Bullitt 06 SE pad corner

Figure 38: Bullitt 06 SW pad corner

Figure 39: Bullitt 06 NE pad corner

Figure 40: Bullitt 06 NW pad corner

Figure 41: Proposed Bullitt 06 wellheads (facing north)

Figure 42: Proposed B Access Road

Figure 43: Thunderbird SE pad corner

Figure 44: Thunderbird SW pad corner

Figure 45: Thunderbird NE pad corner

Figure 46: Thunderbird NW pad corner

Figure 47: Proposed Thunderbird access road

Figure 48: Active burrows within Thunderbird proposed well pad

Figure 49: Falcon SE pad corner

Figure 50: Falcon SW pad corner

Figure 51: Falcon NE pad corner

Figure 52: Falcon NW pad corner

Figure 53: Proposed Falcon access road

Figure 54: Cliff habitat near Proposed Falcon well pad, whitewash observed

Figure 55: Capri SE pad corner

Figure 56: Capri SW pad corner

Figure 57: Capri NE pad corner

Figure 58: Capri NW pad corner

Figure 59: Proposed Capri access road

Figure 60: Proposed Capri wellheads (facing south)

Figure 61: Pinto SE pad corner

Figure 62: Pinto SW pad corner

Figure 63: Pinto NE pad corner

Figure 64: Pinto NW pad corner

Figure 65: Proposed Pinto access road

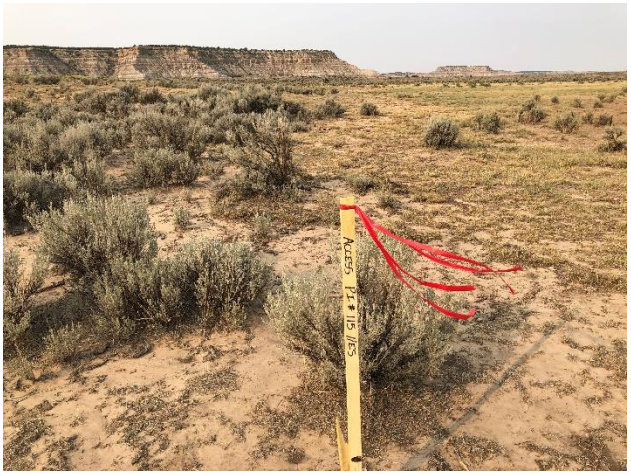


Figure 66: Proposed Pinto Access Road

Figure 67: Torino TUA NW pad corner

Figure 68: Torino TUA SW pad corner

Figure 69: Proposed Torino wellheads (facing north)

Figure 70: Proposed Torino wellheads (facing south)

Figure 71: Proposed Torino access road

Figure 72: Proposed Torino Access Road

Figure 73: Interceptor SE pad corner

Figure 74: Interceptor SW pad corner

Figure 75: Interceptor NE pad corner

Figure 76: Interceptor NW pad corner

Figure 77: Proposed Interceptor access road

Figure 78: Cliff habitat near proposed Interceptor well pad, whitewash observed

Figure 79: Borrow Source 1 Access Road

Figure 80: Borrow Source 1

Figure 81: Borrow Source 2

Figure 82: Borrow Source 3

Figure 83: Borrow Source 4

Figure 84: Borrow Source 5

Figure 85: Borrow Sources 10 and 10A

Figure 86: Borrow Source 10

Figure 87: Borrow Source 11 access road

Figure 88: Borrow Source 11

Figure 89: Borrow Source 12 access road

Figure 90: Borrow Source 12

Figure 91: Borrow Source 13 access road

Figure 92: Borrow Source 13

Figure 93: Borrow Source 14 access road

Figure 94: Borrow Source 14

Figure 95: Borrow Source 15 access road

Figure 96: Borrow Source 15

Figure 97: Borrow Source 16

Figure 98: Borrow Source 16

Figure 99: Borrow Source 17 access road

Figure 100: Borrow Source 17

Figure 101: Borrow Source 18

Figure 102: Borrow Source 19

Appendix G: Acronyms and abbreviations

ACEC	Area of Critical Environmental Concern
AIRFA	American Indian Religious Freedom Act
AMSL	Above Mean Sea Level
APD	Application for Permit to Drill
AQI	Air Quality Index
AUM	Animal Unit Month
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
BMP	Best Management Practice
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFR	Code of Federal Regulations
COAs	Conditions of Approval
CWA	Clean Water Act
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMNRD	Energy, Minerals and Natural Resources Department
EO	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FLPMA	Federal Land Policy Management Act of 1976, as amended
FFO	Farmington Field Office
GHG	Greenhouse Gas
GMST	Global Mean Surface Temperature
GWPs	Global Warming Potentials
HAPs	Hazardous Air Pollutants
IAM	Indian Affairs Manual
IB	Information Bulletin
IPaC	Information for Planning and Conservation
IR	Interim Reclamation
LACT	Lease-Area Custody Transfer Unit
MA	Minerals Agreement
MBTA	Migratory Bird Treaty Act of 1918
MLA	Mineral Leasing Act
NAGPRA	Native American Graves Protection and Repatriation Act
NAAQS	National Ambient Air Quality Standards
NATA	National Air Toxics Assessment
NEI	National Emissions Inventory
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMAC	New Mexico Administration Code
NMED	New Mexico Environment Department
NMOCD	New Mexico Oil Conservation Division
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTL	Notice to Lessees
NWI	National Wetlands Inventory

OHWM	Ordinary high-water mark
RCRA	Resource Conservation and Recovery Act
RFD	Reasonably foreseeable development
RFFA	Reasonably Foreseeable Future Action
RMP	Resource Management Plan
RPFO	Rio Puerco Field Office
ROD	Record of Decision
ROW	Right-of-way
SSURGO	Soil Survey Geographic
SUPO	Surface Use Plan of Operations
TCPs	Traditional Cultural Properties
TDS	Total dissolved solids
THPO	Tribal Historic Preservation Office
T&E	Threatened and Endangered
UIC	Underground Injection Control
USC	United States Code
USDI	United States Department of Interior
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geologic Survey
VOCs	Volatile organic compounds

Appendix H: Social Cost of Carbon

A protocol to estimate what is referenced as the "social cost of carbon" (SCC) associated with Greenhouse Gas (GHG) emissions was developed by a Federal Interagency Working Group (IWG), to assist agencies in addressing Executive Order (E.O.) 12866, which requires Federal agencies to assess the cost and the benefits of proposed regulations as part of their regulatory impact analyses. The SCC is an estimate of the economic damages associated with an increase in carbon dioxide emissions and is intended to be used as part of a cost-benefit analysis for proposed rules. As explained in the Executive Summary of the 2010 SCC Technical Support Document "the purpose of the [SCC] estimates . . . is to allow agencies to incorporate the social benefits of reducing carbon dioxide (CO2) emissions into cost-benefit analyses of regulatory actions that have small, or 'marginal,' impacts on cumulative global emissions." Technical Support Document: Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 February 2010 (withdrawn by E.O. 13783). While the SCC protocol was created to meet the requirements for regulatory impact analyses during rulemakings, there have been requests by public commenters or project applicants to expand the use of SCC estimates to project-level National Environmental Policy Act (NEPA) analyses. The decision was made not to expand the use of the SCC protocol for the lease sale NEPA analysis for a number of reasons. Most notably, this action is not a rulemaking for which the SCC protocol was originally developed. Second, on March 28, 2017, the President issued E.O. 13783, which, among other actions, withdrew the Technical Support Documents upon which the protocol was based and disbanded the earlier IWG on Social Cost of Greenhouse Gases. The Order further directed agencies to ensure that estimates of the social cost of greenhouse gases used in regulatory analyses "are based on the best available science and economics" and are consistent with the guidance contained in Office of Management and Budget (OMB) Circular A4, "including with respect to the consideration of domestic versus international impacts and the consideration of appropriate discount rates" (E.O. 13783, Section 5(c)). In compliance with OMB Circular A-4, interim protocols have been developed for use in the rulemaking context. However, the Circular does not apply to project decisions, so there is no E.O. requirement to apply the SCC protocol to project decisions. Further, the NEPA does not require a cost-benefit analysis (40 C.F.R. § 1502.23), although NEPA does require consideration of "effects" that include "economic" and "social" effects (40 C.F.R. 1508.8(b). Without a complete monetary cost-benefit analysis, which would include the social benefits of the Proposed Action to society as a whole and other potential positive benefits, inclusion solely of an SCC cost analysis would be unbalanced, potentially inaccurate, and not useful in facilitating an authorized officer's decision. Any increased economic activity, in terms of revenue, employment, labor income, total value added, and output, that is expected to occur with the Proposed Action is simply an economic impact, rather than an economic benefit, inasmuch as such impacts might be viewed by another person as negative or undesirable impacts due to potential increase in local population, competition for jobs, and concerns that changes in population will change the quality of the local community. Economic impact is distinct from "economic benefit" as defined in economic theory and methodology, and the socioeconomic impact analysis required under NEPA is distinct from cost-benefit analysis, which is not required.

Finally, the SCC, protocol does not measure the actual incremental impacts of a project on the environment and does not include all damages or benefits from carbon emissions. The SCC protocol estimates economic damages associated with an increase in carbon dioxide emissions— typically expressed as a one metric ton increase in a single year—and includes, but is not limited to, potential changes in net agricultural productivity, human health, and property damages from increased flood risk over hundreds of years. The estimate is developed by aggregating results "across models, over time, across regions and impact categories, and across 150,000 scenarios" (Rose et al. 2014). The dollar cost figure arrived at based on the SCC calculation represents the value of damages avoided if, ultimately,

there is no increase in carbon emissions. But the dollar cost figure is generated in a range and provides little benefit in assisting the authorized officer's decision for project level analyses. For example, in a recent environmental impact statement, Office of Surface Mining estimated that the selected alternative had a cumulative SCC ranging from approximately $4.2 billion to $22.1 billion, depending on dollar value and the discount rate used. The cumulative SCC for the no action alternative ranged from $2.0 billion to $10.7 billion. Given the uncertainties associated with assigning a specific and accurate SCC resulting from oil and gas production that could occur once the oil and gas lease is issued, and that the SCC protocol and similar models were developed to estimate impacts of regulations over long time frames, this environmental assessment (EA) quantifies direct and indirect GHG emissions and evaluates these emissions in the context of U.S. and State/County GHG emission inventories as discussed in the Affected Environment and Environmental Impacts section of the EA.

To summarize, this EA does not undertake an analysis of SCC because 1) it is not engaged in a rulemaking for which the protocol was originally developed; 2) the IWG, technical supporting documents, and associated guidance have been withdrawn; 3) NEPA does not require cost benefit analysis; and 4) the full social benefits of oil and gas production have not been monetized, and quantifying only the costs of GHG emissions but not the benefits would yield information that is both potentially inaccurate and not useful.

References Cited

Rose, Steven et al. 2014. Understanding the Social Cost of Carbon: A Technical Assessment. Electric Power Research Institute.

E.O. 13783. Executive Order 13783 of March 28, 2017. Presidential Executive Order on Promoting Energy Independence and Economic Growth.