Environmental Assessment

FINAL

Midnight Point and Mahogany Geothermal Exploration Projects, Glass Buttes, Oregon

July 2013

Prepared By
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Environmental Assessment

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Table of Contents

Chapter 1 Purpose and Need 1-1

1.1 Introduction 1-1

1.2 Background 1-1

1.3 Summary of the Applicant Proposed Action 1-7

1.4 Purpose and Need for Action 1-8

1.4.1 Bureau of Land Management 1-8

1.4.2 Department of Energy 1-8

1.5 Conformance 1-9

1.5.1 Brothers/LaPine Resource Management Plan 1-9

1.5.2 Three Rivers Resource Management Plan 1-9

1.5.3 Relationship to Statutes, Regulations, or Other Plans and Projects 1-10

1.6 Scoping and Identification of Issues 1-12

1.6.1 Public Scoping Period 1-12

1.6.2 Issues 1-12

1.7 Decisions to be Made 1-13

1.7.1 Bureau of Land Management 1-13

1.7.2 Department of Energy 1-14

Chapter 2 Alternatives 2-1

2.1 Introduction 2-1

2.1.1 Project Area 2-1

2.2 Alternative A 2-1

2.3 Alternative B 2-2

2.3.1 Well Pads 2-5

2.3.2 Drilling Operations 2-11

2.3.3 Surface Reclamation 2-28

2.3.4 Potential Surface Disturbance Summary 2-30

2.4 Alternative C 2-31

2.5 Project Design Features Common to Alternatives B & C 2-35

2.5.1 Safety Plans 2-41
2.6 Alternatives Considered But Eliminated from Further Analysis 2-42

Chapter 3 Affected Environment and Environmental Consequences 3-1

3.1 Introduction 3-1
3.1.1 Units of Measure for the Issues 3-1
3.2 Comparison of Alternatives 3-3
3.3 Recreation 3-6
3.4 Rangeland Management 3-13
3.5 Biological Resources 3-17
3.6 Visual Resources 3-37
3.7 Cultural Resources and Traditional Practices 3-48
3.8 Wilderness Characteristics 3-50
3.9 Public Safety 3-51
3.10 Wetlands 3-52
3.11 Groundwater and Water Rights 3-55
3.12 Cumulative Effects 3-57
3.12.1 Past, Present, and Reasonably Foreseeable Future Activities in the Project Area 3-57
3.12.2 Cumulative Effects 3-60

Chapter 4 Tribes, Organizations, and Agencies Consulted 4-1

4.1 Tribes 4-1
4.2 Agencies 4-1

Chapter 5 List of Preparers 5-1

5.1 Lead Agency 5-1
5.2 Environmental Consultants 5-2

Chapter 6 References 6-1

Appendices

Appendix A Issues Considered But Not Analyzed
Appendix B Design Criteria for Community Pit/Quarry
Appendix C Habitat Mitigation Plan

Tables

Table 2-1 Well Pad Site Locations....2-5

Table 2-2 Summary Table of Potential Surface Disturbance under Alternative B....2-31

Table 2-3 Summary Table of Potential Surface Disturbance under Alternative C....2-32

Table 3-1 Comparison of Effects for Each Alternative....3-3

Table 3-2 Noxious Weeds Species Potentially Occurring in the Project Area....3-28

Table 3-3 Acreage of PPH and PGH Habitat affected by Surface Disturbance from the Public Lands Project....3-30

Table 3-4 Comparison of Existing and Proposed New Roads in PPH and PGH Habitat under the Public Lands Project (Alternative B)....3-31

Table 3-5 Total Acreage of PPH and PGH in the Public Lands Project Area, and PPH and PGH Affected by Noise from the Public Lands Project (Alternative B)....3-32

Table 3-6 Zone of Influence Applied to Each Side of Road for Deer and Elk....3-32

Table 3-7 Total Acreage Mule Deer and Elk Winter Range in the Public Lands Project Area in the Zone of Influence from Existing and Project-Related Roads (Alternative B)....3-33

Table 3-8 Acreage of PGH Affected by Surface Disturbance from the Public Lands Project....3-35

Table 3-9 Comparison of Existing and Proposed New Roads in PPH and PGH Habitat under the Public Lands Project (Alternative C)....3-35

Table 3-10 Total Acreage of PPH and PGH in the Public Lands Project Area under Alternative C, and PPH and PGH Affected by Noise from the Project....3-36

Table 3-11 Total Mitigation Prescribed by the Mitigation Plan....3-60

Table 3-12 Cumulative Effects from the Action Alternatives and Past, Present, and Reasonably Foreseeable Future Activities....3-65

Table C-1 Mitigation calculation for Category 2 Habitat....C-4

Table C-2 Mitigation calculation for Category 1 Habitat....C-4

Figures

Figure 1-1 General Location of Project Site....1-3

Figure 1-2 Alternative B....1-5

Figure 2-1 Federal Geothermal Leases within the Midnight Point and Mahogany Project Areas....2-3

Figure 2-2 Typical Slim Well Pad Layout....2-7

Figure 2-3 Typical Production Well Layout 2-9

Figure 2-4 Slim Well Rig 2-13

Figure 2-5 Typical Slim Well Profile 2-15

Figure 2-6 Full Size Rig 2-18

Figure 2-7 Typical Production Well Profile 2-20

Figure 2-8 Potential Locations for Installation of Rolling Dips and Culverts 2-25

Figure 2-9 Alternative C 2-33

Figure 3-1A Recreational Use – Camping and Recreational Minerals 3-7

Figure 3-1B Recreational Use - Off-Road Vehicle Recreation 3-9

Figure 3-2 Grazing Allotments in Project Area 3-15

Figure 3-3 Sage-grouse Habitat 3-20

Figure 3-4 Big Game Winter Range 3-23

Figure 3-5 Raptor Nests in Project Vicinity 3-26

Figure 3-6A Visual Resources Management Classes in the Brothers/LaPine RMP 3-39

Figure 3-6B Visual Resources Management Classes in the Three Rivers RMP 3-41

Figure 3-7 Key Observation Points 3-43

Figure 3-8 Wetlands and Existing Water Wells in Project Area 3-53

Figure 3-9A Reasonably Forseeable Future Actions 3-61

Figure 3-9B Sage-grouse Habitat and Mitigation Areas 3-63

Acronyms

ACDP Air Containment Discharge Permit

AR Access Road

BGEPA Bald and Golden Eagle Protection Act

BLM Bureau of Land Management

BMPs Best Management Practices

BOPE Blowout Prevention Equipment

BPA	Bonneville Power Administration
CEQ	Council of Environmental Quality
CFR	Code of Federal Regulation
CWA	Clean Water Act
DEQ	Oregon Department of Environmental Quality
DOE	U.S. Department of Energy
DOGAMI	Oregon Department of Geology and Mineral Industries
DOI	U.S. Department of Interior
EA	Environmental Assessment
EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act of 2007
FLPMA	Federal Land Policy and Management Act of 1976
FOA	Funding Opportunity Announcement
FONSI	Finding of No Significant Impact
GHG	Greenhouse Gas
GTP	Geothermal Technology Program
Hg	Mercury
HgS	Cinnabar Ore
KOPs	Key Observation Points
LEL	Lower Explosive Limit
MBTA	Migratory Bird Treaty Act
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
OAR	Oregon Administrative Rules

ODFW	Oregon Department of Fish and Wildlife
OHV	Off-Highway Vehicle
OR	Obsidian Road
OSHA	Occupational Safety and Health Administration
PDFs	Project Design Features
PGH	Preliminary General Habitat
PL	Public Law
POD	Plan of Development
PPH	Preliminary Priority Habitat
PVC	Polyvinyl chloride
RA	Resource Area
RMP	Resource Management Plan
TCP	Traditional Cultural Property
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VRM	Visual Resource Management
WAFWA	Western Association of Fish and Wildlife Agencies
WNv	West Nile Virus

Chapter 1
Purpose and Need

1.1 Introduction

This Environmental Assessment (EA) has been prepared to disclose and analyze the environmental effects of geothermal exploration projects (the Projects) proposed by Ormat Nevada Inc. (the Applicant) in Lake and Harney Counties, Oregon. The proposed Projects would involve the drilling, testing, and monitoring of up to 13 geothermal exploratory wells on public lands (Public Lands project) administered by the Bureau of Land Management (BLM) and up to three geothermal exploratory wells on private lands (Private Lands project) located near Glass Buttes, Oregon (**Figure 1-1**). The objective of the proposed Projects is to evaluate the potential of the geothermal resources in the Glass Buttes area. Any future exploration and/or development activities that may follow the conclusion of the proposed Projects would require additional permit applications and prior approval from the BLM. Such future actions would also be subject to additional environmental review and decision-making processes.

BLM is the federal regulatory agency responsible for management and administration of the nation's geothermal resources, including the leasing of government property and permitting subsurface geothermal exploration activities. BLM is also responsible for performing National Environmental Policy Act (NEPA; 42 USC §4321 *et seq.*) compliance on such geothermal activities and is the lead federal agency for the preparation of this EA. The U.S. Department of Energy (DOE) is considering whether to authorize the Applicant to expend federal funding on the Projects and, therefore, is serving as a cooperating agency in the NEPA process. This EA will assist the BLM and DOE in complying with NEPA and in making a determination as to whether any "significant" impacts could result from implementation of the proposed Projects.[1] This EA will inform the agencies' decision-making processes and will provide evidence for determining whether to prepare an Environmental Impact Statement (EIS) or a "Finding of No Significant Impact" (FONSI), or deny the project.

1.2 Background

The Applicant has secured leasing rights to approximately 37,500 acres of BLM lands in south central Oregon to conduct exploratory drilling for potential geothermal resources. These leasing rights, effective from February 1, 2009 until February 1, 2019, were issued by BLM to the Applicant through an open bid auction process which concluded on December 19, 2008. On September 27, 2010, the Applicant filed Geothermal Drilling Permit Applications with the BLM Oregon State Office for the Mahogany and Midnight Point Geothermal Exploration Projects, located west and east (respectively) of Glass Butte in Lake and Harney Counties, Oregon (**Figure 1-2**).

[1] "Significance" is defined by the Council of Environmental Quality (CEQ) regulation 1508.27 and is evaluated based on this criteria. Definition available online at: http://ceq.hss.doe.gov/nepa/regs/ceq/1508.htm#1508.27

The Applicant proposes to conduct the drilling, testing, and monitoring of up to three wells on federal geothermal leases in the BLM Prineville District (Mahogany project) and up to ten wells on federal geothermal leases in the BLM Burns District (Midnight Point project; together, the Public Lands project). In addition to the Public Lands project, the Applicant proposes to conduct the drilling, testing, and monitoring of up to three wells on private land located adjacent to the federal geothermal leases west of Glass Butte (Private Lands project). The proposed activities – on both public and private lands – would also require improvement to existing access roads and the installation of some new access roads across public lands.

Because the lease areas for the Midnight Point and Mahogany projects are contiguous, BLM has decided to prepare a single EA that would assess the potential environmental effects of both geothermal exploration projects. However, in the event that BLM determines that the Midnight Point and/or Mahogany projects would not result in significant impacts, BLM would issue a FONSI for each project. In addition, DOE will perform an independent review of this EA and make its own determination on whether to prepare an EIS or a FONSI or deny the project.

BLM has determined that because one of the access roads to the proposed private wells is located within the federal leasing area (within the Public Lands project area), the Applicant would be required to submit a Notice of Intent to Drill with a Plan of Operations to be permitted to use the access road for anything more than "casual" use.[2] Because development of the Private Lands project is dependent upon Federal approval of the pending application for the Public Lands project, the Private Lands project qualifies as a "connected non-federal action" under 40 CFR 1508.7, 40 CFR 1508.25(c). This NEPA analysis therefore includes the Private Lands project.

While this environmental review requires disclosure of potential effects on private lands as a connected action, BLM only has the authority to approve, modify, or deny the applications for those actions occurring on public lands. The BLM is not responsible for permitting geothermal exploration activities on the Private Lands project. Rather, the drilling of the Private Lands project would be permitted exclusively through the Oregon Department of Geology and Mineral Industries (DOGAMI). However, if the DOE awards grant funding to the Applicant, the funding would apply to all of the Projects, including the Private Lands project. This action constitutes a federal nexus allowing DOE the authority to prescribe stipulations and/or conditions to the grant. If awarded, the grant agreement between DOE and the Applicant would include the same stipulations and/or conditions contained in this EA.

[2] Examples of casual use activities include driving vehicles over existing roads, sampling, surveying, marking routes, collecting data to prepare an application for a right-of-way, and performing certain activities that do not cause any appreciable disturbance or damage to the public land, resources, or improvements.

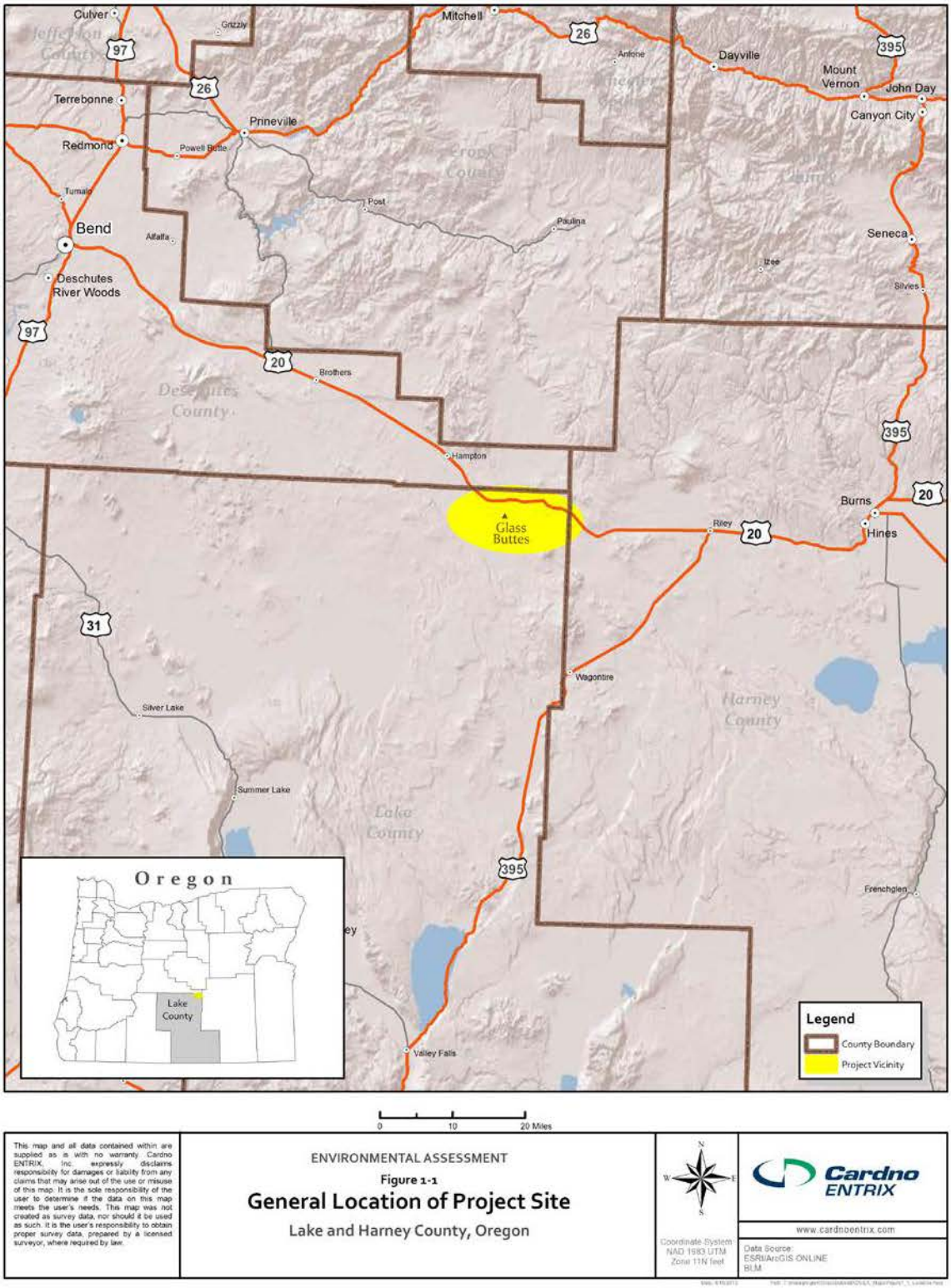

Figure 1-1 General Location of Project Site

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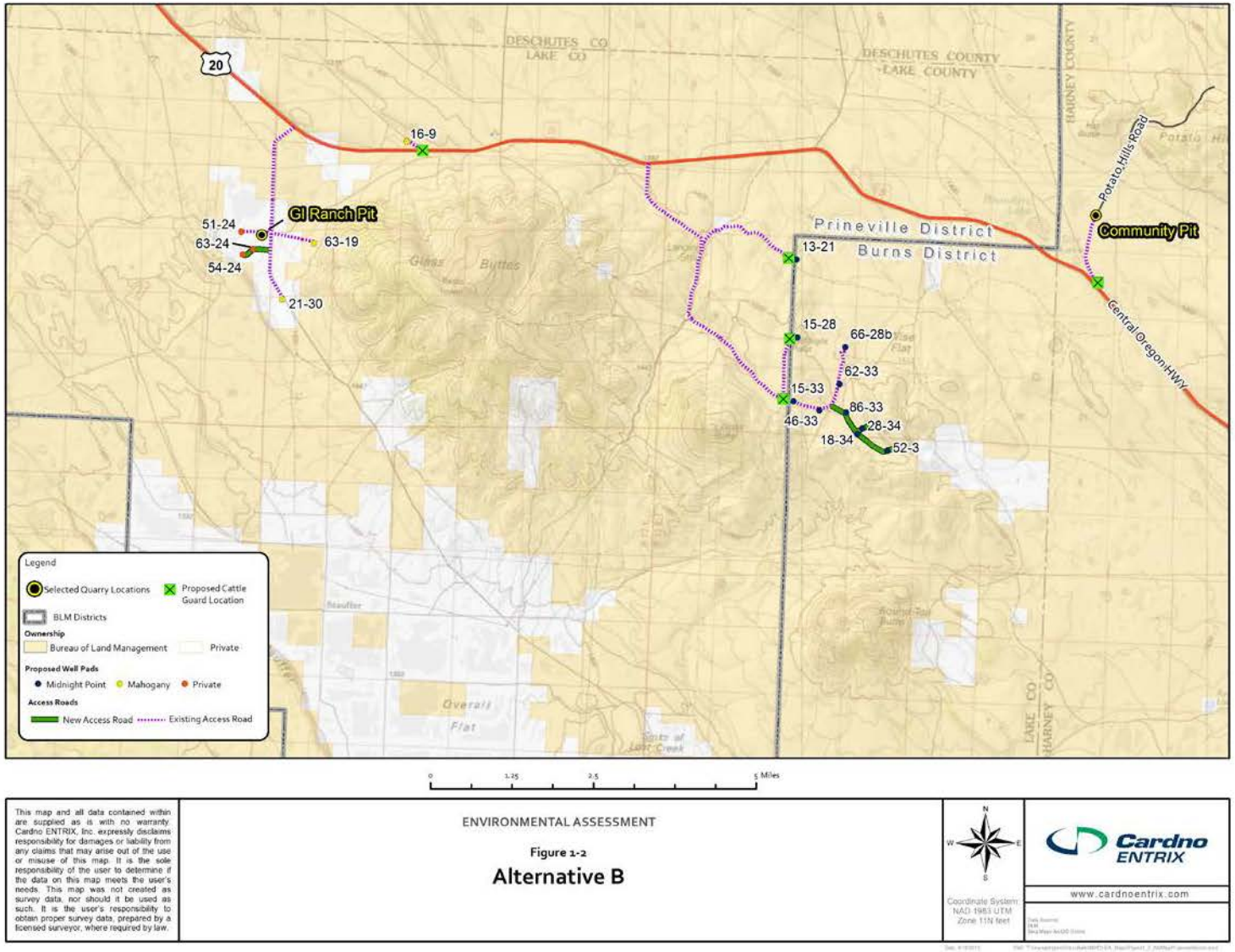

Figure 1-2 Alternative B

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1.3 Summary of the Applicant Proposed Action

The proposed Projects are located approximately 70 miles southeast of Bend, Oregon, and 50 miles northwest of Burns, Oregon, north and south of U.S. Highway 20 (**Figure 1-1**). Each exploratory well would be drilled within a well pad ranging in size from approximately 2.07 to 4.13 acres, depending on well type. Each well pad would accommodate a drill rig and other structures and facilities related to the drilling operation. Access to each well pad would be provided by existing or new aggregate access roads with an all-weather surface accessible from U.S. Highway 20.

The activities described in the Geothermal Drilling Permit Applications for both the Mahogany and Midnight Point projects are described and analyzed in this EA. Up to three "slim" wells would be drilled on lands managed by the BLM Prineville District (Mahogany project) and up to ten production-sized wells would be drilled on lands managed by the BLM Burns District (Midnight Point project).[3] To support drilling operations, the improvements to existing access roads and the installation of some new access roads would be required. Aggregate for access road work would be extracted and transported from an off-site quarry(s) (i.e. the Community Pit, G.I. Ranch Pit, and/or Harney Rock Pit). Cumulatively, the Mahogany and Midnight Point projects would disturb 47.52 acres for well pad development, 4.09 acres for new access roads, 1.32 acres for access road pullouts and truck turnarounds, 0.57 acres for widening of existing roads, and 5 acres of disturbance for aggregate extraction. An additional proposed activity, the drilling of three non-potable water wells to provide water supply for drilling operations, would be drilled within the proposed geothermal well pad sites, resulting in no new surface area disturbance associated with these wells.

In addition to the Public Lands projects, the Applicant proposes to conduct the drilling, testing, and monitoring of up to three wells on private land located adjacent to the federal geothermal leases west of Glass Butte (Private Lands project). The Applicant also proposes to develop a quarry (G.I. Ranch Pit) within the Private Lands project area that would supply aggregate to both the Private Lands project and the Mahogany project. The approximate surface disturbance for the Private Lands project would be 6.21 acres for well pad development, 1.11 acres for new access roads, 1.04 acres for widening of existing roads, and 5 acres for mineral materials extraction.

If the required permits and approvals are obtained, the Applicant proposes to initiate geothermal exploration activities as soon as possible and conduct exploration 24-hours per day and 7-days per week from August 16th to February 28th. The proposed Projects would be implemented over a period of one to three years. The well pads and access roads would be left in place and subject to quarterly or monthly inspection and maintenance by the Applicant, until such time as the well is deemed to be commercially unviable or the geothermal lease is relinquished to BLM. Final reclamation activities for those sites would then be engaged. See **Section 2.2** below for a detailed description of the Projects.

[3] For a description of slim and production-sized wells, please see **Section 2.2.1** of this EA.

1.4 Purpose and Need for Action

1.4.1 Bureau of Land Management

The purpose of BLM's action is to grant, grant with conditions, or deny the Geothermal Drilling Permit Applications for the Mahogany and Midnight Point projects and the right-of way request for an existing Potato Hills Road. The need for the BLM action, to respond to the Geothermal Drilling Permit Applications, arises from the Geothermal Steam Act of 1970 and subsequent implementing regulations. Pursuant to this Act, BLM is required to respond to proposed plans, applications, and projects submitted by a geothermal lessee (or the lessee's designated operator). BLM is responsible for oversight and regulation of geothermal exploration associated with the federal leases. BLM therefore has the responsibility to respond to the proposal by evaluating the Public Lands project and making a decision of whether or not and under what terms to allow the Public Lands project to proceed.

BLM has a further responsibility to comply with Executive Order 13212 regarding energy-related projects, which directs agencies to "expedite their reviews of permits or take other actions as necessary to accelerate the completion of such projects, while maintaining safety, public health, and environmental protections."

1.4.2 Department of Energy

DOE is proposing to provide the Applicant with a financial assistance award funded under the American Recovery and Reinvestment Act of 2009 (Recovery Act) for the Projects. The purpose of DOE's proposed action is to validate innovative exploration activities to locate undiscovered geothermal systems and increase the reliability of site characterization to prioritize target sites for energy production. The need for DOE's action to is reduce the high level of risk during the early stages of geothermal project development to further the objective of DOE's Geothermal Technologies Program (GTP) to establish geothermal energy as an economically competitive contributor to the U.S. energy supply.

As background, in an effort to increase national energy options, reduce vulnerability to disruption and increase the flexibility of the market to meet U.S. needs, DOE's GTP facilitates research, development, and demonstration to establish geothermal energy as a major contributor for electricity generation. As part of the Recovery Act efforts, DOE issued a funding opportunity announcement (FOA) DE-FOA-0000109, entitled, "Recovery Act: Geothermal Technologies Program". Under the authorization of the Energy Independence and Security Act of 2007 (EISA), GTP included the following topic area in the FOA: "Topic Area 1: Validation of Innovative Exploration Technologies" and the Applicant sought funding for the Projects under this FOA. Specifically, the Applicant seeks to merge geophysical and geochemical surveys to reduce exploration risk by characterizing the geothermal resource at Glass Buttes, Oregon. The Projects as defined in this EA comprise the proposed exploration project that DOE is considering partially funding, titled, "Recovery Act: Merging High Resolution Geophysical and Geochemical Surveys to Reduce Exploration Risk at Glass Buttes, Oregon". DOE has authorized the Applicant to use a percentage of its federal funding for preliminary activities, which include geophysical and geochemical surveys, data analysis, and geologic fieldwork. The activities are associated with the proposed Projects and do not significantly impact the environment nor

represent an irreversible or irretrievable commitment by DOE in advance of the conclusion of the EA.

NEPA, the CEQ's regulations for implementing NEPA (40 CFR 1500 to 1508), and the DOE's NEPA implementing procedures (10 CFR 1021) require that DOE consider the potential environmental impacts of a proposed action before making a decision. This requirement applies to decisions about whether to provide different types of financial assistance to private entities.

1.5 Conformance

The Mahogany and Midnight Point projects are located on BLM administered lands subject to the provisions and stipulations of both the Brothers-LaPine Resource Management Plan (RMP) and the Three Rivers RMP. The Brothers-LaPine RMP applies to lands in the BLM Prineville District that include the Mahogany project area and the portion of the Midnight Point project access roads that would be located in the BLM Prineville District. The Three Rivers RMP applies to lands in the BLM Burns District that include the Midnight Point project area.

1.5.1 Brothers/LaPine Resource Management Plan

The two action alternatives (Alternatives B and C) would be in conformance with the Brothers/LaPine RMP (BLM 1989):

- Approximately 910,000 acres of public lands will be open to exploration subject to standard lease requirements and stipulations (page 107).
- Seasonal restrictions will be applied to mitigate the impacts of human activities on important seasonal wildlife habitat (page 97).
- Soils will be managed to maintain productivity and to minimize erosion (page 121).

1.5.2 Three Rivers Resource Management Plan

Alternatives B and C would also be in conformance with the Three Rivers RMP (BLM 1992):

- Provide maximum leasing opportunities for oil, gas, and geothermal exploration and development by utilizing the least restrictive leasing categories necessary to protect sensitive resources (page 2-156).
- Allocate a total of approximately 1,499,000 acres as open to oil, gas, and geothermal leasing subject to standard terms and conditions (page 2-156).
- Protect or enhance groundwater quality on public lands (page 2-10).
- Minimize erosion from roads, mines and other human activities by controlling runoff concentration and velocity (page 2-20).
- Apply approved weed control methods to prevent the invasion of noxious weeds into areas presently free of such weeds and to improve the ecological status of sites which have been invaded by weeds (page 2-53).
- Ensure that BLM-authorized actions within the Resource Area (RA) do not result in the need to list special status specie (pages 2-59).

- Protect, maintain, enhance, or rehabilitate the visual resource values as inventoried and evaluated by managing all public lands in accordance with the Visual Resource Management (VRM) System (page 2-148).
- Protect the cultural and paleontological values in the RA from accidental or intentional loss (page 2-152).
- Meet public needs for use authorizations such as rights-of-way, leases and permits (page 2-182).

1.5.3 Relationship to Statutes, Regulations, or Other Plans and Projects

The proposed Projects would be consistent with the Energy Policy Act of 2005, BLM's 2001 National Energy Policy Implementation Plan, and other federal policies that relate to the use of renewable energy. Furthermore, the Geothermal Steam Act of 1970, as amended by the Energy Policy Act of 2005; the Mining and Mineral Policy Act of 1970; the Federal Land Policy and Management Act of 1976 (FLPMA); and the National Materials and Mineral Policy, Research and Development Act of 1980 directed the federal government to foster and encourage private enterprise to develop renewable energy resources with appropriate environmental constraints. The proposed Projects would be consistent with these national goals.

A U.S. Department of Interior policy, consistent with Section 2 of the Mining and Mineral Policy Act of 1970 and sections 102(a)(7), (8), and (12) of FLPMA, is to encourage the development of mineral resources, including geothermal resources, on federally managed lands. The Secretary of the Interior has the authority and responsibility to lease public lands and certain other federal lands for geothermal development. The Secretary has delegated this responsibility to BLM. Under the terms of the Geothermal Steam Act (and the Energy Policy Act) and subsequent implementing regulations, BLM must respond to the plans and programs submitted by the lessee and either approve, require modification, or deny an application.

The following list of applicable federal laws and regulations serves as the regulatory framework for the proposed Projects:

Geothermal Exploration

- The Geothermal Steam Act of 1970 (Act) (30 USC §1001-1025);
- The Energy Independence and Security Act of 2007;
- 43 CFR 3200, Geothermal Resources Leasing and Operations; Final Rule, May 2, 2007;
- The Energy Policy Act of 2005; The National Energy Policy, Executive Order 13212, and Best Management Practices (BMPs) as defined in Surface Operating Standards and Guidelines for Oil and Gas; and,
- Best Management Practices as defined in the Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development, Fourth Edition (Gold Book) (BLM, 2007a).

Mineral Material Contract Sales

- The Act of July 31, 1947, as amended (30 USC §601 *et seq.*);

- 43 CFR 3601.6, Mineral Material Disposals; and Section 304 of FLPMA (43 USC §1734) and the Independent Offices Appropriation Act of 1952 (31 USC §9701) authorize the U.S. Government to collect fees and to require reimbursement of its costs.

Access Road Rights-of-Way

- Federal Land Policy and Management Act of 1976, as amended, section 501 (43 USC §1761); and,
- The Federal Land Policy and Management Act of 1976 (PL 94 579, 43 USC §1761 (*et seq*.); 43 CFR 2800, Rights-of-Way, Principles and Procedures; Rights-of-Ways under the Federal Land Policy and Management Act and the Mineral Leasing Act; final Rule, April 22, 2005.

This EA has been prepared in accordance with the following statutes, BLM handbooks, and implementing regulations:

- The National Environmental Policy Act of 1969, as amended (Public Law [PL] 91-190, 42 USC §4321 (*et seq*.); 40 CFR 1500 (*et seq*.); Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act;
- U.S. Department of Interior (DOI) requirements (Departmental Manual 516, Environmental Quality [DOI 2004]);
- National Historic Preservation Act (16 USC §470 *et seq*.);
- Native American Graves Protection Act (PL 101-601; 25 USC §3001 *et seq*.);
- Archaeological Resource Protection Act (PL 96-95; 16 USC §470 *et seq*.);
- Endangered Species Act (7 USC §136, 16 USC §1531 *et seq*.);
- The Bald and Golden Eagle Protection Act (16 USC §668(a); 50 CFR 22);
- Migratory Bird Treaty Act of 1918 (16 USC §703-712);
- Executive Order 13186 – Responsibilities of Federal Agencies to Protect Migratory Birds (66 CFR 3853, January 17, 2001);
- Memorandum of Understanding between BLM and U.S. Fish and Wildlife Service (USFWS) to Promote the Conservation of Migratory Birds (BLM MOU WO-230-2010-04);
- Greater Sage-Grouse Interim Management Policies and Procedures (BLM Instruction Memorandum No. 2012-043);
- BLM National Greater Sage-Grouse Land Use Planning Strategy (BLM Instruction Memorandum No. 2012-044);
- BLM NEPA Handbook (H-1790-1), as updated (BLM 2008a);
- Considering Cumulative Effects under the National Environmental Policy Act [CEQ 1997];
- Best Management Practices as defined in the Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development (Gold Book);
- The Geothermal Energy Research, Development, Demonstration Act of 1974;
- BLM Mineral Materials Disposal handbook (H-3600); and,
- Use; Rights-of-Way, Code of Federal Regulation 43 CFR 2800.

1.6 Scoping and Identification of Issues

1.6.1 Public Scoping Period

A scoping notice entitled "Notice of Intent to Conduct Geothermal Resource Exploration Operations" was published on March 11, 2011 in *The Oregonian*, *Central Oregonian*, and *Bend Bulletin*. The scoping notice included a detailed project description and procedures for submitting comments on the proposed Public Lands project and issues of concern. In addition, on March 9, 2011, BLM sent a letter to 76 interested parties containing the same types of information included in the scoping notice. Publication of the scoping notice initiated a 30-day public scoping period which formally concluded on April 11, 2011.

Comments from governmental agencies, environmental organizations, and concerned citizens submitted during the scoping period helped frame the issues considered in this EA.

1.6.2 Issues

Issues Considered in Detail

An issue is a point of disagreement, debate, or dispute with an action based on an anticipated effect. While many issues may be identified during scoping, only some are analyzed in the EA. BLM analyzes issues in an EA when analysis is necessary to make a reasoned choice between alternatives, or where analysis is necessary to determine the significance of impacts. To warrant detailed analysis, the issue must be within the scope of the analysis, be amenable to scientific analysis rather than conjecture, and not have already been decided by law, regulation, or previous decision. Significance requires consideration of context and intensity, as provided in 40 CFR 1508.27. For more information on significance criteria, see pages 70-74 in the BLM NEPA Handbook H-1790-1 (BLM 2008a).

The following issues were raised by the public or BLM staff, or both, during scoping and are considered in detail in this EA:

- How would noise, dust and traffic from the project affect recreation including rock-hounding, camping, and motorized vehicle use at Glass Buttes?
- How would project traffic/activity going through open pasture gates affect grazing allotment integrity and management on BLM lands?
- Could livestock (i.e. cattle and horses) access Highway 20 through an open pasture gate?
- What effect would the creation of roads, well pads, and rock quarries and the increased use and noise associated with the geothermal exploration have on mule deer and elk winter range?
- How would the Projects affect sage-grouse lekking and nesting in the Glass Buttes area?

- How would the amount of sage-grouse Preliminary Priority Habitat (PPH) and Preliminary General Habitat (PGH)[4] habitat be affected by the creation of roads, well pads, and rock quarries?
- Would any raptor nests be disturbed as result of project noise during nesting season?
- Would any migratory birds or associated habitat be disturbed as result of project activities?
- How would well pads, drilling rigs, new roads, all-weather surfaces, and widened roads affect the visual character of the Glass Buttes area?
- What effect would the Projects have on cultural resources and traditional uses/practices in the Glass Buttes area?
- How would well pads, drilling rigs, new roads, and improved roads affect the wilderness characteristics of the Glass Buttes area?
- Would exploration operations pose a risk to public health and safety from encountering natural gas while drilling?
- What are the known or likely impacts of hazardous or toxic substances that potentially could be encountered during operations?
- How many acres of wetlands would be disturbed by the proposed project activities?
- Would the operation of the proposed groundwater wells affect any existing water wells that also utilize the local aquifer?
- Would the Projects cause significant and permanent drawdown of the local aquifer?

Issues Considered but Eliminated from Detailed Analysis

While a number of other issues were raised during the scoping period, not all of them warranted detailed analysis to make a reasoned choice between alternatives or to determine the significance of impacts. **Appendix A** describes issues not analyzed in detail or considered further in this EA.

1.7 Decisions to be Made

This EA is an informational document for agency decision-makers and the public regarding the environmental effects of the proposed Projects. The specific decisions that will be made by BLM and DOE based on the analysis in the EA are described below.

1.7.1 Bureau of Land Management

Based on the information in the Geothermal Drilling Permit Applications for the Mahogany and Midnight Point projects, the SF-299 for the Application for Transportation and Utility Systems and Facilities on Federal Lands for road a right-of-way, and the environmental effects documented in this EA, BLM will decide whether to 1) approve the Applications; 2) approve the Applications with project modifications and/or stipulations; or, 3) deny the Applications.

[4] PPH represents the most productive habitat areas (i.e. lekking areas) for sage-grouse that occupies only a fraction of the sagebrush biome in which they occur. PGH habitat may assist in identifying areas that impacts to sage-grouse population may be less of a risk, or opportunities to mitigate for lost habitat (BLM/ODFW 2011).

BLM has permit and enforcement authority on the Mahogany and Midnight Point lease areas, but is not the permitting authority for the Private Lands Project. The Private Lands Project is a connected action to the Mahogany project because the primary access road passes through BLM Prineville lands. BLM has assessed the potential environmental effects of the Private Lands Project as indirect effects in this EA.

The BLM has determined that the access road to the Community Pit would require a road right-of-way under FLPMA and 43 CFR 2800 since it is outside the lease area. A SF-299 Application and Road Plan of Development (POD) would be required from the Applicant prior to project activities. A separate decision would be issued to issue a right-of-way grant for the road.

1.7.2 Department of Energy

The DOE will use the analysis in this EA to determine whether to authorize, authorize with conditions or deny financial assistance to the Applicant for the Projects. The DOE grant would go towards the geothermal exploration activities of both the Public Lands project and the Private Lands project. This funding creates a federal nexus with the Private Lands Project, allowing DOE the authority to prescribe stipulations and/or conditions to the grant decision.

Chapter 2
Alternatives

2.1 Introduction

This EA analyzes three alternatives, which include Alternative A, Alternative B (comprised of the proposed Projects), and an alternative that prescribes design features for the proposed Projects (Alternative C). These three alternatives are collectively referred to in this EA as the Alternatives. As outlined in Chapter 1, Alternative B includes proposed geothermal exploration activities within and near two separate, but adjacent, lease areas on BLM land located in south central Oregon (Mahogany and Midnight Point projects; together the Public Lands project). Alternative B also includes the access roads that travel through BLM land to three proposed well pads on private land located adjacent to the federal geothermal leases west of Glass Butte (Private Lands project) along with the Community Pit access road right-of-way. The locations of the features of the proposed Projects, including well pads and access roads, have been planned to minimize surface disturbance and avoid sensitive environmental areas and known archaeological sites. Alternative C contains the same project features as Alternative B, but also incorporates design features to further reduce the environmental effects from the Projects. Alternative A allows for the comparison of the potential impacts of Alternatives B and C with the current condition and the expected future condition of the environment in the absence of the proposed Projects. Detailed descriptions of the Alternatives are provided below.

2.1.1 Project Area

The Projects are located in the vicinity of Glass Buttes, approximately 70 miles southeast of Bend, Oregon and 50 miles northwest of Burns, Oregon, just south of U.S. Highway 20 (**Figure 1-2**). The Applicant has secured federal geothermal leases on approximately 37,500 acres of land (Alternative B project area, or project area) administered by the BLM Prineville and BLM Burns Districts. The Mahogany and Midnight Point projects encompass 17,300 acres and 20,200 acres, respectively. The federal geothermal leases associated with the Mahogany project area include OROR-65720, OROR-65721, OROR-65722, OROR-65727, and OROR-65728. The individual leases within the Midnight Point project area include OROR-65723, OROR-65724, OROR-65725, OROR-65726, and OROR-65729 (see **Figure 2-1**). The Applicant has also secured rights to conduct geothermal explorations on 2,495 acres of privately-owned land adjacent to the Mahogany project (Private Lands project area).

2.2 Alternative A

Under Alternative A, the Geothermal Drilling Permit Applications for the Mahogany and Midnight Point projects would be denied by BLM. Because development of the Private Lands project is dependent upon Federal approval of the pending application for access roads that are included in the Mahogany project area, the Private Lands project would not take place under Alternative A because the access routes would not be permitted.

Alternative A includes no action of any kind. No geothermal exploration or development of any kind would occur on Federal lands. No ground-disturbing earthwork, drilling, road-building, pad construction, or other activities described in the project description would occur.

2.3 Alternative B

Under Alternative B, BLM would grant the Geothermal Drilling Permit Applications for the Mahogany and Midnight Point projects without additional terms, conditions, and stipulations.

The Applicant proposes to evaluate the geothermal resources that potentially exist within the federal geothermal lease areas on the west and east sides of Glass Buttes. Under Alternative B, the Applicant proposes to drill up to three wells within the Mahogany project area and ten wells within the Midnight Point project area to determine if commercially viable geothermal resources are present and if so, to characterize those resources (**Figure 1-2**). Each exploratory well would be located within a defined area called a well pad. Each well pad would accommodate a drill rig and other structures and facilities related to the drilling operation. Access to each well pad would be provided by new or existing all-weather surface roads accessible from U.S. Highway 20, and no existing roads within the lease area would be closed due to project activities. Exploration activities would be conducted 24-hours per day and 7-days per week from August 16th to February 28th. Details on the components and operations associated with the Projects are described below.

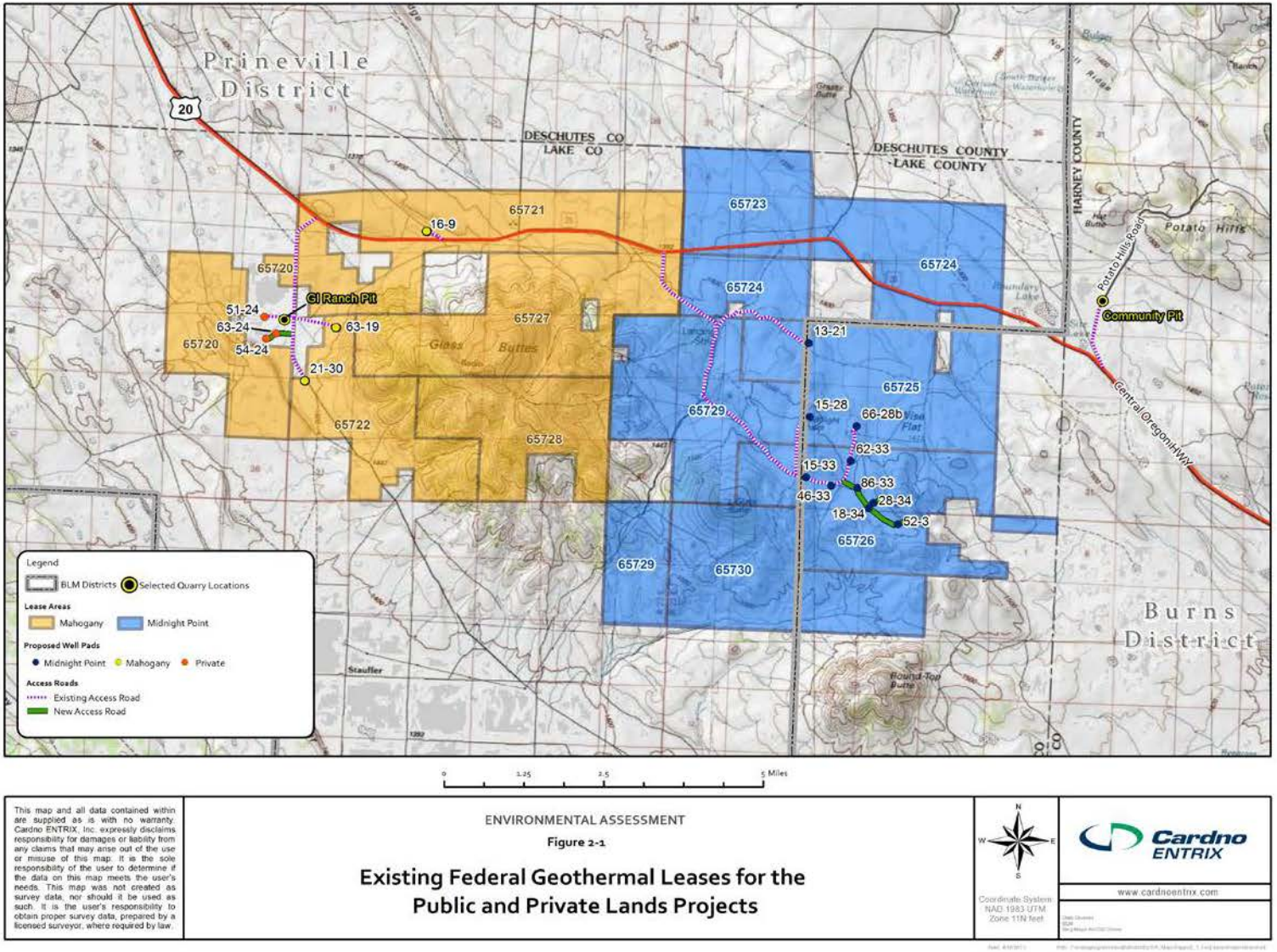

Figure 2-1 Federal Geothermal Leases within the Midnight Point and Mahogany Project Areas.

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2.3.1 Well Pads

The proposed well pad locations are provided in **Table 2-1**. The well pads are numbered with Kettleman numbers, based on dividing a standard 640-acre section into 10-acre subdivisions (further explained on April 2011 BLM form 3260-2; Geothermal Drilling Permit).

Table 2-1 Well Pad Site Locations

Well Pad Number	Lease Number	Township, Range, Section
Mahogany Project		
16-9	OROR 65721	T22S R22E, S9
63-19	OROR 65722	T22S R22E, S19
21-30	OROR 65722	T22S R22E, S30
Midnight Point Project		
13-21	OROR 65725	T23S,R23E,S21
15-28	OROR 65725	T23S,R23E,S28
15-33	OROR 65726	T23S,R23E,S33
18-34	OROR 65726	T23S,R23E,S34
28-34	OROR 65726	T23S,R23E,S34
46-33	OROR 65726	T23S,R23E,S33
52-3	OROR 65726	T23S,R23E,S3
62-33	OROR 65726	T23S,R23E,S33
66-28B	OROR 65725	T23S,R23E,S28
86-33	OROR 65726	T23S,R23E,S33
Private Lands Project		
51-24	N/A	T23S, R21E, S24
54-24	N/A	T23S, R21E, S24
63-24	N/A	T23S, R21E, S24

Source: Midnight Point and Mahogany Geothermal Exploration Permit Applications

The Applicant proposes to drill up to ten full-size wells on the Midnight Point project area and up to three exploratory slim wells within the Mahogany project area. Three additional slim wells would be drilled within the Private Lands project area, but these activities would be permitted by DOGAMI.

Slim wells are also known as *slim-hole wells*, *slim-holes*, *micro-holes*, and *observation wells*. Slim well exploration involves drilling smaller diameter holes and using smaller diameter production casing and tubing than standard full-size wells. The use of small diameter well bore reduces the overall cost of exploration drilling and reserve development, and is a faster drilling method as well. Full-size wells involve drilling larger diameter holes to depths much deeper than slim wells and they also include larger diameter casing and tubing.

A well pad constructed for a slim well is 300 feet by 300 feet (90,000 square feet), or about 2.07 acres. A well pad constructed for a full-sized well is 400 feet by 450 feet (180,000 square feet), or about 4.13 acres. Following the drilling and testing of each slim well on the Midnight Point lease area, the Applicant would determine if the test results indicate that the well is productive and should be converted to a full-size well. In the event that a slim well is converted to a full-size well, the 2.07 acre pad would be enlarged to 4.13 acres to accommodate the full-size well. For purposes of analysis, this EA assumes that all 10 proposed wells on the Midnight Point lease area would be developed to full size. Due to a disturbance threshold of 9 acres as provided in the Brothers-LaPine RMP, the three proposed slim wells on the Mahogany lease area would not be assessed for the potential to expand slim wells to full-size wells. The three slim wells proposed on private lands are also not assessed for expansion. Therefore, if 10 full-size well pads and three slim well pads are developed on BLM lands and the three slim wells pads on private lands, the maximum area of disturbance for well pads would be 53.73 acres. Even though the Applicant is seeking permits for up to 13 wells on BLM administered lands, it is possible that the Applicant would not construct all 13 well pads, but permitting all 13 well sites simultaneously would allow for flexibility in conducting exploration operations in the Public Lands project area.

Additionally, a maximum total of up to three non-potable water wells (one in the Mahogany project area and two in the Midnight Point project area) would be drilled to provide water supply for drilling operations. The water wells would be drilled at proposed well pad locations, so there would be no new surface area disturbance associated with these wells.

Each well pad would accommodate a drilling rig, reserve pit, support equipment, and project vehicles. **Figure 2-2** shows the typical layout for a slim well pad and **Figure 2-3** shows the typical layout for a full-size well pad. The exact orientation and configuration of the well pads would be determined by engineers before construction and would vary by well type.

The proposed well pad locations would be located on relatively flat topography (0 to 8 percent slopes) that gently slopes inward toward the center of the pad to prevent the movement of stormwater off of the constructed site. Depending on existing topography, some clearing and grading (cut and fill) may be necessary at pad sites. Any fill slopes that would be constructed as a part of well pad grading would be no greater than 2 horizontal to 1 vertical (50 percent slope) and would be compacted and maintained to minimize erosion and provide slope stability. The well pads would be constructed to avoid ephemeral washes to the extent practicable. In addition, the pads would be designed to divert any upslope sheet wash or water in ephemeral washes around and away from the well pad. Only those well pads scheduled to be drilled would be cleared and graded. Surface disturbance would be kept to a minimum and only to the extent necessary to accommodate drilling and operation of the planned well.

NOT TO SCALE	ENVIRONMENTAL ASSESSMENT Figure 2-2 **Typical Slim Well Pad Layout**	Cardno ENTRIX www.cardnoentrix.com Image Source: ORMAT Technologies, INC

Figure 2-2 Typical Slim Well Pad Layout

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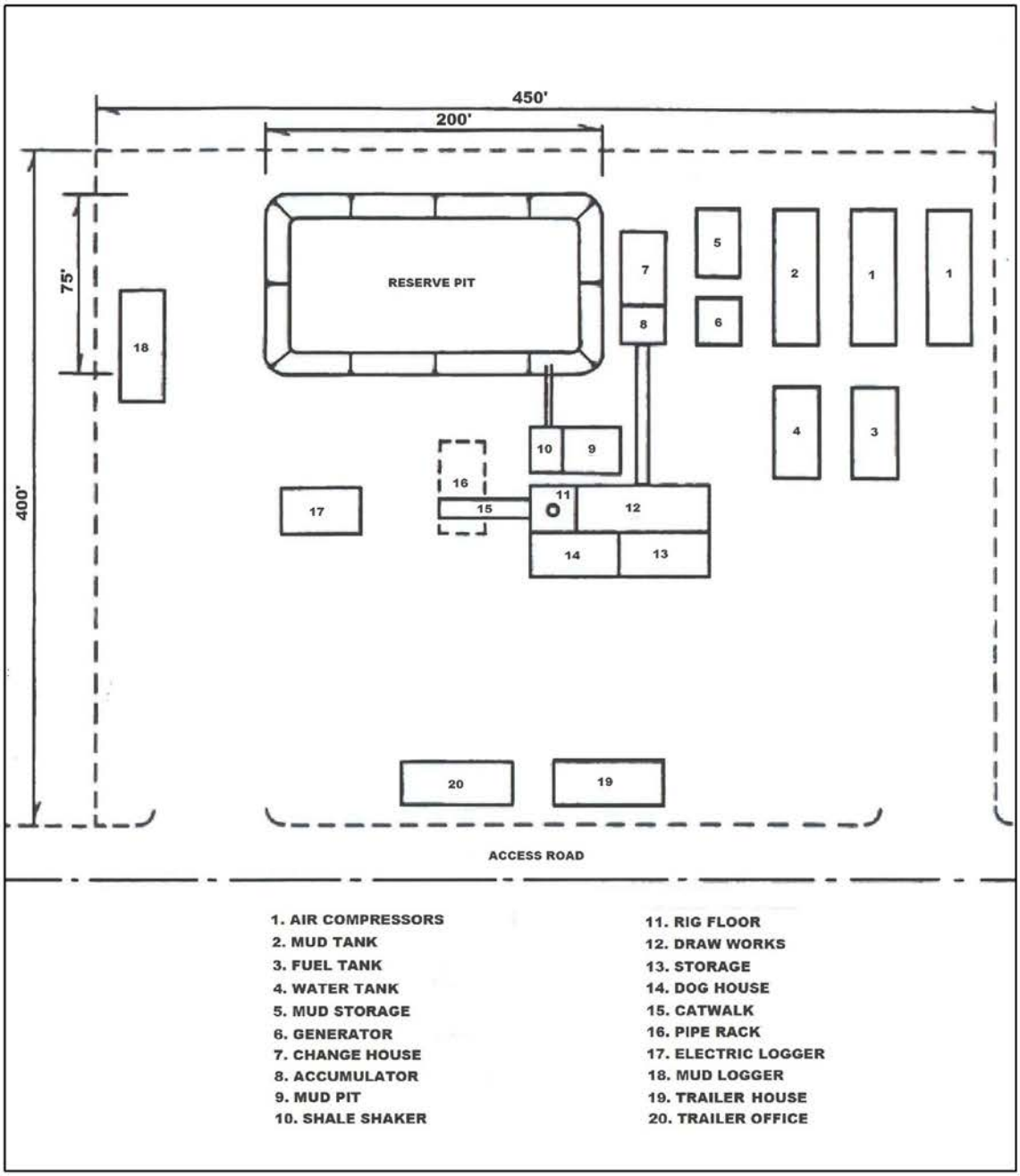

NOT TO SCALE

ENVIRONMENTAL ASSESSMENT

Figure 2-3

Typical Production Well Layout

Cardno ENTRIX

www.cardnoentrix.com

Image Source: ORMAT Technologies, INC

Figure 2-3 Typical Production Well Layout

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A reserve pit would be excavated on each well pad for the storage of drilling mud and fluids, geothermal fluids from flow tests, and drill cuttings consistent with the applicable BMPs identified in the Gold Book (BLM 2007a).[5] The size of the reserve pit would depend on the type of well scheduled for drilling on the pad. A slim well would be constructed with a pit capacity of 15,000 cubic feet while a full-size well would be constructed with a pit capacity of 150,000 cubic feet. The typical depth of the reserve pit would be 10 feet below ground surface measured from the pit bottom. The actual excavation depth of each reserve pit would be determined based on the depth of groundwater to ensure that the bottom of the reserve pit is above the standing water level. Each reserve pit would be located entirely within the footprint of a well pad; therefore, there would be no additional surface disturbance associated with the reserve pit beyond the well pad footprint.

Reserve pits would be compacted during construction and bentonite clay from drilling mud would settle and accumulate on the bottom of the pit to act as an unconsolidated clay liner to minimize percolation. A berm would be constructed around the outer edges of the pit. The berm would measure 4 feet wide by 2 feet tall. Material from the reserve pit excavation would be used for construction of the berm. Stormwater runoff from undisturbed areas around the constructed well pads would be directed into ditches surrounding the well pad and back onto undisturbed ground consistent with BMPs for stormwater.[6] Reserve pits would be constructed and fenced in accordance with the Gold Book (BLM 2007a) in order to prevent any people from falling in the reserve pits, illegal dumping, and wildlife contact with reserve pits. Fencing would include the circumference of the pit as well as netting over the top of the pit. After the well pad area has been graded and spoils from the well pad reserve pit excavation have been laid down for leveling, an average of eight inches of aggregate would be placed over the areas where the drilling work would be conducted.

While each well pad proposed for the Midnight Point project would be permitted to accommodate a full-size well (i.e., at the 4.13-acre size), the well pads proposed for the Mahogany project would only be constructed to the extent necessary to accommodate a slim well (i.e., at the 2.07-acre size). Under no circumstances would a well pad be expanded to a size greater than its permitted size.

2.3.2 Drilling Operations

Only one well would be actively drilled at a time. All wells regardless of well type would be drilled with air or a non-toxic, temperature-stable drilling mud composed of a bentonite clay-water or clay-polymer-water mixture as described in the Applications for both the Public Lands projects. Drilling mud would be used to lubricate and cool the drill bit, bring the rock cuttings to the surface for discharge into the mud tank, and prevent loss of drilling fluids into the rock. Other non-toxic additives would be mixed to the drilling mud as needed to prevent corrosion,

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5 The *Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development* (BLM 2007) is commonly referred to as The Gold Book. This BLM publication was developed to assist operators by providing information on the requirements for obtaining permit approval and conducting environmentally responsible oil and gas operations on federal lands. This document can be viewed at the following BLM website: http://www.blm.gov/wo/st/en/prog/energy/oil_and_gas/best_management_practices/gold_book.html

6 BLM's standards for constructing reserve pits can be found on pages 16-18 of the Gold Book (2007).

increase mud weight, and prevent mud loss, in conformance with the Drilling Program submitted along with the Geothermal Drilling Permit Applications for both the Public Lands projects. Additional drilling mud would be mixed and added to the drilling rig's mud system as needed to maintain the required quantities of the drilling mud.

Slim Wells

Each slim well would be drilled using a truck-mounted rig equipped with diesel engines, fuel and drilling mud storage tanks, mud pumps, and other typical auxiliary equipment (**Figure 2-4**). During drilling, the top of the drill rig derrick would be from 30 to 70 feet above the ground surface, depending on the rig used. An average of four to six service/worker vehicles would be driven to the active slim well site each day during the typical 15-day drilling process. Drilling would be conducted 24-hours per day, 7-days per week from August 16th to February 28th by a crew of up to three workers. Other support personnel (geologists, suppliers, etc.) could bring the total number of workers onsite at one time to as many as ten or more.

Each slim well would be drilled or cored and completed to a nominal depth of 3,000 feet, or to a similar depth selected by the project geologist (**Figure 2-5**). Once drilled or cored to the final depth, the drilling mud in the well would be circulated out of the well bore using water. The water and/or geothermal fluid in the well would be bailed from the well by either lifting with a mechanical bailer or by lifting with air pumped into the well bore so that a clean sample of the geothermal fluid in the reservoir could be obtained for chemical analysis. Alternatively, if the well is capable of flowing, the well would flow to the surface through a small steam separator/muffler to separate the steam (which is discharged into the air if below regulatory levels) from the geothermal water (which is discharged into steel tanks or the reserve pit) so that the geothermal fluid can be sampled for chemical analysis.

Following the cementing of the well surface casing, the blowout prevention equipment (BOPE) would be installed. The BOPE, which must be inspected and approved by the BLM and/or DOGAMI, would be installed, tested and ready for use while drilling the slim well to ensure that any geothermal fluids encountered do not flow uncontrolled to the surface.

ENVIRONMENTAL ASSESSMENT

Figure 2-4

Typical Slim Well

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Image Source:
ORMAT Tecnologies, INC

Figure 2-4 Slim Well Rig

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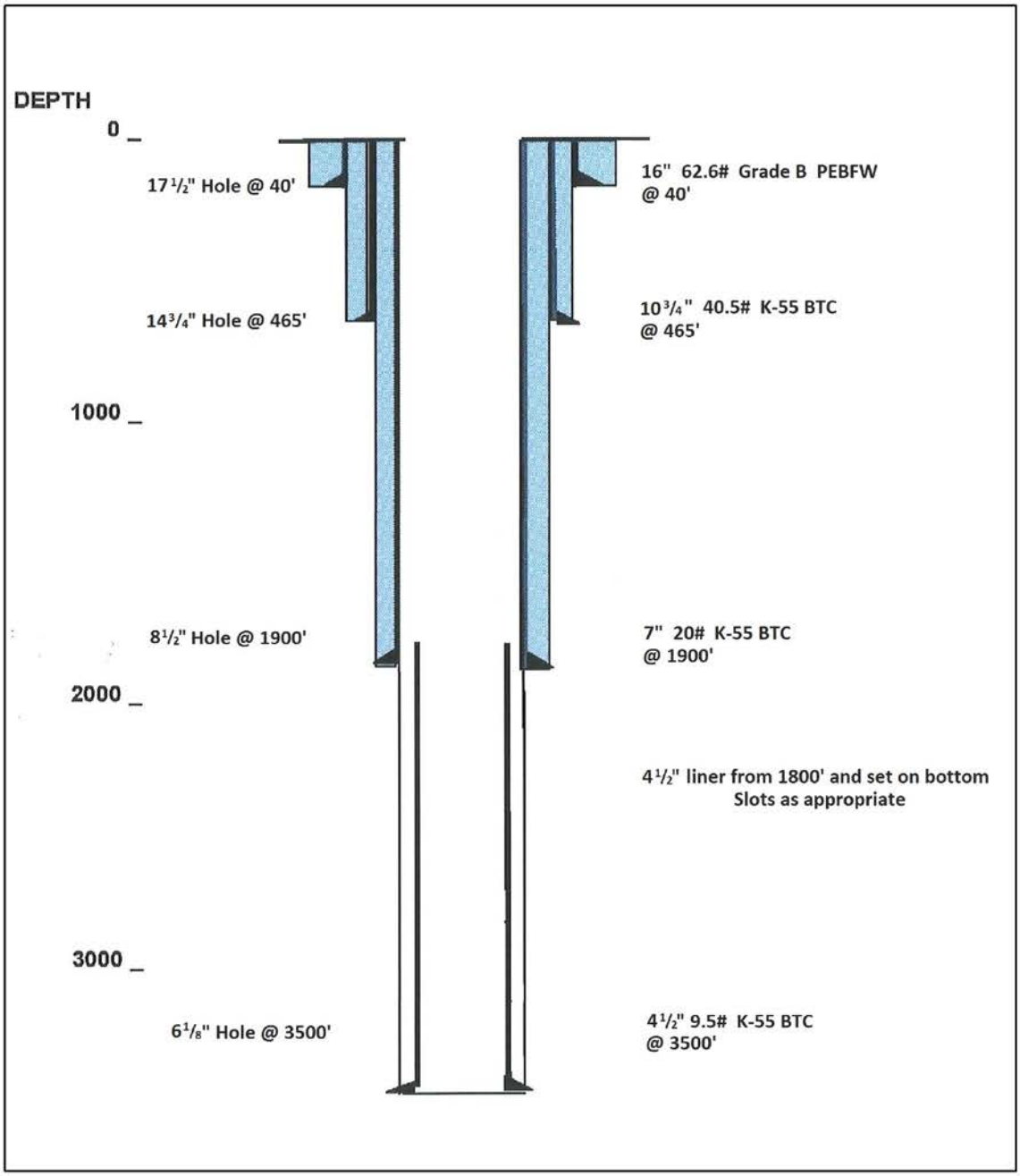

NOT TO SCALE

ENVIRONMENTAL ASSESSMENT

Figure 2-5

Typical Slim Well Profile

Cardno ENTRIX

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Image Source:
ORMAT Technologies, INC

Figure 2-5 Typical Slim Well Profile

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Full-Size Wells

Each full-size well would be drilled with a rotary drill rig similar to those used to drill oil and gas wells (**Figure 2-6)**. During drilling, the top of the drill rig mast could be as much as 170 feet above the ground surface. The typical drill rig and associated support equipment (rig floor and stands, draw works, mast, drill pipe, trailers, mud, fuel and water tanks, diesel generators, air compressors, etc.) would be brought to the prepared well pad on 25 or more large tractor-trailer trucks. Additional equipment and supplies would be brought to the drill site during ongoing drilling and testing operations. As many as ten or more tractor-trailer truck trips would be generated on the busiest day, although on average about two to three large tractor-trailer trucks (delivering drilling supplies and equipment), and about eight smaller service/worker trucks, would be driven to an active well site each day throughout the typical 45-day drilling process.

Drilling would be conducted 24-hours per day, 7-days per week by a crew of nine to ten workers. During short periods, the number of workers on site during drilling would be as high as 18. The full-size wells would each be drilled and cased to a design depth of 5,000 feet, or to a similar depth selected by the project geologist (**Figure 2-7**). Following the cementing of the surface casing, BOPE would be installed. During drilling operations, a minimum of 10,000 gallons of cool water and 12,000 pounds of inert, non-toxic barite (barium sulfate) would be stored at each well pad (as appropriate for the type of material) for use in preventing uncontrolled well flow, as necessary.

Well Testing

Once a slotted liner has been set in the bottom of the well, and while the drill rig is still over the well, the residual drilling mud and cuttings would be flowed from the well and discharged to the reserve pit. This would be followed by one or more short-term flow tests, each lasting from two to 24 hours, and also conducted while the drill rig is over the well. Each test would consist of flowing the full-size well into portable steel tanks brought onto the well site while monitoring geothermal fluid temperatures, pressures, flow rates, chemistry and other parameters. An "injectivity" test may also be conducted by temporarily injecting the produced geothermal fluid from the steel tanks back into the well and the geothermal reservoir. The drill rig would be moved from the well site following completion of these short-term tests.

ENVIRONMENTAL ASSESSMENT

Figure 2-6

Production Well

Cardno ENTRIX

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Photo Source
ORMAT Tecnologies, INC

Figure 2-6 Full Size Rig

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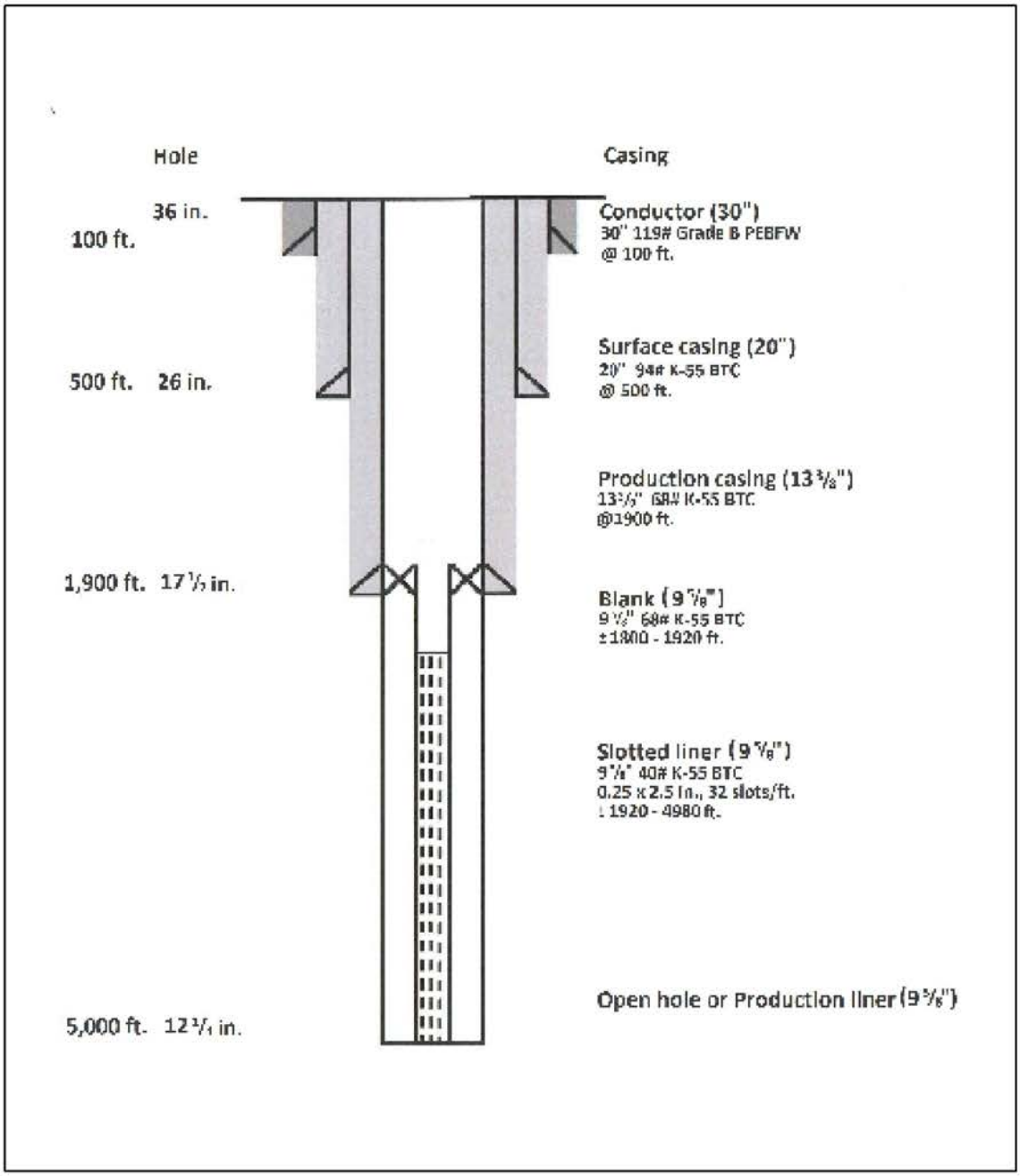

ENVIRONMENTAL ASSESSMENT

Figure 2-7

Typical Production Well Profile

Cardno ENTRIX

www.cardnoentrix.com

Image Source:
ORMAT Technologies, INC

Figure 2-7 Typical Production Well Profile

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One or more long-term flow tests of each full-size well drilled would be conducted following the short-term flow tests to more accurately determine long-term well and geothermal reservoir productivity. The long-term flow tests, each lasting 5 to 30 days, would be conducted by either pumping the geothermal fluids from the well through onsite test equipment closed to the atmosphere (using a line shaft turbine pump or electric submersible pump), or allowing the well to flow naturally to the surface, where the produced steam and non-condensable gases (including any hydrogen sulfide), separated from the residual geothermal fluid, would be discharged into the atmosphere and monitored for content during drilling. Discharge would be in compliance with 40 CFR 302.4. In either case, a surface booster pump would then pump the residual produced geothermal water/fluid through a temporary 8 inch to 10 inch diameter pipeline to a reserve pit. The temporary pipeline would either be laid "cross-country" or on the surface on the disturbed shoulders of the access roads connecting the full-size wells (as required, roads would be crossed by trenching and burying the temporary pipe in the trench). The decision about whether the pipeline would be laid cross-country or along existing access roads would be determined by the location of the wells. No new surface disturbance would occur from either laying the pipeline cross-country or along the disturbed shoulders of access roads; therefore, the effects from either option would be the same. The onsite test equipment would include standard flow metering, recording and sampling apparatus.

Following completion of well testing, all of the drilling and testing equipment would be removed from the site. The surface facilities remaining on the site would typically consist of several valves on top of the surface casing, which would be chained and locked and surrounded by a 12-foot by 12-foot by 6-foot high fence to prevent unauthorized access and vandalism. If a well is found to be unproductive, that well pad would be reclaimed and abandoned, including the removal of any fencing. If a well is found to demonstrate potential for energy generation, the fencing and well caps would remain on-site for the duration of the lease (i.e. until 2019) while the Applicant considers and/or plans the installation of energy generation facilities.

Access Roads

The Applicant proposes to use existing roads as much as possible, but some of these existing roads would be minimally and temporarily improved by leveling spot graveling and widened to accommodate project vehicles traveling to the proposed well pad and mineral material quarry locations. These improvements would be made to closely resemble the existing profile of the access road and would only be done in locations that would result in four inch ruts. Roads would not be widened beyond their existing prism, except in locations where truck pull-outs or truck turn around areas are constructed. Road maintenance of access roads related to this project would only be performed from August 16 to February 28. The Applicant has placed the proposed well pads as close to existing roads as possible to minimize the amount of required new road construction. **Figure 1-2** shows the locations of access roads that would be used by the Projects.

Access roads, other than the Stoffard Road, would be a 15-foot wide travel surface and 2.5-foot wide shoulders on both sides, for a total roadway width of 20 feet. The Stoffard Road would have a 16-foot wide travel surface because the road’s travel surface is already 16 feet wide. Road improvement or construction would occur incrementally as necessary to reach the well pads; roads would not be constructed until access to a well pad is needed. **Table 2-2** shows the linear miles and acres of surface disturbance associated with access road construction for the Projects. No new access connections to U.S. Highway 20 would be required for the Projects.

To access the Midnight Point project, the Applicant would use roads on adjacent BLM Prineville District lands. The Applicant would not widen these existing roads, nor build any new roads within Prineville District in order to access the Midnight Point project, but would instead construct pull-outs, a truck turn around area, and perform limited improvements to the existing roads. Truck turn outs are necessary in order to let construction vehicles pass each other and to allow trucks to turn around because well pads would not offer adequate turn around space.

Access road improvement or construction would result in 4.16 acres of new surface disturbance within the BLM Burns District and 1.82 acres of new disturbance within the BLM Prineville District. All existing roads and proposed access roads on federal lands are or would be located within the federal geothermal lease area with the exception of the Potato Hills Road that provides access to the Community Pit. Potato Hills Road, may be improved but not widened, resulting in no additional ground disturbance.

All access roads would be graded to follow existing topography and minimize cut-and-fill requirements. Rolling dips may be necessary along new access roads in areas where low spots or existing ditches are crossed. Culverts would be used wherever rolling dips are not feasible. Culvert installation would follow Gold Book standards (BLM 2007a) applicable to temporary roads. The rolling dips/culverts would be designed to accommodate flows from at least a 25-year storm event. Utilizing GIS data, the 14 locations identified on **Figure 2-8** represent areas where the topography and contour of the project area suggest the presence of a stream/wash that intersects with proposed access routes (USGS 2012). These locations are considered preliminary for purposes of analysis; a final road plan that includes specific locations of rolling dips/culverts would be summited to BLM for approval prior to the commencement of project activities. All rolling dips/culverts would be installed within areas that would be disturbed through access road improvement/widening. Furthermore, these facilities would be engineered to handle flows from a 25-year storm event.

A dozer would be used to construct proposed access roads and repair existing roads. Road designs and repairs, including road cross section and crowns, rolling dip designs and placement, and road plans and profiles would be executed in accordance with Gold Book standards (BLM 2007a).

During drilling operations, large trucks would be travelling to and from the well pad necessitating vehicle turnouts to allow vehicles to pass one another. The Applicant proposes to install up to 24 vehicle turnouts and 1 truck turnaround in the Geothermal Drilling Permit Application for the Midnight Point project. Vehicle turnouts would be 9 feet wide and 50 feet long, and the turnaround would be 1 acre in size. It is unlikely that all 24 turnouts would be installed, but this amount of disturbance is accounted for in the effects analysis.

Ancillary Facilities

Ancillary facilities that would be used during the drilling activities include temporary quarters for the drilling crew/workers remaining at the site for the duration of drilling. The drilling supervisor and mud logger would typically sleep in a self-contained trailer or motor home on the active well pad while the well is being drilled. The drilling contractor may also elect to have the drilling crew stay at the drilling site during the drilling operations to reduce the substantial hours and miles otherwise required for the crew to commute daily. Crews may elect to stay onsite or

commute during well drilling, depending on the specific crew member's needs and situation. For the crew or portions thereof that would remain on-site during the drilling operation, the drilling contractor would provide self-contained temporary quarters (sleeping area, galley, water tank and septic tank that would be hauled away from the site) or portable trailers or motor homes which would be placed on one of the previously drilled well pads.

Additionally, a separate trailer would be located on each active well pad to provide office space. Any trash generated shall be contained on-site in supply bins (i.e., wildlife-proof dumpsters) and hauled by a local commercial disposal company, as needed, to an approved landfill. No trash would be buried on-site. Vehicles and drilling equipment would be parked within the footprint of a well pad.

Additional components and equipment that would be used during drilling activities include the following:

- A reserve pit at each well pad with a maximum individual potential storage capacity of 150,000 cubic feet;
- Chemical toilets at each active well pad;
- Water storage tanks at each active well pad capable of containing a combined volume of at least 10,000 gallons;
- Up to three groundwater wells, with no more than one at a well pad, located on one or more of the geothermal well pads;
- Pipe racks stored at each active well pad;
- Fuel storage area with secondary containment located at each active well pad;
- Mud storage, mud tank, and mud logger at each active well pad;
- Drilling crew/worker vehicles (passenger vehicles);
- A diesel generator;
- Air compressors;
- Various types of construction equipment including dump trucks and bulldozers; and,
- Top soil for the reclamation of the pad.

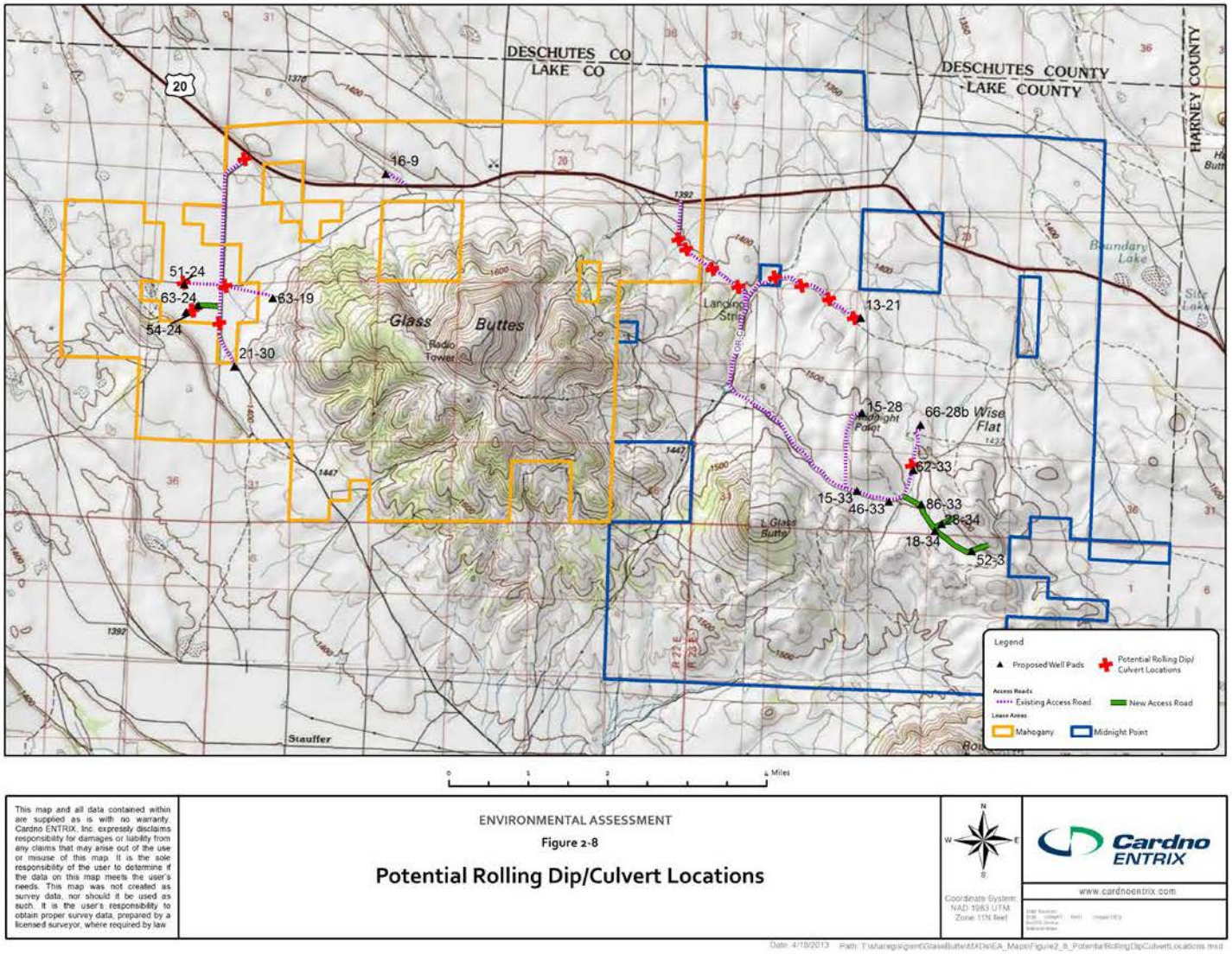

Figure 2-8 Potential Locations for Installation of Rolling Dips and Culverts

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Source of Drill Pad and Road Building Material

Access road and well pad construction would be comprised of clearing vegetation, removing topsoil, grading and adding aggregate to road and pad surfaces. Road surfaces would be graded to follow existing topography to the extent feasible so minimal fill material would be required. Only those well pads scheduled to be drilled would be cleared. Clearing would include removal of organic material, stumps, brush and slash. Topsoil would be salvaged during the construction of all pads and access roads, as feasible, and stockpiled on the pads for use during subsequent reclamation of the disturbed areas. The well pads would be graded so that cut and fill requirements would be balanced to minimize the need for offsite fill material. Most fill material needed for the well pads would be obtained from excavation of the reserve pit. Each drill pad would be covered with up to eight inches of aggregate. Aggregate would be applied to the access roads, as necessary, at an average depth of six inches to create an all-weather surface.

No more than 35,000 cubic yards of aggregate would be required for the Mahogany and Private Lands project, assuming that 6 slim well pads and all proposed access roads were constructed. The total aggregate required for the Midnight Point project would be no more than 55,000 cubic yards to install 10 full-size well pads and associated access roads. The rock particle size used to construct the Projects would range from dust to three-quarters of an inch in diameter.

Aggregate would be obtained from the development of up to two new off-site aggregate quarries located in the vicinity of the proposed Projects (**Figure 1-2**). The 5 acre G.I. Ranch Pit, located within the Private Lands project area to the west of the Mahogany project area, would be developed to supply aggregate to the Mahogany and Private Lands projects. Project vehicles would utilize the same roads to access the G.I. Ranch Pit as they would for well pads in the Private Lands project area.

Aggregate needs for the Midnight Point project would be met through development of a BLM Community Pit. This Community Pit, also referred to as the Potato Hills Quarry, would be located approximately 1 mile north of U.S. Highway 20 (approximately milepost 84.5) and five miles northeast of the Midnight Point project area. The Applicant proposes to develop no more than 5 acres of the total 22.5 acre Community Pit designation. The use of the quarry for this project will be covered under a permit issued by BLM with conditions that will include the design and use criteria provided in **Appendix B**. Any future uses of the Community Pit beyond the proposed 5 acres would be subject to BLM permitting. Access to the Community Pit would be provided through a road right-of-way grant on Potato Hills Road, which may be improved but not widened.

Project vehicles would utilize 7.5 miles of Highway 20 and BLM Road 7241-00 (Potato Hills Road) to transport aggregate from the Potato Hills Quarry to the Midnight Point project area. The Applicant may need to improve and maintain Potato Hills Road to support quarry operations and material transport; however, improvements and use of the existing Potato Hills Road would not expand the road beyond its current prism. All roadway improvements would be in compliance with the regulations of the Mine Safety and Health Administration (30 CFR 1-199), the road right-of-way grant, and the Project Design Features (PDFs) included in **Section 2.5**. Prior to groundbreaking and BLM's issuance of a right-of-way permit, the Applicant would need to

submit an access road plan to BLM detailing the proposed improvements and uses of the Potato Hills Road.

In the event that use of the Potato Hills Quarry is found to be economically infeasible by the Applicant, the Applicant would obtain aggregate material for the Projects from the Harney Rock Pit, located at mile post 97 along Highway 20. Harney Rock Pit is an existing pit with a current Harney County Conditional Use Permit and DOGAMI permit.

Source of Water

Water would be needed for the Projects for drilling operations, construction and compaction of roads, for pads and reserve pits, and for dust control. Water for the Mahogany project and Private Lands project would be obtained from a single well drilled at one of the three proposed well pads. Water for the Midnight Point project would be obtained from up to two wells drilled on one or more well pads. No additional surface disturbance would be associated with the drilling of the water wells. The Applicant would obtain the necessary groundwater appropriation rights from the State, with the BLM serving as co-applicant for the water rights. The wells would be drilled in accordance with Oregon well construction standards (OAR 690-210). Each well would be drilled by a licensed water well driller to a depth of at least 50 feet and cemented with a casing to provide a surface sanitary seal. The wells would be drilled using a truck mounted drilling rig. The well would be drilled down to a productive interval of sands, aggregates or fractures. A submersible electric pump on 4-inch column pipe would then be run to below the producing interval in each well. When they are no longer needed for geothermal exploration operations, the water wells would be plugged and abandoned, with cement plugs across the bottom of the casing and, if needed, with additional plugs to isolate individual producing zones if identified as present.

Water required for slim and full-size well drilling could be as much as 30,000 gallons per day (gpd). Water requirements for grading, construction, and dust control would range between 10,000 and 30,000 gpd depending on site conditions. One or more portable water tanks capable of containing a combined total of at least 10,000 gallons, but not more than 60,000 gallons, would be maintained at each well site during drilling operations. Water would be transported to the geothermal well locations via truck.

As an alternative, water needed for construction and drilling operations could also be purchased from private sources offsite and delivered to the construction location or drilling site(s) by a water truck.

2.3.3 Surface Reclamation

Interim and final reclamation activities proposed for the Projects would be consistent with BLM requirements, including recommendations provided in BLM's Gold Book (2007).

Interim Reclamation

Disturbed areas not needed for active support of operations would undergo interim reclamation within one year after determining if a well has tapped a viable geothermal resource. If a well is found unsuccessful, all drilling and testing equipment would be removed from the unsuccessful well pad. Any liquids in the reserve pits would be evaporated. Solids remaining in the pit, which

consist of nonhazardous, non-toxic drilling mud and rock cuttings, would be sampled for pH, metals, and total petroleum hydrocarbons for confirmation of non-toxicity. The non-hazardous solids would then be mixed with the excavated rock and soil and buried by backfilling the reserve pit. Vertical hydrologic conductivity will be maintained consistent with pre-drilling conditions. This will include efforts to not allow the clay and bentonite to remain intact in the reserve pits and allow for vertical drainage. If the material is determined to be hazardous per The Gold Book (BLM 2007a), then the material would be removed from the site with post-removal site testing to confirm that all hazardous material was removed. The 12-foot by 12-foot by 6-foot high fencing and netting would remain around the pit until the liquids are evaporated and the backfilling process has begun.

During access road and well pad construction, topsoil would be salvaged where possible and stockpiled for use during reclamation. With the exception of an area required to access maintained wellheads, cut and fill slopes would be graded to a final or intermediate contour that blends with the surrounding topography, and the erosion control PDFs listed in **Section 2.5** below would be implemented. The Applicant would maintain healthy, biologically active topsoil and minimize habitat, visual, and forage loss during the life of the wells by stockpiling and/or spreading any extra salvageable topsoil over the area of interim reclamation whenever possible. The area would be revegetated except for the area required to access and maintain the wellhead.

Surface facilities remaining onsite for observation wells would consist of a wellhead and potential monitoring equipment. Following completion of testing activities, the well would be fenced, chained, and locked. Wells could be shut-in with a mineral oil cap as applicable. Pressure and temperature sensors could be installed in the well at fixed depths to monitor any changes in these parameters over time. The well pads and access roads would be left in place and subject to regular inspection and maintenance by the Applicant, until such time as the well is deemed to be unnecessary or the geothermal lease is relinquished to BLM. Final reclamation activities for those sites would then be engaged.

Temporary groundwater wells would either be abandoned following completion of exploration activities, in accordance with Oregon regulations, be converted to permanent use for a potential future energy generation plant, or BLM may retain water wells for rangeland management. If the well is suitable for long-term use, the Applicant would obtain the necessary permits before such use.

Final Reclamation

After all well operations have ceased or the geothermal leases are relinquished back to the BLM (i.e. leases expire in 2019), the Applicant would reclaim remaining disturbance related to the proposed Projects on public and private lands. The Applicant would restore all disturbed areas to preconstruction contours or to surrounding landforms where restoration of preconstruction contours is not feasible. Disturbed areas would be planted with BLM specified seed mix, and invasive, non-native plants and noxious weeds would be controlled in accordance with BLM guidelines and lease stipulations. The Applicant would implement the erosion-control PDFs listed in **Section 2.5** below during reclamation. Project-related equipment and machinery would be decommissioned and removed from the project area. Where possible, equipment and machinery would be reused or sold as salvage, or disposed of at an appropriate waste disposal site or scrap yard. Equipment with no resale value would be sold or given as scrap.

The Applicant would plug and abandon all wells compliant with BLM and DOGAMI regulations. Prior to abandoning the water wells, BLM would be asked if wells are needed for wildlife or range improvements. If BLM requests the wells to remain serviceable, the ownership of the wells would be transferred to BLM. Following the abandonment of wells, the well pads would be disked and graded, if necessary, to loosen soils, bury any mineral material, and restore preconstruction grade. The reserve pits would be backfilled after contained liquids were evaporated and tests indicated pit solids were non-hazardous and non-toxic. Backfilling efforts would not result in soft spots in the soil due to the underlying bentonite. Well pads would be surfaced with stockpiled topsoil where available, and planted with a seed mix specified by BLM and free of noxious weeds at the time of reclamation.

Unless BLM requests otherwise, all roads constructed for project access would be reclaimed by grading to restore preconstruction contours, if necessary, scarified, and then planted with the BLM specified seed mix. Access roads in existence prior to commencement of the project would not be reclaimed. Reclamation would include re-contouring to restore preconstruction conditions or to surrounding landforms if restoration of preconstruction contours is not feasible. All abrupt edges or vertical to near vertical walls created during operation of aggregate source areas would be eliminated during re-contouring reclamation.

The source areas would be scarified if necessary and then planted with a mixture of grass and sagebrush seeds. The specific seed mix would be determined by BLM, but the seed would meet the requirements of the Federal Seed Act (P.L. 76-354; 1939) and the Oregon Certified Seed Handbook (2012). Only seed certified as “noxious weed free” would be used. In addition, the seed would be appropriate to the geographic and elevation characteristics of the area to be seeded (4,000 to 6,500 feet above mean sea level). The actual seed mix applied may depend on the availability of seed but would have a minimum of 98.0 percent purity, 84.0 percent germination and 0.0 percent noxious weed content.

2.3.4 Potential Surface Disturbance Summary

Table 2-2 summarizes the surface disturbances associated with the Mahogany, Midnight Point, and Private Lands projects. Total maximum surface disturbances associated with the Mahogany project would be 6.78 acres and the total surface disturbances associated with the Midnight Point project area would be 51.73 acres, with 1.25 acres of disturbance occurring in the BLM Prineville District to provide truck turnouts/pullouts along the primary access road to the Midnight Point project area. The total surface disturbances associated with the Mahogany and Midnight Point projects would be 58.51 acres.

Total maximum surface disturbances associated with the Private Lands project would be 13.36 acres. As noted in **Section 1.2**, while this environmental review requires disclosure of potential effects on private lands as a connected action, BLM only has the authority to approve, modify, or deny the applications for those actions occurring on public lands. The BLM is not responsible for permitting geothermal exploration activities on the Private Lands project. Rather, the drilling of the Private Lands project would be permitted exclusively through DOGAMI.

Table 2-2 Summary Table of Potential Surface Disturbance under Alternative B

Lease Area & BLM District	Project Component	Disturbance (Acres)	Total Disturbance (Acres)
Mahogany Lease in BLM Prineville District	Slim Well Pads (3x)	6.21	6.78
	Widening of Existing Roads	0.57	
Midnight Point Lease in BLM Prineville District	Truck Turnouts/Pullouts and Turnarounds	1.25	1.25
Midnight Point Lease and Public Domain Lands in BLM Burns District	Full-Size Well Pads (10x)	41.32	50.48
	New Access Roads	4.09	
	Truck Turnouts/Pullouts	0.07	
	Aggregate Source (Community Pit)	5.0	
TOTAL DISTURBANCE TO BLM LANDS			58.51
Private Lands	Slim Well Pads (3x)	6.21	13.36
	New Access Roads	1.11	
	Widening of Existing Roads	1.04	
	Aggregate Source (G.I. Ranch Pit)	5.0	
TOTAL DISTURBANCE			71.87

Note: Totals may not sum due to rounding.
Source: Midnight Point and Mahogany Geothermal Exploration Applications.

2.4 Alternative C

As described in **Section 1.4**, the purpose of BLM's action is to grant, grant with conditions, or deny the Geothermal Drilling Permit Applications for the Mahogany and Midnight Point projects. Under Alternative C, BLM would grant the Geothermal Drilling Permit Applications for the Mahogany and Midnight Point projects with additional terms, conditions, and stipulations. While the following stipulations would change some aspects of the activities proposed by the Applicant, all project features and proposed operations, equipment, disturbance footprints, and reclamation activities would remain the same under Alternative C as Alternative B. The purpose of this Alternative remains to determine if commercially viable geothermal resources are present and if so, to characterize those resources.

In addition to the PDFs common to all alternatives (**Section 2.5** below), the following terms, conditions, and stipulations would be implemented under Alternative C:

Biological Resources

- The G.I. Ranch Pit, new temporary access roads, and well pads that are proposed in PPH (Category 1) sage-grouse habitat as designated by BLM/ODFW would not be approved. This would prevent the approval of the following well pads on public lands: 21-30, 13-21, 15-28, and 66-28b. The access road to the Private Lands project would not be approved for more than casual use, thus no portion of the Private Lands project would happen under this Alternative, including the following wells and facilities: 51-24, 63-24, 54-24, and the G.I. Ranch Pit. The access road to well pad 63-19 would be improved but not widened, resulting in no additional ground disturbance. Exploration and testing activities would not be performed from December 1st through March 31st to avoid potential impacts to big game winter range habitat and sage-grouse winter habitat.

- Reserve pit reclamation activities would not be performed from December 1st through August 15th to minimize the potential for wildlife entrapment in reserve pits.

Through the implementation of the PDFs above, Alternative C would install 2 slim well pads, 7 full-size well pads, 4.09 miles of new access road, 0.38 miles of existing BLM road to be widened, and 8.84 miles of existing BLM road that would be improved within existing disturbed areas. The total disturbed area for Alternative C would be 43.84 acres, as presented in **Table 2-3** below. Operations would be conducted from August 16th to November 30th each year. **Figure 2-9** below provides a visual representation of the Projects under Alternative C.

Table 2-3 Summary Table of Potential Surface Disturbance under Alternative C

Lease Area & BLM District	Project Component	Disturbance (Acres)	Total Disturbance (Acres)
Mahogany Lease in BLM Prineville District	Slim Well Pads (2x)	4.14	4.52
	Widening of Existing Roads	0.38	
Midnight Point Lease in BLM Prineville District	Truck Turnouts/Pullouts and Turnarounds	1.25	1.25
Midnight Point Lease and Public Domain Lands in BLM Burns District	Full-Size Well Pads (7x)	28.91	38.07
	New Access Roads	4.09	
	Truck Turnouts/Pullouts	0.07	
	Aggregate Source (Community Pit)	5.0	
TOTAL DISTURBANCE TO BLM LANDS			43.84

Rangeland Management

- Cattle guards would be installed to prevent livestock passage at locations designated by the BLM Authorized Officer, primarily where any improved or new roads cross grazing allotment boundaries/fences. Cattle guards could be permanent or temporary, but would be in place while the road is being used by the applicant for project related activities. Cattle guards would maintain the integrity of allotments and pasture boundary fencing for the purpose of livestock management. Cattle guards shall be heavy enough to support the weight and wide enough to accommodate well rigs, trucks, and other equipment required for well drilling and testing. If cattle guards or fences are damaged by the Applicant or their contractors, facilities would be promptly repaired or replaced to maintain the function of the affected fence and allow safe vehicle passage. If the cattle guards are to be removed, the road would be repaired and the gate rebuilt by the applicant to BLM specifications. For the purpose of this analysis, three cattle guards would be installed under Alternative C at the locations shown in **Figure 2-9**.

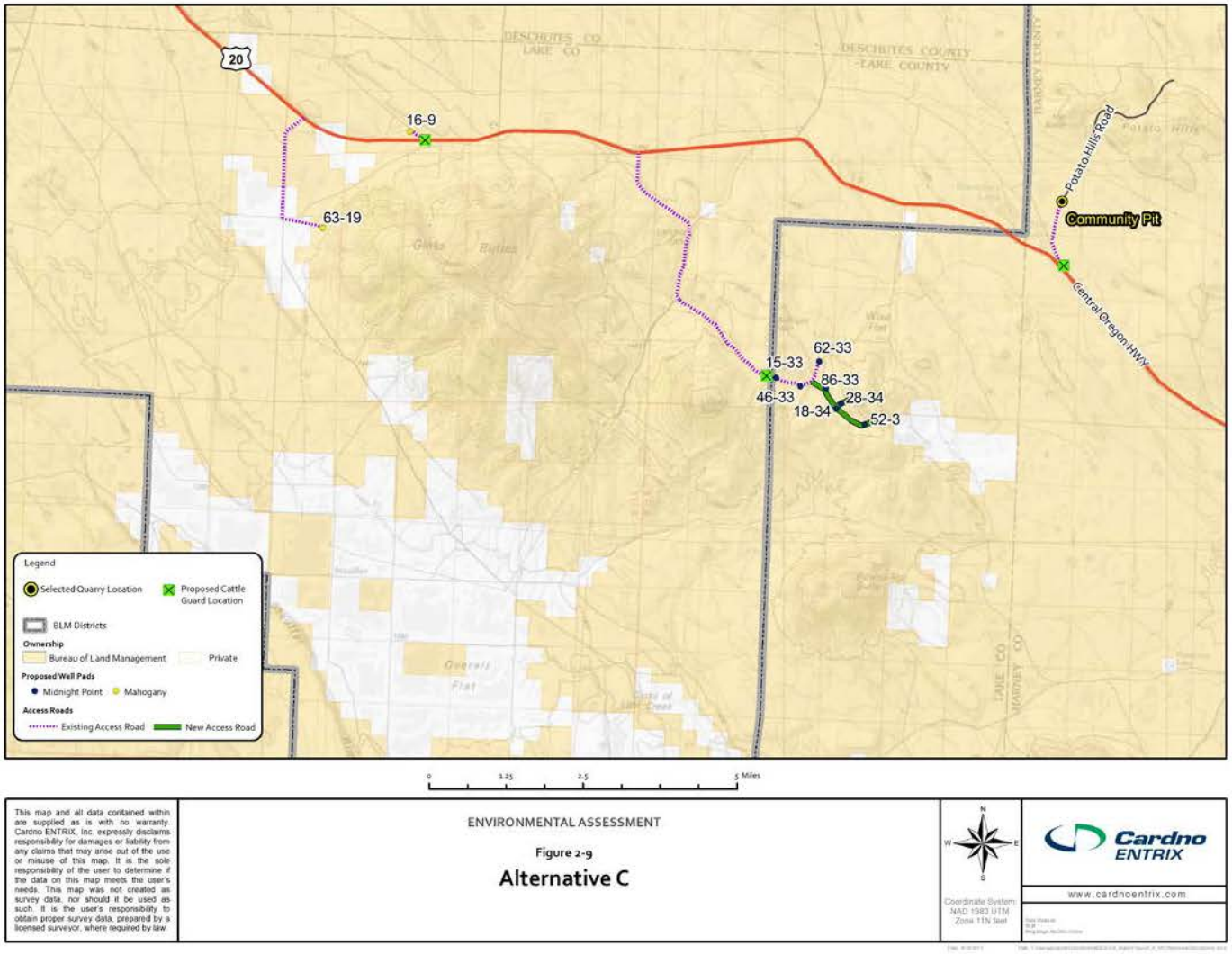

Figure 2-9 Alternative C

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2.5 Project Design Features Common to Alternatives B & C

The following section details the PDFs that the Applicant would implement under both action alternatives (Alternatives B and C).

General

- A pre-construction meeting would be required at a time mutually acceptable to the applicant and the BLM, but prior to approval of the Notice to Proceed.
- Flagging of proposed work by the applicant would be required to allow final clearances by BLM.
- The applicant would provide the BLM with any updates to the Operation Plan, Schedule of Operations, or any changes to the Geothermal Drilling Permit within the Notice to Proceed.
- Mitigation costs would be received and in place at the BLM prior to the BLM issuing a Notice to Proceed to the applicant.
- The applicant would provide the BLM all information that is submitted to other federal (excluding DOE, unless otherwise requested) and state (including DOGAMI) government agencies.
- The applicant would be required to follow all conditions of the DOGAMI and BLM GDP permits and compliance requirements as issued.

Prevention and Control of Fires

- The BLM District Office would be notified immediately of any wildland fire, even if the available personnel can handle the situation or the fire poses no threat to the surrounding area.
- A roster of emergency phone numbers would be available at the project site so that the appropriate firefighting agency could be contacted in case of a fire.
- All vehicles would carry at a minimum, a shovel, five gallons of water (preferably in a backpack pump), and a conventional fire extinguisher.
- Adequate fire-fighting equipment (a shovel, a pulaski, standard fire extinguisher(s), and an ample water supply) would be kept readily available at each active drill site. Water that would be used for construction and dust control would also be available for fire suppression.
- Vehicle catalytic converters (on vehicles that would enter and leave the drill site) would be inspected daily and cleaned of all flammable debris.
- All cutting/welding torch use, electric-arc welding, and grinding operations would be conducted in an area free, or mostly free, from vegetation. An ample water supply would be available onsite from the proposed 10,000 gallon water tank (see Ancillary Facilities above) and shovel would be on hand to extinguish any fires created from sparks. At least one person in addition to the cutter/welder/grinder would be at the work site to promptly detect fires created by sparks.
- The Applicant would be responsible for being aware of and complying with the requirements of any fire restrictions or closures issued by the BLM District, as publicized in the local

media or pasted at various sites throughout the field office district. The Applicant would be responsible for notifying personnel of these restrictions or closures.

- Personnel would be allowed to smoke only in designated areas and would be required to follow applicable BLM regulations regarding smoking.

Soil Erosion

- Topsoil would be salvaged, stockpiled, and reused; however, stumps, brush, and other organic material would be hauled off-site after site clearing.
- Temporarily disturbed areas would be reseeded where previously vegetated using a grass and sagebrush seed mix that is in compliance with BLM and Oregon seed policies. The seed would meet the requirements of the Federal Seed Act (P.L. 76-354; 1939) and the Oregon Certified Seed Handbook (2012). Only seed certified as “noxious weed free” would be used. In addition, the seed would be appropriate to the geographic and elevation characteristics of the area to be seeded (4,000 to 6,500 feet above mean sea level).
- Erosion control measures, including but not limited to silt fencing, diversion ditches, water bars, temporary mulching and seeding, and application of aggregate and rip rap, would be installed within well pads and access roads where evidence of erosion exists.
- Access roads would follow existing contours to the maximum extent possible. In areas where new access roads would need to be constructed across slopes, erosion control measures such as silt fence, surface roughening, and slope stabilization would be provided as necessary.
- Up to 6 inches of aggregate would be used as road surface where appropriate because roads would be used during all seasons.
- Aggregate would be laid down when ground conditions are wet enough to cause rutting or other noticeable surface deformation and severe compaction. As a general rule, if vehicles or other project equipment create ruts in excess of 4 inches deep when traveling cross-country over wet soils, an aggregate surface would be added prior to additional vehicle use.
- In areas of very soft soils, up to 3 feet of aggregate would be used during construction.

Hydrology - Surface Water and Groundwater

Surface Water

- Where proposed, new access roads would need to cross ephemeral washes, rolling dips would be installed. The rolling dips would be designed to accommodate flows from at least a 25-year storm event. Culverts would be used wherever rolling dips are not feasible.
- Silt fences and/or straw bales would be used in areas requiring sediment control.
- Roads and well pads not required for further geothermal development purposes would be re-contoured to preconstruction conditions and seeded to prevent erosion.
- Access roads would follow existing contours to the maximum extent possible. In areas where new access roads would need to be constructed across slopes, erosion control measures such as silt fence, surface roughening of slopes, and slope stabilization would be provided as necessary.

Groundwater

- Excavation into native soil during construction of well pad reserve pits would be minimized to the maximum extent possible.
- Drill pad reserve pits would be compacted during construction and settled bentonite clay from drilling mud would accumulate on the bottom of the drill pad reserve pits to act as an unconsolidated clay liner, reducing the potential for drilling fluid to percolate to groundwater.
- A BLM-approved cementing and casing program for the drilling of observation wells would be implemented to prevent water quality effects on groundwater during or after completion of the wells.
- Borehole geophysics analyses (cement bond logs) would be conducted to document that well casing cementing activities provide an effective seal isolating the geothermal aquifer from shallow alluvial aquifers, therefore minimizing potential impacts on surface springs or streams.
- The use of "blow-out" prevention equipment during drilling and the installation of well casing cemented into the ground would ensure that any geothermal fluid encountered during the drilling would not flow uncontrolled to the surface.
- Any well on the leased land that is not in use or demonstrated to be potentially useful would be promptly plugged and abandoned in accordance with lease stipulations. No well would be abandoned until it has been demonstrated to the satisfaction of the BLM that it is no longer capable of producing in commercial quantities, and would not serve any other useful purpose such as for injection of geothermal fluids or monitoring of the geothermal reservoir or groundwater.
- No water wells would be installed within a 5,000 foot radius of existing water wells on BLM lands.

Biological Resources

- Trash and other waste products would be properly collected and disposed of, with the objective of eliminating any litter. The Applicant would use air-tight containers for any garbage that could attract wildlife. All trash would be removed from the project area and disposed of at an authorized landfill.
- Speeds would be reduced from 25 mph to 15 mph when workers/drivers observe terrestrial wildlife (i.e. deer, sage-grouse) near project activities, especially near/on access roads and posted with signage.
- Employees and contractors would be prohibited from carrying firearms on the job site.
- Reclamation of the disturbed areas, as described earlier in this document, would be completed in order to return these areas to the condition required in the drilling permit Conditions of Approval.
- Areas that become infested with invasive species/noxious weeds during construction would be mapped, reported to BLM, physically (i.e. disking, mowing) and/or chemically (i.e. herbicide) treated, and then seeded with certified weed-free seed and mulching materials.
- Existing weed infestations would be avoided or treated before disturbance.

- All weed prevention and control practices performed on BLM lands would be done so in accordance with all applicable BLM regulations and procedures.
- The applicant would submit a Weed Management Plan to the BLM, and the BLM would approve this plan, prior the Notice to Proceed would be issued. The Weed Management Plan would address the following:
    - Mineral material aggregate applied to federal lands would be from a pit certified by Harney County to be free of weeds.
    - Plan of operations (who, what, when, where, and how) for monitoring and treating any noxious weeds infestations in the work area, especially in areas of activities of disturbance.
    - Spraying products used would only be those allowed with the Prineville and Burns District.
    - Consultation with the BLM District that the weed treatment would take place in prior to performing the weed treatment.
    - For three years following final reclamation, reclaimed sites would be monitored by the applicant, and if weeds are found, the applicant would treat the weeds.
- There would be no surface operations during sage-grouse lekking and nesting season (March 1 to August 15).
- All surface operations (including drilling) and surface construction activities (drill rigs, wellheads, and power plants) would not be visible from leks.
- Where sagebrush is present to begin with, sagebrush would be used in the re-vegetation seed mixes applied during reclamation, or sagebrush plants would be planted to ensure sagebrush returns to the site.
- Fencing reserve pits would include fencing all four sides of the pit as well as applying netting over the top of the pit. A ramp would be placed in the reserve pit as a safeguard in the event that the fencing/netting fails and an animal or human falls in.
- All surface operations (i.e. well drilling and resource testing) would be less than 40 decibels (db) or less than 10 db above ambient sound at surrounding leks.
- Well pad sites and rock quarries would be surveyed for Threatened and Endangered and Special Status plant species in May prior to project implementation. Threatened and Endangered and Special Status plant sites would be avoided if found.
- Surveys for burrowing owls would be performed during breeding/nesting season (April 15-August 1) before any proposed ground disturbing activities (i.e. well pad construction, drilling, road construction/improvements, rock quarries) later in the year. If burrowing owls are discovered within 0.25 miles of a proposed disturbance area, the Applicant would monitor burrows for collapse during drilling operations or other disturbance. Should the burrows collapse, then artificial burrows would be constructed by the Applicant greater than 0.25 miles away as an alternate site for owls to nest the following year based on recommendations from Green (2006).

- Reserve pits would be overbuilt to accommodate a greater volume of water than is discharged. This would result in un-vegetated and muddy shorelines that breeding mosquitos (*Cx. tarsalis*), which may carry West Nile virus, avoid. Steep shorelines would be used in combination with this technique.
- Reserve pit slopes would be built steep to reduce shallow water (>24 in) and aquatic vegetation around the perimeter of reserve pit impoundments.
- The water level of the reserve pits would be maintained below that of rooted vegetation for a muddy reserve pit that is unfavorable habitat for mosquito larvae. Rooted vegetation includes both aquatic and upland vegetative types. Terrestrial vegetation would not be flooded in flat terrain or low lying areas.
- The channel where discharge water flows into the reserve pit would be lined with crushed rock, or a horizontal pipe would be used to discharge inflow directly into existing open water, thus precluding shallow surface inflow and accumulation of sediment that promotes aquatic vegetation.
- The overflow spillway would be lined with crushed rock, and the spillway would be constructed with steep sides to preclude the accumulation of shallow water and vegetation.

Air Quality

- All access roads would be surfaced with aggregate materials, as needed.
- Dust abatement techniques, such as watering on unpaved, unvegetated surfaces would be used to minimize airborne dust, as needed.
- Dust abatement techniques (such as watering, requiring loader buckets to be emptied slowly, and minimizing drop heights) would be applied to earthmoving, excavating, trenching, grading, and aggregate crushing and processing activities.
- A speed limit of 25 mph would be observed on all access roads by project vehicles to minimize potential collisions with recreationists/visitors, other project vehicles/workers, and wildlife. Signage would be used to control vehicle speed and provide an enforceable limit (i.e. 25 mph).
- Equipment and vehicle idling times during construction activities would be kept to the necessary minimum.
- Access roads, project area roads and other traffic areas would be maintained on a regular basis to minimize dust and provide for safe travel conditions.

Noise

- Noise suppression devices would be utilized on all compressors.

Visual Resources

- Periodic application of water would be used on soil surfaces during construction and grading to control dust.
- Cut-and-fill areas would be minimized by proper placement of roads and well pads.
- Equipment placed at the well pads would be removed after drilling and testing so that only the wellhead extends above the well pad.

- Drill rig and well test facility lights would be limited to those required to safely conduct the operations, and would be shielded and/or directed in a manner that focuses direct light to the immediate work area.
- If aggregate is applied to roads or well pads it would be earth-toned (i.e. brown, tan, green) in color at any location that is visible from Highway 20.
- Aggregate applied to the portion of access road R2B that is visible from KOP 11 would be earth-toned in color.
- No artificial light source used at well 16-9 would face directly at Highway 20.
- Disturbances would be reclaimed to preconstruction conditions or equivalent and all rehabilitation work on proposed improved access roads, temporary access roads, and well pads would be performed in such a way that when completed, the color, contours, and planted or seeded vegetation would match the visual characteristics of the surrounding area.

Cultural, Archaeological, Native American and Other Natural Resources

- Known eligible and potentially eligible cultural resource sites would be avoided.
- A 100-foot buffer zone would be established around eligible and potentially eligible cultural resource sites to help provide protection to the sites. Project facilities and disturbance would not encroach into the established 100-foot buffer zone.
- The Applicant would limit vehicle and equipment travel to existing and proposed roads, well pads, construction areas, and aggregate source areas.
- All construction equipment and vehicles used for the proposed Projects would be kept off access roads when not in use.
- Any unplanned discovery of cultural resources, items of cultural patrimony, sacred objects or funerary items would cause all activity in the vicinity of the find to cease, and the BLM would be notified immediately by phone with written confirmation to follow. The location of the find would not be publicly disclosed, and any human remains would be secured and preserved in place until a Notice to Proceed is issued by the authorized officer.

Waste Disposal

- A project hazardous material spill and disposal contingency plan would be prepared that would describe the methods for cleanup and abatement of any petroleum hydrocarbon or other hazardous material spill. The hazardous material spill and disposal contingency plan would be submitted to and approved by the BLM and made readily available onsite before operations begin.
- Secondary containment structures would be provided for all chemical and petroleum/oil storage areas during drilling operations. Additionally, absorbent pads or sheets would be placed under potential spill sources and spill kits would be maintained onsite during construction and drilling activities to provide prompt response to accidental leaks or spills of chemicals and petroleum products.
- Handling, storage, and disposal of hazardous materials, hazardous wastes, and solid wastes would be conducted in conformance with federal and state regulations to prevent soil, groundwater, or surface water contamination and associated adverse effects on the environment or worker health and safety.

- Portable chemical sanitary facilities would be available and used by all personnel during periods of well drilling and/or flow testing. These facilities would be maintained by a local contractor.

Public Safety

- All environmental soil and ground water sampling would be consistent with industry standards, The Gold Book (i.e. publication for 'Surface Operating Standards and Guidelines for Oil and Gas Exploration and Development'), and in coordination with BLM.

Quarries & Pits

- Design criteria found in **Appendix B** would be applied to both the Private and Public Lands proposed quarries/pits.

- In order to receive a mineral material permit for the Potato Hills Quarry, a right-of-way application and permit would be required (not that this permit may include conditions from the Oregon Department of Transportation (ODOT) for access onto Highway 20).

2.5.1 Safety Plans

A summary of the safety plans that would apply to the Projects is presented below:

Injury Contingency Plan

In the event injuries occur in connection with the operations of the Projects, specific and immediate attention would be given to proper transportation as the nearest medical facility is the Harney District Hospital in Burns.

Blowout Contingency Plan

Blowout prevention equipment would be kept in operating condition and tested in compliance with BLM regulations, DOGAMI regulations, and industry standards. In addition, cold water and barite would be stored at the well pad for use in killing (i.e., preventing the continued flow of) the well in case of an emergency. In the event of an emergency, such as a blowout, immediate efforts would be taken to shut surface valves and blowout preventer system. If the means to shut-in or control the flow from the well are lost, the Blowout Contingency Plan contains procedures that would be implemented to completely contain the well and initiate steps to return the area to its normal state prior to the blowout or fluid flow.

Spill or Discharge Contingency Plan

In the event of discharge of formation fluids, drilling muds, petroleum products, or construction debris, the person responsible for the operation would make an immediate investigation, then contact the Drilling Supervisor and advise him of the spill, The Drilling Supervisor would in turn callout equipment, regulate field operations, or do other work as applicable for control and clean-up of the spill.

The Spill or Discharge Contingency Plan contains specific procedures for responding to geothermal fluid, drilling mud, and petroleum product spills:

- Geothermal fluid spills - Contain spillage with dikes if possible and haul to disposal site by vacuum or water trucks or dispose of in an acceptable manner.

- Drilling mud - Repair sump or contain with dikes. Haul liquid to another sump, available tanks or approved disposal site.
- Petroleum products - Contain spill with available manpower. Use absorbents and dispose of same in approved disposal area. Clean up surface staining on soil on a regular basis.

The Applicant would notify agencies and regulatory bodies, and would also advise the local population and affected property owners if a spill affects residents or property. The Applicant would have the source of the spill repaired at the earliest practical time, and continue working crews and equipment on cleanup until all concerned agencies are satisfied.

Hazardous Gas Contingency Plan

All personnel would be trained in warning signs, signals, first aid, and responsibilities in case of hazardous gases. The site would have two briefing areas so that one is upwind from the well and containment basin at all times. Before drilling or testing commences, all personnel would be advised of escape routes. Weekly drills would be conducted. In addition, automatic H_2S detectors would be stationed around the rig. Safety precautions would include the possibility for encountering natural gas (as noted within a nearby well log) during drilling. Lower Explosive Limit (LEL) meters would be installed on the drill rig to monitor natural gas levels. The Hazardous Gas Contingency Plan contains emergency procedures that would be followed in the event that hazardous gas is detected. This plan would be submitted to BLM prior to the commencement of project activities and amended according to agency discretion.

An Air Containment Discharge Permit (ACDP) from the Oregon Department of Environmental Quality (DEQ) would not be required because a) the drill rig engines are non-road engines and do not count towards toward stationary source emissions; b) each well would release not more than 10 tons per year of a regulated pollutant; and, c) the wells would be sufficiently far apart such that each well would be considered a separate "stationary source” as defined in OAR 340-200-0020(134)

2.6 Alternatives Considered But Eliminated from Further Analysis

The BLM considered whether other alternatives could address the purpose and need for action, whether any other alternatives would be significantly different or have significantly different effects, and whether there would be a reasonable need to evaluate other alternatives. BLM also considered alternatives raised by the public during scoping, which are presented and discussed below. Upon satisfactory review of the technology, operations, and equipment proposed in the Geothermal Drilling Permit Applications for the Mahogany and Midnight Point projects, BLM concluded that following alternatives/PDFs would not meet the purpose and need or are already addressed in the proposed alternatives (BLM NEPA Handbook, 2008).

No Exploratory Drilling

This alternative is represented in Alternative A, therefore it is considered substantially similar in design to an alternative that is analyzed.

No Exploratory Drilling in PPH Habitat for Greater Sage-Grouse

This alternative is represented in Alternative C, therefore it is considered substantially similar in design to an alternative that is analyzed.

Include General BLM Management Actions to Reduce Threats to Wildlife

These activities are represented in Alternative C, therefore it is considered substantially similar in design to an alternative that is analyzed.

Designate Areas of Heightened Wildlife Protection on Other Public Lands to Compensate for Project Effects

This alternative is represented in Alternative C and in **Appendix C** Habitat Mitigation Plan for Greater Sage-Grouse so it is considered substantially similar in design to an alternative that is analyzed. The combination of additional stipulations in Alternative C, which creates areas of heightened wildlife protection for this project within the project area that would minimize project effects to wildlife, and the mitigation requirements for disturbance to Greater Sage-Grouse habitat, which would compensate for the minimized wildlife effects of the project by improving wildlife habitat on other public lands, is substantially similar to Alternative C, thus this Alternative is considered but eliminated.

Chapter 3
Affected Environment and Environmental Consequences

3.1 Introduction

This chapter combines descriptions of the affected environment and effects for each of the issues identified for detailed analysis in this EA.

The affected environment includes a brief description of the present condition and trend of issue-related elements of the human environment that may be affected by implementing the Alternatives. It describes past and ongoing actions that contribute to present conditions, and provides a baseline for analyzing cumulative effects.

The effects are the known and predicted effects from implementation of the Alternatives, limited to the identified issues. Direct effects are those caused by the Alternatives and occurring at the same time and place. Indirect effects are those caused by the Alternatives but occurring later or in a different location. Cumulative effects result from the incremental impact of the Alternatives when added to other past, present, and reasonably foreseeable future actions occurring in the general project area. Reasonably foreseeable future actions are those for which there are existing decisions, funding, formal proposals, or which are highly probable, based on known opportunities or trends. The analysis of cumulative effects includes other BLM actions, other federal actions, and non-federal (including private) actions.

The description of the current state of the environment provided in the affected environment section inherently includes the effects of past actions and serves as a more accurate and useful starting point for a cumulative effects analysis than would attempting to establish such a starting point by “adding” up the effects of individual past actions. The importance of “past actions” is to set the context for understanding the incremental effects of the Alternatives. This context is determined by combining the current conditions with available information on the expected effects of other present and reasonably foreseeable future actions.

3.1.1 Units of Measure for the Issues

The following indicators were used to measure the potential effects of the Alternatives on environmental resources tied to the issues.

Recreation

- Annual visitor days for rock-hounding in the project area not inconvenienced by project activities;
- Number of primitive campsites utilized by recreationists; and,
- Number of miles of road and trail available for motorized vehicle use.

Rangeland Management

- The potential[7] for a grazing permittee's livestock to access an unintended allotment due to project vehicles traveling through open pasture gates; and,
- The potential that livestock will access Highway 20 from access roads.

Biological Resources

- Acres directly and indirectly (i.e. noise) affected within BLM's sage-grouse Preliminary Priority Habitat and Preliminary General Habitat;
- The number of acres of big game winter habitat directly and indirectly affected;
- The number of raptor (i.e. ferruginous hawk, red tail hawk, golden eagles) nests disturbed from project noise during nesting season; and,
- Level of potential noxious weed propagation as result of project activities.

Visual Resources

- The Projects' temporary and permanent degree of contrast with surroundings from each Key Observation Point (KOP); and,
- Whether or not the degree of contrast is consistent with BLM Visual Resource Management (VRM) objectives.

Cultural Resources and Traditional Practices

- The number of archaeological resources, both eligible and ineligible for the National Register of Historic Places (NRHP), which would be disturbed as result of the Projects; and,
- The number of days that Native Americans cannot access traditional areas or practice traditional activities due to access restrictions resulting from the Projects.

Wilderness Characteristics

- The potential for project activities to affect the wilderness characteristics present in the Glass Buttes Wilderness Inventory Unit.

Public Safety

- The level of risk to worker safety from potential natural gas explosions encountered during the drilling process; and,
- The level of risk that the project exposes the public to any hazardous and/or toxic chemicals.

Wetlands

- The amount of wetlands (acres) disturbed by the Projects.

Groundwater Resources

- The potential for significant drawdown of the local aquifer by the amount of water withdrawn (gallons per day, acre-feet per year, total withdrawal) for project activities; and,
- The potential, based on proximity (i.e. linear feet), for water wells installed to support project activities to affect existing wells that utilize the same aquifer.

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[7] "Potential" as an indicator or threshold is comprised of three levels of likelihood: Low, Medium, and High. Low potential equates to a probability of 0 to 33 percent chance of occurrence. Medium potential equates to 33 to 66 percent chance of occurrence. And, high potential equates to 67 to 100 percent chance of occurrence.

3.2 Comparison of Alternatives

Table 3-1 below provides a comparison of the Alternatives. The following sections provide details on the affected environment and environmental consequences, which are summarized in **Table 3-1** below.

Table 3-1 Comparison of Effects for Each Alternative

			Alternative A	Alternative B			Alternative C
Resource	Indicator		No Action	Public Lands Project	Private Lands Project	Total	Public Lands Project
Recreation	Annual visitor days for rock-hounding in the project area not inconvenienced by project activities		25,000	9,375 annually for one to three years	0	9,375 annually for one to three years	13,125 annually for one to three years
	Number of primitive campsites affected		0	10	0	10	10
	Miles of available motorized road and trails		149	149	4	153	149
Rangeland Management	The potential for a grazing permittee's livestock to access an unintended pasture due to project vehicles traveling through open pasture gates		Same as current	Low but Increased	None	Low but Increased	Minimal
	The potential that livestock will access Highway 20 from access roads		Same as current	Low but Increased	None	Low but Increased	Minimal
Biology	Acres of mule deer and elk range affected through project-related surface disturbance		0	59	13	72	44
	Acres of mule deer and elk winter range affected by disturbance from vehicle activity and project activities in addition to existing conditions		0	191	0	191	0
	Number of raptor nests that would be affected by project noise during nesting season		0	0	0	0	0
	Level of potential noxious weed propagation as result of project activities		None	Minimal	Minimal	Minimal	Minimal
	Acres of surface disturbance within PPH and PGH sage-grouse habitat	PPH Habitat	0	15	13	28	0[a]
		PGH Habitat	0	44	0.4	45	44[a]
	Acres of PPH and PGH sage-grouse habitat seasonally affected by disturbance from vehicle activity and project activities in addition to	PPH Habitat	0	2,045	230	2,275	727
		PGH Habitat	0	2,649	0	2,649	2,552

			Alternative A	Alternative B			Alternative C
Resource	Indicator		No Action	Public Lands Project	Private Lands Project	Total	Public Lands Project
	existing conditions						
Visual Resources	Projects' short-term and long-term degree of contrast with surroundings from each Key Observation Point (KOP)[b]	KOP 6	None	Weak (short-term effect) None (long-term effect)	Weak (short-term effect) Moderate (long-term effect)	Weak (short-term effect) Moderate (long-term effect)	Weak (short-term effect) None (long-term effect)
		KOP 9	None	Moderate (short-term effect) Weak (long-term effect)	None	Moderate (short-term effect) Weak (long-term effect)	Moderate (short-term effect) Weak (long-term effect)
		KOP 10	None	Weak (short-term effect) None (long-term effect)	None	Weak (short-term effect) None (long-term effect)	Weak (short-term effect) None (long-term effect)
		KOP 11	None	Strong (short-term effect) Moderate (long-term effect)	None	Strong (short-term effect) Moderate (long-term effect)	Strong (short-term effect) Weak (long-term effect)
	Whether or not the degree of contrast is consistent with BLM Visual Resource Management (VRM) objectives	KOP 6	Yes	Yes	Not applicable	Yes	Yes
		KOP 9	Yes	Yes	Not applicable	Yes	Yes
		KOP 10	Yes	Yes	Not applicable	Yes	Yes
		KOP 11	Yes	Yes	Not applicable	Yes	Yes
Cultural Resources	The number of archaeological resources, both eligible and ineligible for the National Register of Historic Places (NRHP), which would be disturbed as result of the Projects		0	0	0	0	0
	The number of days that Native Americans cannot access traditional areas or practice traditional activities due to access restrictions resulting from the Projects		0	0	N/A	0	0
Wilderness Characteristics	The potential for project activities to affect the wilderness characteristics present in the Glass Buttes Wilderness Inventory Unit (WIU)		None (Wilderness characteristics are not present in the Glass Buttes WIU)	None	None	None	None

		Alternative A	Alternative B			Alternative C
Resource	Indicator	No Action	Public Lands Project	Private Lands Project	Total	Public Lands Project
Public Safety	The level of risk to worker safety from potential natural gas explosions encountered during the drilling process	None	Minimal	Minimal	Minimal	Minimal
	The level of risk that the project exposes the public to any hazardous and/or toxic chemicals	None	Minimal	Minimal	Minimal	Minimal
Wetlands	The amount of wetlands (acres) disturbed by the Projects	0	0	0	0	0
Groundwater Resources	The potential for significant drawdown of the local aquifer by the amount of water withdrawn (gallons per day, acre-feet per year, total withdrawal) for project activities	None	Low	Low	Low	Low
	The potential, based on proximity (i.e. linear feet), for water wells installed to support project activities to affect existing wells that utilize the same aquifer	None	Low	Low	Low	Low

[a] Under Alternative C, the existing access road in PPH used to reach well pad 63-19 would not be widened, thus there would not be any surface disturbance to PPH sage-grouse habitat but 0.4 acres of surface disturbance to Low-Density habitat on private land.

[b] A "weak" contrast rating is defined as "the element of contrast can be seen but does not attract attention"; "moderate" is defined as "the element contrast begins to attract attention and begins to dominate the characteristic landscape"; and, "strong" is defined as" the element contrast demands attention, will not be overlooked, and is dominant in the landscape." BLM Manual 8431 – Visual Resource Contrast Ratings.

3.3 Recreation

This section describes the existing recreational uses in the project area. The analysis evaluates how the Projects would affect annual visitor days for rock-hounding, use of primitive campsites by rock collectors, and the miles of road and trail available for motorized use in the project area.

Affected Environment

Recreational activities within the Public Lands project area include rock-hounding (rock collecting), primitive camping, and motor vehicle use. The Pacific Northwest Four Wheel Drive Association members regularly use the roads and trails for off-highway vehicle (OHV) Class II 4X4 use (scoping comment letter received by BLM March 2011). Class II use is "rock crawling." Recreation within the Public Lands project area is unstructured and dispersed; there are no developed recreational sites within the Public Lands project area.

There are approximately 25,000 visitor days per year for rock-hounding in the Public Lands project area, with 3,750 visitor days per month during the August through October peak season. Rock-hounding includes the collection of rocks, minerals, and semi-precious gemstone resources as a hobby and for personal use. The Glass Buttes area is one of the most popular and accessible rock-hounding areas in the BLM Burns District; BLM has noticed an increase in use since 2010 and expects visitation to continue to climb in the coming years. The majority of the Public Lands project area is either located within the area designated under the Brothers/LaPine RMP as a Public Rock-hounding Area - Obsidian or within the area designated by the Three Rivers RMP for Recreational Minerals - Obsidian.

Camping within the Public Lands project area is primitive in nature. Primitive campsites were identified using BLM GIS data and through field visits conducted as part of the May 2010 cultural resources surveys conducted by an environmental contractor. Primitive campsites in the Public Lands project area are primarily used by rock collectors, and are typically located adjacent to a road, under a large juniper tree for shade, and by an area that provides enough space to park an RV camper and a vehicle. Campsite use by rock collectors is evidenced by the presence of obsidian cobbles and saw cut obsidian in piles, modern campfire rock rings filled with obsidian debitage and shatter from flintknapping activities, and modern trash strewn throughout the vicinity of the primitive campsite. The locations of the 11 primitive campsites within the Public Lands project area are shown on **Figure 3-1A**. No other campsites are located within five miles of the proposed project features.

There are 149 miles of road in the Public Lands project area, of which 52.43 miles are currently being used for motorized recreational opportunities. In addition, 8,679 acres within the project area are designated by the Burns District Three Rivers RMP for OHV use, meaning vehicles can travel off of roads and trails. Of the remaining 33,230 acres in the Public Lands project area, 16,032 acres are designated by the Brothers/LaPine RMP as limited to OHV use and 17,198 acres are designated by the Brothers/LaPine RMP for OHV use. The existing motorized roads, trails, and OHV designations are shown in **Figure 3-1B**.

There are no permitted recreation uses in the Private Lands project area (pers. comm. recreation specialist July 7, 2011). In addition, no primitive campsites or motorized trails have been identified within the Private Lands project area. The Private Lands project area does have 4 miles of motorized roads, but these roads are not open to the public except by permission of the landowner.

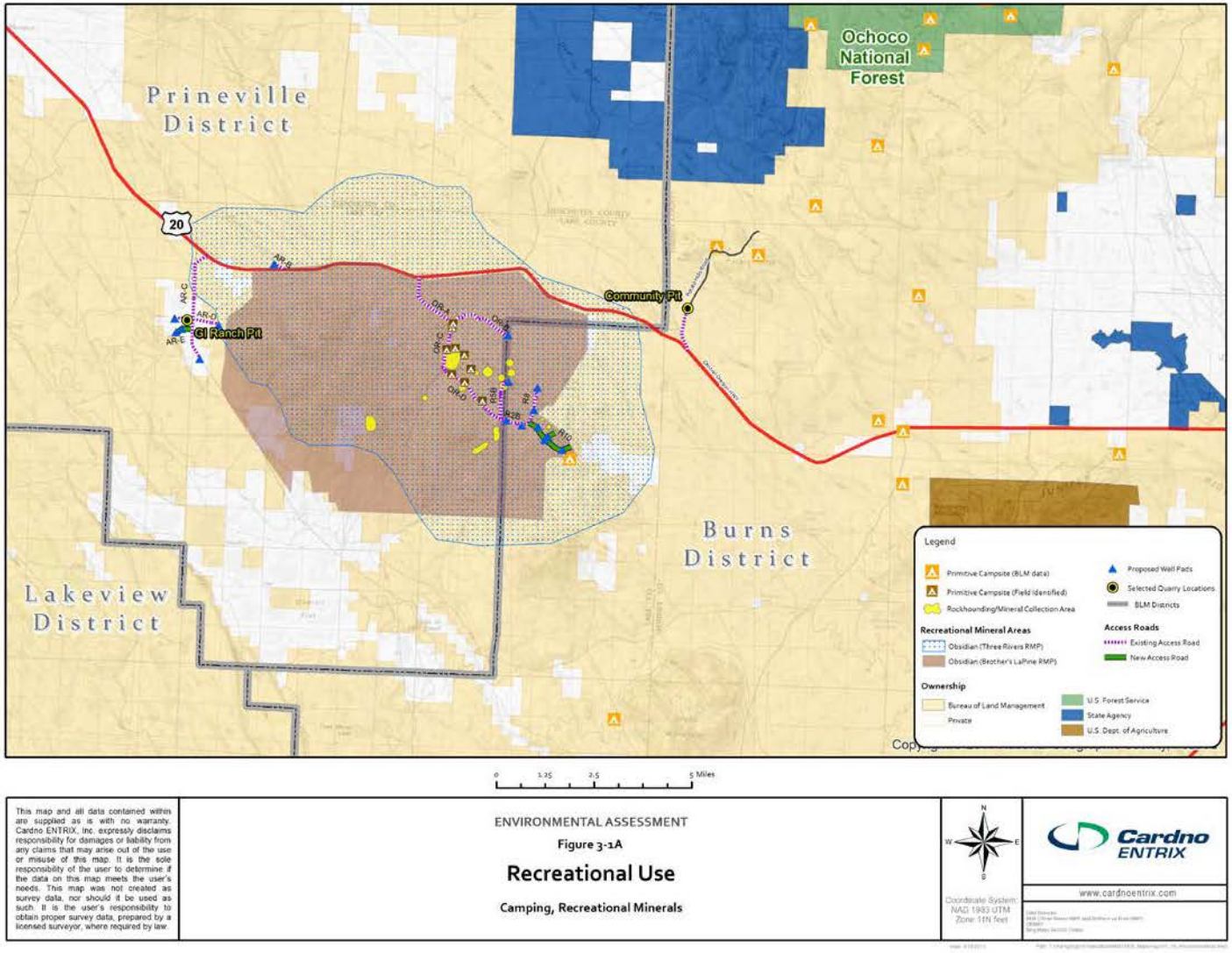

Figure 3-1A Recreational Use – Camping and Recreational Minerals

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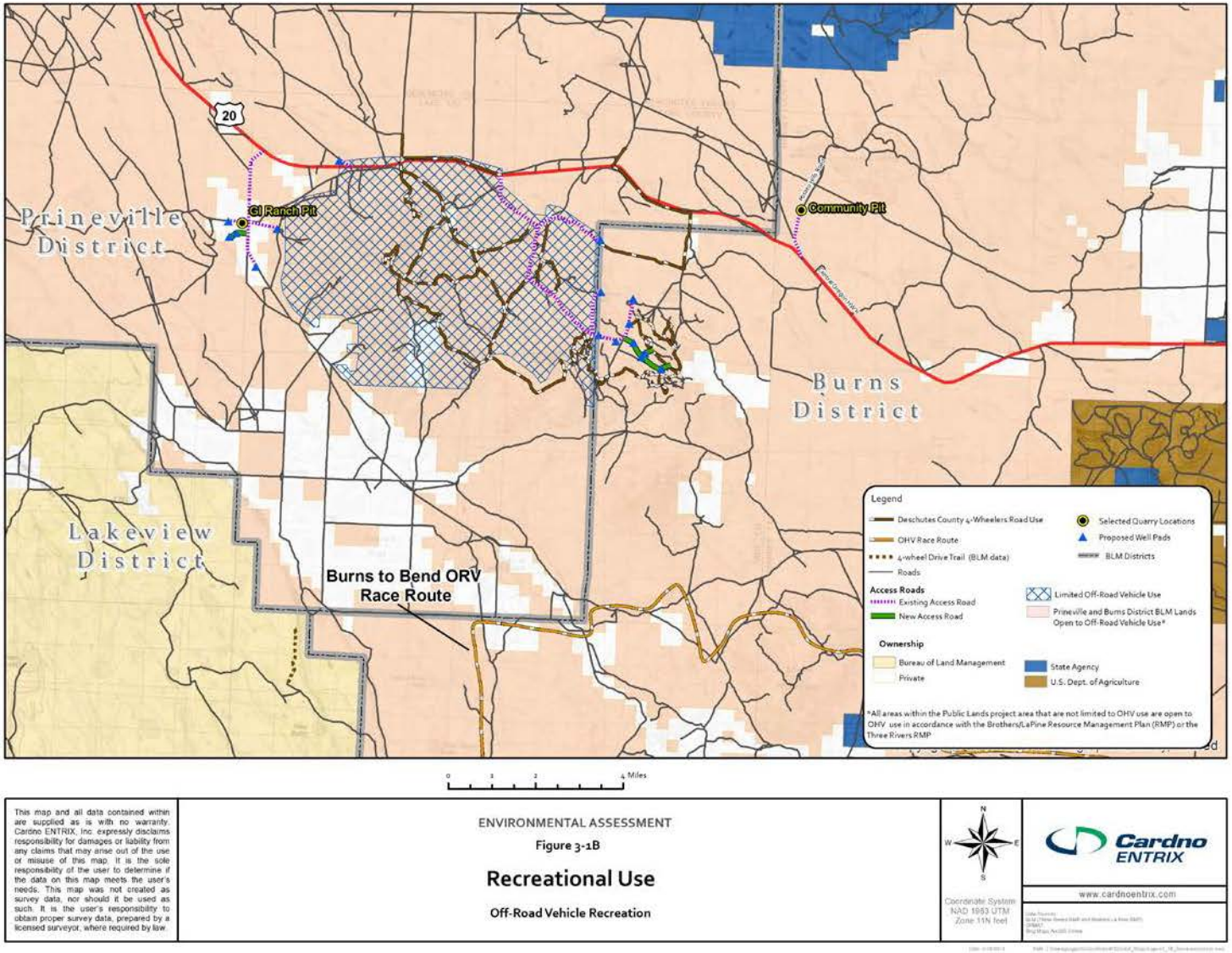

Figure 3-1B Recreational Use - Off-Road Vehicle Recreation

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Environmental Consequences

Alternative A

Public Lands Project Effects

Under Alternative A, the temporary increase in noise, traffic, and air emissions associated with construction of the Projects would not occur. Therefore, no direct effects to recreation would occur under Alternative A. The 25,000 visitor days per year for rock-hounding and use of the 11 primitive campsites within the Public Lands project area would not be affected. In addition, the 149 miles of road in the Public Lands project area, of which 52.43 miles are currently being used for motorized recreational opportunities, would remain available and no congestion would occur to these roads.

Private Lands Project Effects

As described above, there are no permitted recreation uses in the Private Lands project area. In addition, no primitive campsites or motorized trails have been identified within the Private Lands project area. No indirect effects to recreation would occur under Alternative A.

Alternative B

Public Lands Project Effects

Public access to the well pads would be restricted to authorized project personnel for site safety. This precaution would result in a temporary disruption (i.e. six and a half months per year) to rock-hounding at the proposed well pad locations. In addition, noise, dust, and traffic generated by Alternative B would inconvenience visitors in the Public Lands project area during the proposed construction and drilling activities. As described above, BLM estimates that there are approximately 25,000 visitor days per year for rock-hounding in the Public Lands project area. Activities from the Public Lands project would be prohibited during the time period between March 1 and August 15 (**Section 2.5.1**), during which approximately 9,375 visitor days for rock-hounding occur. Visitors during the remaining 15,625 visitor days (August 16 through February 28) would be inconvenienced by the noise, dust, and traffic generated by the proposed construction and drilling activities, but the Public Lands projects are not expected to impact overall visitation or use of the minerals recreation area.

In addition, recreational use of up to ten primitive campsites within one-half mile of the project features, particularly those located adjacent to access roads Obsidian Road-C and Obsidian Road-D as well as R-10, a proposed new access road for the Public Lands project (see **Figure 3-1A**), would be avoided for up to six and a half months each year due to the noise, dust, and traffic generated during construction and drilling activities. These effects would be temporary and a short-term inconvenience to visitors, given that construction and drilling activities would be implemented over a period of one to three years.

During the proposed roadway construction and improvement activities, public use of the access roads would be temporarily congested, but no roads would be closed. Road improvement or construction would occur incrementally as necessary to reach well pads; roads would not be constructed until access to a well pad is needed. The proposed truck turnouts/pullouts would also

allow for slower moving project vehicles[8] to pull aside for non-project vehicles to pass. Therefore, disruption of public access to BLM roads would be minimized and any congestion would be temporary. These effects would occur up to six and a half months each year during construction and drilling activities. These effects would be temporary and a short-term inconvenience to visitors, given that construction and drilling activities would be implemented over a period of one to three years.

The Public Lands project would not result in road closures; therefore, the existing 149 miles of road in the Public Lands project area, of which 52.43 miles are currently being used for motorized recreational opportunities, would remain available.

Private Lands Project Effects

As described within the Affected Environment section above, there are no permitted recreation uses in the Private Lands project area. In addition, no primitive campsites or motorized trails have been identified within the Private Lands project area. Therefore, no measurable effects to recreation are anticipated.

Alternative C

Public Lands Project Effects

While no additional stipulations specific to recreation were included as Alternative C, the timing restrictions proposed for sage-grouse and big game protection would prohibit project activities from December 1 through August 15. Note that some activities may be allowed within this timeframe if those uses would not have a net negative effect and are approved by BLM prior to those activities. Some of the approved activities may include less intrusive actions such as testing and monitoring or other non-ground disturbing activities if appropriate. Additionally, time restriction for the Community Pit could also allow some activity between July 15 and August 15 if deemed appropriate by the BLM wildlife biologist after a current and site specific evaluation. Public access to the well pads would be restricted to authorized project personnel for site safety. This precaution would result in a temporary disruption (i.e. three and a half months per year) to rock-hounding at the proposed well pad locations. In addition, noise, dust, and traffic generated by Alternative C would inconvenience visitors in the Public Lands project area during the proposed construction and drilling activities. As described above, BLM estimates that there are approximately 25,000 visitor days per year for rock-hounding in the Public Lands project area. Activities from the Public Lands project would be prohibited during the time period between December 1 and August 15, with the exception of quarry activities, if cleared by BLM biologists (**Section 2.4**), during which approximately 13,125 visitor days for rock-hounding occur. The remaining 11,875 visitor days (August 16 through November 30) would be inconvenienced by the noise, dust, and traffic generated by the proposed construction and drilling activities, but the Public Lands projects are not expected to impact visitation or use of the minerals recreation area.

In addition, recreational use of up to ten primitive campsites within one-half mile of the project features, particularly those located adjacent to access roads Obsidian Road-C and Obsidian

[8] As stated in **Section 2.5.1**: Project vehicles would abide by a 25 mph speed limit within the project area, and 15 mph when wildlife (i.e. sage grouse, deer) has been observed near project activities.

Road-D as well as R-10, a proposed new access road for the Public Lands Project (see **Figure 3-1A**), would be avoided for up to three and a half months each year due to the noise, dust, and traffic generated during construction and drilling activities. These effects would be temporary and a short-term inconvenience to visitors, given that construction and drilling activities would be implemented over a period of one to three years.

During the proposed roadway construction and improvement activities, public use of the access roads would be temporarily congested. Road improvement or construction would occur incrementally as necessary to reach well pads; roads would not be constructed until access to a well pad is needed. Therefore, disruption of public access to BLM roads would be minimized and any congestion would be temporary. These effects would occur up to three and a half months each year during construction and drilling activities. These effects would be temporary and a short-term inconvenience to visitors, given that construction and drilling activities would be implemented over a period of one to three years.

The Public Lands project would not result in road closures; therefore, the existing 149 miles of road in the Public Lands project area, of which 52.43 miles are currently being used for motorized recreational opportunities, would remain available.

Private Lands Project Effects

As described within the Affected Environment section above, there are no permitted recreation uses in the Private Lands project area. In addition, no primitive campsites or motorized trails have been identified within the Private Lands project area. Therefore, no measurable effects to recreation are anticipated.

3.4 Rangeland Management

Affected Environment

The BLM has a mandate under FLPMA to implement a policy of “multiple use” for public lands, where various resources occurring within the same area can be utilized concurrently. As identified in the Brothers LaPine and Three Rivers RMPs, BLM lands within the project area are allotted for grazing, as well as energy development and recreation.

The Glass Buttes area has been utilized for grazing for decades, with the first grazing uses documented in the mid-1930s with the creation of the U.S. Grazing Service. As shown in **Figure 3-2**, the Hampton, G.I., and Round Top Butte grazing allotments are present throughout the Public and Private Lands project areas, comprising a total of roughly 37,500 acres of pasture. Potato Hills Road to the Community Pit is entirely within the Hat Butte allotment.

The quality of native vegetation for these allotments is considered average for grazing, and 2009 and 2010 allotment evaluations reported that the vegetation and habitat standards set forth in BLM’s Standards and Guidelines for Rangeland Health (BLM 2009, 2010) were being achieved.

Fencing between allotments is present throughout the project area and along the border of Highway 20. Gates are present at the locations where existing access roads intersect allotment boundaries. Cattle guards are present where Highway 20 intersects Obsidian Road A (OR-A) and Access Road C (AR-C), but not where Potato Hills Road intersects with Highway 20. Vehicle strikes with livestock are rare in the project area, both on Highway 20 and along existing roads in

the project area (BLM 2013). Access roads OR-B, OR-D, and R5B would cross the allotment boundary/fence between the G.I. and Round Top Butte pastures. Access roads within the Private Lands project area exclusively access the G.I. pasture and do not cross any allotment boundaries/fences.

Environmental Consequences

Alternative A

Public Lands Project Effects

Under Alternative A, there would be no project traffic and the potential for livestock accessing unintended pastures due to open gates would remain the same as it currently exists. Furthermore, the possibility of livestock accessing Highway 20 would remain the same as currently exists. No direct effects to rangeland management would occur under Alternative A.

Private Lands Project Effects

Under Alternative A, no existing access roads within the Private Lands project area intersect an allotment boundary/fence, and no project vehicles would utilize open gates for exploratory operations. Therefore, there is no potential for livestock to cross into an unintended allotment on private lands. The Private Lands project area and Highway 20 are noncontiguous, so there is no potential for livestock to access Highway 20 from the Private Lands project area. Furthermore, cattle guards are present at the intersection of Highway 20 and AR-C which would prevent livestock from accessing Highway 20.

Alternative B

Public Lands Project Effects

Potato Hills Road is entirely within the Hat Butte allotment so there is no potential for livestock to access unintended pasture as result of project activities. Access roads OR-B, OR-D, and R5B intersect the boundary of the G.I and Round Top Butte grazing allotments. Assuming that existing gates along these access roads are left open to allow for unimpeded access by project vehicles, the overall potential for livestock inadvertently accessing an unintended pasture would remain low but increased.

Similarly, the likelihood of livestock accessing Highway 20 would remain low but would increase if the gate to well pad 16-9 and Potato Hills Road remained open during project activities. These effects would be temporary (August 16 through February 28), while project activities are being conducted under Alternative B.

Private Lands Project Effects

Access road AR-C does not intersect an allotment boundary/fence in the Private Lands project area; therefore, there is no potential for livestock to utilize an open gate to inadvertently access an unintended pasture on private lands.

The Private Lands project area and Highway 20 are noncontiguous, so livestock cannot access Highway 20 from the Private Lands project area. Furthermore, cattle guards are present at the intersection of Highway 20 and AR-C which would prevent livestock from accessing Highway 20.

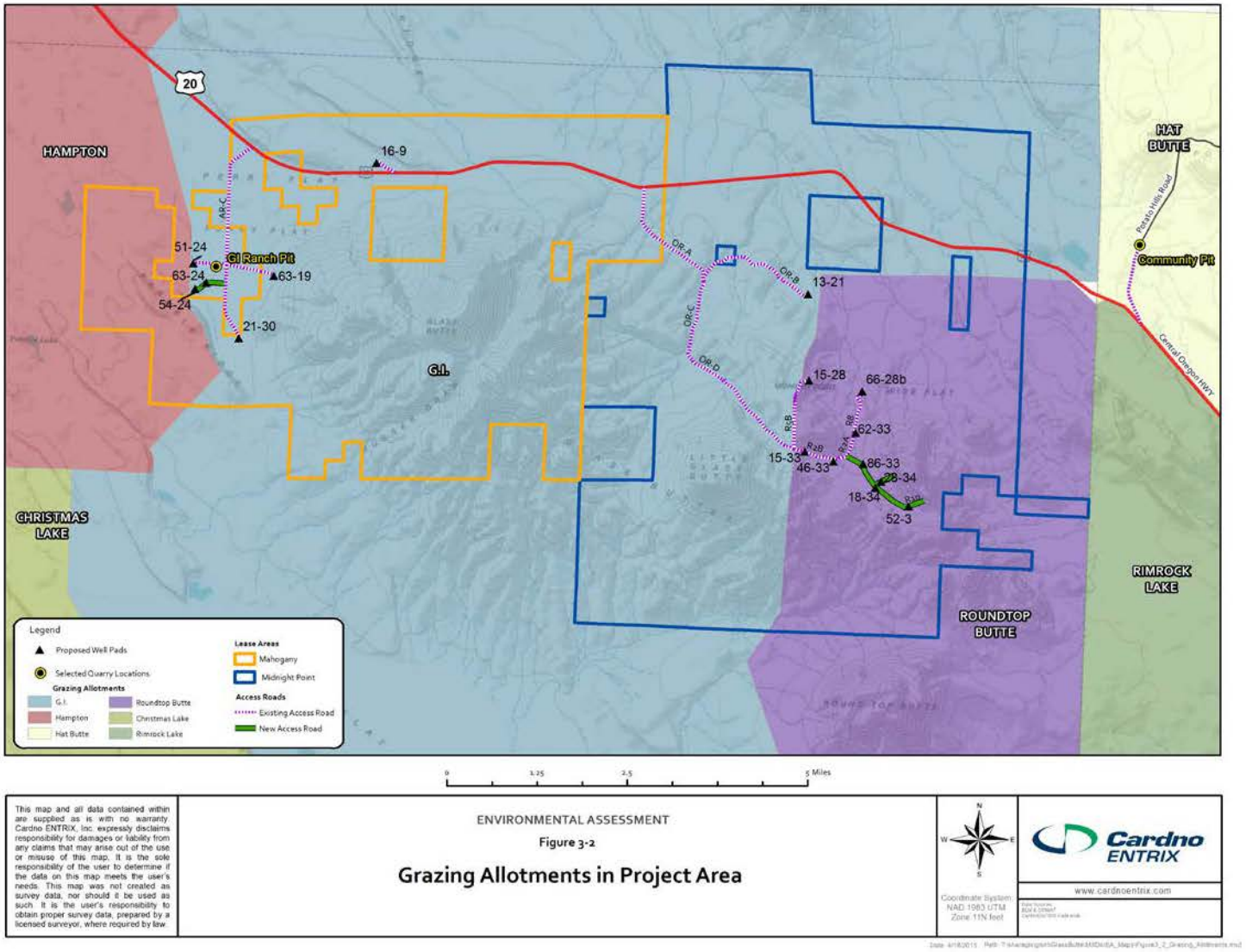

Figure 3-2 Grazing Allotments in Project Area

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Alternative C

Public Lands Project Effects

Under Alternative C, the potential for livestock accessing an inadvertent pasture would be minimized through the installation of cattle guards at the intersection of OR-D with the G.I. and Round Top Butte allotment boundary (see **Section 2.4**; **Figure 2-9**). The installation of cattle guards at the intersection of Highway 20 and Potato Hills Road and the access road to well pad 16-9 would also minimize the likelihood of livestock accessing Highway 20.

Private Lands Project Effects

Access road AR-C does not intersect an allotment boundary/fence in the Private Lands project area; therefore, there is no potential for livestock to utilize an open gate to inadvertently access an unintended pasture on private lands.

The Private Lands project area and Highway 20 are noncontiguous, so livestock cannot access Highway 20 from the Private Lands project area. Furthermore, cattle guards are present at the intersection of Highway 20 and AR-C which would prevent livestock from accessing Highway 20.

3.5 Biological Resources

Affected Environment

Greater Sage-Grouse

Specific to greater sage-grouse in Oregon, the following documents were utilized as sources for current scientific research and policy in drafting this EA:

- **Greater Sage-Grouse Conservation Assessment and Strategy for Oregon: A Plan to Maintain and Enhance Populations and Habitat, 2 April 2011 (*Sage-grouse Strategy*) and accompanying Core Area GIS data (July 24, 2011).** This document provides recommendations for long-term conservation of greater sage-grouse based upon the best available science, and is intended to inform decision-makers regarding the biological consequences of various actions on greater sage-grouse, but not dictate land management decisions. The accompanying GIS data provides locations of Core and Low Density greater sage-grouse habitat. The development of the *Sage-grouse Strategy* considered and incorporated information from the following two sources:
  - **Notice of 12-Month Findings for Petitions to List the Greater Sage-Grouse (50 CFR 17, March 5, 2010).** The USFWS reviewed primary sources of relevant science as well as information provided by states, federal agencies, and private citizens as part of this 12-Month Finding. The five listing factors considered by the USFWS in developing the findings are addressed in the Conservation Guidelines in Section V of the Oregon *Sage-Grouse Strategy*. At the direction of the Oregon Fish and Wildlife Commission or the Oregon Sage-Grouse and Sagebrush Habitat Conservation Team, the Oregon *Sage-Grouse Strategy* may be updated as new information is collected on the life-history of sage-grouse in Oregon or across the range of the species.

- **Greater Sage-Grouse: Ecology and Conservation of a Landscape Species and Its Habitats. Studies in Avian Biology, No. 38.** (Connelly *et al*. 2011. Individual chapters cited independently). The foundation for this volume was the 2004 Conservation Assessment for the Greater Sage-Grouse and Sagebrush Habitat compiled by the Western Association of Fish and Wildlife Agencies (WAFWA). The 2004 Assessment was compiled under tight timeframes and management considerations were not provided at that time. This published volume has revised, updated, and reconfigured the content of the 2004 Assessment and includes conservation implications for each chapter. Each chapter has followed a rigorous, scientific peer-review prior to publication. The chapters in this volume are recognized by the USFWS as the primary source of science for the 12-Month Findings for Petitions to List the Greater Sage-Grouse, referenced above. Where appropriate, this information was also considered and incorporated during the development of the Oregon *Sage-Grouse Strategy*.

Greater sage-grouse (*Centrocercus urophasianus*) are a sagebrush obligate species that use different sagebrush and riparian habitats throughout the year for courtship (lekking), nesting, brood rearing, and wintering, and rely on suitable habitat during each part of the year for their persistence. Sagebrush steppe habitat is present in a mosaic throughout the project area, primarily with grasslands, agricultural areas, and juniper woodlands. Specific habitat needs can be described in terms of breeding habitat, brood rearing habitat, and winter habitat. Unlike other upland game birds, greater sage-grouse have been known to exhibit extensive movement between seasonal ranges and home ranges (Connelly *et al.* 2011). Suitable year-round sagebrush habitat is present at lower elevations of the project area, and high-quality summer brood rearing through winter range occurs in the project area. Breeding habitat includes strutting grounds called leks, which are open areas surrounded by sagebrush and are typically used annually. Optimum greater sage-grouse nesting habitat contains a healthy sagebrush ecosystem completed with sagebrush plants and a strong native herbaceous understory composed of grasses and forbs (Hagen 2011).

Year-round sage-grouse habitat is identified as all sagebrush types, and also includes other habitat types, such as wet meadow, that support greater sage-grouse (ODFW 2012). Aside from lekking areas, seasonal greater sage-grouse habitats have not been mapped because of their variability, so specific estimates for acres of these habitats surrounding the project area are not available. Additionally, movement patterns of greater sage-grouse are not well documented. Birds have been known to be migratory or resident, depending upon habitat and landforms (Beck 1975, Wallestad 1975, Berry and Eng 1985, Connelly et al. 1988, Wakkinen 1990, Fischer 1994 in Hagen 2011, Connelly *et al*. 2011). Throughout a given year, greater sage-grouse could stay confined to an area of 100 km^2 or could exceed 1,500 km^2. Likewise, lekking, brood rearing, and winter range for any given population, or individuals in a population, could overlap entirely, partially, or not at all (Hagen 2011). According to ODFW (2010), greater sage-grouse have been known to travel up to nearly 10 km between ranges in the BLM Burns District.

Currently available greater sage-grouse habitat in the BLM Burns District is estimated to be about 3,055,788 acres[9] (Hagen 2011). In the BLM Prineville District, currently available greater sage-grouse habitat is approximately 1,861,645 acres (Hagen 2011). The management goal for the BLM Burns and Prineville Districts is to maintain or enhance greater sage-grouse numbers and distribution at the 2003 spring breeding population level (approximately 4,300 birds and 3,000 birds, respectively) until 2061.

The BLM interim nation-wide policy is to utilize state-level sage-grouse data for assessing effects to preliminary priority habitat (PPH) and preliminary general habitat (PGH) until BLM considers amendments or revisions to land use plans regarding sage-grouse (BLM 2011). Therefore, ODFW sage-grouse habitat designations and ODFW's mitigation strategy (ODFW 2012) are currently considered by BLM in the management of sage-grouse habitat. PPH areas are generally considered essential and irreplaceable for greater sage-grouse, and PGH areas are also important to the species. Impacts in PGH areas may potentially be mitigated as long as there is no net loss and a net benefit. Initial designations are based on proximity of the area to greater sage-grouse populations, and are not necessarily based on the availability of quality habitat. Initial habitat designations are based on BLM and ODFW GIS information, as shown in **Figure 3-3**.

Mitigation acreages for impacts (if allowed) are determined based on the "category" assigned to the habitat by ODFW biologists during a field visit. In PPH areas, where a site visit confirmed that there is evidence of sage-grouse presence, that sage-grouse depend on the habitat, and that the habitat is essential and irreplaceable, it is designated as Category 1 habitat. Likewise, habitat confirmed to be PGH sage-grouse habitat by an ODFW field visit would be designated as Category 2. ODFW has designated all PPH areas within the project area as Category 1.

Greater sage-grouse use the Glass Buttes area year-round for breeding, nesting, brood-rearing, and wintering. During the winter, sage-grouse forage almost entirely on sagebrush (Hagen 2011). A radio-telemetry study recently demonstrated the importance of the Glass Butte area for wintering sage-grouse (Freese, *et al.* 2009; Bruce 2008). Portions of the project area with steeper terrain and areas with greater than 5 percent juniper cover are precluded from use, or see reduced use by greater sage-grouse.

In total, the Alternative B project area occupies 10,968 acres of PPH and 27,169 acres of PGH sage-grouse habitat (**Figure 3-3**). There are roads, structures and recreational uses that may be diminishing the quality of the existing sage-grouse habitat in the project area. Currently, a cumulative total of 153.1 miles of existing roads traverse the Public Lands Project (149 miles) and the Private Lands Project area (4 miles), of which 39.1 miles are in PPH areas and 114.0 miles are in PGH areas. Using the methodology described in the Mitigation Framework for the Sage-grouse Strategy (ODFW 2012), the area of indirect disturbance for existing roads was estimated based on a 1.0 mile buffer for high traffic roads (Highway 20) and a 0.2 mile buffer for low traffic roads. Based on this analysis, existing roads result in a disturbance of 7,801 acres of PPH and 21,067 acres of PGH sage-grouse habitat in the Public and Private Lands project area.

[9] Wildfires during the 2012 fire season burned about 10 percent of PPH and 4 percent of PGH sage-grouse habitat in southeastern Oregon BLM districts. Sage-grouse habitat within the Project area was not affected.

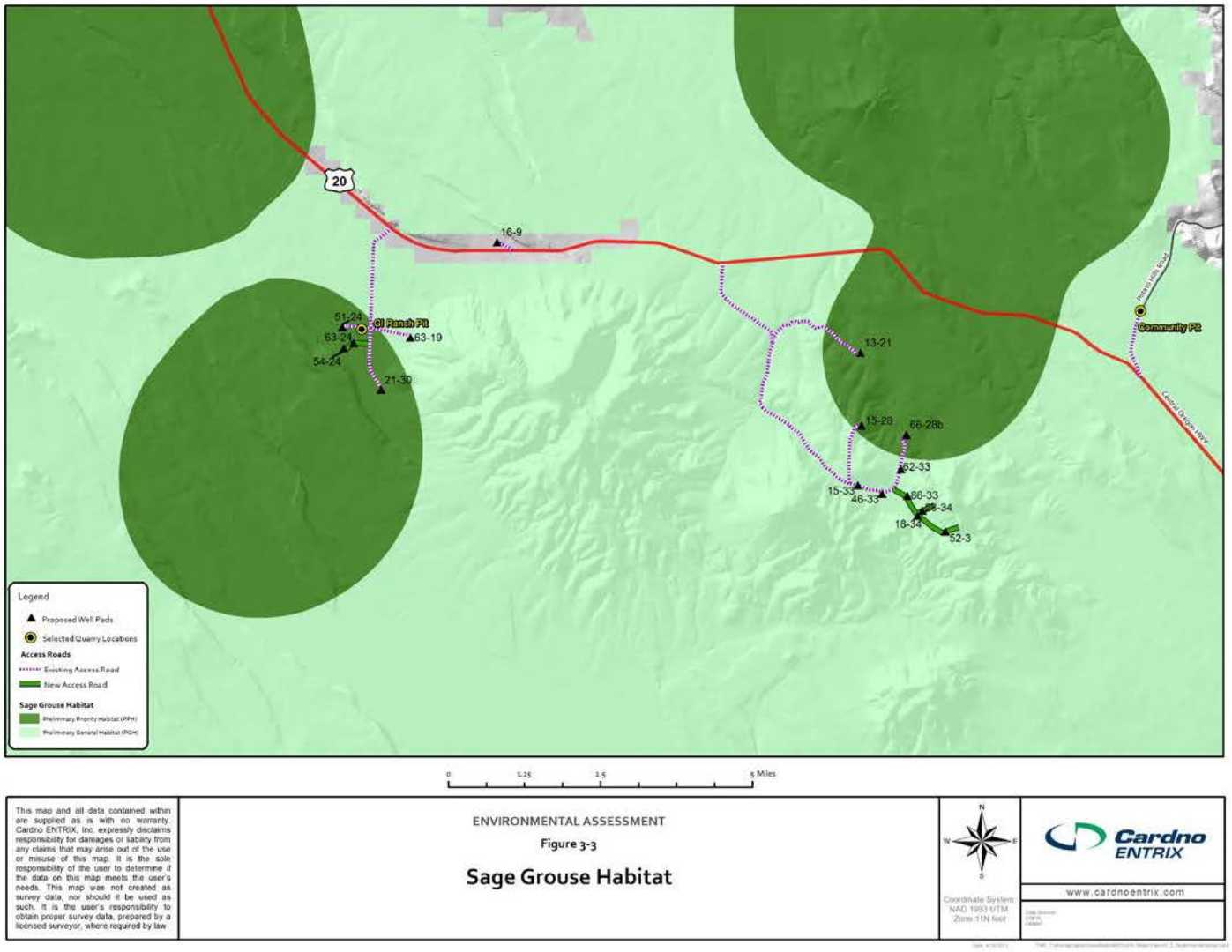

Figure 3-3 Sage-grouse Habitat

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GIS data with greater sage-grouse lek locations were analyzed for lek distance from the project area. Twelve known leks occur within 10 km of the proposed project area, including three lek complexes, each with two leks: Glass Butte, Tired Horse, and Rye Grass. Other leks occurring outside of lek complexes are Parmele Ridge, Bush Well, Nordell Ridge, Canary Lake, False Waterhole, and Swamp Lake.

The number of birds at each lek is expected to fluctuate over time. Visits during the aerial and ground surveys yielded no bird observations at the Bush Well, Canary Lake, and Glass Butte South leks. During aerial surveys for this project, a previously unknown lek, Parmele Ridge, was located. There were ten males and one female present at the lek during the aerial survey, and 11 to 14 birds were observed during follow up pedestrian surveys at the site.

The Glass Butte #2 lek had 18 birds present during helicopter and pedestrian reconnaissance, of which most, if not all, were male. According to ODFW count data, the average count of male birds between 2000 and 2009 was 17 birds at the Glass Butte lek complex (Cardno ENTRIX 2010). The ODFW lek counts for the Glass Butte lek complex indicate grouse populations have fluctuated from year to year, but that the birds have occupied the lek complex for the period from 1984 to 2010 (counts at this lek complex began in 1984). Since 1984, the number of males observed has ranged from a low of 2 in 1997 to a high of 34 in 1994.

Big Game

Big game species that occur within the project area include mule deer (*Odocoileus hemionus*), Rocky Mountain elk (*Cervus elaphus*), and pronghorn (*Antilocapra americana*). These species may be present in the project area at various times of the year. The project area provides important forage and cover for mule deer and elk during winter months when these species struggle to maintain weight, especially when severe storms or a deep winter snowpack can increase mortality at higher elevations. These wintering areas are critical for big game survival and health prior to the spring fawning and calving. Vegetation in the project area is predominantly sagebrush steppe, with some juniper encroachment (ENTRIX 2010). A total of 153.1 miles of existing roads, including both paved highway and dirt access roads, cross the Public and Private Lands Project area.

Big game winter range occurs throughout the entire project area (see **Figure 3-4**). Population counts have not been conducted at the scale of the Glass Butte area, and are difficult to estimate as the number of mule deer and elk fluctuate throughout the year. Generally, mule deer and elk populations use the project area most heavily in the winter, and use is lowest in the summer.

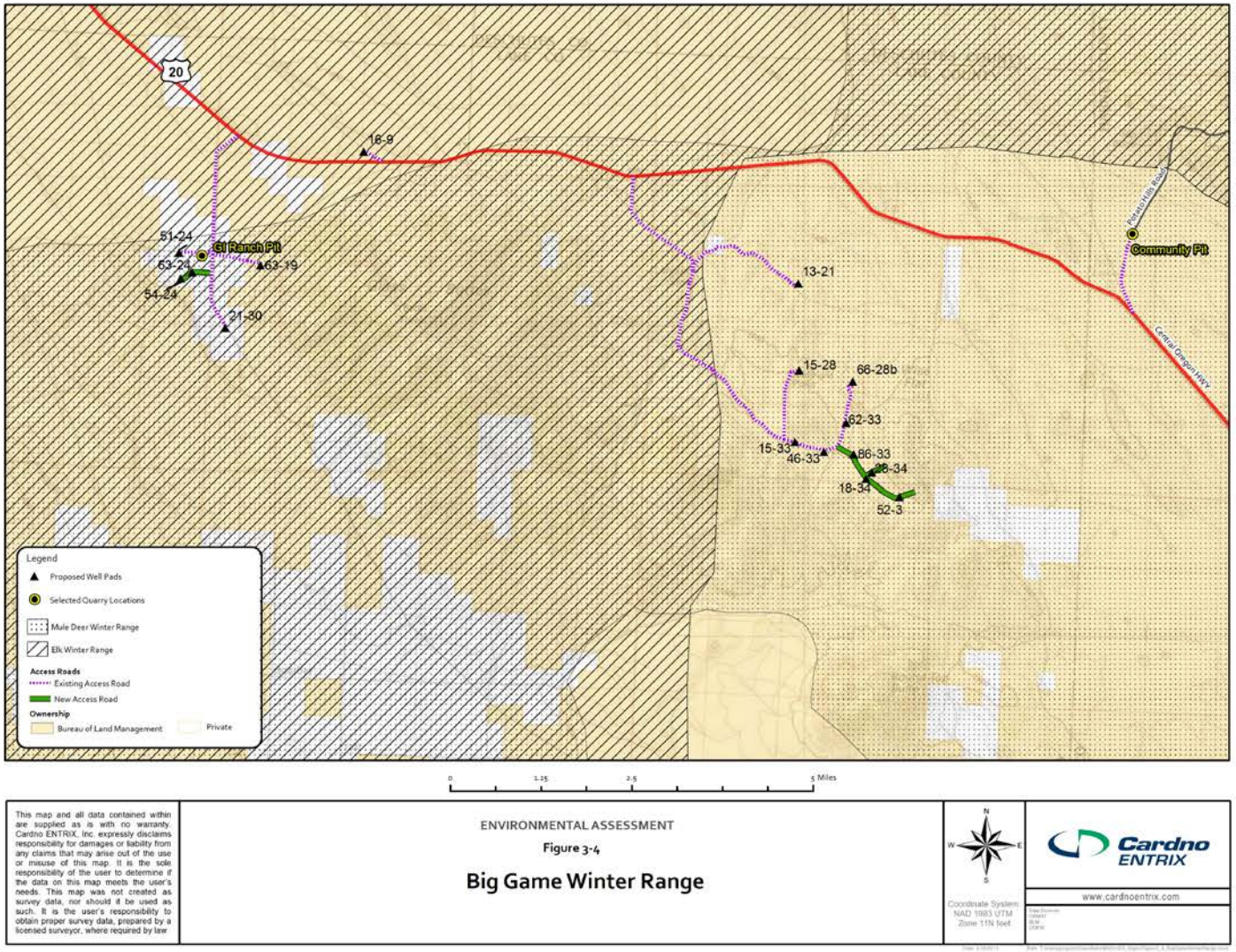

Figure 3-4 Big Game Winter Range

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Raptors

Raptor species are common in the project area, primarily in open habitats, although accipiters (i.e., hawks typically having short rounded wings and a long tail) are present in riparian areas, aspen stands, and juniper woodlands. The ferruginous hawk (*buteo regalis*) would be the only species that would nest in sagebrush habitats, while other hawks, eagles, and falcons would build nests in trees, on cliff faces, or in cavities in cliffs. Additionally, the red-tail hawk (*buteo jamaicensis)* is common in central Oregon. Raptors are protected under the Migratory Bird Treaty Act (MBTA); bald and golden eagles have additional protection under the Bald and Golden Eagle Protection Act (BGEPA).

The presence of both active and inactive raptor nests is important in understanding raptor use of the project area. Active nests were defined as those with signs of activity including behavior of adults, presence of eggs, young, or whitewash, while inactive nests did not display these signs of activity. Presence of both active and inactive nests is important since not all raptor pairs breed every year or utilize the same individual nest within a nesting territory (Scott 1985). Individual raptor nests have been reported to be reused over a period of roughly seven years for species such as golden eagles or ferruginous hawks (USFWS 2002).

Three active raptor nests were discovered during the project field surveys, including a ferruginous hawk nest located outside of the project area and two red-tail hawk nests located inside the project area (**Figure 3-5**). One prairie falcon (*falco mexicanus*) cliff nest was found in good condition but inactive (on April 7, 2010 and again on April 25, 2012) inside the area, and two additional inactive nests were found (one ferruginous hawk and one red-tail hawk located inside the project area). Well pad 52-3 is within 0.5 miles of an active red-tail hawk nest. Well pad 15-28 is within 0.5 miles of two raptor nests, an active and an inactive red-tail hawk nest. Well pad 21-30 is located within 0.5 miles of an inactive raptor nest.

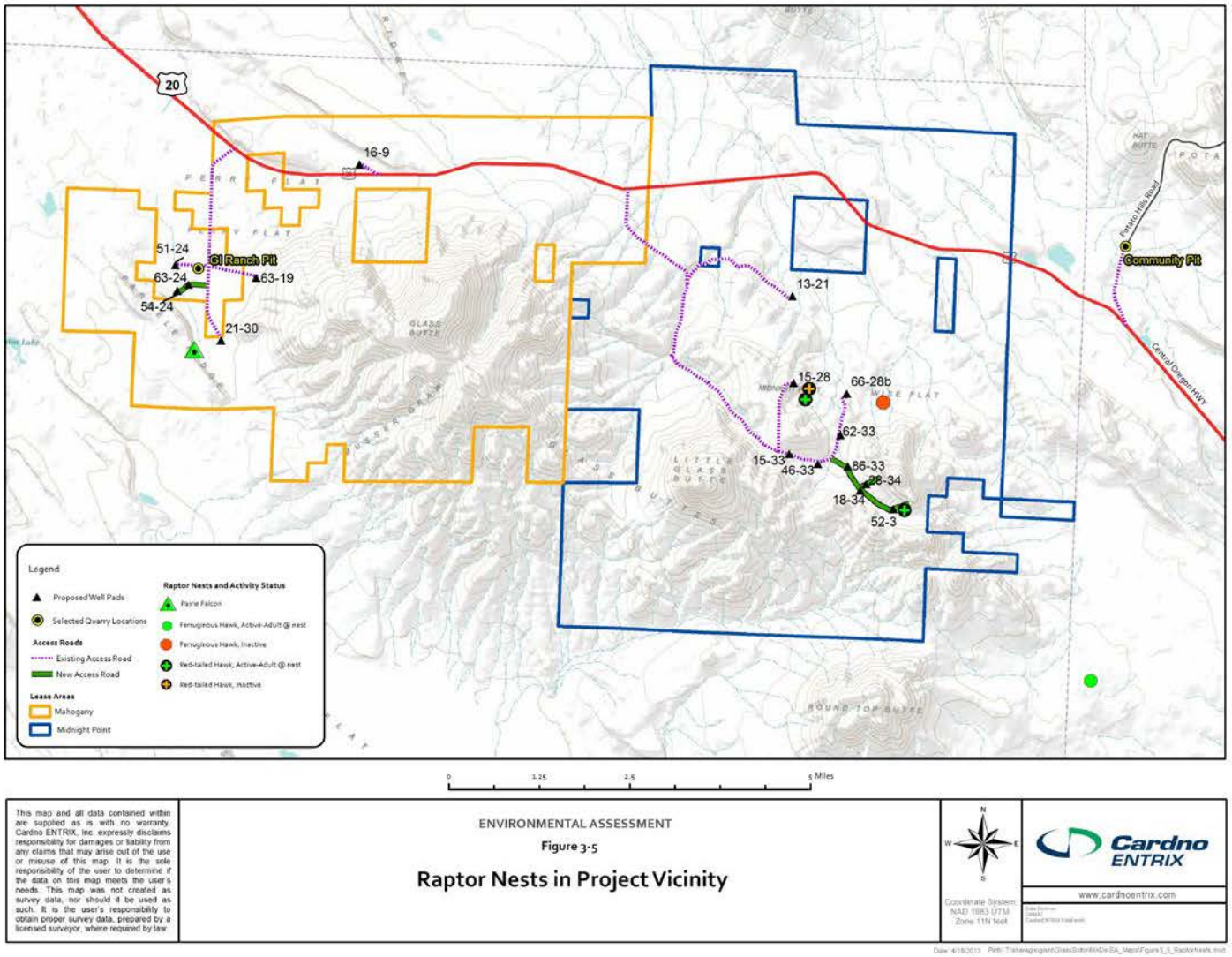

Figure 3-5 Raptor Nest in Project Vicinity

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Noxious Weeds

Noxious weeds have been identified by ODFW, BLM and USFWS as a primary threat to greater sage-grouse (ODFW 2011). Many exotic plant species are found within the project area, but only a portion of these are considered to be noxious weeds. The Oregon Department of Agriculture's (ODA) Noxious Weed Control Program maintains a list of noxious weeds that are scheduled for control in Oregon (ODA 2009b). Infestations of "A" designated weeds are subject to eradication or intensive control when and where found. Treatment of "B" designated weeds is limited to intensive control at the state, county, or regional level, as determined on a site-specific, case-by-case basis. Some of these species have also been designated "T" or target weeds species (ODA 2010). ODA annually develops a list of target weed species that would be the focus for prevention and control by the Noxious Weed Program.

A list of noxious weed species that are of particular concern to the BLM (Burns and Prineville District Offices) is provided in **Table 3-2**. Medusahead rye is the Burns District's priority weed species (Meinicke 2010). This species poses the greatest risk for spread into any newly disturbed areas (Meinicke 2010).

Table 3-2 Noxious Weeds Species Potentially Occurring in the Project Area

Common Name[1]	Scientific Name[1]	Burns District Species of Concern	Prineville District Species of Concern	ODA Rating
Russian knapweed	*Acroptilon repens*	x	x	B
Cheatgrass	*Bromus tectorum*		x	
Whitetop	*Cardaria draba*	x	x	B
Musk thistle	*Carduus nutans*	x	x	B
Spotted knapweed	*Centaurea biebersteinii*	x	x	B
Iberian thistle	*Centaurea calcitrapa and C. iderica*		x	A, T
Diffuse knapweed	*Centaurea diffusa*	x	x	B
Yellow starthistle	*Centaurea solstitialis*	x	x	B
Rush skeleton weed	*Chondrilla juncea*	x		B, T
Canada thistle	*Cirsium arvense*	x	x	B
Bull thistle	*Cirsium vulgare*	x	x	B
Poison hemlock	*Conium maculatum*		x	B
Field bindweed (morning glory)	*Convolvulus arvensis*	x		B, T
Houndstongue	*Cynoglossum officinale*		x	B
Russian olive	*Elaeagnus angustifolia*		x	
Leafy spurge	*Euphorbia esula*	x	x	B, T
Halogeton	*Halogeton glomeratus*	x		B
Orange hawkweed	*Hieracium aurantiacum*		x	A
St John's wort	*Hypericum perforatum*	x		B
Kochia	*Kochia scoparia*		x	B
Perennial pepperweed	*Lepidium latifolium*	x	x	B, T
Dalmatian toadflax	*Linaria dalmatica*	x	x	B, T
Purple loosestrife	*Lythrum salicaria*	x		B

Common Name[1]	Scientific Name[1]	Burns District Species of Concern	Prineville District Species of Concern	ODA Rating
Scotch thistle	*Onopordum acanthium*	x	x	B
Mediterranean sage	*Salvia aethiops*	x	x	B
Tansy ragwort	*Senecio jacobaea*	x		B, T
Medusahead rye	*Taeniatherum caput-medusae*	x	x	B
Saltcedar	*Tamarix ramosissima*		x	B, T
Puncturevine	*Tribulus terrestris*	x	x	B

Environmental Consequences

Alternative A

Public Lands Project Effects

Alternative A includes no action of any kind. The project area is all within elk and mule deer winter range. However, since there would be no action, elk and mule deer and their winter range habitat would not be affected. Using the methodology described for calculating effects to big game in the Mitigation Framework for the Sage-grouse Strategy (ODFW 2012), the area of indirect disturbance for existing roads was estimated based on a 1.0 mile buffer for high traffic roads (Highway 20) and a 0.2 mile buffer for low traffic roads. Based on this analysis, existing roads would continue to result in noise disturbance of 39,864 acres of the 40,420 acres of big game winter range in the project area. No PPH or PGH sage-grouse areas would be affected by the Project, and sage-grouse lekking and nesting would not be affected by the Project. One hundred fourteen miles of roads would continue to traverse the approximately 27,000 acres of PGH sage-grouse habitat in the project area, and 39.1 miles of roads would continue to traverse the over 10,000 acre of PPH sage-grouse habitat in the Public Lands project area. These roads would continue to affect 7,395 acres of PPH and 21,066 acres of PGH sage-grouse habitat due to direct and indirect disturbance in the Public Lands project area. Levels of noxious weeds in the project area would not be affected under Alternative A. Additionally, raptors or raptor nests would not be affected beyond disturbance effects from existing roads.

Private Lands Project Effects

Alternative A would be the continuation of existing land uses on the 636 acres of PPH and 1,859 acres of PGH sage-grouse habitat in the project area. The 2,495 acre project area is all included in elk and mule deer winter range; however, these lands would not have any additional effects beyond disturbance from existing roads. Levels of noxious weeds in the project area would not be affected by the Private Lands project. Approximately 4 miles of existing roads would continue to affect 406 acres of PPH and 134 acres of PGH sage-grouse habitat due to direct and indirect disturbance. No PGH or PPH sage-grouse areas would be affected by the Project, and sage-grouse lekking and nesting would not be affected by the Private Lands project. Levels of noxious weeds in the project area would not be affected under Alternative A. Additionally, raptors or raptor nests would not be affected beyond disturbance effects from existing roads.

Alternative B

Public Lands Project Effects

Greater Sage-Grouse

Effects from the Project to greater sage-grouse would be limited to disturbance of habitat outside of lekking and nesting season. As sage-grouse would not be attending leks during the time that Project operations would occur, all surface operations would be inaudible to breeding birds. Effects of noise on greater sage-grouse during lekking season that would be avoided include declines in lek attendance, increase in stress levels, and altered bird behavior (Patricelli *et al* 2012). Noise may be audible to birds that might use the area during drilling operations. These birds would likely discontinue use of the area until drilling operations ceased. Three of the production size wells (13-21, 15-28, and 66-28b) and one slim well (21-30) would be located in PPH sage-grouse habitat. Seven production size wells (15-33, 46-33, 62-33, 86-33, 18-34, 28-34, and 52-3) and two slim wells (16-9 and 63-19) would be located in PGH sage-grouse habitat. This would result in a total surface disturbance due to well pad construction of 15 acres of PPH habitat and 33.1 acres of PGH habitat area (see **Table 3-3** below).

Additionally, access roads for the Projects would traverse both PPH and PGH sage-grouse habitat areas. Existing roads, as well as those proposed to be installed in Alternative B, in PPH and PGH sage-grouse habitat in the Public Lands project area are shown in **Table 3-4** below. Installation of new roads and widening of the access road leading to well 63-19 would result in 0.2 acres of surface disturbance in PPH habitat and 6.0 acres of surface disturbance in PGH habitat. The Community Pit would disturb approximately 5.0 acres of PGH sage-grouse habitat.

Table 3-3 Acreage of PPH and PGH Habitat affected by Surface Disturbance from the Public Lands Project

Sage-grouse Habitat Affected (acres)	Public Lands Project (acres)
Preliminary Priority Habitat (PPH)	
Wellpads[a]	15.0
Road Widening and Improvements[b]	0.2
PPH Total	15.2
Preliminary General Habitat (PGH)	
Wellpads[a]	33.1
Road Construction and Improvements[b]	6.0
Community Pit	5.0
PGH Total	44.1

[a] Wellpads proposed within the Midnight Point project area are calculated at 4.1 acres for full-size wells. Wellpads proposed within the Mahogany project area are calculated at 2.1 acres for slim wells.

[b] Assumes that 2 of the truck turnouts would be located within PGH area habitat and the remaining 29 proposed turnouts and 1 truck turnaround area would be located within PPH habitat.

Table 3-4 Comparison of Existing and Proposed New Roads in PPH and PGH Habitat under the Public Lands Project (Alternative B)

Sage-Grouse Habitat Type	Total Sage-Grouse Habitat[1]	Existing Roads in Sage-Grouse Habitat		New Roads in Sage-Grouse Habitat	
	Acres	Miles	Miles/acre of sage-grouse habitat	Miles	Miles/acre of sage-grouse habitat
PPH Area	10,331	36.2	<0.01	0.0	<0.01
PGH Area	27,169	113.0	<0.01	1.7	<0.01
Total	37,500	149.2	<0.01	1.7	<0.01

[1] Includes both affected and unaffected habitat within the project area

Additional effects to sage-grouse habitat would occur due to noise generated by the Public Lands project, including an increase in road traffic, drilling noise, and quarry operations. Based on the methodology described in ODFW's implementation document for the Sage-grouse Strategy (ODFW 2012), the geographic extent of the effects to sage-grouse from noise related to the Project would extend 1,609 meters from construction and use of new temporary access roads and improvement and use of existing access roads[10] (ODFW 2012), 600 meters from well pads, and 400 meters from quarry operations. The geographic extent to which noise from drilling and quarry operations would exceed the ambient noise level was modeled using the general methodology developed in 2006 by the John A. Volpe National Transportation Systems Center for the Department of Transportation Federal Highway Administration. Overall, as shown in **Table 3-5**, the noise generated from the Project would affect approximately 2,045 acres of PPH habitat and 2,649 acres of PGH habitat in the Public Lands project area that is not already affected by noise from existing roads (see **Table 3-5** below).

For purposes of calculating the area affected by noise from traffic, the methods recommended in the Oregon Sage-grouse Mitigation Framework were used (ODFW 2012). The Mitigation Framework is based on science supporting a threshold of sounds greater than 40 dbA imposing impacts of reduced breeding activity and increased stress levels in sage-grouse. The Mitigation Framework does not provide a method of calculating effects of a range of sound levels from vehicle traffic, but provides a method of calculating effects of different use levels at a specific distance from the road. Thus the additive effects of the Project within areas already affected by existing noise are not specifically calculated, beyond assuming that habitat would be impacted in these areas. The timing of this Project-related noise would be 24-hours/day, would occur during the fall and winter, and would not occur during sage-grouse lekking and nesting seasons in the spring and summer. As the impacts for this project would outside of breeding times, effects from the project would be limited to habitat avoidance and increased stress levels in sage-grouse utilizing the affected habitat.

[10] This assumes that road use of existing roads increases as a result of the Project. Road use for all Project access roads is estimated to be "high" traffic (>8 vehicles/24 hours) (ODFW 2012).

Table 3-5 Total Acreage of PPH and PGH in the Public Lands Project Area, and PPH and PGH Affected by Noise from the Public Lands Project (Alternative B)

PPH Area (acres)				PGH (acres)			
Total (includes affected and unaffected area)	Area affected by Existing Noise[1]	Total Area Temporarily Affected by Project Noise and Existing Noise[2]	Temporary Increase in Affected Area[3]	Total (includes affected and unaffected area)	Area affected by Existing Noise	Total Area Temporarily Affected by Project Noise and Existing Noise	Temporary Increase in Affected Area
10,331	7,395	9,440	2,045	27,169	21,067	23,716	2,649

Notes:

1) Based on a 1-mile buffer on either side of Highway 20, and a 0.2 mile buffer on either side of all other existing roads in the project area. These effects occur during all seasons. (ODFW 2012)

2) Based on a 1-mile buffer on either side of Highway 20 and all Project access roads, a 600 meter buffer from well pads, a 400 meter buffer from quarry operations, and a 0.2 mile buffer on either side of all other existing roads in the project area (ODFW 2012).

3) Difference between the area affected by existing noise and the area affected by Project plus existing noise.

Big Game

Construction of the Public Lands project would result in surface disturbance to mule deer and/or elk winter range habitat. All wells in the project area would be constructed in mule deer and/or elk winter range habitat, affecting a total of 47.5 acres. An additional 6.0 acres of mule deer and/or elk winter range habitat would be affected due to installation and improvement of roads. Additionally, the Community Pit would be located within winter range habitat and would result in a disturbance of 5.0 acres.

Big game winter ranges are important habitat during colder and snowier winter months when forage availability is reduced. Increased activity along roads is associated with the displacement of big game species (Rowland, *et al* 2005; Forman and Alexander 1998), reducing the amount of forage and cover available in winter habitat. Johnson (*et al.*, 2000) showed effects of different traffic levels on deer and elk habitat use, as shown in **Table 3-6** below. The zone of influence used in this table is defined as the area that is impacted in any way from the Public Lands project. For the Project, the disturbance band that would apply is for high traffic (>8 vehicles/24hours), which is 1,300 meters (0.8 miles).

Table 3-6 Zone of Influence Applied to Each Side of Road for Deer and Elk

Trail or Road Type Status	Zone of Influence
Motorized trails	300 meters
Closed road (no vehicle traffic but open to ATVs)	300 meters
Low traffic (0-1 vehicles/12 hours)	900 meters
Moderate traffic (2-4 vehicles/12 hours	1000 meters
High traffic (>4 vehicles/12 hours)	1300 meters

Source: Gaines, et al. (2003) in BLM (2010)

Vehicle activity on the site could displace animals or cause additional movement of elk and mule deer at a time when they have a need to conserve energy, and would reduce habitat use in the areas surrounding the new and improved roads (Wisdom *et al*. 2005). Using a 0.8 mile buffer from the access roads, vehicle activity associated with the project would affect 191 acres of mule deer and/or elk winter range habitat that is not currently affected by existing roads (see **Table 3-**

7). The effect to big game would be a reduction of habitat quality due to noise disturbance. The animals' response to the effect would be avoidance of the disturbed habitat.

Table 3-7 Total Acreage Mule Deer and Elk Winter Range in the Public Lands Project Area in the Zone of Influence from Existing and Project-Related Roads (Alternative B)

Mule Deer and/or Elk Winter Range			
Total Acres (includes affected and unaffected area)	Acres affected by Disturbance from Existing Roads[1]	Total Acres Affected by Disturbance from Project and Existing Roads[2]	Acres Affected Disturbance from Project Roads3
40,821	40,241	40,432	191

Notes:

1) Based on a 0.8-mile buffer on either side of Highway 20, and a 0.6 mile buffer on either side of all other existing roads in the project area.

2) Based on a 0.8-mile buffer on either side of Highway 20 and all Project access roads, and a 0.6 mile buffer on either side of all other existing roads in the project area.

3) Based on a 0.8-mile buffer on either side of Project access roads.

Raptors

Raptors could potentially be affected by increased noise levels associated with construction of the Projects. However, operational noise levels from the Projects would not be loud enough to disrupt raptors, so no effects from exploration operations (i.e. drilling) are anticipated. Raptors vary in their susceptibility to nest abandonment from industrial activities. Some individual hawks and falcons are accustomed to the presence of heavy equipment and associated noise and dust, while others are more sensitive to disturbance. Generally, red-tail hawks and prairie falcons tend to shift their activity away from industrial and military activity, and would return to the areas when the disturbance ceases (Andersen, *et al* 1986). Activities from the Projects would not occur during the time period between March 1 and August 15 (**Section 2.5.1**). Raptor nesting generally occurs from March to July; therefore, exploration activities would not interfere with raptor nesting.

Noxious Weeds

The Applicant would be required to submit and obtain BLM approval for a weed plan prior to implementation of any ground disturbance on site. The potential introduction and propagation of noxious weeds from the Project would be minimal and most likely related to project or user traffic.

Private Lands Project Effects

Greater Sage-Grouse

The Parmele Ridge lek is approximately 1.5 miles to the south of access road AR-C of the Private Lands project area, and is the closest lek to the Private Lands project. All of the proposed wells, the G.I. Ranch Pit, and most of the access roads are located in PPH habitat. To minimize effects to greater sage-grouse, no surface operations for the Private Lands project would be performed during sage-grouse lekking season and nesting season (March 1 to August 15) (**Section 2.5.1**). All exploration activities would occur outside of lekking season, minimizing any impacts to greater sage-grouse reproductive behaviors.

The three wells within the Private Lands project area and the G.I. Ranch Pit would be constructed on PPH greater sage-grouse habitat, and the new roads would also traverse PPH habitat. The wells and the G.I. Ranch Pit would result in a total of 11.21 acres of surface disturbance to PPH areas. An additional 1.8 acres of surface disturbance to PPH areas and 0.4 acres to PGH area would also occur due to road construction.

While the presence of roads would not necessarily reduce greater sage-grouse use, the timing and amount of road use would determine the extent that greater sage-grouse and other wildlife would avoid the roads and nearby areas. For the Private Lands project, we assume that use of existing roads would increase as a result of the Project. Road use for all roads is estimated to be "moderate traffic" (2-4 vehicles/12 hours. Additional effects to PPH habitat would occur due to noise generated by Private Lands project, including an increase in road traffic, drilling noise, and quarry operations. Effects from roads and other noises would be a reduction in habitat quality due to noise disturbance and avoidance of habitat by greater sage-grouse. Due to the timing of the Project, lekking and nesting in the affected habitat would not be affected.

The geographic extent of the effects to sage-grouse from noise was estimated to be 1,609 meters from all new and improved access roads[11] (ODFW 2012), 600 meters from well pads, and 400 meters from quarry operations. The geographic extent to which noise from drilling and quarry operations would exceed the ambient noise level was modeled using the general methodology developed in 2006 by the John A. Volpe National Transportation Systems Center for the Department of Transportation Federal Highway Administration. The noise generated by the Private Lands project would affect 636 acres of PPH habitat and 261 acres of PGH habitat occurring within the Private Lands project area. These effects would occur outside of lekking and nesting seasons. Existing effects from noises associated with the existing roads currently affect approximately 406 acres of PPH habitat and 134 acres of PGH habitat. Unlike project-related effects, these existing effects occur during all seasons.

Big Game

Construction of the Private Lands project would result in surface disturbance to big game (i.e. mule deer and/or elk) winter range habitat. Construction of the three well pads, 51-24, 54-24, and 63-24 would result in a total of 6.2 acres of disturbance in mule deer and/or elk winter range. Additionally, construction and improvement of access roads would disturb approximately 2.1 acres of winter range. The G.I. Ranch Pit is located in big game winter range habitat, and would result in a surface disturbance of 5.0 acres. Using a 0.8 mile buffer from the access roads, vehicle activity associated with the Private Lands project would affect approximately 636 acres of winter range habitat, all of which would also be affected by existing roads. These effects would include a reduction in habitat quality due to noise, which may cause animals to avoid the habitat.

Raptors and Noxious Weeds

Effects to raptors and noxious weeds from the Private Lands Project would be similar to those discussed above for the Public Lands Project.

[11] This assumes that road use of existing roads increases as a result of the Project. Road use for all roads is estimated to be "moderate traffic (2-4 vehicles/12 hours).

Alternative C

Public Lands Project Effects

Greater Sage-Grouse

In addition to the protection measures discussed under Alternative B, fewer wells and roads would be constructed under Alternative C, such that surface disturbance or operations within PPH sage-grouse habitat would not occur. The additional PDFs for Alternative C (**Section 2.4**) would therefore prevent the approval of several well pads on public lands (21-30, 13-21, 15-28, and 66-28b) and no portion of the Private Lands project would be approved under this Alternative.

Seven production size wells (15-33, 46-33, 86-33, 28-34, 62-33, and 52-3) and two slim wells (16-9 and 63-19) would be located in PGH habitat, which would result in a surface disturbance of 33.1 acres of PGH habitat (see **Table 3-8**). Under Alternative C, access roads for the Public Lands project would result in a disturbance of 5.8 acres of PGH sage-grouse habitat on public land. The access road to well 63-19 would not be widened, but improved, resulting in no additional disturbance to greater sage-grouse habitat. Existing roads as well as those proposed to be installed in Alternative C in PGH sage-grouse habitat are shown in **Table 3-9**. Approximately 149 miles of existing road in the project area currently traverse PPH or PGH sage-grouse habitat. The Community Pit would also disturb approximately 5.0 acres of PGH sage-grouse habitat. After the one to three years of exploration operations, all disturbed areas would be reclaimed and revegetated with native species (**Section 2.3.3**).

Table 3-8 Acreage of PGH Affected by Surface Disturbance from the Public Lands Project

Sage-grouse Habitat Affected (acres)	Total (acres)
Preliminary General Habitat (PGH)	
Wellpads[a]	33.1
Road Construction and Improvements[b]	5.8
Community Pit	5.0
PGH Total	43.9

[a] Wellpads proposed within the Midnight Point project area are calculated at 4.1 acres for full-size wells. Wellpads proposed within the Mahogany project area are calculated at 2.1 acres for slim wells.

[b] Assumes that the 31 proposed turnouts and 1 truck turnaround area would be located within PGH habitat.

Table 3-9 Comparison of Existing and Proposed New Roads in PPH and PGH Habitat under the Public Lands Project (Alternative C)

Sage-grouse Habitat Type	Total Sage-Grouse Habitat[1]	Existing Roads in Sage-Grouse Habitat		New Roads in Sage-Grouse Habitat	
	Acres	Miles	Miles/acre of sage-grouse habitat	Miles	Miles/acre of sage-grouse habitat
PPH	10,331	36.2	0.004	0.0	0.000
PGH	27,169	113.0	0.004	1.7	<0.001
Total	37,500	149.2	0.004	1.7	<0.001

[1] Includes both affected an unaffected habitat within the project area

Additional effects to PPH and/or PGH sage-grouse habitat would occur due to noise generated by the Public Lands project, including an increase in road traffic, drilling noise, and quarry operations. The geographic extent of the effects to sage-grouse from noise related to the project under Alternative C was estimated to be 1,609 meters from all new and improved access roads[12] (Hagen 2011), 600 meters from well pads, and 400 meters from quarry operations. The geographic extent to which noise from drilling and quarry operations would exceed the ambient noise level was modeled using the general methodology developed in 2006 by the John A. Volpe National Transportation Systems Center for the Department of Transportation Federal Highway Administration. Overall, as shown in **Table 3-10**, the noise generated from the Public Lands project would affect approximately 727 acres of PPH and 2,552 acres of PGH habitat that is not already affected by noise from existing roads. This methodology is based on the strategy for calculating mitigation acreage for impacts to greater-sage grouse habitat developed by ODFW (2012). The timing of this project-related noise would be 24-hours/day, would occur from August 16 through November 30, and would not affect lekking and nesting seasons in the spring and summer because it would not occur at that time.

Table 3-10 Total Acreage of PPH and PGH in the Public Lands Project Area under Alternative C, and PPH and PGH Affected by Noise from the Project

	PPH Area (acres)				PGH (acres)			
	Total (includes affected and unaffected area)	Area affected by Existing Noise[1]	Total Area Affected by Project Noise and Existing Noise[2]	Area Seasonally Affected by Project Noise[3]	Total (includes affected and unaffected area)	Area affected by Existing Noise[1]	Total Area Affected by Project Noise and Existing Noise[2]	Area Seasonally Affected by Project Noise[3]
Total	10,331	7,395	8,122	727	27,169	21,066	23,618	2,552

Note:

1) Based on a 1-mile buffer on either side of Highway 20, and a 0.2 mile buffer on either side of all other existing roads in the project area. These effects occur during all seasons.
2) Based on a 1-mile buffer on either side of Highway 20 and all Project access roads, a 600 meter buffer from well pads, a 400 meter buffer from quarry operations, and a 0.2 mile buffer on either side of all other existing roads in the project area.
3) Difference between the area affected by existing noise and the area affected by Public Lands project plus existing noise.

Big Game

The Public Lands project would result in 43.9 acres of surface disturbance to mule deer and/or elk winter range habitat. Under Alternative C, all wells in the project area would be constructed in mule deer and/or elk winter range habitat, affecting a total of 33.1 acres. An additional 5.8 acres of mule deer and/or elk winter range habitat in the Public Lands project area would be affected due to installation and improvement of roads. Additionally, the Community Pit is located within winter range habitat and would result in a disturbance of 5.0 acres.

Big game winter ranges are important habitat during colder and snowier winter months when forage availability is reduced. Increased activity along roads is associated with the displacement of big game species (Rowland, *et. al* 2005; Forman and Alexander 1998), reducing the amount of forage and cover available in winter habitat. Under Alternative C, no project activities would

[12] This assumes that road use of existing roads increases as a result of the Public Lands project. Road use for all Public Lands project access roads is estimated to be “high” traffic (>8 vehicles/24 hours) (ODFW 2012).

occur from December 1 to April 31. Therefore, there would be no displacement of big game species in winter habitat as result of the Public Lands project.

Raptors and Noxious Weeds

Effects to raptors and noxious weeds from the Public Lands Project would be similar to those discussed for the Alternative B, except that there would be fewer effects to each of these resources as fewer wells and roads would be developed and utilized. Furthermore, project activities would occur on a reduced annual timeline, from August 16th to November 30th.

Private Lands Project Effects

Greater Sage-grouse

Under Alternative C, effects to greater sage-grouse from direct disturbance from the 2.9 miles of existing roads within PPH areas within the Private Lands project area would continue, as would the noise effects to approximately 406 acres of PPH and 134 acres of PGH sage-grouse habitat. No ground disturbing activities would occur on Private Lands under Alternative C; therefore, there would be no project effects to greater sage-grouse as result of the Private Lands project.

Big Game

Under Alternative C, 636 acres of mule deer and/or elk habitat would continue to be affected by disturbance from existing roads. The Private Lands project would not occur; therefore, there would be no potential effects to big game winter range.

Raptors and Noxious Weeds

Under Alternative C, the Private Lands project would not occur. Raptors and noxious weeds would continue to be affected by the 2.9 miles of existing roads in the Private Lands project area.

3.6 Visual Resources

Using the BLM's Visual Resources Management (VRM) methodology, this section describes the visual resources within the project area and the expected effects of the Projects on those resources. VRM is a system for minimizing the visual impacts of surface-disturbing activities and maintaining scenic values for the future. It involves inventorying scenic values, establishing management objectives for those values through the resource management planning process, and then evaluating proposed activities to determine conformance with visual resource management objectives. The Visual Contrast Rating system (BLM 2007b) was used to evaluate the contrast of the Public Lands project to the existing landscape in order to determine if the VRM objectives would be met with implementation of the Alternatives. BLM methodology does not apply to non-Federal lands; therefore, BLM VRM objectives do not apply to the Private Lands project area. However, the VRM methodology was also applied to the Private Lands project to provide a consistent method of assessing potential visual effects for each of the Projects.

Affected Environment

The Projects are located in south-central Oregon's high desert region. The area is characterized by vast expanses of open desert scrub on flat or rolling topography and surrounded by large but extinct volcanic features, such as buttes and mountains.

VRM Objectives

The Brothers/LaPine RMP and Three Rivers RMP have classified the majority of the Public Lands project area as high value, or Class II (BLM 2007b; see **Figures 3-6A** and **3-6B**). The portion of the Public Lands project area located along Hwy 20 is designated as Class III, while the southernmost portion of the Public Lands project area is within Class IV. As stated previously, the BLM methodology does not apply to non-Federal lands; therefore, the Private Lands project area has not been assigned a VRM Class. However, the BLM has surveyed some of the land adjacent to the Public Lands project area, including the Private Lands project area. If the Private Lands project area were under BLM jurisdiction, the three proposed wells would be located within an area that rates as Visual Resource Inventory (VRI) Class IV, while the proposed G.I. Ranch Pit and transportation system modifications would be located within areas with VRI Class II scenic value (**Figure 3-6A**).

Key Observation Point Selection

Key Observation Points (KOPs) are locations selected to be representative of critical locations from which a project would be seen. The selection of 20 initial observation points was chosen based upon the proximity of these points to public areas such as Highway 20 and Glass Buttes. Each of these points was visited in the field to determine if the Projects could be seen.

The intent in KOP selection is to identify those locations in proximity to a project which best represent overall views of that project as seen from public places. KOPs are generally selected for one or two reasons: 1) the location provides representative views of the landscape along a specific route segment or in a general region of interest; and/or 2) the viewpoint effectively captures the presence or absence of a potentially adverse impact in that location. Four points (see **Figure 3-7)** were selected from the 20 points initially evaluated to become the KOPs used for the contrast rating analysis. These four were chosen as the best representation for views from the surrounding area. More detailed descriptions of these four KOPs are as follows:

KOP 6: Stafford Access Road (AR-C). This KOP represents views of Glass Buttes' western slopes.

KOP 9: Highway 20. This KOP represents views of the closest well site (16-9) for Highway 20 travelers.

KOP 10: Highway 20 and Access Road OR-A. This KOP represents views from the main access to the Glass Buttes region.

KOP 11: Access Road R2B. This KOP represents views of closer wells sites on back country trails and access roads.

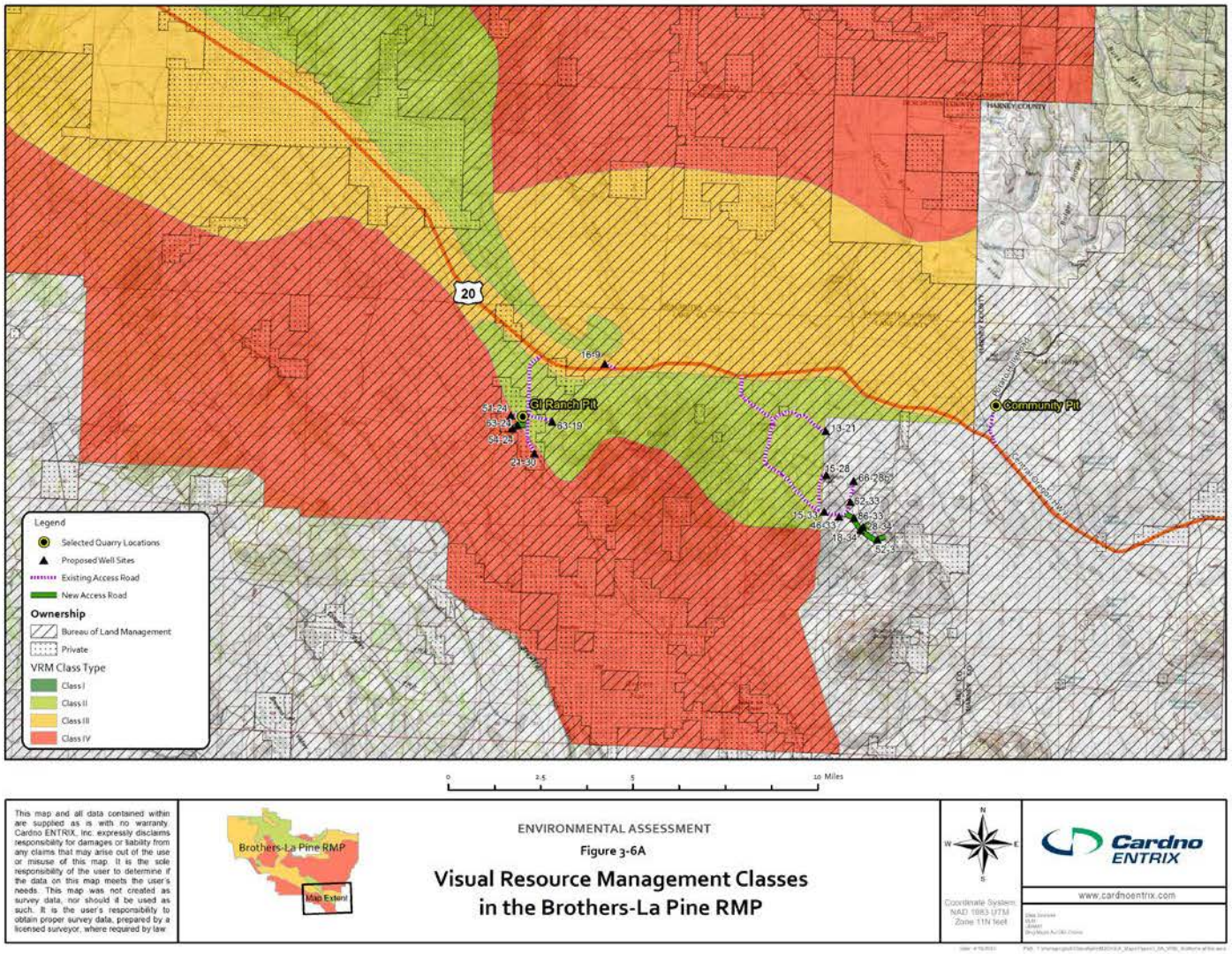

Figure 3-6A Visual Resources Management Classes in the Brothers/LaPine RMP

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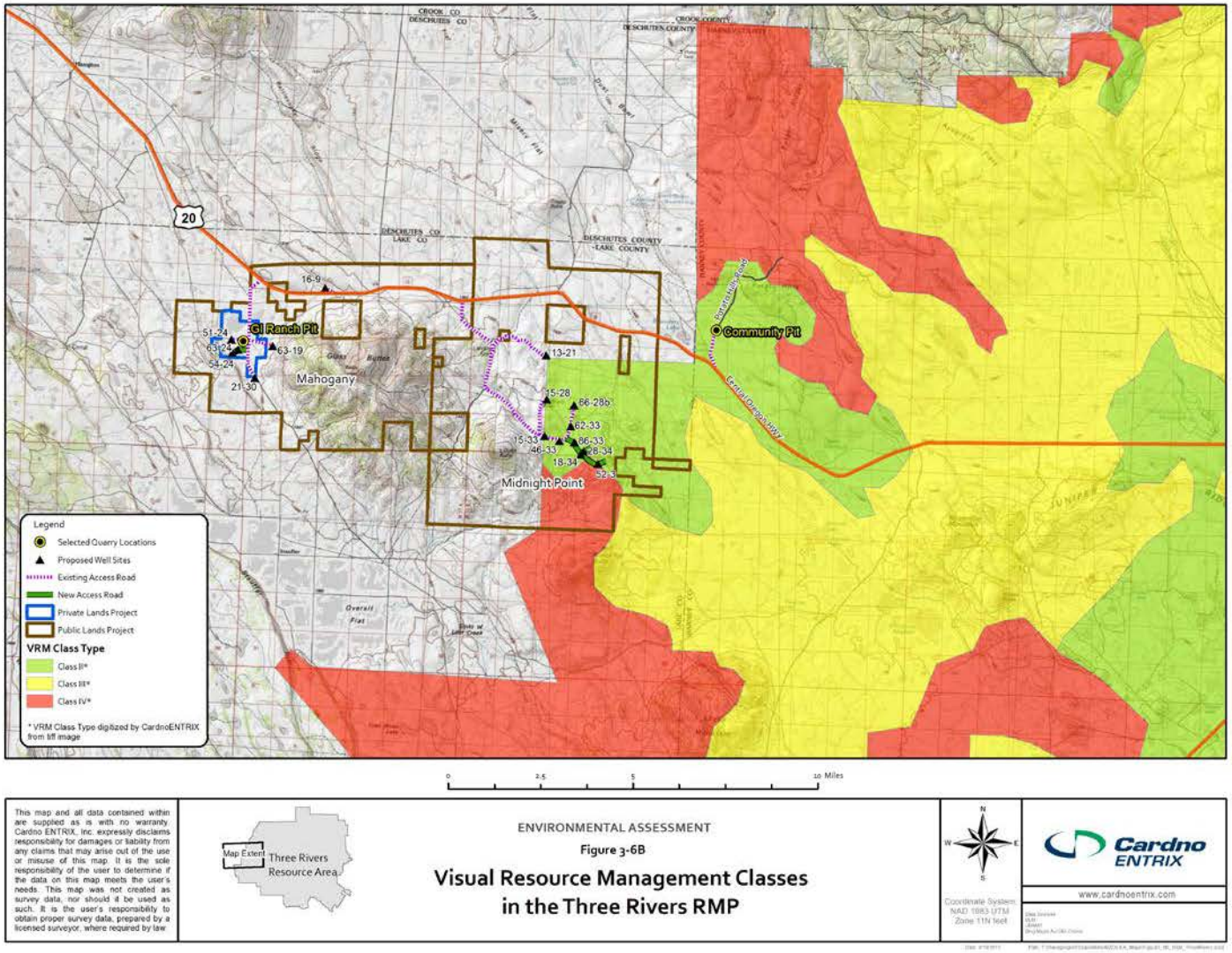

Figure 3-6B Visual Resources Management Classes in the Three Rivers RMP

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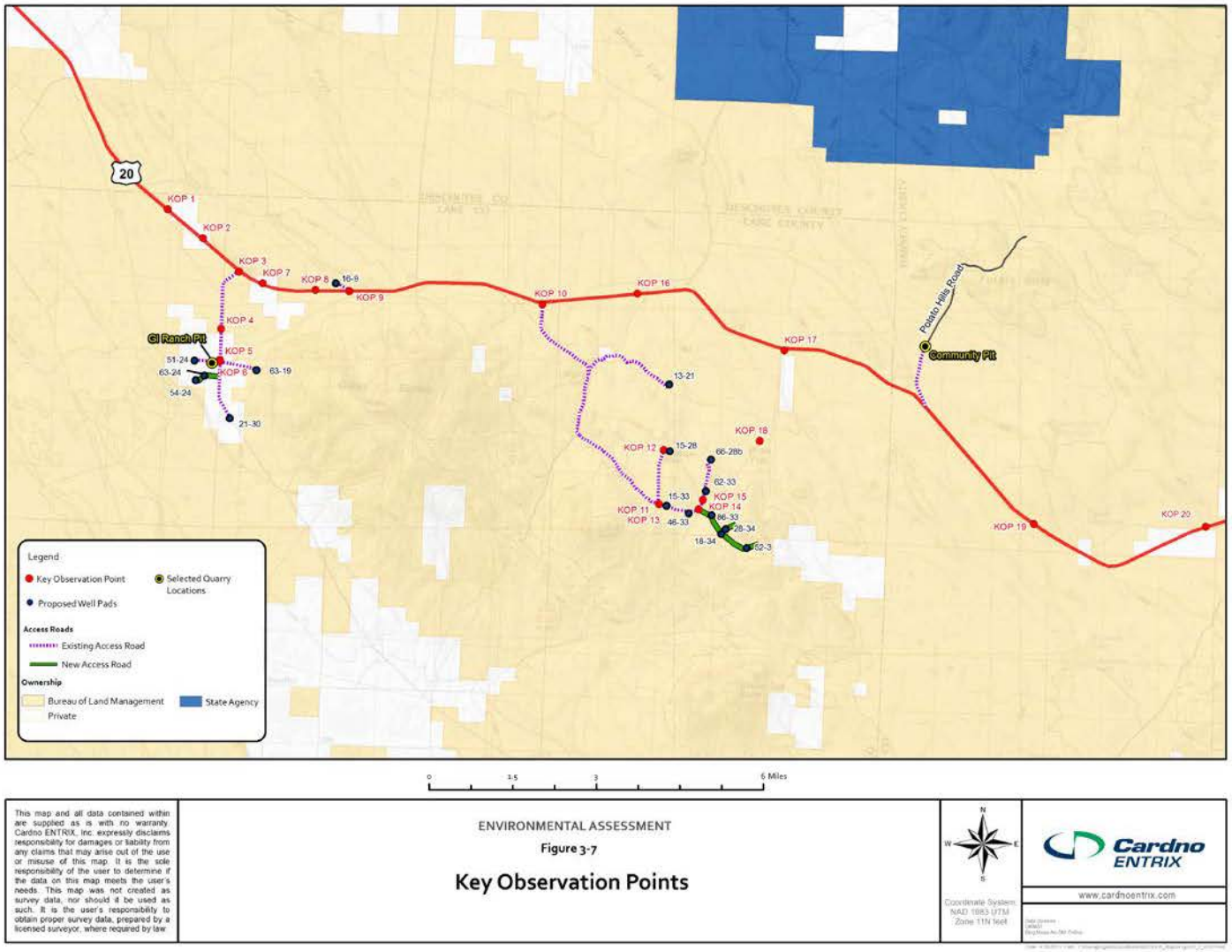

Figure 3-7 Key Observation Points

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Environmental Consequences

Alternative A

Under Alternative A, there would be no change to the existing environment. Therefore the VRM objectives would be met.

Alternative B

Public Lands Project Effects

KOP 6

Well pad 63-19 would be visible from KOP 6. Due to the viewer's distance (approximately 0.75 mile), the form, lines, color and texture of well 63-19 would be almost indistinguishable from the existing landscape. Although well 63-19 would be visible, it would not attract attention from onlookers. Therefore, the degree of contrast between well 63-19 and the existing environment from KOP 6 would be weak. Because management activities within a Class II area may be seen but should not attract the attention of the casual observer, the Public Lands project would be consistent with VRM objectives from KOP 6. In addition, because well 63-19 would be a temporary feature in the landscape (construction and drilling activities would be implemented over a period of one to three years), the impacted landscape would eventually be restored to the existing views.

KOP 9

Well 16-9 and roadway improvements to AR-B (widening of the roadway from 10 feet to a total width of 20 feet) would be visible to the observer from KOP 9.

Due to the distance (0.28 miles) of the well from KOP 9, its texture would not attract attention against the expansive landscape. However, the top of the drill rig derrick (which would be from 30 to 70 feet above the ground surface, depending on the rig used) would rise high above the existing landscape such that the structure's tall mass, vertical lines, and dark colors would be backdropped by the sky's uniform mass, lack of lines, and blue to white colors. The degree of contrast between well 16-9 and the existing environment from KOP 9 would be moderate. The moderate contrast to the existing environment would attract the attention of passing motorists on Highway 20 but would not dominate the view of the casual observer. Because the Class III objective for the area allows for contrasts that may attract attention but should not dominate the view of the casual observer, well 16-9 would be consistent with VRM objectives from KOP 9. In addition, because well 16-9 would be a temporary feature in the landscape, the existing landscape would eventually be restored to the existing views.

While the effects of the well rig would be temporary, the modifications to access road AR-B would be permanent. Roadway improvements to AR-B (widening of the roadway from 10 feet to a total width of 20 feet) would be visible to the observer. As stipulated in **Section 2.5.1** above, any roads visible from Highway 20 would be improved using earth-toned materials to minimize contrast with the warm tans and browns of the existing road and the surrounding vegetation's tans and greens. The degree of color contrast between the improvements to AR-B and the existing environment would be weak. The texture of the improved road would include medium and fine grains instead of the mixture of coarse and fine grains in the existing road, which would represent a moderate contrast.

Although AR-B would be visible, it would not attract attention of passing motorists on Highway 20. Therefore, the overall degree of contrast between improvements to AR-B and the existing environment from KOP 9 would be weak. Because the Class III objective for the area allows for contrasts that may attract attention but should not dominate the view of the casual observer, improvements to AR-B would be consistent with VRM objectives from KOP 9.

Both the temporary and permanent effects of the Public Lands project as seen from KOP 9 would be consistent with VRM objectives for a Class III area.

KOP 10

Well 13-21 would be visible from KOP 10. Due to the viewer's distance (approximately 2.9 miles), the form, lines, color and texture of well 13-21 would be almost indistinguishable from the existing landscape. However, a temporary steam plume rising 20-200 feet, depending on atmospheric conditions (i.e. ambient temperature) and temperature of geothermal fluid, may be visible when well testing is performed. Short-term well testing would produce a temporary steam plume over the course of 2 to 24 hour periods; long-term flow tests would produce a temporary plume from 5 to 30 days. Although well 13-21 would be visible, it would not attract attention from onlookers and the degree of contrast with the existing environment would be weak. Because management activities within a Class II area may be seen but should not attract the attention of the casual observer, the VRM objectives would be met.

KOP 11

Well 15-33 would be visible from KOP 11. In addition, roadway modifications to R2B (improvements – no new surface disturbance) would also be visible to the observer.

At a distance of less than 500 feet away, the drill mast of well 15-33 would dominate the observer's view. The structure's geometric mass would contrast with the landscape's organic forms. The structure's strong horizontal and vertical lines would contrast with the landscape's softer undulating lines and the sky's lack of lines. The structure's vibrant reds, greens, and bright whites would contrast with the landscape's more muted greens and browns and the sky's softer blues and whites. The structure's regular and pronounced texture would contrast with landscape's mottled texture. Furthermore, a 20-200 foot steam plume may also be visible during long-term well testing for up to 30 days.

While the structure is in place, it would dominate the view and be the major focus of viewer attention. Therefore, the degree of contrast between well 15-33 and the existing environment from KOP 11 would be strong. Because management activities within a Class II area may be seen but should not attract the attention of the casual observer, the well 15-33 would be inconsistent with VRM objectives from KOP 11. However, because this structure is temporary (construction and drilling activities would be implemented over a period of one to three years), the existing landscape would be restored to the existing views after the Projects.

While the effects of the drill rig would be temporary, the modifications to R2B would be permanent. However, as stipulated in **Section 2.5.1** above, earth-toned materials would be utilized for the portion of access road R2B visible from KOP 11. These earth-toned materials would minimize contrast with the warm tans and browns of the existing road and the surrounding vegetation's tans and greens. The degree of color contrast between the improvements to R2B and

the existing environment would be weak. The texture of the improved road would include medium and fine grains instead of the mixture of coarse and fine grains in the existing road, which would represent a moderate contrast.

Although R2B would be visible, it would not attract attention of recreationists utilizing back country trails and access roads. Therefore, the overall degree of contrast between improvements to R2B and the existing environment from KOP 11 would be weak. Because management activities within a Class II area may be seen but should not attract the attention of the casual observer, the permanent effects from the improvements to R2B would be consistent with VRM objectives from KOP 11.

Private Lands Project Effects

As stated previously, BLM methodology does not apply to non-Federal lands; therefore, BLM VRM objectives do not apply to the Private Lands project area. However, the VRM methodology was also applied to the Private Lands project to provide a consistent method of assessing potential visual effects for each of the Projects.

KOP 6 is the only selected KOP from which features of the Private Lands project would be visible to the west and southwest. Wells 63-24, 51-24, and 54-24 would each be visible, and would be located at a distance of approximately 0.40, 0.50, and 0.55 mile from the viewer, respectively. At those distances, the forms, lines, colors, and texture of these wells would be almost indistinguishable from the existing landscape. Although the wells would be visible, the wells would not attract attention from onlookers. Therefore, the degree of contrast between these wells and the existing environment from KOP 6 would be weak. The proposed Private Lands project would not modify the area's current visual quality (VRI Class IV). In addition, because these structures would be temporary features in the landscape, the existing landscape would eventually be restored to the existing views.

In addition to the proposed well pads, roadway modifications proposed as part of the Private Lands project would be visible from KOP 6. While the effects of the well rigs would be temporary, the modifications to these roads would be permanent, including improvements (no new surface disturbance) to access road AR-C, the improvement and widening of access road AR-D, and the construction of a new access road (AR-E). Upon improvement, AR-C and AR-D would become a darker shade of gray than the existing roads, and the widened AR-D would cut a wider line through the landscape. In addition, although the flat form of AR-E would be similar to the existing terrain, the road would create a long line bisecting a landform naturally uninterrupted by lines and the cool gray color of the road would contrast with the tans and greens of the surrounding vegetation. The proposed roadway modifications would attract the attention of motorists; therefore, the degree of contrast with the existing environment would be moderate. This level of contrast would result in a shift in the current VRI Class II scenic value to VRI Class III quality.

The G.I. Ranch Pit would also be visible at 700 feet to the west of KOP 6. The quarry would result in a wide clearing with a few piles of rock. These piles would be approximately 20 feet high, rising well above the sagebrush. The tall mass of the piles and dark colors of the rock would be backdropped by the sky's uniform mass and blue to white colors. The contrast to the existing environment would be enough to change the character of the existing landscape, thereby

attracting the attention of recreationists. The level of contrast would result in a shift in the current VRI Class II scenic value to VRI Class III or IV visual quality.

Alternative C

Public Lands Project Effects

KOP 6

The effects under Alternative C would be the same as Alternative B. Please see the direct effects analysis for KOP 6 in Alternative B above. The effects determination, therefore, remains that the effect of the Public Lands project as seen from KOP 6 would include a weak degree of contrast with the existing environment, which is consistent with VRM objectives for a Class II area. In addition, because well 63-19 would be a temporary feature in the landscape, the existing landscape would eventually be restored to the existing views.

KOP 9

The effects under Alternative C would be the same as Alternative B. Please see the direct effects analysis for KOP 9 in Alternative B above. The effects determination, therefore, remains that both the temporary and permanent effects of the Public Lands project as seen from KOP 9 would include a weak degree of contrast with the existing environment, which is consistent with VRM objectives for a Class III area.

KOP 10

While no additional stipulations specific to KOP 10 were included in Alternative C, the only visible project feature from KOP 10 (well pad 13-21) would not be developed under Alternative C to provide additional sage-grouse protection. Therefore, no effects to visual resources would occur from KOP 10.

KOP 11

The effects under Alternative C would be the same as Alternative B. Please see the direct effects analysis for KOP 11 in Alternative B above. The effects determination, therefore, remains that both the temporary and permanent effects of the Public Lands project as seen from KOP 11 would include a weak degree of contrast with the existing environment, which is consistent with VRM objectives for a Class II area.

Private Lands Project Effects

KOP 6 is the only selected KOP from which features of the Private Lands project would be visible. However, due to additional stipulations for sage-grouse protection under Alternative C (**Section 2.4**), the Private Lands project features would not be developed. Therefore, no effects to visual resources from the Private Lands project would occur from KOP 6.

3.7 Cultural Resources and Traditional Practices

Affected Environment

From July 6 to August 19, 2010, and July 25-28, 2012, Cardno ENTRIX conducted cultural resources investigations for the Projects within and adjacent to the proposed locations of the project features for the Public Lands and Private Lands Projects.

A total of 22 archaeological resources were identified in the Public Lands project area, including 18 newly recorded sites, one precontact isolated find, and three previously recorded sites. Seventeen of the newly recorded sites are precontact and one is historic. Two of the previously recorded sites are precontact and one is both precontact and historic. Additionally, one architectural resource was recorded.

A total of nine archaeological resources were identified in the Private Lands project area, including five newly identified sites and four isolated finds. Four of the newly recorded sites are precontact and one is historic. One of the isolated finds in precontact, two are historic, and one is both precontact and historic. One architectural resource was recorded, which was also recorded as a historical archaeological site.

Environmental Consequences

Alternative A

There would be no effects to cultural resources and traditional practices under Alternative A.

Alternative B

Public Lands Project Effects

As per the PDFs, all proposed activities would be designed to avoid disturbance to all cultural resources eligible or potentially eligible and those currently unevaluated for listing in the NRHP. Project designs would avoid sensitive areas to avoid impacts. Any new discoveries of cultural resources would temporarily stop activities related to the Projects and a cultural resources specialist would be contacted. The Projects would resume upon completion of assessment and coordination. These PDFs would prevent any potentially significant effects to cultural properties.

The Projects would not limit Indian tribal members' access to the project area and would not physically prevent tribes from practicing their traditional activities. Through multiple Consultation discussions (which included person-to-person meetings, phone calls, email exchanges, and field trips with the Klamath Tribes and the Confederated Tribes of the Warm Springs council members and staff to the project area) the BLM has been informed that the proposed Projects, even though they would occupy only a very small portion of the overall Glass Buttes area, would destroy sacred and holy areas; however, the tribes have not demonstrated how the Projects would do so. The tribes have not provided the BLM with a method to quantify or mitigate effects of the Projects to sacred and holy areas. The tribes have also not shown that the Projects would coerce tribal members to act contrary to their religious beliefs.

Private Lands Project Effects

The effects from the Private Lands project would be the same as for the Public Lands project, except that Indian tribal members cannot access private property to practice traditional activities without prior consent from the landowner.

Alternative C

Public Lands Project Effects

The effects under Alternative C would be the same as Alternative B.

Private Lands Project Effects

The effects under Alternative C would be the same as Alternative B.

3.8 Wilderness Characteristics

Affected Environment

An intensive inventory evaluating the presence or absence of wilderness character on the BLM-administered lands within the Public Lands project area was documented in November of 1980. The final intensive inventory decision found that wilderness character was not present on these lands.

In 2008, an interdisciplinary team analyzed both information provided by the public and BLM information on the current conditions, along with on-site verification (where necessary), to update its wilderness inventory for the Glass Buttes area (BLM 2008). A second inventory recorded 16,496 acres of BLM-administered lands that include and extend beyond the locations of the proposed project features of the Public Lands project. The 2008 inventory found that BLM-administered lands within the project area have some natural resources located on them which have a higher value than found elsewhere in the region. These resources attract visitors both locally and from outside the local area. However, these attractions have resulted in an increased level of human intrusions, including roads and communication sites on top of Glass Buttes.

The Glass Buttes Wilderness Inventory Unit contains natural resources, includes supplemental values (the geologic resources), and meets the size requirements to qualify as an area with wilderness character. However, the expectation of solitude in the Glass Buttes Wilderness Inventory Unit is decreasing with increased recreational use and is not of an outstanding value. Therefore, the 2008 inventory concluded that the Glass Buttes Wilderness Inventory Unit does not have wilderness character, and BLM has determined that its 1980 inventory finding that wilderness character is not present on BLM-administered lands in the Glass Buttes area remains valid.

Environmental Consequences

Alternative A

Since the project area does not possess wilderness characteristics, there would be no effects to wilderness characteristics under Alternative A.

Alternative B

Public Lands Project Effects

Since the Public Lands project area does not meet the requirements to be characterized as wilderness, the Public Lands project would not affect areas with wilderness characteristics.

Private Lands Project Effects

Secretarial Order 3310 only applies to BLM-administered lands. Therefore, the Private Lands project would not affect areas with wilderness characteristics.

Alternative C

Public Lands Project Effects

The effects under Alternative C would be the same as Alternative B.

Private Lands Project Effects

The effects under Alternative C would be the same as Alternative B.

3.9 Public Safety

Affected Environment

The project area is located in a remote and rural area of south central Oregon. There are no residential population centers with schools, hospitals, parks, and other meeting places within the project area. The closest residence is located approximately 20 miles away from the project area. Potential public safety effects are therefore restricted to occupational workers in the quarries, road-building crews, and drilling sites.

Environmental Consequences

Alternative A

There would be no effects to public safety under Alternative A.

Alternative B

Public Lands Project Effects

Old well logs for the project area show evidence of natural gas (BLM December 4, 2012). Precautions for a release and a potentially explosive environment are included in the Hazardous Gas Contingency Plan (see **Section 2.5.1**), which would include LEL monitoring. Therefore, risks to worker safety from the presence of natural gas in the project area would be minimized.

As described in **Section 2.3.3**, following completion of exploratory well testing any liquids in the reserve pits would be evaporated. Solids remaining in the pit, which typically consist of nonhazardous, non-toxic drilling mud and rock cuttings, would be sampled for pH, metals, and total petroleum hydrocarbons for confirmation of non-toxicity. The non-hazardous solids would then be mixed with the excavated rock and soil and buried by backfilling the reserve pit. If the material is determined to be hazardous per The Gold Book (BLM 2007a), then the material would be removed from the site with post-removal site testing to confirm that all hazardous material was removed. Therefore, the overall risk of the project exposing the public to any hazardous and/or toxic chemicals would be minimal.

Private Lands Project Effects

The effects for the Private Lands project would be the same as those for the Public Lands project.

Alternative C

Public Lands Project Effects

The effects under Alternative C would be the same as Alternative B.

Private Lands Project Effects

The effects under Alternative C would be the same as Alternative B.

3.10 Wetlands

Affected Environment

The project area is located in the northwestern basin and range section of the intermountain semi-desert province ecoregion. This area is characterized by scarce water, few streams, and little surface water (USFS 1994). Wetlands within the project area were identified with the use of mapping data available from the National Wetland Inventory (NWI; USFWS 2011) and USGS National Hydrography Database (NHD 2012). According to the NWI, there are 57.01 acres wetlands in the project area; NHD data shows 9.44 acres of wetlands in the project area. There are 6.1 acres of wetlands that both databases characterize as wetlands for a total of 60.36 acres of potential wetlands in the project area (see **Figure 3-8**).

These wetlands are located in areas that would not experience disturbance due to project activities. Site surveys verified the absence of any wetlands or ephemeral features within or near any proposed disturbance areas for project features (i.e. well pads, access roads). No wetlands exist in the Private Lands project area.

Environmental Consequences

Alternative A

There would be no change to wetlands under Alternative A.

Alternative B

Public Lands Project Effects

No wetlands are present or proximal to any areas proposed for disturbance under Alternative B. Therefore, no effects to wetlands would result from the Public Lands project.

Private Lands Project Effects

No wetlands are located in the Private Lands project area; therefore, no effects to wetlands from the Private Lands project would occur under Alternative B.

Alternative C

Public Lands Project Effects

The effects under Alternative C would be the same as Alternative B.

Private Lands Project Effects

No wetlands are located in the Private Lands project area; therefore, no effects to wetlands from the Private Lands project would occur under Alternative C.

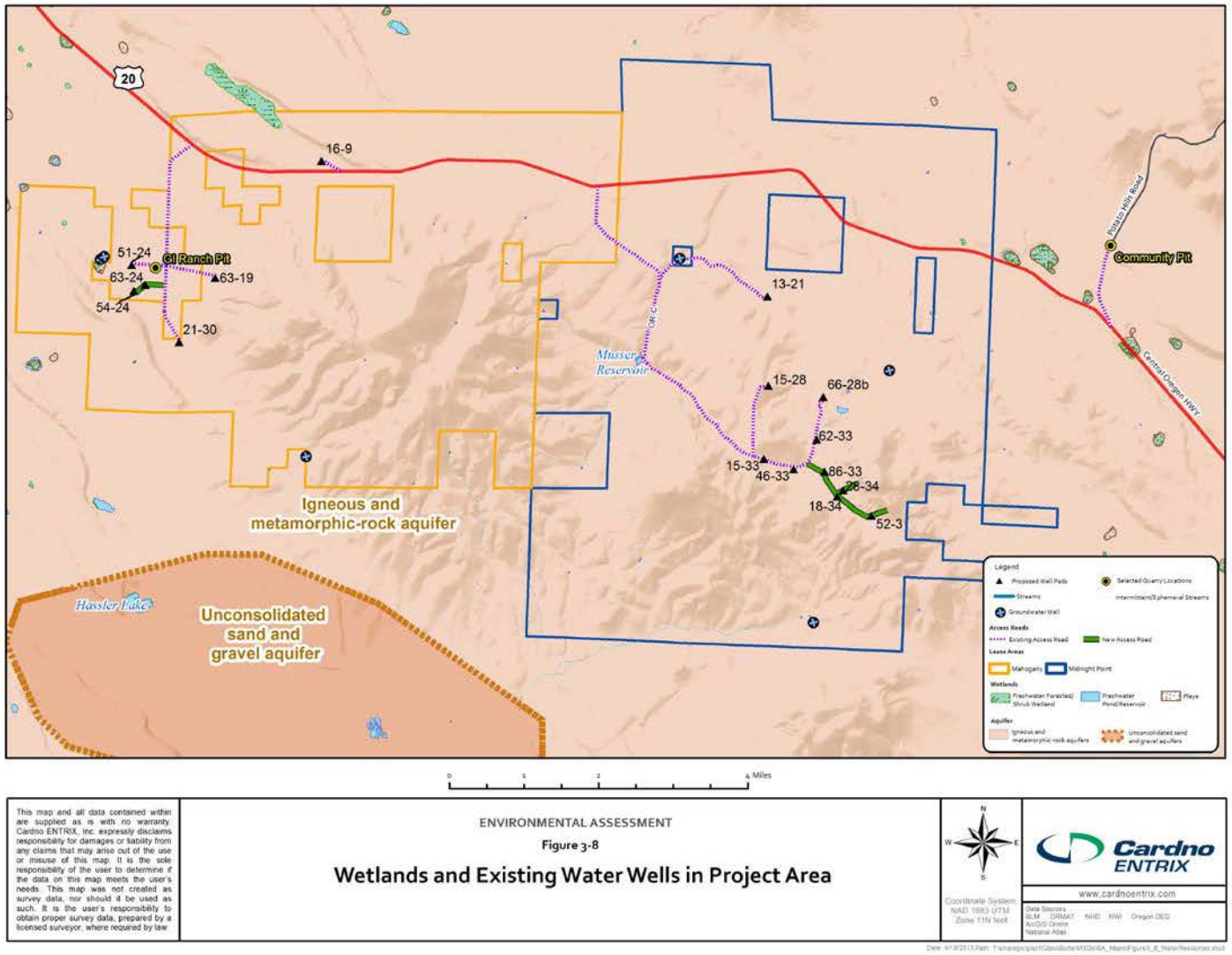

Figure 3-8 Wetlands and Existing Water Wells in Project Area

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3.11 Groundwater and Water Rights

Affected Environment

The Public Lands project area is underlain by Pacific Northwest basaltic-rock aquifers, including both volcanic and sedimentary rock aquifers and Miocene basaltic-rock aquifers. The volcanic and sedimentary rock aquifers of the Pacific Northwest basaltic-rock aquifers are not as productive as the Miocene basaltic-rock aquifers. The volcanic rocks that compose these aquifers generally consist of silicic volcanic rocks. Unconsolidated deposits are generally ash and cinder cones. The sedimentary rocks included in these aquifers are sand and aggregate eroded from volcanic rocks. Miocene basaltic rock aquifers consist primarily of basaltic lava flows, and are the thickest in the northeastern part of Oregon and southeastern Washington, outside of the project area. These aquifers consist mainly of flood-type basaltic lava flows that were extruded from major fissures. Permeability both of these aquifer types is extremely variable (USGS1994). No groundwater features are located in the Private Lands project area.

Groundwater recharge occurs with summer storms or winter snows and discharge occurs with evapotranspiration or water withdrawals. Well depths in this area range from 95 to 300 feet and the depth to groundwater ranges from 15 to 60 feet below the surface in northern Lake County (ODEQ 2012).

The State of Oregon has designated Groundwater Management Areas to address issues of groundwater quality for elevated concentrations of pollutants. Oregon also designates Critical Groundwater Areas to address long-term groundwater declines where pumping exceeds recharge. The project area is not in an Oregon Groundwater Management Area (ODEQ 2009) or in a Critical Groundwater Area (ODEQ 2007).

The project area does not contain any water resources that are considered part of a municipal watershed (Brothers Lapine RMP, 2004). There are no existing groundwater wells within a half-mile radius of a proposed well pad, but there are three existing groundwater wells within a mile radius of a proposed well pad (**Figure 3-8**). These existing wells are mainly used to provide water for cattle and agricultural irrigation, and are not used for potable consumption.

Environmental Consequences

Alternative A

There would be no installation of water wells under Alternative A, and thus no effect to groundwater resources.

Alternative B

Public Lands Project Effects

The proposed Projects would not use any hazardous or toxic substances during exploration and therefore would not contaminate any groundwater resources. Furthermore, the proposed PDFs (**Section 2.5.1**) would isolate the geothermal aquifer, if tapped, from shallow alluvial aquifers, thereby minimizing potential effects to groundwater resources, surface springs, and/or streams.

Under Alternative B, the Projects would pump a maximum of 60,000 gpd or 19.4 acre feet per year for three years. Total maximum project withdrawal from the local shallow aquifer would be 58.2 acre feet. The Applicant proposes to install three total water wells, but only operate one of them at any given time of the Projects. An unconfined Darcy equation was used in calculating potential groundwater drawdown.[13] Accounting for this pumping rate and total withdrawal, drawdown of the local aquifer is not expected to occur. Furthermore, considering that no water wells would be installed within 5,000 feet of an existing well (see **Section 2.5.1**), there is a low likelihood that existing wells that also utilize the aquifer would be affected.

The Applicant would obtain the necessary groundwater appropriation rights from the State, with the BLM serving as co-applicant for the water rights. At the conclusion of the Projects, BLM may elect to maintain the water wells for purposes of livestock grazing irrigation, troughs, and wildlife. Potential future effects from the operation of these water wells for BLM rangeland management purposes are assessed in the Cumulative Effects section of this EA (see **Section 3.12**). If during exploration activities that water quality from these wells is not suitable for livestock or wildlife consumption, these wells would be reclaimed in accordance with the PDFs presented in **Section 2.5.1**.

Private Lands Project Effects

Due to the implementation of the same PDFs and absence of any hazardous/toxic substances, potential effects to groundwater quality would be the same for the Private lands Project as it would be under the Public Lands projects.

The Applicant may locate a groundwater well on one of the three proposed well pads on private lands. This well would service the three wells on private land and the three wells in the Mahogany lease area. Considering that only one water well would draw from the same aquifer during any given phase of the Projects, including the Private Lands project, effects to groundwater on private or public land would be analogous (i.e. annual withdrawal of 19.4 acre feet per year for three years).

The Applicant would obtain the necessary groundwater appropriation rights from the State. At the conclusion of the Projects, BLM would not retain rights to any water wells on private lands. Wells on private lands would be reclaimed in accordance with the PDFs presented in **Section 2.5.1**.

Alternative C

Public Lands Project Effects

Potential effects to groundwater quality under Alternative C would be the same as Alternative B. Potential effects to groundwater availability would be slightly less under Alternative C than Alternative B, due to the reduction of months available for project activities as result of the PDFs for biological resources. Under Alternative C, a maximum of 60,000 gpd or 19.4 acre feet per year would be pumped. Total maximum project withdrawal from the local shallow aquifer would

[13] Darcy's equation, or formula, calculates hydraulic conductivity. For this project, the following formula was applied: $Q=\pi K\{(H^2-h_w^2)/\ln(r/r_w)\}$. Q= discharge (gpm); H^2 = saturated thickness of aquifer (ft); h_w^2 = depth of water in pumping well (ft); ln = natural log; r = radius of influence (ft); rw = radius of well (ft).

be 58.2 acre feet. The pumping rate and total withdrawal proposed under Alternative C are not expected to drawdown the local aquifer. Furthermore, there is a low likelihood that existing wells that also utilize the aquifer would be affected due to the PDF that no project water wells would be installed within 5,000 feet of an existing well (see **Section 2.5.1**).

The Applicant would obtain the necessary groundwater appropriation rights from the State, with the BLM serving as co-applicant for the water rights. At the conclusion of the Projects, BLM may elect to maintain the water wells for purposes of livestock grazing irrigation, troughs, and wildlife. Potential future effects from the operation of these water wells for BLM rangeland management purposes are assessed in the Cumulative Effects section of this EA (see **Section 3.12**). If during exploration activities the water quality from these wells is not suitable for livestock or wildlife consumption, these wells would be reclaimed in accordance with the PDFs presented in **Section 2.5.1**.

Private Lands Project Effects

Under Alternative C, no geothermal or water wells would be installed on the Private Lands project area; therefore, no drawdown or contamination of groundwater resources would be caused by the Private Lands project.

3.12 Cumulative Effects

Cumulative impacts represent the incremental effects of an Alternative when added to other past, present, or reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over a given time period. The specific geographic scale of the cumulative impact analyses depend on the resource under consideration. For the purpose of this analysis, the cumulative effects region of influence for each resource area is the same as the area defined for the direct and indirect effects described above.

Impacts of the Alternatives are assessed for cumulative effects with other actions conducted in the region. Prior sections in **Section 3.0** characterize the existing environment, which includes the current condition of the biological, physical, and social resources, including the impacts from past actions. The consequences of the Projects in the context of these past actions are also described in prior sections. This section considers current or reasonably foreseeable activities in the project area. The actions considered include current projects that have ongoing activities or effects, projects that would be developed concurrently with the Alternatives, and projects that are reasonably foreseeable after construction of the Projects but within the proposed restoration or operation timeframe. The temporal scale of the analysis includes the time period in which the proposed Projects would begin construction and last until final reclamation would be completed, which for the purposes of this analysis is assumed to occur immediately and last until the end of the leasing period in 2019.

3.12.1 Past, Present, and Reasonably Foreseeable Future Activities in the Project Area

Land Management and Use Activities

Lands within the project area are administered in accordance with the Brothers/LaPine and Three Rivers RMPs that were developed by the BLM to guide land use activities within the project area. As a result, the proposed project area undergoes a variety of land use and management

activities, including rock-hounding, livestock grazing, weed and vegetation control, and mineral resource extraction (BLM 2011d).

Geothermal Energy Generation

There are no other geothermal exploration drilling projects planned or proposed within the Alternatives' region of influence at this time; therefore, the impacts associated with other geothermal exploration drilling projects are not a reasonably foreseeable action. If the proposed Projects were to result in findings indicating that the project area would be suitable for geothermal activities, it is possible that further geothermal exploration and/or development activities could be proposed. However, as the results of the exploration activities proposed under the Alternatives are not known at this time, any future geothermal development activities are speculative and, thus, not reasonably foreseeable. Any subsequent exploratory or development activities that might arise would require separate environmental analyses, which would include a cumulative impact analysis that would consider the effects of the Projects. Any such activities would also require a separate decision, which would be independently subject to appeal.

Communication Facilities

Two new communication towers have been proposed within the Projects' region of influence (**Figure 3-9A**; BLM 2011a). BPA has proposed a new communication tower that would encumber approximately 0.4 acre for a period of 20 years. AT&T Communications has also proposed a communication site that would encumber less than 0.1 acre of land. These facilities may include a building, tower, propane tanks, an access road, and possibly fencing.

Wagontire Mountain Wind Energy & Transmission Project

OPS Desert Wind has applied for rights-of-way to 12,947 acres of BLM lands to construct a 56 turbine, 102.5 MW wind farm on and around Wagontire Mountain (**Figure 3-9A**). An additional 4,763 acres of BLM lands were designated for a right-of-way for an 115kV transmission line. The proposed 115kV line would traverse the eastern portion of the Midnight Point project area and interconnect with an existing transmission line that would transmit the power to the Ponderosa substation just south of Prineville. A temporary right-of-way that would be required for construction of the transmission line would be 300 feet wide, while the permanent right-of-way that would be required for operation and maintenance of the transmission line would be 175 feet wide. The applicant (OPS Desert Wind) proposes to use an existing road that parallels the transmission line within the right-of-way to provide site access.

Vegetation clearing and grading would occur within the transmission line corridor as part of site preparation. The temporary and permanent rights-of-way for the transmission line would occupy 174 acres and 101 acres, respectively, within the Midnight Point project area. Construction of the transmission line would take place over a six to nine month period beginning in the fall of 2015.

BLM Retains Water Right to Project Water Wells for Livestock Grazing

BLM would be a co-applicant on the water rights application to the Oregon Water Resources Department for up to three water wells installed during the Projects. In the event that either Alternative B or C is selected for authorization, BLM may retain the water rights to these wells after all project activities have concluded. In the event that the quality of water from any of these wells is not suitable for livestock or wildlife consumption, those wells would be reclaimed and abandoned in accordance with the PDFs in **Section 2.5.1**. If the water quality from a well meets

consumption standards, then BLM plans to use the water to service the livestock grazing allotment. BLM proposes to use up to 15,000 gpd or 4.5 acre feet per year for these purposes.

Geothermal Test Drilling Habitat Mitigation Plan

The Draft Geothermal Test Drilling Habitat Mitigation Plan (Mitigation Plan; **Appendix C**; BLM 2012) describes the mitigation plan for sage-grouse habitat that would be affected by drilling activities proposed for the Public Lands and Private Lands projects. The Mitigation Plan identifies the areas to be mitigated and describes mitigation actions and priority locations for mitigation. One of the primary threats to sage-grouse habitat in the Glass Buttes area is juniper encroachment into open sagebrush habitat (Hagen 2011). Juniper control treatments have been effectively used to reduce juniper cover to maintain and restore sage-grouse habitat in this area. Since juniper encroachment into suitable sage-grouse habitat is one of the primary threats in the Glass Buttes area and treatments are highly effective, the required mitigation action would be to continue juniper control in the Glass Buttes area to expand ongoing control efforts. Funding for ongoing juniper control efforts in the Glass Buttes area is unreliable, so completion of future juniper projects is uncertain. Completion of juniper removal would reduce taller structural components that limit sage-grouse use and reduce vegetation competition for limited resources that reduce the quality of the sagebrush habitat. Restoration of habitat occurs within a fairly short period of time (less than 5years).

For Habitat Category 2 impacts, ODFW recommends mitigation to achieve “no net loss” and a “net benefit” in habitat quantity or quality. Sagebrush steppe communities mapped as PGH habitat in the Alternative B project area have been determined by ODFW to be Category 2. A mitigation ratio of 2:1 (two acres of mitigation treatment for every acre of disturbance) for direct disturbance in Category 2 Habitat would be in effect for this Mitigation Plan to achieve the “no net loss” with “net benefit” goal. The proposed direct ground disturbance in Category 2 Habitat would result in long-term impacts on up to 45 acres under either Alternative B or Alternative C.

ODFW considers Category 1 Habitat to be irreplaceable, and states that “due to the uncertainty and risk involved in trying to mitigate for the loss (i.e. reclaim/restore) of these habitats and biological dynamics, protection of these areas is paramount…” (Hagen 2011). ODFW advocates avoidance of Category 1 Habitat, and makes no recommendation for mitigation of “energy development, and its associated infrastructure or other large scale industrial-commercial developments” in Category 1 Habitat. All PPH proposed to be disturbed has been determined by ODFW to be Category 1.

The proposed test drilling is a temporary, seasonally restricted activity and there is no proposal for energy development or other large scale industrial-commercial developments. Activity associated with test drilling would cease once testing of the geothermal resource is completed. The proposed direct ground disturbance in Category 1 Habitat would result in long-term impacts on up to 28 acres under Alternative B and 0 acres under Alternative C. Although this represents a small percentage of Category 1 Habitat in the state of Oregon, this is critical habitat for sage-grouse that ODFW has stated is unmitigatable. Although ODFW has stated that Category 1 Habitat is unmitigatable, for this specific project, BLM biologists have determined a mitigation ratio of 10:1 is appropriate, given that the proposal for offsite mitigation is juniper treatments as well as other considerations such as the habitat characteristics in the areas proposed to be disturbed, the habitat characteristics of the areas proposed for offsite mitigation (**Figure 3-9B**)

and the specific types of disturbances associated with this specific project. Total mitigation prescribed for the Projects is shown in **Table 3-11** below.

Table 3-11 Total Mitigation Prescribed by the Mitigation Plan

	Alternative B		Alternative C	
ODFW Habitat Category	Effects (acres)	Mitigation (acres)	Effects (acres)	Mitigation (acres)
1	28	275	0	0
2	45	89	45	89
	Total Mitigation	364		89

Source: Bureau of Land Management (BLM). 2012. [Glass Buttes] Draft Geothermal Test Drilling Habitat Mitigation Plan.

The ODFW Mitigation Policy (OAR 635-415-0025) recommends that mitigation for Habitat Category 2 impacts be "in proximity" to a project, and the mitigation area should be located where habitat protection and enhancement are feasible consistent with this plan. Mitigation actions would occur on BLM lands.

Priority mitigation areas are identified in **Figure 3-9B**. These areas are in sagebrush steppe communities with some juniper encroachment, but are of similar habitat potential as sites proposed for test drilling. Based on past telemetry data, mitigation actions in the priority mitigation areas would benefit sage-grouse using the Parmele Ridge lek, Ryegrass lek complex, and the Glass Butte lek complex.

The Applicant would be required to provide a one-time payment for the entire amount of any ground disturbance that the Applicant may be authorized to perform, prior to any ground disturbance taking place. As soon as BLM received funding from the Applicant for offsite mitigation, BLM would begin the process to implement juniper thinning for any ground disturbance that the Applicant may be authorized to do. On average, the process of implementing juniper thinning projects takes approximately three months.

Further details of the required mitigation actions, including implementation details, can be found in **Appendix C**.

3.12.2 Cumulative Effects

As stated above, a cumulative effect represents an additive effect that results from an Alternative's impact in combination with an effect from a past, present, and/or reasonably foreseeable future action. The Alternatives analyzed in this EA would result in direct effects to resources (i.e. greater sage-grouse and big game winter range habitat) that could be impacted by present and/or future actions. The potential for cumulative effects to occur as a result of the Alternatives is shown in **Table 3-12** and described below for each potentially affected resource.

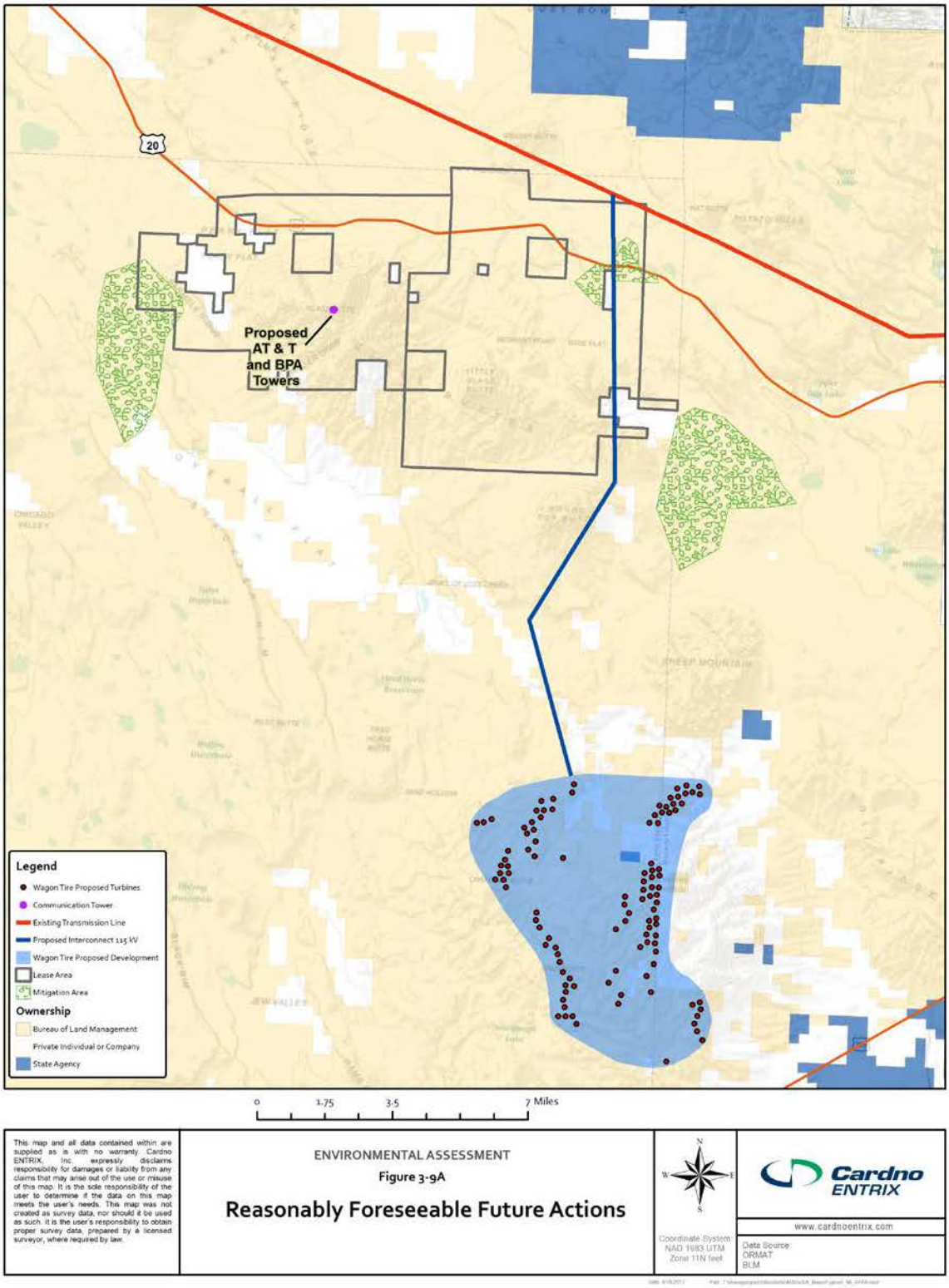

Figure 3-9A Reasonably Foreseeable Future Actions

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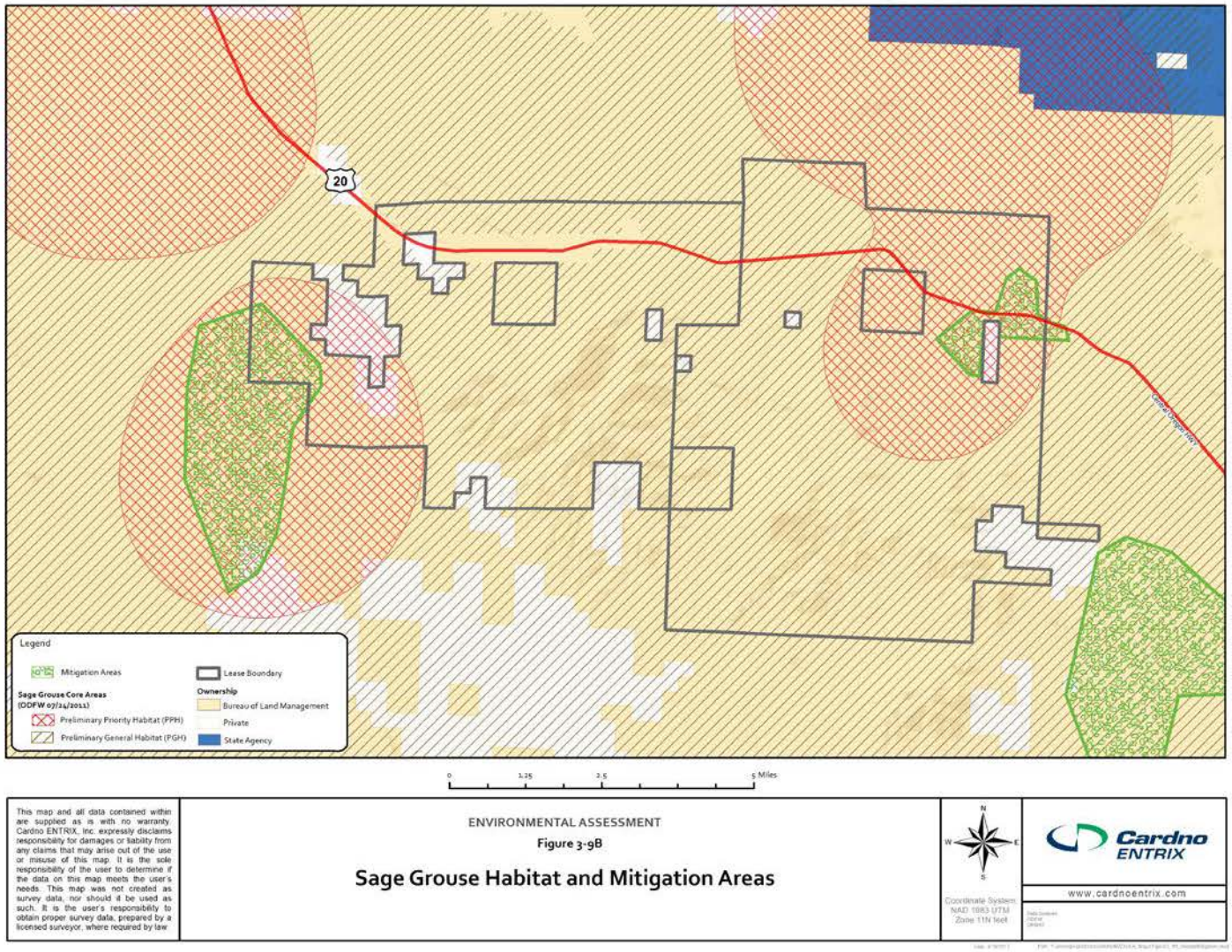

Figure 3-9B Sage Grouse Habitat and Mitigation Areas

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Table 3-12 Cumulative Effects from the Action Alternatives and Past, Present, and Reasonably Foreseeable Future Activities

Resource	Indicator		Effect of Past, Present, and Reasonably Foreseeable Future Activities	Alternative B Cumulative Effect	Alternative C Cumulative Effect
Recreation	Available annual visitor days for rock hounding in the project area not inconvenienced by project activities		9,999 for one year and 24,999 for 19 years	9,374 annually for one to two years and 4,374 between October 1, 2015 and September 30, 2016	13,124 annually for one to two years and 4,374 between October 1, 2015 and September 30, 2016
	Number of primitive campsites affected		0	10	10
	Miles of available motorized road and trails in the Public Lands project area		149	149	149
Rangeland Management	Level of potential for a grazing permittee's cattle and/or horses to get into an unintended pasture due to project vehicles traveling from one pasture to another		Low but Increased	Low but Increased	Low but Increased
	Level of potential that cattle/horse will access Highway 20 from access roads		Low but Increased	Low but Increased	Low but Increased
Biology	Acres of mule deer and elk range affected through project-related surface disturbance		189	261	163
	Acres of mule deer and elk winter range affected by disturbance from vehicle activity and project activities in addition to existing conditions		19	209	0
	Acres of surface disturbance within PPH and PGH sage-grouse habitat	PPH Habitat	62	18	113
		PGH Habitat	113	-122	17
	Acres of PPH and PGH sage-grouse habitat seasonally affected by disturbance from vehicle activity and project activities in addition to existing conditions	PPH Habitat	2,374	5,070	4,712
		PGH Habitat	490	3,083	1,209
Visual Resources	Projects' short-term and long-term degree of contrast with surroundings from each Key Observation Point (KOP)	KOP 6	Weak (short-term effect) Weak (long-term effect)	Weak (short-term effect) Moderate (long-term effect)	Weak (short-term effect) None (long-term effect)
		KOP 9	None	Moderate (short-term effect) Weak (long-term effect)	Moderate (short-term effect) Weak (long-term effect)
		KOP 10	None	Weak (short-term effect) None (long-term effect)	Weak (short-term effect) None (long-term effect)
		KOP 11	Weak (short-term effect)	Strong (short-term effect)	Strong (short-term effect)

Resource	Indicator		Effect of Past, Present, and Reasonably Foreseeable Future Activities	Alternative B Cumulative Effect	Alternative C Cumulative Effect
			Weak (long-term effect)	Moderate (long-term effect)	Weak (long-term effect)
	Whether or not the degree of contrast is consistent with BLM Visual Resource Management (VRM) objectives	KOP 6	Yes	Yes	Yes
		KOP 9	Yes	Yes	Yes
		KOP 10	Yes	Yes	Yes
		KOP 11	Yes	Yes	Yes
Groundwater Resources	The potential for significant drawdown of the local aquifer by the amount of water withdrawn (gallons per day, acre-feet per year, total withdrawal) for project activities		Less than significant	Less than significant	Less than significant
	The potential, based on proximity (i.e. linear feet), for water wells installed to support project activities to affect existing wells that utilize the same aquifer		Less than significant	Less than significant	Less than significant

Recreation

The analysis area for cumulative effects to recreation is primitive campsites within 0.5 mile of the Projects and the reasonably foreseeable future actions that could be affected by noise, dust, and traffic. In addition, the analysis area includes roads and trails available for motorized vehicle use within the project area that would be affected if road closures were to occur under the Projects or under the reasonably foreseeable future actions. Finally, the annual visitor days for rock-hounding in the project area that would not be inconvenienced by the Projects and the reasonably foreseeable future actions are considered.

Alternative A

The communication towers would be sited in a BLM-designated recreation minerals area, where access to 0.5 acres would be restricted for 20 years. Of the 25,912 acres within the project area designated by the Brothers La Pine RMP for minerals recreation, 0.5 acres would represent an un-measurably small loss (0.002 percent) to this recreational opportunity. To provide a conservative estimate, this restriction would inconvenience one user day per year for rockhounding.

Noise, dust, and traffic generated by construction of the transmission line would inconvenience visitors in the Public Lands project area during the six to nine month construction period (beginning in the fall of 2015). As described above, BLM estimates that there are approximately 25,000 visitor days per year for rock-hounding in the Public Lands project area. Assuming construction began October 1, 2015 and was completed by June 30, 2016, up to 15,000 visitor days would be inconvenienced by the noise, dust, and traffic generated by construction of the transmission line. The remaining 10,000 user days would not be inconvenienced by construction of the transmission line. If construction of the communication towers were to occur at a different time than construction of the transmission line, one additional user day could be inconvenienced, while the remaining 9,999 user days would not be inconvenienced by construction of the communication towers and transmission line.

No primitive campsites would be located within one half-mile of the communication towers or the transmission line temporary and permanent rights-of-way; therefore, no campsites would be affected by these facilities.

Installation and operation of the communication towers would not result in road closures. It is unknown whether or not the construction and operation of the transmission line would result in road closures. It is assumed that the existing 149 miles of road in the Public Lands project area, of which 52.43 miles are currently being used for motorized recreational opportunities, would remain open.

Under Alternative A, the geothermal exploration activities proposed for the Projects would not occur. The Mitigation Plan would therefore not be implemented and juniper thinning would not occur as mitigation for the Projects. There would be no effect to recreation from the Mitigation Plan under Alternative A.

Alternative B

Under Alternative B, 15,625 of the 25,000 user days would be inconvenienced by the Public Lands project between August 16 and February 28 of each year over the period of one to three

years that construction and drilling activities for the Projects would be implemented. Construction of the communication facilities would cause a negligible loss of 0.5 acres within the 34,583 acres designated for minerals recreation within the project area. However, to provide a conservative effects estimate, it is anticipated that the presence of the communication facilities would inconvenience one user day per year for rockhounding. Therefore, a cumulative effect of 15,626 user days would be inconvenienced up to three years. The remaining 9,374 user days would not be inconvenienced by the Projects and the communication towers.

During the six to nine month construction period for the transmission line (beginning in the fall of 2015), the cumulative effects to user days would increase. Between October 1, 2015 and September 30, 2016, an additional 5,000 user days would be inconvenienced by the construction of the transmission line. Therefore, a cumulative effect of 20,626 user days between October 1, 2015 and September 30, 2016 are expected to be inconvenienced, but overall use of the minerals recreation area is not expected to decrease. The remaining 4,374 user days would not be inconvenienced by the Projects, transmission line, and communication towers between October 1, 2015 and September 30, 2016.

In addition, the juniper thinning activities prescribed under the Mitigation Plan could cause recreational users to be inconvenienced. The effects analysis for Alternative B already assumes that all recreational users would avoid the Public Lands project area during the construction and drilling activities proposed for the Projects. Therefore, if juniper thinning were to occur at the same time as the construction and drilling activities proposed for the Projects, no additional user days would be affected. If the juniper thinning activities were to occur before or at a different time of the year than the construction and drilling activities proposed for the Projects, additional user days may be affected if users avoid the project area during mitigation activities. It is currently unknown when or how long juniper thinning would occur but a the maximum potential effect would entail the loss of the remaining potential 4,374 user days of the total 25,000 user days currently available.

Considering that no primitive campsites are located in the vicinity of the communication towers, transmission line, or the juniper thinning activities proposed under the Mitigation Plan, there would be no cumulative effects to campsites in the Public Lands project area.

The construction and drilling activities proposed for the Projects, installation and operation of the communication towers, and the juniper thinning activities prescribed under the Mitigation Plan would not result in any road closures. Therefore, the existing 149 miles of road in the Public Lands project area, of which 52.43 miles are currently being used for motorized recreational opportunities, would remain open. It is unknown whether or not the construction and operation of the transmission line would result in road closures and is therefore assume that no road closures would occur.

Alternative C

Under Alternative C, 11,875 of the 25,000 user days would be affected by the Public Lands project from August 16 through November 30 each year over the period of one to three years that construction and drilling activities for the Projects would be implemented. Construction of the communication facilities would cause a negligible loss of 0.5 acres within the 34,583 acres designated for minerals recreation within the project area. As stated above in Alternative A, the

loss of 0.002 percent) of the 34,583 acres designated for minerals recreation within the project area is considered negligible. However, to provide a conservative effects estimate, it is anticipated that the presence of the communication facilities would result in the inconvenience of one user day per year for rockhounding. Therefore, a cumulative effect of 11,876 user days per year would be inconvenienced up to three years. The remaining 13,124 user days would not be inconvenienced by construction of the Projects and the communication towers.

During the six to nine month construction period for the transmission line (beginning in the fall of 2015), the cumulative effects to user days would increase. Between October 1, 2015 and September 30, 2016, an additional 8,750 user days would be inconvenienced by the construction of the transmission line. Therefore, a cumulative effect of 20,626 user days between October 1, 2015 and September 30, 2016 are expected to be inconvenienced, but overall use of the minerals recreation area is not expected to decrease. The remaining 4,374 user days would not be inconvenienced by the Projects, transmission line, and communication towers between October 1, 2015 and September 30, 2016.

As described above, the juniper thinning activities prescribed under the Mitigation Plan could cause recreational users to avoid the area being treated. The effects analysis for Alternative C already assumes that all recreational users would avoid the Public Lands project area during the construction and drilling activities proposed for the Projects. Therefore, if juniper thinning were to occur at the same time as the construction and drilling activities proposed for the Projects, no additional user days would be affected. If the juniper thinning activities were to occur before or at a different time of the year than the construction and drilling activities proposed for the Projects, additional user days may be affected if users avoid the project area during mitigation activities. It is currently unknown when or how long juniper thinning would occur but the maximum potential effect would entail the loss of the remaining potential 4,374 user days of the total 25,000 user days currently available.

Considering that no primitive campsites are located in the vicinity of the communication towers, transmission line, or the juniper thinning activities proposed under the Mitigation Plan, there would be no additional effects to campsites in the Public Lands project area.

The construction and drilling activities proposed for the Projects, installation and operation of the communication towers, and the juniper thinning activities prescribed under the Mitigation Plan would not result in any road closures. Therefore, the existing 149 miles of road in the Public Lands project area, of which 52.43 miles are currently being used for motorized recreational opportunities, would remain open. It is unknown whether or not the construction and operation of the transmission line would result in road closures and is therefore assume that no road closures would occur.

Rangeland Management

The analysis area for cumulative effects to rangeland management is the Public Lands project area and Potato Hills Road.

Alternative A

Project vehicles for the communication towers would utilize existing access roads for construction and monitoring/maintenance purposes. Considering that the locations of the

proposed communication towers are in the middle of the G.I. allotment, no access road anticipated for use would cross an allotment boundary/fence; therefore, there would be no potential for livestock inadvertently accessing an unintended pasture due to project activities. Furthermore, no activities associated with the communication towers are proposed near Highway 20, so the likelihood of livestock accessing Highway 20 would be the same as it currently exist.

The 115kV transmission line for the Wagontire Wind Energy Project would utilize an access road that parallels the right-of-way for construction and maintenance purposes. This access road would stem from Highway 20 and run directly south through the Public Lands project area, crossing the G.I. and Round Top Butte allotment boundary. Project vehicles are expected to leave allotment fences open to allow for uninterrupted access to the transmission line; therefore, the overall potential for livestock inadvertently accessing an unintended pasture would remain low but increased. Furthermore, no cattle guard is in place where this access road would intersect Highway 20; therefore, the overall potential for livestock accessing Highway 20 would remain low but increased as result of project activities.

Under Alternative A, the geothermal exploration activities proposed for the Projects would not occur and juniper thinning would not occur. Therefore, the potential for livestock accessing unintended pasture would be the same as it currently exists in the absence of the implementation of the Mitigation Plan.

Alternative B

Alternative B would result in an increased likelihood of livestock inadvertently accessing an unintended pasture for six and a half months annually (August 16 through February 28). As described above in Alternative A, project activities associated with the transmission line would also result in an increased potential for livestock accessing unintended pasture through an open gate. As result of the improved access roads as result of Alternative B, it is expected that project vehicles conducting the juniper thinning activities proposed in the Mitigation Plan would utilize the same access roads as Alternative B (i.e. OR-B, OR-D, and R5B). While these roads cross allotment boundaries/fences, the overall potential for livestock accessing unintended pasture would remain low but increased.

Assuming the gates to the access road to well pad 16-9 and Potato Hills Road would be left open during exploration activities, Alternative B would result in an increased likelihood of livestock accessing Highway 20. No activities associated with the communication towers are proposed near Highway 20, so the likelihood of livestock accessing Highway 20 would be same as it currently exists for these projects. While juniper thinning activities would occur near Highway 20, no new access roads are proposed for those activities which would create access for livestock to access Highway 20. However, the access road for the transmission line would intersect with Highway 20, so the overall potential for livestock accessing unintended pasture would remain low but increased.

Alternative C

The installation of cattle guards at the areas identified in **Figure 2-9** would minimize the likelihood of livestock accessing unintended pasture and Highway 20 as result of Alternative C. Due to the improved roads as result of Alternative C, it is expected that project vehicles for the communication towers and Mitigation Plan would utilize the same access roads. These access

roads cross the G.I. and Round Top Butte allotment boundary, but the cattle guards as part of Alternative C will prevent livestock from accessing unintended pasture and Highway 20.

However, assuming that a cattle guard would not be installed where the access road for the transmission line intersects Highway 20, the overall potential for livestock accessing Highway 20 would remain low but increased. Furthermore, this access road would cross the G.I. and Round Top Butte allotment boundary/fence, so the overall potential for cattle accessing an unintended pasture through an open gate would remain low but increased.

Biological Resources

The analysis area for the cumulative surface disturbance and cumulative noise effects to PPH, PGH, and big game winter range habitat is the project area.

Alternative A

The communication towers would be sited within PGH sage-grouse habitat and big game winter range habitat, and would result in 0.5 acres of surface disturbance to these habitats. In addition, construction of the communication towers would temporarily increase traffic on access roads to the tower sites. Assuming a high traffic volume (greater than 8 vehicles/24 hours), this would result in 16.3 acres of noise impacts to big game habitat (if construction of the communication towers were to occur between December 1 and April 31) and 1,771 acres of effects to PGH sage-grouse habitat in the project area that are not currently affected by traffic on existing roads.

Vegetation clearing within the temporary right-of-way of the transmission line for the Wagontire Mountain project would affect up to 113 acres of vegetation within PPH, 61 acres of vegetation within PGH, and 188 acres of vegetation within big game winter range within the Midnight Point project area. Vegetation in the permanent right-of-way would be cleared periodically during ongoing operation and maintenance of the transmission line to maintain access to structures and to control noxious weeds. Up to 66 acres of vegetation within PPH, 35 acres of vegetation within PGH, and 110 acres of vegetation within big game winter range would be cleared during operation and maintenance of the transmission line within the Midnight Point project area. Because it is not expected that the entire temporary or permanent rights-of-way would be cleared of vegetation, these are upper-bound estimates.

Construction of the transmission line would generate noise from installation of the tower structures and would temporarily increase traffic on the existing access road along the transmission line. Assuming a high traffic volume (greater than 8 vehicles/24 hours), noise from the Wagontire Mountain project transmission line would affect 490.4 acres of PPH, 602.9 acres of PGH, and 2.3 acres of big game winter range habitat within the project area that are not currently affected by traffic on existing roads.

The total acreage that would be subject to vegetation clearing from construction of the communication towers and the transmission line would be 113 acres of PPH, 61.5 acres of PGH, and 188.5 acres of big game winter range habitat within the project area. A total of 66 acres of PPH, 35.5 acres of PGH, and 110.5 acres of big game winter range habitat would remain subject to vegetation clearing during operation of the communication towers and transmission line.

If construction activities for the communication towers and the transmission line occurred at the same time, these activities would result in cumulative noise effects to 490.4 acres of PPH, 2,373.9 acres of PGH, and 18.6 acres of big game winter range habitat within the project area that are not currently affected by traffic noise from existing roads.

Post-construction operation of the communication towers and the transmission line is not likely to cause noise effects to these habitats. Under Alternative A, the proposed geothermal exploration activities proposed for the Projects would not occur. The Mitigation Plan would therefore not be implemented and juniper thinning would not occur as mitigation for the Projects. There would be no effect to sage-grouse habitat from the Mitigation Plan under Alternative A.

Alternative B

As described above, construction of the communication towers and transmission line would result in vegetation clearing of up to 113 acres of PPH, 61.5 acres of PGH, and 188.6 acres of big game winter range habitats.

The Mitigation Plan would provide 275 acres of mitigation for effects in PPH and 89 acres of mitigation for effects in PGH sage-grouse habitat. However, the temporary right-of-way of the transmission line would intersect the northernmost priority mitigation area (**Figure 3-8B**) for Alternative B, resulting in vegetation clearing that would negate up to 12.2 acres of mitigating effects to PPH.

Alternative B would result in 72 acres of surface disturbance to big game winter range, 28 acres of surface disturbance to PPH sage-grouse habitat on both private and public lands, and 44 acres of surface disturbance to PGH sage-grouse habitat on public lands. Therefore, the cumulative direct change to these habitats resulting from the communication towers, transmission line, Mitigation Plan, and Alternative B would be a net increase of 121.8 acres of sage-grouse habitat mitigating effects related to PPH habitat and a net decrease of 17.5 acres of PGH sage-grouse habitat. Additionally, there would be a total surface disturbance of 260.6 acres to big game winter range habitat.

In addition to increasing the area of surface disturbance, construction of the communication towers and transmission line is expected to temporarily increase traffic on access roads to the tower structures. Assuming a high traffic volume (greater than 8 vehicles/24 hours), construction of the communication towers and transmission line would result in an additional 401.8 acres of noise impacts to PPH, 2,159.9 acres of noise impacts to PGH, and 18 acres of noise impacts to big game habitat that would not already be affected by noise from existing roads and from Alternative B. Noise from Alternative B would result in noise impacts affecting 2,681 acres of PPH, 2,910 acres of PGH, and 191 acres of big game winter range habitat that would not already be affected by noise from existing roads. Therefore, the cumulative number of acres of habitat that would be affected by noise from Alternative B, the communication towers, and the transmission line would be 3,082.8 acres of PPH, 5,069.9 acres of PGH, and 209 acres of big game winter range habitat that are not already affected by noise from existing roads. Construction of the transmission line and communication towers would only cause cumulative noise effects with Alternative C if one or more of these projects were to be constructed at the same time as Alternative C.

Additionally, implementation and monitoring conducted for the Mitigation Plan would produce a temporary noise effect in PPH and PGH sage-grouse habitat and big game winter range habitat. These activities would only cause cumulative noise effects with Alternative B and construction of the communication towers and transmission line if juniper thinning were to occur at the same time as these projects. Big game and greater sage-grouse would be expected to react to the noise by avoiding the affected habitat.

Operation of the communication towers and the transmission line is not likely to produce noise effects.

Alternative C

As described above, construction of the communication towers and transmission line would result in vegetation clearing of up to 113 acres of PPH, 61.5 acres of PGH, and 188 acres of big game winter range habitats. The Mitigation Plan would provide 89 acres of mitigation for effects in PGH sage-grouse habitat. Alternative C would result in 44.5 acres of surface disturbance to big game winter range and PGH sage-grouse habitat. In addition, improving the existing access road to reach well pad 63-19 under Alternative C would result in no additional surface disturbance to PPH sage-grouse habitat on private land. Therefore, the cumulative direct change to these habitats resulting from the communication towers, transmission line, the Mitigation Plan, and Alternative C would be a net decrease of 113 acres of PPH habitat and a net decrease of 17 acres of PGH sage-grouse habitat. Additionally, there would be a total surface disturbance of 163 acres to big game winter range habitat.

In addition to increasing the area of surface disturbance, construction of the communication towers and transmission line is expected to temporarily increase traffic on access roads to the tower structures. Assuming a high traffic volume (greater than 8 vehicles/24 hours), construction of the communication towers and transmission line would result in an additional 482.1 acres of noise impacts to PPH and 2,159.9 acres of noise impacts to PGH that would not already be affected by noise from existing roads and from Alternative C. Noise from Alternative C would result in noise impacts affecting 727 acres of PPH and 2,552 acres of PGH that would not already be affected by noise from existing roads. Therefore, the cumulative number of acres of habitat that would be affected by noise from Alternative C, the communication towers, and the transmission line would be 1,209.1 acres of PPH and 4,711.9 acres of PGH that are not already affected by noise from existing roads. Construction of the transmission line and communication towers would only cause cumulative noise effects with Alternative C if one or more of these projects were to be constructed at the same time as Alternative C.

While noise from construction of the communication towers and transmission line would also affect a total of 18.2 acres of big game winter range that are not already affected by noise from existing roads, Alternative C would not result in noise effects to big game winter range beyond existing conditions; therefore, there would be no cumulative noise effects to this habitat type.

Implementation and monitoring conducted for the Mitigation Plan would produce a temporary noise effect in PPH and PGH sage-grouse habitat. These activities would only cause cumulative noise effects with Alternative C and construction of the communication towers and transmission line if juniper thinning were to occur at the same time as these projects. Greater sage-grouse

would be expected to react to the noise by avoiding the affected habitat. Operation of the towers is not likely to produce noise effects.

Visual Resources

The analysis area for the cumulative effects to visual resources is the area visible from KOPs 6, 9, 10, and 11 as described in **Section 3.6** above.

Alternative A

The communication towers would be located within an area designated as Class IV. The structures would rise above the existing landscape such that the structures' tall mass, vertical lines, and red and white or grey colors would be backdropped by the sky's uniform mass, lack of lines, and blue to white colors. However, due to the viewer's distance (the communication towers would be approximately 2.3 miles from KOP 9, the closest KOP), the communication towers would be visible but would not attract attention from onlookers. Therefore, the degree of contrast between the communication towers and the existing environment from KOPs 6, 9, 10, and 11 would be weak. Because the Class IV objective provides for management activities which require major modifications of the existing character of the landscape, the structures would be consistent with VRM objectives.

The transmission line would cross lands within the project area that are designated Class II and Class III. The tower structures would rise above the existing landscape and the structures' vertical lines would be backdropped by the sky's lack of lines. However, the tower structures would be 2.4 miles from the closest KOP (KOP 11) and would be barely visible from this distance. Because management activities within a Class II area may be seen but should not attract the attention of the casual observer and the Class III objective for the area allows for contrasts that may attract attention but should not dominate the view of the casual observer, the transmission line would be consistent with Class II and Class III VRM objectives from KOP 11.

Under Alternative A, the geothermal exploration activities proposed for the Projects would not occur. The Mitigation Plan would therefore not be implemented and juniper thinning would not occur as mitigation for the Projects. There would be no effect to visual resources from the Mitigation Plan under Alternative A.

Alternative B

The only KOP for which both the communication towers and the project features proposed under Alternative B would be visible while facing the same direction is KOP 6. For KOPs 9, 10, and 11, the communication towers would not be seen by a viewer facing the direction of the project features visible from those KOPs.

From KOP 6, both the communication towers and well 63-19 would be visible at the same time. As described previously, well 63-19 would be located within an area designated as Class II and would temporarily result in a weak degree of contrast with the existing environment from KOP 6. Because management activities within a Class II area may be seen but should not attract the attention of the casual observer, the Public Lands project would be consistent with VRM objectives from KOP 6.

The communication towers would also be visible from this KOP and would result in a weak degree of contrast with the existing environment from KOP 6 given the viewer's distance from the towers (3.2 miles). The towers would be located within an area designated as Class IV. Because the Class IV objective provides for management activities which require major modifications of the existing character of the landscape, the structures would be consistent with VRM objectives. Therefore, the cumulative effect of both Alternative B and the communication towers would remain consistent with VRM objectives.

From KOP11, both the transmission line and features proposed under Alternative B (well 15-33 and roadway modifications to R2B) would be visible at the same time. As described previously, well 15-33 would be located within an area designated as Class II and would temporarily result in a strong degree of contrast with the existing environment from KOP 11. However, because this structure is temporary (construction and drilling activities would be implemented over a period of one to three years), the existing landscape would be restored to the existing views after the Projects. As described previously, the overall degree of contrast between improvements to R2B and the existing environment from KOP 11 would be weak. Because management activities within a Class II area may be seen but should not attract the attention of the casual observer, the permanent effects from the improvements to R2B would be consistent with VRM objectives from KOP 11.

The transmission line would cross lands within the project area that are designated Class II and Class III. The tower structures would rise above the existing landscape and the structures' vertical lines would be backdropped by the sky's lack of lines. However, the tower structures would be 2.4 miles from the closest KOP (KOP 11) and would be barely visible from this distance. The transmission line would therefore result in a weak degree of contrast with the existing environment from KOP 11 given the viewer's distance (2.4 miles) from the tower structures. Because management activities within a Class II area may be seen but should not attract the attention of the casual observer and the Class III objective for the area allows for contrasts that may attract attention but should not dominate the view of the casual observer, the transmission line would be consistent with VRM objectives from KOP 11. The cumulative effects of the permanent effects from Alternative B (improvements to R2B) and the transmission line would remain consistent with VRM objectives.

The juniper thinning activities prescribed under the Mitigation Plan would remove all encroaching juniper from treatment areas, while maintaining the understory sagebrush-native grassland community. These activities would occur within 974 acres designated as Class II, 4,878 acres designated as Class III, and 3,968 acres designated as Class IV. While fewer tall trees would remain in the landscape upon completion of the juniper thinning activities, the visual character of the landscape would remain much the same. No new lines would be introduced and the earth-toned colors, organic forms, and mottled texture of the existing landscape would be maintained. Therefore, there would be no contrast with the existing landscape and the cumulative effects of Alternative B, the communication towers, the transmission line, and the juniper thinning activities would remain consistent with VRM objectives.

Alternative C

The cumulative effects under Alternative C would be the same as Alternative B.

Groundwater Resources and Water Rights

The analysis area for cumulative effects to groundwater resources and water rights is the local aquifers described in **Section 3.11** above.

Alternative A

Under Alternative A, no water wells would be installed, thus BLM would not maintain a water right to any post-project wells. There are no water wells proposed to support any of the other reasonably foreseeable future actions; therefore, there would be no cumulative effect to groundwater resources under Alternative A.

Alternative B

None of the other reasonably foreseeable future actions propose to install water wells, so there is no potential for cumulative effects to groundwater resources during Project activities. However, under Alternative B, BLM would maintain up to three water wells that produced water suitable for livestock and wildlife consumption. This water would be put towards maintaining the livestock grazing allotment located in the project area that has limited water development. BLM proposes to utilize 77,440 gpd or 86.7 acre feet per year. Considering that the water wells would be located no closer than 5,000 feet from any other existing wells, there is not anticipated to be drawdown on the local aquifer, nor is it likely to cause a measurable effect to existing wells in the area.

Alternative C

The cumulative effects under Alternative C would be the same as Alternative B.

Chapter 4
Tribes, Organizations, and Agencies Consulted

4.1 Tribes

- The Burns Paiute Tribe
- The Confederated Tribes of the Warm Springs Reservation of Oregon
- The Klamath Tribes

4.2 Agencies

- Oregon Department of Fish & Wildlife
- Oregon State Historic Preservation Office
- U.S. Department of Energy, Golden Field Office
- U.S. Fish & Wildlife Service
- Oregon Department of Transportation

Chapter 5
List of Preparers

5.1 Lead Agency

Bureau of Land Management

Oregon/Washington State Office

Oregon/Washington BLM Energy Program Lead: Thomas Wawro

Prineville District

District Manager: Carol Benkosky

Natural Resource Specialist: Matthew Shaffer

Natural Resource Specialist, Botany & Weeds: Sarah Canham

Rangeland Management Specialist: Cari Taylor

Archaeologist/Oregon/Washington Paleontology Program Coordinator: John Zancanella

Hydrologist: Richard Pastor

District Geologist: Carol Van Dorn

Recreation Planner: Berry Phelps

Cartographic Technician: Michael Tripp

Civil Engineer: John Lulich

District Planning and Environmental Coordinator: Teal Purrington

Burns District

District Manager: Brendan Cain

NEPA Coordinator: Rhonda Karges

NEPA Coordinator: Holly Orr

Realty Specialist: Pamela Hart

Realty Specialist: Tara McLain

District Engineer: Aaron Eklund

District Engineer: Joe Toelle

Hazardous Materials Specialist: Marsha Reponen

District Planning and Environmental Coordinator: Rhonda Karges

Natural Resource Specialist-Wild Horse & Burro Program: Robert Sharp

Natural Resource Specialist, Botany: Caryn Meinicke

District Archaeologist: Scott Thomas

Rangeland Management Specialist: Bill Dragt

Rangeland Management Specialist: Rachel Beaubien

Outdoor Recreation Planner: John Bethea

Wildlife Biologist: Jason Brewer

Wildlife Biologist: Matt Obradovich

District Weed Coordinator: Lesley Richman

Geologist: Rick Wells

Water Rights Specialist: Jana Wilcox

Wilderness Specialist: Tom Wilcox

Riparian/Fisheries/Wetlands/Water Quality: Lindsay Davies

Lakeview District

Environmental Protection Specialist: Thomas Cottingham

Department of Energy

Golden Field Office

NEPA Specialist: Casey Strickland

5.2 Environmental Consultants

Cardno ENTRIX

Project Manager: Benjamin Pogue

Deputy Project Manager: Katherine Clifford

Chapter 6
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16 USC §703-712 – *Migratory Bird Treaty Act of 1918*. United States Code.

25 CFR 262.3 – *Protection of Archeological Resources*. Code of Federal Regulations.

25 USC §3001[3] – *Native American Graves Protection and Repatriation Act*. United States Code.

29 USC §651 *et seq*. – *Occupational Safety and Health Act of 1970*. United States Code.

30 USC §1001-1025 – *Geothermal Steam Act of 1970*. United States Code.

30 USC §601 *et seq*. - *Surface Resources Use Act of 1955*. United States Code.

30 CFR 1-199 – *Mine Safety and Health Administration*, Code of Federal Regulations.

36 CFR 60 – *National Register of Historic Places*. Code of Federal Regulations.

36 CFR 800 – *Protection of historic properties*. Code of Federal Regulations.

40 CFR 112.7 – *General requirements for Spill Prevention, Control and Countermeasure Plans.* Code of Federal Regulations.

40 CFR 302 – *Designation, Reportable Quantities, and Notification*, Code of Federal Regulations.

40 CFR 1500 *et seq*. – *Council on Environmental Quality*. Code of Federal Regulations.

40 CFR 261.24 - *Identification and listing of hazardous waste*. Code of Federal Regulations.

42 USC §1996 - *Protection and preservation of traditional religions of Native Americans*. United States Code.

42 USC §4321 *et seq*. - *Administrative Rules for Archaeological Permits for Public and Private Lands*. United States Code.

43 CFR 10 – *Repatriation*. Code of Federal Regulations.

43 CFR 2800 – *Use; Rights-of-Way.* Code of Federal Regulations.

43 CFR 3600 – *Mineral Material Disposal*. Code of Federal Regulations.

43 USC §1714 - *Withdrawals of lands*. United States Code.

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Appendix A

Issues Considered But Not Analyzed in Detail

Issues Considered But Not Analyzed in Detail

The following issues were raised by the public or BLM during scoping and internal reviews for the Projects. They have been considered but eliminated from detailed analysis because PDFs incorporated into the action alternatives eliminate or reduce effects on the resource. The relevant PDFs are briefly mentioned below, but are described in detail in **Chapter 2**.

- **What is the irreversible and irretrievable commitment of resources that would occur from the Action Alternatives?**

  The irreversible commitment of resources is described as the "loss of future options." It applies primarily to non-renewable resources, such as cultural resources, or resources that are renewable after a regeneration period, such as soil productivity. The term may also apply to the loss of an experience as an indirect effect of a "permanent" change in the nature or character of the land. An irretrievable commitment of resources is defined as the loss of production, harvest, or use of natural resources. The amount of production foregone is irretrievable, but the action is not irreversible.

  There would be no irreversible and irretrievable commitment of resources expected from the Action Alternatives. No geothermal resources would be consumed during exploration activities and would remain entirely available for potential future use. All disturbed areas would be reclaimed to the condition of prior to disturbance, so there would be no permanent loss or alteration of the existing ecosystem or the environmental character of the project area. The only potential irretrievable commitment of resources would be the aggregate used for access road improvement and installation. However, the aggregate used to improve existing roads would improve road quality for other uses in the project area (i.e. recreation). Aggregate used to install new access roads would be reclaimed and made available for other uses.

- **How would intentional destructive acts (i.e., acts of sabotage or terrorism) affect human life, health, or safety?**

  In December 2006, the DOE Office of General Counsel issued interim guidance stipulating that NEPA documents completed for DOE actions and projects should explicitly consider intentional destructive acts (i.e., acts of sabotage or terrorism). The proposed geothermal exploration project would not involve the transportation, storage, or use of radioactive, explosive, or toxic materials. Consequently, it is highly unlikely that construction or operation of the geothermal project would be viewed as a potential target by saboteurs or terrorists. The project location is not near any national defense infrastructure or in the immediate vicinity of a major inland port, container terminal, freight trains, or nuclear power plants. The Action Alternatives would not offer any targets of opportunity for terrorists or saboteurs to inflict adverse impacts to human life, health, or safety. There are thus no reasonably foreseeable intentional destructive acts that would result from the proposed project.

- **What would the human health effects be from exposure to hydrogen sulfide (H_2S) gas, sulfur dioxide (SO_2) gas, natural gas (methane or CH_4), and silica (Si), arsenic (As), and mercury (Hg) dust during drilling, quarry operations, and road building/use?**

  Exposure to H_2S would be limited through precautions that include the use of H_2S sensors, safety gear and implementing safety trainings. SO_2 gas is not expected to be encountered in the project area. Natural gas (methane) has been observed in a nearby well and LEL monitoring would be part of the precautions for a release and aid in preventing a potential explosion.

  Blasting and crushing during quarry operations would produce dust that has the potential to include Si, As and Hg particles. The PDFs for the Projects include dust suppression, which would be conducted during construction and operation (including quarry operations) to reduce localized dust and maintain acceptable State and Federal air quality standards (Section 2.5.1). In addition, the PDFs include development of a contingency plan which would describe procedures to protect public health and safety, property, and the environment. The expected levels of Si, As and Hg are expected to be consistent with background levels within the local area. The quarry material on federal land is anticipated to be near a Federal Highways Administration (FHA) quarry operated by the Oregon Department of Transportation (ODOT) and is a common source of road building material in the area.

  BLM approval of a reclamation and operation plan will be required prior to the start of operation. All permits from the State of Oregon, including DOGAMI, will need to be obtained prior to operations and BLM authorization. For the above reasons, the issue is not considered in detail in this EA.

- **What would be the effects to the environment and workers from solid waste produced during exploratory drilling and quarry operations?**

  With the exception of fuel and oil, solid waste produced during operation of the Projects is expected to be non-hazardous, and would be disposed of in designated areas on site and regularly removed by a commercial hauler to a permitted, off-site, disposal facility (**Section 2.3.2**). Oil and gasoline would be stored in secondary containment structures on site (**Section 2.3.2)**. Handling, storage, and disposal of hazardous materials, including oil and gasoline, would be conducted in conformance with federal and state regulations to prevent adverse effects on the environment or worker health and safety (**Section 2.5**).

- **How would the Projects affect mining claims and rights-of-way requests in the project area?**

  There are mining claims but not right-of-way applications that are in the proposed foot print of any of the proposed actions; thus, the Projects would have a negligible or no effect on existing mining claims or right-of-way requests

- **What effect would the Alternatives have on the introduction and expansion of noxious weeds in areas of ground disturbance through the transport on equipment, vehicles, and materials?**

  The alternatives would not have a potentially significant effect on the introduction and expansion of noxious weeds from vehicles and other material because areas that become infested with invasive species/noxious weeds during construction would be mapped and

treated, and then seeded with certified weed-free seed and mulching materials. Also, existing weed infestations would be avoided or treated before any ground disturbing activities take place (see Biological Resources PDFs in **Section 2.5.1**).

- **How would the operation of equipment affect soils?**

  Aggregate would be laid down if vehicles or other equipment create ruts in excess of four inches deep when traveling cross-country over wet soils prior to additional vehicle use. Also, in areas of very soft soils, up to three feet of aggregate would be used during construction to prevent effects to muddy and wet soils (see Soil Erosion PDFs in **Section 2.5.1**). The use of aggregate would prevent equipment from having a potentially significant effect to muddy and wet soils.

- **How would the construction and operation of the slim wells, production sized wells, and reserve pits affect ground water quality?**
  The Applicant's proposed project includes design features that would prevent any potentially significant effects to ground water quality from the construction and operation of slim wells, production sized wells, and reserve pits. Excavation into native soils during construction would be minimized to the maximum extent possible. Reserve pits would be compacted during constructions and settled bentonite clay from drilling mud would act as an unconsolidated clay liner, reducing the potential for drilling fluids to percolate to ground water. Upon completion of exploratory drilling, liquids in reserve pits would be evaporated, and solids remaining would be mixed with excavated rock and buried by backfilling the reserve pit (**Section 2.3.3).** Liquid wastes from drilling activities would be stored in lined sumps before being disposed of in accordance with state regulations (See Hydrology – Surface Water and Groundwater in **Section 2.5.1**). "Blow-out" prevention equipment would be used during drilling and well casing would be cemented into the ground. These PDFs would prevent potentially significant effects to water quality.

- **What would be the effects to biological soil crusts from the Action Alternatives?**
  Soil surface microtopography and aggregate stability are important contributions from biological soil crusts as they increase the residence time of moisture and reduce erosional processes. The influence of biological soil crusts on infiltration rates and hydraulic conductivity varies greatly; generally speaking, infiltration rates increase in pinnacled crusts and decrease in flat crust microtopography. The northern Great Basin has a rolling biological soil crust microtopography and the infiltration rates are probably intermediate compared to flat or pinnacled crustal systems. Many biological soil crusts, such as *Collema coccophorum* or *tenax* are nitrogen fixers which provide necessary nitrogen in an otherwise nutrient poor plant community. A survey for biological soil crusts will be done prior to ground disturbing activities to determine if there are any uncommon or special status biological soil crusts present. If they are found, the area will be avoided.

  Once soil crusts are removed, the likelihood of reestablishment is minimal. After rehabilitation, recovery can be as short as one year for mosses (tall and short) if re-vegetation is successful or longer than 50 years for soil lichen, if at all. While the project area disturbance is less than 1 percent of the total acreage within the project area, soil crusts are localized and do not necessarily cover the entire surface of the project area. Removal of soil crust in order to establish a well pad, pond and/or expand the quarry will remove the soil

crusts in that particular area, meaning that up to 100 percent of that less than 1 percent of the total acreage will be removed.

Storing and reusing topsoil is an effective mitigation measure for biological soil crusts over a short period of time (1-2 months). If topsoil is stored for longer periods, biological soil crusts are unable to survive as they do not have access to sunlight which is needed for the photosynthesis process needed in order to survive. Re-vegetating a disturbed area with desired vegetation will provide the habitat necessary for soil crusts to reestablish; however, if they do not exist in the system because they have been removed, then it is unlikely that they will return.

- **How might the trash and waste created from Alternative B or 3 impact wildlife?** There would be no effects to wildlife from trash or waste associated with this proposal because trash and other waste products would be properly contained and removed from the project area to be disposed of at an authorized landfill (see Biological Resources, Fish and Wildlife PDFs in **Section 2.5.1)**.

- **What would be the effects to wildlife from vehicle operators associated with the geothermal exploration activities driving at excessive speeds due to improved road conditions?**

  Due to restrictions placed on vehicle operators, speeds would be reduced from 25 mph to 15 mph when terrestrial wildlife (i.e. deer, sage grouse) is observed by workers/drivers in the project area, especially near access and service roads (see Biological Resources, Fish and Wildlife PDFs in **Section 2.5.1**). These limits would minimize the potential for a project vehicle to strike an animal. In the event that a vehicle strikes an animal, the potential to attract scavenger birds (i.e. ravens) increases, but this increase would be considered negligible due to existing effects from traffic and subsequent road-kill on Highway 20.

- **What would be the effects to wildlife from employees interacting directly with wildlife?** Employees and contractors would be strictly prohibited from carrying firearms on the job site to discourage illegal hunting and harassment of wildlife.

- **What would be the effects of the project on special status plant species?**

  Per USFWS and BLM data inventories, there are no known populations of special status plant species within the project area. Furthermore, none were observed during biological field reconnaissance.

- **What would be the effects to ferruginous hawks, northern goshawks, and western burrowing owl as result of the Projects?**

  Ferruginous hawks (*Buteo regalis*) use the vicinity of the project area during the breeding season and migrate south out of the area during winter. Nest building and incubation period for this species occurs from March through early May (Leary, *et al*. 1998). Furthermore, the United States Fish & Wildlife Service recommends not disturbing nesting sites throughout the U.S. ferruginous hawk range from March 15 – July 15 to not interfere with nesting season (Dechant, *et al*. 2002). No project activities would occur from March 1 – August 15 under either Alternative B or 3; therefore, no effects to ferruginous hawk nesting or brood rearing season are anticipated.

The northern goshawk (*Accipiter gentilis*) inhabits forested habitat, including coniferous, mixed and deciduous forest types. Therefore, it is unlikely they would be found nesting in the sagebrush steppe and juniper woodland habitat around Glass Butte. Breeding season for the north goshawk occurs from March through April, so project activities under Alterative 2 would occur for 15 days during breeding season. However, no northern goshawks or nests were observed during the biological resources surveys and no effects to the species are anticipated.

The western burrowing owl (*Athene cunicularia*) breeds throughout the sagebrush steppe habitat of southeastern Oregon. Breeding season for the western burrowing owl occurs from mid-March to the end of August 15 so 45 days of project activities under Alterative 2 and Alternative C would occur during breeding season. However, there were no burrowing owls or burrows observed during the biological resources surveys conducted in the project area, so no effects to the species are anticipated. In the event that burrows went unnoticed during the site surveys, it is possible that the vibration from the drill rig may collapse a burrow that would be unusable the following spring.

- **Would the proposed quarry operations affect the concentrations of mercury (Hg) in the air and in water bodies in the project area?**

  The Potato Hills Quarry and the G.I. Ranch Pit are located approximately five miles and 9 miles, respectively, from historical cinnabar ore (HgS) mining. Based on these distances, it is assumed that Hg may be encountered in low concentrations in the shallow surface rock excavated and processed from the quarries. Drilling operations would not be expected to disturb the volume needed to create an environmental or health measurable effect. Additionally, the dust suppression measures would aid to contain the micro-quantities of Hg contained in the rock. The proposed quarry or drilling operations are not anticipated to affect the concentrations of mercury in the ambient air or in water bodies in the project area outside of background levels.

- **Would the Projects have an effect on paleontological resources?**

  As per the PDFs in **Section 2.5.1**, all proposed activities would be designed to avoid disturbance to historic properties and paleontological resources. Project design would avoid sensitive areas to avoid impacts. Any new discoveries of cultural or paleontological resources would temporarily stop activities related to the Projects and a cultural specialist would be contacted. The Projects would resume upon completion of assessment and coordination. These PDFs would prevent any potentially significant effects to cultural properties and paleontological resources.

- **Would the Projects have an adverse effect on surface waters?**

  All streams on the project area are intermittent or ephemeral. Additionally, a small reservoir named Musser Reservoir exists in the project area within approximately 50 feet of existing road OR-C. There are no water bodies in the project area that are included on the Clean Water Act 303(d) list.

  One intermittent stream, the South Fork Crooked River, is crossed by access road OR-B, which is an existing access road that would be widened to provide access to well pad 13-21. Additionally, a portion of the existing road OR-C, which would be improved, is adjacent to

an ephemeral drainage and an associated wetland for approximately 1.0 miles. This feature drains to the South Fork Crooked River further downstream. These existing crossings and improvements to OR-C are not anticipated to affect surface waters due to implementation of the proposed erosion/runoff control measures and rolling dips/culverts (see **Section 2.5.1**) The rolling dips and and/or culverts would be designed to accommodate flows from at least a 25-year storm event and would prevent potentially significant effects to ephemeral streams from the construction of new access roads. No ground or surface water features (i.e. aquifers, streams or wetlands) are located in the Private Lands project area; therefore, there are no potential effects would occur.

- **What would be the effects to wildlife and rangeland animals from the reserve pits?**

  Reserve pits would be fenced and netted according to the BMPs identified in the Gold Book (BLM 2007a) in order to prevent wildlife contact with reserve pits (**Section 2.3.1**), thus preventing any significant effects to wildlife and rangeland animals (i.e. cattle) from the reserve pits. Furthermore, to avoid impacts to wildlife, the Applicant would control garbage that could attract wildlife and all trash would be removed from the project area and disposed of at an authorized landfill (**Section 2.5.1**).

- **Would the reserve pits have any effect to raptors?**

  Temporary waste material reserve pits used during drilling for the Projects could be an attractive nuisance to birds. To avoid impacts to wildlife, trash and other waste projects would be properly managed, and the Applicant would control garbage that could attract wildlife. All trash would be removed from the project area and disposed of at an authorized landfill (**Section 2.5.1**).

  Bird and wildlife mortality in reserve pits is preventable (USFWS 2009). Reserve pits would be netted and fenced according to the BMPs identified in the Gold Book (BLM 2007a) in order to prevent human or wildlife contact with reserve pits (**Section 2.3.1**). The fencing placed around the reserve pits would keep out most wildlife, and the netting would prevent raptors from accessing the reserve pits from above. Since fencing would exclude small mammals from the pits, the likelihood that raptors would become entrapped/entangled while hunting over the pits is greatly reduced. Likewise, the exclusion of large mammals from the pits would prevent the death of these animals and in turn prevent scavenger birds (i.e., common raven, turkey vulture, bald eagle, etc.) from entering the pits.

- **Would shore or water birds be affected by the reserve pits?**

  Studies of oil sands tailings pits in Alberta, Canada have shown that ducks, shore birds, geese, swans, wading birds, and gulls are the most likely to become trapped in pits that hold standing water (Timoney and Ranconi 2010). Wildlife observations conducted during field surveys of the project area identified Canada geese (*Branta canadensis*), killdeer (*Charadrius vociferous*), and spotted sandpipers (*Actitis macularia*) near natural ponds (Cardno ENTRIX 2010). These three species are therefore the most likely to be attracted to standing fluids in the reserve pits. However, unlike tailings pits, the proposed reserve pits are not expected to contain standing water and would be netted and fenced which would keep most shore birds from accessing the reserve pits. The proposed pits would contain a muddy, gelatinous

mixture as opposed to standing water. Therefore, it is unlikely that the subject bird species would be attracted to the material contained in the reserve pits.

- **Would there be any effects to migratory birds?**

The Migratory Bird Treaty Act (MBTA) of 1918 expressly forbids any party, unless permitted by regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention…for the protection of migratory birds…or any part, nest, or egg of any such bird" (16 U.S.C. 703). The Bald and Golden Eagle Protection Act affords additional protection to all bald and golden eagles. In total, 836 bird species are protected by the MBTA, 58 of which are currently legally hunted as game birds (CFR 10.13). A migratory bird is any species or family of birds that live, reproduce or migrate within or across international borders at some point during their annual life cycle.

The USFWS is the lead federal agency for managing and conserving migratory birds in the United States; however, under Executive Order (EO) 13186 all other federal agencies are charged with the conservation and protection of migratory birds. In response to this order, the BLM has implemented management guidelines that require migratory birds to be addressed in every NEPA analysis of actions that has the potential to negatively or positively affect migratory bird species of concern.

There are several migratory bird species of conservation concern identified by the USFWS that either occur or have potential habitat (nesting, foraging, or transitory use) within the project area including Swainson's hawk (*Buteo swainsonii*), ferruginous hawk (*Buteo regalis*), golden eagle (*Aquila chrysaetos*), prairie falcon (*Falco mexicanus*), loggerhead shrike (*Lanius ludovicianus*), Sage Thrasher (*Oreoscoptes montanus*), Green-tailed towhee (*Pipilo chlorurus*), Brewer's sparrow (*Spizella breweri*), and sage sparrow (*Amphispiza belli*) (USFWS 2008).

In general, the extent of the habitat disturbed by Alternative B (approximately 59 acres on public lands, and 13 acres on private lands) should not displace any migratory birds since the acreage is not in one block but in several smaller well pads (less than 4.1 acres) and short roads that would be reclaimed at the time of abandonment. Existing habitat next to these sites would be able to accommodate any birds that might be displaced. Mitigation proposed for the action alternatives would provide approximately 400 acres more of habitat for sagebrush dependent species than would be affected due to well pad construction. Mitigation actions (juniper removal) would occur coincidentally or shortly after drilling operations start. The timing of disturbance from construction of well pads and drilling would occur when migratory birds would not be present at the project site based on the PDFs for no surface operations during sage-grouse lekking and nesting season (March 1-August 15), so there would be no affects to migratory birds from noise or associated activity with the drilling of these wells. Juniper removal would occur so that sagebrush habitat was available for nesting when migratory birds arrived in the area. Other PDFs such as fences and netting around

reserve pits at the well pads, would be implemented to negate possible affects to migratory birds.

Appendix B

Design Criteria for Community Pit

Design Criteria

for

Potato Hills Quarry (OROR 067726) with Community Pit Designation

Operator Information

Bureau of Land Management
28910 Highway 20 West
Hines, Oregon 97738

Point of Contact

Mr. Rick Wells
266 South Date Avenue
Burns, OR 97720
Tel: (541) 573-4484
Fax: (541)573-4411

Community Pit\Quarry

The operation of the quarry would be under a Community Pit designation and consistent with 43 CFR 3600. The material source would be for the purpose of supplying mineral materials for various non-Federal Highway funded projects in the general area of the rock quarry.

Method & Equipment

The proposal is to drill, blast, crush, stockpile, and haul material on an as needed basis for road and other uses, including longer-term road maintenance. The equipment used would include, but not limited to, drill rigs, a variety of heavy earth moving equipment (bulldozer, backhoe, loaders, levelers, etc.), trucks (spectrum of sizes), pickup, service trucks, water trucks, crushing equipment (including conveyers, hoppers, etc.), portable electrical generator, temporary fuel storage, equipment and office trailers (during active operation), and miscellaneous equipment and supplies needed to perform the operation of drilling, blasting, crushing, stockpiling, and hauling (including temporary water storage tanks and pumps during active operation). Temporary facilities may be located on site under a special use permit.

Location

The site is located within W.M. (Willamette Meridian) T. 23 S., R. 24 E., sec 18, S1/2NW1/4SW1/4NE1/4, SW1/4SW1/4NE1/4, SE1/4SE1/4SE1/4NW1/4, and E1/2SE1/4SE1/4NW1/4. The location is also referenced as latitude 43°34'42.15"N., Longitude 119°53'02.01"W. The proposed project is located approximately 1 mile north of Highway 20 and on the west side of Potato Hills Road in Harney County, Oregon. The location can be found on

the United States Geological Survey's Hat Butte 7.5 minute topographic quadrangle. The adjacent roadway (i.e., Potato Hills Road) is a BLM administered road (road number 7241-00). The road is assigned the functional classification, "Local", and managed as Maintenance Intensity 3. The approximate elevation is 4,640 feet above mean sea level. For permits covering larger quantities, a road right-of-way permit would be required (a SF-299 Application with Plan-of-Development [POD] would be needed). See provided map (Figure B-1).

Mining Method

The method of mining would be to drill and blast from the surface, move the material to a rock crusher (which may include the use of a grizzly), and then pile the crushed rock for transport off-site. The transportation of the material off-site would be as the material is used in the road construction or maintenance, as well as other possible uses. Stock piles would not have a greater than 3:1 slope. The top soil, waste rock, overburden, and usable crushed rock may be stored separately (size dependent). The conditions of use and development are provided below. Note that reclamation occurs during development as well as some post-use reclamation.

- Remove the top soil and overburden (ranges from 0-3 feet in depth) and stock pile for possible future use in reclamation and act as a buffer along Potato Hills Road and\or visible perimeter of the quarry in a 3 (horizontal): 1 (vertical) slope, contour, and seeded in the fall with a mixture of native and nonnative perennial grasses, shrubs, and forbs as identified by BLM. The minimum 20-foot buffer along Potato Hills Road and 10-foot site buffer would be maintained for the remaining sides of the proposed location;
- Side walls shall be left in a stable condition as well as bermed when a vertical side wall of greater than 4 feet exists;
- All fencing changes and site securing shall be the responsibility of BLM, however, may be included within conditions of negotiated sale contracts and part of initial entry conditions. Note that fencing can be expanded and located on the top of the berm (which is less than 8 feet in height), consistent with the development of the quarry;
- Remove the mineral material from the ground by the use of rock drills, blasting, and mechanical equipment (crawlers, loaders, etc.);
- Unless specified otherwise in a permit, rock crushing operations will utilized less than 16 employees working up to 12 hours per day with portable toilets provided;
- Operational slopes would be ¼ :1 with a final overall surface rehabilitation grade of 3:1 and quarry grade of 2:1 (or 40 foot vertical slopes with 60 foot blenches), which could be completed as the quarry advances, and specified in negotiated sale contracts. Note that steeper vertical slopes can remain after reclamation if requested by a competent person and approved by BLM that the rock type is stable at the steeper slope;
- Interim seeding may be needed if dust becomes a concern of the neighbors and included in conditions of negotiated sale contracts;
- Rock and overburden stockpiles may be separate and may be utilized as berms as long as visually appropriate for the surrounding area;

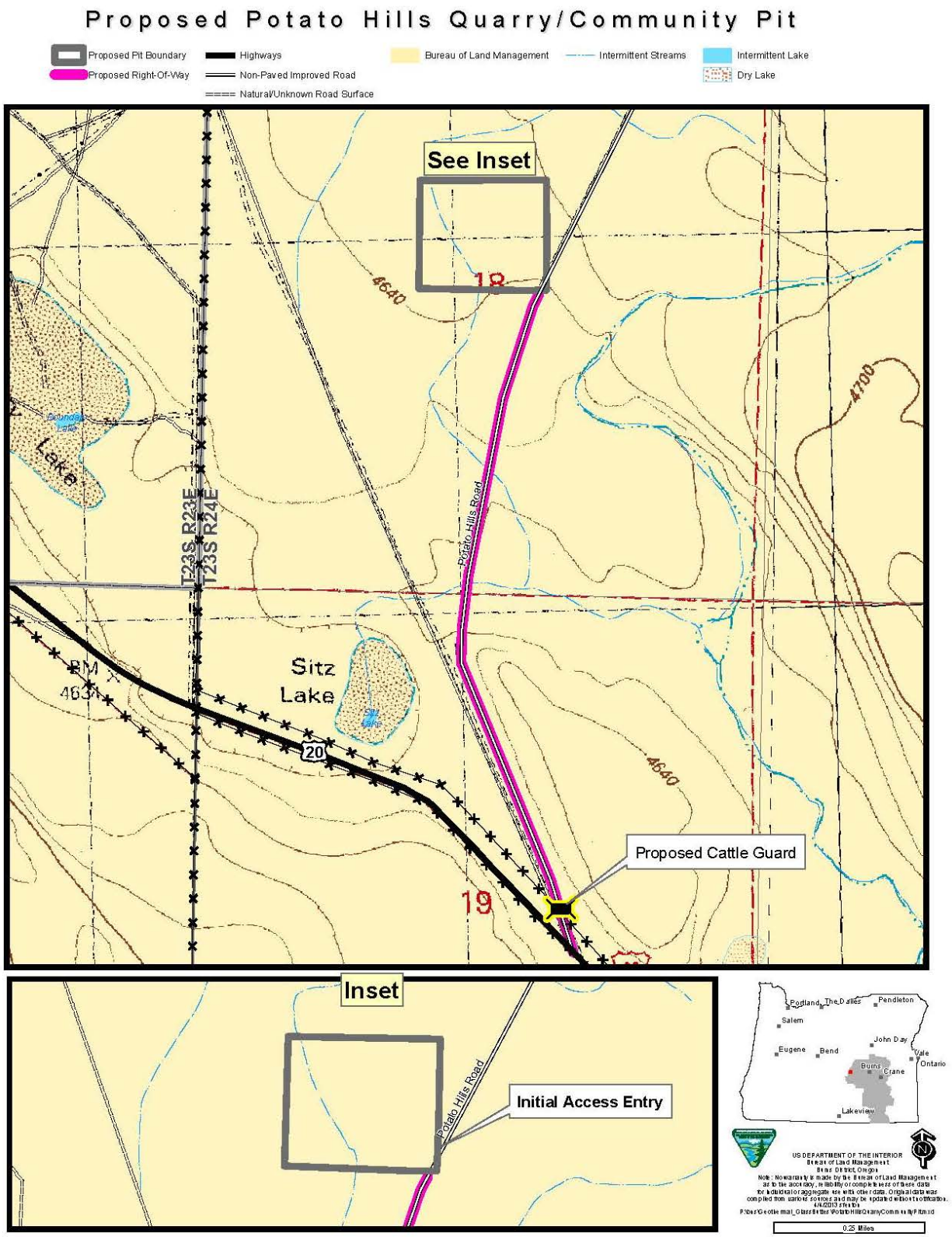

Figure B-1 Potato Hills Quarry/Community Pit

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- Reclaimed areas would be seeded with a native/nonnative weed-free seed mixture dependent upon availability and approval by BLM. Reclamation would occur when an area of the quarry has been exhausted or contains rock for which a need no longer exists. Final reclamation would include re-contouring the disturbed area to blend with the surrounding landscape surface contours, as approved by BLM and considering the rock basin and bench style reclamation (i.e., vertical rock exposure would remain unseeded). The surface area that is compacted may require scarifying prior to seeding;
- Aggregate stockpiles would be located on-site with slopes 3:1. Oversized material may be placed in a separate stockpile within the quarry area so that it is available for use as riprap or berming around the pit as needed;
- Water shall be used during the crushing and hauling (of greater than 50 tons of materials a day) to control fugitive dust, unless permitted otherwise;
- Place the overburden as a berm to buffer it from the roadway and for safety purposes around the quarry (which would include boulders larger than 3 feet in diameter). The depth of the quarry shall not extend into the static ground water with enough source material above the high static water level to allow drainage of a 100-year storm event within a reasonable amount of time (less than 1 week). Approvals for entry for blasting will include a condition to overshoot in blasting to increase the permeability of the quarry floor and allow for storm water drainage;
- Storm water and sediment shall be controlled to prevent from flowing off-site and into the natural landscape, consistent with storm water standards;
- All material and work within the quarry will be performed under a permit from BLM prior to initiation of work. All equipment and material left on-site after the permit has expired becomes the property of the Bureau of Land Management after 90 days per 43 CFR 3601.52;
- In the event cultural or paleontological resources are encountered during any activity within the community pit, work at that site would immediately cease and appropriate BLM personnel would be notified;
- The site will not be used as a disposal location for trash, asphalt, concrete, construction debris, or other non-native debris;
- BLM may visit the site unannounced for inspection visits that will include purposes such as to monitor and ensure proper compliance with the law and regulations, policy, as well as mine and reclamation plans. Site visits may or may not be in coordination with other Federal agencies and State and local governments.

The following are the expected Standard Operating Procedures (SOPs) for the community pit:

- Spray for weeds prior to use within roadways. If standing water is present, weed spraying shall not be co-mingled with the water and BLM should be consulted;
- Any herbicide treatments shall be consistent with the Burns District Noxious Weed Management Program EA/DR OR-020-98-05;
- Monitor the roads and material site annually to ensure no new noxious weeds become established. Should noxious weeds be found, appropriate control treatments would be

performed in conformance with the Burns District Noxious Weed Management Program EA/DR OR-020-98-05;

- Equipment would be washed prior to being brought to the site to prevent the spread of noxious weeds, if noxious weeds are present;
- Water shall be used during the crushing and hauling (of greater than 50 tons of materials a day) to control fugitive dust, unless permitted otherwise;
- Utilize above-ground containment and proper procedures for fuel, herbicides, and other hazardous materials stored or used on the property;
- Permittee shall be responsible to remove all dumping of debris or backfilling unless approved by BLM within the issued permit;
- Spilled hazardous materials and petroleum-based materials would be reported to BLM and promptly cleaned up and disposed of properly by the Contractor or permittee;
- Operational hours shall be between 7 AM and 7 PM with up to 15 employees and portable toilets would be provided;
- Toilet facilities shall be made available for all larger scale multi-day operations;
- Permittee shall institute Best Management Practices (BMP) which would include at least weekly and end of permit cleanup of trash and oil drips;
- Avoid storing liquids over fractured substrate due to the increased risk of contaminating the ground water in the event of a spill;
- Grazing would be allowed to occur within the quarry boundary and is the responsibility of the operator to notify grazing permittee of entry and ensuring fencing is appropriate, if needed;
- Prudent care and diligence is expected to be the standard for operation.
- Blasting, crushing and other activities at the quarry site would not be permitted during March 1 to July 31 to avoid sage-grouse breeding, nesting and brood rearing activity as well as Swainson's hawk nesting and other migratory bird activity.

A *Quarry* is used to denote the blasting and crushing is aspects to obtain the mineral material source. A Community Pit is defined as a relatively small, defined area from which BLM can make disposals of mineral materials to many persons. The surface disturbance is usually extensive in the confined area.is a BLM designation for the quarry that can allow a variety of contractors or permittee to obtain and utilize the quarry. Trespass is a designation used to describe unauthorized use or activity outside of the Community Pit boundary.

Water Management Plan

All water used on site for worker and dust suppression would be hauled onto the site from an off-site source.

Surface Water

Site layout for operation shall take into the slope of the land to control the surface flow of water. The on-site soil does not show obvious signs of storm water erosional characteristics. This may suggest that the soil absorption capacity or permeability is high enough to absorb or retain

typical storm precipitation volumes, thus limiting the flow of water over the land surface. This is also important in site specific mining plan design as sediment problems would not be expected to degrade the natural landscape. The disturbed area would likely results in compaction of the surface soil and increasing the potential of surface water impacts. Berms could be utilized to prevent off-site water flow in the locations that are needed, with the interaction of BLM, and with a goal of minimizing the visual resource impacts.

Ground Water

The depth of the quarry shall not extend into the static ground water with enough earth material above the high static water level to allow drainage of a 100-year storm event within a reasonable amount of time (less than 1 week). Fractured rock on the quarry floor (overshoot in blasting) may be needed to increase the permeability of the quarry floor and thus should be utilized if needed.

Geologic Condition

The dominate rock type is volcanic as observed in quarry locations within the general location.

Power Supply

The electrical power supply would be from portable equipment on-site.

Quality Assurance Plans

To aid in efficient and safe mining activities, a site specific mining plan and\or permit conditions should be discussed and coordinated with employees. The mining plan and\or permit conditions discussion would include the pit limits and extents, location of stockpiles (waste and usable), as well as topsoil and overburden difference and storage locations. It should be noted that the mining plan would need to be flexible to allow for unforeseen geologic and economic conditions. There will be a relatively small number of employees on site at any given time(less than 16 on-site) and shall be under the control and care of the permittee, which will have the responsibility of compliance. One item that would aid in not crossing boundaries would be to clearly mark the boundaries with posts and flagging and described within the permit from BLM.

Spill Contingency Plans

All liquid storage would be temporary and only during active use of the quarry. In the event of a fuel or oil spill, the initial response would be to contain the release as rapidly as possible. The next step would be to notify all required regulatory agencies if the release meets or exceeds reportable quantities. Outside of normal drips, all spills would be reported to BLM within 48 hours. Care would be taken to not store the bulk liquids on top of fractured rock. Weekly and end of project inspections and cleanup and removal of drips onto the soil from operating equipment would occur.

The reportable quantity for fuel oil is 25 gallons. Oregon reportable quantity (RQ) rules are found in the Oregon Administrative Rules Division 142 §340-142. The EPA RQ table is found in 40 CFR 302, Table 302.4.

General Operation Schedule

The blasting and rock crushing activities are expected to start in 2013. Hauling of the material from the site is expected to start after July 15, 2013 (determined by BLM on a case by case basis and dependent upon actual conditions). Timing of operation would be specific to each permit provided by BLM and prior to each permit quarry use restrictions should be evaluated based upon the most recent data available.

Access Road Plan

Access to the quarry will be directly from Potato Hills Road and will not require an additional right-of-way (but may on Potato Hills Road). Improvement and maintenance would be on an as needed basis. Road construction would be within MSHA (Mine Safety and Health Administration) regulations under 30 CFR 1-199. The access road should be controlled by a gate to restrict access to the quarry area as it expands.

Equipment and Material Staging\Storing

The staging of equipment and material storage would be within the proposed quarry boundary. All equipment and material not removed 90 days of the termination of the permit shall become the property of the Bureau of Land Management per 43 CFR 3601.53.

Initial Entry

The initial entry to the quarry must consider the access point and possible future expansion of the quarry. The source rock is expected to be olivine basalt but have areas with higher amounts of iron, and thus red color. Furthermore, the quarry location should not be within the egress\ingress to the quarry and the first blasting should be set back within the quarry boundary. It would be understood that the top soil may not be hauled to the eastern boundary (or other berm) at that time, but rather gradually be moved as the quarry expands. The entry point would be at the point which the quarry boundary intersects Potato Hills Road; however, the initial blast point would be more westerly and proximal to the western boundary of the 5 acre site.

Prior to groundbreaking and subsequent uses, a description and exact location of proposed disturbances on a site map would be provided by BLM within a permit. This information would include a setback between the disturbed area and the quarry boundary and topography. Furthermore, the access road would incorporate an all-weather surface and would be maintained. As such the visual buffer and top soil set aside for reclamation use would move through time, but reseeded as needed. As the quarry is developed and areas no longer needed, they would be remediated, including a buffer zone around the quarry.

General Reclamation Plan

The general reclamation plan is incorporated into the operation conditions above. As noted, the surface soil would be scraped and stored in a berm that doubles as a site obscuring or vision fence along Potato Hills Road, and also along parts of Highway 20. Overburden not suitable for final reclamation should be stored separately in opening and expanding the quarry to be used as a base or within the quarry floor during final reclamation work. The staging area may require scarifying with the reseeding due to compaction of the soil. The overall slopes would be 3:1 for surface (including berms) and 2:1 for the quarry that would include 40 foot maximum vertical

with 60 foot horizontal benches (unless inspected, recommended an alternative, and approved by BLM in writing). The quarry boundary and\or quarry basin would be secured with a combination of fencing or boulders as it expands. The base of the quarry would be over drilled and fractured to allow drainage of a 100-year storm event within one week.

Interim Management Plan

The location would be secured by fencing between uses. The site should have a gate to restrict entry. Fencing would be advanced consistent with the advancement of the quarry outward.

Reclamation Costs (Bonding)

Consistent with 43 CFR 3600, bonding and\or reclamation fees and conditions will be considered and utilized as part of all permits issued for BLM for the use of the quarry.

Appendix C

Habitat Mitigation Plan for Greater Sage-Grouse

Geothermal Test Drilling Habitat Mitigation Plan for Greater Sage-Grouse

Introduction

Ormat Nevada, Inc. (Applicant) submitted a proposal to drill up to 16 geothermal test wells, build temporary access roads, maintain or widen some existing roads, and use or construct two mineral materials quarries/pits in northeastern Lake and Harney Counties, Oregon. The proposed project would occur within a 41,909 acre geothermal lease area and portions of adjacent private lands. Up to three of the wells and one aggregate pit would be located on privately owned surface and subsurface lands, up to one well on privately owned surface and BLM managed subsurface lands, and up to twelve wells and one mineral materials quarry would be located on BLM managed surface and subsurface lands in the Glass Buttes area of the Prineville and Burns BLM Districts (BLM) (**Figure 1**). The project area covers 78 acres of which 59 acres are administered by the Bureau of Land Management (BLM). The BLM is analyzing the Applicant's proposal in an environmental assessment (EA).

The Lease Area is comprised of sagebrush steppe vegetation and contains a mixture of greater sage-grouse (hereafter sage-grouse) habitats classified by Oregon Department of Fish & Wildlife (ODFW) as Core (PPH), Low Density and Non-Core (PGH), sage-grouse habitats (Hagen 2011) (**Figure 1**). The proposed test drilling area is within 28 acres of Category 1 Habitat and 45 acres of Habitat Category 2 sagebrush steppe habitat (Rod Klus, personal communication). Timing restrictions planned as part of the test drilling proposal would avoid impacts to sage-grouse during the critical breeding and brood rearing period; therefore, mitigation for temporary noise impacts is not necessary. This Habitat Mitigation Plan describes mitigation actions for the direct impacts from the proposed test drilling and associated ground disturbing actions on greater sage-grouse habitat. This Mitigation Plan is based on ODFW's Greater Sage-grouse Conservation Assessment and Strategy for Oregon (Hagen 2011) and the revised Mitigation Framework for Sage-grouse Habitats (ODFW 2012). ODFW, USFWS, the Applicant, and the BLM worked together to develop this plan.

The Mitigation Plan identifies the areas to be mitigated and describes mitigation actions and priority locations for mitigation **(Figure 2**). The Mitigation Plan provides a general timeline for funding of mitigation work.

The main participants in implementing mitigation for the Applicant's test drilling are the proponent, the Applicant, and the BLM. The Applicant will be responsible for providing funding for mitigation to the BLM. The BLM is the responsible land management agency for the proposed off-site mitigation on public land and will be responsible for implementing off-site mitigation using the funding that the Applicant provides. The proposed test drilling on public lands must first be authorized by the BLM. The specific timing, locations, and types of mitigation actions would be approved by the BLM, and the BLM would determine when mitigation is successful. The ODFW and USFWS will provide technical information pertaining to greater sage-grouse, effective measures to mitigate impacts, potential mitigation areas, and

would review the results. All organizations will cooperate and coordinate in the effective implementation of all parts of the Mitigation Plan.

Description of the Mitigated Impacts

The proposed test drilling and associated actions are described in detail in the EA (EA Chapter 2). Ground disturbing actions that would be mitigated are the areas (pads) cleared for test drilling, quarry construction, and the construction of new or widening of existing access roads to these areas.

Test Drilling: The main ground disturbing activity, geothermal test drilling, includes removal of vegetation and stockpiling of overburden and top soil (growth media) for reclamation at each drill site (2.07 acres or 4.13 acres, depending on whether it is a slim well or full-sized well), followed by 15 to 90 days of drilling and 5 to 30 days of testing of the geothermal resource. When drilling and testing is completed, interim reclamation (seeding and re-contouring) of the cleared areas not needed to access the well would take place. Final reclamation would take place when the well is deemed to be unnecessary or the geothermal lease is relinquished back to the BLM. Final reclamation would include seeding and re-contouring all remaining unseeded disturbed areas, filling in of the reserve pits, and capping of the well heads. During the implementation phase of the proposed project, the immediate and surrounding area around the drill pad would have little or no habitat value for wildlife, including sage-grouse (EA Section 3.5). Proposed reclamation work would reduce the lengthy period of recovery required for shrub steppe communities to mature into the late seral stage (EA Section 2.3.3). However, it is expected that grasses and forbs would recover within two years and sagebrush would recover within 20 years to pre-disturbance stature.

G.I. Ranch Pit and Community Pit Construction: Two sources of aggregate would be required for use in pad construction and road maintenance. Each pit (one on private and one on public land) would directly impact up to five acres each. Reclamation activities for both pits would be in accordance with the criteria provided in **Section 2.5** of the EA, and the Potato Hills Quarry would also be subject to the criteria provided in Appendix B of the EA and conditions of a material sales or free use permit.

Access Road Construction: New temporary roads would be constructed to provide access to some of the sites (Figure 1). A description of the new temporary access roads is incorporated by reference from the EA (EA Section 2.3.2). In summary the total temporary disturbance from the access roads would total 8.2 acres (Tables 1 and 2). Once test drilling is complete and the site is no longer needed for this project, the newly constructed access roads would be reclaimed to the standards provided in the BLM Gold Book.

Calculation of the Size of the Mitigation Area

One of the primary threats to sage-grouse habitat in the Glass Buttes area is juniper encroachment into open sagebrush habitat (Hagen 2011). Juniper control treatments have been effectively used to reduce juniper cover to maintain and restore sage-grouse habitat in this area. Since juniper control is one of the primary threats in the Glass Buttes area and treatments are highly effective, the required mitigation action would be to continue juniper control in the Glass Buttes area to expand ongoing control efforts.

The habitat mitigation area must be large enough to achieve, within a reasonable time, the habitat mitigation goals and standards of the ODFW's Fish and Wildlife Habitat Mitigation Policy (OAR 635-415-0025). For Habitat Category 2 impacts, ODFW recommends mitigation to achieve "no net loss" and a "net benefit" in habitat quantity or quality. Sagebrush steppe communities mapped as PGH habitat in the project area have been determined by ODFW to be Category 2. A mitigation ratio of 2:1 (two acres of mitigation treatment for every acre of disturbance) for direct disturbance in Category 2 Habitat would be in effect for this Mitigation Plan to achieve the "no net loss" with "net benefit" goal (Table 1).

ODFW considers Category 1 Habitat to be irreplaceable, and states that "due to the uncertainty and risk involved in trying to mitigate for the loss (i.e. reclaim/restore) of these habitats and biological dynamics, protection of these areas is paramount…" (Hagen 2011). ODFW advocates avoidance of Category 1 Habitat, and makes no recommendation for mitigation of "energy development, and its associated infrastructure or other large scale industrial-commercial developments" in Category 1 Habitat. All PPH habitat proposed to be disturbed has been determined by ODFW to be Category 1 (Figure 1).

The proposed test drilling is a temporary, seasonally restricted, activity and there is no proposal for energy development or other large scale industrial-commercial developments. Activity associated with test drilling would cease once testing of the geothermal resource is completed. The proposed direct ground disturbance in Category 1 Habitat would result in long-term impacts on up to 28 acres (Table 2). Although this represents a small percentage of Category 1 Habitat in the state of Oregon, this is critical habitat for sage-grouse that ODFW has stated is unmitigatable. Although ODFW has stated that Category 1 Habitat is unmitigatable, for this specific project, BLM biologists have determined a mitigation ratio of 10:1 is appropriate, given that the proposal for mitigation is juniper treatments as well as other considerations such as the habitat characteristics in the areas proposed to be disturbed, the habitat characteristics of the areas proposed for mitigation (Figure 2) and the specific types of disturbances associated with this specific project.

A more detailed description of the factors that BLM biologists considered for the mitigation ratio of 10:1 is as follows:

- Juniper control would be the mitigation action. This was already agreed upon for mitigation outside PPH, partly because it's one of the primary threats to sage-grouse habitat in the region, and juniper control is feasible and highly successful.
- There is already consensus on a 2:1 ratio for juniper control for impacts in PGH (which is fairly close to the proposed disturbance in PPH-Category 1).
- Several of the drill pads proposed in Category 1 Habitat would be within 1.5 miles of two separate leks. There's not a "value scale" of Category 1 Habitat, but due to the close proximity to leks, to the BLM wildlife biologists, this is even more critical than habitat in Category 1 Habitat that is much farther from leks.
- The areas proposed for disturbance and the areas for mitigation are extremely valuable breeding and winter habitat for a Candidate species that is warranted but precluded by higher priority listing actions.

- Areas for potential mitigation actions would be in habitat of similar potential for sage-grouse. Mitigation treatments would attempt to improve degraded habitat in the vicinity to similar quality habitat as the habitat that would be disturbed by the proposed action.
- Total acres of ground disturbance at well pads and quarry sites would be relatively small.
- Drill pads would be rehabilitated (vegetation would not be permanently lost).
- Disturbance would occur outside the lek, nesting, and most of the brood rearing period.

Some factors considered (i.e. it is in Category 1 Habitat and it is in close proximity to leks) suggested using a substantially higher ratio than 2:1, while other factors (i.e. no proposed surface occupancy and pads would be reclaimed) suggest a ratio closer to the 2:1. Based on these factors, the BLM wildlife biologists feel that offsite mitigation for Category 1 Habitat should involve a much higher ratio than for Category 2 Habitat. There is no indication that replacing a certain number of acres of disturbance in Category 1 Habitat can be mitigated by a ratio of 10:1, or even 20 or 100:1; however, the BLM biologists thought that it is reasonable and attainable to propose a mitigation of 10 acres for every acre of disturbance. This 10:1 ratio is higher than what was decided on for a mitigation ratio for Category 1 sage-grouse habitat in Nevada for the Ruby Pipeline Project (BLM 2010). The "Ruby Project Cooperative Conservation Agreement for the Greater Sage-Grouse and Pygmy Rabbit" calls for a 4:1 ratio for disturbance and also sets a price of $759/mitigation acre for project work proposed to mitigate for the disturbance. This correlates to $3036/acre of disturbance. For this project, even though the 10:1 ratio is higher than for the Ruby Pipeline Project, juniper cutting and machine piling costs about $250/acre and juniper cutting with lop and scatter or hand piling of juniper branches costs about $400/acre. This relates to $2500 - $4000/acre of disturbance which is within a reasonable range compared to the cost per acre of disturbance for Ruby Pipeline.

Table C-1 Mitigation calculation for Category 2 Habitat

Test Drilling Activity	Disturbed Acres*	Mitigation Acres
Drill Pads	33.1	33.1 x 2 = 66.2
Temporary Access Road Construction, Truck Pull-Outs, and Truck Turn Around Areas	6.4	6.4 x 2 = 12.8
Quarry	5	5 x 2 = 10
Total	45	89

Table C-2 Mitigation calculation for Category 1 Habitat

Test Drilling Activity	Disturbed Acres*	Mitigation Acres
Drill Pads	20.7	20.7 x 10 = 207
Temporary Access Road Construction, Truck Pull-Outs, and Truck Turn Around Areas	1.8	1.8 x 10 = 18
Quarry	5	5 x 10 = 50
Total	28	275

The grand total mitigation area for the proposed geothermal test drilling is 364 acres.

Description of Offsite Mitigation Areas

The ODFW Mitigation Policy recommends mitigation for Habitat Category 2 impacts to be "in proximity" to a project, and the mitigation area should be located where habitat protection and enhancement are feasible consistent with this plan. Mitigation actions would occur on BLM lands.

Priority mitigation areas are identified in Figure 2. These areas are in sagebrush steppe communities with some juniper encroachment, but are of similar habitat potential as sites proposed for test drilling. Based on past telemetry data, mitigation actions in the priority mitigation areas would benefit sage-grouse using the Parmele Ridge lek, Ryegrass lek complex, and the Glass Butte lek complex.

A more detailed description of the rationale for the selection of the offsite mitigation areas is as follows:

- Telemetry work shows that sage-grouse in the Glass Buttes area may use a very large (600+ square miles) annual use area; therefore all three offsite mitigation treatment areas would benefit sage-grouse in this area to some degree.
- The nearest proposed offsite mitigation area to both sage-grouse PPH Habitat and a Conservation Opportunity Area (ODFWs highest priority areas) would be two miles southwest of the Parmele Ridge lek; however, juniper treatment in the other proposed offsite mitigation areas would also have beneficial effects to sage-grouse.

Details about the offsite mitigation polygons in Figure 2 are as follows:

- The polygons encompassing highway 20 are in sage-grouse PPH Habitat, contain phase 2 juniper encroachment, and would expand the beneficial impacts of an ongoing juniper treatment. The polygons are between or near two lek complexes that have a combined average of about 37 male birds over the last 5 years; the Parmele lek was recently discovered and had a high count of five males in 2011. Also, the polygons contain known sage-grouse telemetry points.
- The polygon west of the proposed disturbance areas is in sage-grouse PPH Habitat and contains phase 1 juniper encroachment.
- The polygon that is on the Lake and Harney County boundary and is southeast of the proposed disturbance areas is in sage-grouse PGH Habitat, contains phase 1 and phase 2 juniper encroachment, and would expand the beneficial impacts of an ongoing juniper treatment. The polygon is between or near two lek complexes that have a combined average of about 37 male birds over the last five years and the Parmele lek was fairly recently discovered and had a high count of five males last year. Also, the polygon contains known sage-grouse telemetry points.

Mitigation Actions

The goal of mitigation actions in this plan is to improve sagebrush steppe plant communities near the geothermal test drilling area (Figure 2). Several past impacts and current threats to

sagebrush steppe communities are present in the Glass Buttes area, including but not limited to wildfires, presence of noxious weeds and annual grasses, power line right-of-way, and juniper encroachment. However, juniper encroachment is considered one of the more immediate concerns in this area (Hagen 2011). Control of juniper expansion (phase 1 - phase 2) into sage-grouse habitat has a high success rate with immediate benefits because the juniper canopy has not closed to the extent that it degrades the understory vegetation (Miller et al 2005). Since juniper encroachment is a primary threat in the Glass Buttes area (Hagen 2011) and due to the limited amount of mitigation acres required to offset the direct disturbance in this Mitigation Plan, only juniper control is considered for mitigation actions. Juniper control, especially of phase 1 and phase 2 juniper areas, would be usable sage-grouse habitat within a short period (less than 5yrs) of time and at a relatively inexpensive cost compared to other possible projects such as burial of distribution powerlines which would cost around $12/foot with at least 10 miles of line to bury in this area. Also, environmental documents for juniper control in this area have been completed but future funding for these projects is unreliable at best.

The objective of this juniper control mitigation is to remove all encroaching juniper from treatment areas, while maintaining the understory sagebrush-native grassland community. Treatment would include either cutting juniper with chainsaws followed by machine-piling cut trees then burning the piles or cutting trees with chainsaws then cutting and scattering the branches until the cut tree does not stick more than four feet above the ground. This selective treatment would leave the existing sagebrush cover intact and release understory plants especially grasses and forbs. The cutting and machine-piling would be used in most areas unless the terrain is too steep for the excavator to maneuver safely or the ground surface is covered with too many or too big of rocks for the excavator to move over safely. Cutting and scattering of the branches would be used in the areas too steep or too rocky for the excavator or areas where the excavator may not be able to access due to the above factors such as ridge tops surrounded by basalt cliffs.

Mitigation Schedule

The number of wells and related disturbance analyzed in the EA is the maximum amount of disturbance that the Applicant would be authorized to perform. The Applicant will be required to provide a lump sum for the entire amount of any ground disturbance that they may be authorized to perform, prior to any ground disturbance taking place. The Applicant needs to budget mitigation costs when calculating costs for exploration. As soon as BLM received funding from the Applicant for offsite mitigation, BLM would begin the process to implement juniper thinning for any ground disturbance that the Applicant may be authorized to do. On average, the process of implementing juniper thinning projects takes approximately three months.

The mitigation schedule is flexible in that a wildfire could burn a planned juniper thinning project which would require the BLM to move the juniper thinning to another mitigation area, which would extend the completion time of mitigation activities. Any new mitigation areas based on the above scenario would be within a 10 mile radius of the project area. Depending on the size and intensity of the wildfire, revegetation activities such as planting sagebrush or other grasses and forbs could be part of the mitigation included to restore suitable habitat is a shorter period of time than natural revegetation.

Monitoring

Monitoring would indicate whether the mitigation was implemented, if it was effective, and if it achieved the goals and objectives. The goal of the mitigation projects is to improve sagebrush steppe plant communities in the area of the geothermal exploration so they can provide greater sage-grouse habitat. The objective is to improve the condition of native plant communities by removing encroaching juniper. Implementation monitoring would be an annual Mitigation Report submitted to ODFW by BLM each December describing what mitigation was completed, including materials, methods, cost, and area during the previous field season.

Effectiveness monitoring may be conducted by either of the participants, but is BLM's responsibility to ensure monitoring is completed. The BLM conducts lek counts each spring and the BLM would continue this monitoring and the data would be used in evaluating mitigation effectiveness. Photo monitoring would be established that shows plant composition and ground cover to monitor the effects of the treatment(s). The method and intensity of monitoring as well as the timing, frequency, and duration of monitoring would be determined based on the specific project's objectives and treatments. Monitoring data would be compared to the site's ecological site description and the treatment objectives to determine success. Monitoring would continue for the life of the geothermal exploration project.

Evaluation and Adaptive Management

In February 2016, there would be an evaluation meeting with ODFW, USFWS, the Applicant, and the BLM. While cooperation is preferred, the BLM is responsible for the evaluations. The purpose for this meeting is to evaluate mitigation to date.

As the land manager, the BLM is responsible for ensuring that the offsite mitigation achieves the mitigation goals.

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ODFW. 2012. Mitigation Framework for Sage-grouse Habitats. Oregon Dept. of Fish and Wildlife, Salem, USA.

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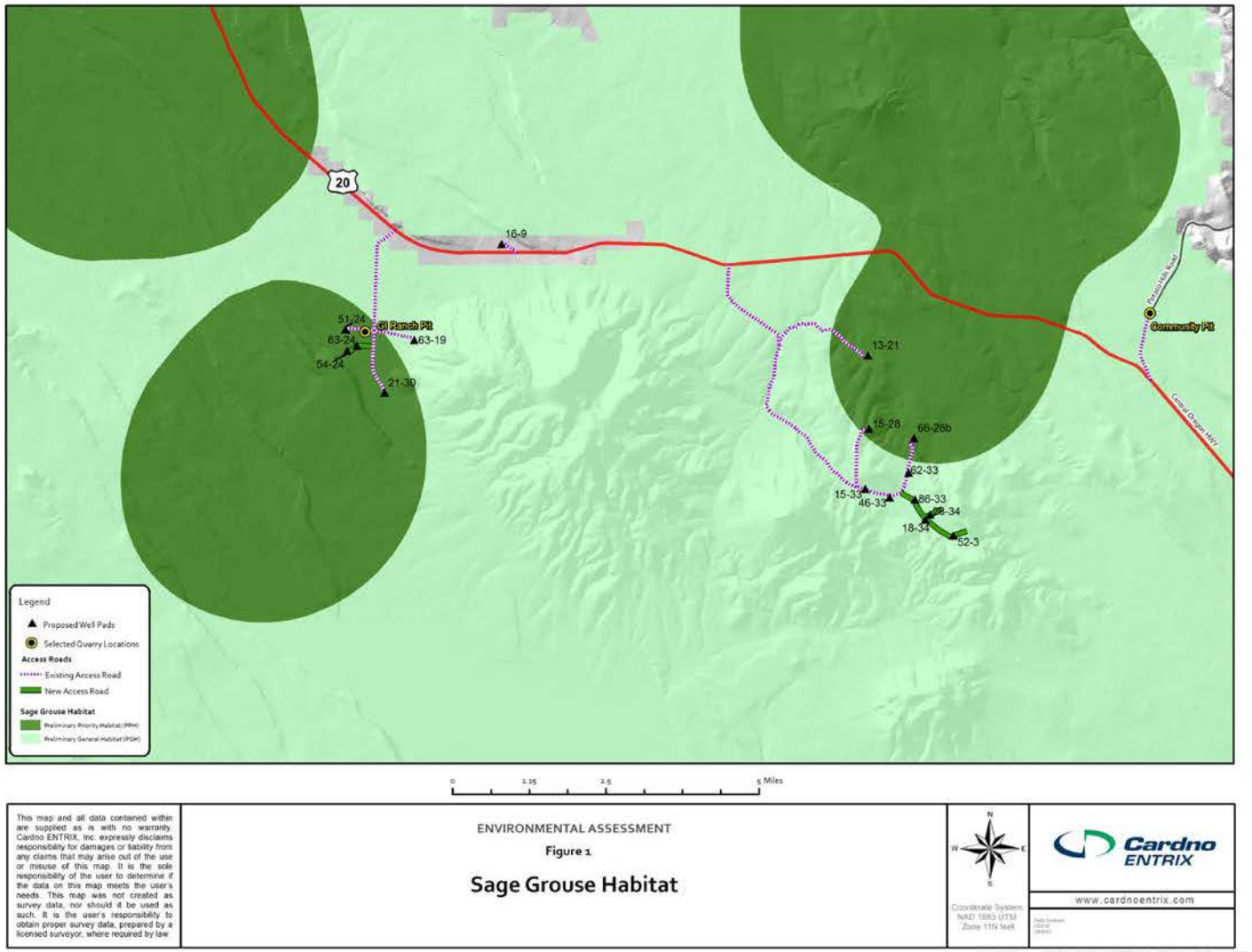

Figure C-1 Sage Grouse Habitat

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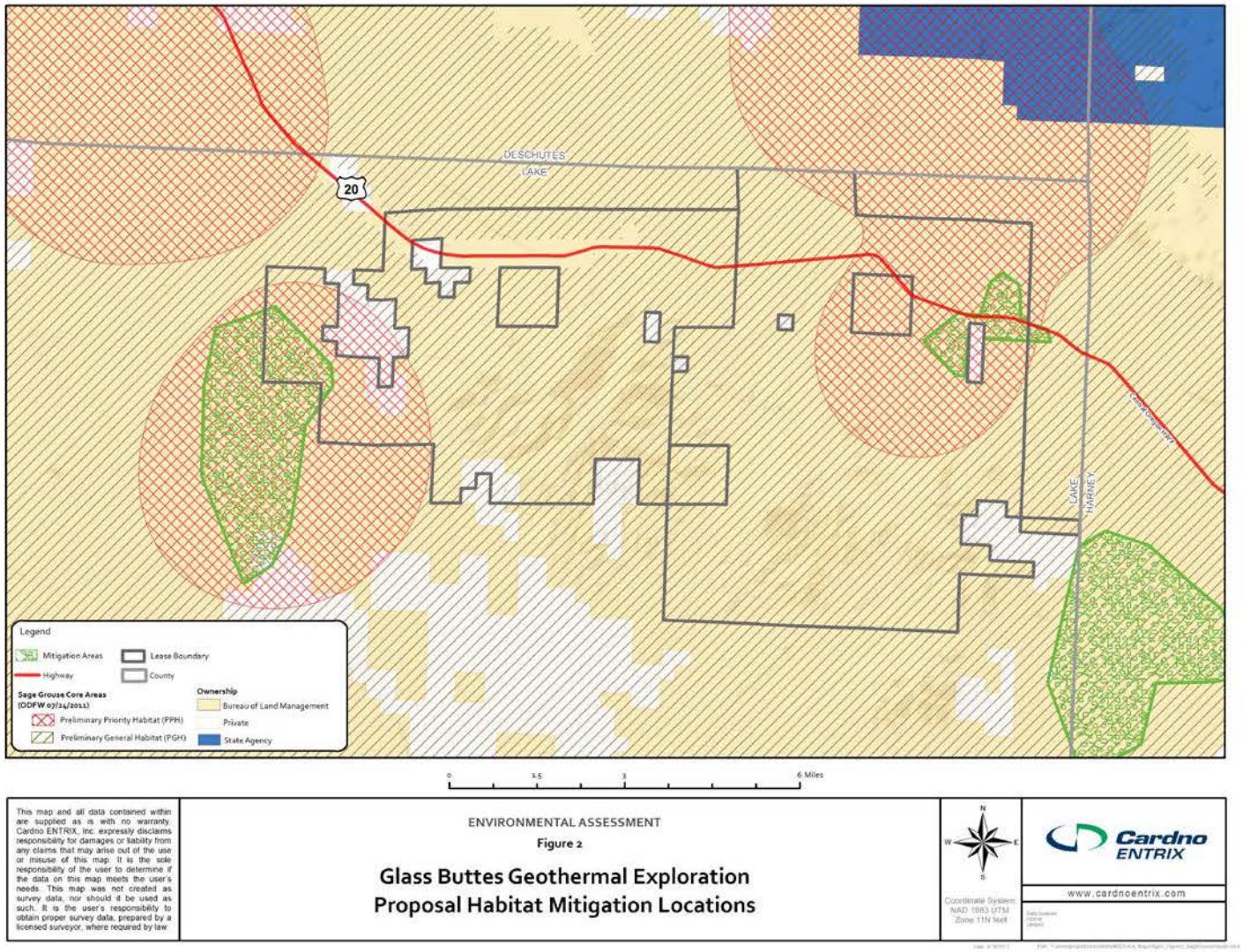

Figure C-2 Glass Buttes Geotheraml Exploration Proposal Habitat Mitigation Locations

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