

**UNITED STATES DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT**

Farmington District  
Farmington Field Office  
6251 N College Blvd., Ste. A  
Farmington, NM 87402

**DECISION RECORD**

for the

**WPX Energy Production, LLC's Proposed Mule Deer  
Winter Drilling Research Project  
NEPA No. DOI-BLM-NM-FO-010-2016-0015-EA**

**I. Decision**

I have decided to select **Alternative B** for implementation as described in the **WPX Energy Production, LLC's Proposed Mule Deer Winter Drilling Research Project Environmental Assessment**. Based on my review of the Environmental Assessment (EA) and project record, I have concluded that **Alternative B** was analyzed in sufficient detail to allow me to make an informed decision. I have selected this alternative because, **by allowing an exemption from the Winter Closure Condition of Approval (COA) in the Rosa SDA, the Rosa Mule Deer research project will be able to continue and attain important data regarding the impacts of horizontal drilling on wintering mule deer.**

**II. Conformance and Compliance**

The proposed action is in conformance with the 2003 Farmington Resource Management Plan (RMP). Pursuant to 40 CFR 1508.28 and 1502.21, this site-specific EA tiers into and incorporates by reference the information and analysis contained in the Farmington Proposed Resource Management Plan/Final Environmental Impact Statement (PRMP/FEIS; BLM 2003a). The RMP was approved by the September 29, 2003 Record of Decision (ROD; BLM 2003b), and updated in December 2003.

Specifically, the proposed action is in conformance with the following objectives:

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 2003b, 2-2 – 2-3)

This EA addresses site-specific resources and effects of the proposed action that were not specifically covered within the PRMP/FEIS as required by NEPA. The proposed project would not be in conflict with any local, county, or state plans.

WPX would comply with applicable federal, state, and local laws and regulations. Necessary permits and approvals for the proposed project would be obtained prior to project implementation.

Many requirements regulating specific environmental elements are found in the appropriate elements sections of the EA (Chapter 3).

### III. Finding of No Significant Impact

I have reviewed the direct, indirect and cumulative effects of the proposed activities documented in the EA for the **WPX Energy Production, LLC's Proposed Mule Deer Winter Drilling Research Project**. I have also reviewed the project record for this analysis. The effects of the proposed action and alternatives are disclosed in the Alternatives and Environmental Consequences sections of the EA. I have determined that **the exemption to the Rosa Mesa Specially Designated Area Winter Closure Conditions of Approval to facilitate completion of research activities investigating impacts to wintering mule deer** as described in the EA will not significantly affect the quality of the human environment. Accordingly, I have determined that the preparation of an Environmental Impact Statement is not necessary.

### IV. Other Alternatives Considered

Under the No Action Alternative (EA, pg. 16), exceptions to the Winter Closure COA for the Rosa Mesa Wildlife SDA, allowing drilling and/or completion activities of WPX wells within the vicinity of, and occurring concurrently with, the ongoing Rosa Mule Deer Study would not be approved. The proposed wells would not be drilled or completed during the Winter Closure period and data would not be collected that may elucidate impacts to mule deer from winter drilling and completion activities during mule deer migration and wintering. Current land and resource uses would continue to occur in the proposed project area. Results and conclusions of the Rosa Mule Deer Study would only provide baseline data and would not address potential effects of drilling and completion on mule deer migration and winter use.

### V. Rationale for the Decision

The Rosa Mesa Mule Deer study was recommended by a Steering Committee made up of wildlife biologists and interested agencies including: Southern Ute Tribe, Jicarilla Apache Tribe, Carson National Forest-Jicarilla Ranger District and the New Mexico Department of Game and Fish. The Steering Committee recommended a study to evaluate the impacts of wintertime horizontal drilling, facilitating the use of consolidated infrastructure in highly fragmented big game winter ranges. Allowing this modification to the Winter Closure COA will allow researchers to compare the 4 years of baseline mule deer habitat usage data collected to date with data collected concurrently with winter drilling operations on the Rosa Mesa. This data will help the BLM better analyze and plan future proposals considered in critical big game winter ranges.

I have determined that the activities described in the proposed action will not adversely affect or cause loss or destruction of scientific, cultural, or historical resources, including those listed in or eligible for listing in the National Register of Historic Places (40 CFR 1508.27(b)(8)). The locations for the current Proposed Action have been previously inspected for cultural resources and were previously analyzed in DOI-BLM-NM-F010-15-0103-EA [BLM 2015]. No discoveries were made during associated construction. All conditions of approval pertaining to the protection and avoidance of cultural resources with the previously analyzed Proposed Action remain in force. As long as activity is confined to the currently established facilities the Proposed Action will have no direct or indirect impacts on historic properties (no historic properties affected). Any new facilities will be subject to a separate site specific analysis.

The proposed activities are not likely to adversely affect any endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (40 CFR 1508.27(b)(9)). Based on a review of species currently listed by the USFWS as occurring in Rio Arriba County (USFWS 2015), as well as the location of the proposed project area and habitat within the proposed project area, the potential does not exist for USFWS-listed species to occur within the proposed project area (refer to Biological Survey Report [BSR] in Appendix B of the DOI-BLM-NM-F010-15-0103-EA [BLM 2015]). Water for drilling would be obtained from the

permitted Manzanaras Mesa Water Well #1R (SJ-193) and/or San Juan 29-6 Unit Water Well 1 Formation (SJ-192); no unaccounted-for water depletions within USFWS-listed fish habitat would occur. Therefore, there is no need for additional Section 7 consultation.

## VI. Public Involvement

The project was entered into the Farmington Field Office NEPA log:  
[http://www.blm.gov/style/medialib/blm/nm/programs/planning/nepa\\_logs0/NEPA\\_Logs\\_2016.Par.66765.File.pdf/2016.11.19\\_FFO\\_NEPA\\_Log.pdf](http://www.blm.gov/style/medialib/blm/nm/programs/planning/nepa_logs0/NEPA_Logs_2016.Par.66765.File.pdf/2016.11.19_FFO_NEPA_Log.pdf)

The project was posted on the Farmington Field Office NEPA web page for a 30-day comment period and an email was sent to notify potentially interested parties on December 16, 2015. No comments were received.

## VII. Administrative Review and Appeal

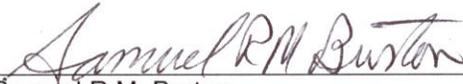
Under BLM regulations, this Decision Record (DR) is subject to administrative review in accordance with 43 CFR 3165. Any request for administrative review of this DR, with or without oral presentation, must include information required under 43 CFR 3165.3(b) (State Director Review), including all supporting documentation. Such a request must be filed in writing with the State Director, Bureau of Land Management, 301 Dinosaur Trail, Santa Fe, NM 87508, no later than 20 business days after this DR is received or considered to have been received.

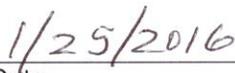
Any party who is adversely affected by the State Director's decision may appeal that decision to the Interior Board of Land Appeals, as provided in 43 CFR 3165.4. If you wish to file a petition for a stay of the effectiveness of this decision during the time that your appeal is being reviewed by the Board, the petition for a stay must accompany your notice of appeal.

A petition for a stay is required to show sufficient justification based on the following standards:

- (1) The relative harm to the parties if the stay is granted or denied;
- (2) The likelihood of the appellant's success on the merits;
- (3) The likelihood of immediate and irreparable harm if the stay is not granted; and
- (4) Whether the public interest favors granting the stay.

In the event a request for stay or an appeal is filed, the person/party requesting the stay or filing the appeal must serve a copy of the appeal on the Office of the Field Solicitor: United States Dept. of the Interior, Office of the Solicitor, Southwest Regional Office, 505 Marquette Avenue NW, Suite 1800, Albuquerque, NM 87102

  
\_\_\_\_\_  
Samuel R.M. Burton  
Field Office Manager (ACTING)  
Farmington Field Office

  
\_\_\_\_\_  
Date

**UNITED STATES DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT**

Farmington District  
Farmington Field Office  
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Farmington, NM 87402

**Finding of No Significant Impact**

**WPX Energy Production, LLC's Proposed Mule Deer Winter Drilling Research Project.  
NEPA No. DOI-BLM-NM-F010-2016-0015-EA**

**FINDING OF NO SIGNIFICANT IMPACT**

I have determined that the proposed action, as described in Environmental Assessment (EA) DOI-BLM-NM-F010-2016-0015-EA will not have any significant impact, individually or cumulatively, on the quality of the human environment. Because there would not be any significant impact, an Environmental Impact Statement is not required.

In making this determination, I considered the following factors:

***Context***

The Farmington Field Office (FFO) is located in northwestern New Mexico. The field office boundaries include approximately 7,800,000 acres, 1.4 million surface acres and an additional 1 million acres of mineral estate of which are managed by the BLM. The distribution of BLM-managed lands is fairly well consolidated in the north and becomes increasingly mingled with Tribal lands to the south. BLM-managed lands abut the Navajo Reservation to the west and south, Jicarilla Apache Nation Reservation to the east, and the Ute Mountain Reservation and Southern Ute Indian Reservation to the north. Aztec Ruins National Monument and Chaco Cultural National Historical Park, managed by the National Park Service, lie within the field office boundaries. The BLM manages approximately 18% of lands within a 10 mile radius of Chaco Cultural National Historical Park.

The Farmington Field Office encompasses the New Mexico portion of the San Juan Basin. The San Juan Basin and surrounding areas have been occupied by varied cultures since the Paleo Indian period (circa 10,000 BC). The San Juan Basin and Four Corners area have one of the most extensive prehistoric and protohistoric occupations in the United States. The most commonly known archaeological resources are the Anasazi structures at Chaco Cultural Historical Park, Mesa Verde National Park, and other National Park Service sites. Scattered across BLM-managed lands are similar, but smaller structures, which were probably related to these larger sites. Twenty-three Chacoan outliers are known to exist within the FFO. Each contains at least one Chacoan structure and most have associated communities, prehistoric roads, and great kivas along with features such as herraduras and special use areas. The FFO contains an extensive system of finely engineered roads radiating out from Chaco Canyon and extending a considerable distance to outlying sites through the San Juan Basin and beyond. These roads are remarkably straight and carefully constructed. The most notable is the Great North Road, which starts at Chaco Canyon and run north to the Aztec Ruins.

Located within the boundary of the FFO is much of Dinétah, the ancestral homeland to the Navajo. Here the Navajo constructed forked-stick hogans, shades, sweat lodges, and other

structures over a several hundred year span. During a short period between 1680 and the mid-1700s, pueblitos were constructed, often associated with other structures. Although not firmly dated, extensive Navajo pictograph and petroglyph sites were painted, etched, pecked, or ground onto the sandstone cliffs of the canyons of Dinétah. Most are believed to be ceremonial art which is no longer traditionally executed in a permanent form.

Native American Traditional and Sacred Areas are known to exist across the FFO. Many are associated with narrative accounts of origin or other traditional stories. Most of the identified sacred areas are associated with the Navajo culture. These places are still important in Navajo ceremonies and daily activities.

Historic Hispanic or Spanish and Anglo sites within the San Juan Basin primarily date from the late 1800s to the present. Although there are some early Spanish land grants in the southern portion of the FFO, most historic sites located on public lands are either Hispanic or Anglo homesteads with associated structures from the late 1800s and early 1900s. Associated with many clusters of homesteads were a school house and often a church which was visited every few months by a priest.

Cultural resource inventories have been conducted throughout the FFO for project undertakings, management studies, and scientific inquiries. As of April 2014, approximately 760,000 acres of the 7,800,000 acres in the FFO boundaries have been inventoried. Over 46,000 sites have been identified ranging from small artifacts to the 800-room structures in Chaco Canyon. Many of these sites are listed on the National Register of Historic Places and Chaco Culture National Historical Park along with several of the Chacoan sites which have been placed on the World Heritage List. The FFO manages 79 ACECs for relevant and important cultural values, including five World Heritage Sites.

The San Juan Basin is an important area for mammalian and reptilian fossils. A variety of paleontological resources exist in the FFO including animal fossils, fossil leaves, palynomorphs, petrified wood, and trace fossils occurring in the Triassic, Jurassic, Cretaceous, and Tertiary rocks. Dinosaur and other fossils have made significant contribution to the scientific record have been found and excavated in the FFO. Paleontological resources are present in the Bisti De-Na-Zin Wilderness Area, Ah-Shi-Sle-Pa Wilderness Study Area, Fossil Forrest Research Natural Area, and seven fossil areas identified in the 2003 Farmington Resource Management Plan.

The San Juan Basin is one of the largest natural gas fields in the nation and has been under development for more than 60 years. Oil was discovered by accident in the Seven Lakes area of McKinley County in 1911. Natural gas was discovered near Aztec, New Mexico, in 1920-1921 with oil of commercial quantity discovered near the Hogback in 1922 (Barnes 1951). Several small pipelines were built to carry the oil and gas from these discoveries to Aztec and Farmington, respectively. Development began in earnest in the late 1940s and early 1950s as the demand for natural gas increased. The Farmington Field office manages 2,765 active oil and gas leases in the San Juan Basin consisting of 2.1 million acres. Leasing began in the mid-1930s and accelerated in the late 1940s. By 1950, over 1 million acres were under lease.

In 1951, El Paso Natural Gas completed the first interstate pipeline out of the San Juan Basin to California. That same year, oil was discovered in the Mancos Shale in Dogie Canyon (Barnes 1951). Since that time, over 30,000 oil and gas wells have been drilled in the San Juan Basin with approximately 16,000 associated rights-of-way. Approximately 23,000 wells are currently producing. Since Stanolind Oil introduced hydraulic fracturing in 1949, nearly every well in the San Juan Basin has been fracture stimulated.

## *Intensity*

1. The activities described in the proposed action do not include any significant beneficial or adverse impacts (40 CFR 1508.27(b)(1)). Per 40 CFR 1500.1(b), the EA concentrated on issues that are truly significant to the action in question, rather than amassing needless detail. Issues have a cause and effect relationship with the proposed action or alternatives; are within the scope of the analysis; have not been decided by law, regulation, or previous decision; and are amendable to scientific analysis rather than conjecture (BLM 2008, page 40). The following issues were identified for the proposed activities:

- How would dust and equipment emissions associated with the proposed project impact air resources?
- How would vegetation-clearing, proposed project activities, and final reclamation associated with the proposed project impact upland vegetation
- How would vegetation-clearing, proposed project activities, and final reclamation associated with the proposed project impact the introduction of noxious weeds?
- How would vegetation-clearing, proposed project activities, and final reclamation impact wildlife, including migratory birds?
- How would vegetation-clearing, proposed project activities, and final reclamation impact the following BLM Special Status Species (SSS): Bendire's thrasher (*Toxostoma bendirei*), ferruginous hawk (*Buteo regalis*), golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), pinyon jay (*Gymnorhinus cyanocephalus*), and prairie falcon (*Falco mexicanus*)?
- How would surface-disturbing activities associated with construction of the proposed project impact cultural resources?

The EA includes a description of the expected environmental consequences of the proposed activities for those issues in Chapter 2.

2. The activities included in the proposed action and alternatives would not significantly affect public health or safety (40 CFR 1508.27(b)(2)). The following design features have been included in the proposed action to address any impacts to public health and safety. The proposed project would be located within an existing oil and gas field currently experiencing concentrated development. Risks to public health and safety associated with the Proposed Action include increased traffic on public roads, wildfire, pipeline leakage, rupture, fire, explosion, and operation of construction equipment. Additional public health and safety risks include spills of wastes, chemicals, or hazardous materials.

Available at the project site at all times would be current Material Safety Data Sheets (MSDS) for all chemicals, compounds and/or substances which would be used during any phase of the Proposed Action. 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 the national BLM Notice to Lessees (NTL)-3A. Best management practices (BMPs) and "good housekeeping practices" including spill control measures would be followed, minimizing potential impacts from hazardous and non-hazardous wastes. Adherence to company safety policies and BLM-FFO COAs and ROW stipulations would mitigate public health and safety hazards. The hauling of project equipment and materials on public roads would comply with all Department of Transportation regulations. All equipment operation would be performed in compliance with appropriate Occupational Safety and Health Administration (OSHA) regulations.

Health and safety issues for construction workers include operation of heavy equipment, drilling, welding activities, and working in the vicinity of other utilities (primarily other oil and gas gathering pipelines and overhead power lines). Although unlikely, well explosions, blowouts and fire are considered possible risks. WPX Energy maintains an emergency response plan. This plan includes the training of personnel to respond to emergencies. The Association of Mechanical Engineers (ASME) and American Petroleum Institute (API) issue standards for the design, construction, installation, and maintenance of pressure vessels, fittings, piping, and pipelines. Operators and their contractors will continue to operate, and maintain all equipment and pipelines according to these standards, which are intended to minimize the potential for explosions and failure of the equipment.

Material storage would only be within existing well pads. Governmental agencies would be notified as required under the Emergency Planning and Community Right to Know Act (1986). The notification of releases such as natural gas, natural gas liquids, and petroleum outside the facility site is required under CERCLA and reporting of releases would be done in accordance with federal and State of New Mexico Oil Conservation Division regulations.

Air quality may affect health and safety. Air quality for Rio Arriba County and for the State of New Mexico is described earlier in **Air Resources section 2.2. of the EA (page(s) 26 thru 31.** Changes to air quality from the proposed action are expected to be relatively minor, as discussed in Section 2.1 of the EA. It is unclear whether these air pollutants would affect the health of nearby residents or workers closest to the well. Workers in closest proximity to the drilling activity use engineering controls and protective gear to minimize risk of effects.

The Air Resources Technical Report discusses the relevance of hazardous air pollutants (HAPs) to oil and gas development and the particular HAPs that are regulated in relation to these activities (USDI BLM 2014). The Environmental Protection Agency (USEPA) conducts a periodic National Air Toxics Assessment (NATA) that quantifies HAP emissions by county in the U.S. The purpose of the NATA is to identify areas where HAP emissions result in high health risks and further emissions reduction strategies are necessary. A review of the results of the 2005 NATA shows that cancer, neurological and respiratory risks in San Juan County are generally lower than statewide and national levels as well as those for Bernalillo County where urban sources are concentrated in the Albuquerque area (USEPA 2012).

The emissions calculator estimated that there could be very small direct and indirect increases in several criteria pollutants, HAPs, and greenhouse gases (GHGs) as a result of implementing the proposed alternative. The very small increase in emissions that could result would not be expected to result in exceeding the National Ambient Air Quality Standards (NAAQS) for any criteria pollutants in the analysis area.

3. The proposed activities would not significantly affect any unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas (40 CFR 1508.27(b)(3)). Unique characteristics are generally limited to those that have been identified through the land use planning process or other legislative, regulatory or planning processes (BLM 2008, page 71). The FFO does not contain any prime and unique farmlands, suitable or designated wild and scenic rivers, or designated caves. Table 1 discloses the distance of the proposed activities to wetlands delineated by the Army Corps of Engineers. Table 2 discloses the distance of the proposed activities to National Park Service units and Congressionally designated areas. The proposed action and alternatives are not located within an Area of Critical Environmental

Concern. Impacts to historic or cultural resources are described in the Cultural Resources section of the EA and discussed further under item 8.

Table 1. Distance of the Proposed Activities from Wetlands

Delineated Wetlands	Distance from Proposed Activities (miles)
Bancos	2-30
Blanco	28-29
Bloomfield	31-32
Cutter Canyon	26-27
Carrizo Oxbow	24-25
Desert Hills	32-33
Valdez	29-30

Table 2 . Distance of the Proposed Activities from Park Lands and Ecologically Critical Areas

Park Land or Ecologically Critical Area	Distance from Proposed Activities (miles)
Ah-Shi-Sle-Pah Wilderness Study Area	52-53
Aztec Ruins National Monument	34-35
Bisti De-Na-Zin Wilderness Area	48-49
Chaco Cultural National Historical Park	60-61
Fossil Forest Research Natural Area	55-56

4. The activities described in the proposed action do not involve effects on the human environment that are likely to be highly controversial (40 CFR 1508.27(b)(4)). Controversy in this context means disagreement about the nature of the effects, not expressions of opposition to the proposed action or preference among the alternatives (BLM 2008, page 71). Oil and gas development has occurred in the San Juan Basin for more than 60 years. While there may be controversy over the appropriateness of oil and gas development, there is not a high level of controversy or substantial scientific dispute over the impacts of that activity. The impacts of the proposed activities are described in Chapter 2 of the EA.

5. The activities described in the proposed action do not involve effects that are highly uncertain or involve unique or unknown risks (40 CFR 1508.27(b)(5)). As described under Context, oil and gas development has occurred in the San Juan Basin since the late 1940s and early 1950s. The field office has permitted over 30,000 wells and 16,000 rights-of-way. Hydraulic fracturing has occurred on nearly every well in the San Juan Basin since the 1950s. As such, the FFO has decades of experience and is knowledgeable about the impacts and risks associated with the proposed activities.

6. My decision to implement these activities does not establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration (40 CFR 1508.27(b)(6)). Approval of these activities in no way assures approval of any future activities.

7. The effects of the proposed activities would not be significant, individually or cumulatively, when considered with the effects of other actions (40 CFR 1508.27(b)(7)). Direct, indirect, and cumulative impacts are described in Chapter 2 of the EA.

8. I have determined that the activities described in the proposed action will not adversely affect or cause loss or destruction of scientific, cultural, or historical resources, including those listed in or eligible for listing in the National Register of Historic Places (40 CFR 1508.27(b)(8)). The locations for the current Proposed Action have been previously inspected for cultural resources and were previously analyzed in DOI-BLM-NM-F010-15-0103-EA [BLM 2015]. No discoveries were made during associated construction. All conditions of approval pertaining to the protection and avoidance of cultural resources with the previously analyzed Proposed Action remain in force. As long as activity is confined to the currently established facilities the Proposed Action will have no direct or indirect impacts on historic properties (no historic properties affected). Any new facilities will be subject to a separate site specific analysis.

9. The proposed activities are not likely to adversely affect any endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (40 CFR 1508.27(b)(9)). Based on a review of species currently listed by the USFWS as occurring in Rio Arriba County (USFWS 2015), as well as the location of the proposed project area and habitat within the proposed project area, the potential does not exist for USFWS-listed species to occur within the proposed project area (refer to Biological Survey Report [BSR] in Appendix B of the DOI-BLM-NM-F010-15-0103-EA [BLM 2015]). Water for drilling would be obtained from the permitted Manzanaras Mesa Water Well #1R (SJ-193) and/or San Juan 29-6 Unit Water Well 1 Formation (SJ-192); no unaccounted-for water depletions within USFWS-listed fish habitat would occur. Therefore, there is no need for additional Section 7 consultation.

10. The proposed activities will not threaten any violation of Federal, State, or local law or requirements imposed for the protection of the environment (40 CFR 1508.27(b)(10)). Sections 1.4 and 1.5 of the EA describe the relationship of the proposed activities to relevant laws, policies, regulations, and plans.

## REFERENCES

Barnes, Frank C., 1951. History of development and production of oil and gas in the San Juan Basin. In *The south and west sides of the San Juan Basin, New Mexico and Arizona*, Smith, C.T.; Silver, C. ed(s), New Mexico Geological Society, Guidebook, 2nd Field Conference, pp. 155-160.

BLM. 2008. *National Environmental Policy Handbook. H-1790-1*. Bureau of Land Management. National Environmental Policy Act Program.

## APPROVED:



Samuel R.M. Burton

Field Office Manger (ACTING)

Date

1/25/2016

**United States Department of the Interior  
Bureau of Land Management**

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Environmental Assessment DOI-BLM-NM -F010-2016-0015-EA

***WPX Energy Production, LLC's  
Proposed Mule Deer Winter Drilling Research Project***

December 2015

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New Mexico • Farmington Field Office



**It is the mission of the Bureau of Land Management to sustain the health, diversity, and productivity of the public lands for the use and enjoyment of present and future generations.**

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# 1. PURPOSE AND NEED FOR ACTION

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## 1.1. Background

The Bureau of Land Management – Farmington Field Office (BLM-FFO) has received a proposal from WPX Energy Production, LLC (WPX) to augment the ongoing Rosa Mule Deer Study in the Rosa Mesa portion of WPX’s Rosa Unit in Rio Arriba County, New Mexico. The Rosa Mule Deer Study is a multi-year study planned and initiated between the BLM-FFO, NMDGF, and Western Ecosystems Technology, Incorporated (WEST). The study was designed to identify the habitat selection patterns and migration routes of mule deer related to oil and gas operations within the Rosa Unit. It is hoped that knowledge gained from this study will improve industry development planning in the future. Indeed, these data could also provide the BLM with reliable knowledge to improve decision making; ensuring that wildlife mitigation measures (e.g. winter drilling COAs) are effective and practical.

Data collected to date has provided baseline migratory and habitat usage information. If WPX were allowed to conduct winter drilling and/or well completion, as stipulated in this document, a comparison of migration and habitat use could provide data to evaluate the efficiency of current mule deer winter range COAs (e.g. Lendrum et al. 2012, 13, Sawyer et al. 2013). Implementing a drilling and/or completion operations as part of the Rosa Mule Deer Study would require a modification to the winter seasonal restriction (Winter Closure) COA for the Rosa Mesa Wildlife Area Specially Designated Area (SDA).

The 2003 Farmington Proposed Resource Management Plan/Final Environmental Impact Statement (RPMP/FEIS; BLM 2003a) established COAs for Wildlife SDAs that impose seasonal timing limitation on construction and drilling from December 1 to March 31 of each year, to mitigate disturbance impacts to wintering big game. WPX’s oil and natural gas leases covering the Rosa Unit portion of the Rosa Mesa Wildlife Area SDA were issued in 1948. The Winter Closure is not a lease stipulation as it was developed after WPX’s leases were granted. The BLM-FFO amended the 2003 seasonal closures in 2008 after completing EA #NM-210-2008-490-Environmental Assessment of the Criteria and Impacts of Granting Exceptions to the Seasonal Closure Periods in Designated Wildlife Areas.

Access to oil and gas reserves in a particular formation is regulated by spacing rules established by the New Mexico Energy, Minerals and Natural Resources Department Oil Conservation Division (NMOCD). On Federal lands, the BLM generally abides by NMOCD rules but has the authority to establish its own spacing and well density rules.

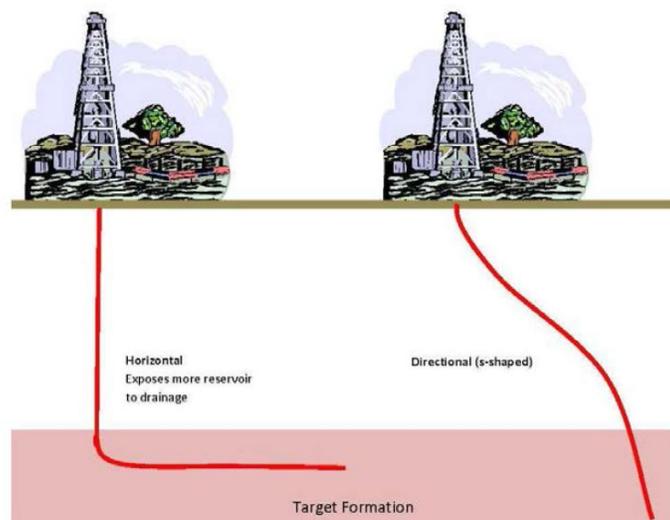
On July 7, 2011, WPX Energy went to hearing before the NMOCD in its application for a project area for the Mancos Participating Area in the Rosa Unit (Case No. 14663). The NMOCD subsequently issued its order approving the entire Mancos Participating Area (save and except any uncommitted tracts contained therein) as a project area and establishing setback requirements of 660 feet from the outer boundary of the Mancos Participating Area (Order R-13200-C).

Discussions of WPX’s development within the Rosa Unit, including both the Middle Mesa SDA and the Rosa Mesa SDA, occurred concurrently. A Steering Committee made up of wildlife biologists and interested agencies (Southern Ute Tribe, Jicarilla Apache Tribe, Carson National Forest-Jicarilla Ranger Station and New Mexico Department of Game and Fish, and Colorado Division of Wildlife) was formed to make recommendations to the BLM regarding management of the mule deer and elk populations in the Rosa Unit and future studies to assess impacts. The Steering Committee discussed and agreed that there was no need to conduct a study on the Middle Mesa side based on Middle Mesa wildlife densities not supporting such a study. The Steering Committee recommended a research project within the Rosa SDA east of the Navajo Reservoir. In December 2011, the BLM-FFO approved the decision to grant WPX Energy an exception to the seasonal closure for the Middle Mesa portion of the Rosa Unit for an approximate 5-year period, imposing certain terms and conditions (BLM 2011f). The environmental analysis for the exception was presented in the Final Environmental Assessment for the Middle Mesa Plan of Development (POD) (DOI-BLM-NM-FO10-2011-254-EA; BLM 2011f).

Natural gas and oil wells can be drilled vertically, directionally, or horizontally. Vertical drilling places a well pad directly above the bottom hole, while directional and horizontal drilling allows for flexibility in the placement of the well pad and associated surface facilities. Directional or horizontal drilling often allows for “twinning,” or drilling two or more wells from one shared well pad. Directional and horizontal drilling applications throughout the San Juan Basin have become relatively common. Generally, the use of this technology is applied when it is necessary to avoid or minimize impacts to surface resources.

Factors such as reservoir depth, angle of deviation, lateral displacement, completion technique, and risk are considered before deciding on the use of directional drilling applications. In addition, operating factors such as production efficiency; rod, pump, and tubing wear; and workover frequency is also a consideration. Generally, directional well completion and operating costs are 20 to 25 percent higher than vertical well drilling costs. The primary economic factors that determine the feasibility of directional applications include, but are not limited to, incremental drilling, completion, and operating costs; oil and gas reserves; rates of production; oil and gas prices; royalties and taxes; and return on investment.

The relationship between a horizontal well and directional/vertical well is not one-to-one in terms of formation contact or volumetric extraction. Specifically, the horizontal development for the wells proposed to be drilled, would be drilled using a purpose-built rig that would drill downward generally in a vertical direction to the target formation (point of entry) at which point the drill bore would extend horizontally across the formation for a distance of up to 11,000 feet. This consistent contact with the formation is what allows for greater natural gas extraction. However, with directional drilling, the drill bore crosses the formation on a nearly vertical plane mainly encountering the vertical extent of the producing formation. Figure 1 illustrates the difference in horizontal well and vertical/directional bores.



**Figure 1. Comparison of directional and horizontal well bores**

Additionally, with the adoption of Order No. R-13499, Case No. 14744, by the Oil Conservation Commission, the spacing of horizontal versus vertical wells complicates direct comparison. A horizontal well is not confined to a single spacing unit when drilled within a designated Project Area, whereas a vertical well is confined to 8 wellbores per 320 acre spacing unit. The pool rules for vertical development restrict the number of wells that can be drilled in a spacing unit and also restrict their location according to setback requirements.

Taking these issues into account, WPX Energy developed a projected number of wells/pads needed for comparison with horizontal drilling, based on extracting natural gas resources from the same area. The projected development assumed that four directional wells per pad could be drilled from one existing location. It was also assumed that Current technology limits directional drilling to a reach of 2,000 feet.

Using horizontal drilling, a maximum of 16 proposed horizontal bores could transect a total of 32 quarter-quarter sections and access two separate zones. Each quarter-quarter section correlates to a 40-acre spacing unit where one vertical/directional Basin Mancos well could be drilled. Therefore, 32 wells at 40-acre spacing could be developed using vertical/directional drilling. Because it is assumed that all well pads could be twinned with existing locations and that up to four wells could be drilled from one well pad, eight well pads would be needed to attempt to access the same reservoir area as horizontal drilling.

However, under current spacing orders and due to different extraction techniques, vertical/directional drilling would drain approximately 25 percent of the natural gas volume as compared to the amount drained using horizontal drilling. This assumption is based on data acquired from previously drilled vertical and horizontal Mancos wells in the Rosa Unit.

For this analysis, the surface disturbance for Basin Mancos/Mesaverde vertical/directional development is estimated using the following assumptions: (1) 5.5 acres of short-term disturbance for new well pad locations with 3 acres reclaimed after completion, resulting in 2.5 acres of long-term disturbance; (2) the size of an existing pad would be expanded by 2.75 acres of short-term disturbance with approximately 1 acre of long-term disturbance following reclamation; and (3) estimated road and pipeline disturbance would follow the analysis in the PRMP (USDI/BLM 2003a) that is an average of 1.5 acres of short-term disturbance decreasing to 1 acre of long-term disturbance, based on an average length of 800 feet by 50 feet wide (USDI/BLM 2003a).

The surface disturbance for Basin Mancos/Mesaverde horizontal development is estimated using the following assumptions and are based on current horizontal drilling development within the Rosa Mesa area (Rosa UT 27 & Rosa UT 29): (1) 6.5 acres of short-term disturbance for new well pad location with 5 acres reclaimed after completion, resulting in 1.5 acres of long-term disturbance; (2) well pads would be co-located/twinned with existing wells and would not require an access road; and (3) estimated pipeline disturbance would be an average of 1 acre of short-term disturbance. The actual number of wells to be drilled is subject to economic and technological considerations, but these numbers are presented to allow for analysis and comparison and are based on the best available information.

**Table 1. Surface Disturbance Comparison Between Vertical/Directional Drilling and Horizontal Drilling to Develop an Area Equal to 32 Quarter-Quarter Sections.**

	<b>Vertical/Directional (Minimum)*</b>	<b>Vertical/Directional (Maximum)*</b>	<b>Horizontal</b>
<b>Number of Wells</b>	32	32	16
<b>Number of New Pads</b>	N/A	8	0
<b>Number of expanded Pads</b>	8	N/A	1
<b>Well pad Disturbance (Acres)</b>	22	44	6.50
<b>Road &amp; Pipeline (Acres)</b>	0	12	0
<b>Pipeline Only (Acres)</b>	0	0	1
<b>Total Short-term Disturbance (Acres)</b>	22	56	7.50
<b>Total Long-term Disturbance (Acres)</b>	8	28	1.5

\* It may not be feasible to physically expand some existing well pads to support multiple well heads due to topography, cultural resources, and other natural resource concerns. Therefore, for this analysis, the minimum disturbance assumes all wells could be twinned with existing well pads. The maximum disturbance assumes all new well pads need to be constructed.

WPX proposes to utilize horizontal drilling and well completion to maximize natural gas extraction from the Basin Mancos pool with less surface disturbance and greater recovery of resources than vertical drilling. WPX currently plans to drill eighteen (18) horizontal wells permitted by the (BLM-FFO) under Applications for Permit to Drill (APDs) for the Rosa UT 27 and Rosa UT 29 Natural Gas Well Pads and Associated Drilling and Completion Development Project (Rosa UT 27 and 29 Development Project). The environmental analysis for the Rosa UT 27 and 29 Development Project was presented in the Environmental Assessment for WPX Energy Production, LLC's Proposed Rosa UT 27 #101H/#102H/#103H/#104H/#105H/#106H/#107H/#108H/#109H/#110H and Rosa UT 29 #101H/#102H/#103H/#104H/#105H/#106H/#107H/#108H Natural Gas Well Pads and Associated Drilling and Completion Development Project (DOI-BLM-NM-F010-15-0103-EA; BLM 2015). These permitted wells would be drilled and completed from the previously constructed Rosa UT 27 and Rosa UT 29 well pad locations within the Rosa Mesa portion of WPX's Rosa Unit.

The Rosa UT 27 and 29 Development Project is located on public lands managed by the BLM-FFO within Sections 19 & 30 of Township 31 North, Range 05 West and Sections 25 of Township 31 North, Range 06 West, N.M.P.M. in Rio Arriba County, New Mexico. The approved wells will develop Federal minerals from the Basin Mancos formation associated with valid existing leases SF-078767 and SF-078771. The Rosa UT 27 and 29 Development Project would include the horizontal drilling and completion of ten natural gas wells from the previously constructed multi-well Rosa UT 27 well pad and eight natural gas wells from the previously constructed multi-well Rosa UT 29 well pad.

The eighteen proposed horizontal wells have each been authorized by an approved APD. The proposed well pads, access road, and pipeline ties would be located entirely on-lease within the Rosa Unit and have each been authorized under APD's. The surface disturbance from the associated two proposed recycling containments, one cuttings disposal, and surface waterlines were authorized by an approved Sundry Notice. All necessary portions of the approved Rosa UT 27 and 29 Development Project have been constructed and do not exceed a total of 42.09 acres of disturbance with approximately 31.70 acres of that being new surface disturbance. Of the total disturbed area, approximately 39.77 acres would be fully reclaimed and 1.61 acres would be reseeded (but not recontoured) during interim reclamation. The remainder (0.76 acres) would be stabilized and used as a working surface throughout the life of the project, and would be fully reclaimed during final reclamation.

The proposed action is the approval of an exception to the Winter Closure COA for wells proposed by WPX and located in the Rosa Mesa Wildlife SDA, for the purpose of supporting the Rosa Mule Deer Study as planned by the BLM-FFO, NMDGF, WEST, and the Steering Committee. These wells include, but are not limited to, the wells located on the Rosa UT 27 and Rosa UT 29 multi-well well pads, as well as those located on future WPX proposed well pads within the area, for the duration of the study and ending April 1, 2018. The future proposed wells would be evaluated on a case-by-case basis at the time they are proposed.

The proposed action would allow for the horizontal wells approved under the APD's and located on existing well pads to be drilled and/or completed during the Winter Closure. The project area would be located within the BLM-FFO management area of Rio Arriba County, New Mexico. The proposed project area is located approximately 27 miles north-northeast of the town of Navajo City, New Mexico; 18 miles south of the town of Arboles, Colorado; 24 miles north of U.S. Highway 64; and 1 mile east of Navajo Reservoir (see Appendix A). Drilling and completion activities would occur within the Rosa Mesa Wildlife SDA and is further described in Section 2.2. The Proposed Action and alternatives evaluated in this EA are analyzed for site-specific impacts as required by 43 CFR § 3162.3-1.

## **1.2. Purpose and Need for Action**

The BLM has received a request from WPX for an exception to the Winter Closure COA for the Rosa Mesa Wildlife Area SDA. This exception will allow for winter time drilling and completion operations to occur in proximity to mule deer which have been affixed with GPS data recorders for the past 4 years. Utilizing the baseline data collected to date, data collected in concert with winter drilling and/or completion

efforts may elucidate impacts to mule deer from winter drilling and completion activities during migrations and wintering.

The need for the proposed action is to meet the BLM's obligation to allow economic extraction, in an efficient and environmentally compatible manner, of the recoverable oil and natural gas reserves known to exist in the valid mineral leases issued to WPX, as administered by the BLM. The BLM's policy is to make mineral resources available for disposal and to encourage development of mineral resources to meet national, regional, and local needs. The Mineral Leasing Act of 1920, as amended (30 USC 181 et seq.), authorizes the BLM to issue oil and gas leases for the exploration of mineral resources and permits the development of those leases. The need for the action is established by the BLM's authority under the Mineral Leasing Act, the Mining and Minerals Policy Act of 1970 (30 USC 21 et seq.), the Federal Land Policy and Management Act of 1976 (43 USC 1701 et seq.), the National Materials and Minerals Policy, Research, and Development Act of 1980 (30 USC 1601 et seq.), and the Federal Onshore Oil and Gas Leasing Reform Act of 1987 (30 USC 181 et seq.). The existing lease is a binding legal contract that allows development of the mineral estate by WPX.

The objectives of the proposed Rosa Mule Deer Study are to assist in balancing development of the minerals and protection of other resources in a manner consistent with the lease rights granted, as well as to provide agencies and industry with the information they need to improve management and minimize potential impacts associated with future development. The proposed action is designed to develop the resources in an economical manner while optimizing resource extraction, protecting wildlife values, consolidating disturbance, reducing surface impacts and advancing agency and industry knowledge of impacts analysis to better manage future development.

It is unclear if drilling or completion operations will greatly influence mule deer behavior more than standard wintertime operations, as stipulated by the current FFO RMP COAs. Further, annual variations in winter conditions can exacerbate or lessen impacts of disturbance on wintering mule deer—i.e. longer duration studies provide better information for decision makers.

To better elucidate these impacts, WPX proposes year-round drilling and/or completions to include December 1 to March 31, each year for which the study continues. BLM's authorization of the requested modification would allow WPX to drill with one rig and/or complete wells during the SDA winter closure until all proposed wells have been drilled and completed so long as the Rosa Mule Deer Study continues. The Rosa Mule Deer Study is considered to be occurring if an appropriate sample size of resident deer within the Rosa Unit are fitted with GPS collars and collecting data concurrently with drilling and completion operations. This study would continue until its planned termination date of April 1, 2018.

### **1.3. Decision to be Made**

The BLM-FFO will decide whether or not to allow an exception to the Winter Closure COA for the Rosa SDA, and if so, under what terms and conditions. The BLM is mandated under the National Environmental Policy Act of 1969, as amended [42 U.S.C. §4321] which requires that environmental obligations are conducted in a manner that protects the mineral resources, other natural resources, and environmental quality. The authorized officer shall prepare an environmental record of reviews (e.g. Documentation of NEPA Adequacy [DNA]) or an environmental assessment as appropriate per [42 U.S.C. §3162.5-1(a)]. The BLM-FFO must determine based on this environmental record of reviews if there are any significant environmental impacts associated with the proposed actions, warranting further analysis in an Environmental Impact Statement (EIS). The BLM-FFO Field Manager is the authorized officer who will decide one of the following:

- To approve the proposal and modify the Winter Closure COA with design features as submitted
- To approve the proposal and modify the Winter Closure COA with additional mitigation added
- To analyze the effects of the proposed action in an EIS; or
- To deny the proposal.

## **1.4. Conformance with Applicable Land Use Plan(s)**

The proposed action is in conformance with the 2003 BLM-FFO Resource Management Plan (RMP). Pursuant to 40 CFR 1508.28 and 1502.21, this site-specific EA tiers into and incorporates by reference the information and analysis contained in the BLM-FFO Proposed Resource Management Plan/Final Environmental Impact Statement (PRMP/FEIS; BLM 2003a). The RMP was approved by the September 29, 2003 Record of Decision (ROD; BLM 2003b), and updated in December 2003.

Specifically, the proposed action is in conformance with the following objectives:

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 2003b, 2-2 – 2-3)

This EA addresses site-specific resources and effects of the proposed action that were not specifically covered within the PRMP/FEIS as required by NEPA. The proposed project would not be in conflict with any local, county, or state plans.

## **1.5. Relationship to Statutes, Regulations or Other Plans**

WPX would comply with applicable federal, state, and local laws and regulations. Necessary permits and approvals for the proposed project would be obtained prior to project implementation.

Many requirements regulating specific environmental elements are found in the appropriate elements sections of this EA (Chapter 3). Several permits, licenses, consultations, or other requirements are discussed below.

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### **1.5.1 Clean Water Act**

Activities affecting Waters of the U.S. are regulated under the Clean Water Act (CWA) (33 USC 1251-1376; Chapter 758; PL 845; 62 Stat. 1155); reauthorized 1991). Specifically, Section 404 authorizes discharges to waters of the U.S. and Section 401 provides water quality certification for such activities. The Section 401 certification would be granted by the New Mexico Environment Department (NMED).

The Nationwide Permit (NWP) program under Section 404 of the Act provides for fills to waters subject to jurisdiction under Section 404 for certain discharges. It is administered by the EPA and U.S. Army Corps of Engineers (USACE). Under the CWA, the USACE has jurisdiction over waters of the U.S. Waters of the U.S. are considered jurisdictional because they have a “significant nexus” to traditional navigable waters. The BLM-FFO and USACE - Durango Regulatory Office have determined that jurisdictional waters (i.e., waters of the U.S.) within the BLM-FFO planning area may include U.S. Geological Survey (USGS) watercourses (i.e., “blue lines” on USGS 1:24,000 topographic maps) and potentially tributaries to these USGS watercourses.

Under Section 402 of the Act, as amended, the EPA regulates storm water discharges from industrial and construction activities under the National Pollution Discharge Elimination System program (NPDES). Permits are required if discharge results in a reportable quantity for which notification is required (pursuant to 40 CFR 117.21, 40 CFR 302.6, or 40 CFR 110.6) or if the discharge contributes to a violation of a water quality standard. However, oil and gas activities have been exempt from NPDES permitting regulations in New Mexico.

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### **1.5.2 Clean Air Act**

The Clean Air Act of 1972, as amended (CAA; 42 USC 7401 et seq.), establishes national ambient air quality standards (NAAQS) to control air pollution. In New Mexico, the NMED has adopted most of the

CAA into the New Mexico Administrative Code (NMAC). The NMED issues construction and operating permits for air quality and enforces air quality regulations and permit conditions.

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### **1.5.3      *Endangered Species Act***

The Endangered Species Act of 1973 (ESA) [16 U.S.C. 1531 et. seq.] requires all federal departments and agencies to conserve species listed as threatened or endangered, and species listed as candidates for federal listing with the United States Fish and Wildlife Service (USFWS), or designated habitat. Under Section 7 of the Endangered ESA, all federal agencies are required to consult with the USFWS or National Marine Fisheries Service on all actions authorized, funded, or carried out by a federal agency that may affect listed species or designated critical habitat.

Consultation with the USFWS was conducted as part of the PRMP/FEIS to address the cumulative effects of RMP implementation (Consultation No. 2-22-01-1-389, Appendix M of the PRMP/FEIS). Water for drilling would be obtained from the permitted Manzanares Mesa Water Well #1R (SJ-193) and/or San Juan 29-6 Unit Water Well 1 Formation (SJ-192); no unaccounted-for water depletions within USFWS-listed fish habitat would occur. Therefore, there is no need for additional Section 7 consultation.

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### **1.5.4      *Archaeological Resources***

Section 106 of the National Historic Preservation Act of 1966 (NHPA), Section 3 of the Native American Graves Protection and Repatriation Act (NAGPRA), and the Archaeological Resources Protection Act (ARPA) provide for protection of historical resources, including cultural and religious properties. NHPA provides protection for sites eligible for listing in the National Register of historic places through federal agency oversight, independent of land ownership when construction, operation, and reclamation of the infrastructure is located on Federal and non-Federal land that does constitute a Federal action. NAGPRA provides ownership disposition of Native American resources intentionally excavated or inadvertently discovered on Federal or tribal lands. ARPA provides protection of archaeological resources over 100 years old on Federal and tribal lands, in the event they are discovered.

Section 106 of the National Historic Preservation Act of 1966 (NHPA; 16 USC 470) requires federal agencies to take into account the effects of their actions on historic properties, and allow the Advisory Council on Historic Preservation a reasonable opportunity to comment. Compliance with the requirements of the NHPA is met by following the 2014 Protocol Agreement between the New Mexico BLM and New Mexico State Historic Preservation Officer, which is authorized by the Programmatic Agreement among the BLM, the Advisory Council on Historic Preservation, and the National Conference of State Historic Preservation Officers (2012).

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### **1.5.5      *Paleontological Resources***

Fossils found on BLM-managed lands are considered part of our national heritage and afforded protection. The BLM manages fossil resources for their scientific, educational, and recreational values. On public lands paleontological resources are managed under authorities and policy's that govern the management and preservation of the resource. Paleontological resources are managed under numerous authorities including the BLM Field Office 2003 Resource Management Plan (BLM 2003b, 4-117), Paleontological Resources Preservation Act of 2009 (Sections 6301-6312 of the Omnibus Public Lands Act of 2009, 16 USC 470aaa), Federal Land Policy and Management Act of 1976 (P.L. 94-579), National Environmental Policy Act of 1969 (P.O. 91-190), Potential Fossil Yield Classification System for Paleontological Resources on Public Lands (IM 2008-009), and the Assessment and Mitigation of Potential Impacts to Paleontological Resources (IM 2009-011). The authorities provide for civil and criminal penalties and also require that public lands be managed to preserve and protect the quality of scientific values of paleontological resources.

The BLM FFO recognized eight Paleontological Special Designated Areas (SDA) in the current Resource Management Plan (more than 135,000 acres) in order to preserve important paleontological resources for scientific study, protection, and other public benefits (BLM 2003b, 4-117). The BLM has determined that

these areas require special management attention in order to protect, and prevent irreparable damage to important paleontological resources. The project is not located within any of these areas.

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### **1.5.6 Wastes, Hazardous or Solid**

The Resource Conservation and Recovery Act [(42 U.S.C.) § 6926, et. seq.] (RCRA) provides Federal authority to control hazardous wastes, including the generation, transportation, treatment, storage, and disposal of hazardous waste. It also sets forth a framework for the management of non-hazardous wastes and control of underground storage of petroleum or other hazardous materials and provides authority for state hazardous waste programs under §3006 of the Act. A 1980, amendment to RCRA conditionally exempted from regulation as hazardous wastes, “drilling fluids, production waters, and other wastes associated with the exploration, development, or production of crude oil or natural gas. On July 6, 1988, EPA determined that oil and gas exploration, development and production (ED&P) wastes would not be regulated as hazardous wastes under RCRA. A simple rule of thumb was developed for determining if an ED&P waste is likely to be considered exempt or non-exempt from RCRA regulations: If (1) the waste came from down-hole, or (2) the waste was generated by contact with the oil and gas production stream during removal of produced water or other contaminants, the waste is most likely to be considered exempt by EPA.

The Comprehensive Environmental Response Compensation and Liability Act [(42 U.S.C.) §9601, et seq.] (CERCLA) provides Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment and provides for liability of persons responsible for releases of hazardous waste. Despite many oil and gas constituent wastes being exempt from hazardous waste regulations, certain RCRA exempt contaminants could be subject to regulations as hazardous substances under CERCLA. The New Mexico the Oil Conservation Division (OCD) administers hazardous waste regulations for oil and gas activities in New Mexico.

All wastes would be disposed of in a proper manner as required by federal and state law, and as described in the Conditions of Approval (COAs). No hazardous or solid waste materials are present within the analysis area. The notification of releases such as natural gas, natural gas liquids, and petroleum, outside a facility site is required under CERCLA and under BLM NTL-3A.

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### **1.5.7 Public Health and Safety**

All worker safety is governed by Occupational Safety and Health Administration (OSHA) safety laws and regulations. Worker safety incidents must also be reported to the BLM under the procedures of Notice to Lessee (NTL)-3A. Pipeline safety regulations are administered by OSHA as well as Department of Transportation (DOT) regulations. Pipeline safety regulations (49 CFR Parts 190 and 192) govern design, construction and operation of gas transmission lines. Any incidents involving DOT-regulated pipelines must be reported under these regulations.

Most substances and wastes generated at oil and gas facilities are exempt from regulation under the Resource Conservation and Recovery Act (1976). The Environmental Protection Agency (EPA) and DOT regulate materials associated with well construction and production activities that are classified as hazardous. When significant amounts of chemicals are stored on-site, governmental agencies will be notified as required under the Emergency Planning and Community Right to Know Act (1986). The notification of releases such as natural gas, natural gas liquids, and petroleum, outside the facility site is required under the Comprehensive Environmental Response Compensation and Liability Act, 1980 (CERCLA) and under BLM NTL-3A. The well locations must have an informational sign, as directed under 43 CFR 3160.

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### **1.5.8 New Mexico State Regulations**

The New Mexico Oil Conservation Division (NMOCD), which is in the New Mexico Energy, Minerals, and Natural Resources Department (EMNRD), regulates oil and gas operations in New Mexico. The NMOCD has the responsibility of gathering production data, permitting new wells, establishing pool rules and allowables, issuing discharge permits, enforcing rules and regulations, monitoring underground injection wells, ensuring that abandoned wells are properly plugged, and ensuring that the land is responsibly

restored. Oil and gas regulations administered by NMOCD are contained in NMAC 19.15. These regulations include the following, with which WPX 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.

## **1.6. Scoping, Public Involvement, and Issues**

### **1.6.1. Scoping and Public Involvement**

Since the beginning of discussions involving development of the Rosa Unit, the BLM/FFO has made extensive efforts to meet early and often to focus the issues, advertised to inform the public, conducted outreach to groups including environmental organizations, and encouraged a diverse group to become involved in the process. Initial discussion included development on both the Middle Mesa portion and the Rosa Mesa portion of the Rosa Unit. These discussions involved the Rosa Mule Deer Study being addressed in this EA, as well as the Middle Mesa POD previously addressed in the DOI-BLM-NM-F010-2011-254-EA (BLM 2011f). Between October 10, 2010, and June 14, 2011, the BLM/FFO held several meetings with the applicant and other consulting agencies such as the NMOCD, New Mexico Game and Fish Department (NMGFD), the U.S. Forest Service Carson National Forest, and other parties to discuss WPX’s proposed development of the area.

In May 2011, a steering committee made up of wildlife biologists from the US Forest Service, Southern Ute Wildlife Division, U. S. Geographic Information Survey (USGS), New Mexico Department of Game and Fish (NMDGF), New Mexico State University, New Mexico Sportsmen for Fish and Wildlife, BLM, and others was organized to help identify issues and make recommendations to BLM regarding future studies to assess impacts to wildlife from probable development on the east side of Navajo Reservoir. The steering committee met four times from May 10, 2011 to September 1, 2011.

A mule deer habitat survey report was completed in March 2011 for the Middle Mesa Rosa Unit by Tierra Natural Resource Consulting to provide a qualitative evaluation of big game use in the vicinity of eight potential horizontal well locations within the Middle Mesa SDA. The report concluded the low number of pellet groups encountered in the survey plots does not indicate wide spread use of the survey area by a dense concentration of mule deer or elk. The field evidence observed did not indicate that the area covered during the survey has supported a large wintering population of deer or elk for at least the prior 2 or 3 winters (Ramakka, 2011). As a result of this field survey, the Steering Committee discussed and agreed that there was no need to conduct a study on the Middle Mesa side based on Middle Mesa wildlife densities not supporting a study. The Steering Committee focused their efforts on the Rosa Mesa area and recommended a research project within the Rosa Mesa Wildlife SDA east of Navajo Reservoir.

A peer review of the recommendation from the Steering Committee was conducted by the NMDGF and assisted the BLM in making a final recommendation for a future study to help provide quantitative information for future development and NEPA analysis. Draft study proposal’s were received by two consulting firms. WEST was contracted to conduct the Rosa Mule Deer Study in November 2011. Forty-two mule deer does were captured between December 15-22, 2011 and fitted store-on-board GPS collars (See Appendix B).

EA No. NM-210-2008-490: *Environmental Assessment of the Criteria and impacts of Granting Exceptions to the Seasonal Closure Periods in Designated Wildlife* (FONSI/DR signed 11/03/2008) eliminated exceptions in Rosa SDA north of La Jara Wash. This decision was presented as Plan Maintenance not a Plan Amendment. Additionally, IM2008-032 *Exceptions, Waivers, and Modifications of Fluid Minerals Stipulations and Conditions of Approval, and Associated Rights-of Way Terms and Conditions* (dated 11/27/2007) allows exception, waiver or modification of COAs if provided for in the permit/grant requirements or an environmental decision. In accordance with 43 CFR 3101.1-4 “An exception, waiver,

or modification may not be approved unless 1) the authorized officer determines that the factors leading to its inclusion in the lease have changed sufficiently to make the protection provided by the stipulation no longer justified: or 2) the proposed operations would not cause unacceptable impacts.” Under the IM2008-032 “exceptions, waivers, and modifications may also be granted when the authorized officer determines that impacts will be acceptable.” Determination depends on case-by-case environmental review.

The BLM-FFO publishes a NEPA log for public inspection. This log contains a list of proposed and approved actions within the BLM-FFO. The log is located on the BLM's New Mexico website ([http://www.blm.gov/nm/st/en/prog/planning/nepa\\_logs.html](http://www.blm.gov/nm/st/en/prog/planning/nepa_logs.html)).

Between January 20, 2015 and November 10, 2015 the BLM/FFO, the applicant, and an environmental consultant [Energy Inspection Services LLC. (EIS)] met four times to discuss the application process and NEPA analysis appropriate for a modification request for winter drilling and completions in the Rosa Unit for purposes of the Rosa Mule Deer Study. The proposed action was presented to the BLM Interdisciplinary Team on September 21, 2015.

An on-site meeting for the Rosa UT 27 and Rosa UT 29 Development Project was held at the proposed project location on January 7, 2015 and again on March 11, 2015. Attendees at the on-site meetings included WPX, BLM-FFO representatives, New Mexico OCD representative, the dirt work contractor, the project surveyor, an archeological consultant, and an environmental consultant (EIS, LLC.). A public invitation to the on-site meeting was posted online ([http://www.blm.gov/nm/st/en/fo/Farmington\\_Field\\_Office/ffo\\_oil\\_and\\_gas/ffo\\_onsites.html](http://www.blm.gov/nm/st/en/fo/Farmington_Field_Office/ffo_oil_and_gas/ffo_onsites.html)); no private citizens or groups attended. At the aforementioned meetings, potential issues of concern were identified by the BLM-FFO and EIS.

Based on the proposed action being within a BLM-FFO Special Designated Area (SDA) this EA will be posted for a 30 day public comment period.

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## 1.6.2. Issues

### Issues Analyzed

The following issues were identified during internal scoping as potential issues of concern for the proposed action. These issues will be addressed in this EA.

- How would dust and equipment emissions associated with the proposed project impact air resources?
- How would vegetation-clearing, proposed project activities, and final reclamation associated with the proposed project impact upland vegetation
- How would vegetation-clearing, proposed project activities, and final reclamation associated with the proposed project impact the introduction of noxious weeds?
- How would vegetation-clearing, proposed project activities, and final reclamation impact wildlife, including migratory birds?
- How would vegetation-clearing, proposed project activities, and final reclamation impact the following BLM Special Status Species (SSS): Bendire's thrasher (*Toxostoma bendirei*), ferruginous hawk (*Buteo regalis*), golden eagle (*Aquila chrysaetos*), bald eagle (*Haliaeetus leucocephalus*), pinyon jay (*Gymnorhinus cyanocephalus*), and prairie falcon (*Falco mexicanus*)?
- How would surface-disturbing activities associated with construction of the proposed project impact cultural resources?

### Issues Considered but not Analyzed

The following issues were identified during scoping as issues of concern that would not be impacted by the proposed action or that have been covered by prior environmental review. These issues will not be analyzed in this EA.

## ***U.S. Fish and Wildlife Service (USFWS)-Listed Species***

As noted previously, cumulative effects of the RMP to federally listed species and their associated habitats were addressed in the PRMP/FEIS. Based on a review of species currently listed by the USFWS as occurring in Rio Arriba County (USFWS 2015), as well as the location of the proposed project area and habitat within the proposed project area, the potential does not exist for USFWS-listed species to occur within the proposed project area (refer to Biological Survey Report [BSR] in Appendix B of the DOI-BLM-NM-F010-15-0103-EA [BLM 2015]). Water for drilling would be obtained from the permitted Manzanares Mesa Water Well #1R (SJ-193) and/or San Juan 29-6 Unit Water Well 1 Formation (SJ-192); no unaccounted-for water depletions within USFWS-listed fish habitat would occur. Therefore, there is no need for additional Section 7 consultation.

## ***Native American Religious Concerns***

Native American Religious Concerns for the current Proposed Action have been previously analyzed in DOI-BLM-NM-F010-15-0103-EA [BLM 2015]. No discoveries were made during associated construction and no new information has come forth. As long as activity is confined to the currently established facilities the Proposed Action will have no direct or indirect impacts on remains that fall within the purview of the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA; 25 USC 3001) or the Archaeological Resources Protection Act (ARPA; 16 USC 470). The proposed action would not interfere any known TCPs, prevent access to sacred sites, prevent the possession of sacred objects, or interfere with or hinder the performance of traditional ceremonies and rituals pursuant to the American Indian Religious Freedom Act of 1978 (AIRFA; 42 USC 1996) or Executive Order (EO) 13007. Any new facilities will be subject to a separate site specific analysis.

## ***Areas of Critical Environmental Concern (ACECs)***

The nearest Bald Eagle ACEC to the proposed project is the San Juan #4 Bald Eagle ACEC and it is located approximately 2.8 miles west.

## ***Groundwater***

Stimulation (i.e., hydraulic fracturing or “fracking”) is a process used to maximize the extraction of underground resources by allowing oil or natural gas to move more freely from the rock pores to production wells that bring the oil or gas to the surface. Fluids, commonly made up of water (99 percent) and chemical additives (1 percent), are pumped into a geologic formation at high pressure during hydraulic fracturing (USEPA 2004). Chemicals added to stimulation fluids may include friction reducers, surfactants, gelling agents, scale inhibitors, acids, corrosion inhibitors, antibacterial agents, and clay stabilizers. When the fracking pressure exceeds the rock strength, the fluids open or enlarge fractures that typically extend several hundred feet away from the well bore, and may occasionally extend up to 1,000 feet from the well bore. After the fractures are created, a propping agent (usually sand) is pumped into the fractures to keep them from closing when the pumping pressure is released. After fracturing is completed, a portion of the injected fracturing fluids returns to the wellbore and is recovered for future fracturing operations (USEPA 2004) or disposal. Stimulation techniques have been used in the United States since 1949 and in the San Juan Basin since the 1950s. Over the last 10 years, advances in multi-stage and multi-zone hydraulic fracturing have allowed development of gas fields that previously were uneconomic, including the San Juan Basin.

Hydraulic fracturing is a common process in the San Juan Basin and applied to nearly all wells drilled. The producing zone targeted by the proposed action is well below any underground sources of drinking water. The Mancos Shale formation is also overlain by a continuous confining layer. The geological confining layer is the Lewis Shale formation that is located above both the Mancos Shale and Mesaverde formations and provides an impermeable layer that isolates the Mancos Shale and Mesaverde formations from both identified sources of drinking water and surface water. On average, total depth of the proposed well bore would be about 5,000 feet below the ground surface. Fracturing in the Basin Mancos formation is not expected to occur above depths of 4,000 feet below the ground surface. Fracturing could possibly extend into the Mesaverde formation overlying the Basin Mancos; however, the formation has not been identified as an underground source of drinking water based on its depth and relative high levels of TDS.

No impacts to surface water or freshwater-bearing groundwater aquifers are expected to occur from hydraulic fracturing of this proposed well.

### ***Recreation***

The project area is not within a BLM SMA managed for recreation. The nearest BLM recreation SMA is Carracas Mesa (Bancos #4), located approximately 2.5 miles north. The Rosa Unit is located within New Mexico Department of Game and Fish management unit 2B. Unit 2B is a relatively popular big game hunting area and currently includes 2 hunts that occur during the current winter closure. Impacts to recreation were not carried forward because activities associated with the permitted drilling will not expand on the area of impact, will not affect hunting access and will not reduce or affect huntable acreage within the hunt unit.

### ***Public Health and Safety***

Worker safety is regulated under the Occupational Safety and Health Act of 1970, as amended (29 USC 651). The proposed project area is fairly remote. The nearest town, Navajo Dam, is approximately 12.5 miles as a crow flies and 44 road miles to the southwest. State Highway 527 (Simms Hwy) is located approximately 14.15 road miles to the south. The project area is not within a BLM SMA managed for recreation. The nearest BLM recreation SMA is Carracas Mesa (Bancos #4), located approximately 2.5 miles north. There are no residences within a mile of the proposed project. The proposed project would not contribute additional impacts beyond that which would occur for drilling operations outside the winter closure time period and, as such, were not carried forward.

### ***Livestock Grazing and Wild Horses***

The proposed project would not result in ground disturbance. Therefore, impacts to livestock grazing or wild horses were not carried forward because the proposed action would not change the forage loss to a significant level for analysis.

### ***Cultural Resources***

The locations for the current Proposed Action have been previously inspected for cultural resources and were previously analyzed in DOI-BLM-NM-F010-15-0103-EA [BLM 2015]. No discoveries were made during associated construction. All conditions of approval pertaining to the protection and avoidance of cultural resources with the previously analyzed Proposed Action remain in force. As long as activity is confined to the currently established facilities the Proposed Action will have no direct or indirect impacts on historic properties (no historic properties affected). Any new facilities will be subject to a separate site specific analysis.

## **1.7. Alternative A: No Action**

Under the No Action Alternative, exceptions to the Winter Closure COA for the Rosa Mesa Wildlife SDA, allowing drilling and/or completion activities of WPX wells within the vicinity of, and occurring concurrently with, the ongoing Rosa Mule Deer Study would not be approved. The proposed wells would not be drilled or completed during the Winter Closure and data would not be collected that may elucidate impacts to mule deer from winter drilling and completion activities during mule deer migration and wintering. Current land and resource uses would continue to occur in the proposed project area. Results and conclusions of the Rosa Mule Deer Study would only provide baseline data and would not address potential effects of drilling and completion on mule deer migration and winter use.

## **1.8. Alternative B: Proposed Action**

The proposed action is the approval of an exception to the Winter Closure COA for the Rosa Mesa Wildlife SDA, allowing drilling and/or completion activities of WPX wells within the vicinity of, and occurring concurrently with, the ongoing Rosa Mule Deer Study for the purpose of supporting the Study

as planned by the BLM-FFO, NMDGF, WEST, and the Steering Committee. These wells include, but are not limited to, the wells located on the Rosa UT 27 and Rosa UT 29 multi-well well pads, as well as those located on future WPX proposed well pads within the Rosa Mesa Wildlife SDA provided the research is still being conducted. The wells from Rosa UT 27 and Rosa UT 29 well pads were previously authorized and constructed under approved APD's. These wells will develop Federal minerals in the Basin Mancos Pool of the Mancos Shale Formation from surface locations positioned on surfaces managed by the BLM-FFO. The two existing well pads, along with their associated well pad construction zones, access road, pipeline corridors, and established water management and cuttings disposal system were constructed in 2015 prior to the Winter Closure. Construction plats of associated facilities can be found in Appendix C of the DOI-BLM-NM-F010-15-0103-EA (BLM 2015).

During the proposed drilling and completion activities within the Winter Closure, data designed to identify the habitat selection patterns and migration routes from 42 collared mule deer would be collected. The data collected during these activities can then be compared to the baseline data collected from the same animals during years 2011-2015, such that potential effects of winter drilling and completion on mule deer distribution or migration could be evaluated. The requested exception would allow WPX to drill with one rig and/or complete wells during the Winter Closure so long as the Rosa Mule Deer Study continues.

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### **1.8.1. Location of Proposed Project Area**

Maps of the proposed wells to be drilled and/or completed on Rosa UT 27 and Rosa UT 29 are provided in Appendix A. The proposed project area is plotted on the Bancos Mesa NW, New Mexico and Gomez Ranch, New Mexico, 7.5-minute USGS quadrangle and the 2011 New Mexico Resource Geographic Information System Program aerial photograph.

The locations of the well pads currently proposed for winter drilling and completion activities are east of Navajo Reservoir and within the Laguna Seca Draw basin. The terrain within this general area is characterized by rolling hillsides with sandstone outcrops and mesas. Specifically, the proposed project area sits at an elevation ranging from approximately 6,223 feet above mean sea level (AMSL) to 6,372 feet AMSL. The Project lies within the HUC10 - Lower Los Piños River watershed. The proposed project area is located within the headwaters and main drainage of Laguna Seca Draw among gently rolling hills with gradual slopes. The principle surface geological formation underlying the proposed project area is the San Jose Formation.

Legal land description of the well pads and associated facilities for the currently proposed wells are provided in Table 2, below.

**Table 2. Legal Land Description for the Proposed Project**

<b>Township, Range</b>	<b>Section</b>	<b>Project Feature</b>
Township 31 North, Range 5 West	19	Rosa UT 27 Pad, Access Road, Surface Waterlines, Section 30 Recycling Containment
	30	Section 30 Recycling Containment, Surface Waterlines
Township 31 North, Range 6 West	23	Section 23 Cuttings Disposal, Access Road
	25	Rosa UT 29 Pad, Surface Waterlines, Section 25 Recycling Containment

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### **1.8.2. Description of Proposed Project**

For a detailed description of design features and construction practices associated with the existing Rosa UT 27 and Rosa UT 29 Development Project, refer to the APDs on file at the BLM-FFO and DOI-BLM-NM-F010-15-0103-EA (BLM 2015). Construction plats associated with these APD's provide additional details.

## **Design Features and Best Management Practices**

WPX would adhere to the Conditions of Approval (COAs) attached to the approved modification/exception request. The following general design features and best management practices (BMPs) have and would continue to occur for the Rosa UT 27 and Rosa UT 29 Development Project.

### ***Control of Waste***

- Drilling of the horizontal laterals will be accomplished with water-based mud. All cuttings will be placed in roll-off bins and hauled to Section 23 cuttings disposal. No blow pit will be used.
- If oil-based mud drilling is used, a closed-loop system will be used to minimize potential impacts to surface and groundwater quality. A 30-mil reinforced liner will be placed under the drill rig mats and all drilling machinery. This area will be enclosed by a containment berm and ditches, which will drain to sump areas for spill prevention and control. The containment berm will be ramped to allow access to the solids control area. The cuttings from oil-based drilling will be hauled to an approved disposal facility.
- Storage tanks will be sized to ensure confinement of all fluids and will provide sufficient freeboard to prevent uncontrolled releases.
- Drilling fluids will be stored on-site in aboveground storage tanks. Upon termination of drilling operations, the drilling fluids will be recycled and transferred to other permitted closed-loop systems or returned to the vendor for reuse, as practical. All residual fluids will be hauled to a commercial disposal facility.
- Green completion technology will be used.
- Any spills of non-freshwater fluids will be immediately cleaned up and removed to an approved disposal site.
- Portable toilets will be provided and maintained during construction, as needed.
- Garbage, trash, and other waste materials will be collected in a portable, self-contained, and fully enclosed trash container during drilling and completion operations. The accumulated trash will be removed, as needed, and will be disposed of at an authorized sanitary landfill. No trash will be buried or burned on location.
- Immediately after removal of the drilling and completion rigs, all debris and other waste materials not contained in the trash container will be cleaned up and removed from the well location.
- No chemicals subject to reporting under the Superfund Amendments and Reauthorization Act Title III in an amount equal to or greater than 10,000 pounds will be used, produced, stored, transported, or disposed annually in association with the drilling, testing, or completing of these wells.
- No extremely hazardous substances (as defined in 40 CFR 355) in threshold planning quantities will be used, produced, stored, transported, or disposed in association with the drilling, testing, or completing of these wells.
- Berms will be constructed around all storage facilities sufficient in size to contain the storage capacity of tanks. Berm walls will be compacted with appropriate equipment to assure containment.

### ***Protection of Paleontological Resources***

- If a paleontological site is discovered, the BLM would be notified and the site would be avoided by personnel, personal vehicles, and company equipment. Workers would be informed that it is illegal to collect, damage, or disturb some such resources, and that such activities are punishable by criminal and/or administrative penalties.

### ***Protection of Cultural Resources***

- All BLM/FFO cultural resources stipulations will be followed as indicated in the Cultural Resource Records of Review that is attached to the COAs in the APDs as the case may be. These stipulations may include, but are not limited to temporary or permanent fencing or other physical barriers, monitoring of earth-disturbing construction, reduction and/or specific construction avoidance zones, and employee education. All employees, contractors, and sub-contractors of the project will be informed by the project proponent that cultural sites are to be avoided by all personnel, personal vehicles, and company equipment. All employees, contractors, and sub-contractors of the project will 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. In the event of a discovery during construction, the project proponent will immediately stop all construction activities in the immediate vicinity of the discovery and then immediately notify the archaeological monitor, if present, or the BLM. The BLM will 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 will be protected in place until mitigating measures can be developed and implemented according to guidelines set by the BLM.

### ***Protection of Flora and Fauna, including SSS, Livestock, and Wild Horses***

- Construction activities will not take place during the Rosa Mesa Wildlife SDA seasonal timing limitation.
- Horizontal drilling of multiple wells from one well pad will minimize the amount of surface disturbance, fugitive dust, and emissions.
- The drilling rig will use natural gas-powered engines and is self-moving between well bores (i.e., does not require multiple trucks or other vehicles to move between well bores drilled on the same pad). Use of natural gas-powered engines will result in less air and noise emissions.
- Recycling containments and surface waterlines have been constructed to minimize truck traffic from hauling of water.
- The cuttings disposal has been constructed to minimize truck traffic from hauling the cuttings and have been strategically placed within exhausted rock quarry pits to reduce surface disturbance and to assist in the reclamation of these pits to near original contours.
- Produced water will be used for well stimulation and will be recycled (i.e., any flowback would be pumped back to the recycling containment, filtered, and used in subsequent stimulations).
- Surface waterlines from the recycling containment would be temporarily located in or adjacent to existing roads or ROWs. 24-inch culverts would be installed and utilized for all road crossing.
- Surface waterlines would only be installed where needed and would not exceed more than two (2) 5.5-inch high-pressure, heavy walled steel pipeline and three (3) 12-inch heavy duty lay flat lines within one corridor at a time.
- In areas where surface waterlines traverse a side hill or steep slope they will be secured with t-post. The 12-inch heavy duty lay flat lines will have a joint every 660 feet and a 6 ft. by 10 ft. containment will be placed under each connection. All lines in service will be inspected every day, several times a day.
- Jersey barriers would be set on the Rosa Unit #204A during staging to exclude equipment and potential disturbance to the reclaimed area, while allowing use of the existing road and working area.
- The recycling containments and cuttings disposals would be in compliance with NMOCD Rule 17

- The recycling containments is lined with a 45-mil LLDPE primary (upper) liner and a 30-mil LLDPE secondary (lower) liner with a leak detection system between the upper and lower geomembrane liners.
- The leak detection system contains a 200-mil Hypernet drainage material between the primary and secondary liner that is sufficiently permeable to allow the transport of fluids to the drainage pipes and observation ports. When the holding pond contains fluid, the liners will be inspected daily.
- The holding pond is netted with extruded polypropylene netting (3 ½ cm sized mesh). It will be supported by a system of perimeter and interior support poles and cables specifically designed to each individual pond for the purpose of excluding birds, bats and other small mammals. The entire perimeter of the netting enclosure will have a 2-foot net overhang on the ground to prevent small animals from entering the enclosure. The support cable used along the perimeter and interior of the enclosure consists of ¼" 7 x 19 galvanized aircraft cable. The netting is woven to the perimeter cable with a 2.5 mm poly wire. The netting enclosure will be secured at ground level with a 4mm corrosion resistant poly wire. The netting enclosure will include double gates for access into the holding pond when needed. Appendix F of the DOI-BLM-NM-F010-15-0103-EA (BLM 2015) further describes and illustrates the netting enclosure that will be implemented and how it will be constructed.
- The outer perimeter of the recycling containment is fenced to exclude wildlife, livestock, and wild horses. The game fence is 8 feet tall. It consists of woven wire fencing and two strands of 12½ GA barbed wire at the top and bottom. The first strand of barbed wire was strung 2 inches from ground surface. The bottom of the woven wire was placed 2 inches above the first strand of barbed wire. Two levels of woven wire fencing fabric, overlapping each other by 3 inches and totaling 7 feet 6 inches in height were stapled to the wooden posts. A second strand of barbed wire was strung 1 inch from the top of the woven wire. Two wooden stays were stapled to the woven wire at 5-foot, 4-inch intervals between wooden posts. Refer to Appendix G – Game Fence Detail of the DOI-BLM-NM-F010-15-0103-EA (BLM 2015) for specific construction and material details.
- When in use, recycling containments would be inspected on a daily basis.
- The recycling containments would be entirely reclaimed following completion of stimulation activities for all planned wells utilizing that containment.
- Vegetation removed during construction, including trees that measure less than 3 inches in diameter (at ground level) and slash/brush, will be chipped or mulched and incorporated into the topsoil as additional organic matter. If trees are present, all trees 3 inches in diameter or greater (at ground level) will be cut to ground level and delimbed. Tree trunks (left whole) and cut limbs will be stacked. The subsurface portion of trees (tree stumps) will be hauled to an approved disposal facility.
- A migratory bird nest survey will be conducted if any vegetation-disturbing activities greater than 4 acres in size occur between May 15 and July 31. The survey must be conducted by a BLM-approved biologist using a survey protocol developed and provided by the BLM/FFO. If active nests are located within the proposed permitted area, project activities will not be permitted without written approval by a BLM/FFO biologist.
- Should any active raptor nests be observed within one-third mile of the proposed project area or should any SSS (listed by the USFWS or BLM) be observed within the proposed project area prior to or during project implementation, construction would cease and the BLM-FFO would be immediately contacted. The BLM-FFO would then ensure evaluation of the resource. Should a discovery be evaluated as significant (protected under the ESA, etc.), it would be protected in place until mitigation could be developed and implemented according to guidelines set by the BLM.
- Wildlife hazards associated with the proposed project would be netted, fenced, covered, and/or contained in storage tanks, as necessary.

- Grazing permittees will be notified when construction is scheduled to begin. All hazards to livestock and wild horses will be fenced or contained.
- All existing improvements (such as fences, gates, and bar ditches) will be repaired to previous or better than pre-construction conditions. Cut fences will be tied to H-braces prior to cutting and openings will be protected as necessary during construction to prevent the escape of livestock. A temporary closure will be installed the same day the fence is cut. Following reclamation, the fence will be reconstructed to BLM specifications.
- Backfilling operations will be performed within a reasonable amount of time to ensure that the trenches are not left open for more than 24 hours. If a trench is left open overnight, it will be temporarily fenced or a night watchman will be utilized. The excavated soils will be returned to the trenches, atop the pipe, and compacted to prevent subsidence. The trenches will be compacted after approximately 2 feet of fill is placed over the pipe and after the ground surface has been leveled.
- Escape ramps/crossovers will be constructed every 1,320 feet. The ends of the open trench will be sloped each night with a 4:1 slope.
- Established livestock, wild horse, and wildlife trails will be left in place as crossovers. In areas where active grazing is taking place, escape ramps/crossovers will be placed every 500 feet. Crossovers will be a minimum of 10 feet wide and not fenced.
- The end of the pipe will be plugged to prevent animals from crawling in.
- Before the trench is closed, it will be inspected for animals. Any trapped wildlife, livestock, or wild horses will be promptly removed and released at least 150 yards from the trench.
- Production equipment will be placed on location in such a manner to minimize long-term disturbance and maximize interim reclamation. As practical, access will be provided by a teardrop-shaped road through the production area so that the center may be revegetated.

### ***Protection of Topsoil***

- The upper 6 inches of topsoil (if available) will be stripped following vegetation and site clearing. Topsoil will not be mixed with the underlying subsoil horizons and will be stockpiled as a berm along the perimeter of the well pad within the construction zone, separate from subsoil or other excavated material.
- Topsoil and sub-surface soils will be replaced in the proper order, prior to final seedbed preparation. Spreading shall not be done when the ground or topsoil is wet. Vehicle/equipment traffic will not be allowed to cross topsoil stockpiles. If topsoil is stored for a length of time such that nutrients are depleted from the topsoil, amendments will be added to the topsoil as advised by the WPX environmental scientist or appropriate agent/contractor.

### ***Protection of the Public***

- The hauling of equipment and materials on public roads would comply with Department of Transportation regulations. No toxic substances would be stored or used within the proposed project area. WPX would have inspectors present during construction. Any accidents involving persons or property would immediately be reported to the BLM-FFO. WPX would notify the public of potential hazards by posting signage, as necessary.

### ***Prevention and Control of Weeds***

- Prior to construction equipment entering the proposed project area, construction equipment would be inspected for noxious weeds and cleaned.

- It will be the operator's responsibility to monitor, control, and eradicate all noxious weed species within the permitted area throughout the life of the proposed project. The operator will contact the BLM/FFO regarding acceptable weed-control methods. If the operator does not hold a current Pesticide Use Permit, a Pesticide Use Permit will be submitted prior to pesticide application. Only pesticides authorized for use on BLM lands will be used. The use of pesticides will comply with federal and state laws. Pesticides will be used only in accordance with their registered use and limitations. The operator will contact the BLM/FFO prior to using these chemicals.

### ***Protection of Air Resources***

- The BLM's regulatory jurisdiction over field production operations has resulted in the development of BMPs designed to reduce impacts to air quality by reducing all emissions from field production and operations. Typical measures could include flaring hydrocarbons and gases at high temperatures in order to reduce emissions of incomplete combustion, requiring that vapor recovery systems be maintained and functional in areas where petroleum liquids are stored, ensuring that compressor engines 300 horsepower or less have nitrogen oxide (NO<sub>x</sub>) emissions limited to 2 grams per horsepower hour, revegetating areas not required for production facilities to reduce the amount of dust, and watering dirt roads 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. Neither petroleum-based products nor produced water would be used.
- BMPs for dust abatement and erosion control will be utilized to reduce fugitive dust for the life of the project, as necessary. Water application, using a rear-spraying truck or other suitable means, will be the primary method of dust suppression along the road.

### ***Noise***

- Engines would be equipped with mufflers and barriers or other sound-proofing measures would be implemented, if needed, to meet the requirements of BLM Notice to Lessees and Operators on Onshore Oil and Gas Leases within the jurisdiction of the FFO NTL 04-2 FFO.

### ***Additional Design Features and BMPs***

- The Rosa UT 27 will be co-located with the Rosa Unit 204A.
- On Rosa UT 27 one 24-inch culvert will be placed where the proposed access road enters the well pad. One silt trap will be placed near the east end of the pad if needed upon reclamation.
- The Rosa UT 29 will be co-located with the Rosa Unit 165A and facilities will be placed on the existing 165A well pad. The existing access road will be re-routed to accommodate for the new wells and production equipment.
- On Rosa UT 29 one 24-inch culvert will be placed where the access road exits the new expansion portion of the well pad.
- The access road will be designed and constructed as a Resource Road in accordance with the BLM Gold Book Standards (BLM and USFS, 2007), BLM 9113-1 (Roads Design Handbook), and BLM 9113-2 (Roads National Inventory and Condition Assessment Guidance and Instructions Handbook). Construction will include ditching, draining, installing culverts, crowning and capping or sloping and dipping the roadbed, as necessary, to provide a well-constructed and safe road.
- Production facilities would be painted Juniper Green to blend with the natural color of the landscape and would be located to reasonably minimize visual impact, to the extent practical. Equipment subject to safety considerations would not be painted.

- Vehicles would be restricted to proposed disturbance areas and existing areas of surface disturbance, such as existing roads and well pads.
- 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.
- Worker safety incidents would be reported to the BLM-FFO as required under Notice to Lessees (NTL) -3A (USGS 1979). WPX would adhere to company safety policies, Occupational Safety and Health Administration regulations, and Department of Transportation regulations.

## Proposed Project Phases

### *Drilling and Completion*

Drilling operations would be conducted in compliance with Federal Oil and Gas Onshore Orders and all applicable NMOC rules and regulations. Upon approval of the modification request, a mobile drilling rig (“rig”) and other equipment would be transported to one of the proposed well pads, where components would be assembled and the rig derrick erected. Other facilities and equipment that would be on the drilling site include: pipe racks, catwalk, hopper, rig personnel camper trailers, closed loop mud system, and personnel vehicles. A typical rig move includes fourteen (14) truck loads and two (2) crane trucks to assemble the rig on location and takes approximately four (4) to five (5) days to complete.

Drilling would begin, continuing through any fresh water bearing formations, then halt. A “shoe” (i.e. a seal) would be landed at the bottom of the hole, a surface pipe (“surface casing”) would be installed from the surface down to the shoe, and then cement would be circulated between the rough wall of the well bore and the casing pipe (“annulus”). The casing would be pressure-tested to ensure that a seal has been created. Drilling would resume through several zones before reaching the target formation, or production zone. An intermediate casing would be installed and cemented in place through these zones in order to seal off any troublesome zones that may present problems in drilling deeper portions of the well. Drilling would resume, entering and continuing horizontally through the target formation to the bottom hole location. A production casing or “production liner” (shortened string of casing that suspends from the intermediate casing) will then be landed and cemented in place. Casings prevent interzonal interaction between oil and gas bearing zones and usable water zones and maintain the integrity of the bore. Drilling operations would continue 24-hours a day until complete. Drill cuttings would be hauled from the location and disposed of at an approved cuttings disposal.

Following drilling of a well, the drilling rig would move to the next well on the same well pad and a completion rig would take its place. Completions would be completed using a Coiled Tubing Unit. Completion and drilling may occur simultaneously on the same well pad. Perforations would be shot through the production string across the zone of the target formation, to prepare for hydraulic fracturing. Fracturing materials, tanks, and pumps would be stored on the location, at the Section 30 Recycling Containment, and staging areas at WPX’s Rosa Unit #183A, Rosa Unit #183B, Rosa Unit #204A, Rosa Unit #10B, Rosa Unit #212A, Rosa Unit #256, and Rosa Unit #165C. The coiled tubing unit would connect to the perforated casing and begin fracturing the target formations through the perforations using pressurized water, fracturing fluids, and sand (to hold created subsurface fractures open).

After completion, the fluids (water and fracturing fluids) would be removed from the well bore and a well head would be installed. Completion fluids would be allowed to flow back to the on-site tanks. Water from fracturing would be recycled and stored within storage tanks and the holding pond located at the Section 30 Recycling Containment for reuse (BLM, 2015). Drilling and completion activities may take approximately 30 days per well depending on the well.

It is estimated that 2,200 barrels of fresh water to drill and 295,000 barrels of recycled produced water for completions would be required for each well. Approximately 1,100 barrels of fresh water from drilling and 103,000 barrels of produced water from completions would be recovered for reuse. Water for drilling would be obtained from the San Juan Basin Water Haulers Association, who would retrieve and truck

their water the permitted Manzanares Mesa Water Well #1R, San Juan 29-6 Unit Water Well 1 Formation, and/or the La Jara Water Well. WPX would ensure that water would be obtained legally and that all required permits would be obtained prior to obtaining water.

WPX Energy proposes to utilize produced water gathered from existing wells and the permitted SWD #1 and SWD #2 Wells on Rosa Mesa for well stimulation. Water from wells on Rosa Mesa would be piped to storage tanks located within permitted TUA's and holding pond within the Section 30 Recycling Containment. This water would be piped through WPX's existing water gathering system in the area where infrastructure is available and trucked where infrastructure is not available. The produced water from existing wells would be utilized to conduct hydraulic fracturing. The use of produced water in drilling fluid is authorized under New Mexico State Regulation (NMAC 19.15.2.52). The water would be produced by existing wells in the Mesa Verde/Dakota and Fruitland coal formations, as well as produced water extracted from existing disposal wells that have been re-injected into the Entrada formation. Produced water would be filtered before entering the holding ponds. Produced water in the holding ponds may be treated or aerated to minimize bacteria growth. The chemicals are added to the pumped stimulation fluid with the equipment located on location or at the staging areas before being pumped to the well bore. Chemicals for fracturing would not be added to the holding pond.

Surface waterlines have been temporarily installed to transport water from the recycling containment to the well being completed for well stimulation. Simulation pumping would be conducted adjacent to the holding ponds and pumped to the individual wells. To recycle the produced water, waterlines would transfer flowback water back to the recycling containment. At that point, the flowback water would be filtered and returned to the holding ponds for reuse in subsequent stimulations. The aboveground stimulation and flowback lines would be installed in or adjacent to existing disturbance. The five temporary lines would be removed following all well stimulation activities.

Green completion technology would be used. Green completions take place during the flowback stage of the completion. The flowback involves removing the water necessary to stimulate the well. During this flowback, natural gas is produced with the water. What makes the well completion "green," or environmentally friendly, is that the gas is separated from the water and placed in a pipeline for sales instead of being released to the atmosphere.

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### **1.8.3.**

#### **Surface Disturbance**

The Project includes the horizontal drilling of multiple natural gas wells drilled from the Rosa UT 27 and Rosa UT 29 well pads, as well as potential future wells that may be proposed in the study area. Wells located on the Rosa UT 27 and Rosa UT 29 well pads and the associated infrastructure supporting them were previously approved and constructed under the Rosa UT 27 and 29 Development Project. Any future WPX proposed wells located on proposed well pads in proximity to the Rosa Deer Study would be evaluated on a case-by-case basis and the construction would be completed prior to Winter Closure. No surface disturbance would take place during the Winter Closure.

#### **1.9. Alternatives Considered but Eliminated from Detailed Study**

Aside from the "No-Action" alternative no other feasible alternatives that would result in significantly fewer impacts or any clear advantages over the proposed action.

## **2. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES**

### **2.1. Methodology**

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### **2.1.1. Direct and Indirect Impacts**

This section describes the environment that would be affected by implementation of the alternatives described in Chapter 2. Aspects of the affected environment described in this chapter focus on the relevant major resources or issues. Certain critical environmental components require analysis under BLM policy. These items are included above in Section 1.6.2.

Under the No Action alternative, current land and resource issues within the proposed project area would continue; there would be no new impacts from oil and gas development. The No Action alternative will serve as the baseline for comparing the environmental impacts of the analyzed alternatives, and will not be further evaluated in this EA (BLM 2008b).

For the purposes of this analysis, the proposed project area is considered the area where drilling and completion activities would occur, that is within the disturbance areas of the existing well pads, recycling containment, cuttings disposal, access roads, associated TUA's, and staging areas. Impacts to the action area are based on predicted trends and typical current land uses. Impacts are defined as either being direct or indirect. The existing environments within the action area are described in detail for each resource in the following sections. Potential environmental effects are identified; evaluated; and classified as (1) Positive, (2) Low, (3) Moderate, or (4) Significant in terms of magnitude and (1) short-term, moderate-term, or (3) long-term with respect to the temporal span. Effects were analyzed assuming Design Features and Best Management Practices listed in Section 2.2.2 are implemented to mitigate impacts. The analysis area will be a defined area with either a natural or human delineated boundary. Often, the analysis area is the watershed in which the action occurs. For some issues, the analysis area may be the grazing allotment or BLM-FFO management area.

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### **2.1.2. Cumulative Impacts**

A Reasonably Foreseeable Development scenario (RFD) was prepared for the FFO in October 2014 (Engler, et al., 2014). The RFD identified high, moderate, and low potential regions for oil development of the Mancos-Gallup Formation. Within the high potential region, full development would include 5 wells per section, resulting in 1,600 completions. Within the moderate potential region, full development would include one well per section, resulting in 330 completions. Within the low potential region, full development would include one well per township, resulting in 30 well completions. Additionally, the RFD predicted 2,000 gas wells could be development in the northeastern corner of the FFO.

The following methods and assumptions were used to predict the potential impact of the development predicted in the RFD.

#### **Past Oil and Gas Development**

Past oil and gas wells were identified using Ongard. Following interim reclamation, the average well pad size for past development is 0.75 acres per well pad.

#### **Present and Future Oil Development**

Based on previous development, it was assumed that development of the high potential region would involve the twinning of well pads. This is the placement of two or more wells on one well pad. The assumption for the analysis is that the development of a section would include two twinned well pads and one single well pad, resulting in three well pads for five wells. In the moderate and low potential regions, it was assumed that development would involve single well pads. The proposed action is located outside of and directly north of the delineated potential oil regions.

The average well pad size for a twinned well pad was assumed to be 500 feet by 530 feet, or 6.08 acres. An additional 0.6 acres was added to account for any associated road or pipeline development, resulting 6.68 acres of short-term disturbance. Following completion of the well, interim reclamation of the well pad and reclamation of any pipelines would occur, resulting in 1.5 acres of long-term disturbance.

The average well pad size for a single well pad was assumed to be 500 feet by 500 feet, or 5.74 acres. Again, an additional 0.6 acres was added to account for associated road or pipeline development, resulting in 6.34 acres of short-term disturbance. Following completion of the well, interim reclamation of the well pad and reclamation of any pipelines would occur, resulting in 1.5 acres of long-term disturbance.

The Random Point Tool in ArcMap was used to randomly assign points representing well pads and associated disturbance based on the RFD assumptions: five wells per section in the high potential region, one well per section in the moderate potential region, and one well per township in the low potential region. This allowed both long-term and short-term disturbance from oil development of the Mancos-Gallup Formation to be calculated for the analysis areas used in this EA.

## **Present and Future Gas Development**

The RFD predicted 2,000 wells could be developed in the gas prone area. The average well pad size was assumed to be 555 feet by 410 feet, or 5.22 acres. An additional 0.6 acres of disturbance was added to account for associated roads and pipelines, resulting in total disturbance of 5.82 acres. Following completion of the well, interim reclamation of the well pad and reclamation of any pipelines would occur, resulting in 1.5 acres of long-term disturbance.

The Random Point Tool in ArcMap was used to randomly assign points representing one well pad and associated disturbance. This allowed both long-term and short-term disturbance from gas development in the northeastern corner of the FFO to be calculated for the analysis areas used in this EA.

## **2.2. Air Resources**

### **2.2.1. Affected Environment**

The proposed wells are located in Rio Arriba County, New Mexico. Additional general information on air quality in the area is contained in Chapter 3 of the Farmington PRMP/FEIS. In addition, new information about greenhouse gases (GHGs) and their effects on national and global climate conditions has emerged since this document was prepared. On-going scientific research has identified the potential impacts of GHG emissions such as carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), water vapor, and several trace gases on global climate. Through complex interactions on a global scale, GHG emissions may cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia (along with corresponding variations in climatic conditions), industrialization and burning of fossil carbon sources have caused GHG concentrations to increase measurably, and may contribute to overall climatic changes, typically referred to as global warming.

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; (BLM, 2014a). This document summarizes the technical information related to air resources and climate change associated with oil and gas development and the methodology and assumptions used for analysis.

The Environmental Protection Agency (EPA) has the primary responsibility for regulating air quality, including six nationally regulated ambient air pollutants (criteria pollutants). These criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>), particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>), sulfur dioxide (SO<sub>2</sub>) and lead (Pb). EPA has established National Ambient Air Quality Standards (NAAQS) for criteria air pollutants. The NAAQS are protective of human health and the environment. EPA has approved New Mexico's State Implementation Plan and the state enforces state and federal air quality regulations on all public and private lands within the state, except for tribal lands and within Bernalillo County. Air quality is determined by atmospheric pollutants and chemistry, dispersion meteorology and terrain, and also includes applications of noise, smoke management, and visibility. Climate is the composite of generally prevailing weather conditions of a particular region throughout the year, averaged over a series of years. EPA has proposed or completed actions recently to implement Clean Air Act

requirements for greenhouse gas emissions. Climate has the potential to influence renewable and non-renewable resource management.

## Air Quality

### Criteria Air Pollutants

The Air Resources Technical Report describes the types of data used for description of the existing conditions of criteria pollutants, how the criteria pollutants are related to the activities involved in oil and gas development, and provides a table of current National and State standards. EPA's Green Book web page (U.S. Environmental Protection Agency, 2013) reports that all counties in the Farmington Field Office area are in attainment of all National Ambient Air Quality Standards (NAAQS) as defined by the Clean Air Act. The area is also in attainment of all state air quality standards (NMAAQS). *The current status of criteria pollutant levels in the Farmington Field Office are described below.*

“Design Values” are the concentrations of air pollution at a specific monitoring site that can be compared to the NAAQS. The 2012 design values for criteria pollutants are listed below in **Table**. There is no monitoring for CO and lead in San Juan County, but because the county is relatively rural, it is likely that these pollutants are not elevated. PM10 design concentrations are not available for San Juan County.

**Table 3. 2012 Criteria Pollutant Monitored Design Values in San Juan County**

Pollutant	2012 Design Concentration	Averaging Time	NAAQS	NMAAQS
O <sub>3</sub>	0.071 ppm	8-hour	0.075 ppm <sup>1</sup>	
NO <sub>2</sub>	13 ppb	Annual	53 ppb <sup>2</sup>	50 ppb
NO <sub>2</sub>	38 ppb	1-hour	100 ppb <sup>3</sup>	
PM <sub>2.5</sub>	4.7 µg/m <sup>3</sup>	Annual	12 µg/m <sup>3,4</sup>	60 µg/m <sup>3,6</sup>
PM <sub>2.5</sub>	14 µg/m <sup>3</sup>	24 hour	35 µg/m <sup>3,3</sup>	150 µg/m <sup>3,6</sup>
SO <sub>2</sub>	19 ppb	1-hour	75 ppb <sup>5</sup>	

Source: U.S. Environmental Protection Agency, 2014

<sup>1</sup> Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years

<sup>2</sup> Not to be exceeded during the year

<sup>3</sup> 98th percentile, averaged over 3 years

<sup>4</sup> Annual mean, averaged over 3 years

<sup>5</sup> 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years

<sup>6</sup> The NMAAQS is for Total Suspended Particulate (TSP)

In 2005, the EPA estimates that there was less than 0.01 ton per square mile of lead emitted in FFO counties, which is less than 2 tons total (U.S. Environmental Protection Agency, 2012). Lead emissions are not an issue in this area, and will not be discussed further.

Air quality in a given region can be measured by its Air Quality Index value. The air quality index (AQI) is reported according to a 500-point scale for each of the major criteria air pollutants, with the worst denominator determining the ranking. For example, if an area has a CO value of 132 on a given day and all other pollutants are below 50, the AQI for that day would be 132. The AQI scale breaks down into six categories: good (AQI<50), moderate (50-100), unhealthy for sensitive groups (100-150), unhealthy (>150), very unhealthy and hazardous. The AQI is a national index, the air quality rating and the associated level of health concern is the same everywhere in the country. The AQI is an important indicator for populations sensitive to air quality changes.

Mean AQI values for San Juan County were generally in the good range (AQI<50) in 2013 with 80% of the days in that range. The median AQI in 2013 was 42, which indicates “good” air quality. The maximum AQI in 2013 was 156, which is “unhealthy”.

Although the AQI in the region has reached the level considered unhealthy for sensitive groups on several days almost every year in the last decade, there are no patterns or trends to the occurrences (Table). On 8 days in the past decade, air quality has reached the level of “unhealthy” and on two days, air quality reached the level of “very unhealthy”. In 2009 and 2012, there were no days that were

“unhealthy for sensitive groups” or worse in air quality. In 2005 and 2013, there was one day that was “unhealthy” during each year. In 2010, there were five “unhealthy” days and two “very unhealthy days.”

**Table 4. Number of Days classified as “unhealthy for sensitive groups” (AQI 101-150) or worse**

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Days	3	6	9	18	1	0	12	9	0	1

Source: U.S. Environmental Protection Agency, 2013a

### **Hazardous Air Pollutants**

The Air Resources Technical Report discusses the relevance of hazardous air pollutants (HAPs) to oil and gas development and the particular HAPs that are regulated in relation to these activities (BLM, 2014a). The EPA conducts a periodic National Air Toxics Assessment (NATA) that quantifies HAP emissions by county in the U.S. The purpose of the NATA is to identify areas where HAP emissions result in high health risks and further emissions reduction strategies are necessary. A review of the results of the 2005 NATA shows that cancer, neurological and respiratory risks in San Juan County are generally lower than statewide and national levels as well as those for Bernalillo County where urban sources are concentrated in the Albuquerque area (U.S. Environmental Protection Agency, 2012).

### **Climate**

The analysis area is located in a semiarid climate regime typified by dry windy conditions and limited rainfall. Summer maximum temperatures are generally in the range of 80 or 90 degrees Fahrenheit (°F), and winter minimum temperatures are generally in the teens to 20s. Temperatures occasionally reach above 100°F in June and July and have dipped below zero in December and January. Precipitation is divided between summer thunderstorms associated with the southwest monsoon and winter snowfall as Pacific weather systems drop south into New Mexico. Table 51 shows climate normals for the 30-year period from 1981 to 2010 for the Farmington, New Mexico, area.

**Table 51. Climate Normals for the Farmington Area, 1981-2010**

Month	Average Temperature (°F <sup>(1)</sup> )	Average Maximum Temperature (°F)	Average Minimum Temperature (°F)	Average Precipitation (inches)
January	30.5	40.8	20.3	0.53
February	35.8	46.8	24.8	0.59
March	43.2	56.1	30.3	0.78
April	50.4	64.7	36.2	0.65
May	60.4	74.8	46.1	0.54
June	69.8	85.1	54.5	0.21
July	75.4	89.6	61.2	0.90
August	73.2	86.5	59.8	1.26
September	65.4	79.1	51.7	1.04
October	53.3	66.4	40.1	0.91
November	40.5	52.2	28.8	0.68
December	31.0	41.2	20.7	0.50

Source: data collected at New Mexico State Agricultural Science Center - Farmington  
<sup>(1)</sup> degrees Fahrenheit

Very recently, pioneering research using space-borne (satellite and aircraft) determination of methane concentrations have indicated anomalously large methane concentrations may occur in the Four Corners region (Kort, Frankenberg, Costigan, Lindenmaier, Dubey, & Wunch, 2014). A subsequent study (Schneising, Burrows, Dickerson, Buchwitz, Reuter, & Bovensmann, 2014) indicated larger anomalies over other oil and gas basins in the U.S. Methane is 34 times more potent at trapping greenhouse gas emissions than CO<sub>2</sub> when considering a time horizon of 100 years (Intergovernmental Panel on Climate Change, 2013). 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 (Howarth, Santoro, & A.Ingraffea, 2011). Methane is also emitted from process equipment, such as pneumatic controllers and liquids unloading, at oil and gas production sites. Ground-based, direct source monitoring of pneumatic controllers conducted by the Center for Energy and Environmental Resources (Allen, et al., 2014) show that methane emissions from controllers exhibit a wide range of emissions and a small subset of pneumatic controllers emitted more methane than most. Emissions measured in the study varied significantly by region of the U.S., the application of the controller and whether the controller was continuous or intermittently venting. The Center for Energy and Environmental Resources had similar findings of variability of methane emissions from liquid unloading (Allen, et al., 2014a). In October 2012, USEPA promulgated air quality regulations controlling VOC emissions at gas wells. These rules require air pollution mitigation measures that reduce the emissions of volatile organic compounds. These same mitigation measures have a co-benefit of reducing methane emissions. Future ground-based and space-borne studies planned in the Four Corners region with emerging pollutant measurement technology may help to pinpoint significant, specific sources of methane emissions in the region.

The Air Resources Technical Report summarizes information about greenhouse gas emissions from oil and gas development and their effects on national and global climate conditions. While it is difficult to determine the spatial and temporal variability and change of climatic conditions; what is known is that increasing concentrations of GHGs are likely to accelerate the rate of climate change.

### 2.2.2. Impacts from Alternative B (the Proposed Action)

Methodology and assumptions for calculating air pollutant and greenhouse gas emissions are described in the Air Resources Technical Report. This document incorporates the sections discussing the modification of calculators developed by the BLM to address emissions for one horizontal gas well. The calculators give an approximation of criteria pollutant, HAP, and greenhouse gas (GHG) emissions to be compared to regional and national emissions levels. Also incorporated into this document are the sections describing the assumptions used in developing the inputs for the calculator (BLM, 2014a).

## Direct and Indirect Impacts

### Criteria Pollutants

Table shows estimated emissions from one proposed horizontal gas well for criteria pollutants, volatile organic compounds (VOC) and greenhouse gas (GHG). For comparison, Table shows total human-caused emissions for each of the counties in the FFO and La Plata County, Colorado, based on USEPA's 2011 emissions inventory (U.S. Environmental Protection Agency, 2014).

**Table 6. Criteria Pollutant and VOC Emissions Estimated for Construction of One Horizontal Gas Well; Average 25 Days to Drill and Complete**

Activity	NO <sub>x</sub>	CO	VOC	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub>
<b>One time operations (tons)</b>								
Construction	5.5	1.5	0.5	2.5	0.25	0.1	0.007	598.85
Completion	0.5	0.1	0.03	0.025	0.025	-	-	55.00
Interim Reclamation	0.006	0.006	0.006	0.001	-	0.003	-	1.24
Final Reclamation	0.006	0.006	0.006	0.001	-	0.004	-	1.66
<b>Ancillary Operations (tons)</b>								
Workover	0.129	0.04	0.01	0.01	0.01	-	-	10.59
Road Maintenance	-	-	-	-	-	-	-	0.26

Activity	NO <sub>x</sub>	CO	VOC	PM <sub>10</sub>	PM <sub>2.5</sub>	SO <sub>2</sub>	CH <sub>4</sub>	CO <sub>2</sub>
Road Traffic	-	-	-	-	-	-	-	0.06
<b>Annual operations (tons/yr)</b>								
Equipment Leaks	-	-	-	-	-	-	0.013	-
Field Compression	0.14	0.29	0.10	0.01	0.01	-	-	19.30
<b>Total</b>	<b>6.28</b>	<b>1.94</b>	<b>0.65</b>	<b>2.55</b>	<b>0.30</b>	<b>0.11</b>	<b>0.02</b>	<b>686.96</b>

**Table 7. Analysis Area Emissions in Tons/Year, 2011**

County	NO <sub>x</sub> <sup>(1)</sup>	CO <sup>(2)</sup>	VOC <sup>(3)</sup>	PM <sub>10</sub> <sup>(4)</sup>	PM <sub>2.5</sub> <sup>(5)</sup>	SO <sub>2</sub> <sup>(6)</sup>
McKinley	11,952.9	17,007.8	3,891.2	70,096.4	7,645.2	1,381.1
Rio Arriba	12,012.3	27,344.6	19,149.8	33,761.2	4,130.6	60.4
San Juan	42,231.5	63,568.9	26,110.8	76,638.3	9,201.0	5,559.3
Sandoval	4,143.8	19,513.9	4,373.1	39,343.0	4,510.8	109.3
La Plata	4,838.2	17,116.3	3,740.1	2,330.0	919.6	127.9
<b>Total</b>	<b>75,187.7</b>	<b>144,551.5</b>	<b>57,265.1</b>	<b>222,168.9</b>	<b>26,407.2</b>	<b>7,237.9</b>

<sup>(1)</sup> NO<sub>x</sub> – nitrogen oxides  
<sup>(2)</sup> CO – carbon monoxide  
<sup>(3)</sup> VOC – volatile organic compounds  
<sup>(4)</sup> PM<sub>10</sub> – particulate matter with an aerodynamic diameter equal to or less than 10 microns  
<sup>(5)</sup> PM<sub>2.5</sub> – particulate matter with an aerodynamic diameter equal to or less than 2.5 microns  
<sup>(6)</sup> SO<sub>2</sub> – sulfur dioxide

Table displays the percent increase in total emissions in the analysis area from the proposed action to construct and operate one horizontal gas well.

**Table 8. Percent Increase in Analysis Area Emissions from the Proposed Action**

	NO <sub>x</sub> <sup>(1)</sup>	CO <sup>(2)</sup>	VOC <sup>(3)</sup>	PM <sub>10</sub> <sup>(4,5)</sup>	PM <sub>2.5</sub> <sup>(5,6)</sup>	SO <sub>2</sub> <sup>(5,7)</sup>
Total Emissions	75,187.7	144,551.5	57,265.1	222,168.9	26,407.2	7,237.9
Horizontal Gas Well Emissions	6.28	1.94	0.65	2.55	0.30	0.13
<b>Percent Increase</b>	<b>0.008</b>	<b>0.001</b>	<b>0.001</b>	<b>0.001</b>	<b>0.001</b>	<b>0.002</b>

<sup>(1)</sup> NO<sub>x</sub> – nitrogen oxides  
<sup>(2)</sup> CO – carbon monoxide  
<sup>(3)</sup> VOC – volatile organic compounds  
<sup>(4)</sup> PM<sub>10</sub> – particulate matter with an aerodynamic diameter equal to or less than 10 microns  
<sup>(5)</sup> Values derived from average emissions for any well drilling in the analysis area. Calculated results available upon request.  
<sup>(6)</sup> PM<sub>2.5</sub> – particulate matter with an aerodynamic diameter equal to or less than 2.5 microns  
<sup>(7)</sup> SO<sub>2</sub> – sulfur dioxide

### **Hazardous Air Pollutants**

The formulas used for calculating HAPs in the calculators are very imprecise. For many processes it is assumed that emission of HAPs will be equivalent to 10 percent of VOC emissions. Therefore, the estimated HAP emissions 0.065 tons/year should be considered a very gross estimate.

### **Total Greenhouse Gases**

The available statewide GHG summary combines GHG emissions from CO<sub>2</sub> and CH<sub>4</sub>. To compare the GHG emissions from the Proposed Action estimated by the calculator with statewide GHG emissions, CO<sub>2</sub>e emissions for both CH<sub>4</sub> and CO<sub>2</sub> were summed. The total statewide GHG emission estimate for 2007 was 76,200,000 metric tons CO<sub>2</sub>e (76.2 million metric tons; (New Mexico Environment Department, 2010)). The estimated CO<sub>2</sub>e metric tons emissions from one conventional gas well (623.2 metric tons) would represent a 0.0008 percent increase in New Mexico CO<sub>2</sub> emissions.

## Cumulative Impacts

The FFO manages federal hydrocarbon resources in San Juan, Sandoval, Rio Arriba, and McKinley Counties. There are approximately 21,150 wells in the San Juan Basin. About 14,843 of the wells in these counties are federal wells. Analysis of cumulative impacts for reasonable development scenarios and RFDS of oil and gas wells on public lands in the FFO was presented in the 2003 RMP. This included modeling of impacts on air quality. A more detailed discussion of Cumulative Effects can be found in the Air Resources Technical Report (BLM, 2014a).

The primary activities that contribute to levels of air pollutant and GHG emissions in the Four Corners area are electricity generation stations, fossil fuel industries, and vehicle travel. The Air Quality Technical Report includes a description of the varied sources of national and regional emissions that are incorporated here to represent the past, present, and reasonably foreseeable impacts to air resources (BLM, 2014a). It includes a summary of emissions on the national and regional scale by industry source. Sources that are considered to have notable contributions to air quality impacts and GHG emissions include electrical generating units, fossil fuel production (nationally and regionally), and transportation.

The emissions calculator estimated that there could be very small direct and indirect increases in several criteria pollutants, HAPs, and GHGs as a result of implementing the proposed alternative. The very small increase in emissions that could result would not be expected to result in exceeding the NAAQS for any criteria pollutants in the analysis area.

The very small increase in GHG emissions that could result from implementing the proposed alternative would not produce climate change impacts that differ from the No Action Alternative. This is because climate change is a global process that is impacted by the sum total of GHGs in the Earth's atmosphere. The incremental contribution to global GHGs from the action alternatives cannot be translated into effects on climate change globally or in the area of this site-specific action. It is currently not feasible to predict with certainty the net impacts from the action alternatives on global or regional climate.

The Air Resources Technical Report (BLM, 2014a) discusses the relationship of past, present, and future predicted emissions to climate change and the limitations in predicting local and regional impacts related to emissions. It is currently not feasible to know with certainty the net impacts from particular emissions associated with activities on public lands.

## 2.3. Upland Vegetation

### 2.3.1. Affected Environment

The proposed project area is located within the Arizona/New Mexico Plateau ecological region. This ecological region occurs primarily in Arizona, Colorado, and New Mexico; a small portion is located within Nevada. This ecological region encompasses approximately 45,870,500 acres (185,632 square kilometers), and the elevation ranges from 2,165 to 11,949 feet AMSL. The ecological region's landscapes include low mountains, hills, mesas, foothills, irregular plains, alkaline basins, some sand dunes, and wetlands. This ecological region is a large transitional region between the semiarid grasslands to the east; the drier shrublands and woodlands to the north; and the lower, hotter, less-vegetated areas to the west and south. Vegetation communities include shrublands with big sagebrush (*Artemisia tridentata*), rabbitbrush (*Ericameria nauseosa*), winterfat (*Krascheninnikovia lanata*), shadscale saltbush (*Atriplex confertifolia*), and greasewood (*Sarcobatus vermiculatus*); and grasslands of blue grama (*Bouteloua gracilis*), western wheatgrass (*Pascopyrum smithii*), green needlegrass (*Nassella viridula*), and needleandthread grass (*Hesperostipa comata*). Higher elevations may support piñon pine and juniper woodlands. This ecological region includes the urban areas of Santa Fe and Albuquerque, New Mexico. Important land uses within this ecological region include irrigated farming, recreation, rangeland, wildlife habitat, and some natural gas production (Griffith, et al. 2006).

The general region surrounding the proposed project area is characterized by broad basins vegetated with sagebrush shrublands and desert scrub communities. Low mesas and hills are vegetated with piñon-juniper woodlands. Minimally vegetated badlands are also scattered throughout the region. The three

primary vegetation communities occurring across the proposed project area are Great Basin desert scrub sagebrush, piñon-juniper woodland, and reclaimed shrub grassland habitat associated with existing disturbance.

The Great Basin desert scrub sagebrush community is dominated by big sagebrush, broom snakeweed, blue grama, and James' galleta. Rabbitbrush was scattered throughout the area and was heavily browsed. Vegetative cover varies from an estimated 25 to 35 percent.

Pinon-juniper woodland community is dominated by piñon pine and Utah juniper (*Juniperus osteosperma*). The understory was sparse, consisting mostly of broom snakeweed, galleta, sideoats grama, and redroot buckwheat. Vegetative cover for understory vegetation was estimated around 8 to 12 percent with a tree canopy cover around 20 to 30 percent. Tree age class varies from saplings to mature with varying dbh. Old growth junipers were observed along the east end of Section 23 Cuttings Disposal.

Reclaimed shrub grassland habitat included blue grama, Russian thistle (*Salsola iberica*), and redstem stork's bill (*Erodium cicutarium*). Ground cover was visually estimated from 8-15 percent. Musk thistle, a New Mexico Department of Agriculture Class B- listed species, was identified within the project area along the surface water line near the existing WFS Laguna Seca Compressor site.

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### **2.3.2. Impacts from Alternative B (the Proposed Action)**

#### **Direct and Indirect Impacts**

The proposed action would not result in construction or surface disturbance activities during the Winter Closure. Construction of all facilities and infrastructure needed for the proposed drilling and completion of wells located on Rosa UT 27 and 29 would be completed prior to the Winter Closure. Construction of these facilities was approved as part of the Rosa UT 27 and 29 Development Project and all vegetation disturbing activities and reclamation processes would occur as outlined in DOI-BLM-NM-F010-15-0103-EA (BLM 2015).

There is the potential for drilling and completion activities to deter herbivores from the surrounding area. As a result, herbivores may concentrate in more isolated areas and increase the foraging pressure to the available vegetation beyond that which is typically experienced. High levels of forage pressure to vegetation during the winter months could temporarily stunt vegetative growth. The deposition of fugitive dust generated along the roads from traffic during drilling and completion activities and during wind events could reduce photosynthesis and productivity of the surrounding vegetation (Thompson, et al. 1984), increase water loss in plants near the proposed project area (Eveling and Bataille 1984), and result in injury to leaves of surrounding vegetation. However, these impacts are expected to be minimal during winter months due to snow cover, minimal live vegetation, and/or frozen ground conditions. Impacts are low and short-term.

#### **Cumulative Impacts**

The analysis area and impact indicator for cumulative impacts is the same as for direct and indirect impacts. Past, present, and reasonably foreseeable future actions within the analysis area, the Lower Los Piños River watershed, which may also impact vegetative cover, growth, and change in species resulting from surface disturbance include the following:

- Oil and gas development, including associated roads and pipelines
- Livestock grazing
- Wild horse grazing
- Vegetation treatments
- Community development

1567 oil and gas well pads have been developed in the Lower Los Piños River watershed. These wells have resulted in a long-term disturbance of 1175.25 acres of surface disturbance. Based on the RFD (Engler, et al., 2014), oil and gas development in the Lower Los Piños River watershed may result in

931.18 acres of short-term disturbance from potential future development, with 691.18 acres of that being reclaimed. This results in 240.00 acres of long-term surface disturbance from potential future oil and gas development in the Lower Los Piños River watershed. The total long-term disturbance for existing and potential oil and gas development in the Lower Los Piños River watershed would be 1415.25 acres. The Proposed Action would not result in surface disturbance. All surface disturbance from the well pads has been previously analyzed and accounted for in the DOI-BLM-NM-F010-15-0103-EA (BLM 2015).

Livestock grazing is expected to continue at the same rate and manner as it currently occurs and no change is expected in the reasonable foreseeable future. Wild horse grazing use may increase or decrease as the wild horse population increases or decreases. No vegetation treatments are planned for this area currently, or in the reasonable foreseeable future. There is very little community development in this area and it is likely to minimally increase in the future. This increase has not been quantified, however it is expected to be minimal based on the surrounding community development.

Indirectly, foraging pressure, fugitive dust or deposition and introduction of invasive species associated with drilling and completion activities, existing roads, and well pads in the immediate area could impact the vegetation within the spatial analysis area, and could continue to do so throughout the life of the proposed project. The proposed project would contribute to direct vegetation disturbance and fugitive dust and/or deposition.

## **2.4. Noxious Weeds and Invasive Species**

### **2.4.1. Affected Environment**

In the San Juan Basin, invasive plants are frequently found in areas that have been disturbed by surface activities. Invasive species are generally tolerant of disturbed conditions, and often times outcompete native species. These plants may displace native plant communities and lead to the degradation of wildlife habitat. A total of 212 invasive and poisonous weeds have been identified on BLM-managed land (Heil and White 2000). The New Mexico Department of Agriculture (NMDA) has designated certain plants as state-listed noxious weeds and their current management classes for each species. The BLM uses the New Mexico statewide list as the baseline document to establish their primary noxious weed species of concern. Invasive plant species are managed on BLM lands through cooperative agreements between the BLM and the San Juan County Soil and Water Conservation District. Additionally, BLM works closely with other federal and state agencies, management groups, private landowners, and industry cooperators to address invasive plant management by incorporation prevention and control measures on projects proposed on BLM lands (BLM 2014b). Musk thistle, a New Mexico Department of Agriculture Class B-listed species, was identified within the project area along the surface water line near the existing WFS Laguna Seca Compressor site.

### **2.4.2. Impacts from Alternative B (the Proposed Action)**

#### **Direct and Indirect Impacts**

During drilling and completions, noxious weed sources could be introduced to disturbed areas from vehicles, equipment, people, wind, water, or other mechanisms. There is the potential for non-native invasive weeds to establish or spread in the area. WPX would be responsible for monitoring and controlling any non-native invasive weed species within the project area for the life of the project. However, these impacts are expected to be minimal during winter months due to snow cover and/or frozen ground conditions. Impacts are low and short-term.

#### **Cumulative Impacts**

The analysis area and impact indicator for cumulative impacts is the same as for direct and indirect impacts. Past, present, and reasonably foreseeable future actions within the analysis area, the Lower Los Piños River watershed, which may also impact vegetative cover, growth, and change in species resulting from surface disturbance include the following:

- Oil and gas development, including associated roads and pipelines
- Livestock grazing
- Wild horse grazing
- Vegetation treatments
- Community development

1567 oil and gas well pads have been developed in the Lower Los Piños River watershed. These wells have resulted in a long-term disturbance of 1175.25 acres of surface disturbance. Based on the RFD (Engler, et al., 2014), oil and gas development in the Lower Los Piños River watershed may result in 931.18 acres of short-term disturbance from potential future development, with 691.18 acres of that being reclaimed. This results in 240.00 acres of long-term surface disturbance from potential future oil and gas development in the Lower Los Piños River watershed. The total long-term disturbance for existing and potential oil and gas development in the Lower Los Piños River watershed would be 1415.25 acres. The Proposed Action would not result in surface disturbance. All surface disturbance from the well pads has been previously analyzed and accounted for in the DOI-BLM-NM-F010-15-0103-EA (BLM 2015).

Livestock grazing is expected to continue at the same rate and manner as it currently occurs and no change is expected in the reasonable foreseeable future. Wild horse grazing use may increase or decrease as the wild horse population increases or decreases. No vegetation treatments are planned for this area currently, or in the reasonable foreseeable future. There is very little community development in this area and it is likely to minimally increase in the future. This increase has not been quantified, however it is expected to be minimal based on the surrounding community development.

The proposed project would contribute to ongoing activity in the spatial analysis area, and may contribute to the increased potential for the establishment and spread of noxious weeds and invasive species within the spatial analysis area.

## 2.5. Wildlife

### 2.5.1. Affected Environment

#### General Wildlife (Especially Deer and Elk)

The BLM is responsible for the wildlife stewardship and habitat in the project area. The project area is located within the Rosa Mesa SDA which is managed by the BLM/FFO to preserve and protect big game habitat (BLM 2003a). The Rosa Mesa Wildlife Area has a total of 69,762 acres, of which 47,406 are federal mineral acres. Over 1,500 deer are estimated to use this area in winter. Their distribution is often dependent upon the severity of the winter and amount of human activity in the area (BLM 2003a, N-167). The ongoing Rosa Mule Deer Study has revealed a well-defined migration corridor being used by wintering deer. Based on results from the 2011-2013 Progress Report (Appendix B), the Rosa UT 27 is located within a moderate use (10-20%) migration corridor and a core use area that was utilized by collared mule deer 2 out of the 2 years of study. The Rosa UT 29 is located within a low use (<10%) migration corridor and a core use area that was utilized by collared mule deer 2 out of the 2 years of study (Refer to Appendix A and B). The proposed action would allow for data collected during drilling and completion activities to be compared to the established baseline data.

The vegetation communities found within the proposed project area provide habitat for a variety of vertebrate and invertebrate species. Wildlife and sign of wildlife identified in the area include mule deer (*Odocoileus hemionus*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), pocket gopher (*Thomomys* sp.), black-tailed jackrabbit (*Lepus californicus*), cottontail rabbit (*Sylvilagus* sp.), and a number of reptiles and birds. The objectives of the BLM wildlife management program are to “ensure optimum populations and a natural abundance and diversity of fish and wildlife values by restoring, maintaining, and enhancing habitat conditions for consumptive and non-consumptive uses” (BLM 2003a, 2-24).

## **Migratory Birds**

Executive Order (EO) 13186, dated January 17, 2001, calls for increased efforts to more fully implement the Migratory Bird Treaty Act of 1918. In keeping with this mandate, the BLM-FFO has issued an interim policy to minimize unintentional take, as defined by the EO, and to better optimize migratory bird efforts related to BLM-FFO activities. In keeping with this policy, a list of priority birds of conservation concern which occur in similar ecological regions similar to the proposed project area was compiled using the U.S. Fish and Wildlife Service's Information, Planning, and Conservation System (IPAC) (USFWS 2015). The U.S. Fish and Wildlife Service's Birds of Conservation Concern (2008) report identifies species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become listed under the Endangered Species Act as amended (16 U.S.C 1531 et seq.).

The selected species have a known distribution in the BLM-FFO area and may be affected by various types of perturbations. These species and an evaluation of their potential to occur within the proposed project area are discussed in the Rosa UT 27 and 29 Development Project Biological Survey Report (BSR) found in Appendix B of the DOI-BLM-NM-F010-15-0103-EA (BLM 2015); a list of species identified within the proposed project area during the biological surveys is also provided in the BSR.

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### **2.5.2. Impacts from Alternative B (the Proposed Action)**

#### **Direct and Indirect Impacts**

##### ***General Wildlife (Especially Deer and Elk)***

The Proposed Action would be located within the Rosa Mesa Wildlife Area SDA. The Rosa Mesa Wildlife Area SDA has seasonal restrictions on construction and drilling activities during a 4-month period (December 1 through March 31) to protect the integrity of the habitat for wintering deer and elk. Impacts to mule deer and elk from energy development are not well understood—especially in the long term. Effects of energy development on long-lived ungulates may take years to manifest, and no long-term study has been conducted (Hebblewhite 2011). Impacts to big game are dependent on a number of variables including timing, duration (years), and intensity. For the proposed activities, the primary impact to wildlife, especially deer and elk, is displacement of animals from vehicle traffic, noise, and human activities; as well as effective habitat loss in an environment that is already highly developed. Disturbance and displacement diverts time and energy away from foraging, resting, and other activities that improve physiological condition. Ongoing disturbances may also limit mule deer use of important habitats (Lutz, et al. 2011). Wildlife may also be exposed to increased mortality associated with increased vehicular traffic.

##### ***Habitat Loss***

Two parameters are considered when evaluating habitat loss—direct habitat loss and effective habitat loss.

Direct habitat loss occurs through the removal of vegetation which reduces the extent or quality of habitat in terms of food and cover. Vegetation removal strips the affected area of its value to wildlife; therefore, direct habitat loss can be quantified by comparing the area of habitat lost to the amount retained. The Proposed Action would not result in a direct loss of habitat through the removal of vegetation.

The amount of habitat available to wildlife is called effective habitat. The effectiveness of habitat is lost when a species abandons or avoids an area. Because avoided areas meet no survival needs, the areas are no longer considered effective habitat. Loss of effective habitat area can exceed direct habitat loss. Effective habitat loss can occur from habitat fragmentation, disturbance, and interference with movement. The impacts of habitat fragmentation are related to the loss of large contiguous area of habitat and the relative increase in habitat “edge” in smaller areas. Construction of roads and other development, as well as human and vehicular traffic on existing roads, can cause habitat fragmentation. Such disturbance can cause animals to shift their activity or alter their behavior.

Mule deer and elk have been shown to avoid natural gas wells, roads, and areas immediately surrounding them. This avoidance results in a loss of effective habitat. Hebblewhite summarized that the

average zone of influence reported in eight different studies extended about 1,000 meters (3,281 feet) from roads and natural gas/oil wells; however, responses varied within seasons and between species (2011). The nature and extent of this avoidance is dependent upon the type of vegetation, particularly the amount of cover present, the volume of traffic, and whether or not the vehicles stop or continue moving.

Disturbance is a primary factor in effective habitat loss as it can alter the ways wildlife use or move through an area and could push individual animals from preferred habitat into less suitable habitat. Such displacement would likely be localized around the source of the disturbance (i.e., equipment noise, human presence, etc.). Small isolated disturbances within non-limiting habitats are of lesser concern as compared to larger-scale developments within habitats limiting the abundance and productivity of a mule deer population (Lutz, et. al. 2011). Easterly et al. (1991) suggested that stress from human activities associated with oil and gas development may be additive to environmental stress and increase winter mortality. Severe, prolonged winters that reduce forage availability and quality also reduce growth and survival of elk (Peek 2003); disturbance during winter may impact access to quality browse.

Noise and human presence associated with drilling and completion operations may cause impacts to wildlife and a loss of effective habitat. Impacts to wildlife from noise are compounded by multiple variables such as the magnitude and duration of the noise generated, proximity of the noise source to an individual, individual behaviors/ responses, time of year (namely, summer vs. winter for mule deer and elk), time of day, and influence of other environmental stressors such as heat or snow depth. Ungulates, like most wildlife, typically flee or escape noise disturbances displayed as either mild annoyance or panic behavior (Fletcher 1980). Such displacement would likely be localized around the well pad or road at the source of the disturbance.

***Injury or Mortality***

Direct impacts from vehicle traffic on roads could include incidental mortality to wildlife. Animal vehicle collisions are variable depending on time of day, speed and volume of traffic, local topography, structural features of the road, and the size and behavior of the individual impacted (Dodd et al. 2004). There is also the potential that wildlife could be exposed to chemicals (e.g., diesel, gas, etc.) or other hazardous materials associated with drilling and completion.

Roads are expected to be used more frequently during drilling and completion of wells than during maintenance and production stages. Table 9 provides a summary of estimated total traffic for the proposed action. It is assumed that since drilling and completion of multiple wells may occur simultaneously on one well pad, vehicle-trips for activities would be reduced and would be isolated to one location.

**Table 9: Traffic Estimate for Drilling and Completion Operations During Winter Closure**

Traffic Type	Round Trips per Daytime Hours (9AM – 3PM)	Round Trips per Nighttime Hours (3:01PM – 8:59AM)
<b>Drilling</b>		
Crew Trucks	6-8	6-8
Cuttings Truck	2-3	Minimal/As Needed (1-2)
Water Truck	6	Minimal/As Needed (1-2)
Maintenance Truck	Occasional (1 trip per 2 days)	0
<b>Subtotal Maximum:</b>	<b>17.5</b>	<b>12</b>
<b>Completions</b>		
Sand Truck	35-40	0
Fuel Truck	2	0
<b>Subtotal Maximum:</b>	<b>42</b>	<b>0</b>
<b>Total Maximum:</b>	<b>59.5</b>	<b>12</b>

\* In addition to the daily traffic estimates above, a fleet of ~2-3 coil tubing units and ~4-6 pump trucks used for completions are expected to make a maximum of 4 round trips to a well pad over the course of the winter closure time period (December 1 – March 31).

## ***Impact Conclusions***

Under the proposed action, additional direct and indirect impacts on deer and elk not previously analyzed would be low and short term occurring within the Winter Closure during drilling and completion of the horizontal wells located on existing well pads.

These conclusions about wildlife impacts are supported by the following reasons:

- Less than 1 percent of the Rosa Mesa Wildlife SDA would be affected.
- Targeted, limited exceptions to allow studies would affect only a small portion of the total closure area and a small portion of the big game wintering in any one year.
- If studies indicate adverse impacts there should be no long lasting residual impacts compared to long term impacts already analyzed in FEIS for RMP.
- Habitat fragmentation would be minimized through the use of existing disturbance.

There would be no direct habitat loss from ground disturbance, as the proposed action alternative occurs on existing disturbance. Habitat loss would only result from the avoidance of habitat due to increase human activity. The scale and pace of this development is consistent with planning area RFDS. Therefore, the impacts of this scenario are included in the ROD for the RMP (BLM 2003a, page 4-112, 2003b).

No new roads would be constructed to access the existing well pads, but there would be an increase of a maximum of approximately 59.5 more vehicle trips during the day and 12 more vehicle trips during the nighttime than under the no action alternative. The duration of this impact would occur for the entire duration of the Winter Closure.

Stimulation activities may result in spatial changes in traffic patterns within the project area as produced water may be trucked from existing well pads to the Section 30 Recycling Containment rather than the normal disposal site.

Because wells would be twinned with existing locations, vehicle-trips for operation and maintenance would not be expected to increase in the long term as workers would access one pad to maintain several wells. Therefore, vehicle-trips in the long term would be similar during the Winter Closure for both the no action and proposed action alternatives for operations and maintenance only. Thus, the no action and proposed action alternative would have similar long-term impacts that have been previously evaluated in the RMP.

During the proposed drilling and completions program, loss of effective habitat from disturbance, would impact wintering mule deer and elk. The severity of impacts could be greater during winters with deep snow when movement is more difficult and browse more difficult to locate. These impacts would also be localized, that is centralized around the one active well pad and the access roads leading to it. Given the minor amount of area that would be subject to avoidance during drilling and/or completion operations as compared to the amount of suitable habitat within the wildlife area, these impacts would be expected to affect individuals but are not expected to have population-level impacts. Impacts have been and would continue to be mitigated through design features listed in Section 2.2.

Design features that would minimize direct habitat loss include:

- Twinned or co-located well pads
- Horizontal drilling of multiple wells from one well pad

Design features that would minimize loss of effective habitat, and the potential for injury or mortality, especially during the Winter Closure period, include:

- Only one rig will be used for drilling operations between December 1 and March 31.
- The implementation of the water system to store and transport water for stimulation through existing surface waterlines are expected to greatly decrease the number of vehicle trips.

Because the purpose of the proposed action is to collect data that may elucidate impacts to mule deer from winter drilling and completion activities during migrations and wintering, it is important that activities are conducted in a way that is “standard” for the industry and will provide a true measure of impacts. As such, minimal design features to reduce impacts have been applied.

Wildlife could come in contact with chemicals or fluids stored on site or in the Section 30 recycling containment. Open water and open cavities may attract wildlife and could result in entrapment. These impacts were previously analyzed in DOI-BLM-NM-F010-15-0103-EA (BLM 2015).

### ***Migratory Birds***

No surface disturbance would result from the proposed action. Due to the mobility of adult birds, they would be unlikely to be directly harmed by the proposed project. Impacts to migratory birds were previously analyzed in DOI-BLM-NM-F010-15-0103-EA (BLM 2015) and are unlikely to differ as a result of the proposed action.

### **Cumulative Impacts**

The analysis area and impact indicator for cumulative impacts is the same as for direct and indirect impacts. Past, present, and reasonably foreseeable future actions within the analysis area, the Lower Los Piños River watershed, which may also impact wildlife species, through direct and effective habitat loss resulting from surface disturbance and increased activities and traffic include the following:

- Oil and gas development, including associated roads and pipelines
- Livestock grazing
- Wild horse grazing
- Vegetation treatments
- Community development

1567 oil and gas well pads have been developed in the Lower Los Piños River watershed. These wells have resulted in a long-term disturbance of 1175.25 acres of surface disturbance. Based on the RFD (Engler, et al., 2014), oil and gas development in the Lower Los Piños River watershed may result in 931.18 acres of short-term disturbance from potential future development, with 691.18 acres of that being reclaimed. This results in 240.00 acres of long-term surface disturbance from potential future oil and gas development in the Lower Los Piños River watershed. The total long-term disturbance for existing and potential oil and gas development in the Lower Los Piños River watershed would be 1415.25 acres. The Proposed Action would not result in surface disturbance. All surface disturbance from the well pads has been previously analyzed and accounted for in the DOI-BLM-NM-F010-15-0103-EA (BLM 2015).

Cumulative impacts to wildlife for the proposed action were assessed based on known occurrences of mule deer and elk in the project area compared with peer-reviewed literature documenting impacts to deer and elk from oil and gas or similar disturbances, as well as past, present, and foreseeable activities that would impact ungulates in the area.

The parameters used in other recent wildlife impact assessments to measure cumulative impacts to wildlife include female survival and density of oil and gas development.

Female mule deer survival is an important parameter to measure in assessing energy impacts (Hebblewhite 2011, Johnson 2009). Watkins et al. (2001) reported adult female survival on the Uncompahgre Plateau in Colorado between 80 to 91 percent from 1997 to 2001; in the Piceance Basin in northwest Colorado, White et al. (1987) reported 83 percent for the same parameter; and Unsworth et al. (1999) found an average of 83 percent survival for adult female mule deer from studies in Colorado,

Idaho, and Montana combined. Johnson (2009) found a low adult female survival rate at about 72 percent between 2004 and 2009 for individuals trapped in the HD Mountains located north of the Project Area. If these statistics are extrapolated to the project area, impacts may affect mule deer populations if they contribute to decreased adult female survival as suggested by Easterly et al. (1991).

Hebblewhite (2011) may provide the only published threshold of development density. In the studies he reviewed, impacts started to appear on ungulates at 0.1 to 0.4 wells per square kilometer. Using the data provided by the BLM, 825 well pads were confirmed using aerial imagery in GIS to occur in the nearby Middle Mesa SDA; a density of approximately 4.4 well pads per square kilometer. A similar density of well pads is assumed to be present in the Rosa SDA. However, these studies were conducted in areas of large expanses of sagebrush grassland with little topographical relief; whereas, the project area contains pervasive stands of piñon-juniper woodland and broken topography with substantial relief. These vegetative and topographical characteristics serve to shield wildlife from the effects of disturbance as opposed to more open areas. The effects of disturbances to wildlife in open areas, such as sagebrush grasslands, would be expected to extend over a greater area since there are no buffers or screens to inhibit them.

The Proposed Action would help to better understand the impacts of oil and gas development on the deer populations in the FFO planning area. The ongoing study has helped to determine the migration routes and high density winter use areas of mule deer on Rosa Mesa and the Proposed Action is planned to elucidate data on potential impacts in which to apply appropriate mitigation measures, as well as assist in pre-project siting.

Given the lack of scientific data on the deer and elk populations in the SDA, as well as the limited literature on the impact of oil and gas development on these specific populations, it is difficult to draw conclusions regarding the long-term or cumulative impacts of the proposed action on wildlife. The effectiveness of the winter closure in the SDA is also uncertain.

Livestock grazing is expected to continue at the same rate and manner as it currently occurs and no change is expected in the reasonable foreseeable future. Wild horse grazing use may increase or decrease as the wild horse population increases or decreases. No vegetation treatments are planned for this area currently, or in the reasonable foreseeable future. There is very little community development in this area and it is likely to minimally increase in the future. This increase has not been quantified, however it is expected to be minimal based on the surrounding community development.

Therefore, the cumulative impacts to big game for the proposed action when added to past, present, and reasonably foreseeable actions are estimated to be indirect, short-term, and additive.

## **2.6. Special Status Species**

### ***2.6.1. Affected Environment***

The BLM manages certain species which are not federally listed as threatened or endangered in order to prevent or reduce the need to list them as threatened or endangered in the future. BLM SSS include BLM Sensitive Species and BLM-FFO Special Management Species (SMS) (BLM 2008a).

New Mexico BLM State Directors have developed a list of BLM Sensitive Species for the State of New Mexico (BLM 2011a, BLM 2011b, BLM 2011c, BLM 2012). In accordance with BLM Manual 6840, the BLM-FFO has prepared a list of BLM-FFO SMS to focus species management efforts toward maintaining habitats under a multiple-use mandate (BLM 2008a, BLM 2008c). BLM-FFO SMS include some BLM Sensitive Species and other species for which the BLM-FFO has determined special management is appropriate (BLM 2008c). The authority for this policy and guidance is established by the ESA; Title II of the Sikes Act, as amended (16 USC 670a-670o, 74 Stat. 1052); FLPMA; and Department of Interior Manual 235.1.1A.

Based on known range and habitat, several BLM SSS have the potential to occur within the proposed project area. These species and their habitat requirements are discussed in detail in the Rosa UT 27 and

29 Development Project - BSR (BLM 2015). The SSS with the potential to occur within the proposed and alternative project areas are as follows:

- American peregrine falcon (BLM SMS): potential foraging habitat available
- Bald Eagle (BLM Sensitive): potential foraging habitat available
- Bendire's thrasher (BLM Sensitive): potential foraging and nesting habitat available
- Golden eagle (BLM SMS): potential foraging habitat available
- Pinyon jay (BLM Sensitive): potential foraging and nesting habitat available
- Prairie falcon (BLM SMS): potential foraging habitat available
- Spotted bat (BLM Sensitive): potential foraging habitat available
- Townsend's big-eared bat (BLM Sensitive): potential foraging habitat available

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## **2.6.2. Impacts from Alternative B (the Proposed Action)**

### **Direct and Indirect Impacts**

#### ***American Peregrine Falcon, Bald Eagle, Golden Eagle, and Prairie Falcon***

The action area includes potential foraging habitat for these species but does not provide suitable nesting habitat. Navajo Reservoir, located west of the proposed project area, provides perching, roosting, and foraging opportunities for bald eagle. The closest BLM-designated Bald Eagle Area of Critical Environmental Concern (ACEC) unit is the Bancos #5 located 1.6 miles north of the proposed Rosa UT 27. Bald eagles were observed in the project area during field surveys conducted for the Rosa UT 27 and 29 Development Project. Any future proposed well pad would be evaluated on a case-by-case basis in relation to bald eagle winter roosting sites. There is similar habitat available in the surrounding area that these SSS raptors could utilize for foraging. Drilling and completion operations would cause increased noise levels in the vicinity of the proposed project area. Occasional human and vehicle presence within the vicinity of the proposed project area would increase above present levels. Audial and visual disturbances associated with the proposed project could cause indirect forage habitat loss by deterring these raptors and or their prey from using available habitat adjacent to the proposed project area. Timing restrictions would be implemented for any active or historical nest in accordance with the BLM-FFO Special Management Species Policy 2008 Update to reduce any potential impacts to nesting (BLM 2008a).

Due to the mobility of adult raptors and the lack of appropriate nesting sites for these species in the vicinity of the proposed project area, it is unlikely that the proposed project would result in 1) injury to a raptor, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior.

#### ***Bendire's Thrasher and Pinyon Jay***

Impacts to Bendire's thrashers and pinyon jays would be similar to those described for migratory birds (Section 3.5.2 [Wildlife– Impacts from Alternative A (the Proposed Action) – Migratory Birds]).

#### ***Spotted bat and Townsend's big-eared bat***

Suitable foraging habitat is present within the action area for both bat species. Suitable roosting habitat is not present. These species are unlikely to occur in the action area during the winter months, since they most likely hibernate or move to lower elevations during this time period. Therefore, there would be little to no impact to these species from the proposed action. Design features detailed in Section 2.2.2

(Description of Proposed Project - Design Features and Best Management Practices) would be implemented to reduce the potential for adverse impacts. Specifically, those design features listing under Section 2.2.2 - Control of Waste and Section 2.2.2 - Protection of Flora and Fauna, including SSS, Livestock, and Wild Horses are implemented to protect from entry or exposure of bats to any adverse impact from the produced water in the holding ponds. The holding ponds would be netted as specified in Appendix F of the DOI-BLM-NM-F010-15-0103-EA (BLM 2015) to restrict bats and minimize potential exposure risk. Recycling containments would be inspected on a daily basis.

## Cumulative Impacts

The analysis area and impact indicator for cumulative impacts is the same as for direct and indirect impacts. Past, present, and reasonably foreseeable future actions within the analysis area, the Lower Los Piños River watershed, which may also impact BLM Special Status Species, through direct and effective habitat loss resulting from surface disturbance and increased activities and traffic include the following:

- Oil and gas development, including associated roads and pipelines
- Livestock grazing
- Wild horse grazing
- Vegetation treatments
- Community development

1567 oil and gas well pads have been developed in the Lower Los Piños River watershed. These wells have resulted in a long-term disturbance of 1175.25 acres of surface disturbance. Based on the RFD (Engler, et al., 2014), oil and gas development in the Lower Los Piños River watershed may result in 931.18 acres of short-term disturbance from potential future development, with 691.18 acres of that being reclaimed. This results in 240.00 acres of long-term surface disturbance from potential future oil and gas development in the Lower Los Piños River watershed. The total long-term disturbance for existing and potential oil and gas development in the Lower Los Piños River watershed would be 1415.25 acres.

Livestock grazing is expected to continue at the same rate and manner as it currently occurs and no change is expected in the reasonable foreseeable future. Wild horse grazing use may increase or decrease as the wild horse population increases or decreases. No vegetation treatments are planned for this area currently, or in the reasonable foreseeable future. There is very little community development in this area and it is likely to minimally increase in the future. This increase has not been quantified, however it is expected to be minimal based on the surrounding community development. The Proposed Action would not result in surface disturbance. Impacts to these species would be similar year-round and have been previously analyzed and accounted for in the DOI-BLM-NM-F010-15-0103-EA (BLM 2015).

## 3. SUPPORTING INFORMATION

### 3.1. Tribes, Individuals, Organizations, or Agencies Consulted

Table 10 contains a list of tribes, individuals, organizations, and agencies invited to attend the on-site for the project.

**Table 10. Tribes, Individuals, Organizations, and Agencies Invited to the On-Site**

Name	Tribe, Organization, or Agency	Attended On-Site
Richard Hodgson	BLM Grazing Allottee	No
Roger Herrera	BLM	Yes

The BLM fulfills its responsibilities under the National Historic Preservation Act (NHPA) through a number of agreements. The National Programmatic Agreement (NPA; 2012) between the BLM, Advisory Council on Historic Preservation (ACHP), and the National Council of State Historic Preservation Officers (NCSHPO) allows the agency to fulfill its NHPA responsibilities according to the provisions of the NPA in

lieu of 36 CFR 800.3 through 800.7 regulations. The NPA, which applies to all BLM activities below specified thresholds, provides among other things, regulatory relief in many instances from the requirement for case-by-case review by State Historic Preservation Officers (SHPOs) and the ACHP, in exchange for managers' maintenance of appropriate staff capability and observance of internal BLM standards as set out in the 8100 Manual series.

The New Mexico BLM has a two-party protocol with the New Mexico SHPO (2014) specifically encouraged by the NPA. This protocol details how the New Mexico BLM and SHPO will regulate their relationship and consult. Specifically, this document outlines among other things, how and when consultation will be conducted between the BLM, SHPO, Tribes, and the public. The protocol also outlines when case-by-case SHPO consultation is or is not required for specific undertakings and the procedures for evaluating the effects of common types of undertakings and resolving adverse effects to historic properties. These common types of undertakings regularly include the common actions undertaken in the BLM FFO.

## 3.2. List of Preparers

This EA was prepared by EIS in conformance with the standards of and under the direction of the BLM-FFO. The following individuals assisted in the preparation of this EA:

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Responsibilities Under the National Historic Preservation Act. Available at:  
[http://www.blm.gov/pgdata/etc/medialib/blm/wo/Planning\\_and\\_Renewable\\_Resources/coop\\_agencies.Par.88790.File.dat/PA\\_Final\\_03\\_1997.pdf](http://www.blm.gov/pgdata/etc/medialib/blm/wo/Planning_and_Renewable_Resources/coop_agencies.Par.88790.File.dat/PA_Final_03_1997.pdf).

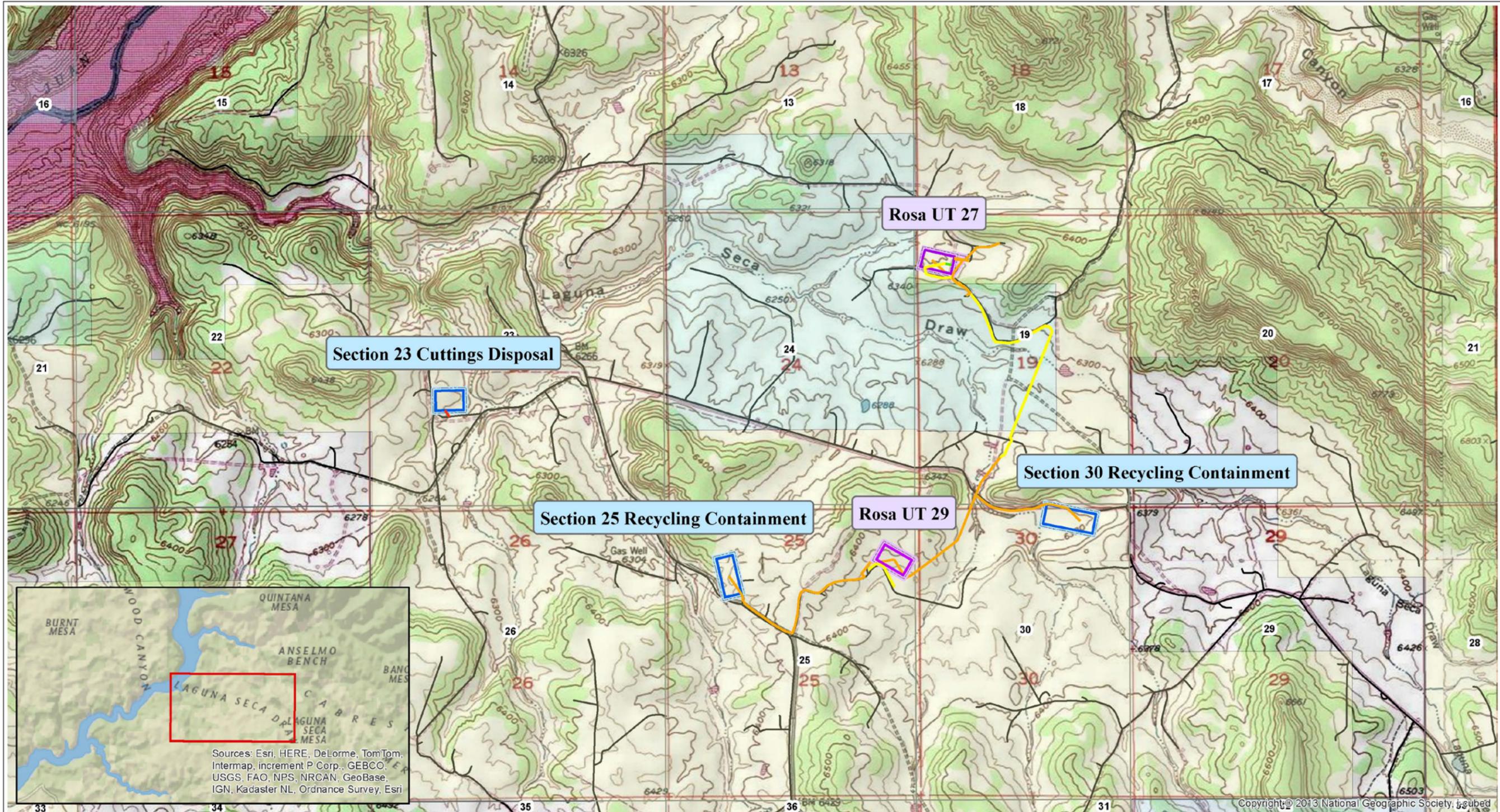
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## **APPENDIX A. MAPS**

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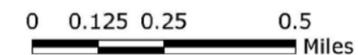
**Legend**

- Surface Fuel Line
  - Surface Waterline
  - Access
  - Buried Gas Pipeline
  - Well Pad Edge of Disturbance
  - Well Pad
  - Edge of Disturbance
  - Pad
  - San Juan Basin Roads (WPX)
- Surface Ownership
  - BLM
  - Indian
  - Private
  - State
  - Section - NM



**WPX Energy Production, LLC's Rosa UT 27 & 29 Natural Gas Development Project Overview Topographic Map**

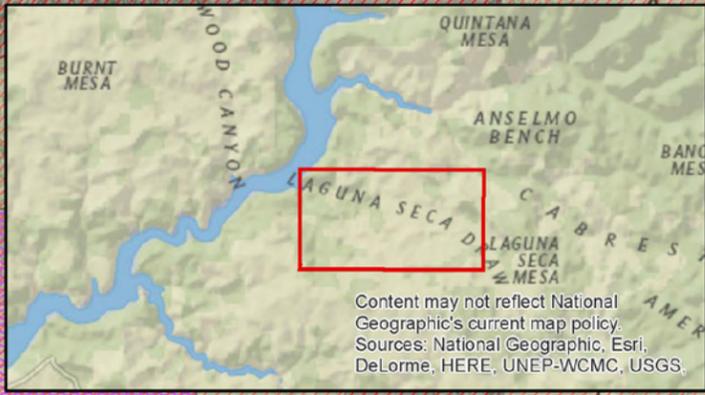
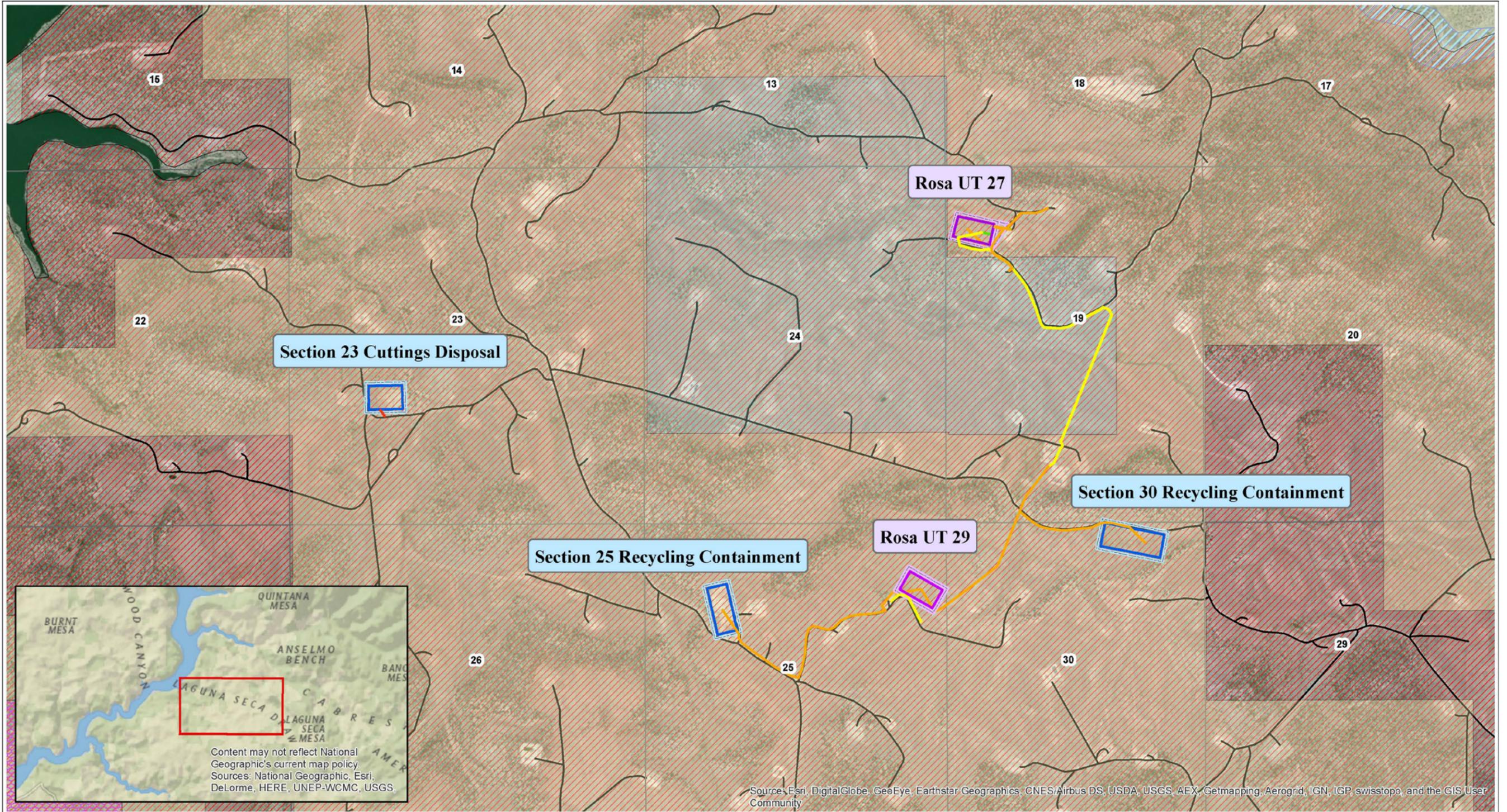
Sections 19 & 30, Township 31 North, Range 5 West and Sections 23, 24, 25, & 26, Township 31 North, Range 6 West  
 New Mexico Principle Meridian  
 Rio Arriba County, New Mexico



**WPXENERGY.**



Projection: NAD 1983 StatePlane New Mexico West FIPS 3003 Feet  
 Date: 3/16/2015 Author: mpaulek



**Legend**

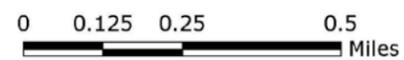
- Surface Fuel Line
- Surface Waterline
- Access
- Buried Gas Pipeline
- Well Pad Edge of Disturbance
- Well Pad
- Edge of Disturbance
- Pad
- San Juan Basin Roads (WPK)
- Surface Ownership**
- B.M.
- Indian
- Private
- State
- Section - NM

- Specially Designated Areas**
- Resource**
- Cultural
- Geology
- Historic
- Recreation
- Recreation/Wildlife
- Riparian
- Riparian/T&E
- T&E Species
- Wilderness
- Wildlife



**WPX Energy Production, LLC's Rosa UT 27 & 29 Natural Gas Development Project**  
**Overview Aerial Map**

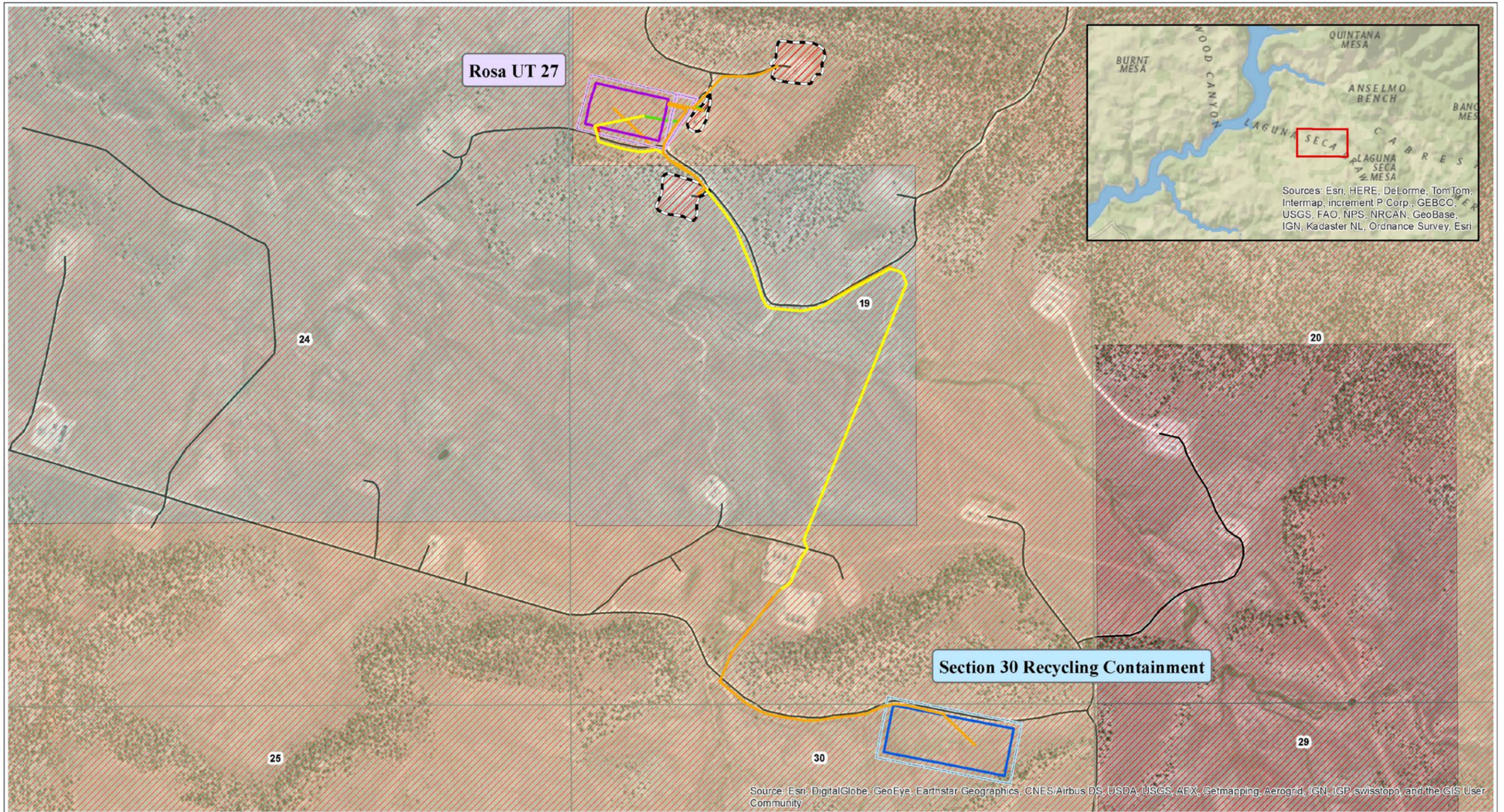
Sections 19 & 30, Township 31 North, Range 5 West and  
Sections 23, 24, 25, & 26, Township 31 North, Range 6 West  
New Mexico Principle Meridian  
Rio Arriba County, New Mexico



**WPXENERGY**

**EIS**  
Energy Inspection Services

Projection: NAD 1983 StatePlane New Mexico West FIPS 3003 Feet  
Date: 3/16/2015 Author: mpaulek



**Legend**

<ul style="list-style-type: none"> <li>Surface Fuel Line</li> <li>Surface Water Line</li> <li>Access</li> <li>Watered Gas Pipeline</li> <li>Wall Pad Edge of Disturbance</li> <li>Wall Pad</li> <li>Edge of Disturbance</li> <li>Pad</li> </ul>	<ul style="list-style-type: none"> <li>Shaping/Trails</li> <li>San Juan Basin Ponds (MPL)</li> </ul> <p><b>Surface Ownership</b></p> <ul style="list-style-type: none"> <li>BLM</li> <li>Indian</li> <li>Private</li> <li>State</li> <li>Section - NMI</li> </ul>	<p><b>Specially Designated Areas</b></p> <p><b>Resources</b></p> <ul style="list-style-type: none"> <li>Cultural</li> <li>Geology</li> <li>Historic</li> <li>Recreation</li> <li>Recreation/Wildlife</li> <li>Seismicity</li> <li>Wilderness</li> <li>Wildlife</li> </ul>
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S

**WPX Energy Production, LLC's Rosa UT 27  
Aerial Map**

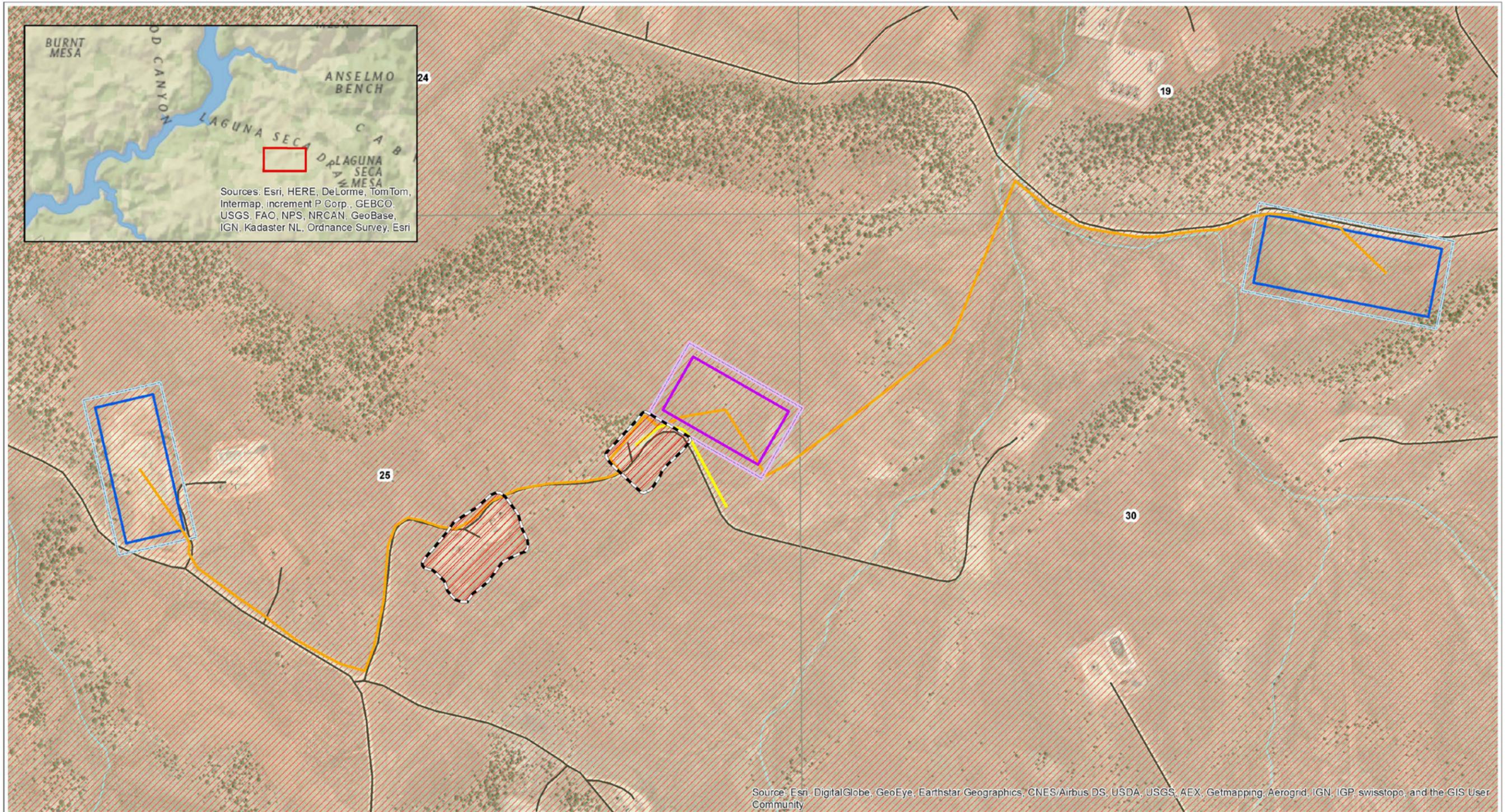
**Section 19, 20, 29 & 30, Township 31 North, Range 5 West and  
Section 24 & 25, Township 31 North, Range 6 West  
New Mexico Principle Meridian  
Rio Arriba County, New Mexico**

0 250 500 1,000  
Feet

**WPXENERGY**

**EIS**  
Energy Inspection Services

Projection: NAD 1983 StatePlane New Mexico West FIPS 3003 Feet  
Date: 3/16/2015 Author: mpaulek



Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

**Legend**

- Staging/Track
- Well Pad Edge of Disturbance
- Well Pad
- Burred Gas Pipeline
- Surface Waterline
- Edge of Disturbance
- Fuel
- USGS Watercourses
- San Juan Basin Roads (WPC)

**Surface Ownership**

- BLM
- Indian
- Private
- State
- Section - NM

**Specially Designated Areas Resource**

- Cultural
- Geology
- Paleontology
- Recreation
- Recreation/Wildlife
- Riparian
- Riparian/AE
- T&E Species
- Wilderness
- Wildlife



**WPX Energy Production, LLC's Rosa UT 29  
Aerial Map**

Section 19 & 30, Township 31 North, Range 5 West  
Section 24 & 25, Township 31 North, Range 6 West  
New Mexico Principle Meridian  
Rio Arriba County, New Mexico



**WPXENERGY**

**EIS**  
Energy Inspection Services

Projection: NAD 1983 StatePlane New Mexico West FIPS 3003 Feet  
Date: 3/16/2015 Author: mpaulek



## **APPENDIX B. ROSA MULE DEER STUDY**

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# Rosa Mule Deer Study

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## Phase 1 (2011-2013) Progress Report



**Prepared for:**

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**August 29, 2014**



NATURAL RESOURCES ♦ SCIENTIFIC SOLUTIONS

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**SUGGESTED CITATION**

Sawyer, H and R. Nielson. 2014. Rosa mule deer study – Phase 1 (2011-2013) progress report. Western Ecosystems Technology, Inc., Laramie, WY.

## INTRODUCTION

The Rosa Mule Deer Study was initiated to provide agencies and industry with the information they need to improve mule deer management and minimize potential impacts associated with ongoing and proposed energy development in the region. The study was specifically designed to identify the habitat selection patterns and migration routes of mule deer before (Phase 1: Years 2011-2013) and during (Phase 2: Years 2014-2016) proposed winter drilling efforts in the eastern portion of the Rosa Unit administered by the Bureau of Land Management (BLM) (Fig.1), such that potential effects of winter drilling on mule deer distribution or migration could be evaluated. However, due to low gas prices, the proposed winter drilling activity did not occur as planned in winter 2013-14. Nonetheless, the detailed information collected on mule habitat use and migration during Phase 1 provides new and valuable information for land-use planning and the management of the Rosa mule deer population. Here, we summarize results from the Phase 1 study, including migration patterns, winter distribution, winter habitat use, and survival.

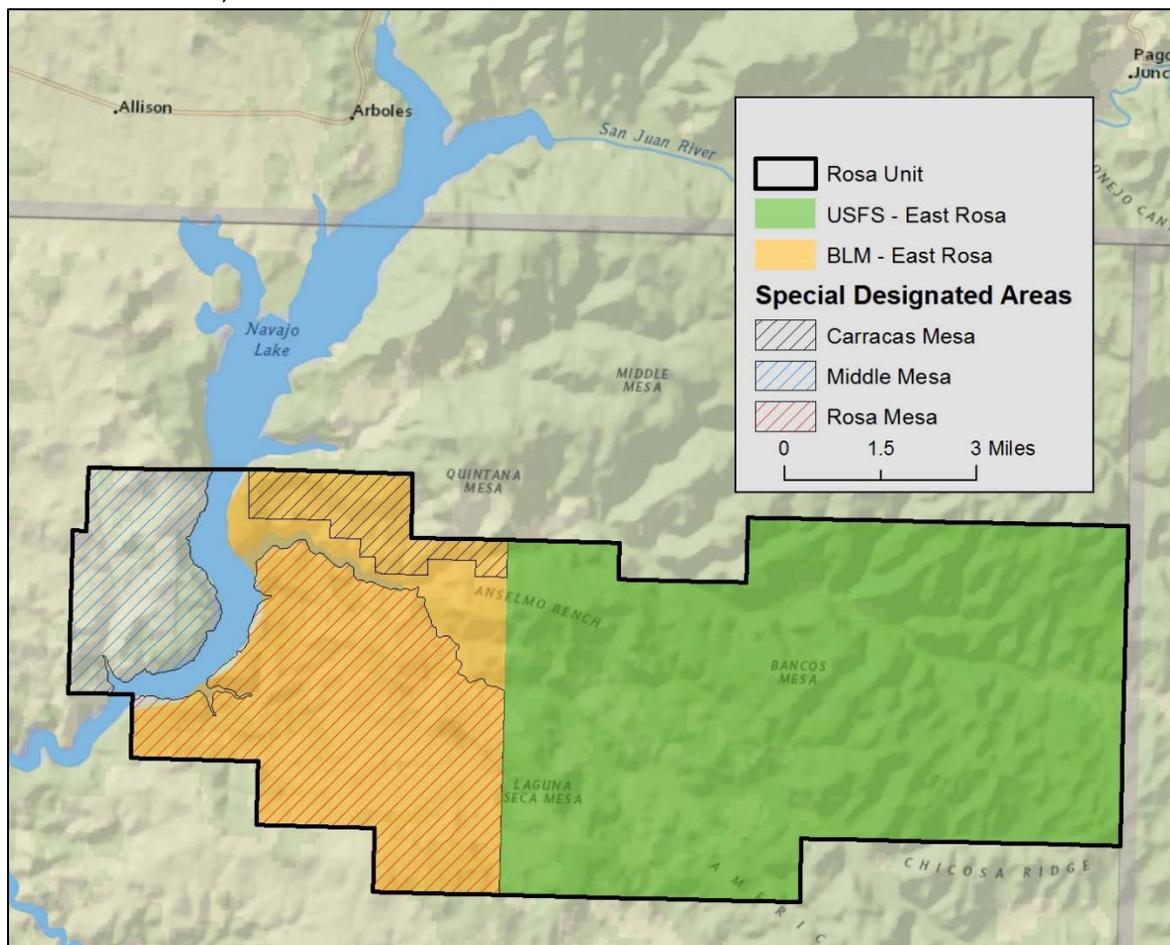


Figure 1. Location of East Rosa BLM lands in and special designated areas in the Rosa Unit.

## METHODS

### Capture and Collaring

This study was designed to collect data through five winters, including 2011-12, 2012-13, 2013-14, 2014-15, and 2015-16. We used helicopter net-gunning to capture 42 adult female mule deer in December 2011, 8 deer in January 2013, and 10 deer in January 2014 (Fig. 2). Animals were equipped with store-on-board GPS collars programmed to collect 1 location every 2 hours during fall, winter, and spring, and 1 location every 5 hours in summer (June 15 – September 15). Collars were equipped with mortality sensors that change transmitter pulse rate if the collar remains stationary for 8 hours. When animals died, their collars were placed on new animals in an effort to maintain a sample of approximately 40 animals. We attempted to capture animals in proportion to their relative abundance across the study area, based on pre-capture helicopter survey. Collars also had release mechanisms designed to drop the collar off the animal on April 1, 2014. However, rather than let the collars drop off, we recaptured animals in January 2014 and swapped out the old collars with new GPS collars programmed to drop off in April 2016. Monitoring the same animals through time facilitates comparisons across years. Phase 1 covered 2 full years (2012 and 2013) and resulted in 288,438 GPS locations collected from 50 individual mule deer (Fig. 3).



Figure 2. A captured mule deer is hobbled and blindfolded while being fit with GPS collar (left), and released (right) in January 2014.

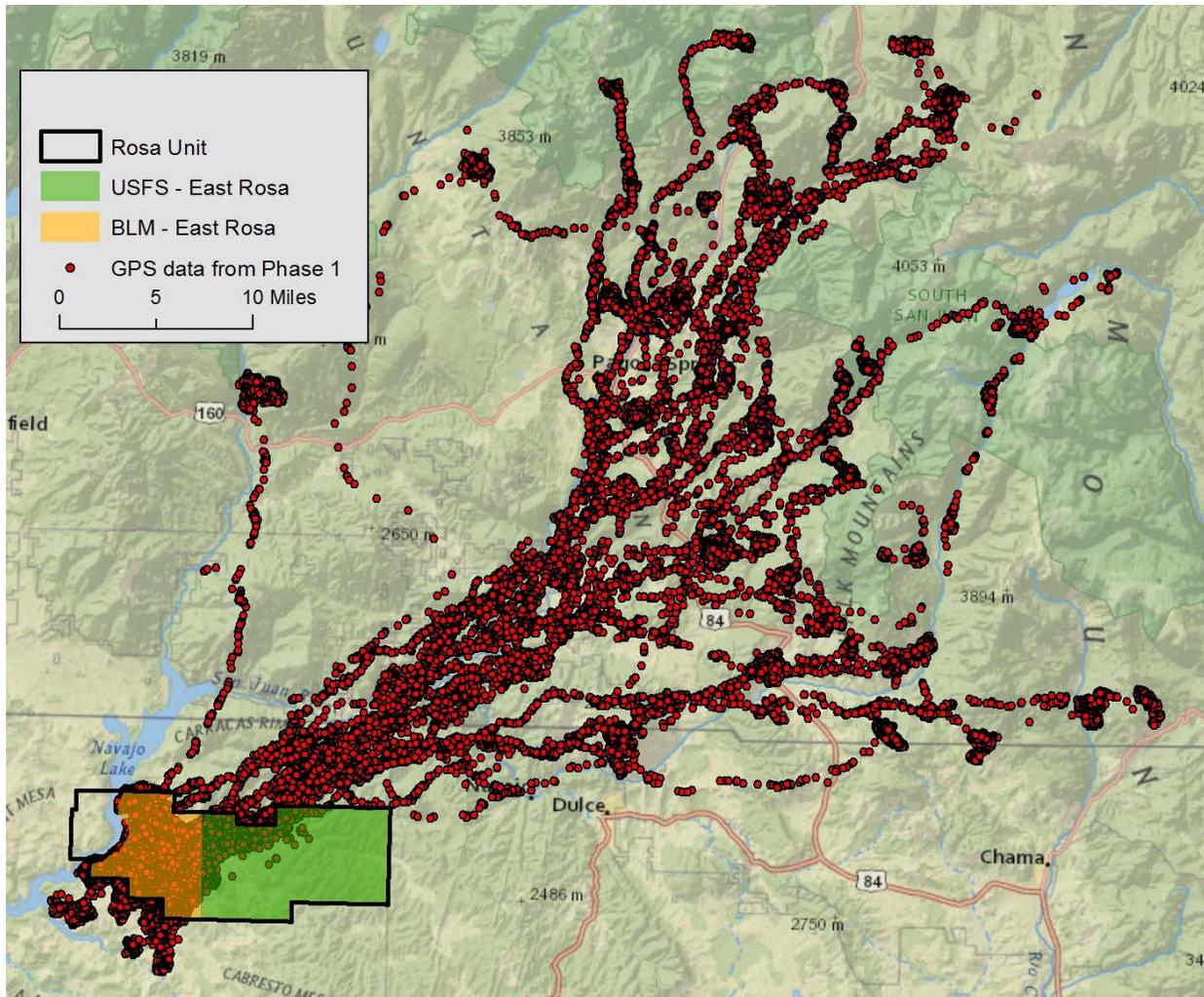


Figure 3. Phase 1 data included 288,438 GPS locations collected from 50 individual mule deer between December 2011 and January 2014.

## Migration Patterns

**Population-level migration routes** – We used the Brownian bridge movement model (BBMM; Horne et al. 2007) to estimate individual and population-level migration routes from GPS data. The BBMM estimates the probability of use, or a utilization distribution (UD), for a sequence of locations. Migration sequences for the spring and fall migration of each animal were identified manually, as locations between distinct winter and summer ranges, including the 12-hr period prior to and following migration (Sawyer et al. 2009a). Once migration sequences were extracted from GPS data, we used the “BBMM” package in R (Nielson et al. 2012) to estimate UDs for individual routes. Individual UDs were then averaged to estimate a population-level migration route (Sawyer et al. 2009a, White et al. 2010). Assuming a representative sample of animals, the population-level migration route reflects both the spatial extent of a migratory population, as well as the intensity of use within the migration route.

**Stopover sites** – A key advantage of the BBMM approach is that it allows route segments used as stopover sites (i.e., foraging and resting habitat) to be discerned from those used primarily for movement. Stopovers are important to migratory mule deer because they allow animals to maximize

energy intake by migrating in concert with plant phenology (Sawyer and Kauffman 2011). We identified stopover sites from the population-level migration route as the top 10% of UD values.

**Proportional level of use** – Another benefit of the BBMM approach is that when multiple migration routes radiate from a common winter range, as is often the case with mule deer, we can identify which parts of those routes are more heavily used than others. By overlaying the 99% contour of each animal's migration route, we calculated the proportion of marked animals that used each migration segment. This step is especially helpful for agencies, industry, and other stakeholders to prioritize which routes are most critical or important. Based on the proportion of the sampled population (<10%, 10 to 20%, or >20%) that used each route segment, we categorized route segments into low, moderate, and high-use areas. In this application, the level of use simply reflects the proportion of sampled animals that used each route or corridor (Sawyer et al. 2009a).

## Migration Timing

In addition to the BBMM, we used the individual migration sequences to calculate net displacement and evaluate patterns in migration timing. Net squared displacement (NSD) is an intuitive and powerful method for describing migration patterns from GPS data (e.g., Bunnefeld et al. 2011). The NSD simply measures the straight line distances between the starting location (i.e., winter capture location) and the subsequent locations for the migration route of an individual. We plotted net displacement for each animal across time and used the average values to describe and visualize the timing of migration across years. Net displacement and NSD take the same shape but are different scales. We used net displacement because the units (m) are more interpretable.

## Winter Distribution

We used GPS data collected December 01 through March 31 to map distribution patterns in winters 2011-12 and 2012-13. We used the BBMM to estimate a winter (December 01 through March 31) UD for each animal and then averaged the individual UDs to create a population-level UD for winters 2011-12 and 2012-13. The winter of 2013-14 was excluded because only a portion of GPS data were available for that winter. For winter areas, we also calculated the "core-use" areas based the top 50% of UD values, which are often used to help agencies identify or modify existing crucial winter ranges boundaries. The winter UDs and core-use areas reflect where most GPS-collared deer spent time.

## Winter Habitat Use

We developed habitat use models for the winters of 2011-12 and 2012-13, using GPS locations collected from marked animals between December 01 and March 31. We followed the approach of Nielson and Sawyer (2013), where a generalized linear model was used to estimate probability of use as a function of habitat variables (e.g., slope, elevation, etc.), with an error term following a negative binomial distribution. This approach combines data from all GPS-collared animals to estimate a population-level model and then bootstraps individual animals to estimate standard errors (SEs) and 90% confidence intervals (CIs) for model coefficients. Key advantages of this approach are that it weights the location data (i.e., number of locations per animal) from each animal appropriately (Thomas and Taylor 2006), treats the animal as the primary sampling unit (Thomas and Taylor 2006), and allows for information-theoretic approaches to model selection (Burnham and Anderson 2002).

Our study area was defined by placing a 1-km buffer around the BLM-managed portion of the East Rosa Unit (Fig. 4). We then measured habitat characteristics of 10,000 randomly selected circular

sampling units with 100-m radii. Habitat characteristics (variables) included elevation, slope, aspect, proportion of big sagebrush (hereafter referred to as sagebrush), proportion of forest cover (pinion-juniper and gambel's oak), distance to well pad, distance to road, road density, and well pad density. Elevation, slope, and aspect were calculated from 30-m digital elevation models. Aspect was transformed into continuous variable (0 to 1) using the TRASP function (Roberts and Cooper 1989) from the Geomorphometric and Gradient Metrics Toolbox in ARCGIS, where values near 1 correspond to land with north-northeast orientation and values near 0 reflect south-southwest orientation. Roads and well pad locations were provided by BLM, but further digitized and refined using 2011 National Agriculture Imagery Program (NAIP) data with 10-m resolution. Prior to modeling, we conducted a Pearson's pairwise correlation analysis to identify possible multicollinearity issues and determine whether any variables should be excluded from modelling. If two variables were found to be highly correlated ( $|r| \geq 0.60$ ), we did not allow both variables in the final model. Next, we counted the number of mule deer locations in each of the 10,000 sampling units and used those counts as the response variable in a multiple regression analysis to estimate the probability of use as a function of habitat variables. We used a stepwise model selection process and Akaike's Information Criterion (AIC) to determine the best model. Once the top model was identified, we then bootstrapped the individual animals to estimate SEs and 90% CIs for the model coefficients. Our final step was to map predictions of the habitat use model. We note that average GPS fix success was >99%, so habitat-induced fix-rate bias (Frair et al. 2004, Nielson et al. 2009) was not a concern.

To evaluate the predictive ability of the habitat use models we developed for winters 2011–2012 and 2012–2013, we performed a simple validation procedure where model predictions are compared (i.e., correlated) with additional deer locations. In this case, we used 20,199 GPS locations collected from 32 mule deer during the first half of the 2013-14 winter to calculate a Spearman rank correlation ( $r_s$ ) characterizing the number of GPS locations that occurred in 10 equal-sized prediction bins based on each of the habitat use models (Boyce et al. 2002). We performed all statistical analyses in R language and environment for statistical computing (R Development Core Team 2013).

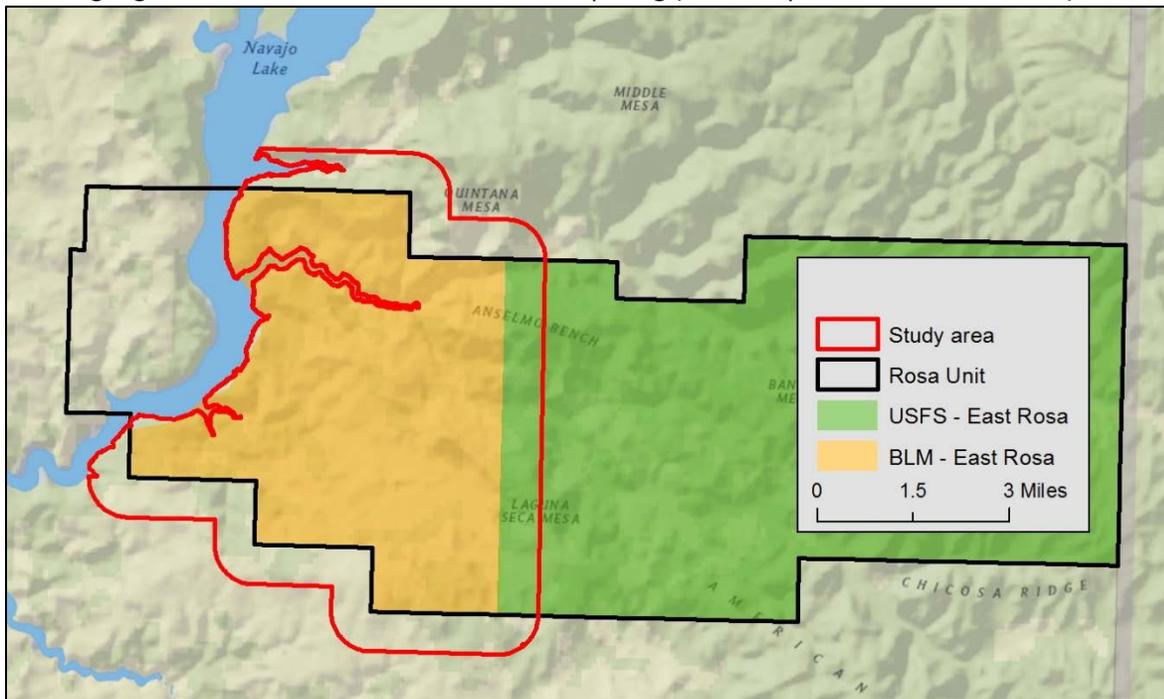


Figure 4. Study area (red) for habitat-use model was delineated by placing a 1-km buffer around the East Rosa BLM lands.

## Survival

Upon study completion, we plan to evaluate mule deer survival with a Cox proportional hazard model, such that various combination of predictor variables (e.g., coefficients from habitat use models, migration path, distance to well pad, etc.) can be considered in the analysis and offer a direct link between habitat use and survival (e.g., Johnson et al. 2004, Aldridge and Boyce 2007). This survival analysis is flexible in that we can examine an assortment of different survival models with different combinations of predictor variables and then use AIC to determine which model has the most support. In addition to a basic survival estimate, the coefficients estimated from this model will allow relative risk to be assessed, e.g., survival of deer far from well pads is 2X greater than those close to well pads, or survival of deer in migration route A is 3X greater than those in migration route B. For now, we simply calculated a basic Kaplan-Meier (1985) estimate for annual survival rates in 2012 and 2013. The more comprehensive survival analysis will be completed following Phase 2.

## RESULTS

### Migration Patterns

**Population-level migration route** – We estimated the population-level migration route from 144 migration sequences (76 spring, 68 fall) collected from 48 individual deer between 2012 and 2013 (Figs. 5-6). The 2-hr GPS intervals resulted in relatively low Brownian motion variance (mean = 1,719, SD = 1,054) compared to other mule deer studies where GPS fix intervals were 2.5-hr (mean = 2,679, SD = 280; Sawyer et al. 2009a) or 4-hr (mean = 5,622, SD = 4558; Coe et al. *In preparation*). A low BMV equates to more precise estimates of the migration route UD. The population-level migration route clearly shows the spatial extent of this migration, extending some 45 to 60 miles from the Rosa Unit northeast into the San Juan Mountains of Colorado. Additionally, the population-level route reflects the intensity of use, or where animals spent most of their time (slow movement) versus areas where they spent little time (quick movement).

**Stopover sites** – The population-level route contained distinct stopover areas where mule deer spent the majority of their time during migration (Fig. 6). Stopover habitat was nearly contiguous from the Rosa Unit north to the New Mexico - Colorado state line, but became more isolated as deer neared their summer ranges in the San Juan Mountains of Colorado.

**Proportional level of use** – Based on the proportional level of use (i.e., how many individual deer routes overlapped with one another), there were 2 to 3 major routes that most animals used to move from the Rosa winter range north to summer ranges in Colorado (Fig. 7). The moderate-use routes extended approximately 35 miles from the Rosa, before they splintered into other, less-traveled routes near summer range. The high-use route extended approximately 20 miles from the Rosa Unit up the San Juan River, near Montezuma Mesa. Several other high-use route segments were located on various branches of the population-level route, including: 1) the Eightmile Mesa area, east of the San Juan River and upstream from the confluence with the Rio Blanco, 2) the Montezuma Mesa area north to Trujillo Canyon and lower Valle Seco, and 3) an area just west of the Navajo river, near La Huida and Barrella Canyons.

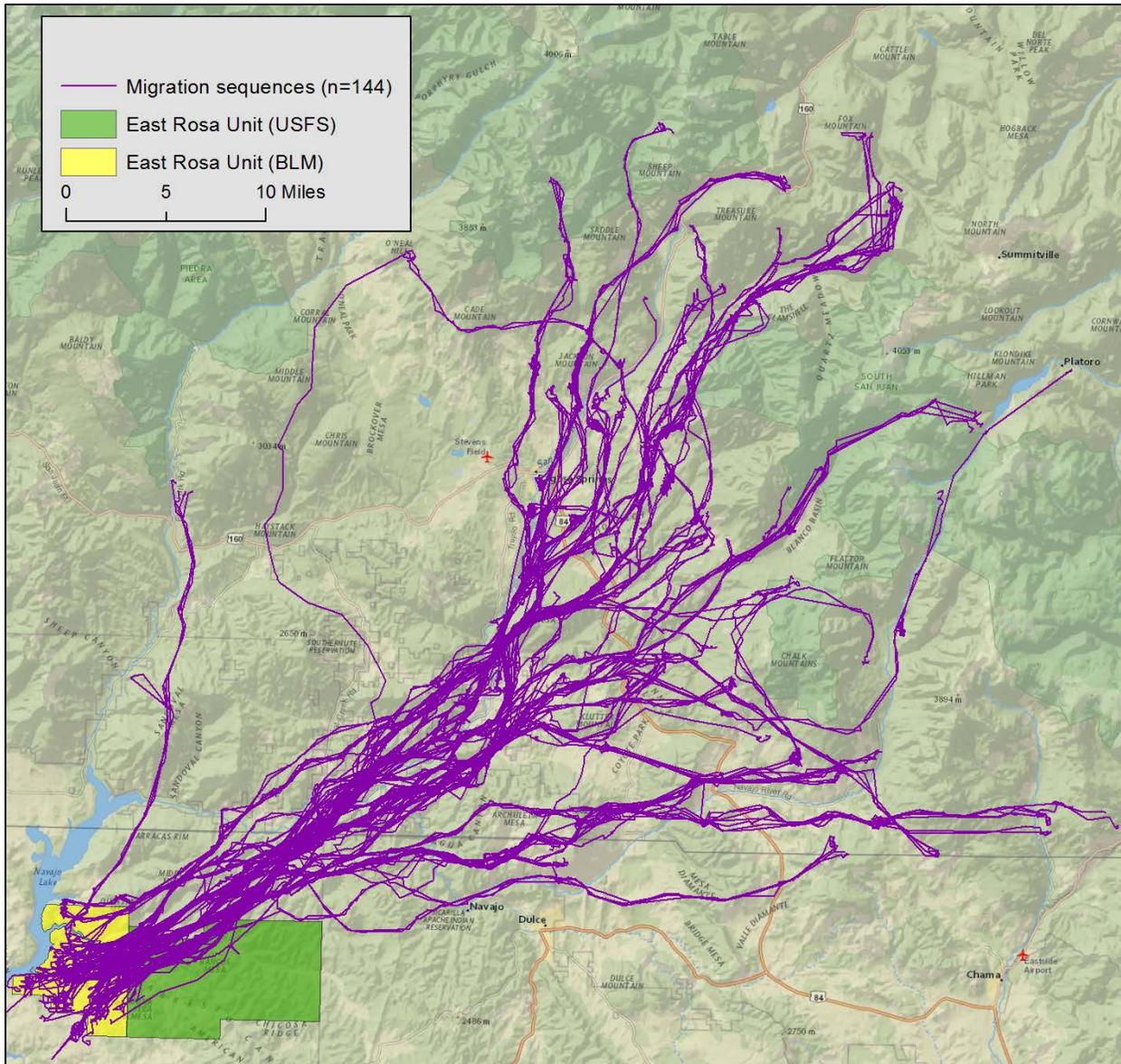


Figure 5. Migrations sequences ( $n=144$ ) collected from 48 individual mule deer between 2012 and 2013.

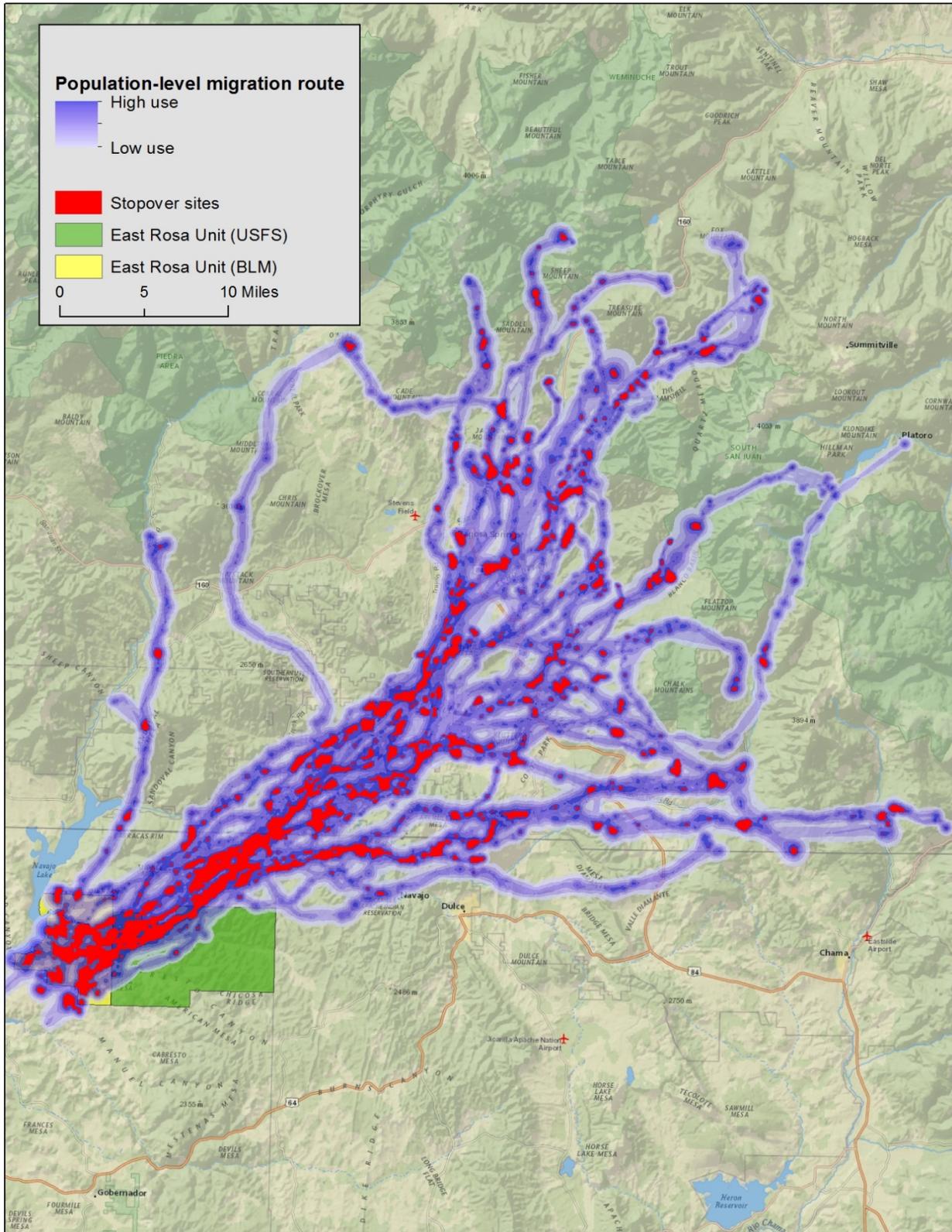


Figure 6. Population-level migration route and stopover sites estimated for the Rosa mule deer herd, 2012-2013.

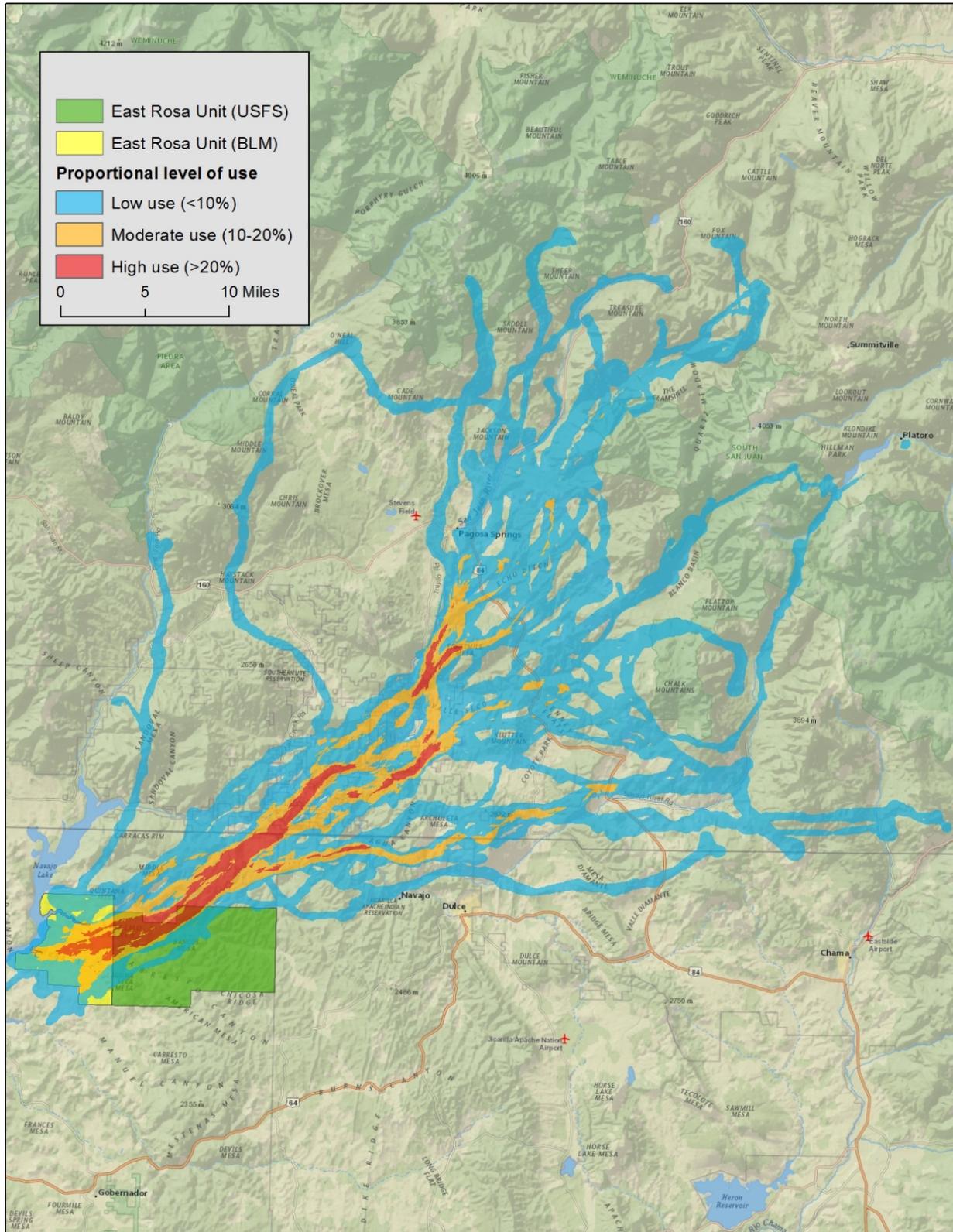


Figure 7. Low, moderate, and high-use segments within the population-level migration route of the Rosa mule deer herd, 2012-2013.

## Migration Timing

The migratory timing of mule deer from the Rosa population was consistent across individuals and years (Fig. 8). Spring migration began in late April, with an average start date of April 21 and April 29 in 2012 and 2013, respectively. The fall migration always started in mid-October, with an average start date of October 16 and October 14 in 2012 and 2013, respectively. Spring migrations typically took 21 days to complete, whereas fall migrations were completed 14 days.

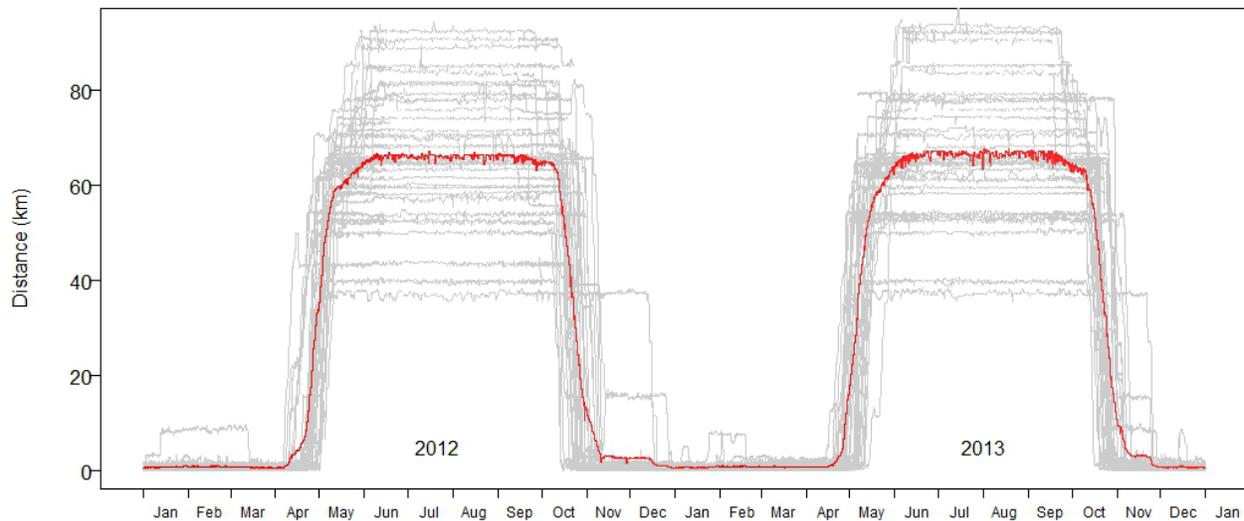


Figure 8. Average (red) and net displacement of individual mule deer (gray), 2012 through 2013. The peaks and valleys represent summer and winter range, respectively. The vertical lines depict migration periods.

## Winter Distribution

Winter UD, including core-use areas, were estimated using 49,801 locations collected from 42 GPS-collared deer during the winter of 2011-12 (Figs. 9-10) and 52,396 locations from 42 GPS-collared deer in the winter of 2012-13 (Figs. 11-12). In general, winter distribution patterns were similar across years, with most deer use occurring in the central part of the study area.

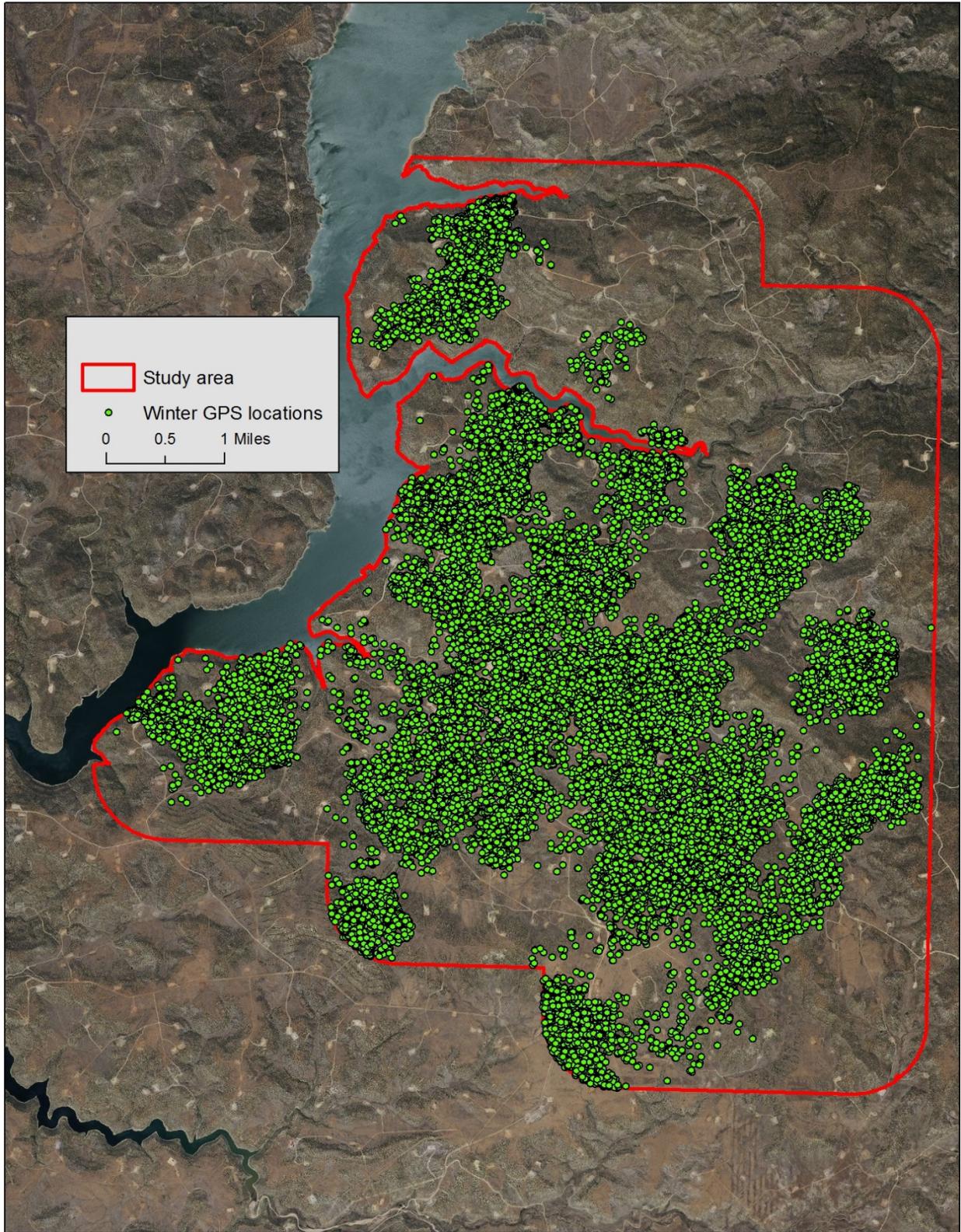


Figure 9. GPS locations (n=49,801) locations collected from 42 GPS-collared deer during the winter of 2011-12.

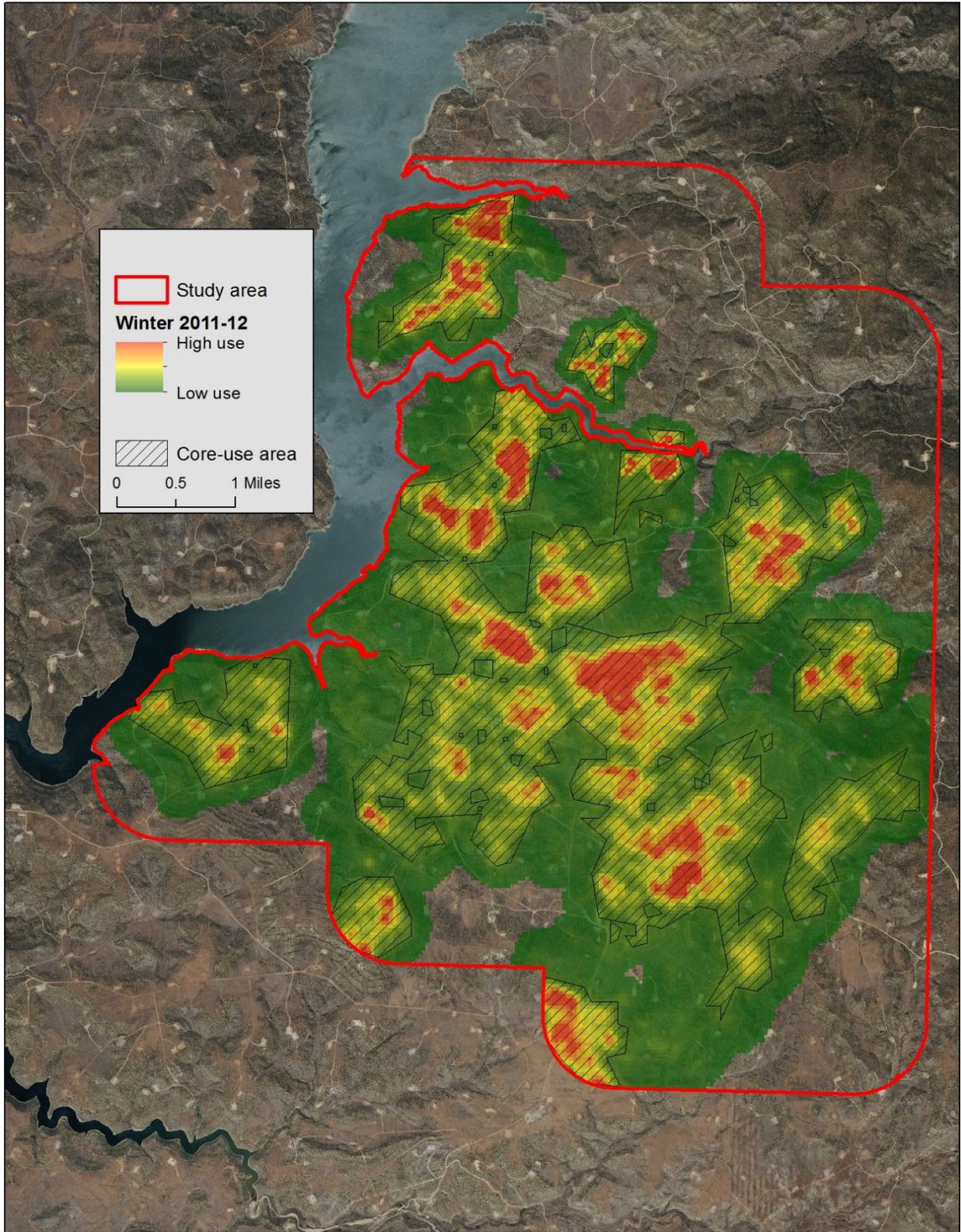


Figure 10. Winter utilization distribution (UD) and core-use areas estimated for the winter of 2011-12.

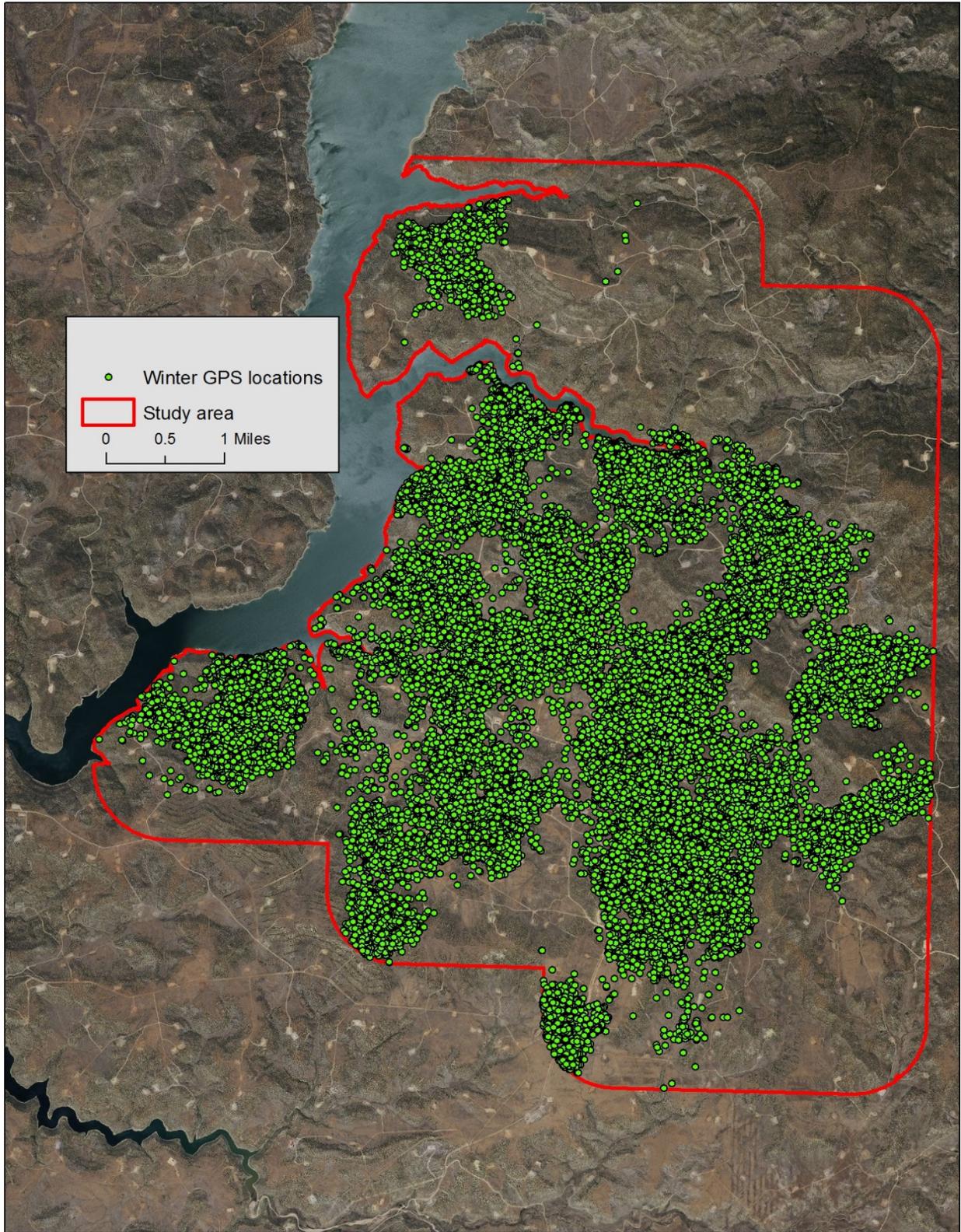


Figure 11. GPS locations (n=52,396) locations collected from 42 GPS-collared deer during the winter of 2012-13.

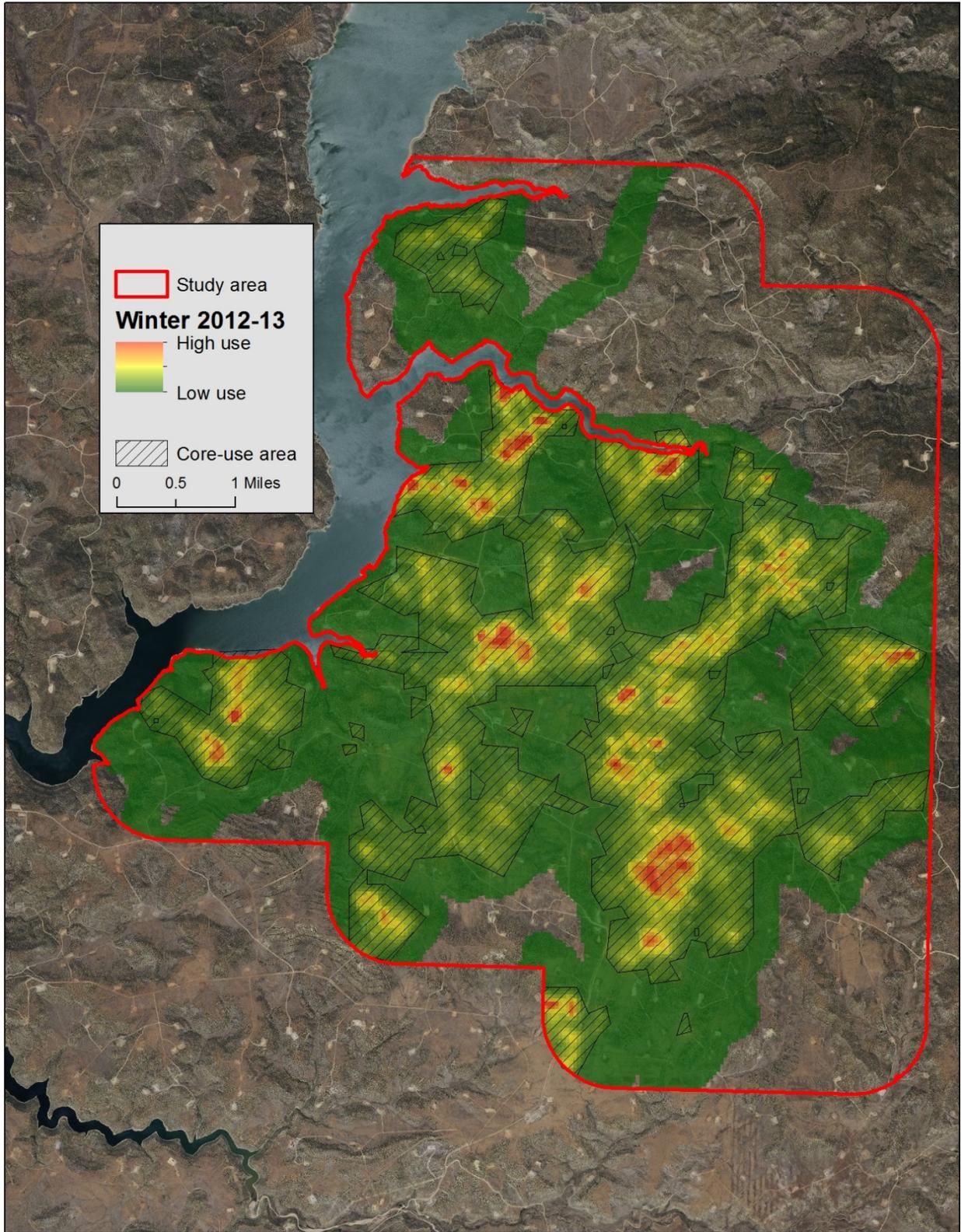


Figure 12. Winter utilization distribution (UD) and core-use areas estimated for the winter of 2012-13.

## Winter Habitat Selection

We used 49,801 locations collected from 42 GPS-collared deer to estimate a population-level habitat use model and predictive map for the 2011-12 winter (Fig. 13). For the following 2012-13 winter, we used an additional 52,396 locations from 42 GPS-collared deer (Fig. 14). Based on AIC values, the top model included 5 habitat variables: elevation, slope, proportion of big sagebrush, aspect, and distance to well pad (Table 1). With the exception of aspect, none of 90% CIs for model coefficients overlapped with zero, which is indicative of consistent habitat use patterns among individual deer. Forest cover was not included the model because it was strongly correlated ( $r=-0.78$ ) with sagebrush. Among all the various disturbance metrics considered (e.g., road density, well pad density, distance to road, distance to well pad), the model with distance to well pad had the lowest AIC value. In general, deer selected for areas with moderate elevations, low slopes, abundant sagebrush, and moderate distance from well pads (Figs. 15-18). The high-use areas depicted in the predictive maps (Figs. 13-14) were concentrated in the central part of the study area and consistent with the core-use areas identified from GPS data (Fig. 10, 12).

Table 1. Estimated coefficients and 90% confidence intervals for habitat use models, winters 2011-12 and 2012-13.

Variable	Winter 2011-12 coefficients	Winter 2012-13 coefficients	90% CI overlap with 0
Intercept	-0.03917	-0.03682	n/a
Elevation	0.40260	0.38160	no*
Elevation <sup>2</sup>	-0.00010	-0.00010	no
Slope	0.02530	0.01977	no
Sagebrush	4.90500	4.69700	no
Aspect	-0.09385	-0.47230	yes
Distance to well pad	0.00449	0.00238	no
Distance to well pad <sup>2</sup>	-0.00001	-0.000007	no

\*Cis that do not overlap with zero indicate statistical significance

When the GPS data collected in winter of 2013-14 were overlaid on the predictions from the 2011–2012 and 2012–2013 habitat use models, the Spearman rank correlations ( $r_s$ ) were 0.97 and 0.95, respectively. The high  $r_s$  values indicated that both models were effective at predicting the locations of GPS-collared deer in the 2013-14 winter.

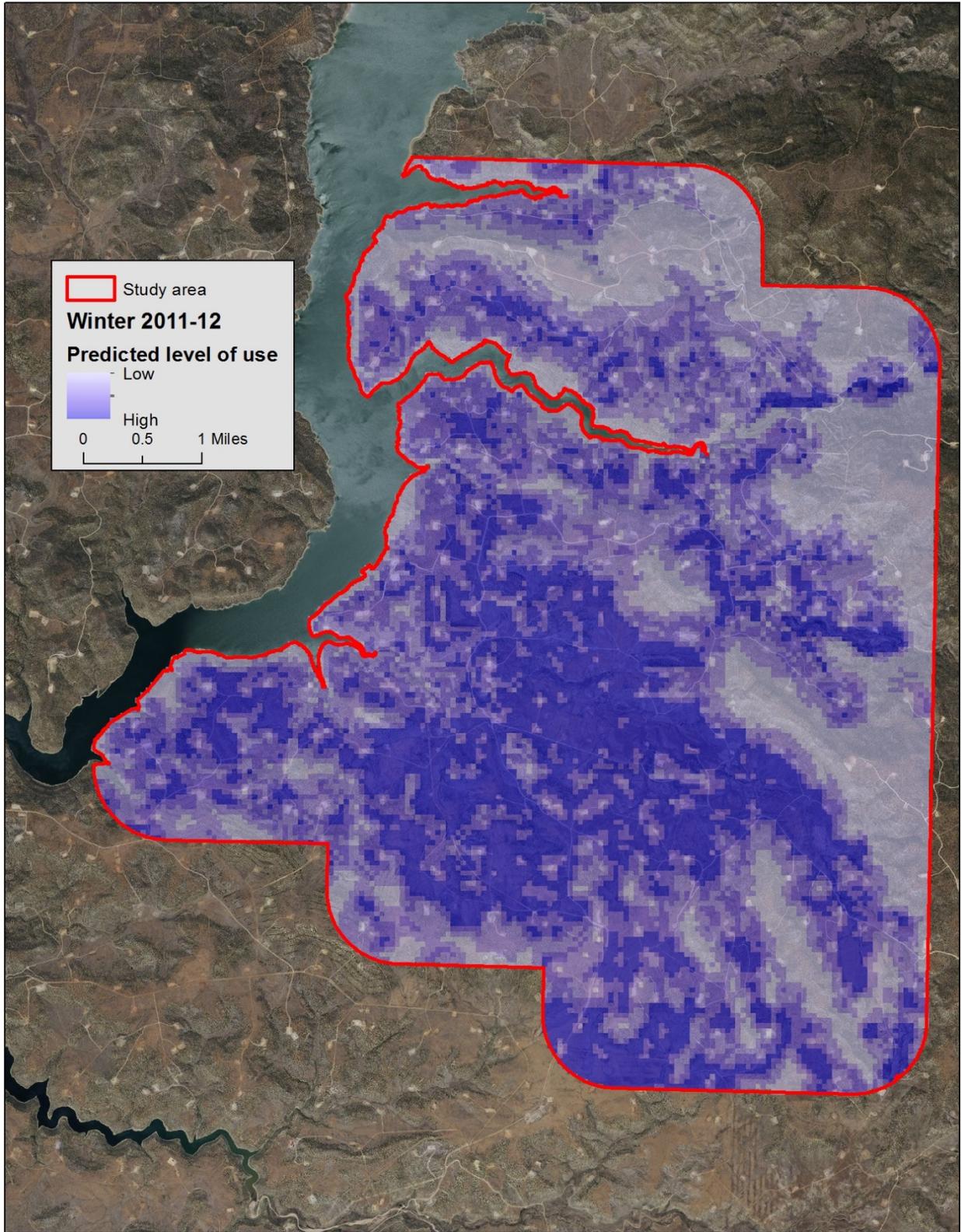


Figure 13. Predicted level of mule deer use during the 2011-12 winter.

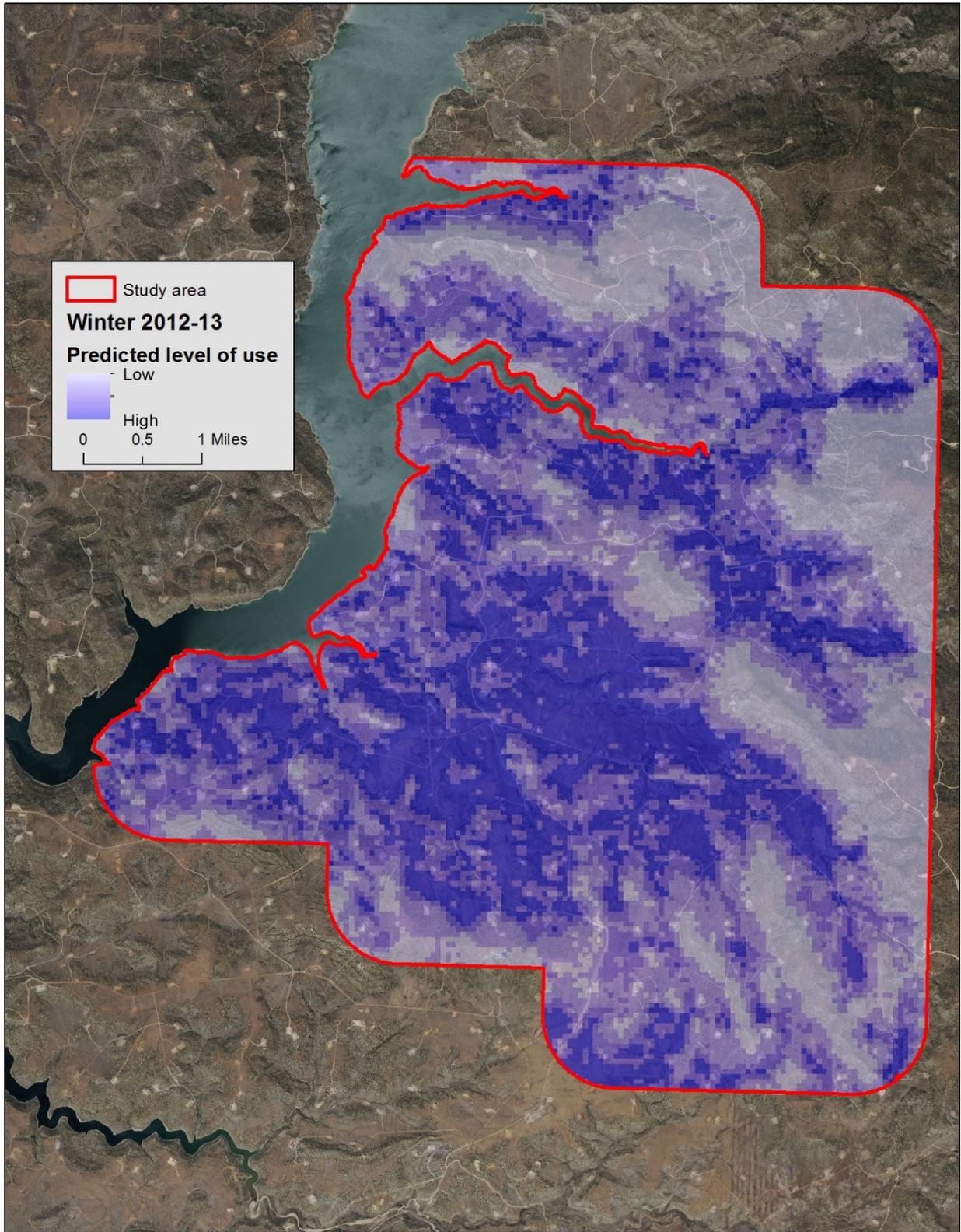


Figure 14. Predicted level of mule deer use during the 2012-13 winter.

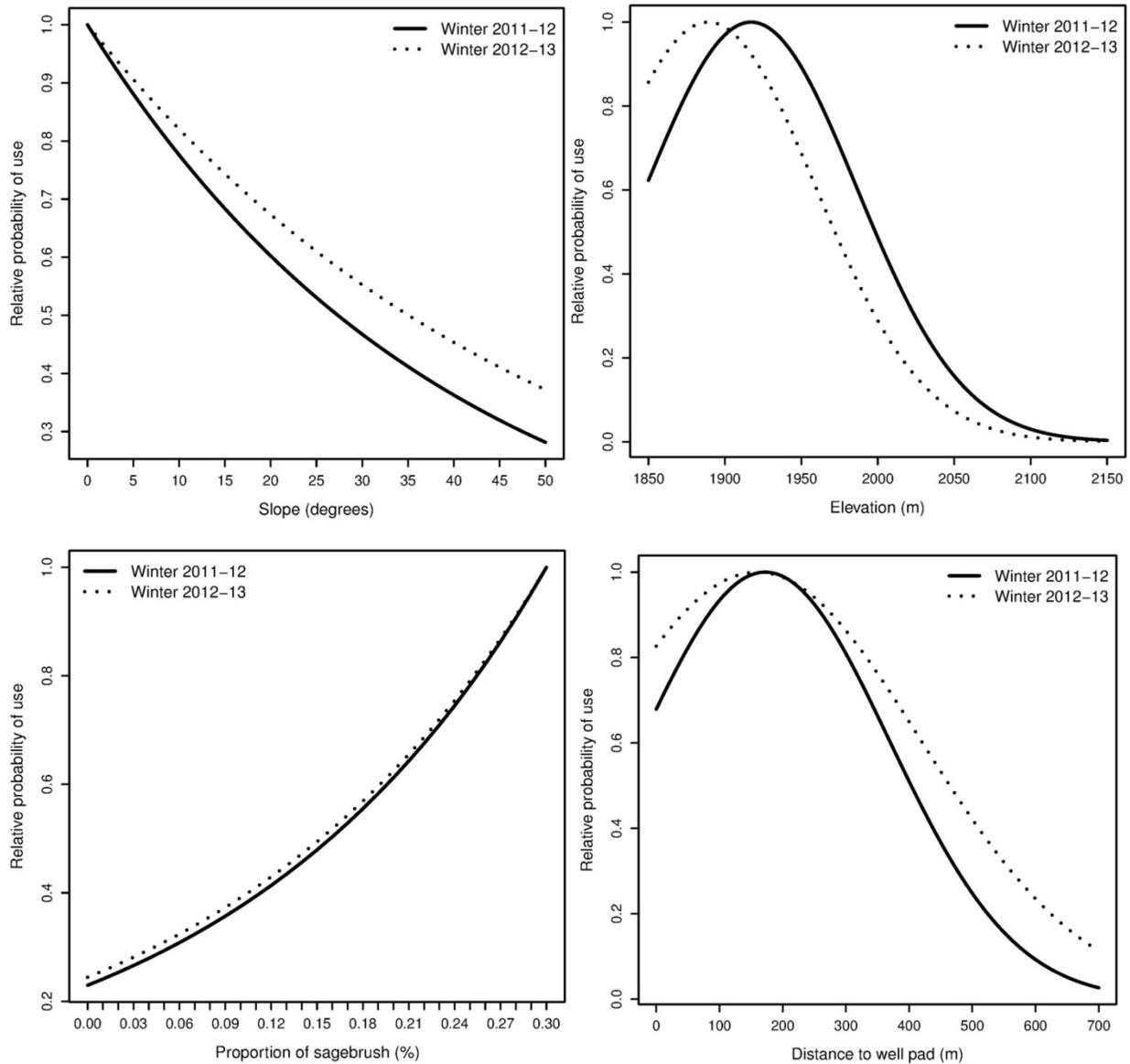


Figure 15. Influence of elevation, slope, proportion of sagebrush, and distance to well pad on the relative probability of deer use during the winters of 2011-12 and 2012-13. Mule deer selected for areas with lower slopes (top left), moderate elevation (top right), abundant sagebrush (lower left), and moderate distance from well pads (lower right).

## Survival

Through July 2014, 38% (23 of 60) of GPS-collared deer had died. Annual survival estimates for 2012 and 2013 were 0.85 and 0.79, respectively. As described in the Methods section, a more comprehensive survival analysis will be completed following Phase 2.

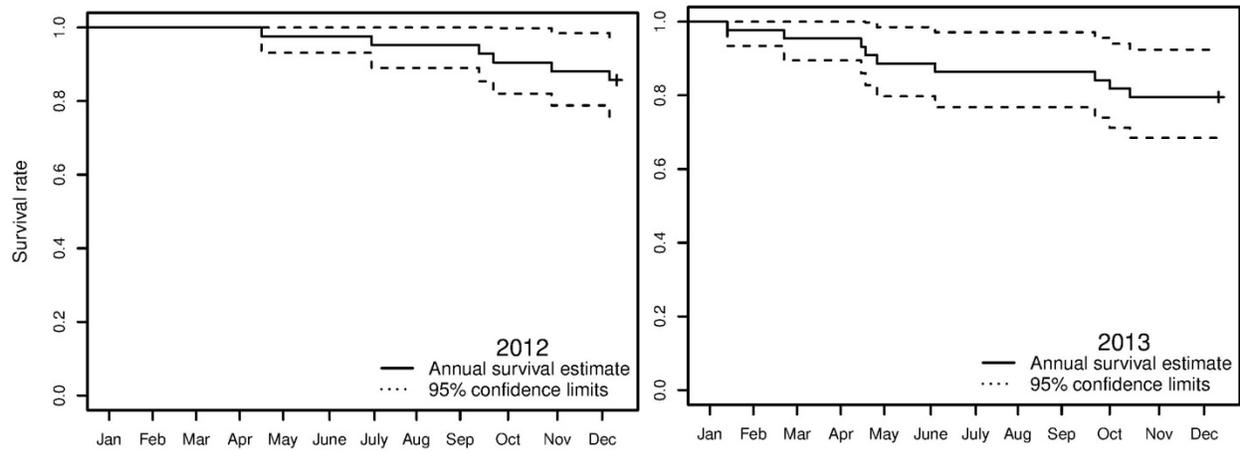


Figure 16. Annual survival rates and 95% confidence intervals of mule deer in 2012 and 2013.

## DISCUSSION

Mule deer populations often have a small fraction of resident or non-migratory animals, but to date, every mule deer captured in the Rosa Unit has been migratory. Managing ungulate populations that migrate long distances is inherently difficult because of the mix of land ownership, land-use patterns, and jurisdictional boundaries. In the case of the Rosa population, the winter range is comprised largely of BLM lands in the San Juan Basin of New Mexico, whereas the summer ranges occur primarily on USFS lands in Colorado some 40 to 70 miles away, across a mix of state, federal, private, and tribal lands. Identifying where migration routes occur can help agencies and other stakeholders improve management of migratory populations in landscapes with complex ownership and land-use patterns (Sawyer et al. 2009a). Provided with fine-scale movement data like those from GPS-collars, it is now possible to identify: 1) population-level migration routes, which reflect the spatial extent and intensity of use of migration routes used by a particular population, 2) stopover sites that represent areas where animals spend >90% of their time during migration, and 3) low, moderate, and high-use routes that depict route segments used by a disproportionate number of animals in the population (Sawyer et al. 2009a). Here, we used GPS data collected during 2012 and 2013 to identify each of these migration characteristics for mule deer that winter in the Rosa Unit. Such information can be used to improve planning, management, and mitigation efforts in the Rosa Unit to minimize impacts or benefit migratory mule deer.

In the multiple-use landscapes of the Intermountain West, protection of the entire population-level route is not feasible, so developing an intuitive and biologically-sound prioritization strategy is needed. Recent work with mule deer in Wyoming (Sawyer et al. 2009a, 2014, Sawyer and Kauffman 2011) suggests that both stopovers and moderate or high-use routes can provide clear and effective ways to prioritize which route segments to consider in land-use planning (e.g., National Environmental Policy Act [NEPA] documents, resource management plans [RMP]) or target for management and conservation efforts. Stopovers are important because they allow mule deer to migrate in concert with changes in vegetation phenology, which in turn improve their ability to maximize energy intake and improve body condition (Sawyer and Kauffman 2011). The high-use routes are important because those are the routes used by the most animals. Outside of the Rosa Unit, the moderate and high-use routes can also help identify where the majority of deer cross highways. For example, deer migrated across US Highway 84 south of Pagosa Springs in multiple areas, but the proportional level of use map indicates that most deer crossed in 5 specific segments: 1) along a timbered ridge just south of Echo Canyon Reservoir, 2) the timbered ridge that extends northeast from Turkey Mountain, 3) Halfway Canyon between Rio Blanco River and Spiler Canyon, 4) a small area between Klutter Mountain and Kenney Flats, and 5) along the Little Navajo River north of Chromo and west of Tater Mountain.

In addition to detailed migration information, we used fine-scale GPS data to document winter distribution patterns and model habitat use in the Rosa Unit. Similar to the population-level migration route, the population-level UDs estimated for winters 2011-12 and 2012-13 illustrate the spatial extent and intensity of use of the winter range. The core-use areas identify which portions of the winter range were most heavily used by GPS-marked deer. Through both years, the winter distribution patterns appeared relatively consistent, with the most deer use occurring in the central part of the Rosa Unit and some clear gaps in the northeast and southeast corners. Although the population-level UDs and core-use areas provide an intuitive means to document and visualize the winter distribution patterns of marked animals, they do not provide any information on what habitat characteristics (e.g., slope, elevation, etc.) influence deer use or how unmarked deer might be using other parts of the Rosa Unit. Accordingly, we complemented the winter distribution analyses with habitat use models that predict the relative probability of deer use across the entire study area, as a function of habitat variables known to be important to mule deer (e.g., slope, aspect, elevation, sagebrush, and distance to well pad).

Not surprisingly, deer preferred areas with lots of sagebrush on gentle slopes and moderate elevations. Similar to other mule deer studies in winter ranges with gas development (e.g., Sawyer et al. 2009b), including the distance to well pad variable improved model fit. However, unlike deer populations in open sagebrush habitats that avoid well pads by up to 1 km (Sawyer et al. 2006, 2009b), the level of well pad avoidance by deer in the Rosa Unit was relatively low, as they preferred areas approximately 200 m from well pads. For context, the maximum distance from any well pad in the study area was only 750 m and the mean distance 210 m. Given these constraints, deer in the Rosa Unit did not have the option to get very far from oil and gas infrastructure. Additionally, the forest cover provided by pinion-juniper and the diverse topography of the area likely help ameliorate effects of human disturbance and activity (Edge and Marcum 1991, Rowland et al. 2005). Overall, the winter habitat use model provides a reliable predictive map of how deer utilize the Rosa Unit and what habitat characteristics are influential. Such maps can be used as baseline data to compare with future years if or when additional development occurs in the Rosa Unit. In short, the predictive maps provide another tool to assist with planning and management efforts in the Rosa Unit.

A strong component of the Rosa study design is that the same animals will be monitored through Phase 1 and Phase 2. This type of “longitudinal” data will eventually allow us to evaluate how or if survival is influenced by certain habitat variables, disturbance metrics, or migration characteristics. While this type of analysis is premature at this time, we do provide basic annual estimates of deer survival. The 2012 survival rate was consistent with those recorded for other mule deer populations across the West, which generally average 0.85 (Unsworth et al. 1999). The 0.79 survival rate observed in 2013 was lower compared to the regional averages (Unsworth et al. 1999).

As mentioned in the introduction, Phase 1 was originally designed to provide baseline data before several winters of proposed drilling, so that potential effects of drilling on migration and winter use could be evaluated (e.g., Lendrum et al. 2012, 13, Sawyer et al. 2013). Although the proposed winter drilling has not occurred, the utility of this baseline migration and winter use data is not diminished. Rather, the detailed and spatially explicit information on winter use and migration provides valuable information for agencies, industry, and other stakeholders to improve the planning process and management of migratory mule deer. The GPS collars currently deployed will collect data until April 2016 and we anticipate the final report to be complete before the end of 2016.

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